Programme Area: Smart Systems and Heat

Project: Value Management

# Title: Future Business Models: Options and Analysis


## Abstract:

An important part of the SSH Programme is Value Management and Delivery which addresses the key issue of how value can be delivered across the entire smart systems value chain (in the context of the UK). The premise here is to understand how smart energy systems can deliver value to all market participants, with the customer at the heart, thereby making commercial deployment more likely. The report describes four initial business models (and two additional hybrids) representing a range of potential approaches to delivering value in the new low-carbon smart energy system and provides an initial, indicative evaluation of these business models. This report was initially produced in October 2014. The detailed information and analyses documented within may be out of date with current thinking.


## Context:

This project studied how value can be delivered across a smart energy value chain - in the context of the UK. It built a clear understanding of how smart energy systems can deliver combined consumer value alongside commercial value for market participants - producers, suppliers, distributors. The analysis will help to make the commercial deployment of smart energy systems more likely. This £600,000 project was delivered by Frontier Economics, a leading economic consultancy.

# Future business models: options and analysis v4

PREPARED FOR THE **ENERGY TECHNOLOGIES INSITUTE** SMART SYSTEMS AND HEAT PROGRAMME: VALUE MANAGEMENT D3 (WA4 SSH)

October 2014

# Future business models: options and analysis v4

**1 Executive Summary 9**

**2 Introduction 21**

*2.1 Context.......................................................................... 21*

*2.2 Objectives ...................................................................... 22*

**3 Methodology 25**

*3.1 Changes to risk and reward ................................................... 25*

*3.2 Business model generation.................................................... 25*

*3.3 Paths to transition ............................................................... 27*

*3.4 Evaluation ......................................................................... 28*

**4 Overview of outputs 33**

*4.1 Changes to risk and reward .................................................. 33*

*4.2 Business models................................................................. 34*

*4.3 Evaluation outputs .............................................................. 38*

**5 Indicative insights 45**

*5.1 Features of the business models that drive success................ 45*

*5.2 Enabling actions.................................................................. 50*

**6 Conclusions and recommendations 56**

*6.1 Enabling actions.................................................................. 56*

*6.2 Recommendations for the demonstration ............................... 58*

*6.3 Priorities for future business model development .................... 60*

**7 Annexe 1: Understanding the challenge: overview of the future energy value chain 62**

*7.1 Disruption 1: Changes in heating technologies. ....................... 63*

*7.2 Disruption 2: Changes in energy supply.................................. 65*

*7.3 Disruption 3: The technology transition from dumb to smart meters.......................................................................... 67*

Contents

**8 Annexe 2: Business Model Assessment Canvases 69**

**9 Annexe 3: Understanding the transition 74**

*9.1 Challenges for transition ... 74*

*9.2 Energy Mutual ... 85*

*9.3 Community Energy ... 94*

*9.4 Power Buffer ... 101*

*9.5 Common themes ... 108*

*9.6 Summary ... 111*

**10 Annexe 4: Developing solutions: Policy context and transition 114**

*10.1 High level policy requirements ... 114*

*10.2 Energy Outcomes ... 116*

*10.3 Energy Mutual ... 119*

*10.4 Community Energy ... 121*

*10.5 Power Buffer ... 128*

**11 Annexe 5: Evaluation 130**

*11.1 Which questions does BMET address? ... 130*

*11.2 How does BMET address these questions? ... 134*

*11.3 Indicative results by business model – examples of BMET capability and output ... 138*

**12 Annexe 6: International review 209**

*12.1 Summary of findings ... 210*

*12.2 Findings by country ... 211*

**13 Annexe 7: Methodology for assessing future risks and rewards 222**

*13.1 Overview of methodology ... 222*

*13.2 Development of future scenarios ... 223*

*13.3 Analysis of scenarios ... 227*

*13.4 Stress testing ... 233*

Contents

**14 Annexe 8: Methodology for developing new business models 243**

*14.1 Our approach ... 243*

*14.2 Long-list of viable value propositions and ideas ... 250*

*14.3 Approach to short-listing ... 253*

**15 Annexe 9: Further details on business models 259**

*15.1 Energy Outcomes ... 260*

*15.2 Energy Mutual ... 285*

*15.3 Community Energy ... 311*

*15.4 Power Buffer ... 336*

# Future business models: options and analysis v4


**Figure 1.** Evaluation criteria 11

**Figure 2.** Focus of the Business Model Evaluation Tool 11

**Figure 3.** Enabling the market to develop 17

**Figure 4.** Policy requirements for business models 19

**Figure 5.** Summary of shortlisting criteria 27

**Figure 6.** Evaluation criteria 29

**Figure 7.** Key attributes of customer groups in the tool 30

**Figure 8.** Evaluation tool- overview 31

**Figure 9.** Focus of the Business Model Evaluation Tool 31

**Figure 10.** Changes to risk and reward 34

**Figure 11.** Energy Outcomes: highlights 35

**Figure 12.** Energy Outcomes and additional storage: hybrid 35

**Figure 13.** Energy Mutual: highlights 36

**Figure 14.** Community Energy: highlights 37

**Figure 15.** Community Energy and Energy Outcomes: hybrid 37

**Figure 16.** Power Buffer: highlights 38

**Figure 17.** Business model potential: transition vectors 51

**Figure 18.** Changes in characteristics on the demand side 63

**Figure 19.** Heat pumps: change in risk and reward 64

**Figure 20.** District heat: change in risk and reward 65

**Figure 21.** Changes in characteristics of the supply side 66

**Figure 22.** Change in risk and reward due to supply side changes 67

**Figure 23.** Smart meters: change in opportunities for rewards 68

**Figure 24.** Energy Outcomes future value chain 77

**Figure 25**: Energy Mutual future value chain 86

**Figure 26.** Community Energy future value chain 95
**Figure 27.** Power Buffer future value chain 102
**Figure 28.** Common themes for business model transformation 110
**Figure 29.** Transition vectors for business models 111
**Figure 30.** System evolution **potential** (not used in evaluation tool) 113
**Figure 31.** Focus of the Business Model Evaluation Tool 131
**Figure 32.** Evaluation criteria used by the tool 132
**Figure 33.** Key attributes of customer groups in the tool 135
**Figure 34.** Structure of BMET 137
**Figure 35.** Energy Outcomes: Customer uptake 141
**Figure 36.** Uptake of Energy Outcomes for interventions 144
**Figure 37.** 2045 bills under Energy Outcomes 147
**Figure 38.** Bill Breakdown for Unconvinced Dependents under Energy Outcomes in 2045. 148
**Figure 39.** Costs, revenues and profits for Energy Outcomes 149
**Figure 40.** Profile of take up of Energy Outcome for different discount assumptions 151
**Figure 41.** Electricity consumption for Energy Outcomes 154
**Figure 42.** Gas consumption for Energy Outcomes 155
**Figure 43.** Total emissions under Energy Outcomes and counterfactual 156
**Figure 44.** Change in investment required at other levels of the value chain 157
**Figure 45.** Take-up of Energy Outcomes with additional storage 162
**Figure 46.** Percentage take up of Energy Outcomes with additional storage at 2045 163
**Figure 47.** Change in costs of serving Successful Ruralites (oil) due to storage 164
**Figure 48.** Charges to consumers taking up Energy Outcomes and with additional storage 165

**Figure 49.** Profitability of the Energy Outcomes with additional storage model 166

**Figure 50.** Total emissions under Energy Outcomes with additional storage 167

**Figure 51.** Spillovers associated with the Energy Outcomes with additional storage model 168

**Figure 52.** Cumulative Energy Mutual uptake by 2050. 170

**Figure 53.** Take up of Energy Mutual 170

**Figure 54.** Urban Constrained bill under Energy Mutual 173

**Figure 55.** Costs, revenues and profits for Energy Mutual 174

**Figure 56.** Scale of Energy Mutual without financial constraints 176

**Figure 57.** Scale of Energy Mutual without financial constraints, with reduced discount 178

**Figure 58.** Total Emissions under Energy Mutual 181

**Figure 59.** Change in investment required by network and generators 182

**Figure 60.** Customer energy bill under counterfactual and Community Energy (2015) and current bill for an average customer. 185

**Figure 61.** Costs of Community Energy over time 186

**Figure 62.** Costs and revenues for Community Energy 187

**Figure 63.** Cumulative discounted profit for Community Energy 188

**Figure 64.** Total carbon emissions of potential customers 193

**Figure 65.** Aggregate spillovers achieved by the model 195

**Figure 66.** Uptake of Energy Outcomes in a Community Energy locality. 196

**Figure 67.** NPV of Community Energy, with and without Energy Outcomes 198

**Figure 68.** Sensitivity of NPV of Community Energy, with and without Energy Outcomes 199

**Figure 69.** Power Buffer - Scale 201

**Figure 70.** Profits for Power Buffer 204

**Figure 71.** Power Buffer – scale 205

**Figure 72.** Profits for Power Buffer at 50% cost of storage 205

**Figure 73.** Space and water heat production by technology in 2030, core ESME scenarios 228

**Figure 74.** Space and water heat production by technology in 2050, core ESME scenarios 229

**Figure 75.** Electricity generation in 2030, core ESME scenarios 230

**Figure 76.** Electricity generation in 2050, core ESME scenarios 231

**Figure 77.** Storage in 2030, core ESME scenarios 232

**Figure 78.** Evaluation of potential supply chain combinations 247

**Figure 79:** Long-list of Left to Right business models 253

**Figure 80.** Short-listing criteria 254

**Figure 81.** Business model Canvas 258

**Table 1.** Summary of initial indicative business model evaluation 39

**Table 2.** Energy Outcomes transition vectors (potential – not used in evaluation tool) 81

**Table 3.** Energy Mutual Transition Vectors. (potential – not used in evaluation tool) 91

**Table 4.** Community Energy transition vectors (potential – not used in evaluation tool) 99

**Table 5.** Power Buffer Transition Vectors (potential – not used in evaluation tool). 106

**Table 6.** Barriers to the energy outcomes business model 119

**Table 7.** Barriers to the energy mutual business model 121

**Table 8.** Barriers to the community energy business model 127

**Table 9.** Barriers to the Power Buffer business model 129

**Table 10**: Bills by customer group under Energy Outcomes 146

**Table 11.** Failure risk score for the Energy Outcomes model 158

**Table 12.** Energy Mutual bills 172

**Table 13.** Energy Mutual take-up at different interventions discount assumptions 176

**Table 14.** Failure risk score for the energy mutual model 179

**Table 15.** Failure risk score for the community energy model 191

**Table 16.** Summary of value and cost to DNO, per feeder, for period 2045-2060 203

**Table 17.** Failure risk score for the Power Buffer model 207

**Table 18**: Summary of international findings 210

**Table 19:** Netherlands 211

**Table 20:** France 212

**Table 21:** Germany 213

**Table 22:** Sweden 214

**Table 23:** Norway 215

**Table 24:** Finland 215

**Table 25:** Denmark 216

**Table 26:** USA 217

**Table 27:** Canada 218

**Table 28:** New Zealand 219

**Table 29:** Australia 220

**Table 30:** South Africa 221

**Table 31.** Comparing core scenarios to Director's Cut (DC) 227

**Table 32.** Summary of key changes in ESME scenarios (v3.1) 233

**Table 33.** Scenario comparison 237

**Table 34.** Proposition Summary and Decision 254

# 1 Executive Summary

Frontier Economics and Total Flow have been commissioned to deliver Work Area 4 of the ETI's Smart Systems and Heat (SSH) project. **This Work Area addresses how value can be delivered across the smart systems energy value chains.** The outputs of this work will support and assist the ETI with the evolution and development of possible business models.

Meeting carbon targets will require a radical change in heating technologies and energy supply. **We have produced four initial business models (and two additional hybrids) representing a range of potential approaches to delivering value in the new low-carbon smart energy system.**

**We have also developed a sophisticated business model evaluation tool (BMET) to help structure the ETI's thinking around the assessment of these models.**

**This report describes and provides an initial, indicative evaluation of these business models.** At this stage**,** the evaluation explicitly focusses on the drivers of value for each business model, rather than trying to predict uptake levels and associated cost and benefits. The numerical outputs of the evaluation are only a starting point: they reflect assumptions and algorithms designed to represent the basic business model design and a set of currently available inputs and values.[1] The real value does not come from considering a single set of outputs. Instead it comes from understanding how business models perform under different assumptions and identifying what drives value. The ETI will verify and update these inputs and assumptions over time (aligned to outcomes from other programme deliverables, validation trails etc.) which will affect the outputs presented in this report.

We understand that it is the intention that BMET capability continues to be developed in order to align to and support the ongoing aims and objectives of the SSH Programme. Only the current capabilities of BMET are referenced in the report.

### *Process for business model design and evaluation*

We have produced and evaluated four initial core business models and two hybrids:

- Energy Outcomes, and a hybrid including additional storage;

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1 For example, we take technology costs and electricity sector scenarios from ETI's ESME model version 3.1, energy prices and carbon prices from DECC's current Policy Appraisal Guidance and distribution network headroom and reinforcement costs from the Smart Grid WS" Forum model (2012).

- Energy Mutual;
- Community Energy, and a hybrid including Energy Outcomes; and
- Power Buffer.

**Our aim was to produce business models representing a broad range of possible opportunities for delivering value in a low-carbon economy.** The needs and desires of consumers were at the heart of our business model design process. We also took into account the new challenges and disruptions associated with a low-carbon economy.

Using the quantitative tool specifically designed for this process (BMET), we then evaluated each core business model in detail to 2050 against a set of criteria agreed with ETI (Figure 1). This evaluation was carried out in the context of an economy where carbon targets have been met. In practice, this means we have evaluated the business models against counterfactual scenarios which include a decarbonised power sector (based on ESME outputs) and an economy-wide carbon price (based on DECC policy appraisal guidance) [2]. It is worth noting that these carbon prices are lower than the carbon price implicit in current policies such as the Renewable Heat Incentive (RHI)[3].

2 DECC (2013), *Valuation of energy use and greenhouse gas emissions for appraisal*

3 For example, the carbon price implicit in the domestic air source heat pump RHI is around six times higher than the DECC non-traded sector carbon price in 2015, assuming the heat pump is replacing a gas boiler. The carbon price implicit in the ground source heat pump RHI payment is even higher.

**Figure 1.** Evaluation criteria

| For business models at local, regional or GB scale, from now until 2050 | |
|---|---|
| Profitability | Can the business model provider make a profit?<br>What is the rate of return associated with different prices? |
| Consumer bills and added value | How much will consumer bills change under the business model?<br>What added value (non-monetary benefits) will they receive? |
| Energy use and emissions | What impact will the business model have on energy consumed and carbon emissions? |
| Adaptability | How does the business model perform under different scenarios?<br>How flexible is it in the face of uncertainty over future conditions? |
| Scale | What is the size of the addressable market?<br>How much of this could a feasible business model supply? |
| Value chain impacts | What costs or benefits will the business model have across the value chain |
| Policy | What level of subsidy (if any) will be required?<br>What are the other required characteristics of the policy environment? |
| Access to finance | What terms might financial backers of the business model require (this will depend upon its risk) |

Source: Frontier Economics

As illustrated in Figure 2, BMET is particularly focussed on allowing exploration of the viability of business models and their impact on consumers over the long term, under different conditions. It allows the user to understand the drivers of value for each business model, and therefore, the suitability of business models for different conditions. It does not currently aim to predict uptake of business models in the short run.

**Figure 2.** Focus of the Business Model Evaluation Tool

| It is well suited to… | It is currently less suited to… |
|---|---|
| • Exploring how the long-term viability of business models vary under different conditions | • Modelling short-term barriers to take-up |
| • Determining what factors underpin the success or failure of a business model | • Producing quantitative forecasts that could immediately be used for business planning |
| • Seeing how the take-up of a business model could vary across broad customer types | • Highly detailed customer segmentation |

Source: Frontier Economics

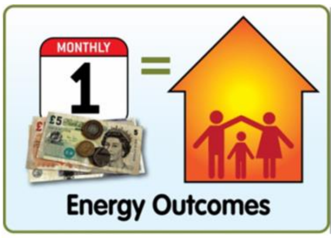
## *Description of the business model and overview of their evaluation*

We now present a high level description of the preliminary business models including an overview of the indicative results of their evaluation. For each business model we cover:

- drivers of benefits to customers;
- an overview of the results of the evaluation modelling, including sensitivities;
- potential impacts on customer bills;
- attributes of a successful business model provider.

We also highlight where the hybrids differ from the main model.

## Energy Outcomes and Energy Outcomes with additional storage




**Provision of comfort for a predictable monthly fee. Not per kWh.** Removes the burden of asset ownership, repair and maintenance and the risk of fluctuating energy costs.

**A better performing system with experts optimising households energy use.** Energy security, performance and comfort, from a brand you trust.

**A multi-year contract to pay for comfort.** The provider takes responsibility for investing in the energy system and the consumer selects the level of comfort.

**Energy Outcomes provides benefits to customers that will be particularly important in a low-carbon smart energy system.** There are three key potential benefits.

- Customers purchase the end product that interests them – comfort. There is a very low level of engagement between customers and energy systems. By offering customers the outcomes that they are interested in, rather than offering options to achieve them, Energy Outcomes can reduce hassle costs for customers, and bypass many of the barriers associated with rolling out the smart energy system.

- Customers do not face the high upfront costs of interventions associated with insulation, low-carbon heat supply and home energy managements systems (HEMS). The provider purchases these technologies on their behalf (obtaining a bulk discount in later years) and customers pay for them through their monthly bills over the five year period of the contract.

- Purchasing comfort, rather than kWhs of energy, transfers the risk customers perceive around unfamiliar low-carbon technologies to the business model provider. Since the provider also takes responsibility for the efficiency of the heating technologies, there is a strong incentive to deliver the most efficient and reliable energy saving interventions. Energy Outcomes also transfers the risk of fuel price volatility from the customer to the provider. This will be attractive if the provider can hedge this risk at a cost that appeals to the customer.

**Our evaluation modelling suggests that these benefits may make Energy Outcomes attractive to consumers in a low-carbon economy**. Under our assumptions there is strong take-up across all customer groups, and an increase in value delivered to customers. At the same time, business model providers can make competitive returns.

Sensitivity testing suggests that the high modelled uptake of Energy Outcomes is driven by two main factors.

- Uptake for some customers is driven by fact that interventions (heat pumps and HEMS) can be financed and installed cost-effectively under the business model: take-up increases with the size of any intervention discount and the level of credit constraint facing customers.

- Other customers are attracted by the fact the business model provider managers their energy price risk. In this case, the viability of the business model is dependent on whether the provider can manage this risk at a price that customers are willing to pay: where customers show little risk aversion, and where the providers' costs of managing risk are high, uptake decreases significantly.

**BMET also suggests that the impact of Energy Outcomes on customer bills could be small.** On the one hand, additional interventions deliver savings to customers in Energy Outcomes. At the same time, customers must pay a premium for the energy cost risk management provided as part of the contract.

**Successful business model providers will need to become excellent in technical systems integration and intervention delivery capability.** A challenge will be to present a radically different consumer proposition as a clear and compelling offer. They will also need to manage risks around fluctuating energy costs, the energy performance of interventions, customer energy behaviour and credit.

**Adding storage (at the domestic level) to the Energy Outcomes model increases its attractiveness to customers, but only in the longer term, and only for households with high electricity consumption (typically those with heat pumps).** We assume the costs of domestic power storage decrease over time, but these costs do not fall sufficiently to make it worthwhile for customers with low energy consumption.

## Energy Mutual


Provides a **platform/brokerage**. Those who are unable or unwilling to invest themselves, but whose property and energy usage offer a strong business case for intervention, are matched with investors who want to make a **socially responsible investment for a return**. As a social investor they may be willing to accept a rate of financial return that is lower than the general market rate.

The business case is developed via a survey from **an expert partner**, introduced by Energy Mutual as the preferred supplier for the retrofit work.

**Energy Mututal brings benefits to customers by providing them with access to low-cost credit for home interventions.** Customers facing credit constraints can access funds through this model at a lower rate than under the Green Deal. Energy Mutual also makes it easier for customers to enagage with energy. Working with its expert partners, the Energy Mutual business model provider will help consumers access a more streamlined service for the installation of interventions. It also provides an investment opportunity for those wishing to make a socially responsible and community orientated investment.

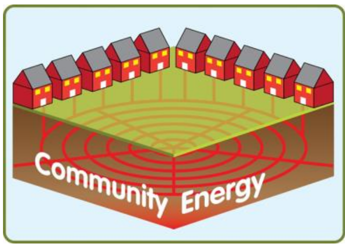
**Our evaluation modelling finds that Energy Mutual could be a viable niche model**, with take-up concentrated among those customers who both can gain high returns from interventions, and have limited alternative sources of low-cost finance available to them.

**The key driver for the success of Energy Mutual is access to investors willing to make socially responsible investments below the market rate.** Sensitivity testing around this parameter suggests that even where this pool of investors is small, the business model can remain profitable, as there are relatively low levels of fixed operating and capital expenditure. However, without access to these investor types, the business model will not be viable.

**Bills are lower under Energy Mutual as the interventions funded deliver savings to consumers.**

**Successful business model providers will need to provide robust on-line capability to both match borrowers with investors and provide assurance to customers of the commercial and financial integrity of the business**. A strong community-focussed brand is crucial to this model, to motivate investors to make these investments. Business model providers will also need to be able to manage risks around customer default.

## Community Energy and Community Energy with Energy Outcomes




A **community-driven** energy supplier with high fuel efficiency and a **strong local brand.** Engaging residents and encouraging **retrofit of homes** as the system extends.

**Generating** locally required **heat and electricity** with combination of CHP, heat pumps and storage technology. Distributing heat, selling electricity to customers and to the wholesale market.

A locally driven Special Purpose Vehicle working closely with the local authority and DNO.

**Community Energy brings benefits to customers by providing them with access to an alternative source of heating.** It also offers customers the chance to join a community-focussed scheme, which engages them and can also drive the installation of interventions such as insulation within homes.

**The evaluation modelling finds that Community Energy delivers value in high density urban communities, where the existing technology is less**

**efficient and limited alternatives exist**. For example, heat pumps may not be viable in some large blocks of flats, and the high-carbon alternatives become very costly under a rising carbon price to 2050. This makes Community Energy a potentially viable model in targeted areas. The lack of existing heat networks forms another barrier: the significant fixed costs of setting up a local network prevent it from being a mass market model for consumers with access to more cost-effective forms of heat, assuming the business model provider requires a commercial return.

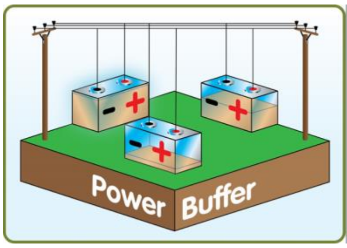
**Sensitivity testing using the evaluation tool shows that the level of diversity in customer needs and preferences is a key driver of the success of Community Energy.** Where customers are more diverse, it makes it more difficult for the business model provider to attract sufficient customers in a given area and to produce a viable business that covers the high fixed costs associated with this model. The fuel costs associated with the heating technology are also an important driver. With low gas prices, Community Energy based around gas-fired CHP is significantly more profitable.

**The impact on bills changes over time.** In areas where it is viable, Community Energy delivers savings to customers on bills in early years. However, where this heating option is provided by gas-fired CHP, costs rise in later years under a carbon price.

**Successful business model providers will need to develop systems integration capability for effective large scale capital delivery projects and work with technology providers to reduce costs**. This will give Community Energy the greatest potential to grow its market. Key risks which the business model provider will need to manage include technical risks around the performance of the heating technology and risks associated with customers wanting to pull out of long term contracts.

**The addition of Energy Outcomes in the model hybrid increases the potential scale of the model**. In this hybrid, customers in the vicinity of a Community Energy scheme could be offered Energy Outcomes. Again this option is only successful in high density urban communities with limited alternative heating options as the profits from an Energy Outcome proposition to customers in the vicinity of a Community Energy scheme are unlikely to be sufficient to make otherwise loss-making schemes viable.

## Power Buffer




Provider of electrical storage capacity to **balance network load, offer flexibility services** and **trade power** on the wholesale market.

Designs, procures, installs, commissions and manages **electrical storage capacity across technologies** at distribution scale.

Load balancing is sold to the System / Network Operator as **a managed service, or pay per use facility.**

**Power Buffer provides cost-effective flexibility services to its customers in the electricity sector (network operators and retailers).** In this way, it helps manage rising electricity load coming from an increasingly inflexible supply mix in a low-carbon smart energy system. It differs from the other business models in that its customers are electricity sector companies, such as distribution network operators (DNOs) and retailers, rather than domestic customers.

**Our evaluation modelling finds that Power Buffer has the potential to deliver value as a niche business model in the 2030s and 2040s**. This value is driven primarily by the benefits it provides to DNOs who use it to defer making a decision to engage in capital-intense reinforcement and new capacity. Revenues from ancillary services to the System Operator provide some additional revenue. This finding is robust under the range of scenarios for meeting carbon targets. The limited uptake of Power Buffer is driven by the high costs of electricity storage relative to alternative options for delivery (principally network reinforcement).

**Sensitivity testing shows that the technology cost of the storage is the key driver of its uptake.** If the storage could be made portable and moved over time to where its value was highest, it would also be a more attractive solution for DNOs.

**By helping to reduce costs for DNOs, Power Buffer has the potential to reduce customer bills.** However, this business model is not viable until later years and therefore does not affect bills in the near to medium term.

**Successful business model providers will need to develop their technology rapidly from leading edge innovation to robust industrial market offerings at a target cost.** This will require a significant cost and reliability focus. Commercially the providers will need to develop contracts which allow them to trade with DNOs and retailers profitably while their capital investment is repaid. Key risks for business model providers are technical risks around the performance of the storage technology and risks associated the DNO finding alternative sources for flexibility.

## Paths to transition

The evaluation tool and the business model assessments have shown the potential for the new value propositions and businesses for low carbon energy. Figure 3 gives a qualitative assessment of factors that may be holding back the development of these new business models[4].

[4] Further detail is provided in Annexe 3, including a description of how an organisation's resources, processes and values (RPV) can dictate its ability to innovate or respond to the disruptive innovation of others.

**Figure 3.** Enabling the market to develop

| | Energy Outcomes | Energy Mutual | Community Energy | Power Buffer |
|---|---|---|---|---|
| Systemic misalignment of current organisations' resource, processes and values with the requirements of an innovative consumer value proposition. | High | High | High | Medium |
| Risk averse current players in the market | High | High | Medium | Low |
| Lack of regulatory clarity or confidence to invest in the new business model (corporate memory or concerns of policy shifts) | High | Low | High | High |
| Lack of a prime mover or Systems Integrator to create / drive a new value chain | High | Medium | High | High |

Source: Total Flow

Changes are required across the value chain to allow these business models to be delivered.

- **The energy value chain will need prime mover businesses to instigate the disruptive change, currently lacking in the energy sector.** In other industries one or more Original Equipment Manufacturers (OEMs) have emerged to orchestrate, coordinate and accelerate the development of systems and the evolution of performance. For example, automotive brands drive supply chain, sales and aftermarket performance, in contrast with domestic energy supply, intervention delivery and heating, which are spread among a range of players. The inability to meet current energy consumer expectations is a result of misalignment of organisational resources, processes and values (RPV).

- **This means systems integration will be crucial for delivery efficiency.** A systems integrator takes responsibility for specifying the performance requirements of their system and leads the value chain to deliver all the elements at a target cost. When the system works and is worth the cost people will buy it, creating a brand and giving OEMs scale. This enables the supply chain to collaborate and grow. Developing a system integration capability will take time and cost but the returns for the first successfully integrated energy systems providers could be substantial.

- **Enabling technologies and systems will need to increase in efficiency.** Enabling technologies currently underperform for their price point and are too unreliable. Function, performance and price point need to transform to appeal to a mass market.

- **Business will need to engage customers.** Consumers show little interest in energy system change: their imaginations have not been captured by a compelling proposition or brand. Consumer brands are lacking in the mass energy market and the products and services are not differentiated or attractive to the majority.

- **Risks should be borne by those best placed to manage them.** If the incentive for reliability moves from the user, who does not have the capability to improve it, to the designer/manufacturer who does, major improvements in reliability and cost can result. The supplier is incentivised to increase performance and reliability while driving down cost when being paid for 'power by the hour' rather than for a capital asset.

## Policy direction

Our business models have been designed to be viable in the context of a low-carbon smart energy system[5]. In particular, they have been designed to be successful given the new patterns of risk and reward that will be present in a low-carbon economy. These are expected to come from changes in heating technologies (including significant investment in energy saving interventions and the uptake of technologies such as heat pumps), changes in the energy production mix (a shift from gas to electricity) and advances in ICT (in particular, the transition from dumb to smart meters).

Major policy intervention will be required over the next decade to ensure this energy system is delivered, both to incentivise low-carbon heating technologies and to decarbonise energy supply.[6, 7]

**The credibility and stability of climate change policy is crucial, both for overall climate targets to be met, and for innovative business models to emerge.** Unless these policies are believed to be effective and stable, innovation in business models will be difficult. Since the models often require a large upfront sunk investment, investors must have the confidence that they will be allowed to earn sufficient profit in future years to justify the initial outlay.

5 We have designed and evaluated the business models in the context of a world where carbon targets are met. However, they may also be viable without successful climate policy. This is not something we have tested.

6 For carbon targets to be met there would need to be a price on carbon, or equivalent policy instruments would need to be in place. Since we are aiming to test how these business models perform in the context of a world where carbon targets are met, we have evaluated each business model under scenarios which include an economy-wide carbon price. This price is an exogenous input, based on DECC carbon price guidance. We have separately assessed what policy support is required for each of the business models (Annexe 4).

7 We note that policy support for low-carbon heating is currently stronger than that under our assumed carbon price. On a per kWh of heat produced basis, the Renewable Heat Incentive provides an incentive six times greater than the incentive that would be provided by an economy-wide carbon price.

We have identified some specific policies that would need to be adopted to enable the business models and these are summarised in Figure 4. These illustrate that creating the right policy environment for these business models will require trade-offs with other policy goals

**Figure 4.** Policy requirements for business models

| | |
|---|---|
| **Limitation on energy tariffs** | Ofgem is introducing legislation to cap the number of tariffs retailers can offer, in response to a concern that multiple tariffs were confusing and leading to disengagement. This policy will fundamentally constrain any business model that requires tariff innovation at the domestic customer level (such as Energy Outcomes). |
| **Lack of long term wholesale market liquidity** | The Energy Outcomes business model offers customers long term fixed energy costs. For this to be viable, the provider must be able to hedge fuel price risk over the longer term. Five year contracts to hedge power prices are currently not traded, and more medium term (two to four year) contracts have low liquidity levels. Ofgem has been looking at liquidity issues for a number of years, and its current proposals for reform may improve this situation. |
| **Unviable risk return trade off for investors** | The Energy Mutual model requires small investors to put up funds in what could be seen as a high risk scheme. Although the platform itself could insure against default of individual borrowers, there will still be the risk of collapse of the Energy Mutual provider itself. One option is would be for Government backing to be provided through the Financial Compensation Scheme. |
| **Customer reluctance to invest in retrofits** | The retrofit market has been slow to take off and many barriers have been identified such as high up-front cost, lack of information and a lack of accredited suppliers. Overcoming these barriers is a central aim of the Green Deal. Policy stability to encourage one or more retrofit systems integrators to make a step change in performance and disrupt a currently incapable market may be even more important in this area. |
| **Limits on DNO activities** | The provisions under the EU Third Energy Package may prevent DNOs taking on new roles in the provision of storage or retail of energy from CHP (subject to some exceptions for installations of small size). These restrictions could limit the options for rolling out the Community Energy and Energy Buffer models. |

Source: Frontier Economics

# 2 Introduction

Frontier Economics and Total Flow have been commissioned to deliver Work Area 4 of the ETI's Smart Systems and Heat (SSH) project. This Work Area addresses how value can be delivered across the smart systems energy value chains (in the context of domestic and small business customers in GB) and how future systems might be configured and operated.

This report presents the conclusions of the second part of Work Area 4. It describes the development and initial, indicative evaluation of new business models and value delivery mechanisms to deliver smart systems and heat in a low-carbon economy.

At this stage**,** the evaluation explicitly focusses on the drivers of value for each business model, rather than trying to predict uptake levels and associated cost and benefits. The numerical outputs of the evaluation are only a starting point: they reflect assumptions and algorithms designed to represent the basic business model design and a set of currently available inputs and values. The real value does not come from considering a single set of outputs. Instead it comes from understanding how business models perform under different assumptions to identify what drives value. ETI will verify and update these inputs and assumptions over time (aligned to outcomes from other programme deliverables, validation trails etc.) which will affect the outputs presented in this report.

We understand that it is the intention that BMET (the evaluation tool) capability continues to be developed in order to align to and support the ongoing aims and objectives of the SSH Programme. Only the current capabilities of BMET are referenced in the report.

The report is structured as follows:

- this section describes the context and objectives of the report;
- Section 2 outlines the methodology;
- Section 3 presents an overview of the outputs of our work;
- Section 4 summarises key insights from the analysis; and
- Section 5 sets out our conclusions and recommendations.

## 2.1 Context

The UK has signed up to legally binding targets to reduce greenhouse gas emissions by 80% over 1990 levels by 2050. To achieve this target, analysis suggests that major reductions in emissions from the heating sector will be required by 2050[8]. At the same time, the smart meter rollout and the development of smart technologies are presenting new opportunities to reduce carbon emissions in a cost-effective way.

In this context, the ETI's SSH programme aims to design a first of its kind smart energy system in the UK. The programme is focussing on domestic customer requirements for space and water heating, in the context of other energy service needs in buildings, and taking account of the evolution of the whole energy system out to 2050.

This project (Work Area 4) is part of the first phase of the SSH programme, which aims to develop the toolkit and capacity to deliver a prototype Smart Energy System to the mass market. Phase I comprises six work areas focussing on technological and commercial aspects of the development of a smart energy system. The second phase will validate the research carried out in the first phase with a significant system level demonstration.

## 2.2 Objectives

The overall objective of Work Area 4 (WA4) is to address how value can be delivered across the smart systems energy value chains to domestic and small business customers in Great Britain, and how future systems might be configured and operated.

The first phase of WA4 characterised the current energy value chains for domestic and small business heating[9]. The aim of the first phase was to allow us to understand the drivers of business models and value delivery mechanisms, and to identify key tensions and issues within the current market place which may be important in the move to new business models.

In this second and final WA4 report, we focus on the future smart energy system.

- We identify potential value delivery mechanisms and business models[10] that can meet customers' needs across the entire smart systems delivery chain in the UK.

- We provide an evaluation framework to enable structured thinking around the performance of alternative potential business models under a range of future circumstances and scenarios.

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8 DECC and CCC analysis suggests that the heating sector will need to be almost completely decarbonised by 2050.

9 Frontier Economics and Total Flow (2013), *WP 4.1.Characterisation of the current energy value chain*

10 Throughout the report, we refer to business models to mean both business models and value delivery mechanisms.

- We characterise approaches to transition from current value chains and business models to future options.

The report is accompanied by an evaluation tool (BMET) populated with six initial business models (including two hybrids), and a model user guide, which describes how the tool works and how additional business models can be added to the tool.

# 3 Methodology

This section describes our methodology for developing and evaluating business models. The outputs of the work produced by each activity are presented in Section 4.

## 3.1 Changes to risk and reward

To develop business models, we first need to understand how the balance of risk and reward may change in the move to a low-carbon economy. In Part 1 of this project[11], we developed a detailed understanding of the existing smart systems delivery chain, including the finance framework. In this second part of the project, we have assessed likely changes in the future, focussing on the characteristics of energy demand (including enabling technologies), energy supply, and the value chain as a whole, both in a future low-carbon economy and in the transition to that economy.

To encompass uncertainty over the future, we analysed a set of scenarios based on differing cost and technology assumptions. The output of this work was a set of three "disruptions" and a matrix describing the ways in which the balance of risk and reward is likely to change in the move to a low carbon economy. These outputs are presented in Section 4 below.

## 3.2 Business model generation

To meet the challenge of developing new, innovative business models we took a whole system perspective of the energy value chain and examined how the elements combine to influence affordability, sustainability, security and customer acceptance.

We developed our business models using two parallel approaches.

- **Left to Right.** New business models need to fit the new pattern of risk and reward likely to be associated with a move to a low-carbon economy. To undertake the *Left to Right* approach, we focussed on the three key disruptions associated with a move to a low- carbon economy and developed business models that could help manage the challenges associated with these disruptions.

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11 Frontier Economics and Total Flow (2013), *WP 4.1.Characterisation of the current energy value chain*

- **Right to Left.** A *Right to Left* approach starts with the requirements of customers and aims to be unencumbered by existing business models and processes. Three key steps in this process are:
  - understanding what individual customers, groups of customers, channel owners and other stakeholders perceive as valuable and burdensome;
  - translating these values into a precise definition of a product and/or service proposition that a target customer group find, or would find, compelling; and
  - translating each value proposition into a statement of operational requirements and then into an end to end value stream capable of supplying the value proposition on demand profitably[12].

We explicitly aimed to produce business models covering a wide range of options for delivering value in a low-carbon economy. To avoid the risk of narrowing options too early we looked at all options for the four core components of upstream, networks, retail and enabling technologies drawing on processes of *Left to Right* and *Right to Left* thinking, and on an **international review**[13] of innovation in consumer markets and examples of best practise.

At the mid-point of this phase of the work we tested the initial outputs of our thinking at a **stakeholder workshop**.[14] The workshop shared the research approach and tested emerging business models in order to gain guidance on the potential of, and likely challenges to, new models and propositions.

The output of this process was a large number of options. This long-list of options was then **filtered based on a set of criteria (Figure 5)**. Filtering reduced the list to twenty value propositions.

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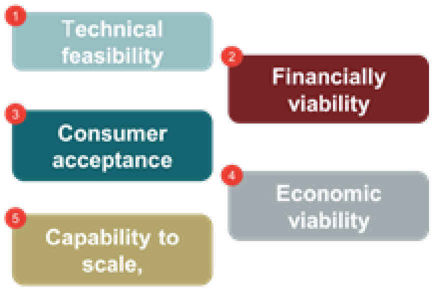
12 Johnson, Christensen, and Kagermann (2008), *Reinventing Your Business Model*

13 The international review is presented in Annexe 6.

14 This workshop involved participants from ETI, ETI members, Other Smart Systems and Heat project teams and Ofgem.

**Figure 5.** Summary of shortlisting criteria




Source: Frontier Economics and Total Flow

As the detail and richness of the solutions emerged, we produced business model canvases[15]. This canvas covers all key aspects of the operation of each business model and its transition from the current market in a standard format.

The most promising business models were developed firstly in to the business model canvas and then, if selected for further development, into a deeper assessment framework. This process reduced the number of business models to six (four core business models and two hybrids).

## 3.3 Paths to transition

After establishing the six business models options, we then could understand how current organisations, customers, technologies, processes and policy could make the transition to these new models. We looked at value chain organisations, customers, technologies and processes.

### Value chain organisations

The first part of this process was to establish the fundamental differences between the businesses and their partners in the current and future states.

Research into the enablers and effects of disruptive innovation has revealed three factors that dictate an organisation's ability to innovate, or to respond to the disruptive innovation of others.[16] These are:

- a sufficient and appropriate mix of tangible and intangible **Resources** e.g. people, equipment, footprint, ideas, insight, money;

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15 Adapted from the Business Model Canvas from BusinessModelGeneration.com, licensed under the Creative Commons Attribution-Share Alike 3.0 Unsupported License. Available at: [http://www.businessmodelgeneration.com/canvas](http://www.businessmodelgeneration.com/canvas).

16 Christensen and Overdorf (2000), *Meeting the Challenge of Disruptive Change*

- fit for purpose **Processes** that enable work to be completed on time to standard; and
- a complimentary set of organisational **Values** that enable risks and opportunities to be assessed quickly and correctly, good decisions to be made and appropriate and sufficient resources to be invested.

These three factors make up an organisation's RPV. Where there are gaps and misalignments between current organisations' RPV and the RPV required for our six smart systems business models, the options are to: transform an existing business to meet future RPV requirements; set-up a new vehicle to precisely fit the requirement; or create a joint venture or special purpose vehicle which blends the capabilities of existing businesses.

Each option poses challenges in terms of funding, timescale and cost to deliver. The most destructive challenge is overcoming the misalignment of organisational values.

### Consumers, technologies and processes

We also considered factors around consumers, technology and processes which could affect the transition.

- Consumer attitudes will naturally migrate over time, but if they can be influenced to adopt low-carbon solutions earlier the transition will accelerate.
- The rate of change of technology and the direction of development will have a significant impact on the transition trajectory.
- The efficiency of business and physical processes greatly influence both the cost and user acceptance of any new or adapted value proposition.

All of these factors evolve over time and have a direct impact on the commercial viability and risk alignment.

### Policy

Policy can either hold back or promote new business models and innovation. To understand policy requirements, we first outlined the policies required for the introduction of a smart energy system. Taking each business model in turn, we then looked at the barriers associated with each business models, and the policies required to overcome these barriers.

## 3.4 Evaluation

The evaluation aims to provide a useful means for structuring thinking around the costs and benefits of business models of different types. It aims to allow the

ETI to understand the drivers of value for each business model, and how the associated costs and benefits may change under different conditions.

We evaluated the business models against a set of criteria, agreed with the ETI. These are shown in **Figure 6**.

**Figure 6.** Evaluation criteria

| For business models at local, regional or GB scale, from now until 2050 | |
|---|---|
| Profitability | Can the business model provider make a profit?<br>What is the rate of return associated with different prices? |
| Consumer bills and added value | How much will consumer bills change under the business model?<br>What added value (non-monetary benefits) will they receive? |
| Energy use and emissions | What impact will the business model have on energy consumed and carbon emissions? |
| Adaptability | How does the business model perform under different scenarios?<br>How flexible is it in the face of uncertainty over future conditions? |
| Scale | What is the size of the addressable market?<br>How much of this could a feasible business model supply? |
| Value chain impacts | What costs or benefits will the business model have across the value chain |
| Policy | What level of subsidy (if any) will be required?<br>What are the other required characteristics of the policy environment? |
| Access to finance | What terms might financial backers of the business model require (this will depend upon its risk) |

Source: Frontier Economics

We then divided domestic customers into representative groups, to ensure our analysis could capture some of the diversity between these customers. These are summarised in **Figure 7**. For all business models except Power Buffer (where each "customer" is a DNO feeder) BMET has been pre-populated with a set of household groups based on ETI analysis of Experian Mosaic data. These groups cover 80% of UK households. These groups should be broadly representative of characteristics such as age, household size and location (urban, suburban or rural). However, given the granularity of these customer groups, it is inevitable that they will not be perfectly representative for all characteristics. The ETI has been carrying out further research into customer segmentation, which could be incorporated into BMET at a later stage.

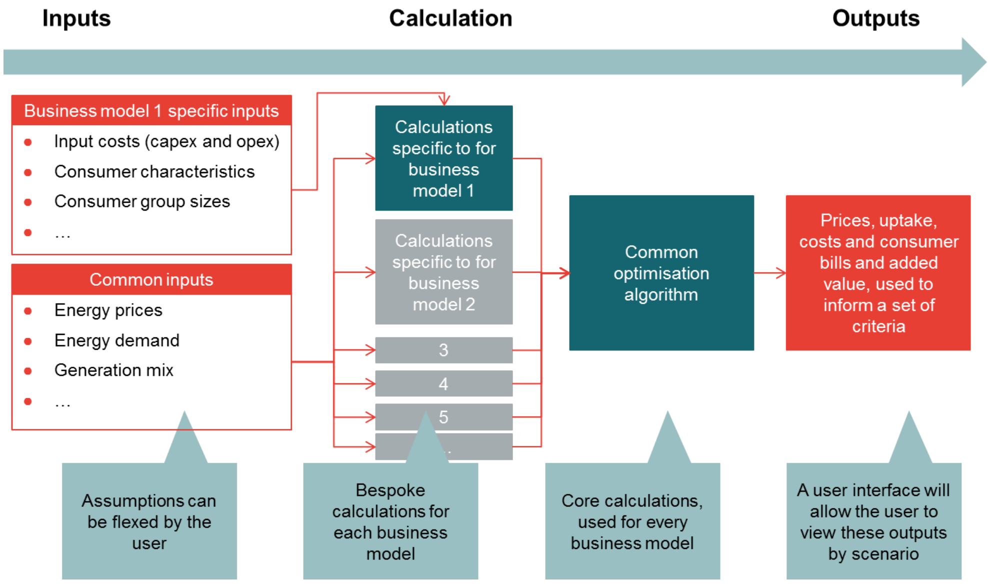
**Figure 7.** Key attributes of customer groups in the tool

| Group name | Affluence | Location | Typical property type (insulation level) | Current heating tech | Proportion of all households |
|---|---|---|---|---|---|
| Young Starters | Mid | Urban | Medium | Gas boiler | 9.8% |
| Busy Comfortable Family | High | Suburban | Medium | Gas boiler | 11.7% |
| Older Established | High | Suburban | Medium | Gas boiler | 7.4% |
| Greener Graduates | High | City centre | Poor | Gas boiler | 6.1% |
| Middle Grounders | Mid | Suburban | Poor | Gas boiler | 7.7% |
| Stretched Pensioners | Low | Suburban | Good | Gas boiler | 9.8% |
| Successful Ruralites (gas) | High | Rural | Poor | Gas boiler | 4.2% |
| Transitional Retirees | Mid | Semi Rural | Poor | Gas boiler | 3.2% |
| Unconvinced Dependents | Low | Urban | Good | Electric resistive | 5.2% |
| Urban Constrained | Low | Urban | Medium | Gas boiler | 8.6% |
| Successful Ruralites (oil) | High | Rural | Poor | Oil | 4.2% |
| Off Grid Rural Electric | Mid | Rural | Poor | Electric resistive | 2.6% |
| | | | | | **80.5%** |

Source: Frontier Economics

To carry out this evaluation, we built an Excel-based Business Model Evaluation Tool (BMET) which allows the business models to be systematically and quantitatively assessed against each of the criteria across each of the customer groups. An overview of the tool is presented in **Figure 8**.

**Figure 8.** Evaluation tool- overview




Source: Frontier Economics

BMET is particularly focussed on allowing exploration of the viability of business models and their impact on consumers over the long term, under different conditions. It allows the user to understand the drivers of value for each business model, and therefore, the suitability of business models for different conditions. However, it does not aim to predict uptake of business models in the short run. This is illustrated in **Figure 9**.

**Figure 9.** Focus of the Business Model Evaluation Tool

| It is well suited to… | It is currently less suited to… |
|---|---|
| • Exploring how the long-term viability of business models vary under different conditions | • Modelling short-term barriers to take-up |
| • Determining what factors underpin the success or failure of a business model | • Producing quantitative forecasts that could immediately be used for business planning |
| • Seeing how the take-up of a business model could vary across broad customer types | • Highly detailed customer segmentation |

Source: Frontier Economics

# 4 Overview of outputs

This section describes the outputs of the work completed.

## 4.1 Changes to risk and reward

There are three main disruptions associated with the move to a low-carbon economy:

- **Changes in heating technologies.** To meet 2050 targets requires a substantial decarbonisation of heat. The scenarios we have examined include significant uptake of heat pumps, and a greater rollout of district heat.

- **Changes in the energy production mix**. Meeting decarbonisation targets will entail a significant shift in the sources of energy supply – with a shift from gas to electricity, and radical changes in the electricity generation mix. The new low-carbon technologies such as nuclear, wind and carbon capture and storage are less flexible and more capital-intense than the typical incumbent technologies.

- **Advances in ICT and the technology transition from dumb to smart meters.** Energy retailers are rolling out smart meters to all domestic and SME customers by 2020. Widespread rollout of smart meters will make near real time information on energy use available and will facilitate a range of new tariffs and business models across the sector. HEMS will be able to make use of data on tariffs and demand to enable consumers to optimise their energy usage.

**Figure 10** summarises the consequences for risk and opportunities for reward of each of these disruptions, some of which will apply mainly in the transition[17].

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17 The detailed analysis is set out in Annexes 1 and 7.

**Figure 10.** Changes to risk and reward

| | New risks | New opportunities for rewards |
|---|---|---|
| **Changes in heating technologies: increase in heat pumps, insulation, district heat** | Increases in peak electricity demand and new unfamiliar demand patterns for electricity (transition)<br>Reduction in the market for oil and gas and reduced utilisation of the gas network<br>Increased competition in the supply of electricity and electricity balancing services from CHP plants<br>Increase in political scrutiny on electricity bills driven by rising electricity demand | Increase in electricity demand<br>Increase in the opportunities to supply fuel (gas or biomass) to CHP plants<br>Increase in the requirement for electricity network expansion<br>New heat networks required |
| **Changes in the energy production mix: shift from gas to low-carbon electricity** | Reduction in supply-side flexibility<br>Increase in political risk for electricity producers - greater reliance on policy support and a global commitment to climate mitigation<br>New generation technologies (e.g. CCS)<br>Greater capital-intensity of generation technologies<br>New generation patterns (transition)<br>Greater volatility in wholesale electricity prices | Increase in the opportunity for flexibility services (e.g. from peaking plant, storage or demand side response)<br>New networks required for carbon capture and storage<br>Expansion required to connect increase in distributed generation<br>Opportunity for businesses managing price volatility for consumers |
| **Advances in ICT: Technology transition from dumb to smart meters , introduction of home energy management systems (HEMS)** | Risk to retailers of stranding of an expensive asset<br>More cost-reflective pricing creating new winners and losers<br>Data protection and privacy issues<br>Risk of customer disenchantment<br>Compatibility and requirements to work with central systems | Greater information available to allow more accurate network planning and design<br>Increase in the ability for demand side changes which add flexibility (e.g. time of use tariffs)<br>Opportunity for businesses which manage consumers overall demand<br>New opportunities for technologies which respond automatically to signals from smart meters (e.g. smart fridges) |

Source: Frontier Economics

## 4.2 Business models

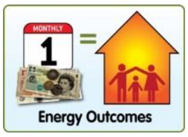
The outcome of our business model development process, in the context of these new risks and opportunities for rewards, was six initial business model ideas (including two hybrids).

- Energy Outcomes;
- Energy Outcomes with additional storage (hybrid);
- Energy Mutual;
- Community Energy;
- Community Energy and Energy Outcomes (hybrid); and
- Power Buffer.

**Figure 11** to **Figure 15** present summary versions of each business model canvas, highlighting what makes each business model distinctive. These describe the critical impacts these models have on the energy system and the appeal for consumers.

The canvases are presented in Annexe 2 with further detail on the business models in Annexe 9.

**Figure 11.** Energy Outcomes: highlights




| | |
|---|---|
| Idea | **Provision of comfort for a predictable monthly fee. Not per kWh**. Removes the burden of asset ownership, repair and maintenance and the risk of fluctuating energy costs. Reliable comfort.<br>**A better performing system with experts optimising your energy use.** Energy security, performance and comfort, from a brand you trust.<br>A multi-year contract to pay for comfort. The provider takes responsibility for investing in energy system and the consumer selects the level of comfort and their tolerance for physical change to their system. |
| Model value | This transforms energy retail with **the Energy Outcomes providers' profit directly linked to the reduction in their customers' total energy consumption.**<br>Potential to engage the majority of householders who have little interest in energy, but want a great service for an affordable price. |
| Revenues | The business charges a **regular monthly fee, smoothed over the contract,** to give consumers stability of payment.<br>Consumers have options to invest up-front in order to reduce their monthly payment; akin to the deposit for a mortgage. |
| Options | A matrix of options will be needed to cover **comfort level**, **depth of retrofit** the consumer will tolerate and the **term** of the outcomes contract (which has a great influence on the monthly fee). This needs to be presented to the consumer in a very straightforward way.<br>Could link with home energy **Storage** and / or with **Community Energy** and **Energy Mutual** finance. |
| Value chain players | A powerful **consumer branded** entity which can convince consumers that they genuinely have energy and cost saving as a driver. Delivery partners with a **service ethos** to minimise domestic disruption and hand-over a vastly improved system. |

**Figure 12.** Energy Outcomes and additional storage: hybrid

| | |
|---|---|
| Idea | The Energy Outcomes model uses **smart connectivity** to allow the provider to track consumer usage, The provider uses this data to **aggregate demand** and minimise the costs of providing the energy.<br>Adding storage capacity (heat and or electricity) at the domestic level gives the Energy Outcomes provider the ability to shift more consumers' demand off-peak and so improve **demand side response** to achieve better pricing from the electricity market. |
| Application | The storage option becomes particularly important for homes as they shift from gas to electric heating and so more dependent on the kWh price. The greater the **variability of hourly prices** the greater the viability of adding heat and electricity storage, particularly for winter periods. |
| Challenges | The addition of storage in the home may be seen as a burden to consumers and so needs positive presentation to be accepted: Loss of domestic **space**, slower **response** and installation **disruption**.<br>The additional **capital cost** of storage will add to the system costs and will need to be factored in to the risk profile for saved cost or extended consumer term. |

Source: Total Flow

**Figure 13.** Energy Mutual: highlights


| | |
|---|---|
| Idea | A brokerage **enabling households unable or unwilling to invest**, to access finance for energy saving improvement.<br>A mechanism for overcoming householders' inertia to take energy saving action; by developing a compelling business case **others can invest in.**<br>An engaging web-based trading platform which enables the matching of borrowers with lenders and investors with investment opportunities. A rapidly recognised, trusted brand. |
| Model value | An enabling investment vehicle to **stimulate domestic energy change** as a one-stop-shop for finance, business case, installation, energy retail and maintenance.<br>Enables **every property in the UK to enter the energy saving market** irrespective of the householder's capability to invest. |
| Revenues | The business generates revenues on a **'pay per transaction**' basis for each borrower/lender match made.<br>Accredited **installers pay commission** for work won through the portal: this must not corrupt the integrity of Energy Mutual. |
| Options | There are options for investors and borrowers to take on different levels of **risk and reward**.<br>At its simplest Energy Mutual offers loan provision to households at an attractive rate.<br>Where an **external investor** enables the energy saving change the property owner gets improvement at a known monthly cost. |
| Value chain players | An organisation with **financial integrity** and **ethically driven** to connect with borrowers and investors.<br>Home improvement delivery partners with a goal of **maximising their customers' energy savings** and minimising domestic disruption. |

Source: Total Flow


**Figure 14.** Community Energy: highlights

| | |
|---|---|
| Idea | A **community driven** energy supplier with high fuel efficiency and a **strong local brand.**<br>Engaging residents in their network and encouraging **retrofit of homes** as the system extends.<br>**Generating** locally required **heat and electricity** with combination of **CHP, Heat Pumps and storage** technology. Distributing heat, selling power at scale to the grid and customers.<br>A locally driven Special Purpose Vehicle working closely with the Local Authority and DNO. |
| Model value | A **step change in fuel efficiency** through a blend of CHP, large scale ground source heat pumps and community scale energy storage.<br>Transforms the relationship between energy supplier and communities; **giving consumers a greater stake in their energy supply** and engaging them in the evolution of their system. |
| Revenues | Revenues from **domestic customers** on a traditional or Energy Outcomes payment basis. Consumer retention should be very high provided brand **trust and cost competitiveness** can be preserved.<br>Additional **community and commercial users of heat** may form part of the base load heat demand. This will contribute the payback for the high levels of capital investment. |
| Options | Highly desirable to have the technology provider on a **'power by the hour'** basis to incentivise system reliability and reduced capital cost.<br>**Integration with local DNO** for capital delivery synergies and network balancing capability to improve network resilience and postpone the need for infrastructure upgrade as demand grows. |
| Value chain players | **Local brand:** Bristol Energy Co-op. **Large-scale technology partner:** Powered by Rolls-Royce. **Community Engagement:** Supporting local schools.<br>Highly effective network delivery, retrofit and maintenance partners with a remarkable consumer focus. |

Source: Total Flow[18].

**Figure 15.** Community Energy and Energy Outcomes: hybrid

| | |
|---|---|
| Idea | The outcomes 'pay for comfort' offer gives householders **comfort & peace of mind for a fixed fee**.<br>This **encourages take-up of retrofit** and achieves greater scale for heat-loss reduction work.<br>Engaged consumers currently too far from the heat network can take-up the Energy Outcomes offer using alternative heating systems; ensuring they are not excluded from the Community Energy ethos. |
| Application | The Energy Outcomes option is most appealing to users who have little understanding of how they can influence their bills.<br>If the prime-mover for Community Energy is a **social housing** estate there is likely to be potential for take-up of an affordable outcomes based solution. |
| Challenges | An Energy Outcomes contract for a **short-term social tenancy** could prove challenging to structure: Combining the requirements of the building owner, the bill payer and the outcomes provider.<br>Adding an additional options of Energy Outcomes provision to a Community Energy offer may cause confusion for some consumers. Too much choice may lead to doing nothing. |

Source: Total Flow

18 Note: Power by the hour means the Community Energy provider contracts from the producer of CHP technologies for hours of CHP operation rather than for ownership of the CHP asset

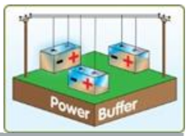



**Figure 16.** Power Buffer: highlights

| | |
|---|---|
| Idea | Provider of electrical storage capacity to **balance network load, offer flexibility services** and **trade power** on the wholesale market.<br>Designs, procures, installs, commissions and manages **electrical storage capacity across technologies** at distribution scale.<br>Load balancing is sold to the System / Network Operator as a managed service, or pay per use facility<br>Retailers and large energy users can buy Power Buffer capacity on a spot rate or contracted basis. |
| Model value | To provide cost effective network levelling capacity which responds to: **consumer and business** demand variation and also fluctuations in **intermittent renewable generation** output.<br>A back-up provision preventing **planned and unplanned outages** impacting the consumer.<br>To achieve this Power Buffer **must be more cost-effective** than the investment required to increase generation and distribution capacity. |
| Revenues | **Contracted or pay per use** payment from the **System and Distribution Network Operators** for providing a responsive alternative to network reinforcement and peaking generation capacity.<br>**Trading electricity** to offer retailers and large energy users an alternative means of balancing. |
| Options | There would be value in a linked network of Power Buffers across a city or region to give greater system resilience and flexibility to cope with intermittent renewable generation.<br>The benefit of levelling grid loads has potential at **multiple scales** from domestic to grid. As technology improves cost per kW and kWh stored will fall. |
| Value chain players | A sizeable, respected **technology brand** which offers flexible options for design delivery and operation.<br>Potential to become an integral part of network provision, in partnership with Network Operators, large users and generators. |

Source: Total Flow

## 4.3 Evaluation outputs

**Table 1** summarises the outputs of the evaluation.

**Table 1.** Summary of initial indicative business model evaluation

| Criteria | Energy Outcomes | Energy Outcomes with additional storage | Energy Mutual | Community Energy | Community Energy with Energy Outcomes | Power Buffer |
|---|---|---|---|---|---|---|
| **Potential scale** | **Mass market potential**<br>Can deliver benefits to a range of customer groups by providing households with the outcome that they require (comfort). Uptake is driven by reduced hassle for customers, by cost-effectively delivering household interventions and by transferring energy cost risk to business model providers. | **Storage element has potential for high electricity users in the long term**<br>Under our assumptions, domestic storage is likely to become cost-effective over time for most groups. This only occurs in the long run however, as technology costs fall, and as within-day price variation on the electricity supply side increases. | **Niche potential**<br>Delivers benefits to customers facing credit constraints, and can make it easier for these customers to engage with energy investments.<br>Likely to be niche rather than mass market as relies on a supply of investors willing to make a socially- responsible investment at below the market rate. A given supply of funds could cover more households if targeted at cheaper interventions (e.g. HEMS rather than heat pumps). | **Targeted potential**<br>Delivers benefits to customers by providing access to an alternative heating source.<br>Likely to be successful in targeted areas as it relies on a high density community (to keep network costs down) with relatively homogenous requirements (so the provider can have confidence that take up will be high). | **Targeted potential**<br>Can reach a more diverse set of customers than Community Energy, but still requires a core of high density customers with relatively homogenous needs. | **Niche potential in the long term** Can help network operators and retailers reduce their costs.<br>Likely to have niche rather than mass market potential unless the cost of storage technology falls more significantly than currently expected. |

| Criteria | Energy Outcomes | Energy Outcomes with additional storage | Energy Mutual | Community Energy | Community Energy with Energy Outcomes | Power Buffer |
|---|---|---|---|---|---|---|
| **Customer costs** | **Slightly lower than the counterfactual for intervention purchase, then slightly higher**<br><br>Customers would purchase retrofits in the absence of the business model (and make energy savings), but at more expensive rates of finance.<br><br>Once interventions are installed, customers are willing to pay slightly more for fixed bills. | **Higher in the near-term, lower in the long-term for high-usage groups**<br><br>Until storage is cost-effective, this business model imposes additional costs relative to the standard Energy Outcomes business model. After this point, it provides a benefit to customers. | **Slightly lower than the counterfactual**<br><br>Customers would purchase interventions in the absence of the business model (and make energy savings), but at more expensive rates of finance. | **Lower in the near term, higher in the long-term**<br><br>Customers who previously had inefficient heating systems[19] initially make savings but costs rise with carbon price in later years. | **Depends on offer**<br><br>Those customers offered Community Energy will have lower costs in the near term but higher costs in later years. Energy Outcomes customers will have lower costs associated with the intervention and then face slightly higher costs in return for fixed bills. | **Reduced costs for customers in later years**<br><br>DNO costs would be reduced, which will feed through to lower bills. |

19 Under our assumptions, electric resistive heating is relatively inefficient.

| Criteria | Energy Outcomes | Energy Outcomes with additional storage | Energy Mutual | Community Energy | Community Energy with Energy Outcomes | Power Buffer |
|---|---|---|---|---|---|---|
| **Commercial viability** | **Viable**<br>In a competitive market, the businesses can make sufficient profit to compensate investors. | **Viable in the long-term**[20]<br>In a competitive market, the businesses can make sufficient profit to compensate investors. However, storage is not currently cost-effective. | **Viable**<br>Potentially highly profitable, if the Energy Mutual providers are the only means through which customers can access this form of finance. | **Viable in certain areas**<br>Sufficiently profitable over the long-run (to 2050) in high-density areas for customers with relatively inefficient incumbent heating systems.[21] | **Viable in certain areas**<br>The Energy Outcomes model is viable for a wide range of customers, but is limited here to areas with potential for a profitable Community Energy scheme. | **Viable in the long term**<br>Ultimately profitable, but not until approximately 2030 when significant rollout commences. |

20 Other forms of storage not delivered through energy outcomes (such as distribution network connected storage) may prove to be more cost-effective. If this is the case then this business model may not be viable.

21 It is only viable if customers can be tied in to the business model over the lifetime of the assets, given that costs will be higher than the counterfactual in later years. As noted, we assume the incumbent systems for these customers are relatively inefficient electric heating systems.

| Criteria | Energy Outcomes | Energy Outcomes with additional storage | Energy Mutual | Community Energy | Community Energy with Energy Outcomes | Power Buffer |
|---|---|---|---|---|---|---|
| **Emissions and energy use** | **Brings forward emissions savings**<br>Brings forward take-up of HEMS and heat pumps, although for most groups these would be taken up eventually anyway in the counterfactual. | **Increase in electricity consumption, potential reduction in emissions (compared to model without storage)**<br>Storage losses from battery lead to increase in overall electricity consumption. However, ability to shift load might lead to lower emissions if renewables can be better utilised. | **Brings forward emissions savings**<br>Brings forward take-up of HEMS and heat pumps, but these would be taken up eventually anyway in the counterfactual for most groups. | **Increase in gas use and long-run increase in emissions, for a gas-fired CHP system**[22]<br>Substitution of gas for electricity initially decreases emissions very slightly but ultimately increases them against the counterfactual. | **Long-run increase in gas use and emissions**<br>The Energy Outcomes part of the offering only brings forward take-up of insulation and heat pumps, so the long-term effect is the same as for Community Energy alone. | **Similar to counterfactual**<br>Battery losses are offset by a reduction of thermal losses. |

| Criteria | Energy Outcomes | Energy Outcomes with additional storage | Energy Mutual | Community Energy | Community Energy with Energy Outcomes | Power Buffer |
|---|---|---|---|---|---|---|
| **Value chain spillovers** | **Brings forward required investment in networks and generation**<br>A more rapid adoption of heat pumps leads to reinforcement costs being incurred earlier. | **Reduction in costs for network operators and the cost of generation**<br>Acceleration of uptake of heat pumps relative to the counterfactual is offset by the use of batteries to flatten peak demand. | **Brings forward required investment in networks and generation** A more rapid adoption of heat pumps leads to reinforcement costs being incurred earlier. | **Reduction in costs for network operators and the cost of generation**<br>Where the incumbent technology is electric resistive heating, a move to community energy will reduce grid electricity use, and therefore reduce pressure on the electricity grid. | **Long-run reduction in costs for network operators and the cost of generation**<br>The main long-term effects are driven by the Community Energy component. | **Reduction in costs for TNO and the cost of generation**<br>The use of storage reduces overall peak demand.<br>The reduction in network costs is paid for by DNOs and is therefore not a "spillover". |

Source: Frontier Economics

22 These results relate to the gas-fired CHP plant considered in our modelling. It would also be possible for the CHP plant to be powered by renewable sources, for example biomass. Alternatively, the Community Energy model could be delivered through an array of large heat pumps.

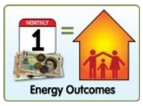
# 5 Indicative insights

In this section, we present insights in two areas:

- characteristics driving the success of the  business models; and
- the most important enabling actions.

## 5.1 Features of the business models that drive success

We now focus on the core features of each the business models that drive their value.  We also consider the risks faced by the business model provider.




### Energy Outcomes

Energy Outcomes has the potential to deliver value as a mass market model.

- **The success of this model depends partly on how effectively the provider can manage risk on behalf of customers, and how much customers value this service.** There are two types of risk that this model manages on the customer's behalf.
  - **The first is the risk associated with installing interventions in the property.** If customers are uncertain of the benefits, the provider can offer the customer certainty of savings. The greater the uncertainty customers have about the savings, the more take-up there will be of this business model by customers who have not yet installed interventions. Flexing customers' uncertainty about the impact of interventions has a big impact on take-up of this business model.
  - **The second is long term management of fuel price risk.** Long term hedging of fuel prices comes at a cost. The size of this premium will determine the take-up of this model given that customer preference for opting for this certainty will depend on its cost. Assumptions on this cost/preference drive whether customers stick with this business model once the first contract period ends and their homes have been retrofitted with energy saving measures.
- **Energy Outcomes allocates risk to those that are best placed to manage that risk.** The integrated package offered by Energy Outcomes means that business is incentivised to provide comfort and service at the lowest cost.  The business is better placed than the consumer to manage risks around key determinants of costs, such as the quality and efficiency of interventions. More efficient interventions are therefore likely to result.

- **It provides a way of spreading the payments for investment that consumers' value**. Consumers are generally less willing than businesses to spend now in order to save later. They are often more credit constrained than businesses or have a different time preference associated with money[23]. Even when opportunities exist that have a positive benefit over a number of years, consumers may not take them up due to the high upfront costs. This provides an opportunity for businesses that can cover upfront costs in return for a share of the savings. The rollout of low-carbon technologies, which tend to be associated with higher upfront costs and lower running costs than the incumbent technologies means these opportunities will increase in the move to a smart energy system.

- **It focusses directly on providing the outcomes desired by consumers.** There is a very low level of engagement between consumers and energy systems. Consumers are generally uninterested in spending time considering new energy options. They also have less access to information on new technologies and may be put off by unfamiliarity and associated perceptions of risk. By offering consumers the outcomes that they are interested in, rather than offering options around the means to achieving these outcomes, Energy Outcomes bypasses many of the barriers associated with rolling out the smart energy system to consumers.

- **This may allow it to help overcome consumer inertia.** By packaging interventions within an "all-inclusive" deal, customers are assumed to no longer face the hassle costs associated with interventions, which may drive consumer inertia. In this way, Energy Outcomes may be able to unlock the benefits of new technologies.

- **It leverages economies of scale.** Energy Outcomes can access technologies such as insulation, heat pumps and HEMS more cheaply than individual consumers. However, our sensitivity analysis shows that even if the discount associated with leveraging economies of scale is removed, the business model remains viable: the benefits from risk management and reductions in hassle costs continue to drive uptake.

- **Uptake of Energy Outcomes varies across customer groups.** Those customer groups with the highest energy use in the counterfactual and the highest level of risk aversion are most likely to take up this model,

23 Consumers can display higher discount rates than businesses, or may judge investment paybacks over a shorter period. BMET offers the option to model these aspects of consumer behaviour, although the model runs reported here assume consumers discount the costs and benefits of an intervention, over its lifetime, at the social rate of 3.5%.

- To ensure its benefits are realised in practical terms, Energy Outcomes will need to offer:
  - a trusted consumer brand which credibly links energy use to home improvement and engages householders either:
    - in a new solution before their current system fails; or
    - offers an attractive (fast and affordable) alternative to the distress replacement of their current system when it has failed.
  - systems integration capability to design and deliver a cost-effective whole house solution with guaranteed comfort levels and costs;
  - creative use of ICT to monitor and guide consumer behaviour to minimise energy consumption;
  - delivery excellence to overcome consumer expectations of disruption, cost overruns, delay, poor workmanship and poor after-sales service; and
  - a reliable value-chain of partner organisations with an intrinsic drive for cost reduction to reduce payback periods and make a higher proportion of interventions viable.
- **Key risks for the Energy Outcomes business model provider are:** under-performance of energy saving measures, consumer energy behaviour, loss of market confidence, regulatory change, delivery partner failure, competitor price pressure and wholesale fuel price risk.


## Community Energy

Community Energy can provide a targeted solution to customer groups that have limited alternative options for efficient heating solutions.

- **Under our assumptions of a gas-fired CHP plant, Community Energy schemes are an expensive option** unless a significant step change in cost savings can be achieved for heat plant and network capital costs. There are fixed costs to setting up the network that do not need to be incurred in the absence of this business model. Therefore, even if you exploit all possible efficiencies in developing the network (such as co-ordinating investment in digging up roads with other utilities and developing strong local partnerships with collaborators), this is still likely to be a higher cost option than viable alternatives for most customers.
- **For Community Energy to be successful it needs to be carefully targeted** In particular:

- it must target areas with a homogeneity of customer types to allow mass take-up in concentrated geographic zones (e.g. social landlords that sign-up all tenants by default to the Community Energy provider), or
- it must rely on a very strong local brand that encourages mass take-up in a particular area.

  It will also help if this business model is focussed on customers with limited alternative options as the business model is more attractive for groups which are unable to install alternative technologies such as heat pumps.

- **The choice of fuel to run the heat plant is important for viability.** We have assumed a gas-fired CHP plant in the modelling. This makes the service cost-competitive in early years, but risks becoming a more expensive option for customers in future under high gas cost scenarios (and will also produce more emissions than electrically-powered options). Unless customers can be locked in to very long term contracts, it raises questions about the viability of the business model. This is because, if customers have the option to change energy supplier, the Community Energy provider will only be able to recover revenues equal to the best alternative competitive offer that its customers could achieve. The Community Energy provider must believe that it can remain profitable given these constraints.

- **Close collaboration with value chain partners** for capital delivery, fuel supply, energy trading, as well as with the local community, is crucial to success.

- **Key risks for the Community Energy business model provider are:** heat supply failure (technical fault / fuel supply), systems supply cost increases, inability to gain planning support and inability to find a low carbon fuel source in future.

## Energy Mutual


Our modelling suggests that Energy Mutual could be a successful niche model, delivering value primarily to lower income customer groups, as these groups tend to have limited access to alternative sources of affordable finance.

- **Like Energy Outcomes, Energy Mutual provides a way of spreading the payments for investment that customers' value.** Lack of access to credit can prevent consumers from making investments that will save money over the medium. Energy Mutual helps overcome this barrier by providing a new source of credit.

- **The key driver for the success of Energy Mutual is access to investors willing to make socially responsible investments below the market rate**. Where these investors can be found, this model can unlock access to new low-carbon technologies for customers with limited access to affordable credit. The greater the limit on these type of investors, the less of a role that Energy Mutual can play.

- **Given access to limited funds, the Energy Mutual business model could impact upon a greater number of households if it focuses on lower cost interventions**. For example, the addition of HEMS to the model (a highly effective and low-cost intervention) increased the number of transactions that the business model provider was able to facilitate. The extent to which the Energy Mutual operator is able to finance low-cost interventions will depend upon transaction costs, which are assumed to be low in our modelling.

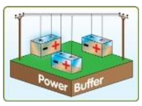
- **If business model providers target the highest returns, they may not focus on the most vulnerable customers.** For example, under current assumptions in BMET, the business model provider focuses all its funds in the first year on the "Successful Ruralite (Oil)" group. Due to their high energy consumption these individuals benefit greatly from the installation of a heat pump, and Energy Mutual is attractive to them as they have limited alternative sources of low-cost finance sources available. However, investors in Energy Mutual may prefer to target customers from a more vulnerable group.

In practical terms, Energy Mutual will need to:

  - offer a trusted, innovative and socially acceptable financial services brand;
  - be as simple and secure to borrow or invest as on-line banking; and
  - develop a network of supplier partners to assure energy performance; high quality installation; low cost; customer service excellence; and,
  - negotiate attractive pricing options to add to the model appeal.

- **Key risks for the Energy Mutual provider are:** failure to attract investors, negative press coverage from delivery partner underperformance and new entrants with greater consumer appeal or marketing investment.

## Power Buffer




Power Buffer provides a niche business, predominantly used by DNOs.

- **The cost of the storage technology is the largest driver of the viability of this business model.** At current levels of expected storage cost[24], this business model will only begin to install assets, and then only at an extremely small scale, in 2030. Its potential market increases significantly out to 2060. If storage costs halved from this level, then it would accelerate growth in this business model.

- **DNOs get most value from this service.** By far the users with the highest value for the Power Buffer service are DNOs. They are using the storage service as a means of meeting peak network demand. This accounts for over two thirds of the value of the services sold. However, the provision of ancillary services does provide an important revenue stream that improves the viability of this model. These will become more important in scenarios with higher levels of intermittent renewables.

- **The value of the service increases if there is flexibility in location of the storage solution.** The tool shows that DNOs only utilise storage solutions on the HV and EHV parts of its network under central cost assumptions and with medium levels of load growth. Where growth in demand is high, storage is only useful for a few years. After that, network reinforcement is required anyway. However, if the location of the storage was flexible at low cost, storage would be more likely to provide a viable alternative on the feeders where load growth is faster. A model which allowed storage to move location, as the need required, would therefore increase the scale of the business. It may also make it a more attractive business model for DNOs to buy (rather than own) as it would reduce the chance that they would feel they could be "held to ransom" by the owner of a particular storage facility connected to their network.

- **Critical success factors for Power Buffer** include forming a partnership with a high-performance, reliable technology solution and building a responsive trading function to maximise revenues from the storage assets.

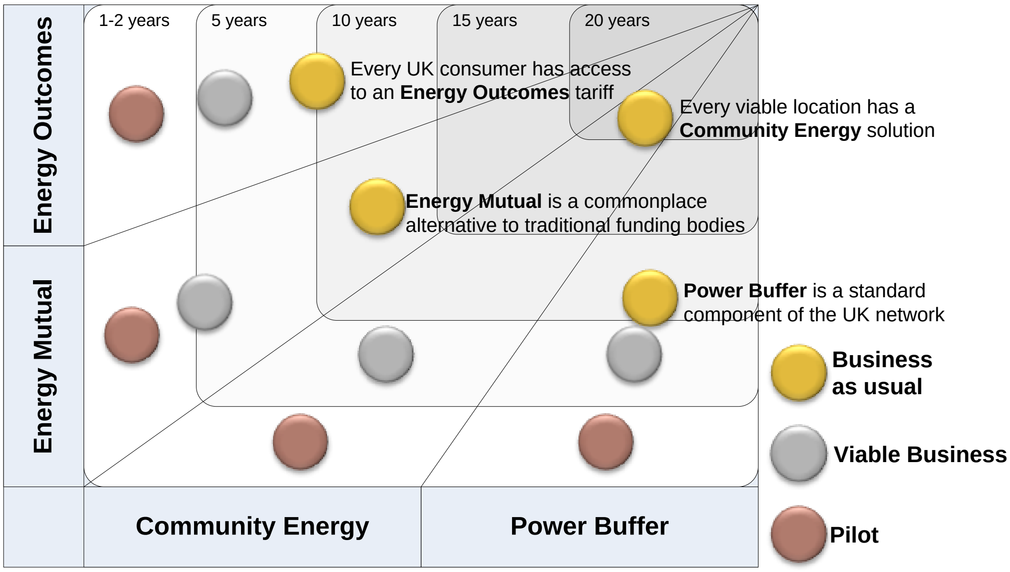
## 5.2 Enabling actions

**Figure 17** summarises our assessment of the timing for transition for each of the business models as covered in Annexe 3. This was developed by contrasting each business model with similar business model transitions from other sectors.

24 These are based on the costs of storage presented in the Smart Grid Forum publication: Frontier Economics and EA Technology (2012), *A Framework for the Evaluation of Smart Grids*

In contrast to our modelling of commercially viable uptake using the evaluation tool, this shows **the potential** for the transition to new businesses**, assuming costs barriers can be overcome.**

**Figure 17.** Business model potential: transition vectors




Source: Total Flow

### 5.2.1 Managing the transition

Throughout the research five recurring themes have emerged as being fundamental to the successful transition of the current energy system. We now deal with each of these in turn.

#### *A transformation in value chain RPV*

The current energy system value chain lacks the RPV to enable or sustain transition. Structurally the value chain lacks a focal point, normally an Original Equipment Manufacturer (OEM) which orchestrates, coordinates and accelerates the development of systems and the evolution of performance. Today:

- Responsibility for domestic energy supply, intervention delivery and heating is spread among a range of players. None of these businesses have yet developed sufficient technical capability, or consumer confidence, to deliver whole house solutions to the standard and cost required.

- For Community Energy and Power Buffer the technology providers are separate businesses, further distanced from capital delivery of plant and pipework. Project managers co-ordinate, but there is no OEM, to control the whole system solution.

The ETI is well placed to explore energy and industrial companies' appetite to take a systems integration role to develop the necessary RPV in the value chain.

An alternative is for a new entrant, already recognised and valued by consumers for their expertise in high performance systems, to enter the sector, leveraging their integration capability, supplier management and brand recognition. This is likely to accelerate market development but pose a competitive risk to current incumbents.

### *The development and industrialisation of enabling technologies and systems*

Today enabling technologies, and the integrated systems they enable, underperform for their price point and are too unreliable. Component and systems maturity is low, waste and redundancy is endemic.

To appeal to a mass market, function, performance and price point need to transform. The ETI have a valuable role to play to educate the market on future requirements, to coordinate and accelerate the development of enabling technologies and systems, and to demonstrate how value chain partners can collaborate to bring these propositions to market waste free.

### *The meaningful engagement of consumers*

Consumers show little interest in energy system change, their imaginations have not been captured by a compelling proposition or brand. Consumer brands are lacking in the mass energy market and the products and services are not differentiated or attractive to the majority.

The ETI's current research will increase understanding of consumer requirements. Sharing results and engaging with relevant consumer brands will identify the conditions under which such brands, with genuine consumer appeal, might invest in the new business models.

### *Migrating risk from consumer to supplier*

As demonstrated in aero-engine contracting, the shift of responsibility for whole life costs from the airline to the engine manufacturer drove major improvements in reliability and cost[25]. The logic is that the incentive for reliability moves from the user, who doesn't have the capability to improve it, to the designer/manufacturer who does.

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25 Performance Contracting in After-Sales Service Supply Chains, S-H Kim, M. A. Cohen and S. Netessine, The Wharton School Pennsylvania, 2006.

This is the premise behind Energy Outcomes. The business is incentivised to provide comfort and service at the lowest cost. The business has agreed a fixed monthly payment with the householder. So the less energy they supply to the home the greater their profits.

A successful Energy Outcomes provider will treat the home as an integrated system (building, heating and occupants) and use their technical expertise to help householders achieve their comfort outcomes at continuously reducing cost. System providers for Community Energy and Power Buffer are also contracted in this way. When being paid for 'power by the hour', not for a capital asset, the supplier is incentivised to increase performance and reliability while driving down cost.

The ETI's strategic system level role ensures it is well placed to present the potential of such a shift and so drive whole systems performance improvement.

#### *Identifying and leveraging cross sector synergies*

Collaboration with external value chains has high potential to reduce system cost, where there are large fixed costs that can be shared between businesses. For example, combining capital delivery tasks for infrastructure (pipes, cabling, IT, highway repair, etc.) achieves major reductions in capital spend.

By working with government and regulatory bodies, the ETI has an opportunity to demonstrate synergies which reduce infrastructure delivery cost.

### 5.2.2 Policy direction

Annexe 4 describes our findings on the policy requirements for business models. Here we pull out the main themes.

#### *Major policy intervention is required to deliver a smart low-carbon energy system*

All of our business models require the delivery of a smart low-carbon system to be viable. This will only happen with significant policy intervention to meet the UK's carbon targets. Recent examples of major policy change include Electricity Market Reform to support low-carbon electricity generation, the Green Deal to support domestic energy efficiency investments and the mandated smart meter roll-out to enable innovation in energy provision.

The success of all our business models will depend on the effectiveness of these, and similar, policies. Unless these policies are believed to be effective and stable, none of the models will be viable. Where the model involves a large sunk investment, investors must have the confidence that they will be allowed to earn sufficient profit in future years to justify the initial outlay. Investors may currently have legitimate concerns that any such profits will meet political resistance, particularly if they occur at times of rising energy costs.

The biggest influence on the viability of all business models will therefore be the success Government has in providing confidence to the market that it will deliver the carbon targets and allow successful companies to earn returns commensurate with the risks they will take.

### *Specific barriers for the business models*

There are then some more detailed policy requirements that are specific to the types of business model we have chosen.

- **Limitation on energy tariffs.** Ofgem is introducing legislation to cap the number of tariffs retailers can offer. [26] This was in response to a concern that multiple tariffs were confusing customers and leading to disengagement. However, this policy response will fundamentally constrain any business model that requires tariff innovation at the domestic customer level. Of our models, Energy Outcomes will be most affected by this policy. It makes it less likely an incumbent retailer would offer this service (as it would require it to use a set of core tariffs to do so). It would also limit the ability of any new entrant to come up with a range of propositions to appeal to different customer segments.

- **Lack of long term liquidity in the wholesale market.** The Energy Outcomes business model relies on offering customers long term stable prices. For this to be viable, the provider must be able to hedge fuel price risk over the longer term. Five year contracts to hedge power prices are currently not traded, and more medium term (two to four year) contracts have low liquidity levels[27]. Ofgem has been looking at liquidity issues for a number of years, and its current proposals for reform may improve this situation. However, this is vital for the success of this model. Customers will not take up long term contracts if they have to pay a large premium to do so.

- **The risk / return trade-off for private investors may not be viable.** The Energy Mutual model requires small investors to put up funds in what could be seen as a high risk scheme. Although the platform itself could insure against default of individual borrowers, there will still be the risk of collapse of the Energy Mutual provider itself. One option would be for Government backing, for example through the Financial Compensation Scheme. The alternative would be to increase the potential return available to compensate investors for the default risk they are taking. This could be through the adoption of a tax relief similar to the community investment tax relief

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26 Ofgem (2013), *The Retail Market Review – Statutory consultation on the RMR domestic proposals*

27 Based on Bloomberg data, and Ofgem (2013) *Wholesale power market liquidity: final proposals for a 'Secure and Promote' licence condition*

(CITR) scheme which allows investors to offset tax liability while earning interest or dividend on their loans. However, the current CITR scheme provides companies rather than individuals with the investments, and therefore changes would have to be made to the CITR scheme in order for it to be applicable to the Energy Mutual model.

- **Continued consumer reluctance to invest in energy saving interventions.** All of the customer-facing models rely on customers engaging in some degree of home retrofitting. This market has been extremely slow to take off and many barriers have been identified such as high up-front cost, lack of information and a lack of accredited suppliers. However, overcoming these barriers was a central aim of the Green Deal. It is too early to judge the success of these policies in transforming the market for energy saving interventions. Once it has had time to develop, it may be that further policy change is required. However, what may be more important is policy stability to encourage one or more retrofit systems integrators to make a step change in performance and disrupt a currently incapable market.

- **Limitations on DNO activities.** The provisions under the EU Third Energy Package may prevent DNOs taking on new roles in the provision of storage or retail of electricity from CHP.[28] These restrictions could limit the options for rolling out the Community Energy and Power Buffer models[29]. In addition, the current P2/6 Planning Standard will limit DNOs ability to use storage services, such as those offered by Power Buffer, as a substitute to network reinforcement. However, reform of this standard to remove this barrier is already under consideration.

28 Subject to some exceptions for installations of small sizes.

29 DNOs may want to own storage to help manage their networks. Current restriction could stop them from earning additional revenue through arbitrage on energy markets.

# 6 Conclusions and recommendations

Our analysis has developed a broad range of business models which could contribute to a low-carbon energy system. The four core businesses and two hybrid models have been evaluated both quantitatively in our evaluation framework and qualitatively from a consumer and commercial capability perspective. The analysis has provided a framework for structured thinking around the potential benefits of business models under different conditions. .

We now set out our conclusions and recommendations in three areas:

- enabling actions required for the business models to be delivered;
- recommendations for the demonstration; and
- priorities for future business model development.

## 6.1 Enabling actions

Our analysis of transition pathways developed organisational requirements for the business models to succeed. Two themes recur: consumer engagement and systems integration.

### 6.1.1 Consumer Engagement

To achieve a low-carbon energy system there is a need to influence a significant proportion of 26 million household bill payers to change the way they use energy.

Consumers do not buy based on the product alone, they are drawn to brands which reassure them they have made the right choice. Branding is needed to engage the markets and give confidence in three distinct sectors:

- **Domestic:** Home technology and improvement – *trust us to manage your home energy system for you.* Here consumers are looking for a provider who will get solutions right first time and install the appropriate technology. As the market grows there will also be scope for different branding tailored to consumer demographics.

- **Financial:** Brokering investment opportunities – *if the business case is viable we will ensure it is funded.* Here the aim is to make it easy for households and investors to engage. The consumer wants the offer to be quick, simple and secure so the branding needs to reflect this.

- **System:** Reliable and effective community solutions with gravitas – *a safe pair of hands to design, build and operate your energy system.* For system solutions like Community Energy the specifier is making a decision on behalf of others and so the provider needs reliability, a reassuring scale and reputation for excellence.

### 6.1.2 Systems integration

A systems integrator takes responsibility for specifying the performance requirements of their system and leads the value chain to deliver all the elements at a target cost. When the system works and is worth the cost people will buy it, creating a brand and giving OEMs scale. This enables the supply chain to collaborate and grow: industrialising to prevent defects and warranty claims; investing to differentiate performance; and collaborating to eliminate component redundancy, underperformance and cost. Developing a system integration capability will take time and cost but the spoils for the first successfully integrated energy systems providers could be substantial.

In the selected business models there is a need for two distinct systems integration roles: at home improvement and community/distribution scale.

#### *Home improvement / intervention installation – Systems Integrator*

Delivering interventions cost-effectively at scale is crucial to both Energy Outcomes and Energy Mutual. Community Energy will also be promoting interventions such as heat pumps, HEMS and insulation, and so a dynamic and competitive market is vital. Currently home improvements are delivered piecemeal with no business taking responsibility for whole house system performance. Current solutions are packed full of cost and redundancy and this leaves the householder unconvinced of their value. Today home improvement companies choose from available products and components, but do not have the scale or technical capability to act as a systems integrator.

We propose that one or more systems integrators are needed to make a step change in performance and disrupt a currently incapable market. Householders will recognise the value of a high performing solution, offered at a target cost they can afford, delivered by a highly capable provider.

By engaging with consumer goods brands (eg: from automotive and electronics) the ETI could stimulate interest from new entrants to the market: either acting alone or in partnership with energy or construction value chain players. The value of new entrants for whole house systems is bringing across both the sophisticated engineering capability and an already recognised and trusted technology brand. If linked to a partner with expertise in the energy landscape, we have a capable system for Energy Outcomes and other intervention delivery.

#### *Community / Distribution scale – Systems Integrators*

For Community Energy and Power Buffer, the technical solutions are on a bigger scale with CHP plant or large-scale heat pumps, large scale heat network installation and high capacity electrical storage. Both these business models face a significant challenge to reduce system costs to make their propositions compelling. The Community Energy business is led locally and so it is the heat plant system partner who has the technical capability and scale to act as the system integrator. The system includes the heat plant, but also the heat network and home installation: the system integrator for Community Energy needs to manage performance across large engineered assets, capital delivery at scale and domestic interventions. For Power Buffer the challenge excludes domestic level intervention and has a lower capital delivery content. There is potential for Power Buffer to be a component of Community Energy and so the system integrator might be the same for both propositions.

The ETI has the energy systems insight to share the market potential and requirements for this role and so engage the engineering and systems integration capability that could deliver it. Phase II of Smart Systems and Heat gives an opportunity to create an exemplar integrated system design and delivery for Community Energy and Power Buffer. The ultimate solution would be to deliver this on a whole systems Energy Outcomes basis – not just providing 'power by the hour', but comfort for a fixed fee.

## 6.2 Recommendations for the demonstration

Annexe 3 identifies mechanisms for trialling each of the business models within the Smart Systems and Heat Phase II programme. Pathfinder projects are proposed for the core business models. Each pathfinder has a very clear outcome to deliver and the process is highly collaborative as contributors work to identify the best routes to a future state value chain.

Here we present the proposed pathfinder projects for each business model.

- **Energy Outcomes.** Given the potential of the Energy Outcomes model for mass market appeal, it will be important to trial core aspects. Demonstrations should focus on the following:
  - understanding how to overcome consumer inertia by delivering the outcomes they desire, without the hassle;
  - learning how to build compelling branded Energy Outcomes partnerships;
  - establishing best practice demonstration systems solutions from the best of the residential heating, automotive and office air conditioning sectors (e.g. demonstrating technical and operational best practice);
  - exploring an Energy Outcomes brand proposition compelling to consumers; and

  - developing a Smart Systems and Heat Energy Outcomes retail offer and trial all aspects of performance across the selected Phase II sites.

- **Energy Mutual.** To be viable, Energy Mutual relies on the accessing investors willing to lend for socially responsible causes at a lower than market rate. Demonstrations should focus on the best ways of accessing these investors, including:
  - learning to develop a localised portfolio of investable property business cases and how to promote them to investors through the Energy Mutual portal; and
  - testing the size of the market for socially responsible investments in property by offering opportunities for investment within the demonstration.

- **Community Energy.** Community Energy may work best when targeted at areas where customers are relatively homogenous, and in particular in areas where customers have limited alternative options. It would be useful to understand how developing a community brand could expand the potential market. Learning could focus on:
  - developing options for an existing energy/heat network to improve and expand a current system and create an enhanced consumer offering;
  - investigating the viability of community CHP with other fuels (for example biomass) which could be more cost-effective in the long-run under higher carbon prices; and
  - testing the viability of CHP or large scale heat pumps at scale in an area where there are restrictions on alternative heating technologies.

- **Power Buffer.** Electrical energy storage is being trialled in two Low Carbon Networks Fund Projects[30]. Isentropic electricity storage is also being trialled by ETI. These trials will provide publically available results on the cost-effectiveness of the services electrical energy storage can supply to DNOs and the potential for revenues from other activities. Given the longer timescales over which Power Buffer is a viable business model, and the high cost of implementing a storage trial, the focus should be on drawing learning from these existing trials, rather than on implementing a new storage trial.

30 Northern Powergrid's Customer Led Network Revolution and UKPN, Smarter Network Storage.

### 6.2.1 Complementary Activities

There is overlap of required capabilities across the business models. To maximise the learning from the pathfinders they should not be completed in isolation. For example:

- installation process excellence is very important for Energy Outcomes and is highly desirable for both Energy Mutual and Community Energy;
- capital delivery is important for both Power Buffer and Community Energy; and
- consumer response to propositions and brands in central to all bar Power Buffer.

### 6.2.2 Timing

The value of pathfinder projects is to learn what does and does not work. This enables organisations to prepare for and de-risk future activity. Early commencement of pathfinders will be valuable to inform SSH Phase II.

Of the proposed pathfinders, all can be launched in advance of the commencement of SSH Phase II delivery. Only the scale demonstration of Energy Outcomes and the creation of the Community Heat deployment need to be precisely co-ordinated with the Phase II programme.

## 6.3 Priorities for future business model development

Based on our development and evaluation of business models, we have identified three areas where the ETI can add value in the field of business model development.

- **Innovative business models can overcome barriers usually tackled by policy, while remaining commercially viable.** Energy Outcomes overcomes many of the barriers associated with consumer uptake of low-carbon technologies, such as lack of information, hassle perceived risks and credit constraints. Community Energy and Energy Mutual demonstrate that business models can be used to help hard to reach groups overcome barriers to the adoption of low-carbon technologies. At the same time, these business models provide competitive returns for investors. The **ETI are in a strong position to promote business models as an alternative to policy, for example where policy action is difficult.**

- **Understanding the diversity of consumers is crucial.** Our modelling shows that the uptake of the services provided by business models varies significantly by consumer group. For example, Community Energy is a successful business model when carefully targeted, but is unlikely to be viable among customer groups in low-density areas. The **ETI's consumer research in Work Area 5 of the SSH will provide extremely useful insights to be drawn upon in the further development of business models.**

- **The evolution of technology costs is crucial.** Business models can help provide innovative mechanisms to overcome barriers to uptake. However, the fundamental economics also needs to be right for the business models to be successful. The slow uptake of Power Buffer and Energy Outcomes with storage in our modelling illustrates the importance of technological progress and the evolution of technology costs in the move to a low-carbon economy. The **ETI's continued work in the trialling of technologies is likely to create opportunities for new business models.**

# 7 Annexe 1: Understanding the challenge: overview of the future energy value chain

The UK has signed up to legally binding targets to reduce greenhouse gas emissions by 80% over 1990 levels by 2050. To achieve this target, analysis suggests that major reductions in emissions from the heating and electricity supply sector will be required by 2050[31]. At the same time, smart meter rollout and the development of smart technologies are presenting new opportunities to reduce carbon emissions in a cost-effective way.

In this annexe, we explore the future challenges in the energy value chain, in a world where 2050 carbon targets are met. We aim to develop an understanding of the context and commercial environment within which future business models will operate. In particular, to develop business models, and to design the required supporting policy framework, we need to understand how the balance of risk and reward may change in the move to a low-carbon economy. This annexe presents our analysis of changes in risk and reward in a low-carbon economy. Annexe 7 describes the basis for this analysis.

In Part 1 of this project[32], we developed a detailed understanding of the existing smart systems delivery chain, including the finance framework.

In this part of the project, we assess likely changes to **risk and reward in the future,** focussing on the characteristics of energy demand (including enabling technologies), energy supply, and the value chain as a whole in a future low-carbon economy.

Our assessed of risk and reward is based on detailed analysis of 2050 scenarios, presented in Annexe 7. Based on looking at a broad range of 2050 scenarios, we identify a set of 'disruptions'. Each 'disruption' groups together a set of major changes required if 2050 targets are to be met. The three key disruptions are:

- Disruption 1: changes in heating technologies;
- Disruption 2: changes in the energy production mix; and
- Disruption 3: advances in ICT and the technology transition from dumb to smart meters.

We now describe each disruption and discuss the consequences for risk and opportunities for reward.

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31 DECC and CCC analysis suggests that the heating sector will need to be almost completely decarbonised by 2050.

32 Frontier Economics and Total Flow (2013), *WP 4.1.Characterisation of the current energy value chain*

## 7.1 Disruption 1: Changes in heating technologies.

To meet 2050 targets requires a substantial decarbonisation of heat. The 2050 scenarios we have examined include substantial uptake of heat pumps, and a significant roll out of district heat. **Figure 18** compares these technologies to the main incumbent technology (gas boilers). This shows alongside the unfamiliarity of these technologies to consumers[33], they also have very different technical and economic characteristics.

**Figure 18.** Changes in characteristics on the demand side

| | Gas boilers | Heat pumps | District heat |
|---|---|---|---|
| **Responsiveness** | **High**<br>One hour to heat a house from cold | **Low**<br>24 hours to heat a house from cold. Back-up technologies may be required. | **High**<br>Can provide similar level of service to gas boilers |
| **Heat grade** | **High**<br>Can meet large demands e.g. from poorly insulated homes | **Low**<br>Only function in well-insulated homes | **High**<br>Can meet large demands e.g. from poorly insulated homes |
| **Additional infrastructure requirements** | **Use existing**<br>Gas supply, transmission and distribution | **Expand existing**<br>Electricity supply transmission and distribution | **Create new**<br>Local heat production and distribution network required |
| **Costs** | Lower capital costs, higher running costs. Current lifetime costs of around **7p/kWh*** | High capital costs, lower running costs Current lifetime costs of around **13-17p/kWh*** | High capital costs, lower running costs Lifetime costs vary by scheme |

Source: Frontier Economics[34]

These differences lead to a change in risk and reward for commercial entities across the energy value chain. These changes are summarised in **Figure 19** and **Figure 20** and can be grouped into the following themes.

- **Opportunities for rewards from the manufacture and installation of new technologies.** In the transition, there will be significant opportunities for businesses in the enabling technologies sector to become involved in the rollout of new technologies, though there are challenges associated with newness of these technologies and political risk around the policy support they will require.

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33 In particular heat pumps. See Ipsos MORI and the Energy Saving Trust (2013), *Homeowners' Willingness To Take Up More Efficient Heating Systems*, DECC.

34 Source of costs: Source: Committee on Climate Change (2011) *Renewable Energy Review*

- **Opportunities for rewards from the provision of flexibility services.** Without thermal storage, heat pump demand for electricity is likely to be relatively inflexible. Given the significant electricity load associated with heat pumps, their roll out is likely to significantly reduce the flexibility of the demand side and create commercial activities based around the provision of flexibility – e.g. investment in storage, or harnessing demand side response (DSR).

- **Opportunities for rewards from the management of perceived consumer risks around unfamiliar technologies.** Consumers may perceive risks associated with the new technologies, particularly in the earlier stages of roll out. There are likely to be opportunities for companies to become involved in managing this risk (in this context and more widely).

**Figure 19.** Heat pumps: change in risk and reward

| | New risks | New opportunities for rewards |
|---|---|---|
| **Upstream** | Reduction in the market for oil and gas<br>Greater inflexibility on the demand side<br>New unfamiliar demand patterns for electricity (transition) | Increase in electricity demand<br>Increase in the opportunity for supply side technologies which add flexibility (e.g. peaking plant, storage) |
| **Networks** | Increases in peak electricity demand<br>Clustered rollout may cause acute local issues (transition)<br>New unfamiliar demand patterns for electricity (transition)<br>Reduced utilisation of the gas network | Increase in the requirement for electricity network expansion<br>Increase in the opportunity for network technologies which add flexibility (e.g. storage) |
| **Energy retail** | Rising electricity bills driven by rising electricity demand increases political scrutiny<br>Reduction in gas demand | Increase in electricity demand<br>Increase in the opportunity for demand side changes which add flexibility (e.g. time of use tariffs) |
| **Enabling technologies** | Requirement to train installers in new technology (transition)<br>Uncertainty over rate of uptake – rate will be driven by policy so politically determined (transition) | New market for heat pumps<br>Increase in market for energy efficiency appliances, given need for well-insulated houses |

Source: Frontier Economics

**Figure 20.** District heat: change in risk and reward

| | New risks | New rewards |
|---|---|---|
| **Upstream** | Increased competition in the supply of electricity and electricity balancing services from CHP plants | Increase in the opportunities to supply fuel (gas or biomass) to CHP plants |
| **Networks** | Reduced utilisation of the gas network | New heat network required |
| **Energy retail** | Reduction in demand | Opportunity to supply retail services to large community energy schemes |
| **Enabling technologies** | Uncertainty over rate of uptake – rate will be driven by policy so politically determined (transition) | Installation of new heating technologies required |

Source: Frontier Economics

## 7.2 Disruption 2: Changes in energy supply

Our scenario analysis (Annexe 7) shows that meeting decarbonisation targets will entail a significant shift in the sources of energy supply – with a shift from gas to electricity, and radical changes in the electricity generation mix. The new low-carbon technologies have very different characteristics to the typical incumbent technologies. These characteristics are set out in **Figure 21**, compared to combined cycle gas turbine (CCGT), which is currently the main investors' choice of conventional technology in the UK.

**Figure 21.** Changes in characteristics of the supply side

| | CCGT | Nuclear | Wind | CCS |
|---|---|---|---|---|
| **Flexibility** | **High** Can ramp up and down within minutes and can start from cold within 4h | **Low-Medium** May be able to vary output by up to 75% but takes 48h to start from cold | **Low** Intermittent - can only generate when the wind is blowing | **Uncertain–** Pre-combustion likely to be more flexible, post-combustion likely to be less flexible |
| **Additional infrastructure requirements** | **Use existing** electricity transmission and distribution networks | **Use existing** electricity transmission and distribution networks | **Expand existing** electricity transmission and distribution networks | **Create new** carbon transport and storage network required |
| **Capital intensity*** | **Low** Estimated running costs are about 70% of total costs | **High** Estimated running costs are about 25% of total costs | **High** Estimated running costs are <5% of total costs | **Medium** Estimated running costs are about 40-45% of total costs |
| **Main cost risks** | Fuel price risk | Construction cost risk Political risk | Construction cost risk Weather/climate | Fuel price risk Construction cost risk |

Source: Frontier Economics

Again, these differences lead to a change in risk and reward for commercial entities across the energy value chain. These changes are summarised in **Figure 22** and can be grouped into two significant areas.

- **Political risk for upstream business will increase.** Low carbon technologies will generally require policy support or a long term and stable carbon price to be economic. This means that investors will be more reliant on Government action and global development on climate change mitigation than they are currently.

- **Opportunities for new rewards from the provision of flexibility services.** The supply side will be more economically and technically inflexible and in some cases intermittent. Again, this leads to more opportunities for businesses based around the provision of flexibility.

- **Opportunities for rewards from managing cost risks for consumers.** The increased volatility of electricity prices may lead to opportunities for the management of consumer costs.

**Figure 22.** Change in risk and reward due to supply side changes

| | New risks | New opportunities for rewards |
|---|---|---|
| **Upstream** | Greater political risk - greater reliance on policy support and a global commitment to climate mitigation<br>New generation technologies (e.g. CCS)<br>Greater capital-intensity of generation technologies | Greater opportunities to invest in technologies that add flexibility (e.g. storage and peaking plant) |
| **Networks** | New generation patterns and (transition) | New networks required for carbon capture and storage<br>Expansion required to connect increase in distributed generation<br>Increase in the opportunity for network technologies which add flexibility (e.g. storage) |
| **Energy retail** | Greater volatility in wholesale electricity prices<br>Potentially increasing costs of electricity generation may increase political scrutiny | Increase in the opportunity for demand side changes which add flexibility (e.g. time of use tariffs)<br>Opportunity to take an increased role in managing price volatility for consumers |
| **Enabling technologies** | None | None |

Source: Frontier Economics

## 7.3 Disruption 3: The technology transition from dumb to smart meters

At present, most existing metering technology is 'dumb'. This means household consumption cannot be monitored in real-time and meter reading requires a site visit. Meters cannot communicate remotely to retail suppliers and therefore meter readings must be taken periodically (e.g. with the householder reporting a meter reading by phone or via the internet and/or an employee of the retailer visiting to take a meter reading). This means that information on consumption patterns of households is limited. It limits the granularity with which retailers can charge for electricity. For example, unless their customers have smart meters, it is not possible for retailers to vary their charges by time of day.

Energy retailers are rolling out smart meters to all domestic and SME customers by 2020[35]. Widespread rollout of smart meters will make near real time information on energy use available and will facilitate a range of new tariffs and business models across the sector.

[35] https://www.gov.uk/smart-meters-how-they-work

The risks and rewards associated with this disruption are set out in **Figure 23**.

The key point here is that smart meters will act as an enabler to allow the opportunities for rewards described above to be exploited. However, smart meters will be associated with a number of risks for retailers and the enabling technology sector, and as a consequence, consumers.

**Figure 23.** Smart meters: change in opportunities for rewards

| | New risks | New opportunities for rewards |
|---|---|---|
| **Upstream** | None | None |
| **Networks** | None | Greater information available to allow more accurate network planning and design |
| **Energy retail** | Risk of stranding of an expensive asset<br>Unwinding of existing customer cross subsidies will create new winners and losers<br>Data protection and privacy issues<br>Risk of customer disenchantment | Increase in the ability for demand side changes which add flexibility (e.g. time of use tariffs)<br>Opportunity for businesses which manage consumers overall demand |
| **Enabling technologies** | Compatibility and requirements to work with central systems | New opportunities for technologies which respond automatically to signals from smart meters (e.g. smart fridges) |

# 8 Annexe 2: Business Model Assessment Canvases

This Annexe presents canvases[36] for the four business models developed in this project:

- Energy Outcomes;
- Energy Mutual;
- Community Energy; and
- Power Buffer.

36 The format for the business model canvas is adapted from the Business Model Canvas from BusinessModelGeneration.com, licensed under the Creative Commons Attribution-Share Alike 3.0 Unported License. Available at: http://www.businessmodelgeneration.com/canvas.

**Energy Outcomes - Provision of Comfort for a predictable monthly fee. Not per kWh. Electricity retail offer combined.**

Removes the consumers' burden of asset ownership, repair and maintenance and transfers the risk of fluctuating energy costs.

A technology led Energy System Integrator who sees the opportunity for a profitable business based on reducing energy supplied to homes.

## Partners

**Smart Data IT Ltd**.
Home data links

**Home Transformation Ltd**: Installer of retrofit, heat-pumps, storage, controls HEMS, smart data & home improvements.

**Energy Saving Component Manufacturers**: Tier 1 product / material suppliers.

**Electricity Wholesale / Retail Partners Ltd**. A Generator or wholesale electricity provider.

**Residential Maintenance Management Ltd:** Home asset care and consumer support.

**(Storage System Providers ltd.** Option to provide domestic heat and electricity storage)

## Key Activities and Resources

### Activities

Assess current energy use and enable reduced future needs for each household.

Develop compelling consumer offerings and secure multi-year contract.

Drive supply chain product and process improvement as Systems Integrator.

Co-ordinate installation.

### Resources

Assessment and design methodology to manage risks of variable future household consumption.

Retail billing organisation approved by regulator.

## Consumer Value Proposition

A trusted and relevant brand removing the anxieties and hassle of current energy systems in return for a predictable monthly cost, spread over a suitable contract period.

Choose your comfort level and the amount of change to your home;

Energy Outcomes offers options for:

- Fixed and variable charging.
- Different levels of retrofit.
- Other home improvement
- Investment or zero upfront cost.
- Storage options for better response or lower cost.

A leading edge technology brand to improve your home.

## Relationship and Channels

### Relationship

5yr+ contract with house-hold for delivery of a fixed level of comfort. Outcomes provider upgrades and manages household energy assets, and supplies energy needed to maintain comfort.

A 2 way relationship where the provider supports users to achieve their changing needs cost effectively.

### Channels

Branded alternative option offered through U-Switch.

Local Authority community groups.

Home improvement firms adding additional value.

## Customers and Market Share

### Customers

Risk-averse households wishing to avoid hassle and happy to let others manage the energy system for them

Energy users with a large energy savings potential to offset system investment.

Those with gas / oil heating systems at or near the end of their useful life.

### Market Share

Likely to be a slow take up with a very different value proposition for consumers.

May require 'loss leader' contracts to prime the market.

## Costs

Start-up : Expert design system development and brand creation.

CAPEX: Capital for up-front investment in customer properties

OPEX: Wholesale energy, marketing, maintenance and customer care costs.

## Revenues

Monthly payment from customers.

- Up to 3 Levels of Comfort tariff: Simple to understand.
- Energy cost element can be fixed or floating.

**Energy Mutual- A brokerage enabling households unable or unwilling to invest, to access finance for energy saving improvement.**
A mechanism for overcoming householders' inertia to take energy saving action; by developing a compelling business case they or others can invest in.
A web-based trading platform which enables the matching of borrowers with lenders and investors with investment opportunities.

## Partners

**Retrofit & Smart Data Installation Partners Ltd.** Trusted property assessment and delivery partner.

**Safe and Secure Online Payment Partners Limited.** The mechanism for parties to transact.

**Web based Trading Partners Limited.** The brokering tool provider.

**Community Mutual Matching Association** A special interest group to match the Energy Mutual brand and offers with a target market.

**Energy Retailer Ltd.** (Bulk purchase of energy).

## Key Activities and Resources

### Activities

Brokering deals between investors, borrowers and households for energy system improvement.

Inspiring those with potential to improve their energy costs.

Attracting quality investors & high saving retrofit projects.

Unbeatable transaction speed, cost & transparency

### Resources

Strong first to market brand advantage (Ebay / Paypal).

Trading platform and transactional security

High calibre customer service team to explain technical solutions and financial offers.

## Consumer Value Proposition

A branded web-led proposition, engaging households, investors and installers on an energy saving journey;

Offers households a clear path to both finance and technical `.

Offers households unwilling or unable to invest to trade their business case to other investors.

A unique web based portal to match energy investors and energy borrowers cheaply, quickly and transparently.

Corporate borrowers may use loans to invest in 3rd party projects. (rent-a-roof)

**"Enabling Investment in all our tomorrows".**

## Relationship and Channels

### Relationship

Respected and valued by borrowers and investors for its clear social purpose.

Acclaimed by consumer champions & money-saving gurus.

Portal for locating approved and reputable vendors.

Great source of advice even without the funding.

### Channels

Web based portal.

Linked to and embedded in provider, government and social enterprise web sites.

Community Group 'Shops'.

Regular media exposure.

## Customers and Market Share

### Customers

**Investors:**

Individuals / Communities.

Charities, Local or National Government, Pensions.

Installers / manufacturers.

**Borrowers:**

Householders, Landlords. Housing / School Trustees, Retrofit businesses.

### Market Share

Removes the financial barrier to householders taking up retrofit, but, requires delivery excellence to grow successfully.

## Costs

**Start-up : Gaining licence to trade. Brand building.**

**CAPEX**: Integration of off the shelf trading and online transaction vehicles.

**OPEX**: On-going marketing to consumers, partners and institutional investors

## Revenues

Fixed or % price per trade for borrowers and investors.

Commission from Retrofit Installation team for each Mutual matched contract.

Potential for web based advertising.

**Community Energy & Storage - A community scale energy supplier with high fuel efficiency and a strong local brand.**
Generating locally required heat & electricity with CHP/Heat Pumps , distributing heat, selling power at scale to the grid and customers.
A locally driven Special Purpose Vehicle created between a broad range of partners. Distribution level electrical and heat storage.

## Partners

**Community Base-load**
The key customer RSL/LA

**System Partners Ltd**
CHP / electrical storage manufacturer / installer.

**Network Capital Delivery Partners Ltd.**
Heat network installers.

**Electricity Retail Partners Ltd.** Customer for exported power.

**Community Retrofit Ltd**
**Home system installer.**

Fuel Partners Ltd.
Gas or other fuel supply.

**Residential Maintenance Management Ltd:**
Home asset care and consumer support.

## Key Activities and Resources

### Activities

Specify, commission and operate a community scale heat, power & electrical plant. Manage a heat network and storage, with plans to grow the system & capacity.

Trade with energy retailers for the import/export of lower carbon power.

Deliver home retrofit at scale and / or HEMS.

### Resources

Local (multiple) CHP plants operating 24/7 in winter, scaled back for summer.

Community retail team for direct engagement with owner occupiers for network expansion.

## Consumer Value Proposition

A competitively priced heat and electricity solution; with a compelling community brand appeal.

Provision of responsive heat and hot water to all consumer groups.

Managed and maintained by others, to minimise cost and householder hassle.

A step change in fuel efficiency, designed to scale as demand grows.

Options to increase scale:

- Key offer retrofit and heat
- Energy outcomes plans
- Just energy outcome and retrofit for households too isolated to join heat grid.

## Relationship and Channels

### Relationship

1:1 relationship with a key customer (Local Authority).

Close personal links with the community served: A living community partnership.

Must gain, maintain and protect consumer trust at all costs

Stimulate local interest.

### Channels

Show property presenting the solutions and benefits.

Directly at the "come and see our site" outlet.

Partner locations: Local Authority or Landlord sites.

## Customers and Market Share

### Customers

All Consumer Group types

Technically possible for up up-to 7.5m households in urban centres above 50k.

Of which high potential:

- 2m off gas urban.
- 2.3m Urban Social Housing
- 1m in other target flats.(some overlap)

### Market Share

An excellent base load development can generate demand from private house-holds to accelerate expansion of the network.

## Costs

**CAPEX**: Capital delivery of community heat network (£6k-£10k per home), Connection to the electricity grid (and possible local grid). Future expansion.

**OPEX:** Power by the hour, billing, customer acquisition, system maintenance.

## Revenues

Monthly bill based on per kWh tariff, or unmetered restricted flow charge. plus metered electricity and repayment of retrofit investment cost.

Option to include Outcomes based payment for comfort.

**Power Buffer - Provider of electrical storage capacity to balance network load and trade power on a variable price basis.**

The business designs, procures, installs and commissions storage capacity across technologies at distribution scale.
The services from this capacity are traded with the System or Network Operator or Retailer as a managed service, or pay per use facility.

## Partners

**Distribution Network Operator (DNO)** at the point of connection

**Storage Technology Partners :**
Original Equipment Manufacturers (OEMs Siemens, Hitachi, GE, ABB, Isentropic )

**Network Storage Installation Partners:**
Capital delivery of large assets (where not plug and play)

## Key Activities and Resources

### Activities

Design, procure, install and commission electricity storage capacity connected at multiple points and different voltages on the distribution network.

Sell flexibility services to DNOs and System Operator

An arbitrage mechanism to buy low priced power and sell at a profit to retailers.

### Resources

System design capability at distribution scale (ie City-community) across storage technologies.

Creation and successful management of JV's

## System Value Proposition

An energy storage solution which provides the electricity network with a mechanism for levelling the load on the local and national grids and back-up for power outages.

This acts as extra capacity and can be traded on an annual facility, or pay per use basis.

This postpones the need for investment in increased distribution network capacity

Off-peak power bought and stored until it can be used/ sold more profitably.

Rental or temporary capacity to protect consumers from network upgrade or repair.

## Relationship and Channels

### Relationship

Joint Venture with DNO or TNO or large power user and a technology provider.

Multiple year contracts for (semi) permanent storage assets on the basis of:

- leased asset.
- managed service
- pay per use facility

### Channels

Business to Business –

- Energy Buffer direct approach to DNOs
- Direct offer to energy retailers
- Market research for large power users

## Customers and Market Share

### Customers

DNOs seeking to level peak loads in near capacity network links / nodes.

Energy Retailers for peak capacity.

National Grid for balancing function.

Community Energy plants

Large energy generators / users for trading ToU.

### Market Share

A new market, separated from the network operators by regulation. Or

A specialist storage provider sub-contracted to network operators.

## Costs

**CAPEX:** Battery or other technology. Network connection cost.

**OPEX:** Off peak electrical power purchase price. Arbitrage trading costs.

## Revenues

Arbitrage trading payments per kWh and kW.

Network balancing payments from DNO / System operator per kW reduction of peak demand.

# 9 Annexe 3: Understanding the transition

This annexe summarises the approach taken to the development of the transition path for the selected business models.

The current state value chain is contrasted with the future state requirements. The transition challenges are then examined and timescales and pathways suggested giving an understanding of the resources, processes and values required.

For each business model a number of hypotheses to test are proposed, along with Pathfinder Projects needing to be undertaken during SSH Phase II trials.

The figures on potential market size, growth and efficiency changes presented throughout this annexe relate to maximum technical potential. In this way, they differ from the figures presented in the context of the evaluation. The evaluation estimates uptake based on costs and customer willingness to pay.

## 9.1 Challenges for transition

### Resources Process and Values (RPV)

Ten years of research into the enablers and effects of disruptive innovation reveal three factors that dictate an organisation's ability to innovate, or to respond to the disruptive innovation of others.[37] These are:

- a sufficient and appropriate mix of tangible and intangible **Resources** e.g. people, equipment, footprint, ideas, insight, money;
- fit for purpose **Processes** that enable work to be completed on time to standard; and
- a complimentary set of organisational **Values** that enable risks and opportunities to be assessed quickly and correctly, good decisions to be made and appropriate and sufficient resources to be invested.

An organisation's RPV is akin to its DNA. In keeping with the analogy, DNA, and the characteristics that it promotes, enables biological systems to compete in a range of hostile environments. Those best suited thrive, good fits survive and mismatches die. Unlike biological systems organisations do not need to reproduce to adapt. Instead they perceive changes in the environment, take a view on whether these changes are opportunities or risks, and then adjust their behaviour accordingly.

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37 Clayton M. Christensen and Michael Overdorf (2000), *Meeting the Challenge of Disruptive Change*

Perceiving changes in the environment is not an exact science and is informed by the collective beliefs and experiences of the people at an organisation's helm. More often than not incumbent organisations ignore, or fail to perceive, market data, that conflicts with their view of the world. Even when faced with irrefutable evidence most dither, stubbornly clinging to what made them great, rather than embracing the necessary actions to maintain their greatness.

In biological systems alien species pose a disproportionate risk. In business, new entrants, unencumbered by legacy resources or misaligned processes, tend to read their environment more accurately, have fewer constraining beliefs to overcome, adapting quickly to displace established and previously dominant competitors.

Christensen's research[38] suggests extinction can come quickly, especially for those organisations that necessarily invested heavily in proprietary solutions. Faced with stripped down versions of their own offering many find it impossible to abandon the people and capabilities that enabled their dominance. IBM, Kodak, British Airways, General Motors, Astra Zeneca, Nokia and Compaq all represent spectacular falls from positions previously thought unassailable.

There are a number of notable exceptions where organisations have repositioned themselves fundamentally and successfully e.g. BT, Virgin and Rolls Royce. Christensen's research again reveals valuable insight into why this might be so. In each case success follows:

- the arrival of a new leader not associated with the organisation's past;
- the creation of a maverick independent business unit to explore and test new opportunities and ways of working isolated from the host organisation's influence; and
- the acquisition of, or strategic partnering with, a business, rich in the missing capabilities, appropriately funded, scaled aggressively and reporting to the new CEO (e.g. Dell's partnering of Intel).

### Presentation of transition paths for the selected business models

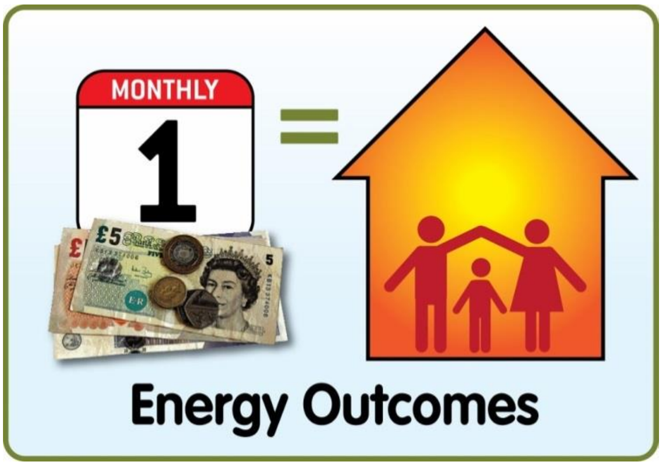
For each business model, we describe the transition path in eight steps:

- fundamentals of the business model;
- future state value chain diagram;
- critical success factors;
- strategic gaps in the current state;
- options for change;

[38] Clayton M. Christensen and Michael Overdorf (2000), *Meeting the Challenge of Disruptive Change*

- suggested approach to transition;
- transition timescales and rate of improvement; and
- phase II trials: pathfinders and hypotheses.

### 9.1.1 Energy Outcomes




#### Fundamentals of Energy Outcomes

Energy Outcomes is a business model which turns the current energy market on its head by offering fixed payment for comfort; rather than a variable price per kilowatt hour. In so doing it resolves a number of the sacrifices consumers currently bear and this throws new challenges to the business model provider.

As described in Annexe 2, Energy Outcomes will need to:

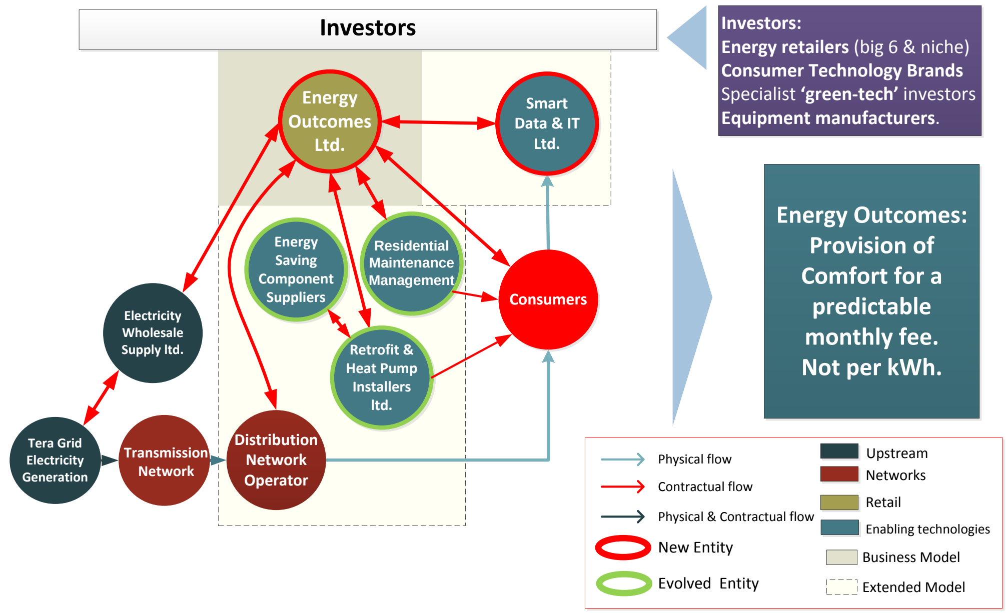
- maximise its profits by minimising home energy consumption;
- take responsibility for the energy performance of heating systems and building fabric and have the capability to improve them effectively;
- design, specify, procure, install and maintain new and upgraded systems in customers' homes with the minimum of disruption at lowest cost; and
- manage multi-year contracts with fully or semi-fixed pricing irrespective of weather, fuel price, equipment failure or consumer behaviour, subject to fair usage.

To dominate the market place Energy Outcomes will need a credible and trusted consumer brand consistent with high end technical innovation, continually delivering more for less.

## Future state value chain diagram

**Figure 24** shows the future value chain businesses for Energy Outcomes. The pale shaded boxes show the key partners for the Energy Outcomes provider and their capabilities could be included in the business model.

**Figure 24.** Energy Outcomes future value chain




Source: Total Flow

## Critical success factors

Energy Outcomes has six critical success factors:

- a consumer brand synonymous with domestic innovation or reliable high performance technology e.g. Dyson, Audi;
- brand development and marketing making energy system investment and ownership visible and chic, akin to car ownership (no one thought hand drying was much of a conversation topic until Dyson turned up);
- whole house, integrated systems design;
- supplier selection, engagement and management where Energy Outcomes sets the challenge for technical excellence and reliability of products, continuous improvement and routine cost reduction in product and process (automotive and electronics industries have shown this approach delivers doubling of performance and halving of costs over a decade);

- the capability to trade in the energy market, meeting regulatory requirements for selling to consumers and contracting for energy competitively; and
- a customer service ethos which reinforces the consumer's decision to choose Energy Outcomes, based on their ability to meet or exceed expectations. This creates brand loyalty and is a powerful marketing tool to get people recommending the brand and offering.

## Strategic gaps in the current state

We have identified three strategic gaps in the current state.

- *Gap in systems design*: There is a lack of integration between energy retailers and suppliers of energy saving interventions. Integration will be required to leverage their expertise and improve whole house system performance.
- *Gap in values*: Current energy sector businesses are focussed on meeting regulatory requirements (including system maintenance and capacity expansion). There is less of a focus on systems innovation and continuous cost and performance improvement than there is in some other industries (e.g. automotive or aerospace industries).
- *Gap in values:* Focussed on profitability through attraction of new customers and increasing total energy sales, not on maximising consumer value. Maximising consumer value will encourage consumers to migrate rapidly and enable the business to dominate the market: A disruptive proposition.

## Options for change

Changing the **values** of large organisations internally, and affecting how consumers perceive their brand's values externally, is a difficult, though not impossible challenge. To succeed with Energy Outcomes current incumbents of the existing energy system will need to achieve both.

Current players have five options:

- developing capability within existing energy retail businesses;
- creating an independent subsidiary;
- buying an existing brand;
- consortium partnering of aligned brands; and
- ceding the initiative to a new entrant or entrants.

The key to Energy Outcome's success is a strong and trusted consumer brand enabled by a rich systems design and integration capability. Brands like Virgin, M&S and Saga have the ability to engage their target markets but lack a systems design and build capability. Technology-led consumer brands e.g. Audi, BMW, Dyson, have the capability to achieve both, but have no experience of the energy sector.

Organisations with sufficient scale could enter the market alone, buying in the energy market expertise required (Audi, Rolls-Royce, Hitachi). Energy brands partnering other consumer-facing brands with systems capability also have the potential to succeed (EDF Energy powered by Dyson Home Technology). In such a partnership corporate aspirations and values will need to align from the outset or there could be serious consequences.

Another option to consider is for current energy players to develop an independent subsidiary operated with the sole purpose to explore the potential of the Energy Outcomes proposition.

The final credible option is for current energy businesses to partner with large consumer retail brands e.g. Tesco, M&S etc. These type of partnerships have already been tested for standard energy retail offerings, but are not greatly differentiated offerings.

Creating an internal systems integration capability is a theoretical option but one which takes decades to develop. It is risky and cash hungry; making this approach unlikely to align with the values of most institutional energy investors.

Capability could be acquired. However, the market value of capable brands would make this expensive. Alternatively the acquisition of a less capable brand might be more financially attractive but defeats the value of the acquisition.

Faced with these alternatives it is more likely that Energy Outcomes will enjoy greater success either under the ownership of a valued technology-led consumer brand e.g. "Audi Residential" enabled by a first tier expert in thermal energy efficiency (eg: Denso, Delphi or Valeo), or by a recognised energy brand "EDF Residential" enabled by consumer brand famed for its innovation and performance (Dyson, Samsung or Apple).

## Suggested approaches to transition

Once a brand proposition is conceived the mass market will migrate to an Energy Outcomes proposition based solely on its price point. The market will not tolerate current costs plus a margin: The proposition must be designed to a target cost which the consumer values .

To gain market share Energy Outcomes will need to price its offer for mass appeal and have confidence in its capability to produce a warrantied solution at target cost and performance.

Delaying launch until the target cost is achieved risks investing in a proposition which may miss the mark on consumer appeal or end up being late to market.

Once the Energy Outcomes offer has attracted a critical mass of early adopters it has the capability to grow rapidly. Disruptive propositions in other sectors have been shown to migrate market share by 40% per annum[39]. As the market develops there will be a need for differentiated brand propositions for each consumer group served (as different car marques and price points appeal to different owners). To succeed, Energy Outcomes must either: pick a target market and remain focused, or provide a portfolio of brand consistent options, each with a distinct combination of functionality, performance, utility and price.

If it fails to build a consumer brand then it will be prone to attack from low cost, poor performance alternatives, risking bad press and the resultant loss of confidence across the entire market.

### Transition timescales and rate of improvement

The basic technology and physical transformations for an Energy Outcomes model exist today and, provided there is no regulatory restriction on an outcomes- based energy offer, the value proposition could be proven within two years. The challenge of creating a viable model will then be three-fold:

- stimulating demand with a compelling offer and trusted brand;
- developing the mechanisms for assessing properties, predicting household usage and preparing an attractive and viable proposal; and
- developing the products, technology and installation processes to be able to guarantee comfort at a target cost affordable to the consumer.

Trusted consumer brands take time to build, unless they have an existing platform (Virgin Money as an extension of Virgin records) or manage to catch the spirit of the age (Google's rapid growth).

For Energy Outcomes, building on existing consumer technology brands could provide a strong message and potentially achievable within three years.

Property assessment is improving with laser scanning and cost-effective heat-loss assessment. The challenge is to link this to behaviour and technical solution performance. This requires significant numbers of pilot projects and investment to develop robust algorithms and confidence in the outcomes. This might take five years of research to master and up to ten years to refine to a lowest cost solution.

Current product supply and installation is woefully inefficient with systemic waste at every step. Significant opportunities exist to reduce cost. If Energy Outcomes providers can attain what is routinely achieved in the automotive supply chain; the industrialisation of product and process design could improve

[39] Skate to Where the Money Will Be, Clayton Christensen, Michael Raynor, Matthew Verlinden, HBR 2001

performance, and reduce cost, by circa 30% every seven year development cycle. The annual 1-2% payback improvement is driven by rising energy costs projected to rise ahead of general inflation until 2030.[40]

This is because the consumer has less sensitivity to energy price with lower energy consumption and more of their costs covering fixed capital repayment.

These points are summarised in **Table 2**, but it should be noted that much lower improvement rates are used in the evaluation tool quantification.

**Table 2.** Energy Outcomes transition vectors (potential – not used in evaluation tool)

| Business Evolution | Vector | System Evolution | Vector |
|---|---|---|---|
| **Full pilot** | 1-2 years | System performance | +30% every 7 years |
| **Viable business** | 6 years | Payback improvement | 1-2% per annum |
| **Business as usual** | 10 years | | |

Source: Total Flow

### 9.1.2 Phase II Trials: pathfinders and hypotheses

#### *Energy Outcomes hypotheses to test*

To test and demonstrate the potential of the Energy Outcomes model we need to tackle the three key issues highlighted above:

- stimulating demand with a compelling offer and trusted brand;
- developing outcomes-based processes; and
- building products, technology and installation process capability.

- **Hypothesis 1:** Demand for Energy Outcomes can be generated with investment in demonstration homes backed by a visible consumer brand.
    - The Energy Outcomes payment model is such a change from existing pay per kWh models that we need to verify that it meets the needs of consumer groups and clarify what their concerns are with the change.

[40] DECC Tables 4-8: Retail fuel prices (real 2012 prices)

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/68944/Tables_1-20.xlsx

  - Consumer mistrust of home improvement businesses to deliver to quality, time and cost needs to be overcome. Offering a choice of technology brands will clarify if such brands can change consumer perception.

- **Hypothesis 2:** Consumers will be attracted to whole house retrofit of energy saving measures if it is an affordable energy saving solution offering an aesthetic home improvement option.
  - Energy payback alone is insufficient to get most consumers to act. Developing an aesthetic and value adding consumer **benefit** is expected to add significantly to consumer appeal.
  - Current **sacrifices** of disruption, delay, high-pressure sales all reduce the take-up of energy saving interventions. Developing a customer facing offer which alleviates these will have a major impact on Energy Outcomes appeal.

- **Hypothesis 3:** Current energy value chain partners are attracted to the business opportunity that Energy Outcomes represents.
  - Existing energy providers will need to be convinced that the risks of fuel price, system performance and consumer behaviour can be managed within the Energy Outcomes offer.
  - The SSH Phase II programme will offer the opportunity for energy and consumer technology brands to develop and test (collaboratively / separately) consumer Energy Outcomes offerings.

### *Energy Outcomes pathfinder projects for Phase II trial*

**We propose that the trial considers four aspects for Energy Outcomes.**

- **Learning how to build compelling consumer branded Energy Outcomes partnerships.** This would involve:
  - assessing the appetite of energy businesses for the creation of an Energy Outcomes offer;
  - identifying potential partners, with a relevant consumer technology brand and system design capability, to create the Energy Outcomes model;
  - clarifying the 'controlling mind' within the partnership for both the brand and the Systems Integration roles; and
  - developing a set of shared business values, financial and brand expectations from the model, including attitude to risks.

- **Establishing best practice demonstration systems solutions from the best of the residential heating, automotive and office air conditioning sectors.** This would involve:
  - inviting value chain partners from sectors that can contribute design, products, processes, installation and maintenance capability to develop a best whole house solution from existing technology;
  - predicting the outcomes and compare and contrast performance with actual delivered trial solutions and focusing on consumer experience, pre- and post-installation energy usage, system reliability and delivery cost; and
  - developing pathways to achieve target cost of design, install and through life operation.
- **Exploring and testing Energy Outcomes brand proposition to ensure they are compelling to consumers.** This would involve:
  - testing consumers' appetite for Energy Outcomes branding e.g. M&S, Audi, Virgin, E-On, EDF Energy, Siemens, Local Authorities, etc;
  - assessing consumers' appetite for outcome-based contracts by providing offers at a range of price points and intervention levels; and
  - where viable, offering an Energy Outcomes solution for an unimproved home to test.
- **Developing a SSH Energy Outcomes retail offer and trialling all aspects of performance across the selected Phase II sites.** This would involve:
  - market testing the Energy Outcomes offer based on **target** costs and energy savings for energy saving interventions (current costs and savings will not be compelling);
  - developing three comfort options (eg: Unlimited, Standard, Basic. Design) and straightforward commercial terms for the Energy Outcomes offer;
  - setting a long-term target cost and technical performance requirement for the delivery of energy savings interventions and smart data;
  - developing a stock model of the Phase II trial area to assess technical challenges and tenure mix;
  - securing show-home properties from the Local Authority in the heart of the community;

- refining technical offerings (e.g. Good, Better, Best for aesthetics and finishes), and including added value options to tip the sale (e.g. decoration, landscaping, loft clearance); and
- scale up delivery capability, providing supply chain contracts and installation teams of four with central technical resource.

### *Scaling the solution*

To scale Energy Outcomes from the pilot requires:

- the suite of design and assessment tools to give a robust evaluation of home energy and the basis on which to make an outcomes based offer;
- installation excellence for both technical performance and the consumer experience; and
- supply chain capability for on-time delivery and a cost reduction focus.

Although property energy assessment tools exist; no current or near market offers have been identified. Such tools could be proprietary to Energy Outcomes businesses or licenced from a central organisation to give common standards.

Scaling installation, whilst maintaining quality and customer service, has been a major challenge for current UK home improvement companies. Creating robust standard work and quality assuring each delivery team is crucial to build and maintain the reputation of the brand and the Energy Outcomes offer.

Existing supply chains should be capable of responding reliably to demand, but the 'cost down, performance up' capability driven by Energy Outcomes as the system integrator may require new entrants from other sectors.

The suggested approach is to develop focused local retail clusters, leveraging commitment from local authorities to improve their housing stock performance. Once the core is established, satellite clusters can be added and central resource expanded to provide national coverage. The energy saving intervention partner must be closely integrated with Energy Outcomes to ensure that delivery capability matches demand growth. Installation teams could run on a franchise or licensee model e.g. Audi dealerships, Costa Coffee or Kwik Fit, with the installation partner or Energy Outcomes assuring quality.

To accelerate the growth of capability in line with growing demand requires the industrialisation of processes (commercial and installation) and the training which enables them. To achieve this Energy Outcomes will need to focus on the creation of standard work for each activity, so that teams can be trained reliably and rapidly at a rate to suit demand growth. This and a standard management approach will enable Energy Outcomes to improve at a rate which meets or exceeds the expectation of the market.

## 9.2 Energy Mutual


### Fundamentals of the business model

Energy Mutual is an enabling vehicle to stimulate domestic energy improvement as a one-stop-shop for finance, business case, installation, energy retail and maintenance. The business enables every property in the UK to enter the energy saving market irrespective of the householder's capability to invest.

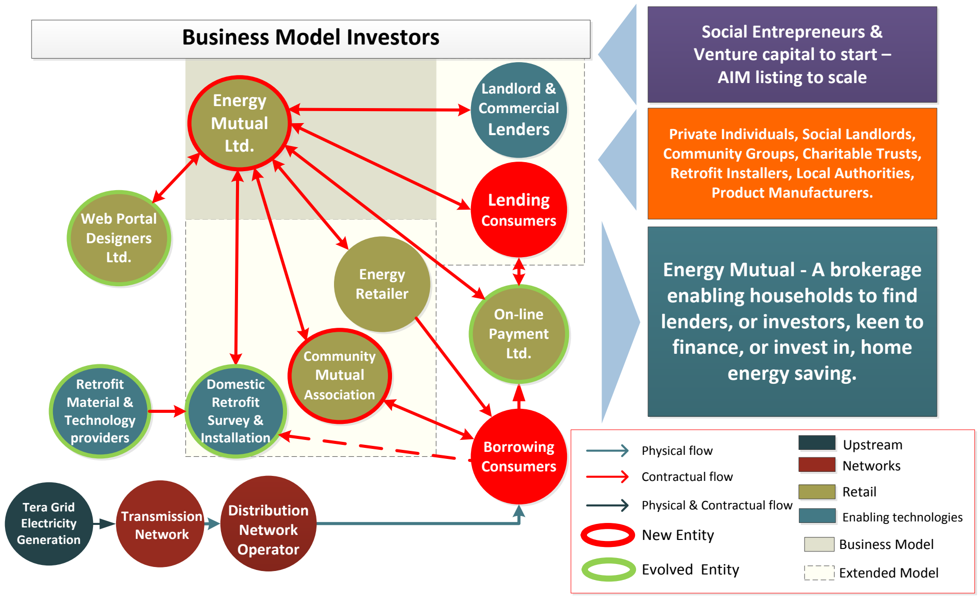
As described in Annexe 2 above, Energy Mutual will need to:

- attract lenders, investors and borrowers with a trusted and secure financial brand and appealing domestic property improvement offering;
- overcome householders' inertia to take energy saving action; by developing a compelling business case they or others can invest in, along with a hassle free mechanism to realise the opportunity;
- present the property business case, clearly demonstrating the financial return, carbon savings, home value added and personal or business social responsibility gain and showcase the art of the possible for home energy improvement as delivered by its trusted and approved partners; and
- develop a robust network of home improvement capability which precisely meets consumers' expectations for energy saving, attractive design and functional home improvement.

### Future state value Chain diagram

**Figure 25** presents the Energy Mutual future value chain. This shows that Energy Mutual is an enabler for energy investment and not directly part of the energy supply value chain.

**Figure 25**: Energy Mutual future value chain




Source: Total Flow

## Critical success factors

We have identified five critical success factors for Energy Mutual:

- a trusted financial services brand synonymous with its innovative use of technology to create consumer value e.g. First Direct, Virgin Money;
- a socially responsible enterprise which fuels investment in consuming less energy; whilst offering broader consumer appeal (e.g.: Tridios bank);
- a means for ensuring it is as simple, familiar and secure to borrow, lend or invest as it is to do your on-line banking;
- supplier partnering and development to assure; energy performance, high quality installation, low cost and customer service excellence; and
- the capability to aggregate its customers’ energy demand and negotiate the best energy pricing for borrowers, lenders and domestic investors.

Energy Mutual could be a commercial business, or a not for profit backed by government to build profitable growth in the value chain.

## Strategic gaps in the current state

There are five strategic gaps in the current state for Energy Mutual.

- *Gap in process.* Capability to enable domestic energy investment opportunities to be identified, sized and traded is required.

- *Gap in process.* A process to enable those looking to invest in domestic energy solutions to find and secure best fit investment opportunities them is needed.

- *Gap in values.* High street lenders are focused on minimising default risk rather than improving sustainability or long-term return.

- *Gap in values.* There is a lack of personal relationships between existing lenders and borrowers, resulting in less ownership of debt by consumers and reduced flexibility to accommodate individual circumstances from lenders.

- *Gap in capability.* Capability to present compelling business cases to householders or potential investors to stimulate energy improvement investment is required.

### Options for change

Here we consider options to build the Energy Mutual business by:

- developing capability within existing financial businesses, or energy value chain players;
- creating an independent subsidiary;
- buying an existing brand;
- consortium partnering of aligned brands; and
- bringing in a new entrant or entrants.

Energy Mutual is an enabler not a lender. It is a portal that brings together borrowers and lenders, investments and investors. Viable forms this business might take are either (1) a portal agnostic to the propositions it promotes (eg: Carphone Warehouse), (2) a portal for a range of companies and propositions willing to pay for the right to be presented (e.g. Moneysupermarket.com), or (3) a single branded outlet promoting the solutions supplied by their own value chain (eg. Vodafone, EE, TalkTalk etc.)

A trading platform, or match maker, is a relatively simple proposition to engineer, as can be seen by the explosion of internet dating sites. The real challenge is not this, but the much more difficult task, of bringing together and orchestrating a currently disparate value chain to create solutions that yield acceptable levels of return. If there is a business case to be made then Energy Mutual will succeed.

To flourish it will need to develop with four distinct components:

- a brand with sufficient appeal to overcome market inertia and mobilise a critical mass of house owners to act;
- a brand trusted by house owners looking either to invest funds, secure funding or to trade their property's business case;
- a brand trusted by institutional investors; and
- a brand trusted by members of the value chain.

There is no precedent in the financial services sector for any organisation to attempt this. There are many examples of companies positioning themselves into one or more niches, but not all four.

Insider knowledge of the strengths and weaknesses of the financial services sector seems a pre-requisite to bring technology enabled consumer brands to market successfully. RateSetter, Cleardebt, Folk2Folk and First Direct are all successful examples of new businesses led by former senior banking executives that have launched and grown innovative value propositions to create new markets from nothing, and this should be taken into account.

To enable sound system solutions and business cases to be traded will require Energy Mutual to marshal a single or multiple competing value chains. In the absence of an energy systems leading brand or OEM, Energy Mutual might either act as the catalyst to its emergence or take responsibility to develop a solution in its own right.

How Energy Mutual enables value to flow up and down the value chain will affect the way it is perceived by current energy partners and the regulator. Energy Mutual will miss an enormous opportunity if it comes to market as a slightly adapted version of the Green Deal. Positioned correctly it could lead to a consumer revolution as marked as mobile phone ownership, domestic broadband uptake or the transformation in popular share ownership in the 1980's.

An alternative solution might be for Energy Mutual to be an independent branded outlet financed directly by every member of the energy industry to educate house owners, enable trading and to match opportunities with solutions and investors.

The last viable option we have considered is for a trusted consumer brand with high street and online presence, experienced in selling financial services products to extend their offering. Here the Post Office would most closely fit the role.

### Suggested approach to transition

To get Energy Mutual trading rapidly; a value chain made up of a trading vehicle (e.g. Go Compare), a new entrant into the market for energy saving interventions (e.g. Energy Outcomes) and an innovative and established financial services brand (e.g. First Direct, Zopa) appears the most straightforward to deploy.

- The new entrant (potentially an Energy Outcomes provider), will benefit from the creation of Energy Mutual as a new mechanism to engage with consumers and one which reduces consumers' burden of securing finance.

- The ethical finance business benefits from a targeted home energy improvement market as part of their unique offering. This will increase their throughput of funding and makes their brand synonymous with energy saving. As the brand grows the need for institutional finance might reduce, being replaced by crowd or mutual funding.

- Any of the current trading vehicles might wish to play or it might be an opportunity to develop a new brand with modest amounts of marketing and systems investment. Many lessons can be learned by studying BT's 1984 "Tell Sid" campaign and other successful consumer launches since.

- Adding a fourth partner as a Community Interest Group (eg. Cambridge Energy Saving Co-operative), might add focus both to marketing and regional delivery capability. Having proven the model Energy Mutual might then be scaled through other community partners, geographic vehicles or through direct consumer marketing.

- Local success has been achieved in less than six months with a locally focused peer to peer lender[41], focusing on Devon and Cornwall, who has brokered £4m of investment since start-up in February 2013.

As an alternative; the not-for-profit start-up of Energy Mutual could attract funding from a range of sources, for example, local or national government aiming to stimulate home energy saving or installation businesses able to invest in a potential new channel. Private individuals may also see value in investing in the business on a crowd funding basis, as well as acting as investors in the business cases Energy Mutual creates.

Discussions with an existing peer to peer lender and on-line portal revealed that a new trading entity would be likely to take two years to achieve the required financial accreditations and start trading. In contrast; a collaboration between an existing finance portal (creating a new and joint brand), working with a partner in a highly targeted market (either by geography or social group), could be trading within three months. In this case the limiting factor for trading would be the development of the marketing to reach the target sector.

41 Folk2Folk http://www.folk-folk.com/

## Transition timescales and rate of improvement

For Energy Mutual to succeed. investors need to trade with borrowers, a transaction which needs to satisfy three criteria:

- there is an acceptable return for the investor (financial or otherwise) and an acceptable cost of borrowing to the borrower;
- the sacrifices of difficulty to trade are minimised; and
- Energy Mutual is seen as a high quality organisation where opportunities and investors are seen as credible and low-risk.

**Return** for investors is dependent on the business case and three factors have been identified as likely drivers:

- **Financial return:** From an Energy Mutual perspective the financial return can be increased with external factors such as "Community investment tax relief"[42] which effectively increases lenders return by making them tax free for socially worthwhile projects. Where investors take more risk (offering low interest rates based on savings potential) options may be developed for sharing the upside with householders.
- **Carbon offsetting:** Consumers and businesses are beginning to include their carbon footprint in decision making. If Energy Mutual provided a robust mechanism for crediting carbon offsetting, whilst promoting those who were doing so it could demonstrate significant value to investors.
- **Social responsibility:** By acting as a trading platform for good causes as well as domestic projects Energy Mutual can attract investment for social purposes including energy improvement of a school or a day care centre with low or zero expectation of financial return. However, care needs to be taken that this does not dominate the key driver of mass scale domestic business case development.

Viable business cases, with a blend of returns, will be found without technology change and should not limit pilot launch within two years and the creation of a viable business within five. However, developing the mass market where domestic energy investment is the norm will take a technology enabled compelling financial case.

**Trading sacrifices** include the difficulty of finding an investment opportunity or partner and the process which needs to be followed to complete the trade.

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[42] CITR http://www.hmrc.gov.uk/specialist/citc_guidance.htm

The fundamentals of the trading platform are well developed in internet banking and peer to peer lending and the creation of a branded portal can be completed within a year. Peer to peer lending lenders have focused on the speed and simplicity of transactions so that individual trades can be completed in a matter of days with straightforward standardised documentation.

**Brand Credibility and Quality:** Traditional banking has focused on longevity of brand and stability. More recently agile and innovative brands and offerings have proven that new entrants can make an immediate impact and grow rapidly[43]. Setting a clear market focus and paying attention to creating, or partnering with, a relevant brand means viable business could be established within five years.

**Payback improvement** will be accelerated by energy price inflation unless a fixed price or outcomes payment is contracted; this is because the consumer has less sensitivity to energy price with lower consumption and more of their costs covering capital repayment. With domestic energy prices projected to increase by 1-2% above inflation until 2030, payback can be expected to improve even without an improvement in the technical performance of the available solutions.

**Cost of customer acquisition**: is a key metric for banks and other contracted businesses (mobile phones etc.) The goal is to minimise the cost to win new customers whilst ensuring existing customers remain loyal.

A summary is shown in **Table 3** as follows, but it should be noted that much lower improvement rates are used in the evaluation tool quantification.

**Table 3.** Energy Mutual Transition Vectors. (potential – not used in evaluation tool)

| Business Evolution | Vector | System Evolution | Vector |
|---|---|---|---|
| Full pilot | 1-2 years | Acquisition cost per home | TBC (retail bank contrast) |
| Viable business | 3-5 years | Payback improvement | +1-2% per annum |
| Business as usual | 12 years | | |

Source: Total Flow

43 In the peer to peer lending market 9 new start-ups in 2013 and 4 others are preparing to launch

## Phase II trials: pathfinders and hypotheses

### *Energy Mutual hypotheses to test*

**Hypothesis 1:** By demonstrating a business case for installation of energy saving measures, Energy Mutual will be able to generate a diverse pool of potential investors.

- An on-line portal to showcase innovative and tried and tested business cases, with an intuitive trading portal for investors and property owners, will set Energy Mutual as the home of domestic energy investment.

- Investors choose their risk profile and whether they want to invest in a business or consumer proposition before committing funds to a project.

**Hypothesis 2:** Owner Occupiers value a one-stop-shop for arranging finance and energy-focused refurbishment of their property from a trusted broker.

- Householders who can see both a business case and personal benefits from investment in their property will borrow to increase the value of their home, provided the hassles of arranging installation are minimised.

- If the transaction is clear and straightforward; matching the borrower with both a source of finance and a trusted delivery partner, Energy Mutual will grow rapidly.

**Hypothesis 3:** Capable installers of energy saving measures and smart systems can grow their business rapidly with alternative routes to enable property transformations.

- Installers can prepare a convincing business case but are often unable to help the householder find the funding that will enable the work to start.

- Energy Mutual provides value for capable home improvement businesses by matching them with investor(s) who invest in a specific business case. Investors develop confidence in the property transformation installer's ability to deliver a return.

- Energy Mutual gives opportunities for suppliers to invest in projects using their technology or capability. Manufacturers provide the product and investment for projects to stimulate the market for their innovation.

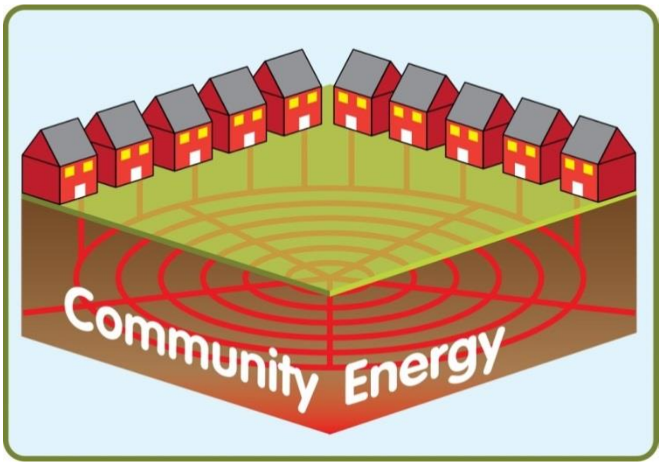
### *Energy Mutual pathfinder projects for Phase II trial*

**We propose that the trial considers three aspects for Energy Mutual.**

- **Learning how to develop a localised portfolio of investable property business cases and how to promote them to investors through the Energy Mutual portal.**
  - identifying an innovative and capable domestic energy refurbishment designer to prepare robust property business cases in a standard format;
  - investing in a broad range of property pathway surveys and proposals with landlords and owners across the Phase II trial area;
  - presenting the ideas in a clear and appealing format to the property owners and a pool of potential investors; both commercial and private;
  - seeking feedback on the business case appeal and any misalignment between investors' expectations and the offer; and
  - developing mitigation strategies to bridge the gap; either through improved returns from process improvement or through temporary subsidy.
- **Learning how to deliver Energy Mutual funded property transformations with subsidised funding costs if required.**
  - from the business cases above identifying those with a compelling, or close to compelling, proposition for the householder or other investor;
  - Energy Mutual matches the household with capable energy saving measures and smart systems delivery partners and acts as the home transformation broker;
  - where the consumer values the offer, but there is a bridgeable gap between their willingness to pay and the installers target cost; SSH programme finance (in the guise of Energy Mutual) funds the gap, with the rider that any upside in return is to Energy Mutual's benefit; and
  - where the consumer is not interested in a clear business case the opportunity is presented to the pool of investors identified above, identifying any gap between the investors' expectations and the cost of the works. The SSH programme could provide funding, but the proposal is to do so to a level where it just bridges the gap between current and predicted cost. Reducing the risk of devaluing energy improvement measures.

All properties invested in in this way have additional performance monitoring funded by SSH in order to build an evidence base for the installation of energy saving measures.

## 9.3 Community Energy




### Fundamentals of the business model

Community Energy focuses on engaging a local community in a competitively priced low-carbon solution which is governed by the community, in the community, for the community.

For continued success Community Energy will need to:

- identify potential sites and rapidly pursue them to completion, or deselect them with minimal costs incurred;
- partner with Local Authorities and other 'base load' users;
- design, specify, procure, install, operate and maintain large scale heat and electricity generating plant and the network(s) to distribute energy;
- drive performance and cost improvement in the supply chain, including capital equipment (heat plant etc.) and capital delivery (network pipe laying, installation of energy saving measures); and
- manage fuel price risk by hedging on the wholesale energy market.

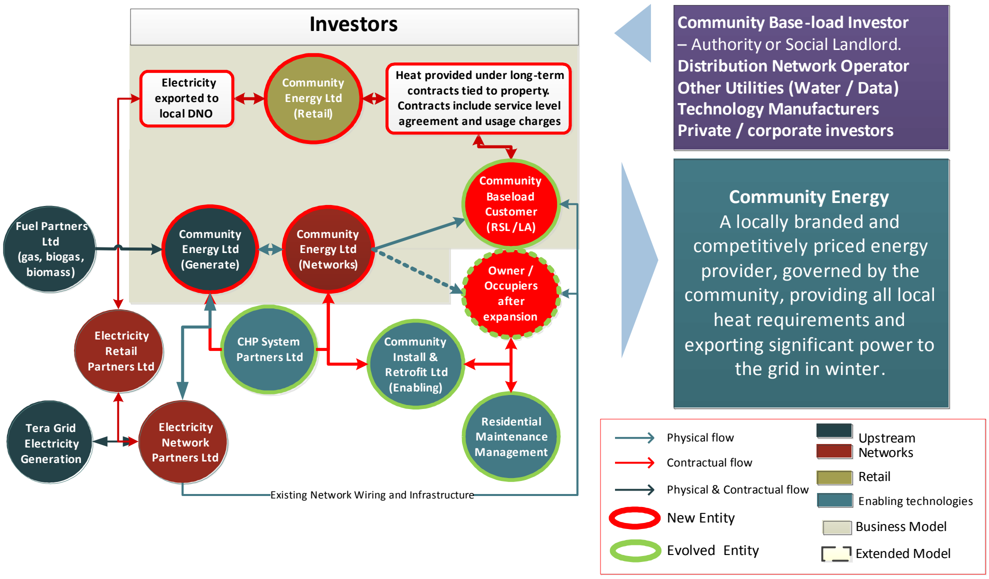
To expand their network beyond the base load Community Energy must:

- Create attractive Owner Occupier propositions to generate demand for connecting to the expanding and scaling heat network.

### Future state Value Chain diagram

**Figure 26** presents the Community Energy future value chain. Showing both the 'prime mover' heat network (within the business model) and the future extension to owner occupiers.

**Figure 26.** Community Energy future value chain




Source: Total Flow

## Critical success factors

We have identified a number of critical success factors:

- as a capital intensive business any reduction in capital equipment and network installation cost has a major impact on viability;
- three groups of system suppliers have significant impact on costs making partner selection and a match in business values crucial:
  - **Plant:** The large scale generation plant as the prime mover.
  - **Delivery network:** The pipe network laying and civil engineering to get heat and power to homes.
  - **Home:** The home installation of equipment and extension to installation of energy saving measures.
- a credible brand for local authorities and other prime mover organisations based on technical capability and assured delivery;
- a compelling consumer brand to attract new households to join the network as it scales;
- marketing to generate sufficiently 'dense' demand which avoids disproportionate connection costs;

- setting contracts for trading power with energy retailers or large power users will need to be a core competence;
- partnering with the local DNO for effective connection to and integrating with the grid to reduce network investment;
- creating distribution level electrical and heat storage;

### Strategic gaps in the current state

We have identified four gaps.

- *Gap in systems design*. Capital equipment is robust and well-engineered but lacks a whole systems perspective to integrate fully with the grid. It is not currently available as a wrap-around "power by the hour" service offering.
- *Gap in capital delivery*. Heat network and installation of home energy saving measures are too costly based on process design, labour effectiveness and material costs. Subsidy and grant funding is needed to bridge the gap.
- *Gap in values*. A lack of connection between the energy consumer's use and the source of this energy. Little understanding of heating options available and their impact; minimal engagement in energy reduction as a result.
- *Gap in integration and consents*. Co-ordination with planning, highways, utilities and local groups is burdensome and time consuming.

### Options for change

Here we consider options to build the Community Energy business by:

- developing capability within existing financial businesses, or energy value chain players;
- creating an independent subsidiary;
- buying an existing brand;
- consortium partnering of aligned brands; and
- new entrant or entrants.

Energy retailers have experience in the UK and internationally of leading or contributing to CHP installations and networks in partnership with the city or local authority. Such projects can be seen as a series of one-off opportunities; rather than a systematic approach to identification, delivery and management of Community Energy projects. Existing energy businesses have the resources and capital delivery processes for creating an internal or subsidiary business model, the challenge for their values will be twofold:

- creating the leadership of, and commitment to, cost reduction and performance improvement in every aspect of Community Energy delivery; and
- developing a **local** consumer and community brand which gives Community Energy desirability in the minds of the community served. Residents of the 'prime mover' project are important, but the owner occupiers who must be convinced to opt-in will be critical to success at scale.

The closest existing business to Community Energy identified is Ener-G as a turnkey provider of bespoke low carbon energy systems. Their brand is technically based and acts as a supplier to the 'base load' organisation, rather than developing the business case itself. Cities like Malmo have developed the required capability internally which might be spun-off as a business.

New entrants, in the form of other high calibre engineering capital equipment providers (ABB, Rolls-Royce, GE, Siemens, Hitachi), have the systems integration competence to drive the required technical improvement but have not stepped forward to develop the commercial offering case as set out in the business model canvas.

Brands from outside the energy and engineering sectors in consortia with existing businesses may have the capability to generate consumer interest, but this is likely to be most valuable when an existing Community Energy project is expanded.

To capture the imagination of residents might require a big personality. e.g. a Boris Johnson, or similar, determined to carry the argument for localism, or a personality associated with a large local population e.g. Alex Ferguson, might be valuable to promote Community Energy.

### Suggested approach to transition

For Community Energy, the core requirement is for an organisation which has the scale and credibility to reassure the communities it serves that their project can be delivered, will perform and has genuine community value. This reduces the opportunities for start-up organisations and new entrants outside the energy and engineering sectors.

The capability to make the individual business cases more compelling, through cost and performance improvement will enable Community Energy to scale and this makes the systems integration capability of prime importance to the model.

Tenant engagement, although less crucial, will play an important part in convincing households that their landlord has made the right decision on their behalf. The significance grows when owner occupiers are needed to opt in to an expanding network.

Drawing these strands together convinces us that a consortium approach is the most likely to deliver a dynamic and scalable Community Energy offer. Engineering gravitas and project management capability coupled with a consumer brand, which has become synonymous with utility provision, could meet the requirements of both community and the consumer. (For example BT Community Energy powered by Hitachi). An existing energy player, creating a new community-focused division, will have the resources and processes to link with a technology provider with a highly respected brand, ideally familiar to consumers. (eg: Bristol City & E-On Local powered by Rolls-Royce). If the technology provider provides the commercial impetus to identify sites and develop the business case the additional value of the Energy Company may become marginal (York Community Power with Siemens Technology).

In all of these cases the local brand and community representatives should be the governance and driving force behind Community Energy. **Figure 26** shows the technology provider as part of the **extended** business model but their key role is an enabler of a wholly local solution.

## Transition timescales and rate of improvement

The core heat and power technologies for Community Energy exist today. They are well engineered elements which are built into bespoke systems. The Community Energy model is based on an innovative configuration of CHP, heat pumps and storage which could be piloted within one to two years with a location where planning consent was not a barrier.

There are some significant challenges at the engineering level to create a standardised platform of componentry which will allow a step change reduction in cost as the heating and generation plant shifts from one-off bespoke designs to a suite of common elements which can be connected to meet community requirements in the initial phase and then scale at less than linear cost. In the capital delivery element standardised work processes and improved technology for installing infrastructure have the same high potential to deliver a major shift in the Community Energy cost base. Experience from engineered systems and utility delivery confirms that the bulk of benefits can be delivered within eight years, although significant cost improvement will be seen within the first two.

The timing for Community Energy to reach mass market business as usual is a moot point. Once the cost structures have shifted (in eight years) it should reach a tipping point. However, the consumer market can be fickle and the point at which the majority of a street sign up to Community Energy is hard to predict. With education, brand appeal, political leadership and a compelling cost profile the twenty five years to 'business as usual', where all viable opportunities are developed, may be improved upon.

Although the heating technologies (CHP, GSHP) are well established; production at scale and integration with some of the emerging heat and power storage systems is less well developed. This gives significant opportunity for step change cost reduction and performance improvement with each product lifecycle. Parallels in automotive and aerospace industries routine demonstrate 30% performance improvement, without cost penalty every seven years[44]. Annualised cost improvement from enhanced manufacturing capability as the businesses scale is mandated at 5% for automotive sub-assembly manufacturers and is achieved by process improvement to reduce labour content of tasks[45]. With lower volume engineered CHP plant we reduce the estimate to 3.5%. Current programmes for capital delivery with network operators and water utilities show this to be a conservative annualised saving. These figures are summarised in **Table 4** but it should be noted that much lower improvement rates are used in the evaluation tool quantification.

**Table 4.** Community Energy transition vectors (potential – not used in evaluation tool)

| Business Evolution | Vector | System Evolution | Vector |
|---|---|---|---|
| **Full pilot** | 1-2 years | System performance | +30% every 7 years |
| **Viable business** | 8 years | System cost reduction | +3.5% per annum |
| **Business as usual** | 20 years | | |

Source: Total Flow

Phase II trials: pathfinders and hypotheses

## *Community Energy hypotheses to test*

- **Hypothesis 1:** Owner-occupier demand for Community Energy can be generated from a local base-load system and a compelling local brand:
  - linked to a community focal point – school or community centre; and
  - backed by a trusted and appealing consumer brand investing in cooperate social responsibility (CSR).
- **Hypothesis 2:** The current need for subsidy of Community Energy networks can be eliminated with industrial systems design to target cost:

[44] Total Flow ltd. Product & Process Design Case Study – Delphi Automotive - 2007

[45] Total Flow ltd. Product & Process Design Case Study - Autoliv 2002

  - streamlining capital delivery with standardised processes and lean systems design; and
  - combining heat network installation with other utility renewal enables a step-change in network delivery cost.

- **Hypothesis 3:** Existing energy retailers could play a lead role in a Community Energy consortium if they realign their business values; the consortium needs to align behind the goal of lowest system cost as a guiding principle.

### *Community Energy pathfinder projects for phase II trial*

**We have identified two aspects of the Community Energy model that it would be particularly useful to trial.**

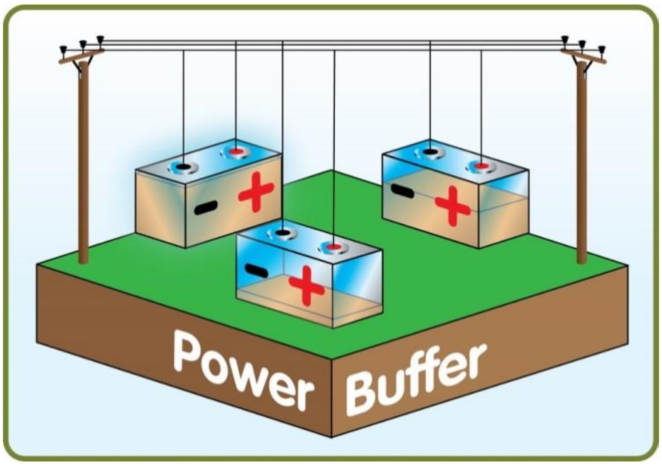
- **Developing options for an existing energy/heat network to improve and expand a current system and create an enhanced consumer offering.**
  - identifying a location with potential and ambition to scale an existing network and play a larger role in local energy infrastructure;
  - working with community groups to develop added value consumer propositions for energy tariffs, installation of energy saving measures and smart controls (HEMS);
  - developing links with local DNO to understand strategic power network challenges and synergies from heat plant and network installation; and
  - creating a proposal for existing network expansion and upgrade; use as a draft template for the SSH demonstration community heat network.

- **Developing options for a scalable SSH demonstration Community Energy network integrated with infrastructure renewal.**
  - identifying a local authority and/or social landlord with a location that has potential for a large scale (1000+ home) Community Heat network with an identified base-load (≈ 200 homes), suitable for a scalable CHP and GSHP system. Key selection drivers:
    - an opportunity to build on existing or emerging community spirit; with an ambitious Local Authority keen to implement a network;
    - a mix of household tenures (social, private landlord and owner occupier), demographics and house types at medium or high density;

- DNO links for power export and network partnership; and
- Potential for infrastructure synergy for renewal or upgrade (water, power, sewage, data services, gas, road surface).

- developing a top level strategic scheme for roll-out from the base-load to cover adjacent owner-occupier streets;
- selecting technology and delivery partners with experience, but crucially with ambition to deliver a quality system at an affordable cost;
- marketing the community project and enable local residents to engage off-plan; and
- planning the development of the community infrastructure to deliver the Base-load development, as a minimum, within the SSH timescales.

## 9.4 Power Buffer




### Fundamentals of the business model

Power Buffer is a business-to-business provider of permanent or temporary electrical storage capacity. The technology has three distinct benefits:

- it smoothes load spikes on critical assets to avoid network overload;
- it acts as a safety backup to cope with planned and unplanned outages; and
- when not being used to assure network resilience Power Buffer is able to trade flexibility services from its storage capacity.

For success the Power Buffer business model must:

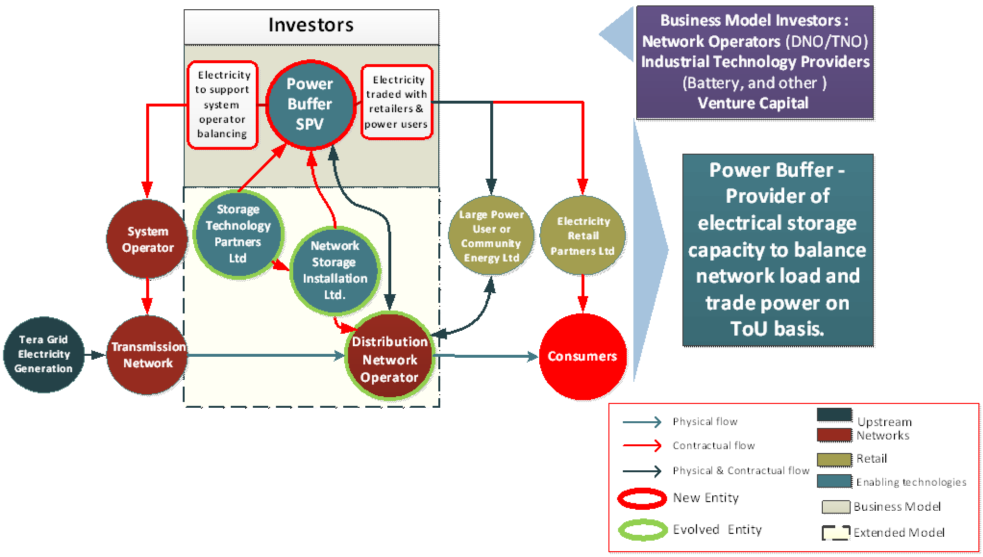
- provide a valuable service to DNOs for improved network resilience and avoided/postponed infrastructure investment;

- agree the financial value and basis of payment for the service;
- design, procure, deploy, maintain and upgrade power storage solutions tailored to the specific needs of each customer;
- develop cost-effective and low-maintenance technical solutions which can be installed at customers' sites with minimal space and disruption;
- offer a range of contract types to appeal to different customer needs;
- meet regulatory requirements and create a trading capability for selling power profitably to external customers.

## Future state value chain

**Figure 27** describes the value chain for Power Buffer.

**Figure 27.** Power Buffer future value chain




Source: Total Flow

## Critical success factors

We have identified six critical success factors:

- a highly responsive, reliable and cost effective mechanism for levelling network load;
- a robust and transparent contract for profitably providing resilience to a DNO or System Operator on a managed service, or pay per use basis;

- for energy trading: **Sale price** must be ≥ **Charging price** ÷ **efficiency** + **required return** (based on asset and installation WACC, plus operating cost and profit);
- a straightforward mechanism for trading power with energy retailer and other power users, on a regular or spot trading basis;
- a partnership with technology providers to refine Power Buffer capability in line with customer needs and continually improve the system and cost performance of the storage technology; and
- an ability to identify opportunities to extend the market to different scale (domestic or transmission storage) or as temporary network capacity.

### Strategic gaps in the current state

There are three key strategic gaps.

- *Gaps in regulatory clarity*. A DNO will be able to own and operate a Power Buffer as an alternative to network reinforcement. However, under current regulations it will not be allowed to trade energy from this Power Buffer.
- *Gaps in technology and manufacturing maturity*. This is an emerging and rapidly developing market and innovative technical solutions are being tested. As a result it is currently unclear which solution is best matched to a situation and manufacturing capability is not yet developed to deliver at scale.
- *Gaps in capital delivery capability*. Large scale electrical storage technology is at the prototype stage. As a result rapid, low-cost deployment methods have yet to be developed.

### Options for change

Here we consider options to build the Power Buffer business by:

- developing capability within existing financial businesses, or energy value chain players;
- creating an independent subsidiary;
- buying an existing brand;
- consortium partnering of aligned brands; and
- Bringing in new entrant or entrants.

Storage technology developers and manufacturers may be best placed to develop the Power Buffer business model. Large power asset providers (Hitachi, Siemens, GE) have the scale of resources necessary to industrialise product and process and will already have working relationships with DNOs to understand their technical and business requirements.

With more innovative new entrant technology businesses there may be reluctance from the networks to back a solution which doesn't have the scale of one of the aforementioned brands. For emerging technologies to scale they may need to be acquired by a large power asset business and be offered as part of a portfolio of products (to fund the industrialisation of the product as well as access to the market). To enable the acquired business to continue to innovate it may be best served being kept as a separate R&D unit with the autonomy and resources to develop leading technology and lower cost solutions.

Large energy users will also be attracted to an established industry player; unless a new entrant offers a compelling cost or technology and service proposition.

A consortium approach may have value for solutions which require complex civil engineering works, in contrast to plug and play installation. These are most likely for heat storage solutions, or those operating at larger than distribution network scale.

Energy retail businesses have the trading expertise to manage the Power Buffer model and established links with DNOs. They would need to acquire the technical expertise to design and deploy solutions and it may be questionable whether providing solutions to the DNO is part of their core business. Offering the Power Buffer solution to their larger business customers would be a good fit and added value service from energy retailers.

### Suggested approach to transition

In an area of rapid technology innovation Power Buffer needs to guide customers to the most appropriate solution from their range; rather than promoting a single technology (unless it is confirmed as a universal solution). If Power Buffer is not the technology provider; it will require the engineering resource to keep abreast of innovation and review the most suitable suppliers.

This steers us towards Power Buffer being an independent subsidiary of a major power engineering group: The heritage and access to R&D resource provides technical leadership, but its independence will ensure that Power Buffer is not only inward looking for technology but has free rein to scan the market for innovation.

Technology businesses at this scale are likely to be used to capability contracting (power or storage by the hour rather than asset ownership) which will provide the requisite options for customers. The brand and existing link to DNO customers will also be an asset.

The challenge to be put to the technology subsidiary model is that of target cost and performance: Engineering led organisations tend to be heavily focused on the product performance. Investing in systems integration capability from higher volume aerospace or automotive sectors will support the industrialisation of both manufacturing and design processes and instil the target cost mentality to match the engineering excellence.

## Transition timescales and rate of improvement

The Power Buffer transition is predominantly technology led: Once the solutions are selected business model viability and profitability becomes a function of scale and the rate of improvement in both storage performance and cost.

A range of technologies are currently being deployed as pilots at a variety of scales, so a working pilot within two years seems likely.

A viable business will be achieved when a combination of the following hold true.

- The cost and performance of Power Buffer improves to a point where its deployment is more attractive than increasing network capacity. This makes the business viable based on network resilience alone.
- Power Buffer cost and performance make it viable to trade with power with minimal buy and sell price differentials.
- The mismatch between generation capacity and demand increases the spread between Balancing Market 'system buy' and 'system sell' price to an extent that large scale trading with Power Buffer is cost effective.

The evolution of Balancing Market pricing is difficult to predict.

The current cost of technology is too high to be viable, although some analysts project a 1% cost reduction per annum[46]. This looks unambitious in comparison with Lithium-ion battery cost reduction of 9.9% per annum from 1998 -2005, and 5.4% per annum from 2002 – 2005.[47]. Taking a more cautious view based on longer established technology we suggest Power Buffer costs will reduce by 5% per annum. With a second generation of the technology after seven years; a 20% improvement in cost per MWh/MW stored is also anticipated.

This should give a viable business at the second generation, with only a minor lag until Power Buffer becomes a mainstream solution. The gap to 'business as usual' is smaller than other models as a result of the much smaller (and non-

46 EA Technology et al (2012), *Assessing the Impact of Low Carbon Technologies on Great Britain's Power Distribution Networks*

47 an evaluation of current and future costs for lithium-ion batteries for use in electrified vehicle powertrains David L. Anderson, Duke University 2009.

consumer) customer base who will need less convincing once the concept is proven.

A summary is shown in **Table 5** below but it should be noted that much lower improvement rates are used in the evaluation tool quantification.

**Table 5.** Power Buffer Transition Vectors (potential – not used in evaluation tool).

| Business Evolution | Vector | System Evolution | Vector |
|---|---|---|---|
| **Full pilot** | 1-2 years | System performance | +20% every 7 years |
| **Viable business** | 8 years | System cost reduction | +5% per annum |
| **Business as usual** | 12 years | | |

Source: Total Flow

Phase II trials: pathfinders and hypothesis

### *Power Buffer hypotheses to test*

**Hypothesis 1:** Power Buffer can play a significant role in levelling localised/regional network load to improve network reliability and defer investment.

- Where local distribution networks are running at or near capacity; sudden demand spikes may trip network points to fail.
- With Power Buffers to level network load; the same distribution infrastructure can supply greater total power to end consumers without cabling and node investment.

**Hypothesis 2:** Localised generators (Community Energy) and large power users will benefit from Power Buffer capability to manage energy import export.

- Community Energy generates power for export and values Power Buffer capability to store and feed into the grid at peak times to maximise export revenue.
- Large power users may also have generation capacity and will value Power Buffer capability to store electricity to avoid peak pricing and network charges.

**Hypothesis 3:** The transmission network benefits as Power Buffer smooths DNO network load and reduces the need for short term peaking capacity.

  - Contrast current DNO/TNO flows and peaks with modelled flows using Power Buffers across the DNO. From this the reduction in network balancing activity can be predicted and the impact of more levelled network load on peaking capacity and cost can be quantified.

**Hypothesis 4:** Where the local network has intermittent renewable generation capacity Power Buffer will aid the balancing of generation and demand.

  - For solar installations Power Buffer will be able to store midday peak generation for feeding back to supply evening peak demand.
  - With less predictable wind output more sophisticated store / hold / export algorithms for Power Buffer will be required.

### *Power Buffer pathfinder projects for Phase II trial*

It will be useful to trial two aspects of Power Buffer.

- **Reviewing a current electrical energy storage facility to establish the minimum sustainable OPEX and CAPEX.** This will involve:
  - working with a current an existing electrical energy storage facility to identify performance characteristics, operating, capital and capital delivery costs as a baseline for future systems;
  - reviewing each element with a design to target cost approach and establish an evolved future cost model for Power Buffer across scales of storage;
  - taking the greatest opportunities and work with manufacturers or capital delivery teams to design a future state and transition path to deliver target cost; and
  - creating a proposal for existing storage facility expansion and upgrade; use as a draft template for the SSH demonstration Community Heat Network.
- **Identifying the best option to deliver a Power Buffer solution within a Community Energy model, large power user or distribution level generator.** This will involve:
  - as part of a Community Energy Phase II trial; exploring alternatives for incorporating Power Buffer technology at sufficient scale to support both DNO and Community Energy needs;
  - for the DNO; sizing and connecting the Power Buffer to level existing network load irrespective of Community Energy operation;

- for Community Energy; designing the Power Buffer to have sufficient capacity to trade based on modelled heat demand and peak pricing;
- for capacity which is common to both requirements creating a shared asset and for specific needs create independent, but connected assets;
- developing the capability to control / operate the Power Buffer as a solely DNO facility, a Community Energy facility or a hybrid facility; and
- identifying the cost and operating challenges to establish the viability of a hybrid Power Buffer for DNO and generator balancing.

## 9.5 Common themes

The following common themes emerge from the business model reviews above.

- **Value Chain players need new Resources, Processes** and **Values** to participate in the future business models. They will need to evolve, acquire, collaborate or create them from scratch; or risk extinction.
- **Consumer engagement is important to shift attitudes: Attention to relevant business branding will support this.** Business and their propositions must attract consumers not sell them products.
- **Technology is developing rapidly** –industrialisation to reduce cost is as important as improving technical performance.
- **Synergy through collaboration outside the immediate offering will be important**– between business models and external value chains.
- **A shift of responsibility for risk is required**– away from the consumer taking the risk of fuel price, technology performance and effective operation to the energy and systems provider.

### Value Chain players need new Resources, Processes and Values

We first look at alignment of resources, processes in value chain organisations.

- There are significant **resources** within current energy businesses in terms of technical capability, capital assets and access to investment capital to deploy in new business models. New entrants may face a challenge to raise the resources for investment, with competitive pressure from large incumbents, but their agility and lack of legacy thinking may give them an edge. **Regulation should encourage investment based on innovation and long-term return rather than rewarding incremental improvement of the status quo.**

- In operational **processes** (from billing and system maintenance through to capital delivery), current business processes have proven robust and delivered a reliable energy system. However the **effectiveness of delivery processes has huge scope for improvement:**
  - at domestic level for installation and general building work;
  - capital delivery of new plant (Community Energy and Power Buffer);
  - across all utilities for installing or upgrading cabling and pipework etc; and
  - potential in operational processes is less marked, but worth pursuing.
- Current business **values** have a good fit with meeting the requirements of safety and other regulation, but are generally less well aligned with consumer requirements. For the selected business models evaluated, in all but Power Buffer **there is a need for a broadening of consumer focus and a strong and credible brand for the business models to take off[48].**

## Consumer engagement is important to shift attitudes

To achieve a low carbon energy system there is a need to influence a significant proportion of 26 million household bill payers to change the way they use energy. This need not be a dramatic shift in lifestyle, but could be technology and supplier enabled with creative new value propositions.

**A drive to raise the profile of energy and its impact is needed to encourage consumers to engage to the same level (or better) than achieved for waste recycling.** This could be top-down from Government, but creative **consumer brands** (eg: the M&S Plan A House, Rolls-Royce Community Energy) are likely to gain more traction. Combining approaches could be devastatingly successful.

## Technology is developing rapidly

The technical performance and cost of new and evolved solutions will have a major impact on consumer acceptance. Technology will develop most rapidly with **competitive pressure and an on-going market need**, based on a minimum technical performance and a maximum target cost. Where the gap between current and required performance is wide, **subsidies can be used to bridge the gap, but changes in support need to be gradual and clearly signalled** to avoid businesses exiting the market.

48 Some niche players have set themselves apart to align values with consumer segments and large players have aimed to improve their consumer standing getting involved in community projects.

## Synergy through collaboration outside the immediate offering

In capital delivery and utility provision in particular there is significant potential from shared programmes. As an example: typically 80% of pipe and cable laying costs are in the access trench digging and reinstatement. The vast majority of these can be shared by laying multiple utility networks at the same time.

Identifying and exploiting these synergies has potential to create a shift in the viability of marginal businesses and specific business cases.

Alignment between sector regulators will be necessary to enable, and encourage, effective an appropriate asset sharing.

## Transfer of Responsibility and Risk

In most instances currently consumers take the full risk of fuel price variation, domestic technology performance and their personal (in)ability to optimise their energy consumption. **The first energy provider willing to offer its customers a mechanism for offloading the risk whilst still saving them money has an opportunity to create a disruptive offer and shift the market dramatically.**

**Figure 28** summarises the common themes.

**Figure 28.** Common themes for business model transformation

| The degree of relevance of each of the common themes by Business Model. | Energy Outcomes | Energy Mutual | Community Energy | Power Buffer |
|---|---|---|---|---|
| Consumer Engagement & Local Branding | High | High | Medium | N/A |
| System Building | High (smart data & retrofit) | Low (independent) | High (new elements) | Medium |
| Technology Development | Low (most existing) | Low (most existing) | Medium (industrial) | High (industrial) |
| Capital Delivery Process | High (retrofit) | N/A | High (industrial) | Medium (industrial) |
| Transactional Processes | Medium (outcome design) | Low (web portal) | Medium (trading) | Medium (trading) |
| External Synergy | Home Improvement | Home Improvement | Utility upgrade | Network upgrade |

Source: Total Flow

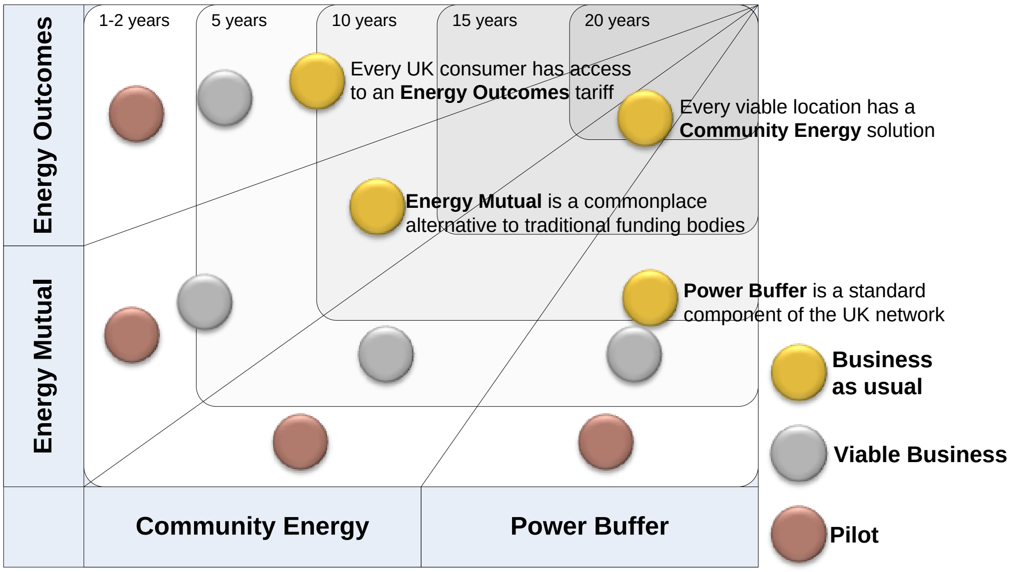
## 9.6 Summary

### Transition Vectors

To give an indication of the transition path for the four core business models; an assessment was made of the time it is likely to take to get the business model to pilot, viable business and 'business as usual' or maturity. This assessment is based on technical potential, in contrast to the evaluation (Annexe 5), which is based on likely uptake given costs and customer willingness to pay.

Defining maturity or 'business as usual' was most problematic and so individual definitions are included in **Figure 29**.

**Figure 29.** Transition vectors for business models[49]




Source: Total Flow

Our assessment is that all business models can developed to a **Pilot** project within two years making all viable for the SSH Phase II trials.

**Business model viability** is estimated based on a mix of technology development / cost reduction needs. The low technology and low start-up requirements for Energy Mutual indicate it can get to market earliest.

[49] In contrast to our modelling of commercially viable uptake using the evaluation tool, this shows the potential for the transition to new businesses, assuming costs barriers can be overcome.

**Energy Outcomes:** Could be made available to all consumers within ten years: This does not mean that Outcomes provision will necessarily dominate the market, but that it will be accessible to all who are attracted.

**Energy Mutual** takes longer to mature to a point where it becomes a commonplace alternative to established lenders for 'business as usual'. The goal is to get to a point where every home which has a viable business case for installation of energy saving measures will have an investor to enable it.

**Community Energy:** Takes the longest to fully mature (with all potential sites exploited) as a result of the major infrastructure change required across all dense urban populations. In addition the significant consumer engagement required for owner occupiers as the networks expand.

**Power Buffer:** Requires significant technology development and industrialisation to reach business viability, but with a narrow customer base it is likely to shift rapidly to maturity soon afterwards.

### Performance and cost evolution

Any industrial or transactional process can be improved or developed with lean thinking and continuous improvement methodologies. The rate and magnitude of change is dependent on the level of maturity of the existing processes and the complexity of current processes:

- the less mature the product or process the greater the potential for and rate of improvement; and
- the more complex the process (number of components and transactions) the greater the improvement potential.

Where there are multiple hand-offs between businesses across the value chain there is a risk profit on profit and reduced consumer value. This is a result of a lack of maturity of the supply chain where suppliers aim to maximise short term profit (through high margins) rather than collaborate across the value chain to achieve a target cost which grows the overall market. Supermarkets and Automotive OEMs are adept at minimising profit on profit whilst aiming to ensure the supply chain players remain sustainably profitable.

Experience from advanced industrialised sectors (automotive, electronics and aerospace) shows that at every new product lifecycle (eg: new vehicle model) there is a step change in performance and cost. While, with a supply chain focused on simplification of process and elimination of waste, additional year on year cost savings are achievable.

The assessments made in **Figure 30** are based on contrasts with products of similar complexity and at similar stages of their product innovation and development. It is important to note that these are improvement rates achieved in other equivalent industries and are not a given for the four business models.

As a result this improvement potential has not been factored into the quantitative evaluation tool runs. If similar levels of improvement capability can be achieved the viability and profitability of the business models will be greatly improved.

**Figure 30.** System evolution **potential** (not used in evaluation tool)

| | System Evolution | |
|---|---|---|
| | Performance Improvement | Cost Reduction |
| Energy Outcomes | 30% every 7 years | 4% saving per year |
| Energy Mutual | Reduced Acquisition Cost (TBC) | 4% increase in return per year |
| Community Energy | 30% every 7 years | 3.5% saving per year |
| Power Buffer | 20% every 7 years | 5% saving per year |

Source: Total Flow

To achieve such levels of improvement there needs to be an internal or external driver to push for change; coupled with a depth of product and process improvement capability.

The following Annexe explores the policy and regulatory factors which have the potential to impact the evolution and impact of the selected business models.

# 10 Annexe 4: Developing solutions: Policy context and transition

This annexe describes the main features of energy policies, market arrangements and regulatory frameworks required to deliver the six business models in the context of a smart energy system.[50] For each of the business models in turn, we examine the policy, market arrangement and regulatory requirements and we describe the path of transition to these policies.

## 10.1 High level policy requirements

The ETI have described a smart energy system as a system that is:

- based on consumer requirements for energy based services, and also meets UK climate change targets;
- incorporates power, heat, transport and the energy infrastructure;
- includes energy demand, supply, delivery and storage; and
- integrates energy control and management across the system[51].

Therefore a future smart energy system must develop from today's system[52] to meet UK climate change targets and will integrate energy control and management across the system. This section introduces the high level policy requirements that have been identified, while later sections look into the specific policies affecting each business model.

### 10.1.1 Meeting climate targets

Extensive work on the policy requirements for meeting UK climate targets has been published by DECC and the Committee on Climate Change[53].

These highlight several key requirements for policy actions of relevance.

- **Heating.** To allow carbon targets to be met, buildings will need better insulation, and consumers will require more energy-efficient products while obtaining their heating from low carbon sources.

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50 Hybrids do not add any extra policy requirements, so these are not assessed here.

51 ETI (2012) *Request for Proposal: Value Management and Delivery*

52 In Part 1 of WA4, we looked in detail at today's energy system. Frontier Economics and Total Flow (2013), *WP 4.1.Characterisation of the current energy value chain*

53 For example: DECC (2011) *Carbon Plan*, Committee on Climate Change (2010) *Fourth Carbon Budget*

  - Low-carbon heating technologies such as heat pumps are currently more expensive than the incumbent options. A carbon price applied to gas and heating oil or subsidies on the low-carbon alternatives are required for rollout to be successful. Government's Renewable Heat Incentive is aimed at delivering this required support to 2020. Further support may be required beyond then. On a per kWh of heat produced basis, the RHI provides an incentive six times greater than the incentive that would be provided by an economy-wide carbon price (at DECC's projected level)[54].
  - A range of policy reforms will be required to support the roll out of district heat. These are discussed further below in the context of the Community Energy scheme.
  - Energy efficient investments (e.g. cavity wall insulation) often save consumers money. However, there are barriers to their adoption. Schemes to reduce hassle and upfront costs are required. For example the Green Deal removes the upfront cost by spreading the costs of energy efficiency improvements over multiple years.
  - Other energy efficient investments (e.g. solid wall insulation) are not economic for consumers, particularly in the absence of a carbon price. For investments in these areas to take place, subsidies or other incentives will be required.

- **Electricity sector.** The electrification of heating, transport and industrial processes may increase average electricity demand by between 30% and 60%.[55] To meet 2050 targets the electricity sector needs to be almost completely decarbonised.
  - Low-carbon generation is currently more costly than fossil-fuelled generation, especially when the externality from the carbon emissions from conventional plants is not factored in. This means a stable long term carbon price and/or subsidies for low-carbon generation will be required. Government's Electricity Market Reform programme is aimed at putting this support in place.
  - Some low-carbon plants are at an early stage of maturity. For example, Carbon Capture and Storage (CCS) has not yet been demonstrated at scale, and many renewable technologies are largely untried. To help bring these technologies to market, investment in development and

54 DECC (2013) *Carbon Valuation*

55 DECC (2011) *Carbon Plan*

demonstration is required. Government is currently active in this area – for example £1 billion has been set aside to support CCS.

### 10.1.2 Integrating energy control and management

At present, infrastructure to integrate energy control and management across the system is not in place. For example, most household metering of electricity is dumb. This means household consumption cannot be monitored in real-time.

Energy retailers have a requirement to roll out smart meters to all domestic and SME customers by 2020.[56] This is the first step to allowing integrated energy control and management across the system.

## 10.2 Energy Outcomes

Four main barriers need to be overcome for Energy Outcomes to be introduced.

- **Ofgem plans to limit the range of tariffs that energy retailers can offer households.**
  - **Barrier.** Ofgem published a consultation on its Retail Market Review domestic proposals in June 2013. Its final proposals include a requirement that energy suppliers limit the number of core tariffs that they offer customers, and that they make these tariffs more comparable between different suppliers.[57] These restrictions may act as a barrier to introducing a model which charges customers based on outcomes (e.g. comfort level) rather than inputs (electricity and gas used).
  - **Policy enabler.** An exemption to the Energy Outcomes business model provider would remove this barrier. This exemption could be based on the business model provider offering a bespoke service over and above electricity and gas supply, requiring more differentiated pricing between different households.
- **The business model provider may face regulatory constraints on its ability to impose early exit fees.**
  - **Barrier.** When setting early exit fees for customers choosing to end the contract before the five year period is complete, the business model provider must adhere to Ofgem regulation around setting charges for

56 https://www.gov.uk/smart-meters-how-they-work

57 See Ofgem, 2013, The Retail Market Review – Statutory consultation on the RMR domestic proposals, available at: http://www.ofgem.gov.uk/Markets/RetMkts/rmr/Documents1/The%20Retail%20Market%20Review%20-%20Statutory%20Consultation%20on%20RMR%20Domestic%20Proposals.pdf.

energy supply contracts. This regulation allows Ofgem to consider the fairness of charges, and unduly onerous terms and conditions are prevented.[58] However, the overall contract with the consumer will also cover other elements (e.g. energy management, installation of energy saving measures) not directly relating to energy supply, potentially introducing complexity over which terms fall under the energy supply regulation.

- **Policy enabler.** Regulation of charges such as early exit fees protects consumers and it is therefore undesirable to change this. In any case, the business model provider is likely to find that providing customers with clear and fair exit fees is necessary to attract customers.

- **It may not be possible to hedge energy costs over the five year contract period given current wholesale market liquidity levels.**
  - **Barrier.** Currently five year contracts to hedge power prices are not traded, and more medium term (two to four year) contracts have relatively low liquidity levels.[59] This acts as a barrier to hedging energy costs over the five year contract period.
  - **Policy enabler.** Ofgem has been consulting on regulatory changes that could increase wholesale electricity market liquidity. Its proposals in June 2013 included new generation licence conditions for large energy generators. These conditions would require large generators to publish the prices at which they buy and sell wholesale electricity up to two years in advance and to trade with smaller market participants at these published prices if requested.[60] These measures could increase liquidity by enabling better market access for smaller participants, which is likely to result in increased forward trading volumes, as these participants are less likely to be vertically integrated and may therefore have a greater need for wholesale trading. However, these proposals alone may not be sufficient to make five year futures products available.

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58 See Ofgem, 2013, The Retail Market Review – Final domestic proposals, available at: http://www.ofgem.gov.uk/Markets/RetMkts/rmr/Documents1/The%20Retail%20Market%20Review%20-%20Final%20domestic%20proposals.pdf.

59 Based on Bloomberg data, and Ofgem, 2013, Wholesale power market liquidity: final proposals for a 'Secure and Promote' licence condition, available at: http://www.ofgem.gov.uk/Markets/RetMkts/rmr/Documents1/Liquidity%20final%20proposals%20120613.pdf.

60 See Ofgem, 2013, Wholesale power market liquidity: final proposals for a 'Secure and Promote' licence condition.

- **Returns from investments in energy saving measures and adopting low-carbon heating technologies can be low.**
  - **Barrier.** This may act as a barrier to households switching to the Energy Outcomes model at the rate required to meet climate change targets. In addition, barriers unrelated to the upfront costs may prevent consumers from taking up these measures (e.g. hassle, a lack of awareness, lack of confidence in the technology, and so on).
  - **Policy enabler.** Subsidies and the extension of carbon pricing to include gas and heating oil may be required to improve the returns to investments in energy saving measures. The Government has introduced a number of new policies aimed at increasing demand for energy saving measures (including the Green Deal and ECO), and time is needed to evaluate their success. Once this is done, it should be apparent what, if any, further policies are required.

Table 6 summarises these barriers and assesses the importance of each and describes the policy path to transition for Energy Outcomes.

**Table 6.** Barriers to the energy outcomes business model

| Policy, regulatory and market arrangement barriers | Assessment of the magnitude of each barrier |
|---|---|
| **Number of domestic energy tariffs** | High – restrictions on the number of tariffs could prevent the energy outcomes pricing model from being applied. |
| **Restrictions on imposing early exit fees** | Low – regulation of early exit fees is unlikely to prevent the provider recovering their costs if the contract is cancelled. |
| **Ability to hedge over a five year period** | High – five year hedging contracts are currently not traded, and liquidity levels are low for more medium term contracts. |
| **Returns from investments in energy saving measures can be low** | Medium – this is already targeted by some policy measures (e.g. the RHI and Green Deal), but more may be required to encourage sufficient uptake. |

Source: Frontier Economics

## 10.3 Energy Mutual

We have identified four main barriers to the implementation of Energy Mutual.

- **Returns from investments in energy saving measures can be low.**
  - **Barrier.** As with Energy Outcomes, It may be difficult to find energy efficiency investments that provide a sufficient return for private investors.
  - **Policy enabler.** See the corresponding section for the Energy Outcomes model.
- **There is a lack of information on the returns from investments in energy saving measures.**
  - **Barrier.** Investments may be seen as more risky than they are because of a lack of information.
  - **Policy enabler.** Credible information on outturn benefits from investments in energy saving measures could be made available. This could be driven by industry or Government and could come from the data being collected as part of the implementation of the Green Deal.

- **The platform provider must be licensed and adhere to financial services regulation.**
  - **Barrier.** It may be costly to comply with regulation, and compliance may restrict the set of eligible lenders or borrowers that could use the platform. Requirements on the Energy Mutual business model provider include credit licensing from the Office of Fair Trading and registration with the Office of the Information Commissioner.
  - **Policy enabler.** This regulation is desirable to protect lenders and borrowers and is unlikely to be removed. However, a process of simplification of compliance rules for smaller financial entities, of which Energy Mutual may be one example, may be something that Government would wish to see more generally.
- **Investors require sufficient returns or protection on their investments.**
  - **Barrier.** If no protection is provided for invested funds against a borrower being unable to repay a loan or the collapse of the Energy Mutual platform, or returns are not competitive relative to similar investments that are protected, investors may be put off using the platform.
  - **Policy enabler.** The business model provider itself could overcome the risk associated with individual borrower default, by making provisions to be able to offer a guarantee to investors, for example as in the case of the Zopa peer to peer lending site.[61] However, the wider risk of the provider itself defaulting could only be removed through Government providing a guarantee to investors that they could recover their funds in such a case of. This would be likely to require a state aid exemption unless the business model provider was authorised by the Financial Conduct Authority (FCA) or the Prudential Regulation Authority (PRA), then investors could be protected under the FSCS. However, this may not be compatible with the peer to peer lending model. Alternatively, the return provided could be increased through the adoption of a tax relief similar to the community investment tax relief (CITR) scheme which allows investors to offset tax liability while earning interest or dividend on their loans. However, the current CITR scheme provides companies rather than individuals with the investments, and therefore changes would have to be made to the CITR

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61 Zopa operates a 'Safeguard Fund,' through which investors can get back their money plus interest in the event of default by a borrower. This is funded using part of the fee charged to borrowers when their loan is approved, and the fund is held in trust by a not-for-profit organisation. See: http://uk.zopa.com/lending/lend-money-safely.

scheme in order for it to be applicable to the Energy Mutual model. State Aid legislation may prevent the tax relief from being extended.[62]

**Table 7** summarises the barriers to the Energy Mutual business model and assesses their magnitude.

**Table 7.** Barriers to the energy mutual business model

| Policy, regulatory and market arrangement barriers | Assessment of the magnitude of each barrier |
|---|---|
| **Role of policy support in ensuring sufficient returns** | Medium – The platform is likely to fail if projects do not have sufficient returns to attract investors or households installing the measures however this may still be possible absent further Government intervention. |
| **Investments may be seen as being of higher risk than they are given a lack of information on returns from investments in energy saving measures** | Medium – This may deter investors from providing funds to the platform but information from Green Deal investments should help. |
| **The platform provider must be licenced** | Low – licence requirements have not posed a barrier to existing peer-to-peer lending facilities |
| **Investors require sufficient returns or protection on their investments** | High – whether the returns will be sufficient to attract investors, or whether the model would survive default of a provider, needs testing in the market. |

Source: Frontier Economics

## 10.4 Community Energy

We have identified a range of barriers and enablers for Community Energy.

- **There is a lack of recent UK experience of district heat schemes.**
  - **Barrier.** There has been limited recent experience of installing district heating networks in the UK: 85% of small networks, 50% of medium

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62 European Commission, Community Investment Tax Relief, 2012, http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/gb/supportmeasure/support_mig_0002.

networks and 70% of large networks were built prior to 1990.[63] There are barriers related to this lack of experience, for example, developers have identified a lack of accepted contract mechanisms as a barrier to development.

- **Policy enabler.** Government could act as an enabler, for example by providing resources that could be used when developing the case for the community energy business model, or providing a platform to match developers with community groups. Other policy enablers could include sharing more UK specific information on best practice in developing and implementing district heat schemes, for example as has been done for London via the 'District Heating Manual for London,'[64] which includes guidance on planning and contracts. The government opened a Call for Evidence on Community Energy in June 2013,[65] and new measures may result from this.

- **There is uncertainty around the economic and technical potential for district heat schemes such as Community Energy in the UK[66].**
  - **Barrier.** There is currently a lack of UK evidence for scoping potential areas for heating networks.
  - **Policy enablers.** There is scope for Government to sponsor research in this area to provide the scoping that is required. Existing enabling actions include the publication of a UK CHP Development Heat Map by DECC,[67] which shows heat loads from different sectors (e.g. domestic, commercial offices) at a highly granular level. In addition to this, further Government-sponsored feasibility work to identify the rates of return associated with different district heating projects could help enable developers to identify viable locations for heating networks, and

63 DECC, 2013, Summary evidence on District Heating Networks in the UK, available at: https://www.gov.uk/government/publications/summary-evidence-on-district-heating-networks-in-the-uk.

64 ARUP for Greater London Authority, 2013, District Heating Manual for London, available at: http://www.londonheatmap.org.uk/Content/uploaded/documents/DH_Manual_for_London_February_2013_v1.0.pdf.

65 DECC, 2013, Community Energy Call for Evidence, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/207920/community_energy_call_for_evidence.pdf.

66 See the Committee on Climate Change, 2012, *Meeting the Carbon Budgets – 2012 Progress Report to Parliament*, which finds that more evidence is required on the potential for district heating; and Richard Rugg, Utility Week, 24th May 2013, *Getting Warmer*, which finds that there are difficulties identifying feasible projects and developing the case for them, as well as barriers around structuring projects and technical complexity.

67 http://chp.decc.gov.uk/developmentmap/

the scope for expansion. This could also help determine where rates of return are sufficient for networks to be introduced by private developers, and where local authorities (who may be able to access low-cost finance and therefore accept lower rates of return) must be involved for a network to be viable.

- **The costs of heating networks are high in the UK.**[68]
  - **Barrier.** In some cases, Community Energy will not be able to compete with alternative heating systems.
  - **Policy enablers. The application of an economy-wide carbon price (including on gas and heating oil) or** subsidies may be required for widespread uptake of Community Energy schemes. Some funding is already in place. The government announced in 2013 that it would make £9 million of support available for local authorities to launch district heating networks[69]. Additional policy support includes the Renewable Heat Incentive (RHI) where the heating network heat supply is from an eligible installation and Energy Companies Obligation (ECO). There are also policy measures to support CHP installations, for example via exemption from the Climate Change Levy (CCL), and through additional support from the Renewables Obligation for installations fired by biomass or waste.
- **Heating networks are associated with high installation costs resulting in lengthy payback periods, potentially of around 20 years.**[70]
  - **Barrier.** Developers can have difficulty accessing finance for viable heating networks.
  - **Policy enablers.** One policy enabler could be provision of tax breaks to developers, and increased partnering with local authorities who may have lower finance costs. Funding by Government, as described above, also helps to reduce this barrier.

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68 Pöyry and Faber Maunsell (2009), *The potential and costs of district heating networks, A report to the Department of Energy and Climate Change*

69 This is supplemented by an additional £1 million for Manchester, Nottingham, Sheffield, Newcastle and Leeds to develop heating networks. Given that local authorities are often heavily involved in developing heating networks, (e.g. through private sector partnerships) this is a key enabler for the community energy model. Cogeneration & On-Site Power Production, 2013, *IDEA applauds UK Department of Energy and Climate Change for heat strategy, http://www.cospp.com/news/2013/03/29/idea-applauds-uk-department-of-energy-climate-change-for-heat-strategy.html.*

70 DECC, 2013, *The Future of Heating: A strategic framework for low carbon heat in the UK.*

- **District heat schemes like Community Energy require planning approval.**
  - **Barrier.** Difficulties around planning approvals and a lack of local authority resources or expertise may act as barriers.
  - **Policy enabler.** This may require enablers such as fast track planning, as well as provision of standardised guidance and encouragement of information sharing between local authorities on planning issues associated with heating networks.
- **A connection to the distribution network is required.**
  - **Barrier.** High costs or long waiting times associated with connecting heat plants to the distribution network may act as a barrier. Inconsistent fees for grid connection have been identified as a barrier in the context of renewable developments,[71] and this could similarly affect CHP installations looking to export surplus electricity.
  - **Policy enabler.** Distribution connection charging methodologies have been largely common across DNOs since October 2010.[72] However, connection charges are levied on the connecting party and, depending on the location of the provider; these may be a material cost. Given that charging methodology was only recently reviewed, there is unlikely to be a push to make significant changes again soon.
- **Running a private network for electricity generated through CHP requires a licence.**
  - **Barrier.** If the business model provider chose to operate a private network, it would require a licence to be an independent distribution network operator (IDNO). This would result in it being subject to IDNO regulatory requirements, including around price controls and ring-fencing.[73]
  - **Policy enabler.** Licencing requirements for IDNOs already differ from those for DNOs, limiting the regulatory burden. A further policy enabler could be to provide exemptions for sufficiently small private networks.

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71 See article in Utility Week, Megan Darby, 14 June 2013, *'Horrendous' connection fees deterring renewables*.

72 See http://www.ofgem.gov.uk/Networks/ElecDist/Policy/DistChrgs/Pages/DistChrgs.aspx

73 See Ofgem, 2005, Regulation of Independent Electricity Distribution Network Operators, Decision Document, available at: http://www.ofgem.gov.uk/Networks/ElecDist/Policy/IDNOs/Documents1/11186-17605.pdf.

- **There are restrictions on resale of gas and electricity to domestic customers, and requirements that householders supplied with electricity through their landlord's connection are permitted to obtain a connection with a different supplier.**
  - **Barrier.** A maximum resale price (MRP) is set for electricity bought from suppliers and sold onto domestic customers (by landlords or in this case the community energy business model provider). This requires that the resale price is no more than the amount paid by the reseller plus VAT.[74] This means that any top up electricity bought by the business model provider (typically when the CHP generation is insufficient to meet householder demand) must meet these requirements. The costs of running the electricity or gas system must be recovered separately from the resale costs, and are not subject to a maximum resale price. The provider must permit householders to get a connection with a different supplier of their choosing, meaning that demand is not guaranteed.[75]
  - **Policy enabler.** The provider will need to ensure that the business model is structured so that it remains viable when buying top up power and selling this at the MRP to householders. Further research would be needed to understand whether this restricts the *form* of tariffs that it can offer to its customers, although it would seem reasonable to assume that this will not be a barrier if the provider can demonstrate that its customers were paying at or below the MRP. It would be less likely that Ofgem would consider granting a derogation that would prevent householders from getting a connection with an alternative supplier. This could affect the viability of the Community Energy business as it would need to believe it could price below the cost of the best available alternative supplier for a period sufficient for it to recover its costs.
- **District heating is not currently regulated in the UK, but increasing adoption may lead to new regulation being introduced.**
  - **Barrier.** The Community Energy model would introduce local monopolies for the supply of district heat. This has already resulted in competition concerns in Europe (e.g. the German Cartel Office is investigating district heating pricing in 30 areas).[76] This could be a

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74 See http://www.ofgem.gov.uk/domestic-consumers/Pages/Resaleofgasandelectricity.aspx.

75 See http://www.eversheds.com/global/en/what/articles/index.page?ArticleID=en/Real_estate/Tenants-freedom-choose-energy-suppliers.

76 Lang, M., and Mutschler, U. (2013) *German Cartel Office launches investigation into district heating prices, http://www.germanenergyblog.de/?p=12471*

barrier given that high upfront costs of district heating mean that profit is likely to be negative initially, before being gradually recovered over time. If regulatory changes prevented this profit being earned, then the business model provider may never recover its initial costs.

- **Policy enabler.** This could be helped by clear statements on regulatory intentions around heating networks, and by ensuring that any regulation recognises the long payback periods associated with district heating. Any regulatory burden should also be commensurate with the size of their operations.

- **District heating schemes have not always provided a good service in the past.**
  - **Barrier.** Consumer perceptions of heating networks are sometimes poor. DECC's heat strategy[77] identified the issues as a lack of control of heat supply and bills, plus low efficiency.
  - **Policy enabler.** While this is in part in the control of the business model provider to address, policy actions such as providing resources to communities to help them understand the benefits and costs of new heating networks could also help.

77 DECC (2013) *The Future of Heating*

**Table 8.** Barriers to the community energy business model

| Policy, regulatory and market arrangement barriers | Assessment of the magnitude of each barrier |
|---|---|
| **There is a lack of expertise in developing and implementing district heat schemes, Developers have identified a lack of accepted contract mechanisms as a barrier to development** | Medium – publications such as the District Heating Manual for London have reduced these barriers. |
| **There is currently a lack of UK evidence for scoping potential areas for heating networks** | Medium – this has been reduced by the publication of a heat map. |
| **In some cases, Community Energy will not be able to compete with alternative heating systems** | High – heating network installation costs are relatively high in the UK. |
| **Developers can have difficulty accessing finance for viable heating networks** | High – policy intervention has provided funding for heating networks. |
| **Difficulties around planning approvals and a lack of local authority resources or expertise may act as barriers** | Medium – this varies by local authority. |
| **High costs or long waiting times associated with connecting CHP plants to the distribution network may act as a barrier to the introduction of the community energy model** | Medium – This varies across areas, and may be a significant barrier for some projects. |
| **Running a private network for electricity generated through CHP requires a licence** | Medium – the business model provider could introduce the business model without the electricity network being private. |
| **Resale of gas and electricity to domestic customers is subject to a maximum price, and householders supplied with electricity through their landlord's connection must be permitted to obtain a connection with a different supplier** | Medium – the business model provider would need to believe it could price below the cost of the best available alternative supplier for a period sufficient for it to recover its costs. |
| **There is regulatory risk around the community energy model, as greater adoption of heating networks may** | High – heating networks create local monopolies, increasing the likelihood of competition concerns. |

| | |
|---|---|
| **raise competition concerns and make increased regulation more likely, which could make heating networks less cost competitive relative to other heating technologies.** | |
| **Consumer perceptions of heating networks are sometimes poor, historically being associated with a lack of control of heat supply and bills plus low efficiency.** | Low – this is something that could also be addressed by the business model provider. |

Source: Frontier Economics

## 10.5 Power Buffer

We have identified three main barriers and enablers for Power Buffer.

- **The asset life associated with storage may be long.**
  - **Barrier.** This may act as a barrier to investing in storage in the context of storage assets being long lived, and an expectation that costs will reduce, potentially significantly, over time.
  - **Policy enabler.** Given the asset lifetimes associated with storage, a stable policy environment that supports the introduction of storage is likely to encourage investment. In turn this may lead to lower relative costs of storage over time, making the business model more viable. UK Power Networks' recent consultation on business models for distribution level storage discusses different regulatory treatment principles that could be applied to storage.[78]
- **For DNOs to use these services to defer network reinforcement, agreed guidance for the use of storage for network planning and design must be in place.**
  - **Barrier.** The DNO planning standard P2/6 limits the incentives for DNOs to use storage as an alternative to traditional network reinforcement.
  - **Enabler.** Testing of the potential for DNOs to use storage is underway, and a review of the planning guidance is planned to address this issue.

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78 Baringa and UKPN, 2013, Smarter Network Storage – business model consultation, available at: http://www.ukpowernetworks.co.uk/internet/en/community/documents/Smarter-Network-Storage-Business-model-consultation.pdf.

- **There are regulatory restrictions on DNOs owning and trading from storage, as it is not classed differently from generation assets.**
  - **Barrier.** The regulatory restrictions specify that DNOs may own and trade energy from storage facilities which provide less power than 10 MW per installation or which provide less than 50 MW of power and have a net capacity of less than 100 MW, subject to a 'De Minimis' rule limiting the extent to which DNOs can engage in activities outside the distribution business.
  - **Policy enabler.** In the case of the Power Buffer model, these regulatory restrictions will only act as a limit to the extent that DNOs are best placed to lead this business model. This is untested, although the business case shows that they are likely to be the biggest beneficiary.

**Table 9.** Barriers to the Power Buffer business model

| Policy, regulatory and market arrangement barriers | Assessment of the magnitude of each barrier |
|---|---|
| **Stable policy support and regulatory arrangements** | High – this is likely to be an important determinant of whether storage is cost competitive in the medium-term. |
| **DNO network planning requirements limit the ability of DNOs to use storage as an alternative to network investment** | Low – a review is due to commence to update planning requirements to remove the barrier. |
| **Regulation restricts the extent to which DNOs can own and trade from storage** | Medium – the impact of this restriction depends on whether DNOs are well placed to develop this model. |

Source: Frontier Economics

# 11 Annexe 5: Evaluation

One of the key aims of this project has been to develop a tool to help structure the ETI's thinking around the performance of alternative potential business models, and how this performance changes under a range of future circumstances and scenarios.

Frontier Economics has developed a Business Model Evaluation Tool (BMET) which has been provided to the ETI alongside this report. This tool allows testing of the performance of business models under a range of assumptions and against a set of criteria agreed with the ETI. It has been populated with the six business models described in Annexe 2. It has also been designed so that users can also add new business models to the tool.

This annexe outlines how we have evaluated the business models and presents the results of the evaluation.[79] It is structured as follows:

- first, it outlines the aims of BMET, and the questions that the tool can be used to explore;
- second, it describes how BMET addresses these questions; and
- finally, it outlines the results of the modelling for each business model.

## 11.1 Which questions does BMET address?

The aim of the evaluation tool is to allow assessment of business models under a range of future scenarios, under which carbon targets are met. We are interested in understanding how beneficial business models can be to 2050 for GB society as a whole, for consumers and for businesses within the smart energy system.

As illustrated in **Figure 2**, BMET is particularly focussed on allowing exploration of the viability of business models and their impact on consumers over the long term, under different conditions. It allows the user to understand the drivers of value for each business model, and therefore, the suitability of business models for different conditions. However, it does not aim to *predict* the uptake of business models in the short run.

[79] These results are based on Version 1.5 of the model, submitted to ETI on 28 January 2014.

**Figure 31.** Focus of the Business Model Evaluation Tool

| It is well suited to… | It is currently less suited to… |
|---|---|
| • Exploring how the long-term viability of business models vary under different conditions | • Modelling short-term barriers to take-up |
| • Determining what factors underpin the success or failure of a business model | • Producing quantitative forecasts that could immediately be used for business planning |
| • Seeing how the take-up of a business model could vary across broad customer types | • Highly detailed customer segmentation |

Source: Frontier Economics

## Evaluation under uncertainty

There is a large degree of uncertainty over the evolution of the energy sector out to 2050. There is also a large degree of uncertainty over the costs and effectiveness of business models, and consumers' response to the value propositions associated with them.

In the light of this uncertainty, producing an evaluation framework that enables a better understanding of **the factors that drive the value of business models** under different scenarios is more useful than producing a single estimate of the benefits associated with each business model.

With this in mind, we have built a **transparent** tool. We have ensured that the assumptions are explicit, and that key inputs can be flexed. This allows the user to run sensitivities and thereby develop a greater understanding of what is driving the success or otherwise of business models.

## Assessment criteria

No one factor determines how beneficial the business models can be. We have therefore built BMET in a way which allows us to address a range of questions in seven key areas. These seven areas form our evaluation criteria.

The tool allows business models to be assessed against these criteria, at the local, regional and GB scale, from now until 2050. The criteria were agreed with ETI and are summarised in **Figure 32** below.

**Figure 32.** Evaluation criteria used by the tool

| For business models at local, regional or GB scale, from now until 2050 | |
|---|---|
| Profitability | Can the business model provider make a profit?<br>What is the rate of return associated with different prices? |
| Consumer bills and added value | How much will consumer bills change under the business model?<br>What added value (non-monetary benefits) will they receive? |
| Energy use and emissions | What impact will the business model have on energy consumed and carbon emissions? |
| Adaptability | How does the business model perform under different scenarios?<br>How flexible is it in the face of uncertainty over future conditions? |
| Scalability | What is the size of the addressable market?<br>How much of this could a feasible business model supply? |
| Value chain impacts | What costs or benefits will the business model have across the value chain? |
| Policy | What level of subsidy (if any) will be required?<br>What are the other required characteristics of the policy environment? |

Source: Frontier Economics

The criteria set out the high level questions that must be answered to be able to develop the case for further testing of each business model.[80] We now provide more detail on each one.

- **Profitability.** To be viable on a standalone basis (i.e. without policy support), the business models must be profitable. Comparing rates of return associated with different prices helps to determine optimal pricing, and allows profitability comparison with other business models. As part of the evaluation under this criterion, we also assess how easy the business model will be to finance.

  As BMET is set to maximise the sum of profit and consumer welfare, subject to financing needs, interpretation of the profit made in the model should be made carefully. A positive level of profit indicates that the business model can operate at a level to provide a high enough return to investors to make it financeable, given the WACC. However, the magnitude of the profit itself cannot be interpreted as a predicted level of profit. This is

80 A more narrow set of criteria applies to non-consumer-facing models, for example for the Energy Buffer business model.

because we have not modelled the competition in the respective market, but have assumed a competitive, or well regulated, market.[81]

- **Consumer bills and value added.** It is also important to understand the impact on consumers out to 2050. To understand these impacts, we take into account changes in consumer bills, alongside value added associated with each business model (for example through a reduction in risk or hassle).

- **Energy use and emissions.** The energy system scenarios against which the business models are assessed are all consistent with the UK meeting its decarbonisation targets out to 2050. They therefore include, for example, a decarbonised electricity sector, and an economy-wide carbon price set at a level consistent with meeting the targets.[82] However, each of the business models differs in terms of the incentives it places on consumers to save energy and to adopt demand side low-carbon technologies such as heat pumps. An assessment of these differences and their consequences for energy demand and emissions savings is included in this criterion. Where less energy saving behaviour or take-up of low-carbon technologies is incentivised by a business model, the implication is that other actions elsewhere in the economy will be required to ensure that carbon targets are met.

- **Adaptability.** There is significant uncertainty around future conditions in the energy sector and more broadly. Business models that perform well under a range of different outturn scenarios are likely to be lower risk, and consequently are more desirable, than those where the benefits vary significantly by scenario, particularly where there is the risk of sunk costs. To evaluate their resilience to uncertainty, we assess business model performance under different future scenarios.

- **Scale.** It is also important whether business models are potentially suited for the mass market, or for a more niche or targeted uptake. Assessing the size of the market for the business model, and the degree to which the business model could feasibly supply this market, contributes to the overall assessment of the extent to which the business model can meet future energy system challenges.

81 Where there is a supply-side constraint (such as limited available funds in the Energy Mutual model) then it is possible for the provider to show high levels of profitability, even under these assumptions. This is because an increase in price of the service is required to constrain demand.

82 DECC (2013), *Valuation of energy use and greenhouse gas (GHG) emissions*

- **Value chain impacts.** As well as assessing the benefits to business model providers and consumers associated with the business models, it is also important to assess any spillovers from the business models activities to other parties in the value chain. Under this criterion, we assess the wider impacts of each business model across the energy value chain.

- **Policy.** Some business models may be only viable if particular policy or regulatory barriers are removed (or continuation of enablers). Others may require policy support in the form of subsidies. Under this criterion, we have assessed these barriers and their magnitude for each business model. Policy impacts are covered in Annexe 4, rather than in this Annexe.

## 11.2 How does BMET address these questions?

We now describe how the tool assesses business models against the criteria described above.

The tool aims to assess each business model in a transparent and flexible way, with users able to alter the assumptions to test their impact on the results. To facilitate this, the tool has been constructed in a "bottom-up" fashion, analysing the outcomes of decisions made by customers and business model providers in response to costs and benefits that they face under each business model.

The following sections describe the choices that are modelled by the tool and how these are implemented.

### Customer choices

To represent customer choices, we calculate customers' **willingness to pay** for the services provided by each business model. Customers' willingness to pay for the business model services is determined by the monetary value[83] associated with taking up the business model (e.g. an energy bill saving, or a reduction in hassle), less the monetary value associated with carrying out their next-best alternative option (their counterfactual).[84] If the business model is offered to customers at a price which is equal to or below their willingness-to-pay, it is assumed that they will take it up.

Willingness to pay will vary across customers. For domestic customers, it will vary according to factors such as their income, their demographic characteristics

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83 Some costs and benefits, such as bills that would be incurred in the counterfactual, are already in monetary terms. Others (the value placed upon time/ hassle, or certainty of expenditure) are expressed in monetary terms.

84 The counterfactual describes what would have happened in the absence of the introduction of the business model. It provides a baseline against which changes are assessed.

and the energy efficiency of their homes. The willingness to pay of business customers will be determined by the cost and revenue characteristics of the business.

To capture differences in willingness to pay caused by these factors, domestic customers are divided into representative groups in the tool. These are summarised in **Figure 33**. For all business models except Power Buffer (where each "customer" is a DNO feeder) BMET has been pre-populated with a set of household groups based on ETI analysis of Experian Mosaic data. These groups cover 80% of UK households. These groups should be broadly representative of characteristics such as age, household size and location (urban, suburban or rural). However, given the granularity of these customer groups, it is inevitable that they will not be perfectly representative for all characteristics. The ETI has been carrying out further research into customer segmentation, which could be incorporated into BMET at a later stage.

**Figure 33.** Key attributes of customer groups in the tool

| Group name | Affluence | Location | Typical property type (insulation level) | Current heating tech | Proportion of all households |
|---|---|---|---|---|---|
| Young Starters | Mid | Urban | Medium | Gas boiler | 9.8% |
| Busy Comfortable Family | High | Suburban | Medium | Gas boiler | 11.7% |
| Older Established | High | Suburban | Medium | Gas boiler | 7.4% |
| Greener Graduates | High | City centre | Poor | Gas boiler | 6.1% |
| Middle Grounders | Mid | Suburban | Poor | Gas boiler | 7.7% |
| Stretched Pensioners | Low | Suburban | Good | Gas boiler | 9.8% |
| Successful Ruralites (gas) | High | Rural | Poor | Gas boiler | 4.2% |
| Transitional Retirees | Mid | Semi Rural | Poor | Gas boiler | 3.2% |
| Unconvinced Dependents | Low | Urban | Good | Electric resistive | 5.2% |
| Urban Constrained | Low | Urban | Medium | Gas boiler | 8.6% |
| Successful Ruralites (oil) | High | Rural | Poor | Oil | 4.2% |
| Off Grid Rural Electric | Mid | Rural | Poor | Electric resistive | 2.6% |
| | | | | | **80.5%** |

Source: Frontier Economics

To take account of the fact that there will also be variation in willingness to pay within these customer groups, consumers' willingness-to-pay is modelled as being distributed around an average. This means that uptake of a business model for a particular customer group will decrease with price.

## Business model provider choices

We also model choices made by business model providers in BMET.

The business model providers have a choice of price for each customer group[85] in each choice period. For any given price, uptake will be set by customers' willingness-to-pay (higher prices lead to lower uptake). To determine the prices set by business model providers, we assume that they will maximise social welfare (the discounted sum of profits and consumer surplus), subject to the overall net present value of the business model being positive.[86] This is consistent with the behaviour of business model providers in a competitive market, or a market regulated in such a way as to proxy for competition.[87]

Taking the product of uptake and price allows us to estimate business model providers' revenue. The business model providers' costs will depend upon uptake multiplied by variable operating expenditure, less any other costs. Considering revenue and costs together allows us to determine the business model providers' profitability for any combination of prices.

### Implementation of BMET

We have constructed BMET so that it models the choices and optimisation described above in a common way across all business models. However the way in which the parameters describing customer and business model provider behaviour are constructed will vary substantially between business models. For example, the customers for Energy Outcome, Energy Mutual and Community Energy are households, but the principle customers for Power Buffer are DNOs.

To account for this diversity in business models, and to enable additional business models to be "plugged in" to the tool in the future, we have separated the common optimisation algorithms from the business model-specific inputs in the construction of the tool.

The resulting structure of BMET is shown in **Figure 34** below.

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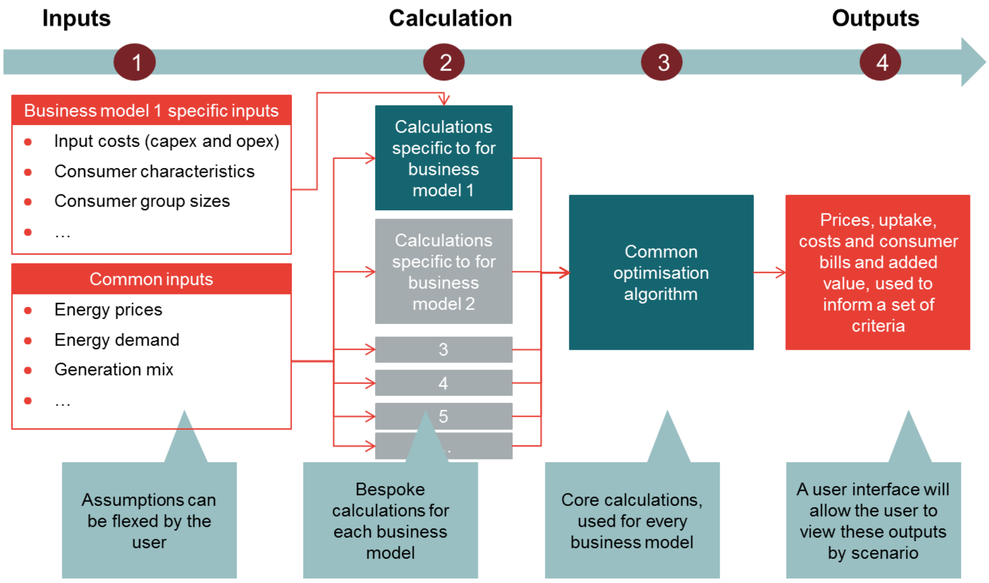
85 It is possible to constrain the prices to be the same across different customer groups, if it is believed that the same value proposition would be offered to both and that it is not feasible to price discriminate between them.

86 The net present value (NPV) is equal to the sum of profits (or losses) accruing to the business model provider over time, discounted at its cost of capital. This is a measure of the overall profitability of the business model (it is a valuation of the business). In addition, the tool can ensure other constraints are met – for example, that the business model must break even by a certain date, and that it must make sufficient profit to cover its cost of capital in all future periods.

87 In such a market, it would be expected that the overall welfare resulting from the business model would be maximised, subject to the businesses being able to break even. Total welfare is equal to consumer surplus (the monetary benefit customers obtain, less price paid) plus producer surplus (the revenue firms obtain, less costs – i.e. profits).

**Figure 34.** Structure of BMET




Source: Frontier Economics

This describes a four stage process.

- First, assumptions specific to each business model are inputted to the tool (e.g. the costs of providing business models, the associated benefits provided to consumers, such as reductions in risk or hassle). Alongside these business model-specific inputs, are a set of inputs (such as electricity prices) which are common across each business model.

- Second, the tool performs calculations specific to each business model. At this stage, for example, we forecast whether a household would choose to install energy saving measures in their homes in the absence of the business model, and how this would affect price they pay for energy.

- Third, the common optimisation is applied to determine the results of consumer and business model choices (as described above).

- Fourth, the outputs of the optimisation are used to inform the assessment against each of the evaluation criteria.

## 11.3 Indicative results by business model – examples of BMET capability and output

This section sets out the indicative results of the evaluation and the implications of these results.

### 11.3.1 Business model 1: Energy Outcomes

In the Energy Outcomes model, the provider offers customers a fixed price contract for the delivery of a certain level of comfort for five years. The provider delivers this comfort by supplying energy and undertaking interventions to increase the energy efficiency of the homes.

We model Energy Outcomes in a number of stages.[88]

- First, we have defined seven bundles of interventions which could be installed either by the consumer themselves or the business model provider. These bundles are made up of: insulation upgrades, installation of a heat pump, installation of a home energy managements system (HEMS) or any combination of these.

- Second, BMET considers which intervention bundle (if any) the typical consumer would purchase in the absence of the business model (i.e. in the counterfactual). To do this, it calculates the net present value of purchasing the intervention bundle (the value of future energy savings, minus the costs of purchase). Even if an option may offer significant cost savings over a long period, consumers may not purchase it if the upfront cost is too high, as they may not have access to the required capital. To capture this effect, it is assumed that each consumer group has a "credit constraint". If the cost of the intervention bundle is higher than the credit constraint then the customer will not purchase the bundle.

- The tool then considers which intervention bundle (if any) the business model provider would offer. This decision is based on the net present value to the business model provider, which consists of the wholesale cost savings over the duration of the contract, minus the price of the intervention bundle. In addition, we assume that the business model provider is able to capture the consumers' benefits of lower bills beyond the contract period, through a higher price.

- Finally, the tool considers whether the consumer will take up the business model. The consumers' monetary willingness to pay is equal to their costs

[88] These are described in more detail in the model user guide.

under the counterfactual. This is adjusted to take account of non-monetary aspects, based on the values of time/hassle and risk under the business model, minus those under the counterfactual. In addition, the business model provider will spread out the cost of the intervention bundle over five years, therefore the consumer credit constraint will only prevent the intervention bundle being purchased if a fifth of its cost exceeds the amount that the consumer group is assumed to be willing to spend in one go.

When modelling HEMS, we undertake a further adjustment. Under the assumed costs and benefits of HEMS, almost all households would take it up. However, in practice there are likely to be barriers to take-up such as a lack of information regarding the effectiveness of HEMS and hidden costs around the hassle customers perceive.

To delay the installation of HEMS, we have applied an "additional hassle factor" which increases the costs to households of HEMS installations under the counterfactual.[89] Energy Outcomes overcomes this hassle factor by focussing on delivering the outcomes customers are interested in, rather than seeking to engage them in individual technologies. This hassle factor therefore does not increase the costs of HEMS to households under the business model.

We have set the hassle factor at a level of £1,000 for 2015-2020, and assumed it then reduces by half each subsequent year. We have currently set this at a level which delays counterfactual HEMS installation. More work on the drivers of consumer inertia would be needed in this area to determine the actual level of this hassle cost in reality.[90]

### 11.3.2 Indicative results

The evaluation using BMET finds that Energy Outcomes has the potential to be a successful mass market model in a low-carbon economy. There are a number of factors driving its uptake.

- it helps customers spread the upfront costs of new technologies;

89 This factor is not included under the business model, since it is assumed that the business model provider is able to rationally weigh up the costs and benefits of HEMS, and with an outcomes-based contract the consumer does not need to make an active decision to "opt in" to HEMS (it just comes as part of the wider bundle of energy services).

90 It is also likely that a hassle factor would apply to the installation of insulation and heat pumps. We have not applied an independent hassle factor to these interventions at this stage. However, under the current set of HEMS parameters, all households except "Stretched Pensioners" and "Urban Constrained" would take up HEMS by 2045. As a result, all bundles offered to these customers include HEMS (the business model provider is assumed to install all interventions at once) with the associated hassle cost. Therefore the take-up of all bundles will be delayed. The type of hassle cost that we are modelling for these households is therefore always the same, regardless of the number of interventions that are in a bundle – therefore the effect is the same as a fixed barrier to engagement with any sort of energy-related investment.

- it allows customers to manage the risks around new unfamiliar technologies and fuel prices;
- it avoids the barriers to HEMS take-up described above; and
- it helps customers access a bulk discount on low-carbon technologies in later years.

All four factors can combine to drive a high willingness to pay and strong uptake across most customer groups. Customers can continue to take up the model, even after they have any interventions installed. In this case, willingness to pay is driven by the Energy Outcomes provider's ability to manage fuel price risk efficiently, and to remove some of the risks associated with technology operation from the household.

There are additional factors, not directly modelled by BMET, that may limit the take-up of the business model by certain groups. For example, some customers may be disengaged from the market so that they do not take up a proposition which would benefit them. To account for this, we have made some broad assumptions regarding the proportion of households in each group that could feasibly be in the market for Energy Outcomes. This is dependent upon three factors:

- The extent to which households in the group are likely to be in a dwelling suitable for any retrofits the Energy Outcomes provider may offer. All but a few heritage properties should be suitable for the range of interventions, so this factor is insignificant for most groups.
- A general estimate of customer inertia, estimated from the "Experian Mosaic Green Aware" indicator used in the OTEoEH project.
- The specific appeal of the Energy Outcomes proposition to each household group, assessed from the match between the value propositions and consumer groups as developed in Annexe 8, summarised in the Canvases in Annexe 2.

### *Potential scale*

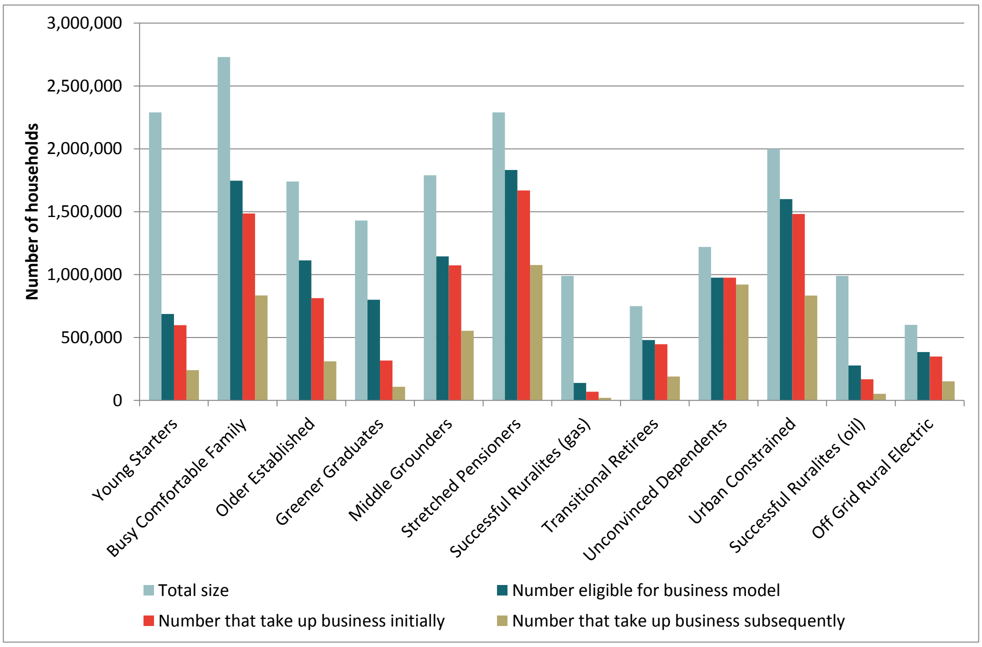
**Figure 35** shows, for each customer group covered by the tool:

- the nationwide number of households of that type;[91]
- the number which are assumed to be in the feasible market (as explained above) for Energy Outcomes;

91 As described above, the household groups within BMET cover 80% of UK households.

- the number of households that may take up the business model for an initial period, where the provider may install interventions; and
- the maximum number of households in a year that stay on the continuation of the Energy Outcomes contract in the periods subsequent to the period in which they received an intervention.

**Figure 35.** Energy Outcomes: Customer uptake




Source: Frontier Economics

**Figure 35** shows that, according to BMET, a very high proportion of households may take up the business model for at least one period, during which they receive interventions (a heat pump and/or HEMS). Under our assumptions on the costs and benefits of insulation (Box 1), it is never cost-effective for any of these household groups to install it.[92]

92 These assumptions are based on EMSE, V3.3.

## Box 1: Insulation assumptions

The heating requirements of households prior to additional insulation have been taken from ESME v3.3. ESME includes space heating requirements (in kW per heating degree day) for each of the 12 combinations of density (high, medium or low) and thermal efficiency (excellent, good, medium or poor). The household groups in BMET have been mapped to these housing types on the basis of typical location (e.g. rural groups are low density, urban groups are high density) and an assumed current efficiency of insulation for the groups.

ESME v3.3 includes two packages containing insulation: "Retrofix" and "Retroplus". Both packages include measures such as cavity wall insulation, external wall insulation, loft insulation and draughtstripping. The "Retroplus" package is more extensive (for example, it includes triple glazing and an increased level of airtightness), at a higher cost. ESME specifies, for each of the six combinations of package and housing density, the investment cost and the percentage decrease in space heat demand that results from it. BMET currently assumes that all groups will consider the "Retroplus" package, except for Young Starters, Busy Comfortable Family and Older Established – this is intended to reflect the way that these groups may have easier-to-treat houses.

Under these assumptions, no take-up of insulation occurs under the counterfactual or in any business model. We ran a sensitivity with all groups being offered the cheaper "Retrofix" package, and this did not affect the result that no uptake of insulation would occur.

In prior versions of BMET, there was take up of insulation. There are two reasons.

- Insulation assumptions were previously based on ESME v3.1. In this version of ESME, insulation was assumed to be much more cost-effective. The change in assumptions on the cost-effectiveness of insulation is the major driver of this impact.
- There is also a small effect from the inclusion of HEMS. We previously did not include HEMS in BMET. To the extent that HEMS and insulation are alternative ways of reducing energy consumption, the inclusion of HEMS may make insulation less attractive to consumers.

Uptake of heat pumps and HEMS is driven by two factors: the business model allows consumers to overcome upfront costs which they may have been unable to in the counterfactual; and, in later years, the business model provider can purchase such interventions at a significant discount to the retail price.[93] We

93 This discount is assumed to increase from 0% in 2015 to 20% by 2050.

examine the robustness of the business model to this assumption below, and explore which factors are responsible for take-up. **Figure 36** shows how the initial take-up of Energy Outcomes varies by group over time.

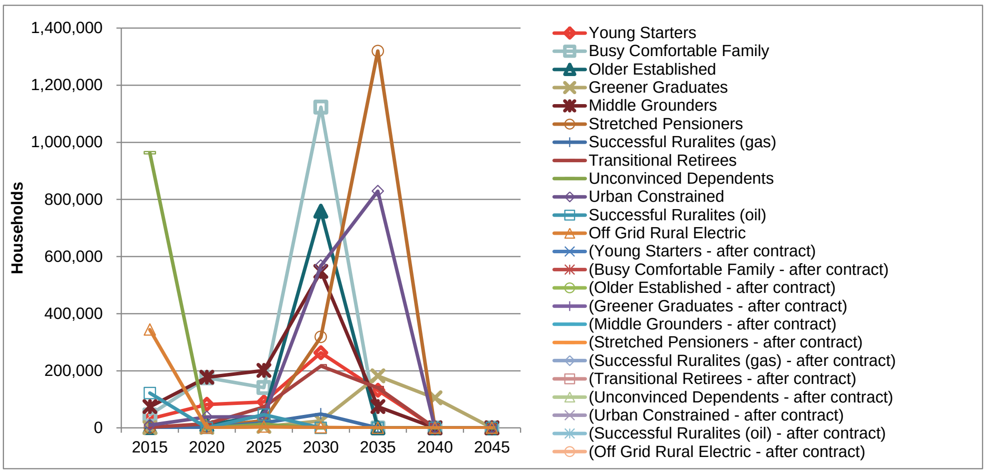
- Take up in 2015 is highest among the Unconvinced Dependents and Off Grid Rural Electric groups. Both of these groups initially have electric resistive heating. Since this is a relatively expensive heat source, they therefore benefit greatly from the installation of a heat pump and HEMS. The business model allows them to access a heat pump and HEMS more cost-effectively than in the counterfactual as these are credit-constrained groups which would otherwise have to borrow to fund the purchase of the heat pump. In addition, accessing HEMS under the business model means that they do not incur the substantial "hassle cost" that they would face in the counterfactual.

- Take up is relatively high in the Successful Ruralite (oil) group that stand to gain from a heat pump and HEMS from the first period. Over half of this group do not take up Energy Outcomes. This is because this group has access to capital, and low risk aversion. Even though Energy Outcomes reduces their hassle cost, it is approximately as expensive for this group to carry out these installations themselves (at the start of the period, it is assumed that the business model provider has no cost advantage in the purchasing of interventions). Take-up is therefore lower than the two groups above, but still high (at 44% of the group).

- Large numbers of "Busy Comfortable Families", "Older Established", "Stretched Pensioners" and Urban Constrained households take up the business model in later periods. Their lower levels of electricity consumption mean that a heat pump and HEMS only pay off several decades into the modelling, in the mid-2030s.

The drivers of the differences in take up of Energy Outcomes across groups are therefore primarily related to their initial energy consumption, their access to capital and their level of risk aversion.

**Figure 36.** Uptake of Energy Outcomes for interventions




Source: Frontier Economics

Energy Outcomes continues to be offered to households, after their properties have had interventions installed over previous contract periods. Uptake of Energy Outcomes is considerably more variable in these subsequent periods. Once a household has interventions installed, the main modelled benefit to customers of Energy Outcomes is the management of energy cost risk. Customers pay the Energy Outcomes provider a premium to manage this risk on their behalf. This business model therefore appeals more to those consumer types that place a high value on the removal of risk.

Within the model, customers with a relatively high energy bill compared to disposable income place a higher premium upon avoiding risk (although these fuel-poor customers will also be limited in the amount which they can pay, so they will not be prepared to pay a large amount for fixed bills). The Unconvinced Dependents group has the highest willingness to pay for this certainty, and virtually all of the eligible households in this group are projected to participate in the business model after the initial installation of interventions. By contrast, the penetration among wealthier groups such as Successful Ruralites is lower. This is because the value that these groups are assumed to place upon stable bills is outweighed by the costs the business model provider incurs in hedging over a five-year contract.

## Customer bills and added value

Under this business model, consumers are assumed to pay a constant tariff over the lifetime of the contract. Although this is a "pay for comfort" model, the costs of supplying sufficient heat will vary by household type, and the business model provider(s) will be able to observe this. As a result, households of different types are charged different prices in the tool.

Tariffs vary considerably according to whether the business model provider is installing interventions (which will need to be paid back within the five-year contract period) or just managing energy cost risk for the consumer.

**Table 10** shows, for each consumer group:

- the peak year for their take-up of Energy Outcomes;
- the interventions that would be installed by the provider and their cost to the provider in that year; and
- the yearly payment made under the tariff.

**Table 10**: Bills by customer group under Energy Outcomes

| Customer group | Year of greatest uptake | Interventions installed | Cost of Interventions | Yearly payment (includes fuel) |
|---|---|---|---|---|
| Young Starters | 2030 | HP & HEMS | £3,999 | £2,058 |
| Busy Comfortable Family | 2030 | HP & HEMS | £5,223 | £2,637 |
| Older Established | 2030 | HP & HEMS | £4,236 | £1,693 |
| Greener Graduates | 2035 | HP & HEMS | £7,364 | £3,062 |
| Middle Grounders | 2030 | HP & HEMS | £8,797 | £3,620 |
| Stretched Pensioners | 2035 | HP | £1,831 | £989 |
| Successful Ruralites (gas) | 2030 | HP & HEMS | £9,010 | £3,403 |
| Transitional Retirees | 2030 | HP & HEMS | £8,797 | £3,649 |
| Unconvinced Dependents | 2015 | HP & HEMS | £3,455 | £2,078 |
| Urban Constrained | 2035 | HP | £2,911 | £1,449 |
| Successful Ruralites (oil) | 2015 | HP & HEMS | £9,790 | £3,585 |
| Off Grid Rural Electric | 2015 | HP & HEMS | £10,136 | £3,950 |

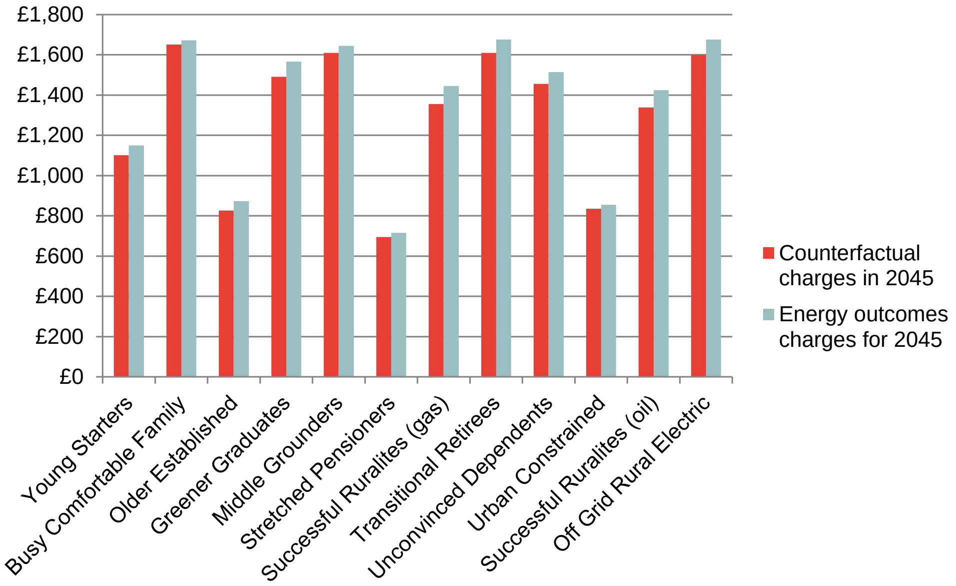
Source: Frontier Economics

The yearly payments shown in **Table 10** include payments for the energy saving interventions and risk management, as well as for energy supply. They are therefore not directly comparable to payments made under a standard evergreen tariff.

However by 2045, interventions have largely been installed, and therefore the bills under energy outcomes relate only to energy supply and risk management.

**Figure 37** shows the yearly bills under Energy Outcomes in 2045 for all customers eligible to take up this business model, compared to counterfactual bills. At this stage, it can be seen that average bills are closely in line with those in the counterfactual – this is because the counterfactual evergreen tariff is a close substitute to the business model.[94] Energy Outcomes bills are higher, because of the premium customers pay for the business model provider to manage their risks.

**Figure 37.** 2045 bills under Energy Outcomes




Source: Frontier Economics

To illustrate why these customers take up Energy Outcomes, despite the higher bills, **Figure 37** focusses on one of the groups in 2045 in more detail. Unconvinced Dependents take up the energy-only package in significant numbers in 2045.

**Figure 37** shows that for Unconvinced Dependents, there is a significant benefit in terms of the risk they avoid. This benefit outweighs the marginally higher costs of energy relative to the counterfactual.[95]

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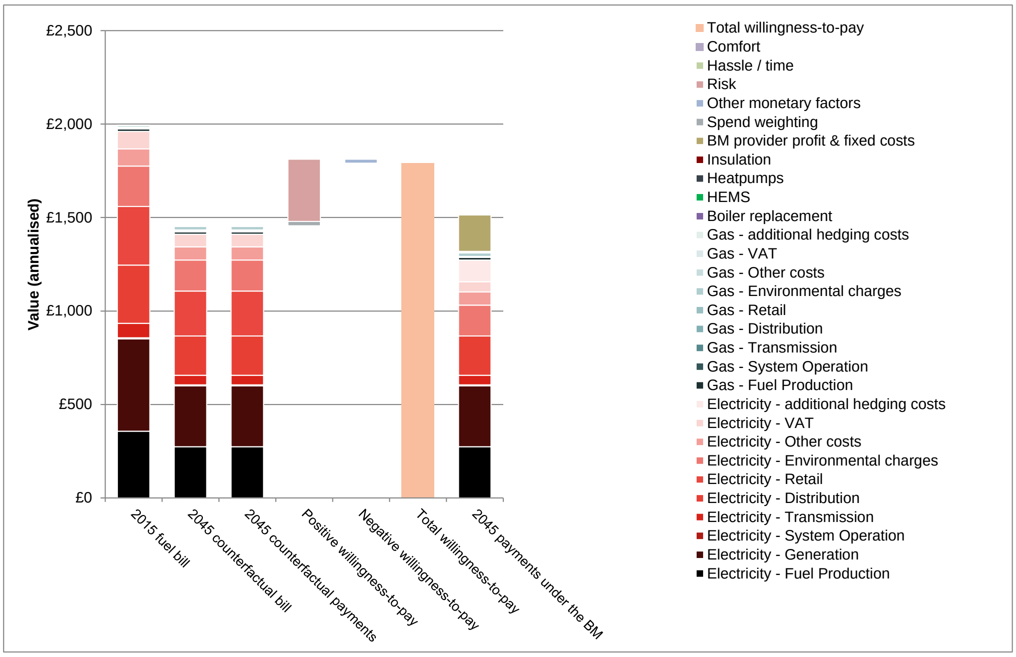
94 Bills are slightly higher under the business model. Partially, this represents the extra value that consumers gain from fixing their prices (and the cost this imposes upon the business). However, this is also due to a modelling assumption: The counterfactual bills show the average for the entire group, but there is assumed to be heterogeneity within the groups as to the willingness-to-pay for the business model. Since only those individuals with a higher willingness-to-pay take up the business model, they will on average be willing to pay slightly more than the group average.

95 In the previous version of the model (and report) we used Stretched Pensioners to demonstrate this point. Stretched Pensioners place no longer as high value on risk since they no longer purchase a heat pump that increased their (perceived and actual) bill volatility.

**Figure 38.** Bill Breakdown for Unconvinced Dependents under Energy Outcomes in 2045.




Source: Frontier Economics

- The first bar shows the annual bill breakdown in 2015 (assuming no change in heating technology or insulation level), at which point this group is using electric resistive heating for their heating needs.
- The second bar shows the counterfactual (without Energy Outcomes) annual bill breakdown for this group in 2045 (at which point they are projected to be using a heat pump for their heating requirements, regardless of whether they choose to take up an Energy Outcomes contract).
- The third bar also includes counterfactual spend on interventions. However, since this group has already purchased any interventions by 2045 this is identical to the second bar.
- The next set of bars shows the monetary value of the gain or loss this consumer group would make taking up an Energy Outcomes contract in 2045 (excluding the payment made to the business model provide itself), which primarily of a value upon reduced bill volatility (the pink bar).
- The next bar shows the resulting average willingness to pay (WTP) for those customers who take up the business model.

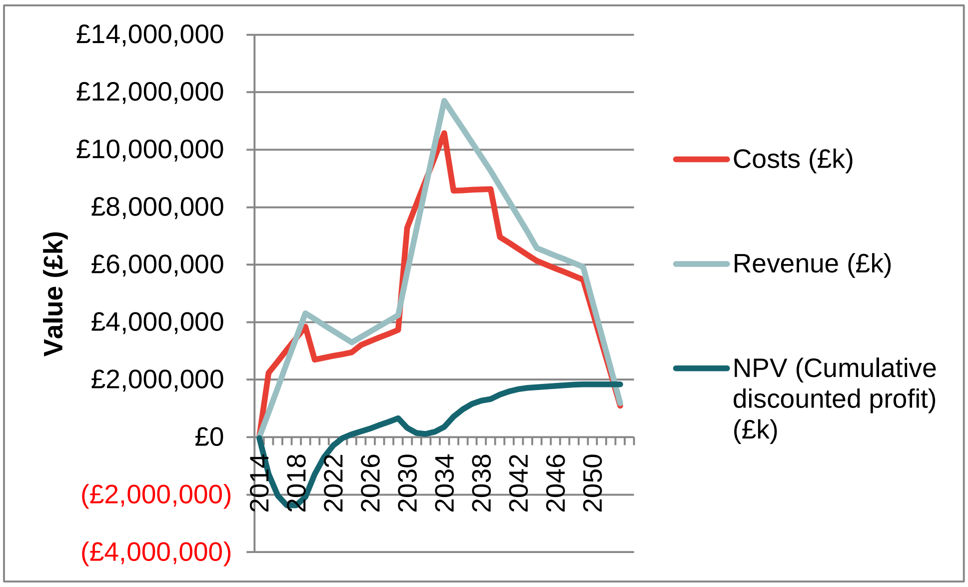
- The final bar provides a breakdown of consumer charges under the business model.

The results for other groups are similar, though other groups are less risk averse.

### *Profitability*

**Figure 39** shows the streams of revenues and costs arising out of the business model.[96] The teal line indicates the cumulative discounted profitability (i.e. net present value).

**Figure 39.** Costs, revenues and profits for Energy Outcomes




Source: Frontier Economics

There are three points to note.

- The business model is projected to cover its cost of capital by 2025 – this is because the evaluation tool was run specifying a 10-year payback period which, given the profitability of this business model, is feasible. The business model makes relatively modest profits (as a proportion of revenue) beyond this,[97] but again this is due to the assumption of competitive markets.

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96 The evaluation tool models this business model using five-year periods. Costs and revenues have been smoothed to simulate phased take up within these periods. The model does not simulate contracts commencing after 2050, so the revenues and costs decline to zero after this point.

97 The tool calculates an IRR of 17%, however this is not highly meaningful for a business model that does not involve a high set-up cost.

- Costs increase before revenues, leading to a period of unprofitability. This is because the business model provider must finance interventions at the start of each five-year contract, which are then only paid off gradually through bills.

- There is a peak in modelled profitability in the mid-2030s. This corresponds to the point at which heat pumps become cost-effective for many household groups.

### *Sensitivities*

There are two important elements driving take up of Energy Outcomes:

  - it covers the cost of installing interventions spreading the payments over the five-year contract and manages the risk with delivering expected savings during the contract period; and

  - it offers a proposition that manages future energy price risk for customers.

We now consider sensitivities that look at the importance of each of these elements in turn.

Energy Outcomes helps customers overcome upfront costs associated with interventions. We tested a sensitivity where customers are not credit constrained, and the business model provider received no discount on interventions. Under this sensitivity, the consumer can install the same interventions as the business model provider, at the same cost. Therefore in this case, Energy Outcomes is purely offering a risk management service. Under these assumptions, the maximum uptake of the model (i.e. the number of households taking it up in the period with highest uptake) dropped from around 6.3 million households to 4.2 million, a fall of around one third. Since uptake remains high, this suggests that **risk management is an important feature of the business model offering and a significant driver of uptake**.[98]

We also tested the importance of the bulk discount on interventions that providers can offer to customers in Energy Outcomes. We tested three levels 25%, 0% (i.e. no intervention discount). We compared these to the default level at which it increases from 0% in the first year, to 18% by 2045. These effects are shown in **Figure 40.**

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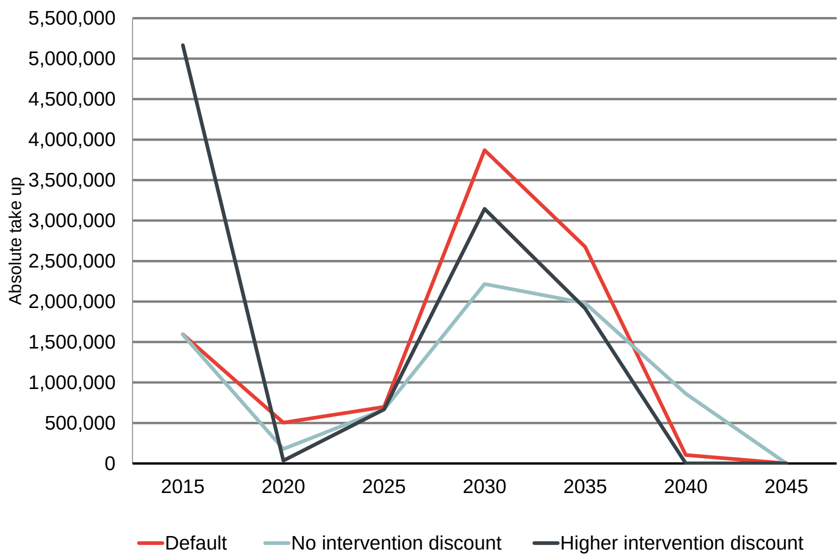
98 In this sensitivity, the business model provider can still help avert the "additional hassle cost" associated with HEMS. However, the high levels of uptake associated with the business model *after* HEMS has been installed demonstrates the importance of risk management to the success of this business model.

- With a higher discount, overall take-up of Energy Outcomes increases slightly and is significantly brought forward to earlier periods: in the first period take-up is in excess of 5 million households. .

- Removing the discount makes no difference to take-up in the first period since, under the default assumptions, there was no discount in place anyway. Take-up is reduced in the middle of the modelled period (when take-up would otherwise be highest), leading to a lower total take-up across the modelled period.

**Figure 40.** Profile of take up of Energy Outcome for different discount assumptions




Source: Frontier Economics

Energy Outcomes has also been designed to transfer energy price risk from customers to the business model providers. Whether managing risk is an essential aspect of the offer which drives take up, or a constraining factor on the offering of the business model provider will depend on the balance between how customers value risk management and how much it costs the business model to provide it. To explore the importance of this risk management in the Energy Outcomes model, we tested several different scenarios, varying the importance of risk to consumers and the costs to the business model of hedging energy price risk.

- We first looked at sensitivity where consumers were willing to pay double the baseline value to avoid risk, and the cost of hedging energy price risk for the business model was 2%, rather than the 10% baseline value. In this case, the business model reached 10.0 million consumers in its most popular year, up from 6.3 million in the baseline case. It is also notable that the business model had positive rates of uptake across all groups, even when providing energy-only services after interventions.

- We then looked at a sensitivity where consumers' willingness to pay for risk is reduced by 50%, and the cost of hedging increases to 20%, uptake (in the year it is highest) falls to 3.5 million households. It is notable that under this set of assumptions very few households take up the business model after they have had interventions installed, other than the Unconvinced Dependents group who place the highest value on risk due to their low incomes.

This analysis shows:

- there is potential for Energy Outcomes to be a mass market model, even where customers have low levels of risk aversion, and where the costs of managing risks are very high; but
- that the success of the Energy Outcomes business model outside of the period of interventions depends predominantly on the relationship between the cost to the business model provider of hedging energy cost risks and the willingness of customers to pay to avoid these risks.

### *Adaptability to different scenarios*

Energy Outcomes is adaptable to the range of ESME scenarios tested within the model, as it is not dependent on any particular decarbonisation pattern.

### *Energy usage and emissions*

Energy Outcomes facilitates the installation of heat pumps and HEMS, which leads to substitution of electricity usage for gas, and lower overall heating energy requirements. However, even in the absence of the business model, these technologies are sufficiently cost-effective under the carbon price that it is assumed that consumers would install them themselves in a later period under the counterfactual[99]. In a few cases, the business model provider will install such technologies earlier than the household would have, therefore gas consumption is lower (and electricity consumption higher) to start with.

The main impact of Energy Outcomes is therefore to bring forward carbon savings.

The figures below show total electricity consumption, gas consumption, and carbon emissions (from electricity/gas) in the presence of the business model and without it.

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[99] Under the revised insulation assumptions from ESME 3.3, insulation is typically not taken up.

The figures for domestic electricity consumption, gas consumption, and carbon emissions are taken straight from BMET, and will be lower than total projected figures from sources such as Digest of UK energy statistics (DUKES).[100] This is because the tool considers only a subset of UK households:

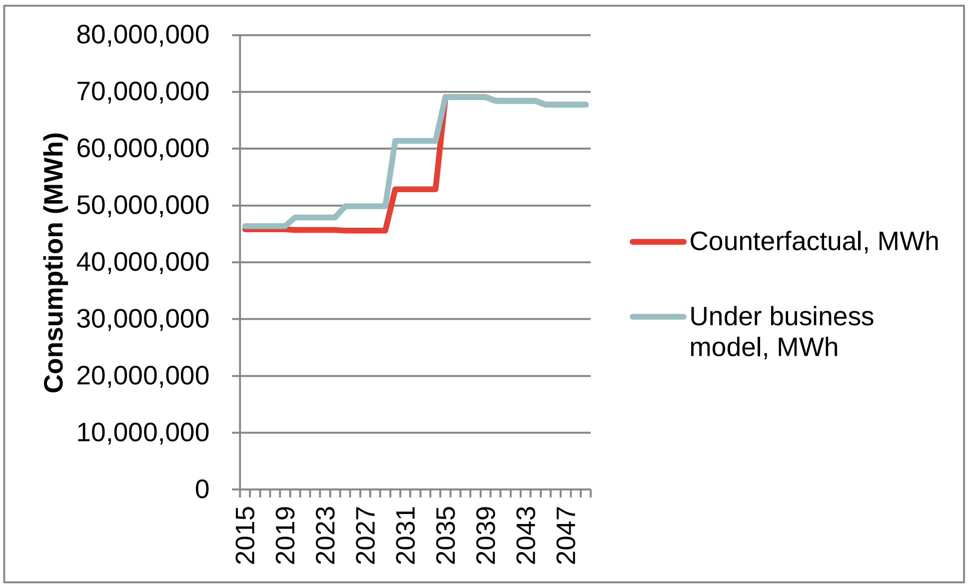
- Firstly, as described previously, the household groups in BMET currently cover 80% of UK households. Energy consumption related to the remaining 20% of households is not included in these graphs.

- In addition, as described in section 11.3.2, we have assumed that some of the remaining households could not feasibly take up energy outcomes (for example due to general customer inertia). Energy consumption relating to these households is not included in the modelling.

The red counterfactual line shows the modelled consumption of this set of households if none of them were to take up the business model. The blue "business model" line shows the modelled consumption of the same set of households if the business model is available. Not all these households will take up the business model – the proportion which do take it up can be seen in **Figure 35**.

100 https://www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes

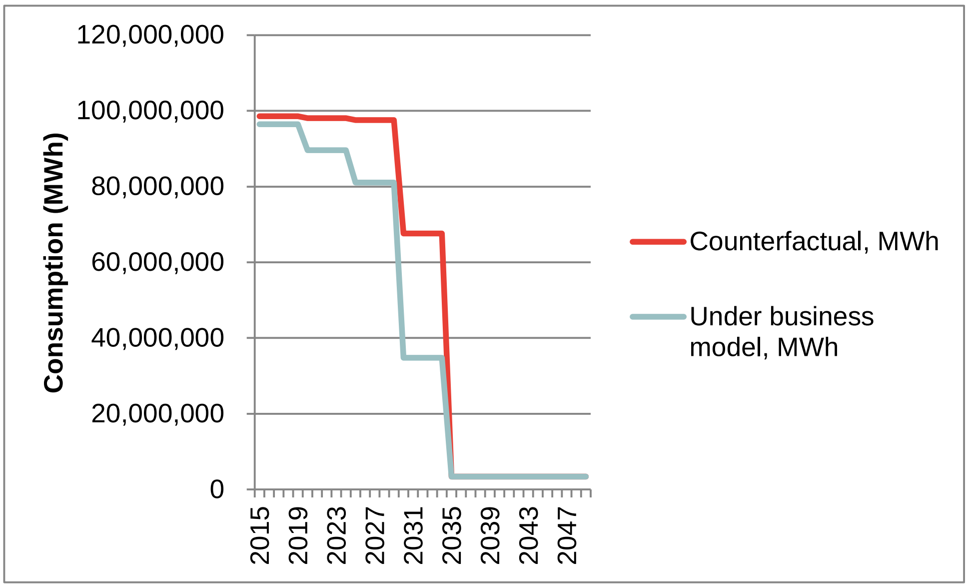
**Figure 41.** Electricity consumption for Energy Outcomes




Source: Frontier Economics

Under both the counterfactual and the business model, electricity usage is affected in two conflicting ways: HEMS reduces it, while heat pump installation increases it (since heat pumps are usually substituting for a heating system that used either gas or oil). The former effect dominates, therefore electricity usage increases over time in both the counterfactual and under the business model. In the presence of the business model, this trend is accelerated, since interventions are generally installed earlier than under the counterfactual.

**Figure 42.** Gas consumption for Energy Outcomes

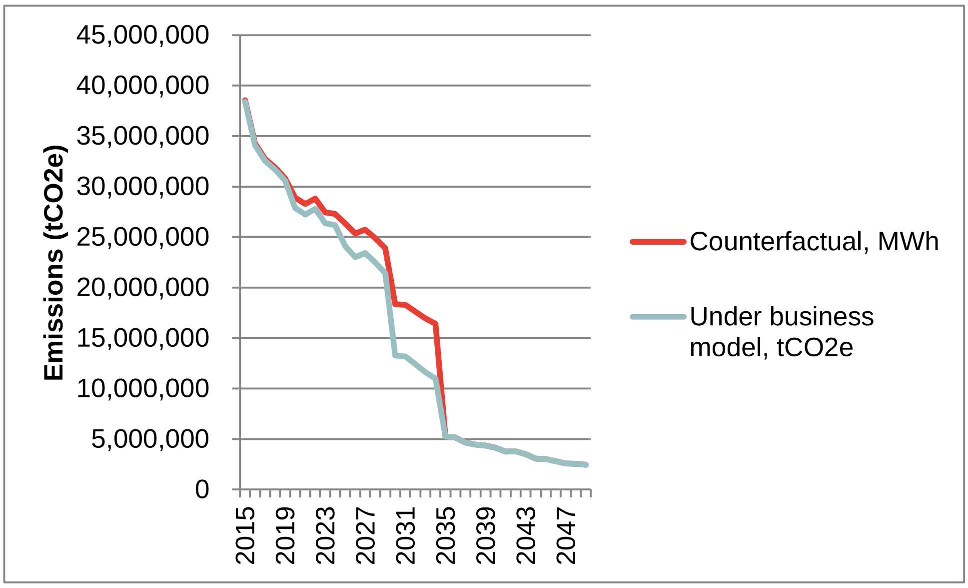



Source: Frontier Economics

Gas consumption is reduced as boilers are converted to heat pumps, a trend that is faster under the business model than the counterfactual.

**Figure 43** shows total emissions under Energy Outcomes and the counterfactual. This shows that Energy Outcomes brings forward emissions savings (due to the earlier uptake of interventions), but that annual emissions converge to the same level by 2050.

**Figure 43.** Total emissions under Energy Outcomes and counterfactual




Source: Frontier Economics

## Value chain impacts

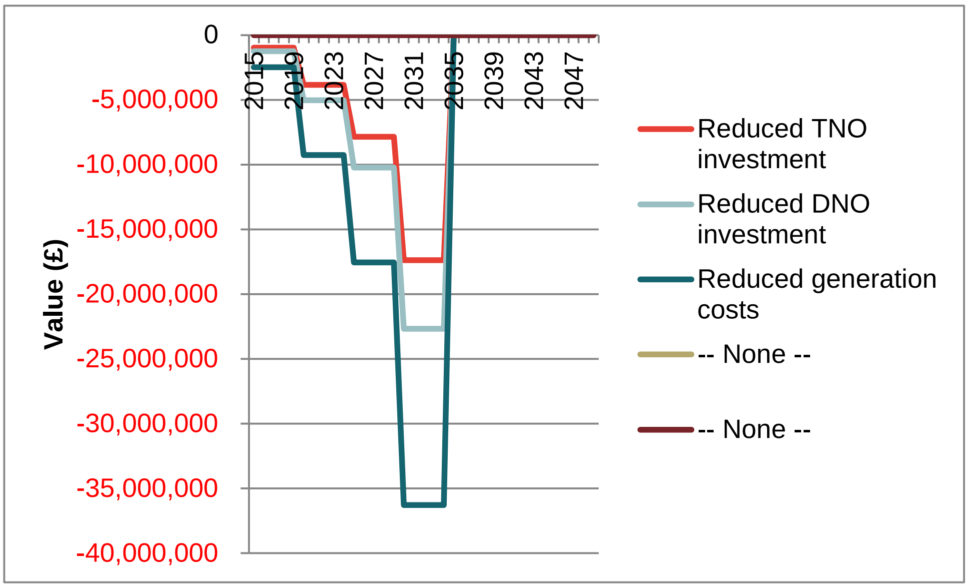
We have considered three impacts across the rest of the electricity value chain:

- impact on DNO investment requirements;
- impact on TNO investment requirements; and
- impact on investment requirements in generation plant.

As with overall electricity consumption, peak electricity demand is affected by two conflicting forces: HEMS installation reduces demand, while heat pumps will increase it. As a result of the widespread roll-out of heat pumps under the assumptions within the model the latter effect dominates. The business model accelerates this trend, leading to an increase in required investment.

This is shown in **Figure 44**.

**Figure 44.** Change in investment required at other levels of the value chain




Source: Frontier Economics

## *Adaptability*

A further aspect of the adaptability analysis was an assessment of the risk of failure of each business model. The results of this assessment are set out in **Table 11**. The methodology behind this is described in the model user guide.

**Table 11.** Failure risk score for the Energy Outcomes model

| Factor | Sub-factor | Rating | Justification (where rating is not quantitative) |
|---|---|---|---|
| **Size and scale** | Average annual asset value (£m) | £0.51m | |
| | Total annual revenues (£m) | £1,295 m | |
| **Competitive position and market structure** | Stability and predictability of regulation | Medium | The business model provider will be subject to the same level of regulation as an energy supplier. A key area of potential regulatory change is around the number of tariffs that can be offered. |
| | Expected customer churn | Medium | Customers will be locked in for the five-year duration of the contract, subject to agreed terms for early exit. |
| | Barriers to entry | Low/Med | In principle it would seem possible to enter this market within a year, as there are no long lead-time investments required. Although becoming an energy supplier may require some scale / expertise, firms already in the energy supply sector could move into providing this type of contract with relative ease. |
| **Cost stability** | Volatility of costs | Medium | It will be possible to manage the risks associated with the interventions (in terms of its cost and its ability to deliver expected savings). Fuel costs are highly variable, but should be more easily hedged. |

| | | | |
|---|---|---|---|
| | Fixed/variable cost split (averaged across all years) | 0.37% | |
| **Revenue stability** | Volatility of revenues | Low | Customers are locked in to a fixed price contract for five years; therefore there should be very little unforeseen variation in revenue (assuming there is not a widely taken-up break clause). |
| **Correlation between costs and revenue** | Extent to which cost shocks can be passed through to consumers | Low/Med | If contracts are not indexed to energy prices, it will be impossible to pass through cost shocks to a given customer within the 5-year fixed period. However, new cohorts of customers (in practice, there will be overlapping cohorts) could be given different prices. |
| **Failure risk score:** | | High/moderate risk | |

Source: Frontier Economics

### 11.3.4 Business model 2: Energy Outcomes with additional storage

The evaluation tool has the option to add either heat and/or electricity storage to the Energy Outcomes and Community Energy models. We have carried out a run of the tool with storage integrated into the Energy Outcomes business model.

Storage is deployed within the tool to flatten peaks in load, with load moved from the six hours of highest demand to the six hours of lowest demand. If the differential in electricity prices[101] between the time of highest and lowest demand is sufficient to cover battery losses, this will result in a reduced electricity bill.

We have modelled point-of-use electricity storage, since this is potentially applicable to all households (within the evaluation tool, heat storage will have no benefit when used in association with a gas boiler, since gas prices are not assumed to vary hour-by-hour).

The modelled electrical storage system consists of an EV-style battery, sized in such a way as to be able to flatten the profile of electricity demand. The capacity of the battery varies by property (it will be larger for households with a higher, peakier, demand for electricity).

The Energy Outcomes provider is assumed to install the battery at the same time as any other interventions (heat pumps, insulation and/or HEMS). The business model provider will benefit from lower bills for the duration of the contract, while the household will receive these benefits in the future if they choose not to renew the contract.[102]

#### *Key Results*

It is useful to compare the evaluation results for this model with the results for Energy Outcomes without storage. The success of this business model rests on the ability of the addition of storage to be profitable. If this is not the case, it would always be preferable to operate an Energy Outcomes model without storage.

The cost of storage falls over time, and in most cases we find that storage is cost effective by 2045 (under our assumptions, the cost of the battery exceeds the electricity bill savings). In general, the effectiveness of storage is strongly related to the take-up of heat pumps and HEMS:

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101 If used with a heat pump, heat storage will have the same effect upon the profile of electricity demand.

102 The evaluation tool assumes time-of-use tariffs, therefore consumers can themselves directly benefit from demand-smoothing.

- Storage becomes more useful as heat pump take-up increases (when the tool was run with a less efficient heat pump and lower resulting heat pump take-up, storage was not cost-effective for the majority of groups). This is because heat pumps increase electricity demand, so there is a greater demand for electrical storage to shift. Electrical storage and heat pumps are therefore to some extent[103] complementary.

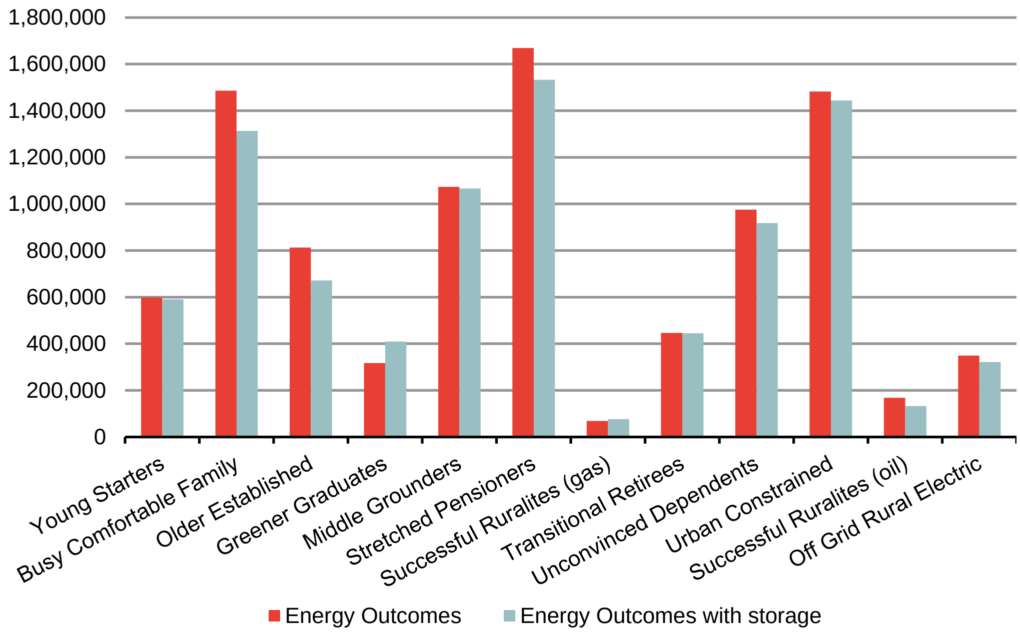
- Storage can actually become less useful if HEMS is already present. This is because HEMS also acts to decrease peak demand, lowering the additional gains to be made from storage. HEMS is therefore a substitute for electrical storage.

### Scale

**Figure 45** compares the take-up of Energy Outcomes with storage to the default Energy Outcomes business model (here, take-up is measured as the number of households taking up the business model at least once). It can be seen that take-up is lower for most groups.

103 This holds if heat pumps are replacing gas or oil boilers. Where heat pumps replace electric resistive heating, they reduce peak demand.

**Figure 45.** Take-up of Energy Outcomes with additional storage

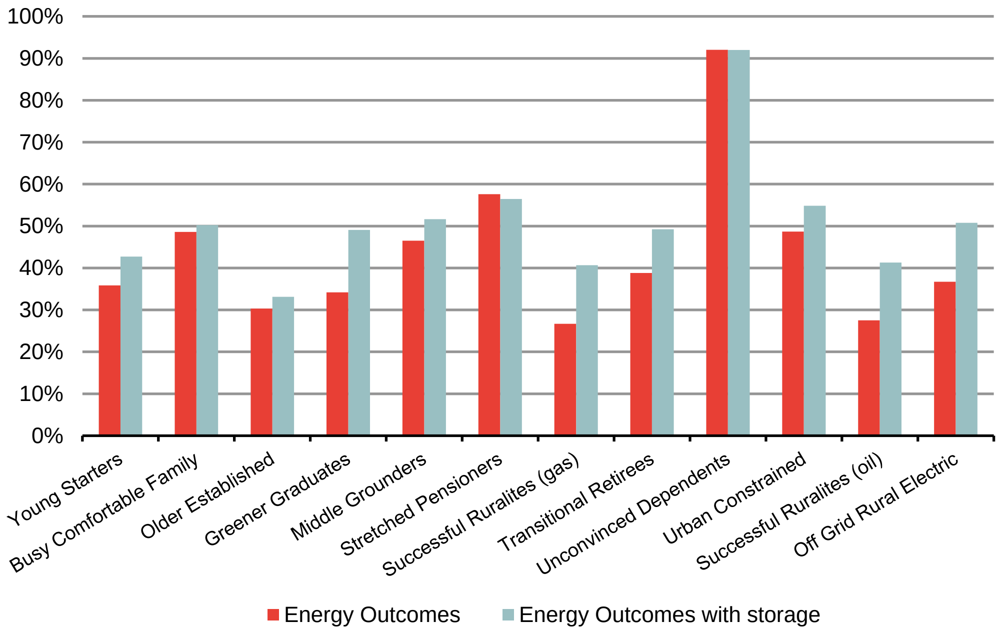



Source: Frontier Economics

This reduced take-up is a result of electrical energy storage not being cost-effective in the earlier periods. We have constrained the business model provider to always include a storage element to their offering, and this reduces its attractiveness during the periods when many households would be looking to install interventions.

In order to better reflect the long-term viability of this business model, **Figure 46** shows the percentage of households that take up this variant of Energy Outcomes at 2045 (as a proportion of total eligible households), compared to the standard business model. Where take up is higher for Energy Outcomes with Storage than for Energy Outcomes alone, this indicates that storage is beneficial.

**Figure 46.** Percentage take up of Energy Outcomes with additional storage at 2045

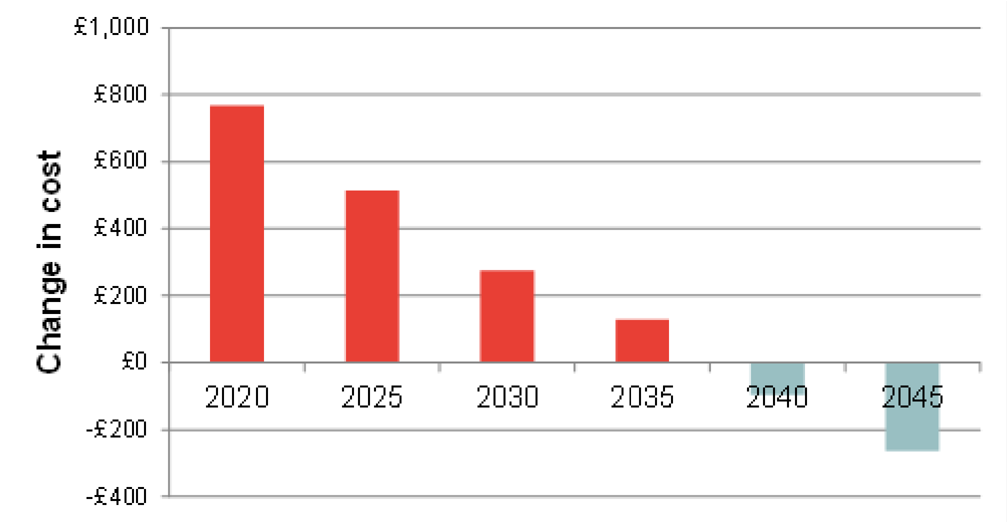



Source: Frontier Economics

Take-up is higher than under Energy Outcomes for all household groups except "Stretched Pensioners". This is the group with the lowest electricity consumption, and therefore the least to gain from electrical storage.

The chart below shows how the costs and benefits of storage vary over time for a group that benefits from it in the long-term (Successful Ruralites previously using oil for their heating needs). High electricity consumption at peak hours is assumed to give higher network and generation costs. As a result, the implementation of storage can significantly reduce the cost of electricity for these groups, assuming the operator buys electricity on a time of use basis. The effect that this has varies over time. For example, a battery with a capacity of approximately 1.5kWh battery (assumed to cost around £1,300) would save approximately £122 a year from the bill of a Successful Ruralite in 2020. This would lead to a net increase in the costs faced by the business model provider. However, by 2045, the battery would only cost £257 – the bill savings (still approximately £122) would exceed this over five years. In the years prior to this, providing storage as part of the Energy Outcomes offer would increase the costs to serve consumers, therefore increasing the price. This would reduce the attractiveness of the business model.

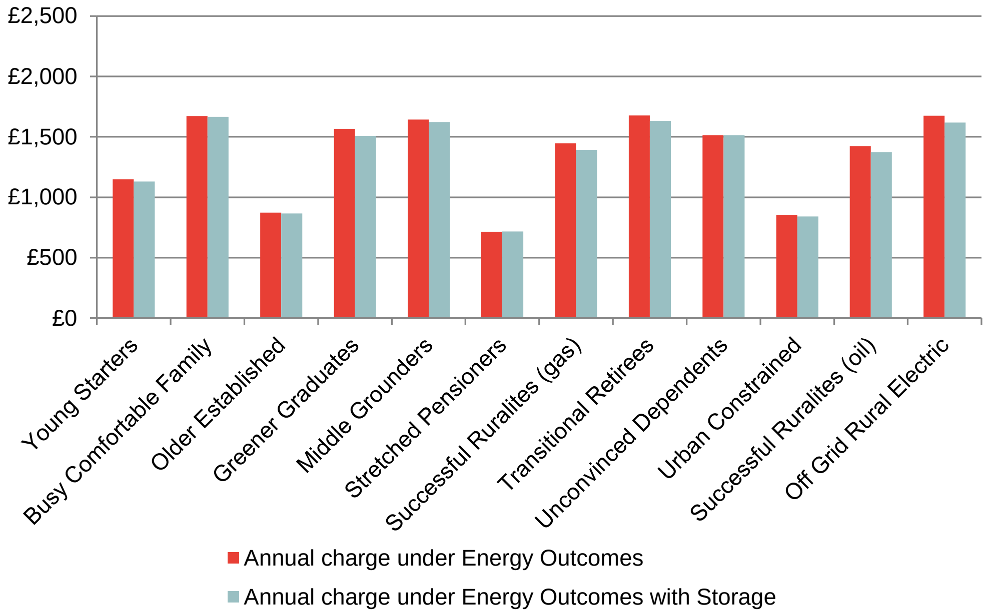
**Figure 47.** Change in costs of serving Successful Ruralites (oil) due to storage




Source: Frontier Economics

The charges made to consumers by both business models (for an offer of energy and storage only) in 2045 are shown below in **Figure 48**. This shows the overall decrease in bills offered by storage by this late stage.

**Figure 48.** Charges to consumers taking up Energy Outcomes and with additional storage



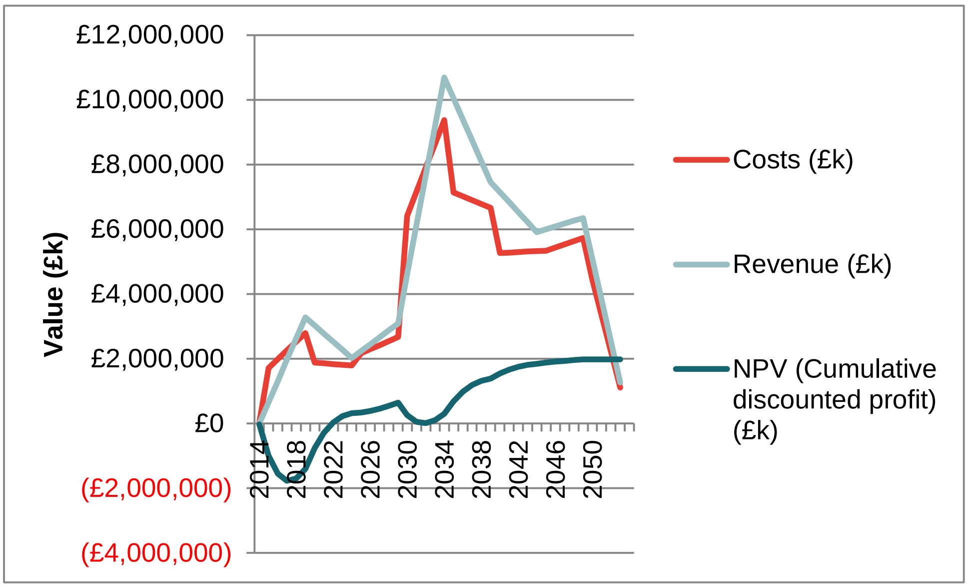

Source: Frontier Economics

We note that storage may be more feasible if based around electric vehicles which the consumer already owns as this will remove the upfront cost of the battery. In addition, it may be possible for an aggregator to make use of storage devices for ancillary uses (e.g. frequency response). This is discussed in greater depth as part of the Power Buffer business model.

### *Profitability*

As noted above, the storage model becomes cost-effective only late in the period. It is therefore not surprising that the Energy Outcomes with Storage model becomes most profitable in the later years (this is also due to the way in which heat pumps become cost effective with time, discussed above). **Figure 49** shows the costs, revenues and profits modelled in BMET. This suggests that an Energy Outcomes provider should offer the storage variant of the model later in the period.

**Figure 49.** Profitability of the Energy Outcomes with additional storage model



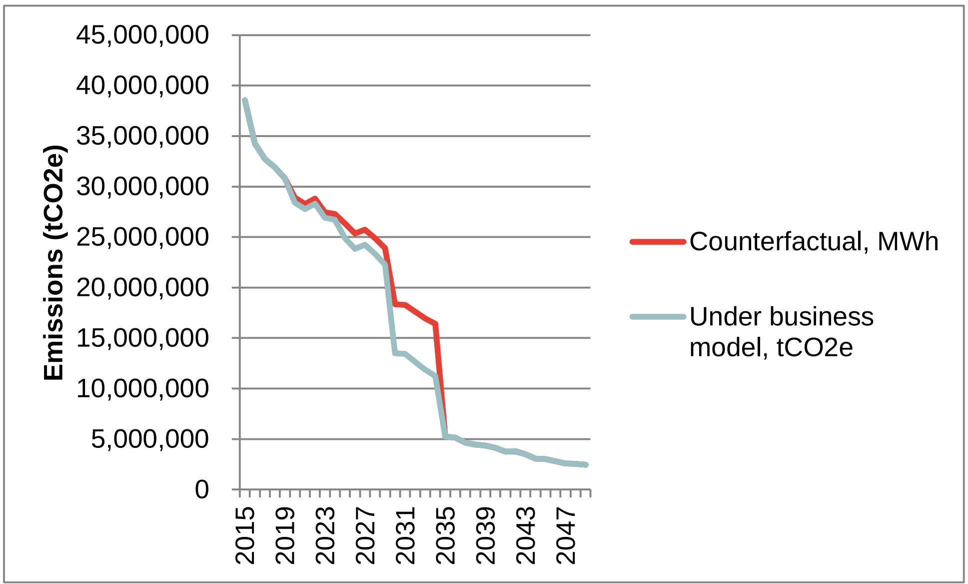

Source: Frontier Economics

## *Emissions*

This business model has a very similar impact on energy usage as Energy Outcomes alone. The net effect on emission is shown below.[104] The main impact of the business model occurs later in the modelling period, as storage becomes cost-effective. Note that, because BMET uses average emissions factors, it does not take into account any changes in carbon emissions that occur as a result of demand-shifting (which may for example reduce reliance on emissions-intense peaking plants such as OCGTs).

104 As described above for Energy Outcomes, the consumption and emissions figures relate only to those households for which business model take-up is considered feasible, and should not be compared to aggregate forecasts of UK consumption or emissions.

**Figure 50.** Total emissions under Energy Outcomes with additional storage



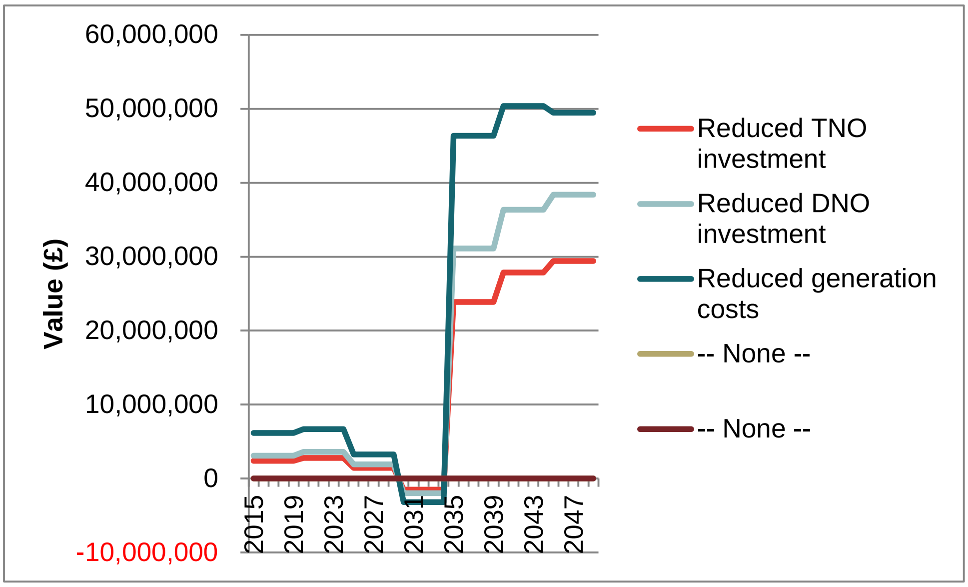

Source: Frontier Economics

## *Value chain impacts*

The business model has a larger impact on the spillovers. The major impact of adding storage is to flatten the electricity load profile. This will reduce the capacity investment costs to generation and networks.

**Figure 51** shows the net effect of the business model on the investment of these third parties. It is notable that, even though earlier investment in heat pumps increases the demand for electricity quicker than in the counterfactual, the total investment required to sustain it is almost always lower than the counterfactual. The inclusion of storage (which flattens peaks in demand) means that this business model leads to lower reinforcement costs than under the counterfactual, despite the installation of additional heat pumps. This stands in contrast to the case of Energy Outcomes, in which required investment was increased

**Figure 51.** Spillovers associated with the Energy Outcomes with additional storage model




Source: Frontier Economics

## *Sensitivities*

To understand the drivers of take up of Energy Outcomes with storage, we have explored a number of sensitivities.

- **Cost of storage.** A key assumption driving the take-up of storage in later years for some groups is the reduction in the cost of storage over time. Should our assumed curve of prices prove to be optimistic, and costs not fall, the storage option will never perform better than a basic Energy Outcomes model. In contrast, if battery prices fall, or EV batteries can be used by the provider, the storage option would become more popular and may be taken up earlier, or by a wider range of customer groups.

- **Intervention take-up**. We tested a number of different assumptions on the level of intervention discounts an Energy Outcomes provider was able to access. At a discount of 25%, the business model has a higher uptake due to the cost advantage it enjoys over households carrying out their own interventions in the counterfactual.

The other factors determining the success of Energy Outcomes business model, listed above, will also apply to this variant.

### 11.3.5 Business model 3: Energy Mutual

The crucial driver of Energy Mutual's success is its ability to provide households with access to affordably-priced credit. For this credit to be provided more cheaply than the market rates (e.g. through schemes such as the Green Deal), investors must be found who are willing to accept a lower return for ethical and socially responsible investments.

Our central modelling assumption is that Energy Mutual can access credit at a rate lower than the market rate. We assume the total size of the pool of available credit is equivalent to the current size of the peer-to-peer lending market, and that lenders are willing to lend at rates comparable to those seen in other ethical schemes. We also assume that Energy Mutual providers can offer a bulk discount on interventions. Under these assumptions, Energy Mutual is a successful business model for customer groups without access to mortgage finance.

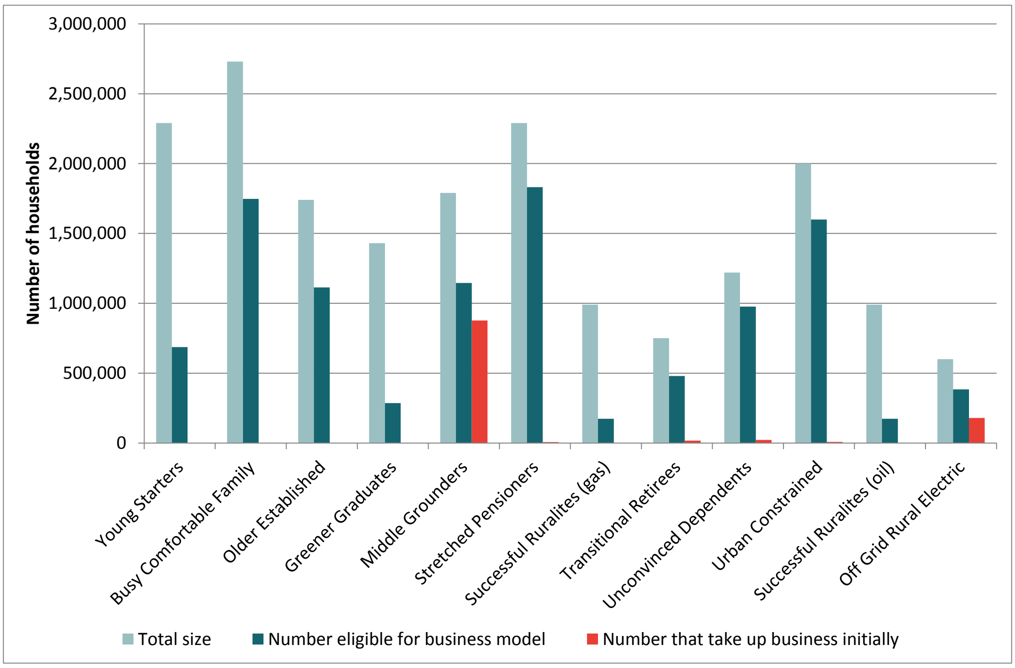
Under Energy Mutual, the installation of HEMS is associated with an "Additional Hassle Factor" cost regardless of whether the installation occurs under the counterfactual or the business model. This is different to Energy Outcomes, where the hassle cost was only applied in the counterfactual. The reason for this is that, under Energy Outcomes, the business model provider encapsulates the installation of HEMS as part of the overall service of providing comfort – the consumer does not need to actively choose to install HEMS. By contrast, while Energy Mutual provides a way of financing HEMS, it is still up to the consumer to decide to take up HEMS in the same way as if they had financed it through an ordinary loan. As a result, any non-monetary barriers to HEMS take up (for example, lack of information) that exist under the counterfactual are likely to exist under Energy Mutual, unless the business model provider were able to actively carry out activities such as customer education that would not occur in the counterfactual.

#### *Scale*

**Figure 52** shows, for each customer group covered by the tool:

- the nationwide number of households of that type;
- the number which are assumed to be in the feasible market for Energy mutual; and,
- the number of households which take up the business model.

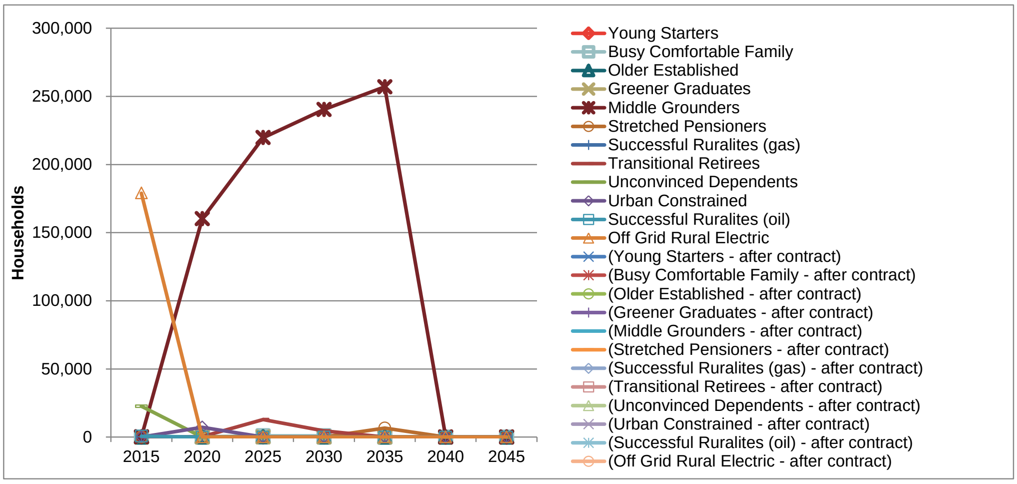
**Figure 52.** Cumulative Energy Mutual uptake by 2050.




Source: Frontier Economics

**Figure 53** shows how the make-up of household types joining the model varies by group over time.

**Figure 53.** Take up of Energy Mutual




Source: Frontier Economics

There are many groups that in principle would benefit greatly from this business model, but there is a limited availability of funds. As a result the business model provider sets prices to cover the demand only for the most lucrative groups (i.e. those with the highest willingness-to-pay compared to the cost of provision), which are "Off-grid Rural Electric" in the initial period and "Middle Grounders" thereafter.

"Off-grid Rural Electric" households are initially on electric resistive heating, and would therefore install a heat pump (and HEMS) in the first period anyway. The business model provides them with a cheaper way of doing this. Insufficient funds are then left over to offer the business model to the other two groups which would install a heat pump in the first period.[105]

Out of all the other groups which do not have access to mortgage finance, "Middle Grounders" is the one with the highest heat requirements[106] (and therefore heat pump capital cost) – this is why BMET targets the available funds at this group in subsequent periods.

By 2040, all household groups have already purchased any interventions, and there is therefore no further scope for the Energy Mutual business model.

### *Consumer bills and added value*

For this business model, it is assumed that customers pay back the value of the loan, plus interest, at a constant rate over the five-year contract period. **Table 12** shows, for each consumer group:

- the year in which their uptake peaks;
- the interventions that the Energy Mutual provider is financing;
- the costs of these to the business model provider; and
- the yearly repayment made by the customer group to the provider (for groups with material uptake – those which are not offered the business model in significant quantities are not shown).

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105 There are two such groups. The first is "Successful Ruralites (oil)", which which are assumed to be able to finance the cost of a heat pump in a single lump-sum (rather than borrowing) due to their greater wealth. The second is "Unconvinced Dependents" who, due to the smaller size of heat pump required, are also assumed to be able to afford to buy it without recourse to expensive borrowing. As a result, both groups have a lower willingness-to-pay for the business model relative to the costs of providing it to them, which is why BMET targets funds at "Off-grid Rural Electric" instead.

106 "Transitional Retirees" are very similar, but are assumed to have somewhat more disposable income that can be used to purchase the heat pump without the need to borrow.

**Table 12.** Energy Mutual bills

| Customer group | Year of greatest uptake | Interventions installed | Cost | Yearly payment |
|---|---|---|---|---|
| Young Starters | No material uptake | | | |
| Busy Comfortable Family | No material uptake | | | |
| Older Established | No material uptake | | | |
| Greener Graduates | No material uptake | | | |
| Middle Grounders | 2035 | HP&HEMS | £5,660 | £2,220 |
| Stretched Pensioners | No material uptake | | | |
| Successful Ruralites (gas) | No material uptake | | | |
| Transitional Retirees | No material uptake | | | |
| Unconvinced Dependents | No material uptake | | | |
| Urban Constrained | No material uptake | | | |
| Successful Ruralites (oil) | No material uptake | | | |
| Off Grid Rural Electric | No material uptake | HP&HEMS | £7,780 | £2,864 |

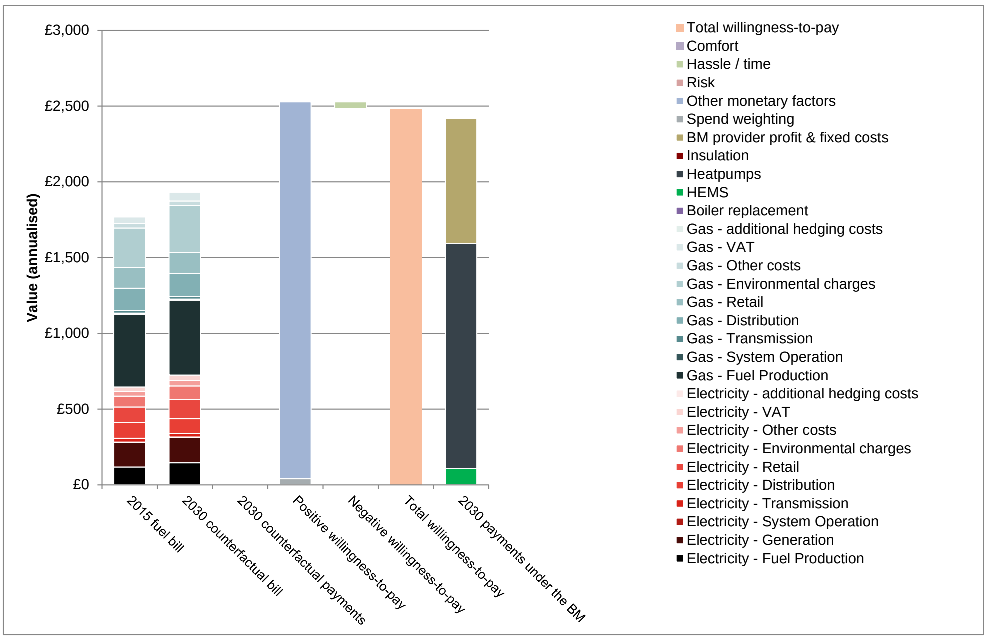
Source: Frontier Economics

The gain made by consumers compared to the counterfactual can be substantial. **Figure 54** shows, for the Middle Grounders group in 2030:

- the modelled bill in 2015 (assuming no change in heating technology or insulation level);

- the counterfactual (without Energy Mutual) annual bill breakdown for this group in 2030 (at which point they are still projected to be using a gas boiler for their heating requirements);
- their spend on interventions in the counterfactual during this period (zero);
- the monetary value of the gain or loss this consumer group would make taking up an Energy Mutual contract in 2045, consisting mainly of bill savings from the heat pump and HEMS installation (blue), the additional hassle factor associated with HEMS (light green), and a term ("spend weighting") to account for the way in which those that take up the business model will be those with the highest willingness-to-pay (grey);
- the resulting willingness-to-pay; and
- a breakdown of consumer charges under the business model, showing the amount spent (in annualised terms over the 5 year contract) on HEMS, the heat pump, and profit for the business model provider.

**Figure 54.** Urban Constrained bill under Energy Mutual




Source: Frontier Economics

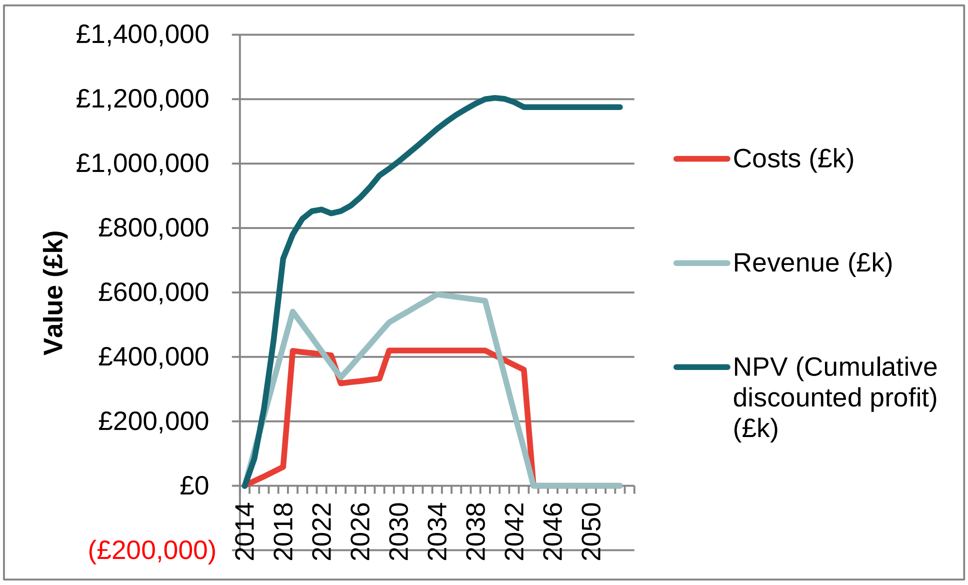
This shows that by providing access to finance for energy saving investments, Energy Mutual saves customers money. This group wouldn't have installed any intervention in the counterfactual in this period. However, by financing this using

Energy Mutual, they are able to afford the installation of a heat pump and HEMS.

## *Profitability*

**Figure 55** shows the streams of revenues and costs arising out of the business model.[107] The teal line indicates the cumulative discounted profitability (i.e. net present value).

**Figure 55.** Costs, revenues and profits for Energy Mutual




Source: Frontier Economics

**Figure 55** shows that Energy Mutual has the potential to be highly profitable. This is because there is a constraint on the supply of funds which means that the business model provider charges high fees for matching lenders with investors as a way of limiting demand to the level of available supply. This constraint binds for most periods until 2040 as the provider is financing expensive heat pump installations for all the periods,

After the first year (during which set-up costs are incurred) the business immediately begins to make a profit. This is due to the assumed structure of the loans from lenders (a lump sum is lent in the first year, interest is paid at the end of each year of the five-year contract, and the principal is repaid along with the final interest instalment at the end). The business model provider is never "out of

107 The evaluation tool models this business model using five-year periods. Costs and revenues have been smoothed to simulate phased take up within these periods. The model does not simulate contracts commencing after 2050, so the revenues and costs decline to zero after this point.

pocket." This, combined with the low set-up costs, mean that its financing requirements (excluding the peer-to-peer lenders from which funds are channelled) are minimal.

### *Sensitivities*

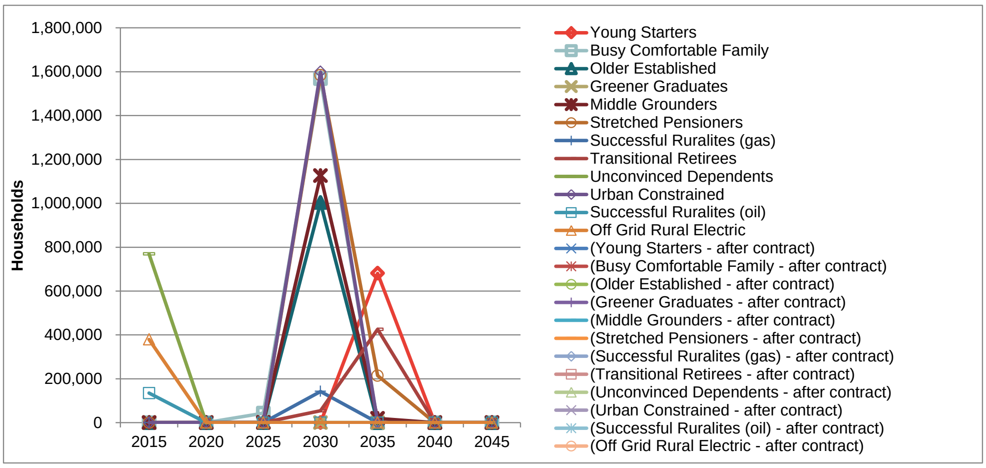
We have carried out sensitivity analysis on Energy Mutual on a range of parameters. First, we focussed on the willingness of people to undertake socially responsible investment in return for a return that is slightly lower than the competitive rate, exploring the impact of our assumptions on:

- the amount of funds available from peer-to-peer lending; and
- the rates of return the business model must secure for their lenders.

The impacts of relaxing these assumptions are unsurprising. When rates of return rise above other commercially available rates (such as the rate of Green Deal finance), the Energy Mutual model is no longer viable. When the level of available funds increases, take-up increases. To test the impact of availability of funds, we ran the business model through BMET without a constraint on funds.[108] **Figure 56** shows that under these conditions, take-up is generally close to 100% of those eligible for the business model. This reflects the beneficial terms upon which the Energy Mutual firm is assumed to be able to purchase interventions alongside the competitive credit cost. In practice, one would expect similar business models to have access to such discounts, therefore this may overstate potential uptake.

108 The tool was set to maximise total welfare, providing that the business model covers its costs within the first ten years

**Figure 56.** Scale of Energy Mutual without financial constraints




Source: Frontier Economics

The impact of the assumption on the availability of a bulk discount providers can offer to customers is also important to the success of this model. We have tested three levels 25%, 5% and the baseline level increasing from 0% in 2015 to 20% by 2050. **Table 13** shows how uptake of the model varies according to this assumption.

**Table 13.** Energy Mutual take-up at different interventions discount assumptions

| Interventions discount assumption | Maximum Business Model Take-up | Business model is profitable? |
|---|---|---|
| **0% interventions discount** | 223 thousand households | Yes |
| **Baseline Discount (0% in 2015 to 20% by 2050)** | 264 thousand households | Yes |
| **25% interventions discount** | 305 thousand households | Yes |

Source: Frontier Economics

Where no discount is provided, uptake of interventions is reduced slightly. This reflects the additional cost of interventions, which reduces the attractiveness to consumers, and limits the number of consumers the provider can sell to given the limited funds available. At this cost of providing interventions, the Energy Mutual provider does not exhaust the limited pool of funds available in 2020. However, when BMET has been run with alternative assumptions that lead to lower heat pump usage, take-up of Energy Mutual is markedly reduced without an intervention discount. This shows that **the importance of the intervention discount varies according to how valuable the services provided by the business model are.**

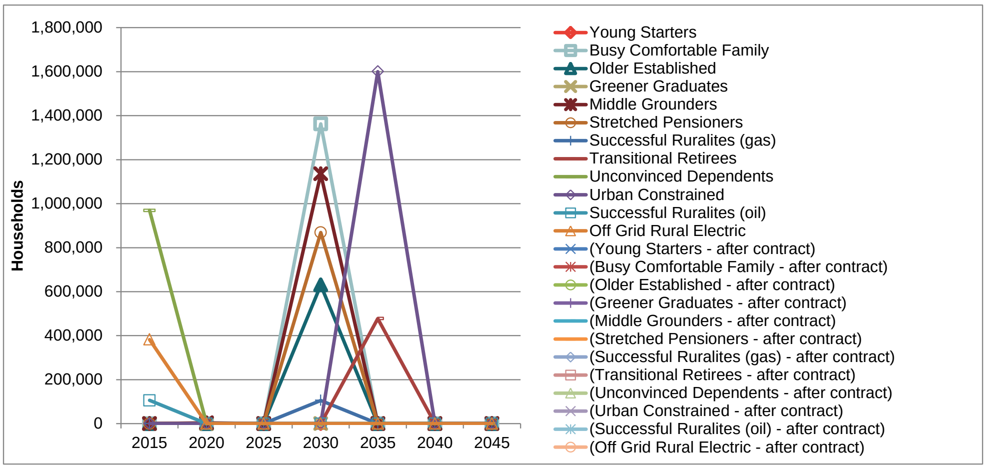
At higher levels of interventions discount, the Energy Mutual provider continues to operate at the capacity of its pool of available funds, as the offer is now substantially more attractive to consumers than the counterfactual finance. The higher the discount, the greater the number of consumers that can be served with the same pool of funds, as each consumer requires less funds.

To test which of the groups were most affected by the interventions discount assumption used, we ran the tool with both the interventions discount and the limit on lending removed. This therefore reduces any supply constraints and makes it clear which groups would choose the model. **Figure 57** shows the total uptake by groups. Comparing this to the equivalent take-up graph when interventions discount is included (**Figure 56**), shows which groups' take-up of the model is driven by the discount alone. We see that take up in the Young Starters, Busy Comfortable Families, Older Established and Stretched Pensioners groups is driven to a large extent by the discount (these groups have considerably lower uptake when the discount is removed). Busy Comfortable Families and Older Established are assumed to have access to cheaper finance through a mortgage, which explains why the business model is less attractive without the discount (while the Successful Ruralite groups also have access to funds at this level, they take up a heat pump immediately due to the high gains on offer).

Young Starters are a group with relatively tight credit constraints, and would not be able to afford the yearly repayments to the Energy Mutual provider without the intervention discount. Stretched pensioners, by contrast, are assumed to be capable of funding the small heat pump that they require without credit, which reduces their dependence upon the business model provider.

It is notable that the business model still achieves its highest take-up in the middle period, particularly 2030. This suggests that using Energy Mutual to finance heat pump installations will become increasingly more attractive for some groups, due to the increased cost-effectiveness of the underlying interventions.

**Figure 57.** Scale of Energy Mutual without financial constraints, with reduced discount




Source: Frontier Economics

## *Adaptability to different scenarios*

Energy Mutual is adaptable to the range of ESME scenarios tested within the model, as it is not dependent on any particular decarbonisation pattern.

The results of the further failure risk analysis for the energy mutual business model are set out below.

**Table 14.** Failure risk score for the energy mutual model

| Factor | Sub-factor | Rating | Justification (where rating is not quantitative) |
|---|---|---|---|
| **Size and scale** | Average annual asset value (£m) | £0.02m | |
| | Total annual revenues (£m) | £356m | |
| **Competitive position and market structure** | Stability and predictability of regulation | Med/High | The business model provider will be subject to the same regulation as any lender, though without being covered by the Financial Services Compensation Scheme (FSCS). It is unlikely to require energy-specific regulation, since it is not a supplier. |
| | Expected customer churn | Medium | Investors and borrowers will be locked in for the five-year duration of the contract. |
| | Barriers to entry | Low | The business model requires relatively little capital expenditure, and there are no regulatory barriers to entry. It would be straightforward for an organisation such as a bank to enter. |
| **Cost stability** | Volatility of costs | Low/Med | Installation costs may vary over the long term (which will affect the amount that must be returned to investors), however the business model provider does not need to be concerned about shorter term fluctuations in fuel prices, since it is not an energy supplier. |

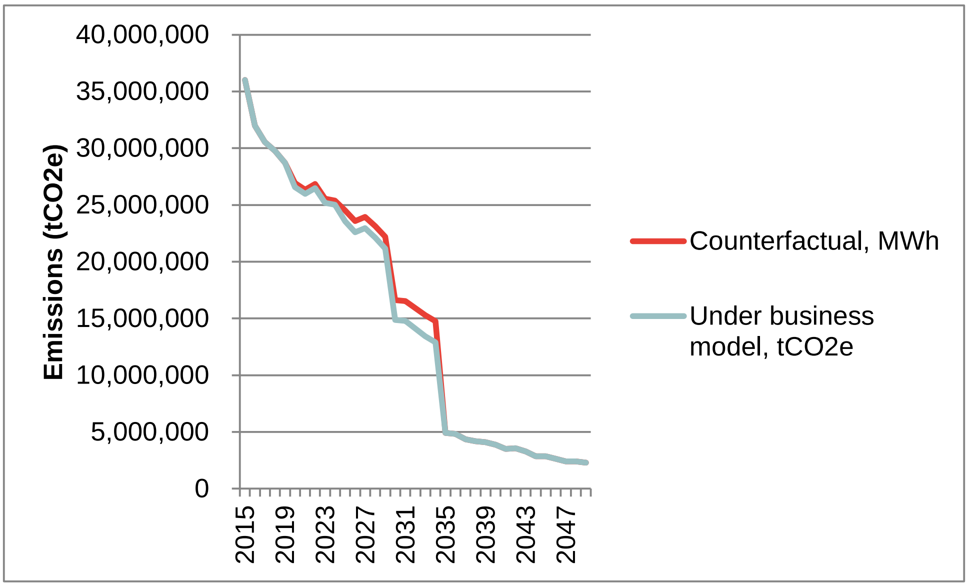
| | | | |
|---|---|---|---|
| | Fixed/variable cost split (averaged across all years) | 0.115% | |
| **Revenue stability** | Volatility of revenues | Medium | Customers are locked in to a fixed price contract for five years; therefore there should be very little unforeseen variation in revenue (assuming it is rare for customers to default upon their loans, or that the business model provider offers an insurance product to protect investors against borrower default). |
| **Correlation between costs and revenue** | Extent to which cost shocks can be passed through to consumers | Medium | Medium-term shocks in the cost of investments could be passed through to investors. |
| **Failure risk score:** | | High/moderate risk | |

Source: Frontier Economics

### *Energy use and emissions*

The business model facilitates the installation of heat pumps, insulation and HEMS earlier than under the counterfactual for some Middle Grounders. As a result there is a short-run fall in carbon emissions, but no long-run effect (although the total quantity of carbon released will be lower, due the acceleration of abatement). This is shown in **Figure 58**. [109]

**Figure 58.** Total Emissions under Energy Mutual




Source: Frontier Economics

## Value chain impacts

As described above, the most significant impact of Energy Mutual is to cause interventions to happen earlier than they do in the counterfactual. This increases peak demand, and causes networks and generators to increase investment in reinforcement and capacity respectively. This is shown below in **Figure 59**.

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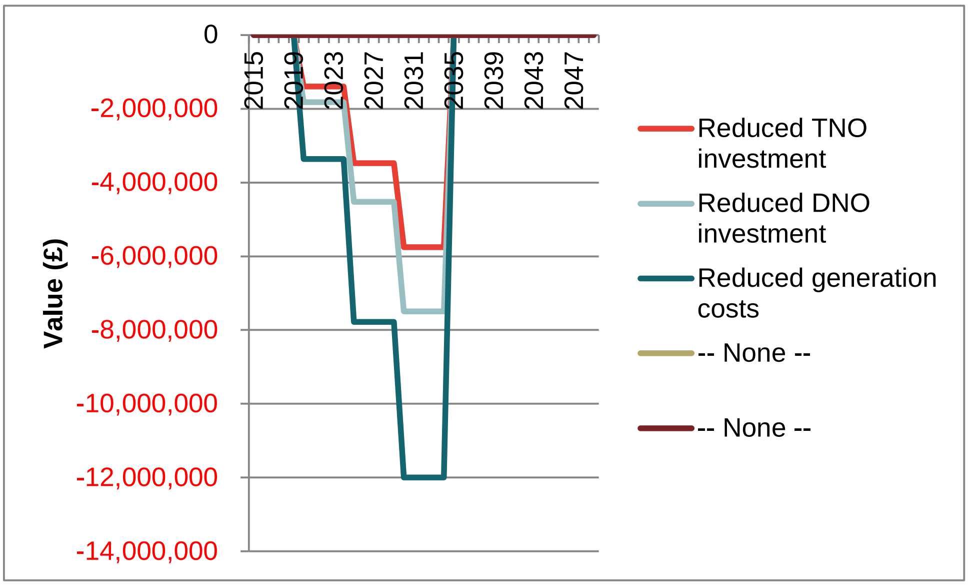
109 As described above for Energy Outcomes, the consumption and emissions figures relate only to those households for which business model take-up is considered feasible, and should not be compared to aggregate forecasts of UK consumption or emissions.

**Figure 59.** Change in investment required by network and generators




Source: Frontier Economics

### 11.3.6 Business model 4: Community Energy

Community Energy has the following features which constrain the extent to which it can become a more cost-effective way of producing and supplying energy than alternative options:

- there are large fixed costs to set up a new network, which would not be borne in the absence of the business model;
- the CHP plant can be more efficient than using a gas boiler or heat pump, but not significantly so; and therefore, and
- the business model must attract significant numbers of customers to stretch the energy savings over the fixed costs of the required investments.

Our modelling indicates that Community Energy could deliver value when successfully targeted. It is likely to appeal principally to customers in high density accommodation, and with relatively similar needs and preferences to their neighbours. It appeals especially to those with limited alternative heat systems available. Indeed, under our assumptions, running Community Energy with gas CHP on a representative mix of customers yields very low uptake. In this section, we therefore report its application to a targeted market within which the system can attract a large number of households who currently have higher than average energy bills and limited alternatives for energy supply.

We focus on the case of 500 households in a dense, urban location with an existing electric resistive heating system. Suitability constraints on these customers' homes mean that they have no option to install a heat pump. This would be the case if they were in a block of flats where noise restrictions precluded the use of air source heat pumps and space restrictions ruled out ground source heat pumps.

In this situation, customers' willingness to pay for this business model will be driven by the inefficiency and high cost of their counterfactual energy use.

### *Scale*

Our modelling shows that the customers described above would choose to take up this business model. This is driven by several factors, which give an indication of when this business model may be profitable.

- **Heating technology**. The customer group considered here consists of households currently using electric resistive heating who are not able to upgrade to a heat pump. Their energy bills under the counterfactual are therefore relatively high. As a result, a Community Energy provider is able to offer to satisfy the groups heating requirements at a lower cost of energy, with variable energy costs of approximately 70 to 80% of the amount the household would pay under the counterfactual. The Community Energy provider is then able to set a charge to customers, based upon their energy usage, which is lower than the household would pay under the counterfactual. This is the largest single driver of the take-up of this business model.

- **Inability to upgrade**. The households considered in the base model are not able to upgrade their heating technology to a heat pump (or a gas boiler). As a result, Community Energy is the only avenue through which they can move to a more efficient technology. The Community Energy operator is not able to attract customers to the model at a profitable price if the household is able to install a heat pump. In this way, Community Energy take up is driven by the lack of other options to upgrade heating efficiency.

- **Similarity in the group**. Economies of scale also drive the viability of Community Energy. It is crucial that a large proportion of customers in the community are attracted to the business model, as extending the network to reach larger areas is costly, but providers must reach a large enough base to recoup their fixed costs. Focussing the rollout of this model on communities where customers face similar drivers of willingness to pay is therefore important.

### *Consumer bills and added value*

The breakdowns of customer bills are shown in **Figure 60**[110] These figures represent the average electricity and gas bills for customers, relative to the equivalent bill in the absence of the business model. The costs/benefits of the business model are shown on an annualised average basis across the entire period 2015 – 2049.

Community Energy providers are assumed to index their charges to the gas price, as this reflects their largest variable cost. As a result, the customer faces similar risk profiles to the counterfactual under which they buy energy each year. Therefore the only saving achieved by the Community Energy's proposition relative to the counterfactual is in terms of its monetary value. There could also be some additional willingness to pay relative to the counterfactual occurring from the reduced need for space for a heat pump or boiler. In this base case, the customer uses electric resistive heating, and so makes no significant gain in space by taking up the Community Energy model[111]. However, for customers who would use heat pumps in the counterfactual, this may be an additional positive impact.

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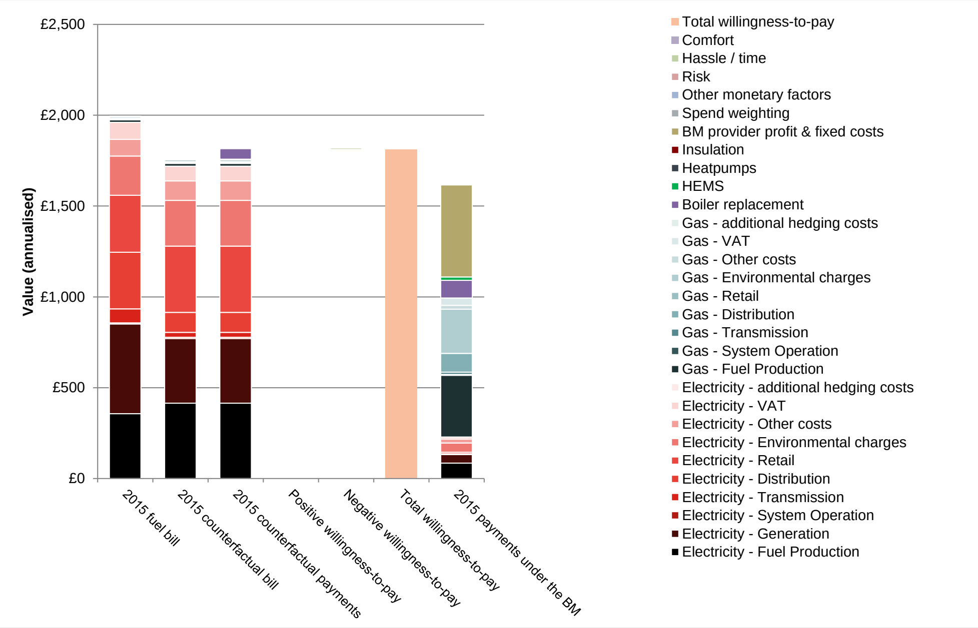
110 There is only one customer group here, therefore we show group level bills.

111 This is therefore not modelled in the evaluation tool., but may be a relevant factor to consider qualitatively, particularly in high density customer groups where households tend to have less space per person (and, in any case, Community Energy would require the installation of a heat exchanger).

**Figure 60.** Customer energy bill under counterfactual and Community Energy (2015) and current bill for an average customer.




Source: Frontier Economics

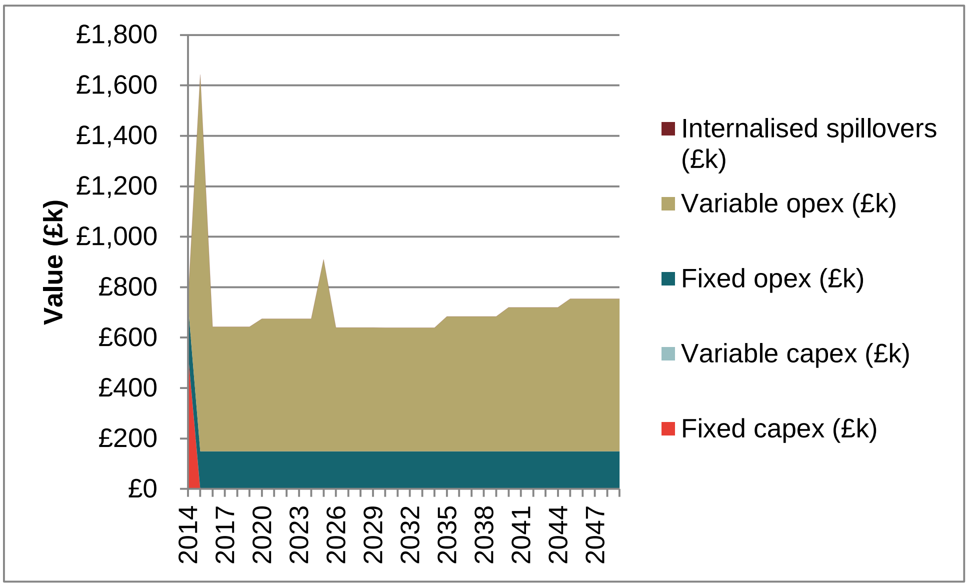
From 2015, the Community Energy provider is able to offer significant monetary savings to this customer group relative to their counterfactual bill, were they to remain with electric resistive heating. It is notable that the gain falls significantly by 2045. The counterfactual energy bill would then be cheaper than that offered by the community energy provider. This reflects the changing relativity of gas and electricity prices in the base case. The increasing cost of gas relative to electricity means that a Community Energy system, which uses a large amount of gas but little electricity, becomes less attractive relative to counterfactual heating options including heat pump and electric resistive heating, which rely heavily on electricity. This suggests that providers in later years will be better off focussing on large-scale heat pumps or biomass-fired CHP.

This illustrates the importance of the relative changes in gas and electricity prices in determining the attractiveness of Community Energy. As energy prices change, gas-fuelled Community Energy will become less attractive to customers.

## *Profitability*

A large proportion of costs are accrued by the Community Energy provider in the first period, due to the high fixed cost required to set up the network. This peaks at almost £1.6m in the first year, when the operator has to install heat exchangers accounting for almost £1m of fixed opex. The breakdown of these costs over time is illustrated in **Figure 61** below. There are large amounts of fixed capex and fixed opex incurred in the set-up year (around £550k and £200k respectively). This is a similar magnitude to the variable energy and operating costs incurred in the following periods. Therefore, given that a large proportion of the costs are fixed, it will be important to achieve maximum uptake.

**Figure 61.** Costs of Community Energy over time

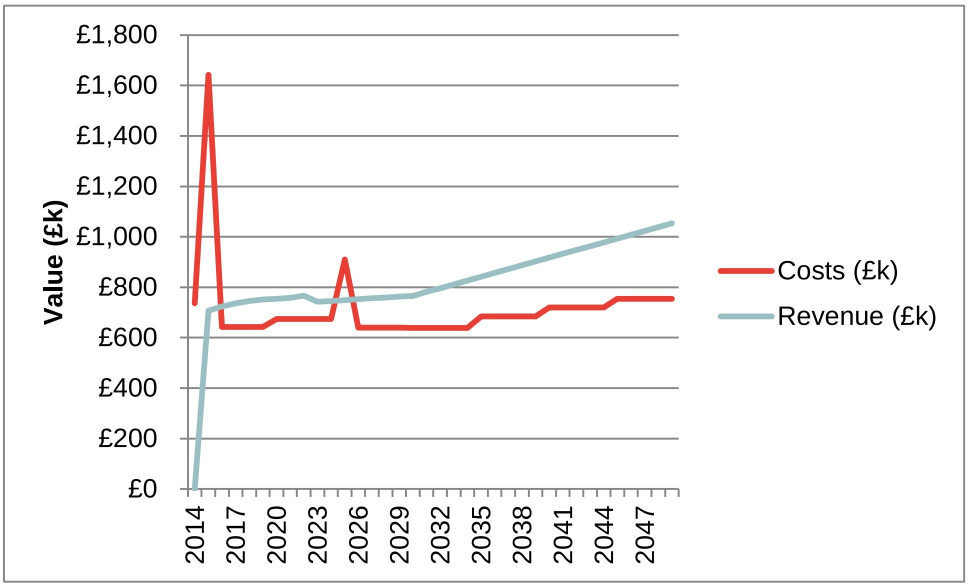



Source: Frontier Economics

The streams of costs and revenue over time are shown in **Figure 62**. The structure of costs means that the business is initially unprofitable, but makes an increasing margin over costs over time. Non-energy costs such as billing, staff and maintenance costs (together totalling around £300 per household per year) do not increase at the same rate as gas prices, and therefore the margin made over these costs increases. The revenues from charging the customers for heating, electricity and maintenance total around £1450 per household per year, which increase noticeably as gas prices rise from 2030. The Community Energy provider also benefits from selling the electricity produced as a by-product of meeting the household heating needs. This accounts for a smaller, but significant amount, saving the Community Energy provider around £150 per household[112].

112 This is included as a reduction in the variable costs in the evaluation tool through the volume of electricity purchased which is now foregone, but this is equivalent to the case in which the provider sells it to the grid.

**Figure 62.** Costs and revenues for Community Energy




Source: Frontier Economics

The high initial outlay and increasing variable profit margins over time result in a business model which only achieves overall profitability relatively late in the period. This can be seen from **Figure 63** which shows the cumulative profit over time. The Community Energy provider makes a profit each year following the first year, thus gradually reducing the cumulative loss.

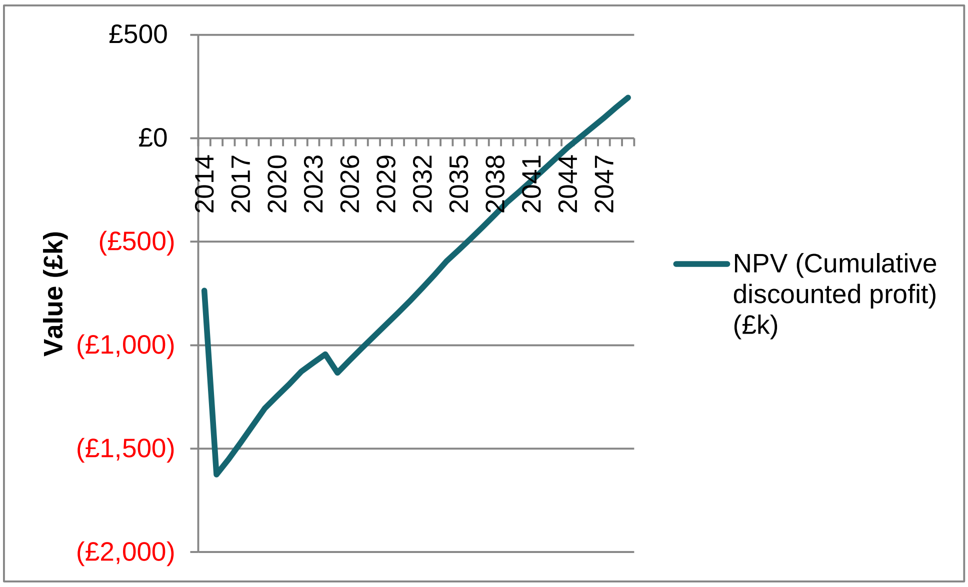
The model suggests that the level of this variable profit is the key to determining the profitability of the business model. Specifically, the energy costs of the CHP plant relative to the energy costs customers face in the counterfactual appear to constrain the success of the model. In this case, the CHP plant is able to produce heat and electricity and sell to households at a profit for less than they would have paid under the counterfactual. However, for other heating technologies this is not the case.

This illustrates the importance of long term contracts to a Community Energy provider; if they cannot guarantee that they will maintain the revenue stream over time, they may not ever reach profitability. This is particularly interesting given the finding, illustrated above, that the business model becomes less attractive to customers over time[113]. If customers had the choice to re-evaluate their decision to take up community energy during the 35 year contract, it is possible they

113 This result is driven by the use of gas in the CHP plant, and so may be avoided by switching the system to use biomass or large-scale heat pumps. Although it is currently not as cost effective, under certain scenarios the biomass price will not rise as much as gas, and therefore may become more efficient over time.

would choose to leave. Without long term contracts, this would leave the Community Energy provider unable to recover their initial fixed costs. This being the case, it may be a better strategy for the Community Energy provider to index their charges to customers to a measure of their counterfactual bill, rather than gas prices. This would discourage customers from leaving the model, but allow the provider to still recoup their fixed costs while counterfactual prices are higher, at the start of the period.[114]

**Figure 63.** Cumulative discounted profit for Community Energy




Source: Frontier Economics

## *Sensitivities*

Performing sensitivities around our base scenario reinforces our conclusion that the Community Energy model will perform profitably when targeted carefully. The most important of these are listed below.

- **Ability to attract a high proportion of the potential customer base.** We ran a sensitivity increasing the variation of willingness to pay within the customer base. Increasing the average distance of each customer's willingness to pay from its mean value from 1% to 10% means that the business model has significantly different attractiveness to customers within the group. Therefore, it is less likely the operator would be able to attract all customers. Indeed, under this scenario, less than 80% of customers took up

114 It will be possible to alter the structure of prices in this way to break even earlier and then operate less profitably later in the period if the discount rates of the consumer and business are similar.

the model, compared to 100% under the previous scenario. A large proportion of fixed costs had already been incurred creating a network that reaches 500 customers, therefore this has the effect of reducing profitability. Indeed, when increasing the standard deviation of customer willingness to pay to 10%, we found that the model was no longer profitable.

- **Switching off the CHP plant in summer.** The community energy provider is assumed to use the CHP plant to satisfy heating and hot water needs throughout the year under the base scenario. However, during the summer there is relatively low demand for heat. Therefore, it may be more profitable to provide this using an alternative means. We evaluated this model, assuming that the operator would maintain and use the electric resistive heater households already have. This proved to be unprofitable. Although the cost of maintaining the electric resistive heater (assumed to be a £200 replacement cost, incurred once) is relatively small, this heating type is no more efficient, and therefore does not provide savings.[115]

- **Availability of heat pumps.** Within the target market considered, consisting of customers with inefficient electric resistive heating, there may be significant gains to be made from upgrading to a heat pump. Under our base case we assume that households are not able to do so (it is assumed under the default assumptions that households are also unable to install HEMS). Relaxing this assumption leads to customers choosing to install a heat pump and HEMS in the counterfactual. The savings this brings means that customers are willing to pay less to a Community Energy provider to forego their energy bill. Under our baseline assumptions, customers are still willing to pay enough to cover the costs of the Community Energy provider. However, the annualised willingness-to-pay falls from around £1,800 to just over £1,600, reflecting the overall lower costs in the counterfactual (since the cost of the heat pump and HEMS is outweighed by bill savings). As a result, were electricity prices to be slightly lower (or heat pumps slightly more efficient), customers would not be willing to pay the required price for Community Energy.

- **Lower gas prices.** We have run the evaluation tool with a set of lower gas prices. Under this scenario, the business model performs better, breaking even in 2035, and making a sizeable return in the years after this.[116] This

115 Although there will be some fixed costs saved as a result of not operating the CHP plant throughout the summer, we don't believe that this will be large enough to reverse this finding.

116 Note that, in reality, some of these gains may be shared with customers. Due to the assumed homogeneity of customers, there are a wide range of prices for which all customers will take up the business model (demand is highly inelastic for prices which are low when compared to customer willingness-to-pay). The tool seeks to maximise overall social welfare, and is indifferent as to which

reflects the increased attractiveness of a gas heating system in a scenario where gas prices remain lower relative to electricity, and thus the system remains cheaper to run than the counterfactual. Further, under this gas price, Community Energy continues to provide cheaper energy bills to households than their counterfactual to the end of the period, in contrast to the base case.

- **The density of the housing considered.** We evaluated the business model when the Community Energy provider targets 720 customers, in keeping with a system set up in a medium density area. This gives a larger customer base over which the fixed costs may be shared. However, the potential customers also contain a wider variation of different types of heating requirements and counterfactual bills. As a result, the business model performs less successfully as take-up of eligible customers is lower. The model is taken up by 480 of 720 customers, with the majority of customers coming from the three residential social landlord groups (Stretched Pensioners, Unconvinced Dependents and Urban Constrained). The Community Energy provider has a small negative variable profit margin under this scenario. This reflects the more efficient counterfactual energy bills when the scheme is rolled out to a wider customer base with pre-existing access to gas boilers.

### *Adaptability*

The results presented above are robust to a range of ESME scenarios.

The results of the failure risk assessment for the community energy model are set out in **Table 15**.

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of these prices are used (since total welfare will be the same, the only difference will be how much goes to customers or the business model provider).

**Table 15.** Failure risk score for the community energy model

| Factor | Sub-factor | Rating | Justification (where rating is not quantitative) |
|---|---|---|---|
| **Size and scale** | Average annual asset value (£) | £272k | |
| | Total annual revenues (£) | £840k | |
| **Competitive position and market structure** | Stability and predictability of regulation | Medium | Heating networks are currently not regulated over and above standard competition regulation, but this may change over time as heating networks become more prevalent. |
| | Expected customer churn | Low | Once customers are connected to the district heat network, it will generally always be more economical than using alternative heating options. Although individual householders may change, the buildings themselves will stay with the system. |
| | Barriers to entry | High | It is unlikely to be cost-effective for a competitor to set up a parallel district heating network. In addition, there is large initial capital expenditure required for the network and CHP unit. |
| **Cost stability** | Volatility of costs | Medium | Although fuel costs are variable, they are a lower proportion of total costs than for a supplier/ energy outcomes provider, since the community energy provider has considerable capital costs relating to the plant and network. However, in the short-term it would not be possible for the community energy plant to switch to an alternative fuel if there were |

| | | | |
|---|---|---|---|
| | | | spikes in the price of the fuel used by the CHP plant. |
| | Fixed/variable cost split (averaged across all years) | 23% | |
| **Revenue stability** | Volatility of revenues | Medium | Revenues are likely to be relatively stable over time as the size of the customer base is determined by the network size, and customers are unlikely to substitute away once connected. |
| **Correlation between costs and revenue** | Extent to which cost shocks can be passed through to consumers | Medium | If contracts are not indexed to energy/fuel prices, it will be impossible to pass through cost shocks to a given customer within a fixed contract period. This may be mitigated by shorter term contracts or indexing. |
| **Failure risk score:** | | High/moderate risk | |

Source: Frontier Economics

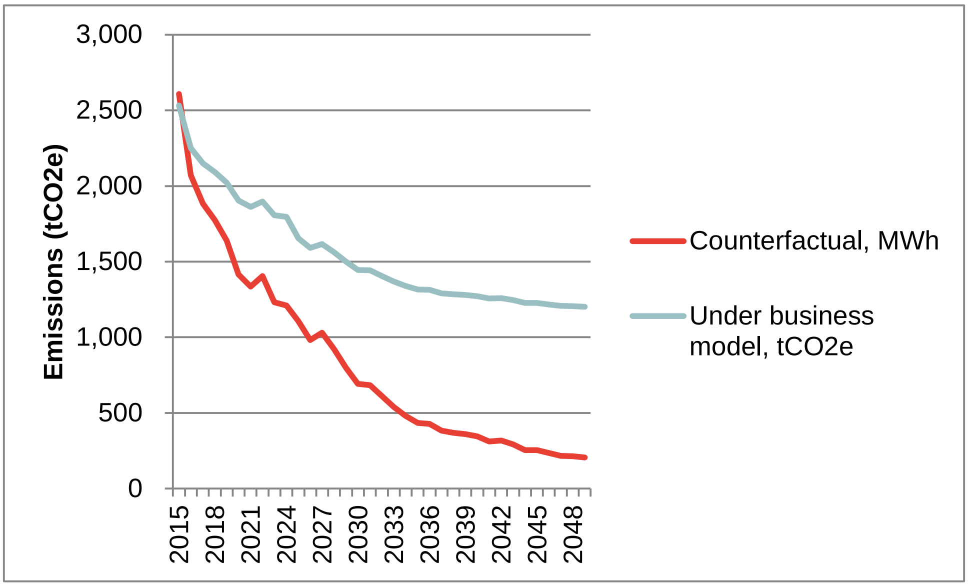
## *Energy use and emissions*

The gas usage by the group taking up Community Energy increases dramatically from less than 300MWh per year, to over 6,000MWh[117]. This reflects the move to use gas to provide the heating and hot water previously provided through electric resistive heating. However, this gas usage also produces electricity which can be used to satisfy the customer's requirement for electricity.

There is a considerable saving in electricity imports from the grid, both due to the move away from using electric resistive heating, and due to the electricity by-product. Electricity imported from the grid is more than halved, from 5,740MWh to around 3,3000MWh.

The net effect of these changes on the carbon emissions of these customers (the chart below relates to a single Community Energy system) is shown in **Figure 64**. The move to a Community Energy system represents a shift from electricity to gas, therefore the net effect will depend on both the efficiency of both systems, and the carbon intensity of electricity production.

**Figure 64.** Total carbon emissions of potential customers




Source: Frontier Economics

Initially the move to Community Energy reduces the total carbon emissions very slightly. The Community Energy provider is able to meet customer's heating needs more efficiently than customers would do under the counterfactual using

117 As the potential customers considered here are identical, and demand is assumed to be relatively flat, there is no variation over time.

resistive heating. Additionally, the Community Energy provider reduces the electricity consumption from the grid, by using the electricity by-product of the heat generation.

However, it is notable that the Community Energy system performs worse relative to the counterfactual over time. This reflects reductions in the emissions-intensity of grid electricity. Therefore the Community Energy model may be less effective in moving toward carbon targets as electricity generation changes, if it continues to be based on gas-fired CHP. Indeed, it emits a greater amount of carbon than the counterfactual after only a couple of years, and is responsible for a substantially higher volume of emissions overall.[118] This reinforces our conclusion that supplying energy from other sources such as biomass-fired CHP may be required in the long run.

### *Value chain impacts*

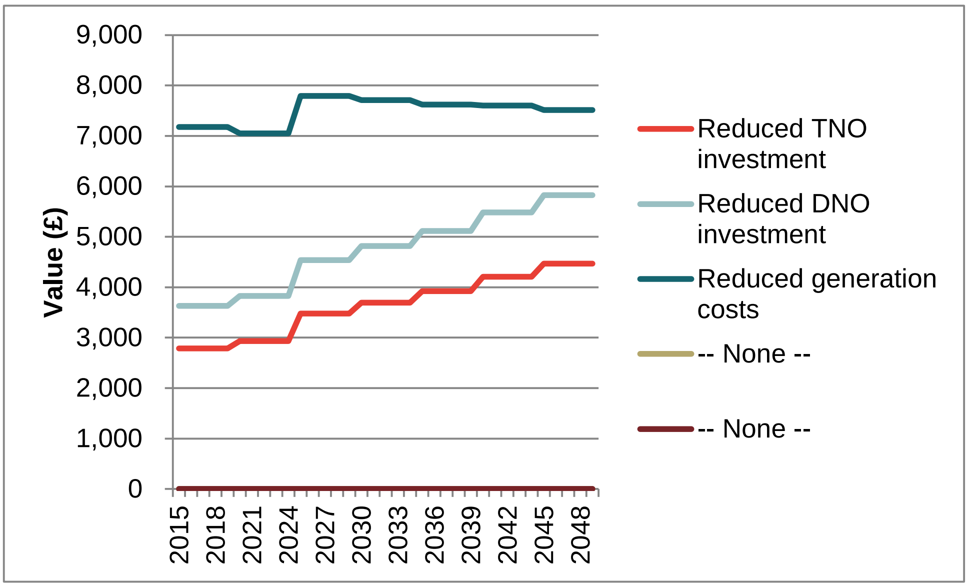
The Community Energy provider still imports a substantial proportion of households' electricity requirements from the grid. Therefore it appears that the business model provider would not be able to bypass using the national networks.

As the households are assumed to use electric resistive heating on an Economy 7 tariff, households use limited electricity in the peak periods in the counterfactual. However, under the business model, the Community Energy provider will run the CHP plant at peak periods to provide heat, and so can use the electricity by-product to reduce peak electricity demand from the grid even further. This causes the reductions in reinforcement and investment costs illustrated **Figure 65**.

Note the increase in the value of the spillover effect (a decrease in peak demand) occurring in the mid-2020s. This is as a result of the Community Energy provider choosing to install HEMS.

118 Earlier versions of the tool showed the Community Energy business model producing a net carbon reduction until the 2020's. The Community Energy CHP unit is now assumed to require more gas as a result of an amended assumption regarding water heat requirements.

**Figure 65.** Aggregate spillovers achieved by the model




Source: Frontier Economics

The increases in DNO and transmission savings over time reflect the increasing costs of network reinforcement over time. In contrast, the generation savings are decreasing over time, as the cost of a CCGT becomes cheaper, and so reduced capacity saves relatively less investment.

## Business model 5: Community Energy with Energy Outcomes

This business model represents a situation where a Community Energy operator offers Energy Outcome tariffs to households within its local area that are not connected to the district heat network. This could provide a means for the provider to maintain engagement with households which it will not initially be able to serve on the district heating network.

In our discussion of Community Energy above, we simulated a residential social landlord-led Community Energy scheme with a population of 500 in a high density area. For this hybrid model, we consider that there could additionally be a surrounding medium-density area of 400 households which might be suitable for a future expansion of the district heating system on which Community Energy is based, but in the meantime could be suitable for Energy Outcomes.

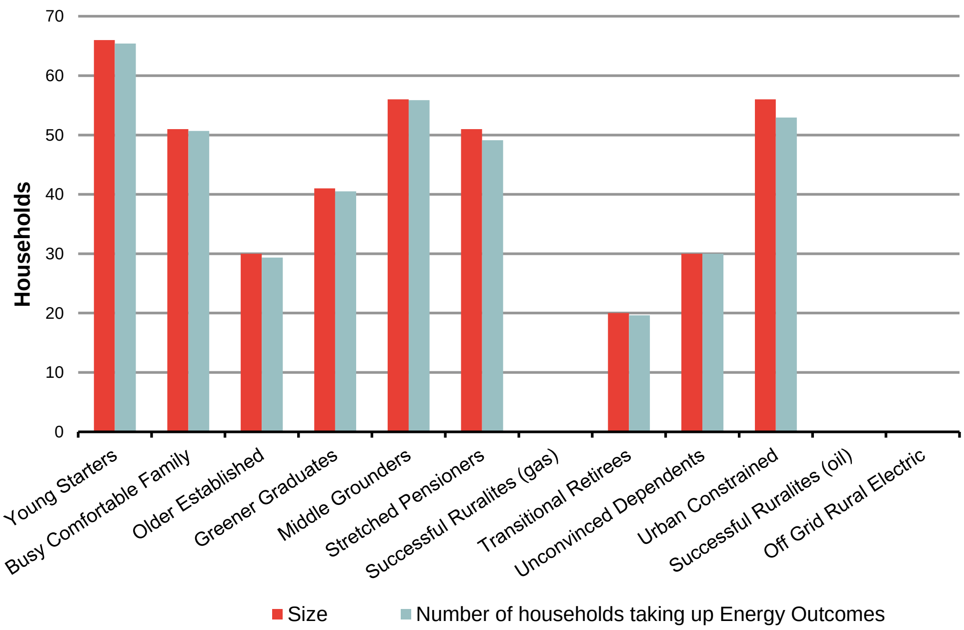
We ran the Energy Outcomes model (without storage)[119] on this group of customers, in order to determine the take-up of Energy Outcomes among this group.

## *Scale*

**Figure 66** shows, for each customer group covered by the tool:

- the number of households available for Energy Outcomes in the locality[120]; and
- the number which would take up the business model at least once.

**Figure 66.** Uptake of Energy Outcomes in a Community Energy locality.




Source: Frontier Economics

In line with the nationwide results, this analysis projects that a relatively high proportion of households would take up Energy Outcomes in the area surrounding the Community Energy scheme, but not all.[121] In particular, large

119 Given the small scale of the offering, it was assumed that no additional fixed costs would be required beyond those needed for the initial Community Energy scheme.

120 It is assumed that all of these households could feasibly take up the model.

121 Take-up is particularly high since it is assumed that there are no additional fixed costs, and that the provider will therefore price at variable cost in order to maximise uptake and consumer welfare. In practice, one would expect some of the fixed costs that are common to Community Energy and Energy Outcomes to be levied upon Energy Outcomes customers, leading to slightly lower levels of

numbers of Middle Grounders, Unconvinced Dependents, Busy Comfortable Families and Older Established households are projected to take up the business model. These are the groups for which a future Community Energy scheme expansion could be most attractive. It is therefore plausible that a Community Energy provider could use an Energy Outcomes proposition as a means of engagement, with a view to rolling Community Energy out to these customers at a later date.

### *Profitability*

The local Energy Outcomes scheme described above could be run profitably. We have also considered whether it would be possible for the addition of a local Energy Outcomes scheme to make a previously non-profitable Community Energy scheme feasible.

To examine this issue, we considered a medium density variant of the Community Energy business model. This has a total market size of 720 households. Operating alone, it is not a commercially viable business, as the lower density of customers means fixed costs are higher than in the high-density case.

Alongside this scheme, we modelled a local Energy Outcomes scheme containing as a potential market an outlying area of 400 households, in addition to those households projected to not take up the central Community Energy scheme. We ran the tool in a profit-maximising mode, to determine the greatest amount that a business model provider would be able to gain from including these households.[122] **Figure 67** shows the profitability of the original Community Energy scheme, and the combined profitability when the local Energy Outcomes scheme is included.[123] This shows that the Energy Outcomes scheme does not achieve sufficient scale to significantly offset the losses made by the Community Energy scheme, and the combined business model does not cover the Community Energy setup costs.

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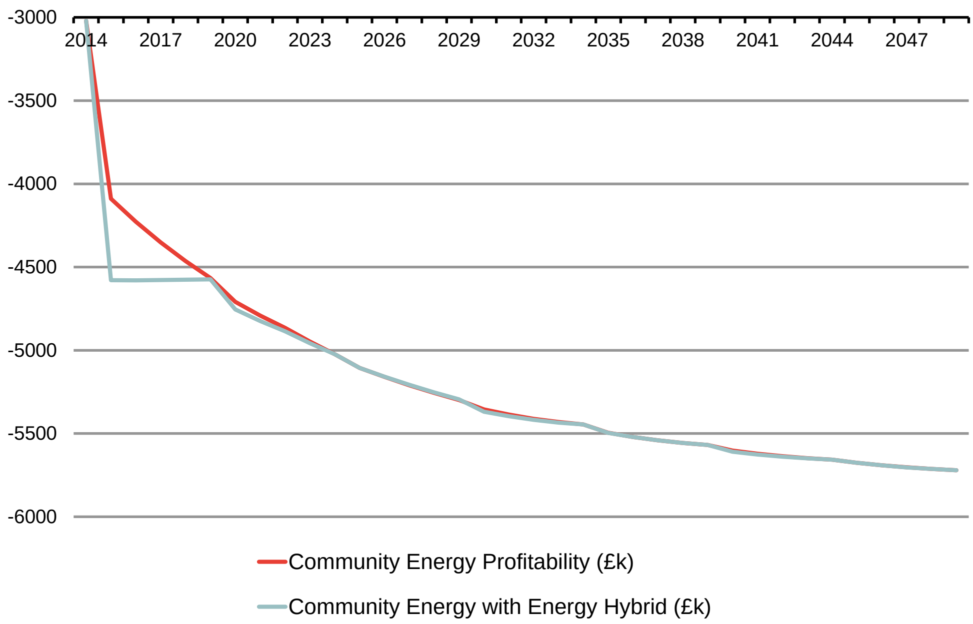
penetration. However, a large proportion of these costs may be borne by Community Energy customers, since these have a lower price sensitivity.

122 This assumes that the local Community Energy firm is the only firm able to provide an Energy Outcomes offering, and therefore any constraint upon its pricing will relate to the availability of alternative business models in the counterfactual.

123 To integrate both business models, a common WACC of 5% was used.

**Figure 67.** NPV of Community Energy, with and without Energy Outcomes



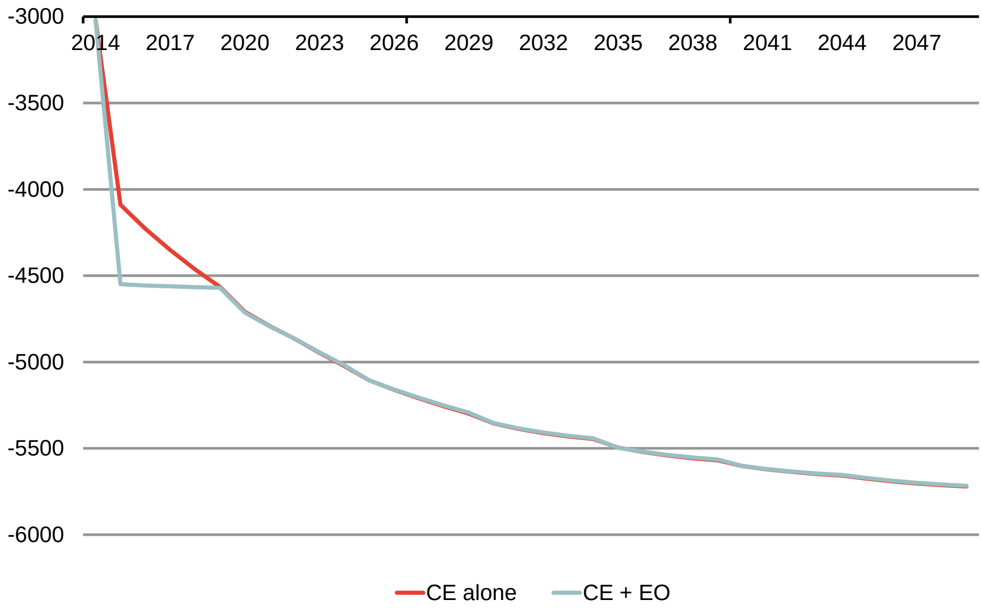

Source: Frontier Economics

## *Sensitivities*

We have assumed that there are no additional fixed costs to offering an Energy Outcomes offer as part of our baseline assumptions. This is a key assumption. If there are fixed costs to providing Energy Outcomes which are *not* common to Community Energy, this further increases the likelihood that the hybrid business model is infeasible.

We also ran a sensitivity to look at the impact of the provider being able to offer a 25% reduction in the cost of installing energy saving measures. **Figure 68** shows the profitability of the original Community Energy scheme, and the hybrid scheme under this new assumption. It remains the case that the Energy Outcomes offer is not sufficiently profitable to offset the losses of the Community Energy model. It therefore appears unlikely that a local Energy Outcomes scheme could offset a loss-making Community Energy scheme, even under favourable assumptions. This is due to the scale of investment required for Community Energy, compared to the small profit margins obtainable through Energy Outcomes.

**Figure 68.** Sensitivity of NPV of Community Energy, with and without Energy Outcomes




Source: Frontier Economics

## Business model 6: Power Buffer

Power Buffer is a business that provides electric storage capacity to DNOs, and balancing services to other businesses in the electricity value chain. It designs, procures, installs and commissions storage capacity across technologies at distribution scale. Services from this capacity are offered on fixed term contracts, or on a pay per use basis.

The services provided by Power Buffer's electrical energy storage (EES) technology could be sold to a number of different participants: DNOs (which can postpone network reinforcement); the System Operator (which requires reserve capacity); and trading on the wider wholesale markets. However, DNOs are likely to be the primary customer of the business model provider for the following reasons:

- the storage is physically located on the DNO's network;
- once the DNO has designed their network under the assumption that storage will flatten peaks, they will always need first priority when allocating storage usage (since failure to flatten a peak below network capacity could lead to equipment failure or blackouts); and

- other technologies (such as larger-scale storage or power stations) are likely to be more cost-efficient for reserve and trading usages, so provision of these services is not core to this business model, but potentially provides ancillary benefits to the business.

We therefore model DNOs as the main customer of this business model.

The tool models Power Buffer in a number of stages.

- Taking half-hourly load profiles and electricity prices, and taking into account the technical characteristics of the storage, the tool carries out an optimisation routine to determine how the storage unit could be best used to flatten peak load.

- The tool then calculates the proportion of DNOs' feeders that would require reinforcement at some point during the 15 year period in the absence of the storage. The value of deferring this reinforcement through the use of storage is calculated. This value determines the DNO's monetary willingness-to-pay for the Power Buffer model.

- The tool then considers the other sources of revenue available to Power Buffer. The tool calculates the proportion of the storage unit that will be available for non-DNO usage on each day of each year. The tool first estimates how the storage unit could be used to maximise the gains from trading on the wholesale market. It then considers the value of providing different types of flexibility services (frequency response, fast response and STOR), in pounds per kW per day.

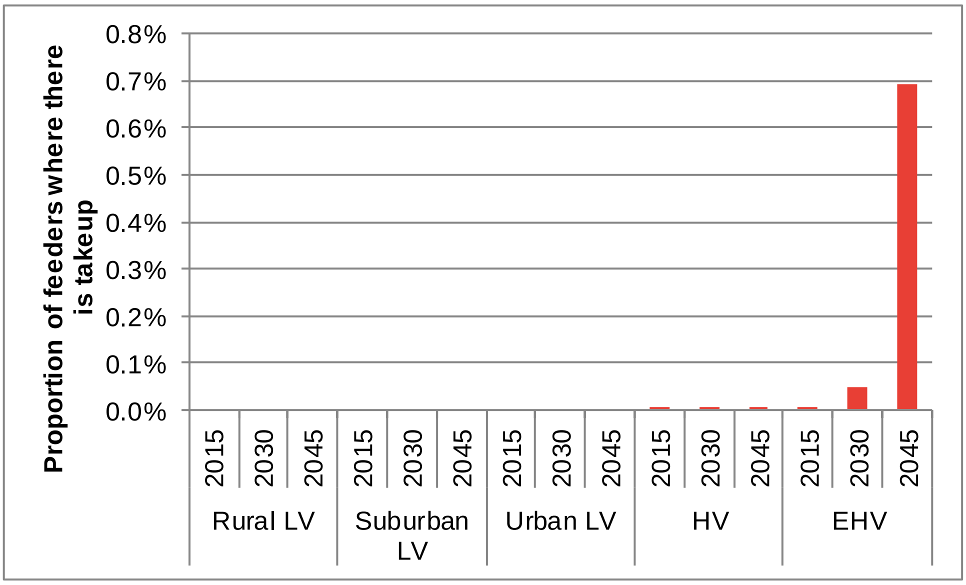
- The value of these additional services is added to the value of services to DNOs, and compared to the cost of the storage technology. The Power Buffer model is taken up where the costs are outweighed by the overall value provided by the model.

Under our central assumptions, Power Buffer delivers value as **a niche business model late in the transition to a low-carbon smart energy system**. This value is driven strongly by the benefits it provides to DNOs, with revenues from ancillary services to the System Operator helping at the margin. This finding is robust to assessment under the range of ESME scenarios.

### *Scale*

Under central assumptions, this is a highly niche business model up to 2045, with a small amount of uptake thereafter (approximately 100 feeders nationwide, primarily EHV). **Figure 69** shows uptake of the model by voltage level as a proportion of the total number of feeders nationally.[124]

**Figure 69.** Power Buffer - Scale




Source: Frontier Economics

**Figure 70** shows that this business model is successful at higher voltages only. Major reinforcements on EHV network types[125] are assumed to cost £25m. The load is increasing slowly enough that the use of a battery is projected to defer this cost for the entire lifetime of the battery (or just under this), a benefit worth approximately £13.5m to the DNOs. The use of the battery for reserve is projected to yield approximately £0.5m per year in revenue. The battery itself is projected to cost just over £15m by 2045, and so it is a worthwhile proposition for these networks, providing the gains from reserve operation can be realised.

We have modelled the uptake of this solution across a range of network with different levels of demand growth. A battery may be an inappropriate solution for networks with particularly low *or* high demand growth. Where demand growth is very low, there is no requirement for reinforcement or storage to manage peak demand. Where demand growth is very rapid, it is more cost-effective to undertake major works which increases headroom on the network by a much larger amount than the storage solution can.

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124 Note that a large number of feeders will not require reinforcement. As a proportion of feeders requiring reinforcement, the uptake figures will be higher, but will still be negligible for all but a small number of feeder types, in the final period.

125 Both storage and reinforcement costs for HV networks are a fifth of those for EHV networks – the same points therefore apply to HV as to EHV, but have not been stated here for brevity.

It is notable that virtually no low voltage (LV) feeders take up the business model. This can be explained by the relative cost of storage to major reinforcements for these feeders. In 2045, the cost of storage on an high voltage (HV) or EHV feeder is assumed to be around £15m, approximately 60% of the £25m reinforcement cost. By comparison, the £230,000 cost of storage on LV networks is over 90% of the cost of major reinforcement (£250,000). Given the way in which major reinforcement is assumed to solve any capacity problems once and for all (while a battery requires replacement and may not be able to defer reinforcement forever), it is clear that batteries are not cost-effective at these prices for LV networks.

### *Consumer bills and added value*

As the customers of this business model are DNOs, rather than end-consumers the impact on customer bills is indirect. Since the business model enables DNOs to defer or avoid expenditure, it would lower the overall cost of the electricity system, which would ultimately be expected to be reflected in lower DUoS charges and lower end-consumer bills. The extent to which this occurs will depend on the regulatory environment in which DNOs operate, and the level of competition in the supply market, neither of which are explicitly modelled by the evaluation tool.

The evaluation tool does allow us to forecast the fees paid by DNOs to the business model provider. Under the assumptions of the business model, this consists of a fixed yearly fee over the 15-year life of the storage system, with the business model provider able to obtain ancillary revenues from reserve and trading. **Table 16** below shows these fees (for the two types of network with greatest uptake), as well as the cost of the storage unit, its value to the DNO, and the revenues gained from utilising spare storage capacity.

**Table 16.** Summary of value and cost to DNO, per feeder, for period 2045-2060

| | *EHV low growth in peak demand* | EHV medium growth in peak demand |
|---|---|---|
| **Cost of storage unit** | £15.1m | £15.1m |
| **Value of deferred reinforcement to DNO** | £11.8m | £13.5m |
| **Total revenues accruing from ancillary usage**[126] | £5.3m | £3.1m |
| **Yearly fee paid from DNO to provider**[127] | £1.1m | £1.3m |

Source: Frontier Economics

### *Profitability*

The cumulative, discounted sum of profits is plotted in **Figure 70**.

The business model does not become profitable until the end of the modelled period. This is partially due to the way in which we have simulated a competitive market, where supernormal profits cannot be made in the long-run. However, given the lack of a substantial market for this business model (as modelled) for several decades, it would not be possible for it to pay back its start-up costs in the short-run even if this restriction were relaxed.

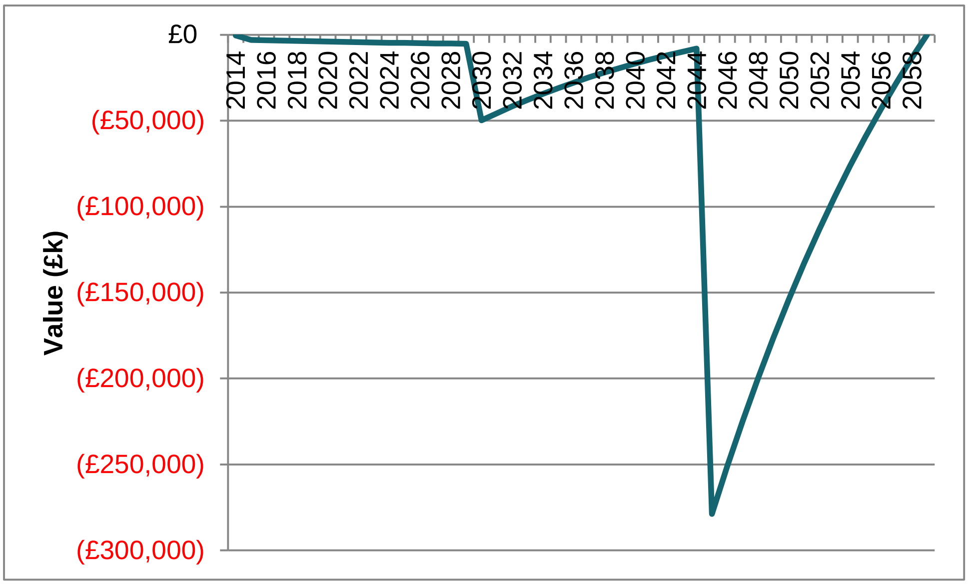
- The requirement to purchase storage units up-front before the 15-year contract produces revenues creates a substantial financing requirement.

126 Frequency Response is always the most productive use of spare storage capacity. This figure also includes incidental gains and losses from wholesale buying/selling of electricity while the storage unit is employed for peak-lopping, however these are insignificant.

127 This figure multiplied by 15 exceeds the value of reinforcement. However, the fee is spread over 15 years and discounted, therefore it is worthwhile for DNOs to pay it.

Overall, these results show that the business model would be profitable, however (based upon the projected take up) it would not be economic to begin rolling it out for some time.

**Figure 70.** Profits for Power Buffer




Source: Frontier Economics

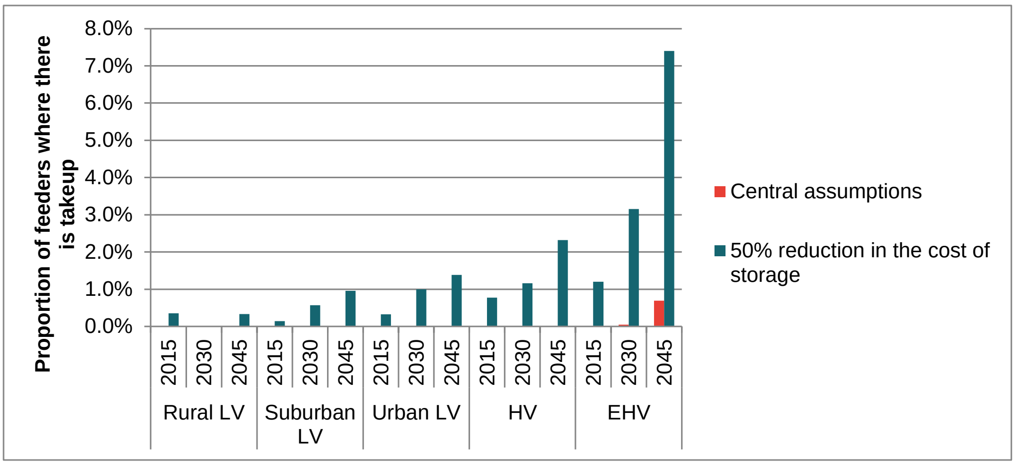
## *Sensitivities*

The limited uptake of Power Buffer is primarily driven by our assumptions on the costs of electricity storage relative to the alternatives (principally network reinforcement).

To determine the extent to which the business model's scale would adjust in the face of a breakthrough in storage technology, we looked at the impact of halving the costs of storage.

As shown in **Figure 71**, this results in storage becoming attractive on LV feeders, and a meaningful number EHV installations (171 – just over 11 per year) occurring between 2015 and 2030.

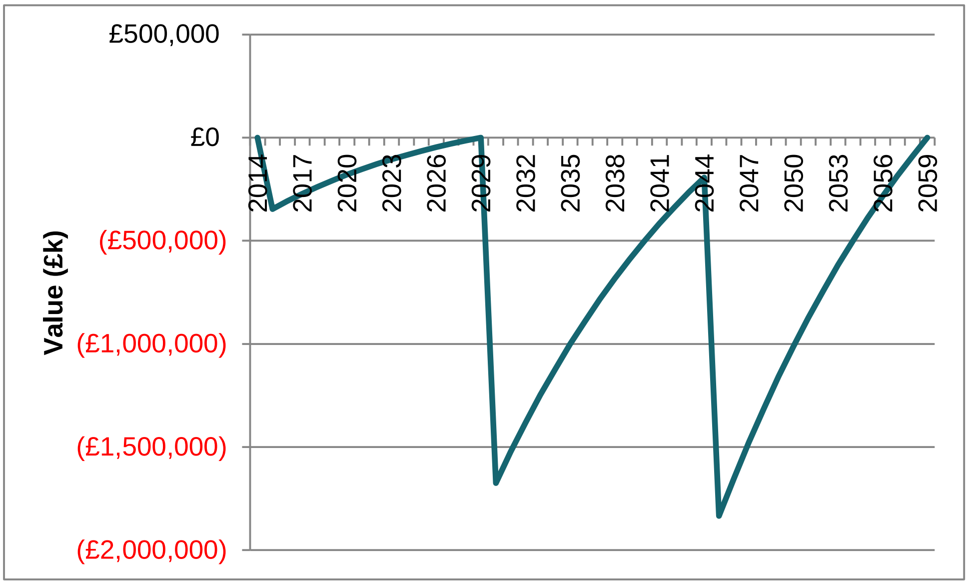
**Figure 71.** Power Buffer – scale




Source: Frontier Economics

The result is that the business model is simulated to become profitable from 2015, paying back the investment by 2029, as shown in **Figure 72**.

**Figure 72.** Profits for Power Buffer at 50% cost of storage




Source: Frontier Economics

## *Adaptability*

The performance of Power Buffer does not change across the ESME scenarios included in the tool. In particular, we examined the robustness of the model in the face of changes to the overall generation mix (in this case, moving from the

ESME "DC" to "No Nuclear" scenario, which alters the profile of wholesale costs. This makes virtually no difference to the model, since gains and losses from purchasing and selling electricity only make a small contribution to the viability of the proposition.[128]

We assessed the failure risk of the power buffer model, the results of which are set out in **Table 17** below.

128 Although some energy will be lost due to the inefficiency of the battery, the way in which peak loads are reduced has the effect of reducing thermal losses, almost entirely averting the inefficiency losses.

**Table 17.** Failure risk score for the Power Buffer model

| Factor | Sub-factor | Rating | Justification (where rating is not quantitative) |
|---|---|---|---|
| **Size and scale** | Average annual asset value (£m) | £0.03m* | |
| **Competitive position and market structure** | Stability and predictability of regulation | Medium | A review of planning guidance around DNO use of storage as an alternative to traditional network reinforcement is planned, introducing some regulatory uncertainty. |
| | Expected customer churn | Low/Me d | It is likely the total number of customers will be relatively small, and storage assets are long-lived, resulting in relatively low customer churn (assuming limited use of break clauses in contracts). |
| | Barriers to entry | High | Barriers to entry are currently high, due to restrictions on storage asset ownership by DNOs, as well as the high capital costs involved. |
| **Cost stability** | Volatility of costs | Low | The cost of storage devices will vary over the long-term, but is less likely to experience short-run fluctuations. |
| **Revenue stability** | Volatility of revenues | Medium | Revenues are likely to be relatively stable if contracts are long term, but the actual use of the storage assets may be infrequent, potentially introducing revenue volatility depending on the contract structure. |

| | | | |
|---|---|---|---|
| **Correlation between costs and revenue** | Extent to which cost shocks can be passed through to consumers | Medium | Costs of storage are expected to fall over time. This could be passed onto new consumers (ensuring competitiveness), but could not be passed on where the investment in (more expensive) storage assets has already been sunk, potentially affecting competitiveness of the business model provider. |
| **Failure risk score:** | | Low/moderate risk | |

Source: Frontier Economics

* For the purposes of the modelling, batteries have not been treated as an asset since they are assumed to have no alternative use value and are fixed in place. If included, this figure would be considerably higher.

# 12 Annexe 6: International review

The objective of this research was to identify innovative/creative delivery systems, initiatives and business models existing in other countries, including:

- innovations to drive lower consumption, reduce costs and improve security/sustainability;
- business models to reduce peak demand; and
- innovations to increase consumer take-up of energy efficiency.

To undertake this review, Total Flow researched information sources including the following for each country:

- energy company websites;
- local and national government websites; and
- community websites.

Other lines of research included UN and EU websites, conference proceedings and technology supplier sites.

## 12.1 Summary of findings

**Table 18** presents a summary of Total Flow's research in this area.

**Table 18**: Summary of international findings

| *Country* | *Headline Findings* |
|---|---|
| *Netherlands* | *Power Matching City Hoogkerk; smart grid enabled DSR (23 home pilot)* |
| *France* | *Some time-based pricing; Government influencing demand* |
| *Germany* | *Significant green focus; community CHP in some large cities; low-cost loans for retrofit of energy efficient measures.* |
| *Sweden* | *Community CHP; many localised energy companies* |
| *Norway* | *District heating with CHP prevalent; many localised energy companies* |
| *Finland* | *Many localised energy suppliers; 50% district heating* |
| *Denmark* | *Many community heat and power examples; business models for carbon offsetting and wind power prioritisation; smart city Copenhagen* |
| *USA* | *California reducing consumption through tier and time-based rates; nationwide technology-enabled Smart Grid programme* |
| *Canada* | *British Columbia consumer competition encouraging 10% usage reduction; some district heating; Toronto deep water cooling; Ontario demand response programme* |
| *Australia* | *Smart Grid, Smart City, 30,000 home pilot underway and due for completion September 2013, results available early 2014.* |
| *New Zealand* | *Wide range of pricing options, including low user and time based tariffs* |
| *South Africa* | *National electricity supplier actively promoting 10% consumption reduction targets* |

Source: Total Flow

## 12.2 Findings by country

We now present findings by country.

### 12.2.1 Netherlands

**Table 19** sets out the findings for the Netherlands.

**Table 19:** Netherlands

| | |
|---|---|
| **Energy companies** | Combined utilities: Essent (largest; also supply Belgium), Eneco, plus subsidiary Oxxio, Liander N.V. Nuon Energy, Electrabel. Transmission: TenneT. Generation: Elektriciteits , |
| **Consumer business models** | Essent: Promoting smart buying and storage of energy in the home during low price periods for use during higher price periods, but identifies this as future technology. |
| **Commercial business models** | Electabel offers "AlpEnergie", an option for electricity guaranteed from totally renewable source, hydro stations. Also conducting a reactive energy study to avoid overloading the grid; promotion of condenser banks. |
| **Distribution models** | Power matching: Power Matching City Hoogkerk an advanced smart grid technology pilot (source: www.RWE.com): switching equipment automatically to use energy in an optimum way. Twenty-three households have been equipped with a mix of heat pumps, HRe-tanks, solar panels, domestic appliances , plus a few electric cars<br><br>The system is linked to the Dutch energy exchange, and the software determines the optimum price for energy trading.<br><br>Even putting the consumer as first priority has not been enough to make it attractive for consumers to participate.<br><br>Self generation: Essent's HRe boiler (high-efficiency with electricity generation), or micro-CHP (Source: www.essent.eu) |
| **Community power** | Slow uptake; some electricity generating windmills, biomass, etc. (Source: The Community Power Report) |
| **Awareness/ education** | Essent and AlertMe launched E-Insight, a "smart energy" service called "What costs Watt?"<br>• Remote control of devices via internet or smartphone<br>• Provides performance comparisons on devices and the savings achievable if upgrading to new energy-efficient model (source: AlertMe website)<br>Electable "Start to Save" programme with promotional stickers, etc. |

### 12.2.2 France

**Table 20** sets out the findings for France.

**Table 20:** France

| | |
|---|---|
| **Energy companies** | Combined utilities: EDF, GDF-Suez |
| **Consumer business models** | EDF: Offers pricing options aimed at reducing consumption (Source: www.edf.com)<br>GDF: Offers electricity and gas with carbon offsetting |
| **Commercial business models** | EDF: "Equilibre" allows commercial customers to opt for electricity guaranteed from renewable sources<br>Under regulation effective as of July 1st 2013, shops and offices must turn off their unnecessary lights at nights. (source www.enn.com). |
| **Distribution models** | GDF – Suez: The heating network (heating and domestic hot water) in Paris is one of the largest in the world (along with Moscow and New York). From 2014, more than 50% of the energy will come from local energy sources, renewable and recovered: biomass, geothermics, heat from sewers and waste, etc. In Paris GDF Suez also operates the largest cooling network in the world (climespace). (Source: GDF website). |
| **Community power** | GDF: See above |
| **Awareness/ education** | EDF Mailings and smart-phone apps designed to educate residential customers; a website and its Bleu Ciel d'EDF e-newsletter are packed with facts and tips. Under its Bleu Ciel brand, EDF also markets a series of fee-paying energy and service offers, comprising advice, appraisals, personalized support and financial packages for renovation projects.<br>GDF: Integrated solution for helping social housing associations and their tenants to control energy and water charges: "Performance in the home" offer combines the monitoring of consumption and equipment operation with information for residents about best practices. |
| **Consumer Tariffs** | Lower tariff for night time consumption (8 hours/day); higher tariff rest of the day. Requires hot water tank and/or electric heating.<br>Different prices for different days of the year and times of day |

### 12.2.4 Germany

**Table 21** sets out the findings for Germany

**Table 21:** Germany

| | |
|---|---|
| **Energy companies** | E.ON, RWE, EnBW, Vattenfall (wind) |
| **Consumer business models** | RWE: The interest of German consumers in green electricity products declined slightly in 2012 compared with 2011. Conversely, the number of contracts concluded for green electricity with a subsidiary company eprimo has developed positively. Every second or third customer of eprimo is currently opting for the green electricity tariff. The number of customers purchasing green electricity currently amounts to nearly 200,000.<br>E.ON: Limited consumer tariff information found on corporate website<br>SWM: Offer a "rental in warm" contract that limits monthly consumption with rates escalating when consumption exceeds this. |
| **Distribution models** | E.ON: Selling micro CHP for homes and future cells<br>RWE: Identifies "Smart Country" (c.f. City) (needs translation from German language); Smart City Essen = "AmpaCity". |
| **Community power** | EnBW: promoting district heating on website<br>SWM: Munich's district heating network is one of the largest in Europe at around 800 kilometres in length. M-Fernwärme district heating is available in Munich city centre as well as in the districts of Freimann, Bogenhausen, Perlach, Sendling, Messestadt Riem and neighbouring areas (source: SWM). In Munich about 70% of electricity produced comes from district heating plants (source: Wikipedia). |
| **Awareness/ education** | Energy saving devices are promoted on RWE website as an example. |

### 12.2.5 Sweden

**Table 22** sets out the findings for Sweden.

**Table 22:** Sweden

| | |
|---|---|
| **Energy companies** | Five large producing companies account for approximately half of the production: Vattenfall, E. ON, Fortum, Statkraft and Dong. Many other local players. Vattenfall is Sweden's largest network operator. Note: Nordic electricity market is a common market, with production plants supplying electricity to "Nord Pool". |
| **Consumer business models** | Vattenfall offers extensive energy advice service for household customers on its' websites, as well as smart services that enable customers to follow and decrease their energy consumption on their home computer in real time. No innovative invoicing systems identified. Local community energy providers' sites are all in Swedish language. |
| **Distribution models** | Sweden has a high level of district heating. |
| **Community power** | Local power appears to be very popular; many links lead to municipality energy sites, all in Swedish language.<br>High proportion of community heating in urban areas.<br><br>Malmo green city: Western Harbour, a community in Malmö, runs on 100% renewable energy from the sun, wind, hydropower, and biofuels generated from organic waste. A nearby 2MW wind turbine provides much of the electricity to Western Harbour, the rest coming from solar panels. Solar collectors on buildings provide 15% of the heating, but a more important source is a heat pump connected to aquifers undergrounds -- the water in the limestone bedrock is used to provide heat in winter and cooling in the summer. |

### 12.2.7 Norway

**Table 23** sets out the findings for Norway.

**Table 23:** Norway

| | |
|---|---|
| **Energy companies** | National companies include NTE,Lyse and Statkraft accompanied by a high proportion of district, community heating. The network companies have monopoly within a given geographic area. |
| **Consumer business models** | Lyse Renewable – for the environmentally conscious: "If you choose the Lyse Renewable electricity deal, they guarantee that you only pay for electricity from a 100% renewable source." The price is the same as that for the Purchase Price deal. (Source: Lyse website) |
| **Generation** | Hydro (local) common; connected by national grid |
| **Community power** | High proportion of district, community heating |

### 12.2.8 Finland

**Table 24** sets out the findings for Finland.

**Table 24:** Finland

| | |
|---|---|
| **Energy companies** | Many local electricity distribution companies and about 120 generating companies. The largest are Fortum Oyj and PVO. Fingrid run the grid. All Fortum's power is hydro or wind generated. |
| **Consumer business models** | Fortum: Residential customers can choose a contract that best suits their needs with options including a convenient and eco-labelled continuous-price contract, a fixed-price contract or a flexible contract that is directly based on Nord Pool pricing. |
| **Commercial business models** | Fortum: We provide our business customers with extensive energy solutions including energy portfolio management, risk management and energy efficiency consultancy. |
| **Generation** | Geothermal electricity is 13% of total supply (Source: NZ Geothermal Association); also geothermal heat into houses. |
| **Community power** | 50% district heating |

### 12.2.10 Denmark

**Table 25** sets out the findings for Denmark.

**Table 25:** Denmark

| | |
|---|---|
| **Energy companies** | DONG Energy |
| **Consumer business models** | Dong Vindstrøm uden merpris is a pricing scheme aimed at prioritising wind power (source Dong website). They also have a carbon offsetting pricing scheme |
| **Distribution models** | iPower is an important part of the future Danish Smart Grid; DONG Energy is working on developing an intelligent energy system that can ensure optimal cohesion between generation and consumption of energy in a future in which renewable energy sources account for an ever-growing share of energy. The iPower project focuses on developing methods and tools for the intelligent management of decentralised electricity-consuming and generating units and marks an important step on the way to the development of a Smart Grid. |
| **Generation** | DONG Energy is systematically developing new energy technologies that can cut CO2 emissions in energy production. REnescience mixes household waste with enzymes to produce biogas, which DONG Energy uses as a supplementary fuel source at its power stations. |
| **Community power** | In Denmark district heating covers more than 60% of space heating and water heating (source: Dansk Energy). Most major cities in Denmark have big district heating networks, including transmission networks operating up to 125°C and distribution networks operating up to 95°C<br>The largest district heating system in Denmark is in the Copenhagen area operated by CTR I/S and VEKS I/S. In 2006 the central Copenhagen network served 275,000 households (90-95% of the area's population) through a network of 54 km double district heating distribution pipes providing a peak capacity of 663 MW (source: CTR/IS 2006). Thus, district heating dominates the heating scene of Denmark.<br>Today,about 80% of DH is co-produced with electricity (source: Danish Energy Agency). |
| **Awareness/ education** | Dong: eFlex is a demonstration project involving 155 families as test pilots. They have had a remotely readable electricity meter and other advanced technology installed in their homes, and can manage and adjust their electricity consumption via an online customer portal. The project is intended, among other things, to identify what incentives there may be for achieving and bolstering the consumer flexibility needed to create a more flexible and intelligent power grid – a Smart Grid – in Denmark. (Source: Dong website) |

### 12.2.11 USA

**Table 26** sets out the findings for the USA.

**Table 26:** USA

| | |
|---|---|
| **Energy companies** | High level of competition; many electricity suppliers (e.g. Xcel in MN) and gas suppliers (e.g. CenterPoint Energy in MN). UK National Grid are active in the NE region (Boston, NY, RI). |
| **Consumer business models** | California (Edison): Tier pricing in which every household is given a "baseline allocation," or set amount of kilowatt hours (kWh) of electricity to use each month – charged at a lower price than energy used above that amount. This baseline establishes their rate tier. The more energy used over the baseline allocation, the higher the tier, and the higher rates paid.<br><br>Southern California Edison's (SCE) Off-Peak Savings Plan (also called Rate Schedule TOU-D-T) is a flexible choice that can help consumers save money when they use energy wisely. With the Off-Peak Savings Plan, if they reduce on- peak energy usage or use renewable energy technologies (like solar generation) they can lower their average electricity costs.<br><br>Omaha Public Power District: "Become a Green Power Partner today and you can help support OPPD's investment in renewable energy. OPPD's Green Power Program harnesses power from the wind and landfill gases to generate electricity in an environmentally friendly, green way. By tapping green resources, OPPD reduces its dependence on non-renewable resources. Note: OPPD's traditional electric generation is less expensive than Green Power, but there are many environmental and economic advantages to using renewable energy. Your participation will help build a better future." |
| **Distribution models** | Smart Grid – USA<br>USA Federal Government is promoting the use of Smart Grid technologies (ref: www.smartgrid.gov). |
| **Community power** | Multiple examples of CHP: For example Consolidated Edison of New York operates the New York City steam system, the largest commercial district heating system in USA. In addition to providing space- and water- heating, steam from the system is used in numerous restaurants for food preparation, for process heat in laundries and dry cleaners, and to power absorption chillers for air conditioning. |
| **Awareness/ education** | Most energy supplier sites include education/awareness. For example CenterPoint promote energy reduction schemes and offers on their website (e.g. shower heads) plus they offer home audits.<br>Big cities can have education/awareness on their sites (e.g. Chicago).<br>High levels of education and promotion for Smart Grid |

### 12.2.12 Canada

**Table 27** sets out the findings for Canada.

**Table 27:** Canada

| | |
|---|---|
| **Energy companies** | The Canadian electricity system is part of an integrated North American electricity grid, but Canada's electricity markets have primarily developed along provincial or regional boundaries.<br>Electricity pricing varies by province or territory according to the volume and type of available generation and whether prices are market-based or regulated. Alberta has moved the furthest in restructuring its electricity market. Its electricity prices are more market-based compared to other provinces and territories. Ontario has chosen to partially restructure its electricity market. Prices in other provinces and territories are set by the electricity regulator to cover costs and allow for a reasonable rate of return to investors. (Canada Gov www)<br>In a majority of provinces, large government-owned integrated public utilities play a role in the generation, transmission and distribution of electricity. Ontario and Alberta have created electricity markets in the last decade in order to increase investment and competition in this sector of the economy. e.g. Hydro One and Union Gas in Ontario. |
| **Consumer business models** | Ontario: Ontario province is encouraging remote control of devices to save energy (source "saveONenergy.ca"): A technician comes to the home at a convenient time to install a small device that makes slight adjustments to reduce your appliances electricity demand. Appliances such as central air conditioners or electric water heaters will be remotely activated during weekdays between 12 noon and 7 p.m and activations will only last for a maximum of four hours.<br>British Columbia: "Team Power Smart" – free programme with access to exclusive contests, deals and events. Thousands of British Columbians are already on the team saving energy and reducing their electricity bill. For example: "Activate a challenge, reduce your electricity use by 10% over 12 months and you could be eligible for a $75 reward."<br>British Columbia: Rebates available for home improvements<br>Alberta: Most energy companies offer green packages with guaranteed sources. |
| **Commercial business models** | Ontario: businesses can get benefit from energy management by operating and available during a predefined schedule of about 1,600 hours per year. Under this program, they will receive capacity payments for each hour of the pre-defined schedule of about 1,600 hours per calendar year, plus additional energy reduction payments when they reduce energy as the result of an activation notice. Typically, activations last for a four-hour period, usually during times of peak demand on hot summer days. (Source: saveONenergy website). |

| | |
|---|---|
| **Community power** | Good adoption in many cities, towns and remote communities e.g. Montreal District Energy system and deep water cooling system in Toronto, which uses the cool energy in cold lake water to air-condition high-rise buildings in downtown Toronto. |

### 12.2.13 New Zealand

**Table 28** sets out the findings for New Zealand.

**Table 28:** New Zealand

| | |
|---|---|
| **Energy companies** | Grid operator = Transpower; many energy retailers e.g. NZ Energy Corp, Contact NZ, Meridian Energy, Empower, Genesis Power, etc. Note: The electricity sector in New Zealand uses mainly renewable energy sources such as hydropower, geothermal power and increasingly wind energy. The 77% share of renewable energy sources makes New Zealand one of the lowest carbon dioxide emitting countries in terms of electricity generation. Many offshore islands and some parts of the South Island are not connected to the national grid and operate independent generation systems, mainly due to the difficulty of building lines from other areas.<br>Limited gas distribution network. |
| **Consumer business models** | Genesis: Various pricing options aimed at reducing consumption, including “controlled off peak”, “day/night” and “night only”.<br><br>Empower: Low User Plans. “You could benefit from changing to one of our Low User Plans if your electricity usage is less than 8,000kWh a year, or 9,000 kWh a year if you live in the Lower South region. Our low user plans have a lower fixed daily charge than our standard options and a higher variable charge for the electricity used. The amount of the variable rate varies depending on where you live and what type of meter your property has.”<br><br>Meridian energy also has a low user plan, depending on location: consumers in the Lower South Island may benefit from a Low User plan if their electricity usage is less than 8,000-9,000 kWh a year. |
| **Distribution models** | Contact NZ: Some customers generating electricity at home choose a distributed or embedded facility. These facilities are connected to the local distribution system which helps to balance their demand for electricity with the available supply. When they find they are generating more electricity than they require, Contact NZ can purchase any excess electricity produced. Alternatively, if they are producing less than they need, Contact NZ can top up their supply by selling them the extra energy required via the national grid. |
| **Community power** | Geothermal heating predominantly used for industrial purposes |
| **Awareness/ education** | Genesis energy: “My energy coach” is an online consumer education tool. |

### 12.2.14 Australia

**Table 29** sets out the findings for Australia.

**Table 29:** Australia

| | |
|---|---|
| **Energy companies** | Several gas and electricity companies, e.g. United Energy, Multinet Gas, Alinta, Envestra, AGL, Origin, Energy Australia, etc. |
| **Consumer business models** | Origin: offer three green pricing options which ensure the supplied energy comes from green sources.<br>Alinta: no innovative pricing schemes identified.<br>Energy Australia: no innovative pricing schemes identified.<br><br>However, new pricing schemes planned with Smart Grid, Smart City (below) include "SeasonSmart" (customers will not be charged peak rates during Spring and Autumn, only Summer and Winter), and "PriceSmart" (customers have off-peak and shoulder charges except at 14 peak events when appliances must be turned off). |
| **Commercial models** | Origin offer three green pricing options which ensure energy comes from green sources. |
| **Distribution models** | Smart Grid, Smart City project and trial currently underway: Australia has assumed international leadership with its $100 million Smart Grid-Smart City project, the rollout of which commenced in late 2010. Since then up to 30,000 households have participated in the multiyear Ausgrid-led $100 million project. It aims to build a business case for key smart grid applications and technologies, and gather data to guide broader adoption. The initiative draws to a close in September 2013, with the major analysis due in early 2014. |
| **Community power** | Grass roots projects: embark Australia |
| **Awareness/ education** | Some consumer education on energy company websites |

### 12.2.16 South Africa

**Table 30** sets out the findings for South Africa.

**Table 30:** South Africa

| | |
|---|---|
| **Energy companies** | Eskom provide 95% of South Africa's electricity. Gas is not delivered direct to South Africa homes; it can only be supplied in canisters |
| **Consumer business models** | Eskon website urges consumers to save 10% of their electricity usage to "make it easier to manage the power system during this challenging time", while also enabling them to do planned maintenance to ensure the reliability of their plant. |
| **Awareness/ education** | Eskom are promoting 10% energy reduction, but with no hard incentives. In response to the energy challenges facing South Africa, Eskom has established an Integrated Demand Management (IDM) division. IDM is dedicated to ensuring short-term security of electricity supply by consolidating initiatives aimed at optimising energy use and balancing supply and demand. This demand side management programme requires is the implementation of more energy-efficient technologies, processes and behaviours amongst all consumers. |

# 13 Annexe 7: Methodology for assessing future risks and rewards

This annexe presents the basis for the analysis of risks and rewards presented in Annexe 1.

- we first provide an overview of our methodology;
- we then explain the rationale for our choice of future scenarios;
- we then analyse the scenarios, drawing out their key features; and
- finally, we stress test our scenario with a range of alternative future developments.

## 13.1 Overview of methodology

Our methodology for assessing future changes in risks and rewards is as follows:

- **Development of future scenarios.** The first stage in the analysis is to develop a set of scenarios that describe a low-carbon future.
  - **Identification of factors to vary across scenarios**. We first identified the most important factors to vary across scenarios to ensure that the scenarios encompass a broad range of potential futures.
  - **Choice of scenario source.** A range of sources for 2050 scenarios exist. We reviewed the available scenarios to choose which would be most appropriate for this work.
- **Analysis of scenarios.** We then analysed the likely changes in risk and reward across our six chosen scenarios, summarising the output as a set of disruptions.
- **Stress testing based on extreme scenarios.** To encompass a broader range of scenarios, we also stress tested our analysis against a set of "extreme" scenarios.

The output of this work is the set of three "disruptions" associated with a move to a low-carbon economy, described in Annexe 1 above.

## 13.2 Development of future scenarios

In this section, we explain the purpose of the scenarios in more detail, describe how the future scenarios were chosen and developed and set out our six chosen ESME scenarios[129].

### 13.2.1 Purpose of scenarios

Throughout this analysis we are assuming that the UK's 2050 carbon targets will be achieved. However, there is considerable uncertainty about the future energy and heat sector, as a range of different options could be applied on both demand and supply side to achieve these targets.

Considering a range of scenarios allow us to encompass some of the uncertainty around the future. In particular it allows us to investigate two areas.

- By understanding the common features of future scenarios (in particular, the balance of risk and reward), we can develop business models most suited to those features.

- As well as feeding into the development of the business models, our scenario work enables us to evaluate the business models, in particular, to understand how a business model developed with one scenario in mind may perform if a different scenario ensues. It is important to understand this, given that the transition to a new business model may take time, and may need to begin while conditions are still highly uncertain.

### 13.2.2 Identification of factors to vary across scenarios

In this section, we set out the main factors which we vary across scenarios. Given that the purpose of the scenarios is to encompass a broad range of uncertainty, and given the need to work with a manageable range of scenarios, the factors to vary across scenarios should represent:

  - the most important value drivers: those factors which will most affect the value of business models in each scenario; and

  - those value drivers around which there is the most uncertainty.

With this in mind, we have focussed our scenario analysis around four main areas, described below.

- **Heating technologies.** The scenarios encompass a range of different space and water heat technology mixes. Heat pumps, district heat, gas boilers and

[129] The analysis in this chapter was based on ESME V3.1.

biomass boilers all have very different technical and economic characteristics and may require different business models. For example, with highly capital-intense end use technologies such as heat pumps, business models that spread the upfront costs to consumers over time may be suitable.

- **Generation mix.** The attributes of energy supply in each scenario help determine the business models that will be most suitable. For example, in a scenario with intermittent electricity supply, business models which encourage consumers to be flexible in their demand may be appropriate. To understand this, we have focussed on the overall electricity generation mix, including the balance between large-scale and micro-generation.

- **The role of storage and DSR (DSR).** The scenarios consider variations in the prevalence of different storage technologies, at the domestic level (as an enabling technology), distribution level and bulk level. In addition the scenarios encompass different requirements for flexibility (e.g. due to the level of intermittent electricity generation) and differing levels of DSR to meet the need for flexibility.

### 13.2.3 Choice of scenario source

It is important to balance the need to cover a wide range of potential future states of the world with the need to produce meaningful analysis based on a manageable number of scenarios.

In this section we set out the rationale for using six ESME scenarios as our core scenarios, and describe the core ESME scenarios which we selected.

#### *The rationale for using ESME scenarios*

ESME calculates the least-cost technology mix that allows 2050 climate targets to be met, looking across the energy system. It takes demand for energy services, the availability of low-carbon technologies, and the costs and constraints on fuels and technologies as inputs. In calculating the least-cost technology mix, it assumes consumers will take up the most cost-effective technology available to them.

In this way, ESME scenarios are not projections of what is likely to happen, but instead are a description of how 2050 targets could be met in the most cost-effective way. Enabling these scenarios to happen will require a range of barriers to be overcome, for example through policy interventions and the development of new business models.

ESME scenarios are suitable for our work for a number of reasons.

- **They describe a world that our business models aim to enable**. Rather than including assumptions on business models and policies, and projecting what is most likely to happen, these scenarios set out a cost-minimising path to meeting 2050 targets. This means that we can focus on developing the business models that can enable these scenarios to happen.

- **The model is held by ETI.** This means that the most useful scenarios and a comprehensive range of outputs for each of these scenarios can be accessed. It also means that we have been able to discuss the interpretation of the scenarios with the ETI experts who generate them.

- **The input assumptions used are consistent with the ETI's view of a plausible future in a range of areas.** They are based on the ETI's central assumptions on costs, fuel prices, demand scenarios etc.

We also considered using two alternative sets of scenarios.

- **Published MARKAL scenarios.** The Committee on Climate Change and DECC have published scenarios generated from the MARKAL model[130]. We considered using these to supplement the ESME outputs. However, focussing on scenarios from just one model will allow us to develop a much clearer understanding what is driving the difference between scenarios. In addition, the detailed outputs of all of these scenarios have not been published. We compare the core ESME scenarios with the published MARKAL scenarios below.

- **DECC 2050 pathway scenarios.** The DECC 2050 pathways tool allows physically and technically plausible scenarios for meeting the 2050 targets to be generated[131]. However, for our purposes, these are less suitable than the ESME scenarios as they are not based on a cost-minimising path to 2050. We compare the 2050 pathway scenarios with the core ESME scenarios in a later section.

### 13.2.4 Scenarios used in this analysis

We considered an initial set of core scenarios from the ESME model (v3.1). These include:

- Director's Cut (DC) – the ETI's core scenario;

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130 For example, DECC (2011) *Carbon Plan,* https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47616/3748-carbon-plan-annex-a-dec-2011.pdf and CCC (2010) *Fourth Carbon Budget*, http://www.theccc.org.uk/reports/fourth-carbon-budget

131 DECC (2010) *2050 Pathways*, https://www.gov.uk/2050-pathways-analysis

- Renewables World – differs from the core scenario in that the 2020 renewables target is assumed to be met, and biomass is available for import;
- Constrained World - economic growth and demand for energy services are slower than in the core scenario; and
- DC variations, including a scenario with no nuclear, one with no CCS and one with no biomass.

The ETI also provided a scenario without $CO_2$ targets. Given this project is focussing on smart systems in the context of a low-carbon economy, we did not consider this scenario further.

We followed the ETI in considering the DC as the core scenario, and selected scenarios that vary from this scenario in this project's key parameters. For this purpose, Table 31 compares each scenario to the DC, and sets out whether or not it was considered in detail as part of our work. As well as considering the ETI's core scenarios, we looked at scenarios including more variations on the DC scenario. These variations altered the following:

- less domestic storage of heat and hot water as this is relatively stable across the DC variations; and
- a reduction in the costs of insulation by 50%.

**Table 31.** Comparing core scenarios to Director's Cut (DC)

| | Heat technologies (space heating) | Energy supply (generation mix) | Include |
|---|---|---|---|
| **Renewables** | Similar to DC | Similar to DC | **No** |
| **Constrained** | Similar to DC | Similar to DC | **No** |
| **DC no nuclear** | Similar to DC | No nuclear, the highest level of CCS | **Yes** |
| **DC no CCS** | No gas boilers, more biomass | No CCS, the highest levels of intermittent generation | **Yes** |
| **DC no biomass** | No gas boilers, no biomass | Similar to DC | **Yes** |
| **No domestic storage** | No domestic storage of heat and hot water | Similar to DC | **Yes** |
| **Cheap insulation** | Insulation at 50% cost | Similar to DC | **Yes** |

Source: Frontier Economics, based on ESME (v3.1)

We therefore used a set of six ESME (v3.1) scenarios as our core set in the analysis. These are now analysed and compared with non-ESME scenarios in more detail.

## 13.3 Analysis of scenarios

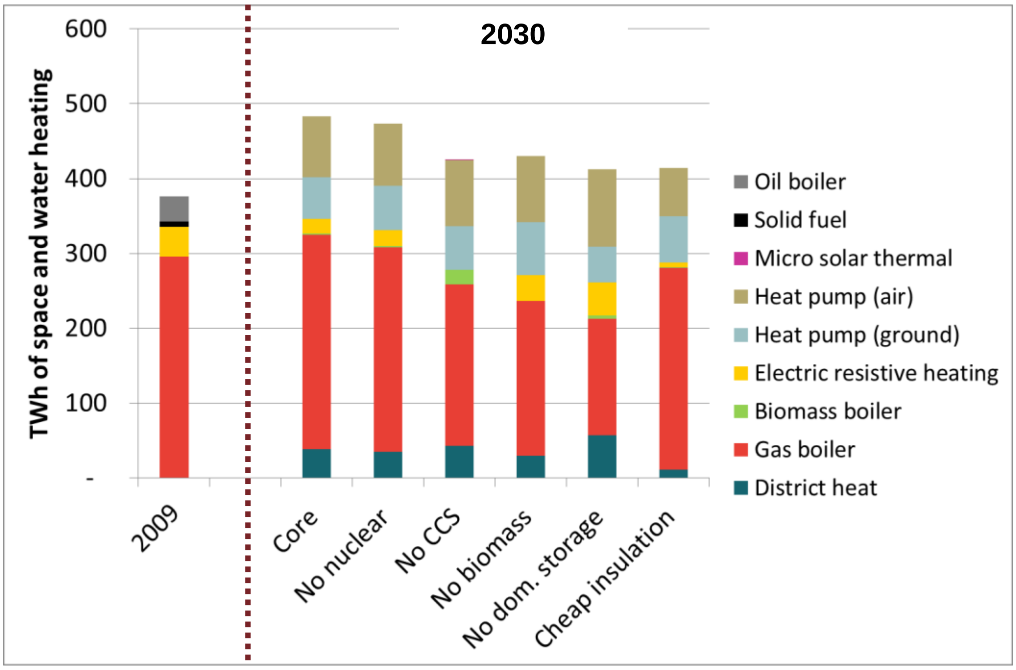
This section compares different scenarios for the energy sector out to 2050, focussing on the heating mix, adoption of electric vehicles (EVs), the generation mix, and the role of storage/ DSR. We analysed a wide range of scenarios for future energy generation, use and emissions, both the six core scenarios described above, and a wide range of additional ESME and non-ESME 2050 scenarios for comparison.

The differences between the alternative and the core scenarios highlighted some additional future disruptions, which were used for stress-testing the future business models.

### *Heating*

Total TWh of space and water heat production will increase by 2030 in all the core scenarios. Oil boilers and solid fuel boilers will no longer be used, while heat pumps and district heating start to feature significantly in the heating mix, as shown in **Figure 73** below.

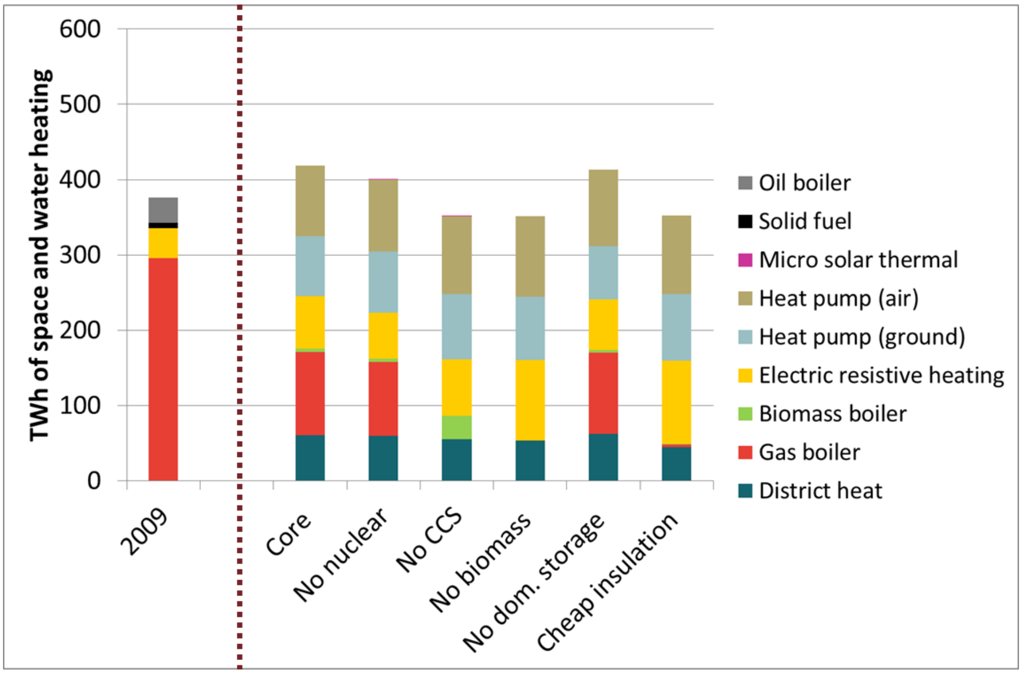
**Figure 73.** Space and water heat production by technology in 2030, core ESME scenarios




Source: ESME modelling (v 3.1)

By 2050, gas only plays a significant role in heating in three of the six core scenarios; and electric heating dominates. Across the scenarios, between 41% and 55% of heating is supplied by heat pumps by 2050. Electric resistive heating is projected to grow across the scenarios as it provides back up to heat pumps. This is shown in **Figure 74** below.

**Figure 74.** Space and water heat production by technology in 2050, core ESME scenarios

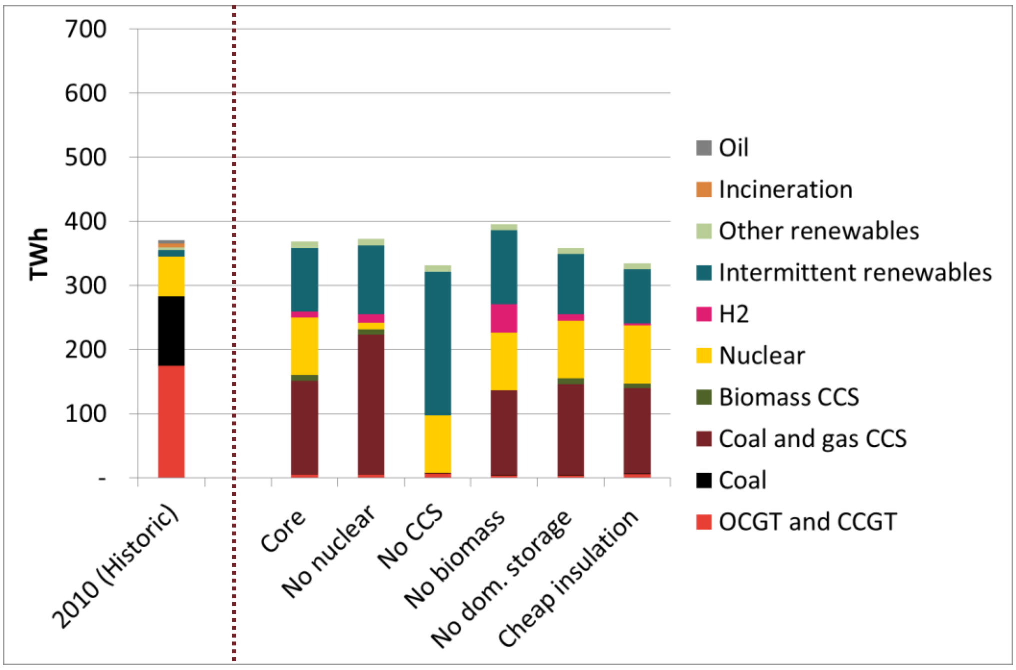



Source: ESME modelling (v 3.1)

## *Generation mix*

All the scenarios involve major changes to electricity supply by 2030 to meet decarbonisation targets, as shown in **Figure 75**. Low-carbon technologies dominate, with a broad mix between nuclear, CCS and renewables, with overall generation similar to its current level.

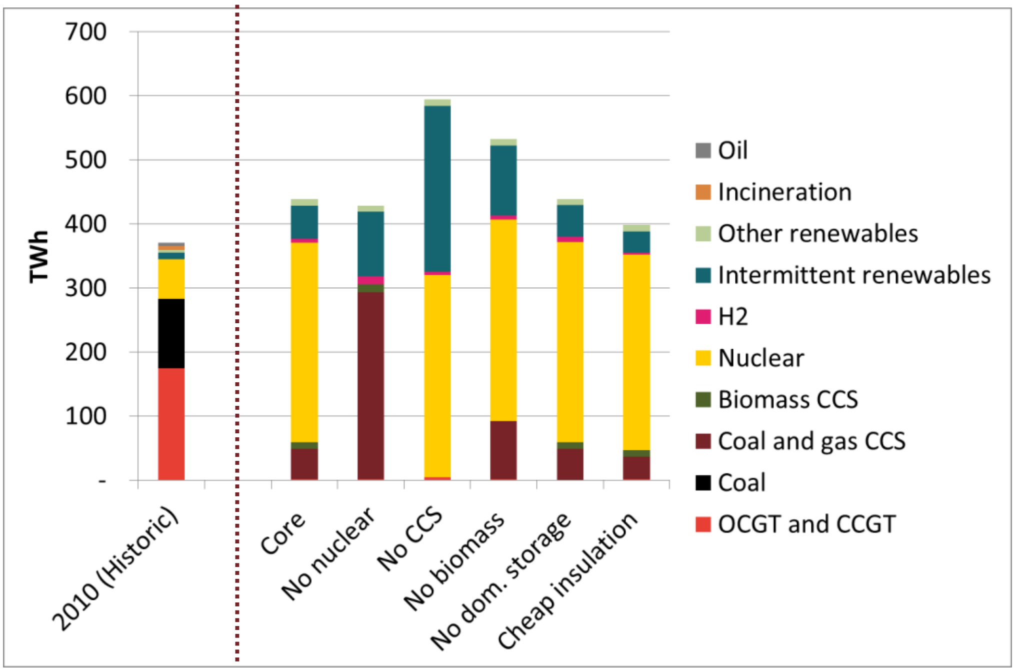
**Figure 75.** Electricity generation in 2030, core ESME scenarios




Source: ESME modelling (v 3.1)

Total electricity generation increases to 2050 in all the scenarios, in part due to electrification. Nuclear power plays a greater role in electricity generation relative to today, with the exception of the no nuclear scenario where coal and gas carbon capture and storage (CCS) predominates. This is shown in **Figure 76**.

**Figure 76.** Electricity generation in 2050, core ESME scenarios

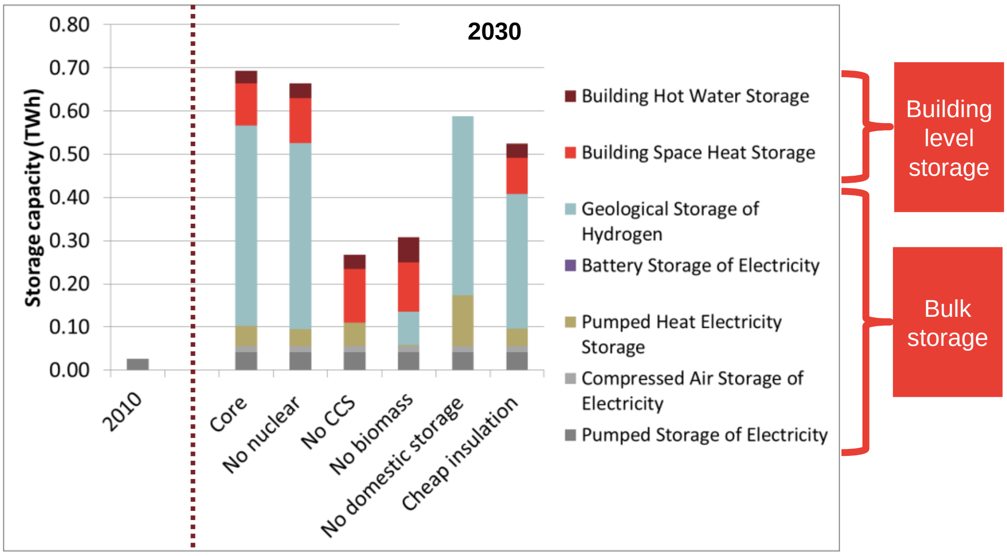



Source: ESME modelling (v 3.1)

## *Storage and DSR*

The core scenarios involve substantial growth in storage relative to today, as shown in **Figure 77** below. However, there are key differences between the storage and DSR required in the different scenarios.

**Figure 77.** Storage in 2030, core ESME scenarios




Source: ESME modelling (v 3.1)

NB: data on current Economy 7 storage not available.

The storage and DSR differences and their drivers across the scenarios are as follows.

- The need for DSR may be lower in the no nuclear scenario, due to greater use of carbon capture and storage which is able to provide both baseload and flexible generation.

- The no domestic storage scenario is based on the possibility that consumers may not wish to use storage because of the space costs associated with it. This results in much less demand shifting.

**Table 32** describes the key changes across our scenarios.

**Table 32.** Summary of key changes in ESME scenarios (v3.1)

| | |
|---|---|
| **New heating technologies** | Increase in the importance of electricity as a fuel.<br>Electrification of heating (and potentially transport) increases the overall electricity demand faced by generation, as well as peak electricity demand.<br>No significant role for oil.<br>New district heat networks required<br>Decreased requirement for gas networks and high uncertainty over post-2030 requirements for gas networks<br>Distribution and transmission network investment required to meet additional peak load on electricity networks resulting from the electrification of heating<br>Adoption of new heating technologies (heat pumps, biomass boilers, district heating) acts as a step change which businesses can target for introducing new consumer energy offers.<br>Gas boilers are projected to remain important but there is high uncertainty over post-2030 requirements for them. |
| **Change in the energy production mix** | Important role for nuclear, renewables (mainly wind) and carbon capture and storage).<br>Uncertainty over role of gas in central heating after 2030 introduces uncertainty to future gas supply. |
| **Technology transition from dumb to smart meters** | Much more data available on consumer demand patterns by exact location |

Source: Frontier Economics

## 13.4 Stress testing

The six ESME scenarios we have chosen do not encompass the full range of possibilities. This section stress tests the key changes summarised in **Table 32** against a range of other scenarios.

This section provides a brief description of each scenario we have looked at in the stress testing process. **Table 33** compares each alternative scenario with the core ESME scenarios. The focus of this comparison is on bringing out key differences with the core ESME scenarios which imply different future risks and rewards. The alternative scenarios we have considered include the following.

- **Low gas price scenario.** This is an ESME scenario from a set of 100 gas price iterations, with the lowest gas price of all the iterations.

- **Balanced transition scenario.** This ESME scenario results in multiple heating solutions being adopted, including a shrinking role for gas, as households switch to heat pumps, district heat, and micro-CHP.

- DECC's 2050 pathway analysis uses MARKAL as well as ESME modelling. The key features of DECC's broad 2050 futures are described below.

  - In **Core MARKAL**, nuclear and CCS deliver 74% of electricity generation, and there is also a relatively high proportion of intermittent renewable capacity. There is almost no natural gas space heating by 2050, with heat pumps the main source of heating. The model relies on a high degree of energy demand reduction. However, there is limited demand response in the transport sector, and electric, hydrogen and biomass to liquid vehicles largely replace conventionally fuelled vehicles by 2050.

  - In the **higher renewables and more energy efficiency** scenario, wind accounts for 55% of electricity supply in 2050. Challenges from intermittency are managed via base-load from nuclear and CCS, as well as 20 GW of pumped storage. As before, heating needs are met by heat pumps, while cars are electricity or hydrogen fuelled. However in contrast to the core MARKAL scenario, there is more insulation, behaviour change and smart heating controls, as well as greater demand response in transport.

  - The **high nuclear, less energy efficiency** scenario involves nuclear power providing base-load electricity supply, with less energy efficiency and CCS not becoming commercially viable. Again, heating is electrified and there is a shift towards electric and hydrogen fuelled vehicles. Bioenergy plays a key role in transport and energy decarbonisation.

  - The **higher CCS, more bioenergy** scenario results in negative net power sector emissions in 2050 as biomass fuels CCS. There is demand response in heating and transport, and unlike the previous scenarios there is a half and half split between heat pumps and district heating/CHP.

- A paper by the UCL Energy Institute for the **Committee on Climate Change (CCC)** uses the MARKAL model to analyse 32 different decarbonisation scenarios in the 2020s to meet 2050 targets. Many of the iterations test the implications of different policy assumptions.

- The **NERA and AEA heat model for the Committee on Climate Change**[132] explores three possible paths for decarbonisation of heating. These are the deployment of heat pumps in conjunction with decarbonisation of electricity generation, use of bioenergy (both biogas using the existing gas network and biomass), or the use of district heating networks, which could complement the existing gas network.

- The **Redpoint and Ecofys bioenergy model for DECC**[133] has a set of scenarios varying the amount of available bioenergy (in the UK and in total). The baseline electricity, heat and transport demand is consistent with the CCC's Extended Ambition scenario to 2020, the Medium Abatement scenario to 2030, and the Spread Effort pathway from the March 2011 DECC 2050 calculator.

- The most recent **UK Energy Research Centre (UKERC)** work updates the initial UKERC scenarios using the MARKAL model. This integrates policy developments and tests the implications of different future policies on the scenarios. Not all the UKERC scenarios assume decarbonisation targets are met, and we have focussed our comparison on those consistent with meeting carbon targets.

- The **European Climate Foundation (ECF)** has produced a 2050 Roadmap which focuses on decarbonisation at the European level.[134] These scenarios are not directly comparable with the core ESME scenarios, as they are not designed for the UK specifically.

- **Shell** produces an annual set of long-term scenarios covering the future energy mix and emissions, as well as economic growth and broader policy settings.[135] We considered their 2013 scenarios, but found limited comparability with our core ESME scenarios. This is because the Shell scenarios are global, which means they may be less applicable to the UK context. In addition, the scenarios are projections of the future, rather than

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132 NERA Economic Consulting and AEA for the Committee on Climate Change (2010), *Decarbonising heat: Low-carbon heat scenarios for the 2020s*

133 Redpoint and Ecofys for DECC (2012), *Assessment of the appropriate uses of bioenergy feedstocks in the UK energy market*

134 http://www.roadmap2050.eu/project/roadmap-2050

135 Shell, 2013, New Lens Scenarios, A shift in perspective for a world in transition, available at: http://s03.static-shell.com/content/dam/shell-new/local/corporate/Scenarios/New_Lens_Scenarios_Low_Res.pdf.

assessments of how to meet carbon targets at least cost, and both of the two scenarios published by Shell in 2013 involve emissions far exceeding those that are required for it to be likely that climate change is constrained to a 2ºC rise in global temperatures.

Following the stress testing, we conclude that while there are a range of alternative scenarios out there, the six ESME scenarios we have chosen cover a good range of the published possibilities. **Table 33** provides more detail on the basis for this conclusion.

**Table 33.** Scenario comparison

| Scenario | Key differences compared to the core ESME scenarios | | | |
|---|---|---|---|---|
| | Heating | Transport | Generation | Storage and DSR |
| **ESME low gas prices (v3.1)** | Heating mix is slightly more focused on gas, which represents 65% of space heat production in 2030 and 37% in 2050, compared to 62% and 34% respectively in the core scenario. | No take up of electric cars; instead there are 11 million hydrogen cars by 2050. This is likely to be driven by pre-combustion CCS which produces hydrogen.<br><br>This compares to 6 million hydrogen cars and 21 million hybrid and PHEVs in 2050 in the core scenario. | Gas and coal represent 35% of electricity generation in 2030 and 32% in 2050, compared to 40% and 11% respectively in the core scenario. This is mainly at the expense of nuclear generation, though nuclear is still the greatest proportion of total generation by 2040. | |
| **ESME balanced transition (v3.1)** | Heating mix is more diverse and the role of gas is relatively smaller by 2030 (and concentrated in suburban areas, including low-carbon gas heating options). | No information. | Dependent on 75TWh of bio-methane being available. | |

| Scenario | Key differences compared to the core ESME scenarios | | | |
|---|---|---|---|---|
| | Heating | Transport | Generation | Storage and DSR |
| **DECC 2050 pathways (used in the Carbon Plan)** | Greater role of district heating and CHP in the high CCS and bioenergy scenario, (where there is a roughly half and half split between heat pumps and district heating/CHP in 2050). This implies less electrification and a continuing role for networks. | Greater electrification of transport than in the core ESME scenarios – for example the high CCS and bioenergy scenario assumes for new vehicles that 80% are electric (i.e. using batteries) and 20% use fuel cell in 2050. | Limited generation differences compared to the core ESME scenarios. For example nuclear and CCS deliver 74% of electricity generation in 2050 in the core MARKAL run, compared to 84% (including biomass with CCS) in the core ESME scenario.<br><br>However domestic biomass with CCS plays a relatively large role in one DECC pathway, representing 471 TWh of final energy demand in 2050, much of which is for generation. This compares to 213 TWh of biomass for primary energy consumption in the core ESME scenario. | Potentially higher demand response in the high renewables/energy efficiency pathway, which involves more insulation, behaviour change and smart heating controls, as well as greater demand response in transport relative to the core MARKAL scenario. (Not directly compared with the core ESME behaviour assumptions). |

| Scenario | Key differences compared to the core ESME scenarios | | | |
|---|---|---|---|---|
| | Heating | Transport | Generation | Storage and DSR |
| **Committee on Climate Change** | Shift to heat pumps and district heating. Some scenarios show gas heating continuing for a longer period. | Electrification of transport. | Similar mix of electricity generation to the core ESME scenario – predominantly nuclear, CCS, and renewables. | |
| **NERA and AEA heat model for the Committee on Climate Change** | The scenarios show a range of abatement options for heating by 2030. The central scenario focuses on heating decarbonisation through heat pumps, while the alternative scenario has a greater role for bioenergy (biogas and biomass) as well as district heating. | The scenarios focus on heating. | | The majority of heat pumps (by emissions abatement) in the central scenario do not include storage. This assumes technological improvements in the ability of heat pumps to store heat. |

| Scenario | Key differences compared to the core ESME scenarios | | | |
|---|---|---|---|---|
| | Heating | Transport | Generation | Storage and DSR |
| **Redpoint and Ecofys bioenergy model for DECC** | The scenarios show a relatively minor role for bioenergy in heating in the long-term, as options for combining it with CCS are limited. In 2050, the scenarios show a role for bioenergy in domestic heating primarily through district heating, as in the ESME scenarios. | The scenarios are wide-ranging on the types of car projected to be used in 2050. The core scenario with lower bioenergy resources available shows a roughly even split between battery EVs and non-bio plug-in hybrids, with a small amount of conventional fossil fuel cars. In the core scenario with higher bioenergy, conventional cars (both fossil bio fuel based) play a greater role. Battery EVs dominate in the scenarios with no CCS and higher bioenergy, and no hydrogen and lower bioenergy. | Similarly, a relatively minor long-term role for bioenergy as part of the decarbonisation of electricity generation. Bioenergy contributes via small-scale plants (e.g. CHP from direct biomass) and through declining or transitional production (e.g. landfill gas or co-firing) in the near to medium term. | |

| Scenario | Key differences compared to the core ESME scenarios | | | |
|---|---|---|---|---|
| | Heating | Transport | Generation | Storage and DSR |
| **UKERC 2050** | Electrification of heating, as in the core ESME scenarios. | There is no electrification of transport in any of the revised UKERC scenarios. Instead, biofuel hybrid vehicles make up 60% of demand for road transport fuel in 2050 in the low-carbon scenario. | Higher role for biomass in the UKERC low-carbon scenario, where biomass's contribution to primary energy use is roughly 1/3 higher than in the core ESME scenario. | |
| **European Climate Foundation (ECF) (scenarios at the EU-27 level)** | Electrification of heating and switch to district heating/CHP. | The ECF scenarios have a mix of both electric and fuel-cell vehicles in 2050. | One power decarbonisation scenario assumes 10% of electricity is supplied by CCS, 10% by nuclear and 80% by renewables (including biomass, solar, wind, hydro and others). This is high compared to the core ESME scenarios; though it should be noted the ECF scenario is not a direct comparison as it is at the EU-27 level. | Significant interconnection, reserve sharing, and demand response. It is unclear how this compares directly with the core ESME scenario assumptions. |

| Scenario | Key differences compared to the core ESME scenarios | | | |
|---|---|---|---|---|
| | Heating | Transport | Generation | Storage and DSR |
| **Shell –** NB: these are less applicable as the scenarios are global and represent projections of the future, rather than assessments of how to meet carbon targets at least cost. | | | Increasing role for solar PV, fuel cells/hydrogen, and biofuels in the longer-term. | |

Source: Frontier Economics

# 14 Annexe 8: Methodology for developing new business models

This annexe covers the methodology for the analysis carried out by Total Flow to develop new business models. We present the methodology in four sections:

- we first describe our approach at a high level;
- we then describe how we produced a long-list of viable value propositions and ideas;
- we present our short-listing methodology; and
- finally we outline selected business model headlines.

## 14.1 Our approach

Attempting to predict the future energy market as a single system is very complex. To facilitate our analysis we have broken the future system into six core elements.

1. the consumer;
2. compelling value propositions;
3. primary energy supply chain components: generation, distribution, etc.;
4. secondary energy value chain components: billing, installation;
5. tertiary enterprise capabilities: back office enterprise capability; and
6. enabling value chain components: trading mechanisms & market shifts.

In this way we have been able to free our thinking to explore each element without being overwhelmed by the billions of potential combinations that are plausible.

### 14.1.1 The consumer

Consumer energy behaviour and perceptions of value are being studied in detail in Work Area 5, but a working hypothesis for responses to alternative energy scenarios was needed to test the value chain models.

## *The work completed.*

Drawing on previous peer reviewed ETI research[136]; six consumer and two landlord groups have been selected to cover the range and diversity of UK householders, based on their age, affluence and family status.

For each group we have applied **Right to Left Thinking**[137] to identify **value through the eyes of the consumer** for their interaction with the energy value chain. Scope includes: education, engagement, point of sale, installation, through-life operation and disposal.

For each interaction we have examined the existing energy value chain through the eyes of each consumer group to identify the **benefits** perceived and enjoyed and the **sacrifices** perceived and endured [138]

## *Working hypotheses*

Based on this analysis, we identified a set of working hypotheses for use throughout the rest of the analysis.

- **Heating** and hot water systems are seen as **basic necessities** not significantly value adding.
- Older, affluent groups, in **retirement** or heading towards it, are the **most likely to invest** in energy system change: A major motivation being to **reduce their exposure** to rising energy costs.
- The **fuel poor have most to gain** in terms of comfort from insulation and a new energy system, but **lack the means** to invest.
- Few consumers find it easy to make the link between their energy behaviour and the size of their bill. **Enabling controls** and technology are **difficult to use** and do not give a clear picture of how to make better use of energy.
- Currently retail choices can be perceived as very **complex**. This makes it difficult for some consumers to make an **informed choice** or have a voice.
- For deep levels of domestic energy saving return on investment / **payback is lengthy** with current propositions highly dependent on current and future energy behaviour. Without a compelling proposition the rate of change will be very limited.

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[136] Customer Value Methodology, 5.2 Report, Optimising Thermal Efficiency of Existing Homes, ETI 2011

[137] **Left to Right or Right to Left?,** *Ellins, C.S.,* 2007

[138] **Title: Managing Customer Value**,: *Saliba, Michael T.; Fisher, Caroline M,* 2000

### 14.1.2 Compelling value propositions

With the landscape described above the **sacrifices** and uncertainties of investing in domestic energy improvement **outweigh the benefits**. To overcome this *'Why would I bother?'* obstacle businesses must reduce householder sacrifices and seek additional value that they would be willing to pay for.

#### *The work completed*

- The impacts of the 2050 energy scenarios[139] were tested against each consumer group to identify which will deliver positive **benefits** and where consumers would need to make **sacrifices** in their domestic situation.

- Richly detailed consumer and landlord propositions have been developed as starting-point requirements specifications for solution providers to create new offerings and '**value delivery mechanisms'**.

- By examining other household changes, **triggers** which might influence a change in energy system were identified and assessed.

#### *Working hypotheses*

According to our working hypotheses, the majority of households are not yet engaged in the idea of energy change and will need educating and **inspiring** with compelling propositions if they are to shift from their current solution.

Four key shifts in the benefits/sacrifices equation will enable compelling propositions to emerge.

- Significant **reduction in cost** of new systems and installation is required to bring the cost within the consumers' willingness to pay (previous ETI research[140] shows typically a £10k maximum spend on home improvement in a five year period for the mass market).

- A major **shift of the benefits/sacrifices equation** is needed to change how consumers research, design, buy, install, operate and maintain whole house solutions. It needs to be easier to find a provider and get a quality job done. If the market for the installation of energy saving measures has the equivalent of McDonalds, Pizza Express & Brasserie Blanc there will be easy to find, recognised brands who deliver reliable quality to meet market price-points.

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139 Annexes 1 and 7 describes the 2050 scenarios we have examined for this work, and the change in risks and rewards expected in a future smart energy system.

140 ETI Optimising Thermal Efficiency of Existing Homes, WA4: Target Supply Chain Scenarios 2012

- Greater confidence in, or **guarantee of, the savings** and improvements predicted by retailers or independent advisors is required. Alternatively energy retailers could have the confidence to become the investor and operator of domestic systems. Previous ETI research[141] indicates that general building companies in this market are **not trusted** to deliver a quality result on-time and within budget: Unless personally recommended by friends and family.

- **Additional perceived value** of the solution is required; over and above the energy benefit (e.g.: reliability, in-use performance, social kudos, improved functionality or aesthetics).

We also identified a set of elements that are missing from a compelling consumer proposition today:

- there is no mechanism to evaluate capital purchases;
- most customer tariffs do not reflect differences in peak and off-peak costs of energy supply;
- some consumers lack understanding of differential pricing tariffs and lose out as a result
- it is difficult to judge cause and effect of energy behaviour;
- energy is just not important enough;
- there is a lack of providers able to link energy saving to other enabling, and more important events e.g. house extensions;
- householders need **clarity** of a **net benefit** to engage in the process of energy system change;
- they need a **proposition** which they can understand and value;
- they need educating/informing by a knowledgeable independent source or a brand they trust; and
- they must have the **resources** (time and funds) to be able to effect the change.

### 14.1.3 Primary energy supply chain components.

With the market (consumer) requirements identified we need to describe precisely the **essential elements of the heat system**. (Secondary and tertiary elements provide supporting and back-office capabilities respectively).

[141] ETI Optimising Thermal Efficiency of Existing Homes WA 5.4 Customer Engagement Report

## *The work completed.*

In energy provision, as for any product or service, right sized instant capacity minimises systemic waste and losses. Starting from this ideal of local instantaneous generation for local demand; we have explored and evaluated options from local to national level generation of heat and electricity.

- Where instantly available capacity is not viable; **Buffering*** strategies were developed.
- When considering the options, we used the following valuation criteria: system $CO_2$ impact, consumer acceptability, disruption, whole life cost (TOTEX), technology readiness and potential for the solution to operate at scale (**Figure 78**).

**Figure 78.** Evaluation of potential supply chain combinations

| Domestic - Nano Buffering | | | | Assume we have elec grid connection consuming 4K heat load say 2kw. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Supply | Fuel Storage | Capacity | Nano Heat Storage | Description | LowCarbon | Consumer | Implement | TOTEX | Technology | Scale | Example |
| N/A | N/A | N/A | N/A | No energy system: Fails consumer Load/time Requirement | | | | | | | Cave |
| Unlimited | Unlimited | Unlimited | N/A | Cave with legs as fuel | | | | | | | Geo Thermal, Hydro, Wave |
| N/A | N/A | Unlimited | N/A | Unlimited renewable supply | | | | | | | Geo Thermal, Hydro, Wave |
| N/A | N/A | Balanced | Y | Intermittent Renewables: Heat Storage | | | | | | | Solar, Wind, Tidal |
| Unlimited | N/A | N/A | N/A | Unlimited heat supply | | | | | | | District Heat |
| Unlimited | N/A | Unlimited | N/A | Pipe or wire to heat (could be H2?) | | | | | | | Gas combi |
| Unlimited | N/A | N/A | Y | Unlimited heat suply & Nano stock (some redundancy) | | | | | | | District Heat |
| Unlimited | N/A | Balanced | N/A | Pipe or wire to balanced heat system slow response | | | | | | | Heat-pump No Storage |
| Unlimited | N/A | Balanced | Y | Pipe or wire to heat with h-stock Storage | | | | | | | Heat-pump + Storage |

Source: Total Flow

## *Working hypotheses conclusions - emerging system solutions*

- **Tera- Nano:** Electricity generated nationally, heat conversion domestically. This is today's model with electricity generated and transported at a national level. To achieve carbon targets, heat generation needs to shift to low-carbon electricity. Electricity generation is associated with significant heat losses at Tera Generation, but use of heat pumps increases efficiency. Domestic heat storage and insulation will be necessary.

- **Nano-Nano:** Electricity and heat generation on-site. Requires low-waste delivery of fuel and efficient conversion to useable heat and power (μCHP – $CO_2$ problem) **or** cost-effective on-site renewables. Both face technical / cost challenges, but renewables for off-gas rural homes could be viable if the cost of infrastructure is offset against the cost of renewables. μCHP becomes viable when efficiencies & costs approach those of miniCHP, particularly if $CO_2$ issues are met. Major transformation of homes required for renewables, deep insulation and domestic energy storage. With no transmission or distribution of energy, each household would require capacity matched to its peak demand or local storage capability.

- **Mini-Mini**: Community energy networks (**Macro-Macro** for urban areas).

  CHP plant at the 100 – 1,000 home level (Macro to 10,000 homes). Currently shown to achieve 60-80% recovery of combustion heat to offset investment in new local heat networks. Fuel sources include gas, biomass & waste incineration

- **Tera-Tera**: Grid level generation of power and heat.

  Capturing heat of generation at grid level could provide another source of low-carbon heat This lower grade heat has less **energy** making it less valuable This approach could maximise the useful output of nuclear (or CCS) sites and reduce required peak electrical generation capacity. However, there are major technical challenges associated with it.

- **Smart systems.** Levelling of power flows

  Currently the energy supply system is reactive – responding to variation in demand. Historical trends help predict demand peaks but generators and network operators have limited scope to proactively manage demand or store electrical energy.

  Turning off non-essential loads as grid demand peaks will reduce the need for increased capacity. Consumer sacrifices to load shift currently outweigh the financial benefit (for most consumers). Smart ICT automation and storage can both contribute to the levelling of power flows.

  If an energy provider manages the shift for a collective group of customers this will have a significant positive impact on the network.

These **system solutions** might be delivered by a single entity, but are more likely from a collaborating consortium, or a value chain made up of a series of B2B and B2C relationships. The greater the number of **interfaces** and **hand –offs** across the value chain the greater the **complexity** and likelihood of escalating costs.

We divide the **value chain** where **Resources**, **Processes** and **Values** of the organisations are difficult to align or are contradictory.

There are also three distinct aspects of future energy systems which need to be considered: The future state **operation and management** of the system, the local physical **transition programme** to enable the new system (installation of heat pumps, community storage etc.) and the **market transformation** which will enable new business models to emerge and trade successfully.

### 14.1.4 Secondary value chain components

Beyond the primary capabilities discussed above; other activities are required to enable the system to operate. In this section, existing tasks and operations are challenged to establish if they can be eliminated.

#### *The work completed.*

- Each activity in the current, and potential future value chains has been described as a single verb then challenged to establish if it can be eliminated, combined with other tasks or its impact reduced.
- Activities were clustered based on matching organisational **Resources, Processes** and **Values** (RPV) required to deliver them successfully.
- Important activities which don't align with the core RPV are assigned to partner organisations (e.g.: heat pump installation). Partners are critical to the business model success and may have a stake in a Joint Venture.
- Where not core to the value proposition activities are outsourced to the tertiary level (e.g.: bill printing, IT systems).

#### *Working hypotheses*

The key distinction for secondary activities are those which are essential to the proposition but have little direct on-going link with the consumer. In general they are enabling tasks like installation, survey, key technology providers and enabling ICT.

These activities could be part of the core business model if it is considered that the value of the activity is crucial for the success of the proposition. An example might be the installer of energy saving interventions for an energy retailer's home upgrade: The quality and service of the install is a key determinant of the success of the offer.

### 14.1.5 Tertiary enterprise capabilities

The final category of organisational capability are the 'back–office' tasks which are not core to the process but currently necessary to the business model. These should be reviewed in detail as the business model is created.

At this stage of the analysis this level of detail is too great for a valuable review. Once specific business models need preparing it becomes useful to explore enterprise capabilities and other necessary and enabling value chain components.

## 14.2 Long-list of viable value propositions and ideas

From the list of viable systems architectures (Tera-Nano, Mini-Nano, etc.) we looked at the consumer behaviours which would have a positive impact on the energy system.

- **Demand reduction** – Help me use less.
- **Demand shift** - Make it easy for me to consume off-peak
- **Do it for me** - Manage my system and pass on part of the saving.
- **Sweat my assets** – Sharing boilers and storage to reduce system cost.
- **Improve my living space** – Make energy change a marginal cost.
- **Investing for an energy return** – Show me a business case to invest in.

These were turned into the following consumer value propositions and tested against the target consumer groups.

### 14.2.1 Distinct Consumer Value Propositions

Each proposition was plotted on the Mathias Grid[142] to show how he consumer responds to the proposition and also how they hope to be perceived by others.

#### *Life Savers*

For the proposition to take off the mechanisms to save energy must be easy to choose and have more appeal for consumers than current tariffs.

*My choice does not need to be ostentatious, but I do want others to know I have done the right thing.*

| Value Proposition | Life Savers |
|---|---|
| Mathias Grid | |
| Self | I'm a Life Saver. Are you? |
| Others | Thank you for saving our lives |
| We will give you the knowledge and tools to reduce your energy needs permanently without affecting your families development |  |
| Product | x% free or marginal cost then steep hike in unit cost |

Appeals to:

- Older Groups and the Green Aware Renters.

[142] Peter Mathias, MSc Dissertation, University of Warwick, 2009.

## Level Headed

To be effective DSR cannot rely on consumers manually making changes. It needs to be technology enabled.

*I'm not going to remember to turn my dishwasher on at midnight: Give me a way to make it easy; better still if it's cool technology.*

Appeals to:

- Green Renters, Middle Grounders, Transitional Retirees.

| Value Proposition | Level headed |
|---|---|
| Mathias Grid | |
| Self | I'm a Level headed. Are you? |
| Others | Thank you for being less demanding |
| We will give you the knowledge and tools to shift your energy consumption to low peak times and tariffs. |  |
| Product | X% unit cost reduction for demand shifting to low peak |

## Comfort Assurance

Giving people the outcomes they really want, at a price they find compelling could lead to a massive shift in market share.

*I don't understand kilowatt hours. I just want to know my family will be warm and have plenty of hot water – without costing the earth.*

Appeals to:

- Stretched Pensioners, Green Renters, Private Landlords

| Value Proposition | Comfort Assurance |
|---|---|
| Mathias Grid | |
| Self | I love my creature comforts |
| Others | You deserve your creature comforts |
| You buy heat and hot water and we choose the mechanism and assure this through life. |  |
| Product | Buy comfort and security in exchange of giving up control, assets & system ownership |

## Trading Spaces

If 26 million boilers are only operating for a few hours a day we have many redundant assets in the energy system.

*If someone will provide me with the warmth and hot water I need: Why would I bother to have a boiler?*

Appeals to:

- Social Landlords, Transitional Retirees.

| Value Proposition | Trading Spaces |
|---|---|
| Mathias Grid | |
| Self | I'm trading spaces |
| Others | Together we're Hot! Together We're Cool! |
| Choose to buy energy and liberate your space or fully utilise, sell and make money, from leveraging your generation or storage assets. |  |
| Product | Enabling households & communities to choose between buying or supplying electricity and heat generation. Frontier Economics |

### *Living Spaces*

Energy is not top of many people's list of priorities. If significant energy saving comes at only a tiny cost on top of building an extra room it's an easy decision to make.

*I can't be bothered with loft insulation but I'll put some in when I extend the lounge; That'll add a few grand to the value.*

Appeals to:

- Private Landlord, Busy Comfortable Family.

| Value Proposition | *Living* Spaces |
| --- | --- |
| Mathias Grid | |
| Self | More for less |
| Others | Let's enjoy today so I can enjoy tomorrow |
| We will help you maximise the value of your property and minimise your property's lifetime energy needs by designing and executing a single integrated transformation plan at a time in your life that suits you. |  |
| Product | Whole household energy upgrade piggy backed on valued property enhancement |

### *Energy Dividends*

A home survey to build a business case gives householders the option of investing, or giving someone else the chance to do so.

*If I find out what's the best solution for my house: either I can borrow to get it done, or someone will invest for me.*

Appeals to:

- Busy Comfortable Family, Middle Grounders, Private Landlords.

| Value Proposition | Energy Dividends |
| --- | --- |
| Mathias Grid | |
| Self | I'm A Smart Investor |
| Others | Thank you for investing in me |
| Open market for investing in and enjoying lifetime dividends from the reduction in energy in other households. |  |
| Product | Innovative share based investment, dividend & capital gain vehicle |

## 14.2.2 Right to Left – consumer proposition long-list

This analysis produced a consumer proposition and business model long-list. For clarity the proposition, summary and decision are presented together in XYX after a description of the approach to selection.

## 14.2.3 Left to Right – disruptions based long-list.

A Left to Right approach reviews an existing system, and its expected evolution, and looks at the opportunities to take individual elements and make improvements. The goal of this approach is to evolve system outcomes to meet new requirements and increase efficiency.

If the evolved system is to be viable, emerging business models need to fit the new pattern of risk and reward likely to be associated with a move to a low-carbon economy. To undertake the Left to Right approach, we therefore focussed on the three key disruptions associated with a move to a low- carbon economy (outlined in Annexe 1) and developed business models that could help manage the challenges associated with these disruptions.

The outcome of this process is set out in **Figure 79**.

A number of the ideas generated with this approach overlapped with the consumer focused approach; as would be expected and the solutions merged to simplify the short-listing.

**Figure 79:** Long-list of Left to Right business models

| Value chain disruptions | Business models |
| --- | --- |
| Change to heating technology mix | • Installation packages<br>• Financial arrangements to smooth upfront costs<br>• Disruption management service<br>• Aggregators |
| Change in the energy supply mix | • Time of use tariffs or real-time pricing<br>• Aggregators<br>• Rewarding lower demand<br>• Domestic storage<br>• Community-scale electrical energy storage<br>• Bulk storage (e.g. hydrogen from wind)<br>• Interconnection<br>• Carbon transport/storage/sequestration |
| Technology transition from smart to dumb metering | • Advisory/education (similar to EST)<br>• Software to control appliances<br>• Hardware<br>• Data management (DCC)<br>• Facilities management (smart business services)<br>• Security/fire safety services |

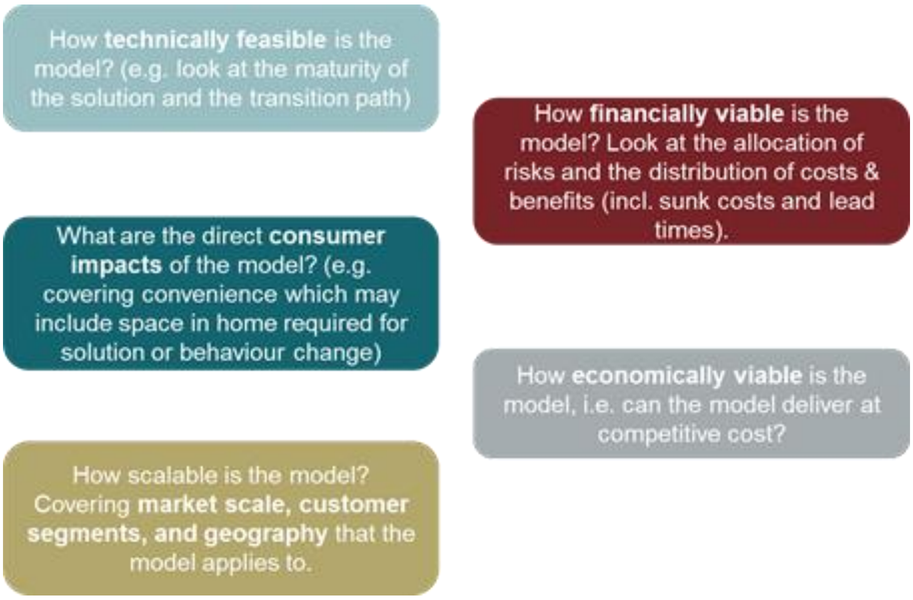
Source: Frontier Economics

## 14.3 Approach to short-listing

The evaluation tool is the mechanism for assessing the economic viability of the business models at the detailed level. The tool needs a broad range of data to underpin each business model and so we need to reduce the potential business models to a short-list. Six models will be fully reviewed through the tool.

To filter down the long-list of business model ideas five criteria from the evaluation tool were used to identify outliers.

**Figure 80.** Short-listing criteria




Source: Frontier Economics

Solutions which were identified a particularly innovative and also deliverable within the Smart Systems and Heat programme timeframes were given extra weight: These being part of the ETI programme remit.

### 14.3.1 System level fit and peer review

Each business model idea was then matched to one (or more) of the system level solutions explored above (Tera-Nano, Mini-Mini, Nano-Nano). This gave clusters of solutions to present for peer review at a workshop in March 2013.

Responses to the "Dragons' Den" pitches were particularly useful to sharpen the ideas and give additional focus on particular business models.

### 14.3.2 Proposition Summary and Decision

Using the selection criteria and the Workshop feedback more detail was put on the consolidated list of twenty high potential business models and reviewed with ETI to select those ideas worth developing.

**Table 34.** Proposition Summary and Decision

| | Proposition | Elevator Pitch | Decision |
|---|---|---|---|
| 1 | Consumer & Supply Chain Education (government or government agency) | A business or not for profit organisation, paid for (initially at least) by central funds, to inform and advise consumers | **Reject:** Not core to ETI or sufficiently commercial |

| | Proposition | Elevator Pitch | Decision |
|---|---|---|---|
| | | and potentially SME suppliers. | |
| 2 | Bespoke Consumer Property Pathways | A business offering a whole-house energy and improvement journey. One which can be phased (as you can afford the steps) or adapted to changing family needs and emerging technology. | **Reject:** Home improvement too broad for ETI remit |
| 3 | Consumer Retail verticals (Think Home Depot in the US) | | |
| a | Domestic Whole House Solutions | A stand-alone whole house refurbishment and retrofit offering | **Develop further** |
| b | Domestic Energy Control Solutions | Home automation and electrical installation to make the most of Time of Use tariffs, automated and web-enabled controls | **Reject:** Too narrow for sufficient impact |
| c | Domestic Energy Outcome Solutions | Payment for comfort and hot water – the energy supplier takes care of the system and the energy saving investment required | **Develop further** |
| d | Domestic Living Space Solutions | A business renowned for high quality home refurbishment, providing additional value of whole house energy saving for only a marginally higher cost than the minimum regulated energy requirements. | **Reject:** Home improvement too broad for ETI remit |
| e | Energy Brokers | A consumer collective using crowd buying power to negotiate the best energy deals. | **Reject:** Too narrow and at market. |
| 4 | Energy Supply Business Verticals *(Scale & technology agnostic)* | | |
| a | Energy Generation | A business focused on the most appropriate generation technology from Nano (home) to Tera (grid) level. Not limited to a niche. | **Develop Further:** At community scale only. |

| | Proposition | Elevator Pitch | Decision |
|---|---|---|---|
| b | Energy Transmission | As above but for network assets design, delivery and operation. | **Reject:** Too narrow. |
| c | Energy Storage | A scale and technology agnostic provider of energy storage to level network loads. A Dinorwig pumped storage to Duracell provider. | **Develop further**: Power not heat |
| 5 | Integrated Mini-Nano Providers (Generate, Transmit, Store) | Small scale domestic or community level energy provision to serve distinct communities and engage them in their energy supply. | **Develop Further:** At community scale only. |
| 6 | Data Management Providers: | System performance & consumer demand capture, monitoring & billing, intelligent use of ICT to share data and balance demand and supply. | **Reject:** Too narrow – include with other models |
| 7 | Consumer Through life Repair & Maintenance | The post installation management of systems and technology: Smart Facilities Management (Smart FM) | **Reject:** Too narrow – include with other models |
| 8 | Consumer Through life system upgrade & optimisation | Smart facilities management, plus on-going needs review. This may result in a change of tariff or an upgrade of equipment to better serve the consumer. | **Develop Further:** To include home installation |
| 9 | Remove, recycle, refurbish, dispose vertical | A stand-alone business to manage the end of life processes for technologies and systems to maintain the value of the property | **Reject:** Too narrow and not aligned to ETI remit |

Source: Total Flow

### 14.3.3 Top level canvas

From the models selected for further development the project team developed the top six into a single page proposal and presented to the ETI review team:

- idea;

- value proposition;
- Unique Selling Point;
- customers;
- costs;
- offer; and
- revenue.

Of the six business models presented two were eliminated as follows:

- **Energy Wise:** Maintain home assets and advise on tariffs. A consumer champion. Not distinctive enough and some aspects already in place.
- **Bespoke Energy:** Home property upgrade plan for energy and fabric. Property improvement is not central to SSH programme.

The four selected for further assessment were:

- **Energy Outcomes:** Pay for comfort – not for kWh.
- **Energy Mutual:** Energy saving investment brokerage
- **Community Energy:** Local heat and electricity provider
- **Power Buffer:** Energy storage at all scales (narrowed to distribution)

### *Hybrid models*

After further review and exploration of potential business models the potential from combining the selected offerings into one business model was assessed.

Evaluating models independently gives greater clarity of the impact and sensitivity of each idea. However, there are synergies (e.g.: reduced overhead burden) from the hybrid models and so the final two evaluation tool assessed business models were:

- **Energy Outcomes with Local Energy Storage**
- **Community Energy with Energy Outcomes offer**

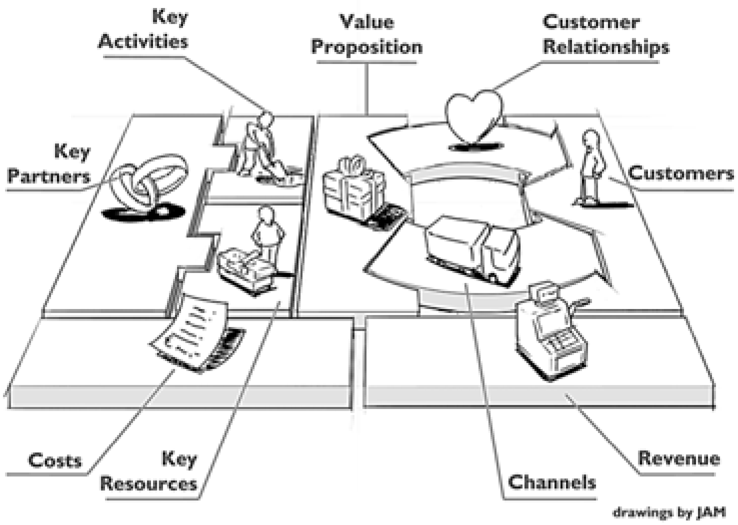
### *Business model assessment*

The two elements of the final business model assessment are:

- The Evaluation Tool – as developed in Annexe 5
- The Business Model Assessment Canvas – presented in Annexe 2

The detailed Business Model Assessment Canvas was developed during the project from the original BusinessModelGeneration.com [143] single page canvas (**Figure 81**).

**Figure 81.** Business model Canvas




Source: Business model generation[144]

Behind each element in the diagram, we developed a standard template of sheets to present the insight behind the model. This is designed to give reviewers and potential business model participants sufficient detail to understand the organisational challenges and value of the proposition.

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143 Business Model Canvas from BusinessModelGeneration.com . **Licensed under the Creative Commons Attribution-Share Alike 3.0 License. at:** http://www.businessmodelgeneration.com/canvas**.**

144 Adapted from the Business Model Canvas from BusinessModelGeneration.com, licensed under the Creative Commons Attribution-Share Alike 3.0 Unsupported License. Available at: http://www.businessmodelgeneration.com/canvas.

# 15 Annexe 9: Further details on business models

This Annexe describes the four business models that have been developed in this project:

- Energy Outcomes;
- Energy Mutual;
- Community Energy; and
- Power Buffer.

Each section begins with a summary business model canvas[145] and then provides further detail on key aspects associated with each canvas.

145 The format for the business model canvas is adapted from the Business Model Canvas from BusinessModelGeneration.com, licensed under the Creative Commons Attribution-Share Alike 3.0 Unported License. Available at: http://www.businessmodelgeneration.com/canvas.

## 15.1 Energy Outcomes

# Business Model Assessment

frontier economics

energy technologies institute

TotalFlow

Energy Outcomes

**Energy Outcomes - Provision of Comfort for a predictable monthly fee. Not per kWh. Electricity retail offer combined.**
Removes the consumers' burden of asset ownership, repair and maintenance and transfers the risk of fluctuating energy costs.
A technology led Energy System Integrator who sees the opportunity for a profitable business based on reducing energy supplied to homes.

## Partners

**Smart Data IT Ltd.** Home data links

**Home Transformation Ltd**: Installer of retrofit, heat-pumps, storage, controls HEMS, smart data & home improvements.

**Energy Saving Component Manufacturers**: Tier 1 product / material suppliers.

**Electricity Wholesale / Retail Partners Ltd.** A Generator or wholesale electricity provider.

**Residential Maintenance Management Ltd:** Home asset care and consumer support.

**(Storage System Providers ltd.** Option to provide domestic heat and electricity storage)

## Key Activities and Resources

### Activities

Assess current energy use and enable reduced future needs for each household.

Develop compelling consumer offerings and secure multi-year contract.

Drive supply chain product and process improvement as Systems Integrator.

Co-ordinate installation.

### Resources

Assessment and design methodology to manage risks of variable future household consumption.

Retail billing organisation approved by regulator.

## Consumer Value Proposition

A trusted and relevant brand removing the anxieties and hassle of current energy systems in return for a predictable monthly cost, spread over a suitable contract period.

Choose your comfort level and the amount of change to your home;

Energy Outcomes offers options for:

- Fixed and variable charging.
- Different levels of retrofit.
- Other home improvement
- Investment or zero upfront cost.
- Storage options for better response or lower cost.

A leading edge technology brand to improve your home.

## Relationship and Channels

### Relationship

5yr+ contract with house-hold for delivery of a fixed level of comfort. Outcomes provider upgrades and manages household energy assets, and supplies energy needed to maintain comfort.

A 2 way relationship where the provider supports users to achieve their changing needs cost effectively.

### Channels

Branded alternative option offered through U-Switch.

Local Authority community groups.

Home improvement firms adding additional value.

## Customers and Market Share

### Customers

Risk-averse households wishing to avoid hassle and happy to let others manage the energy system for them

Energy users with a large energy savings potential to offset system investment.

Those with gas / oil heating systems at or near the end of their useful life.

### Market Share

Likely to be a slow take up with a very different value proposition for consumers.

May require 'loss leader' contracts to prime the market.

## Costs

Start-up : Expert design system development and brand creation.

CAPEX: Capital for up-front investment in customer properties

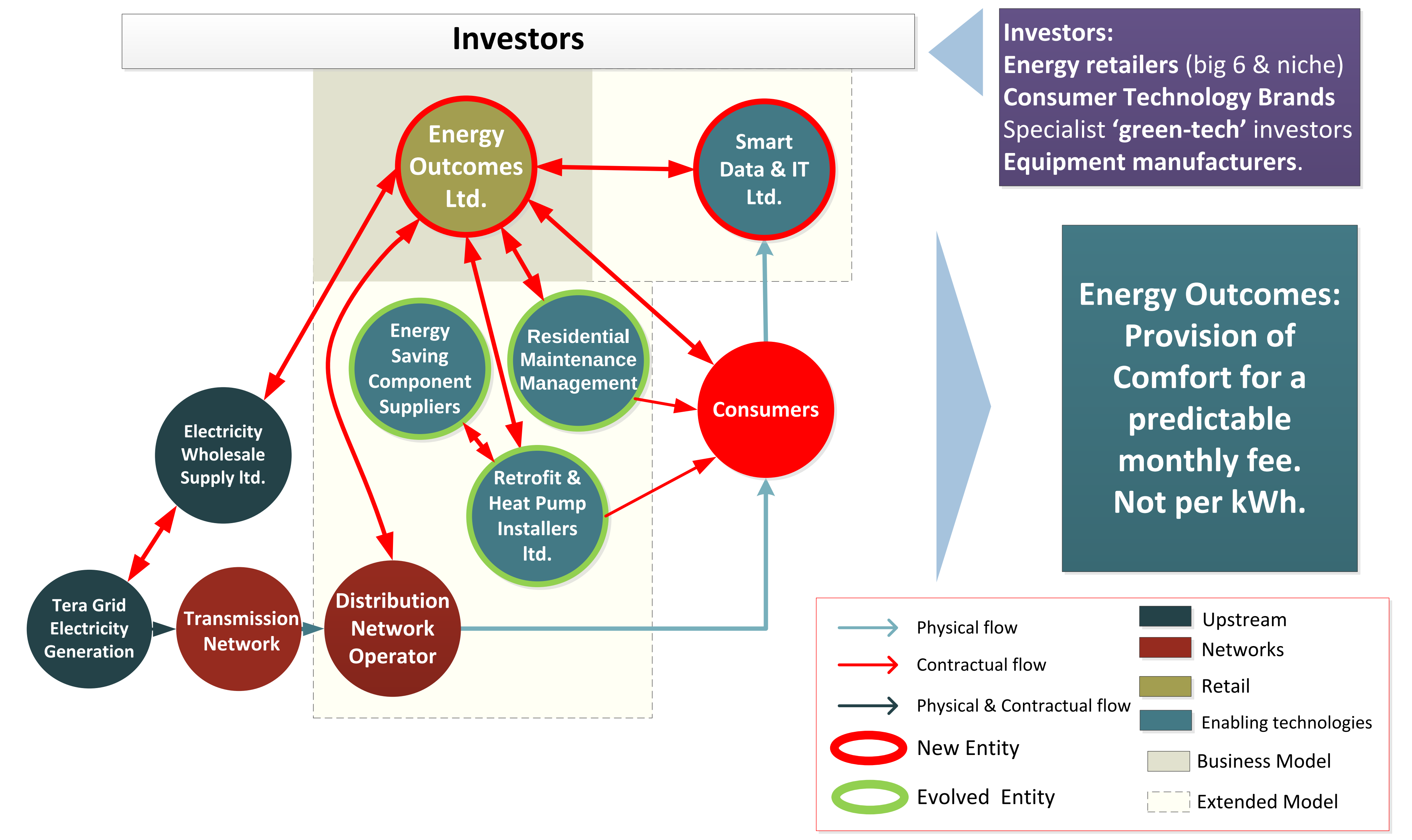
OPEX: Wholesale energy, marketing, maintenance and customer care costs.

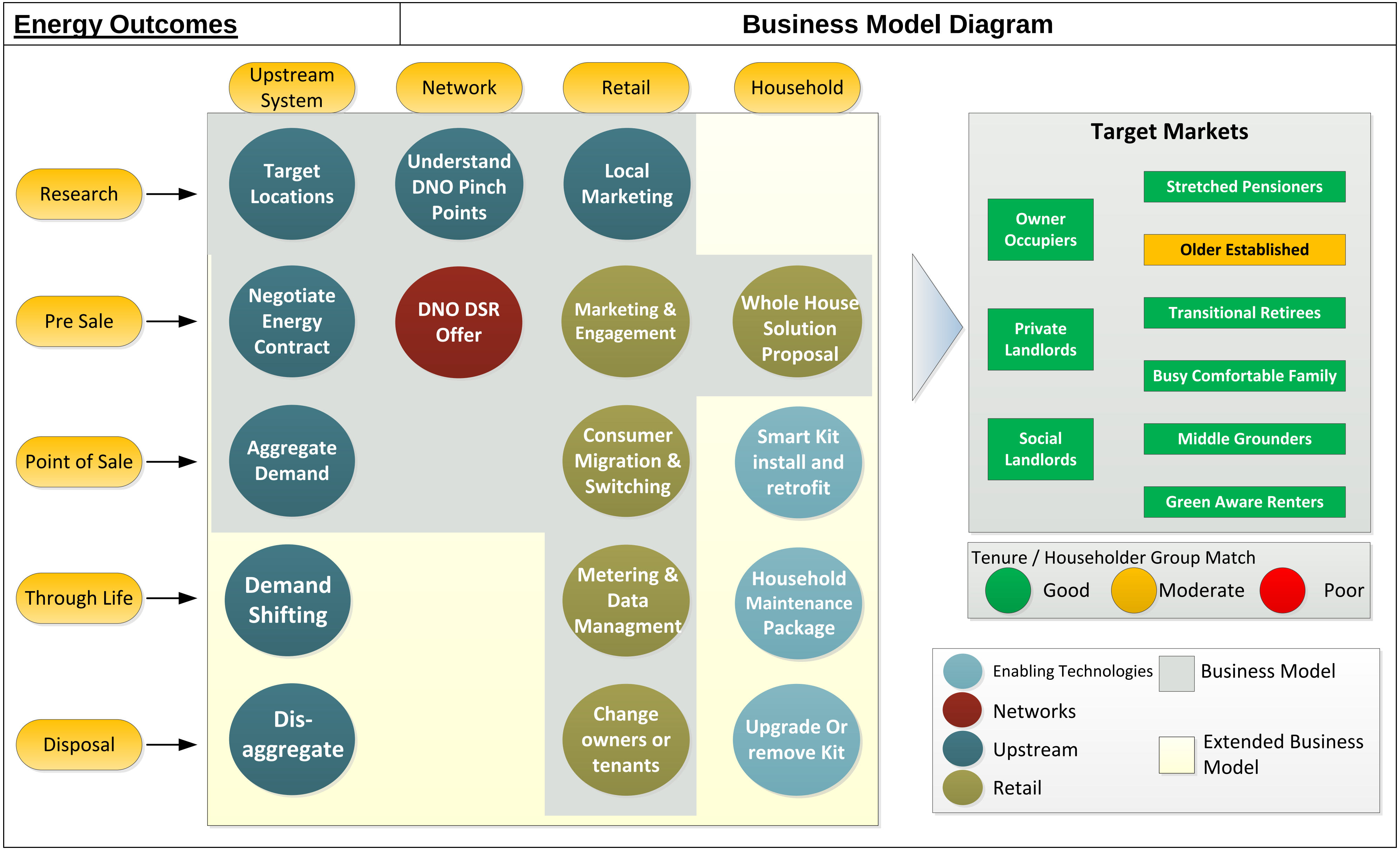
## Revenues

Monthly payment from customers.

- Up to 3 Levels of Comfort tariff: Simple to understand.
- Energy cost element can be fixed or floating.

| Energy Outcomes | Value Chain Elements |
|---|---|





Energy Outcomes
Business Model Diagram
Upstream System
Network
Retail
Household
Research
Pre Sale
Point of Sale
Through Life
Disposal
Target Locations
Understand DNO Pinch Points
Local Marketing
Negotiate Energy Contract
DNO DSR Offer
Marketing & Engagement
Whole House Solution Proposal
Aggregate Demand
Consumer Migration & Switching
Smart Kit install and retrofit
Demand Shifting
Metering & Data Managment
Household Maintenance Package
Dis-aggregate
Change owners or tenants
Upgrade Or remove Kit
Target Markets
Owner Occupiers
Private Landlords
Social Landlords
Stretched Pensioners
Older Established
Transitional Retirees
Busy Comfortable Family
Middle Grounders
Green Aware Renters
Tenure / Householder Group Match
Good
Moderate
Poor
Enabling Technologies
Business Model
Networks
Upstream
Extended Business Model
Retail

| **Energy Outcomes** | **The Business Idea** |
|---|---|
| **The Idea** | A vehicle enabling consumers to contract for reliability, performance and comfort, not for assets and energy.<br>Energy Outcomes is a radical reworking of the current energy landscape: The provider is more profitable the less energy they sell.<br>Rather than consumers buying excess energy to fuel current, badly designed, installed and inefficient domestic energy assets, Energy Outcomes enables householders to select and contract the level of comfort, reliability and performance they value.<br>Energy Outcomes takes into account the personal circumstances, energy usage and energy system performance of the household to prepare a Bespoke Comfort Quotation.  This enables consumers to reduce energy consumption by selecting from three options of comfort level and three options for system / retrofit intervention. Households choose their preferred trade-off between comfort level, contract duration and the hassle of having their existing energy system and property reengineered.<br>Once a contract has been formed and all works made good, Energy Outcomes Limited is rewarded for maintaining and continually improving system performance; reducing the through life cost and energy required to achieve the level of comfort contracted.<br>As part of the contract Energy Outcomes visit the property, at least annually, to maintain and upgrade hardware assets.  Software, firmware and appliance settings can be adjusted remotely on demand to maintain the system in peak performance.<br>Smart data enables system performance to be monitored alerting Energy Outcome engineers to intervene to correct any sudden deterioration in system performance. Smart controls switch key appliances to save energy, taking the handover of control further.<br>Householders are able to buy cost of comfort price stability, akin to a fixed price mortgage. They can request increases and decreases to their comfort levels; either on a temporary basis (hosting the relatives for Christmas, going on holiday) or on a change of needs basis (new child).<br>A tariff limit, rather than hard stop of energy supply, allows households to exceed their agreed comfort level but with inflated pricing, akin to an unapproved overdraft. Households can be easily and cheaply notified of an approaching usage limit with mobile communications.  A simple way to maintain goodwill and dialogue with consumers at trivial cost.<br>A “subject to fair usage” caveat will discourage, or prevent, cynical or accidental contract abuse.<br>The model is designed to separate householders’ comfort from their system, but behavioural changes which further reduce cost to supply comfort should be encouraged; so that both the householder and Energy Outcomes Ltd. enjoy a share of the financial gain.<br>Changes in property ownership give the new owner options to select a comfort level suitable for their needs. The unpaid value of invested capital will be worked into a new contract or bought out via a balloon payment by the old or new property owner.<br>The capital cost of the smart retrofit (the system and its ideally plug and play installation). is crucial to Energy Outcomes success. The greater the energy saving the investment achieves, the less impact the future market price per kWh will have on profitability.<br>In a generation, Energy Outcomes Limited will redesign all of their componentry and energy system assets to meet self-imposed objectives for target design cost, through life operating cost, service intervals and system performance.<br>Energy Outcomes Limited aims for target cost reductions and system performance improvements comparable to the automotive industry over the last 30 years; (namely a circa 30% improvement in cost and performance between system designs and a 4% |

| **Energy Outcomes** | **The Business Idea** |
| --- | --- |
| | reduction per annum in manufacturing and supply chain operating cost). NB: These are higher goals than used in the evaluation tool. |
| **Strategic Value** | In the current state the poorer the nation's domestic energy system performs the higher the revenue for energy retailers. Apathy, ignorance and complexity for the householder perpetuate the status quo.<br>In an Outcomes future state Energy Outcomes Limited makes more money the less energy they need to meet the comfort level they have contracted to.<br>By turning the energy market on its head Energy Outcomes can invest in energy systems innovation, ultra-reliability and performance improvement; confident they will secure a return.<br>Consumers, blissfully unaware of the staggering advances Energy Outcomes Limited have made in system performance and technology employed, can focus on enjoying what they value: A hot shower, a cosy house and happy kids with stable energy bills. |
| **Critical Success Factors** | Experience from automotive and consumer goods sectors, shows that an organisation acting as Systems Integrator is needed to drive major improvement in supply chain capability. There is no smart-systems and retrofit system integrator currently and this may provide a major opportunity for a trusted and relevant technology brand. Rolls-Royce, Audi or Phillips might play this role.<br>The first business models to identify and act upon the opportunity to use their capability to optimise home energy use can shift the market with a disruptive proposition. The Energy Outcomes offer can eliminate, at a stroke, three of the major sacrifices consumer face in their energy decisions:<br>**System Performance:** Domestic maintenance plans have taken the first step on the path of suppliers removing consumer's exposure to boiler breakdown. The opportunity is for Energy Outcomes is to use engineering excellence to provide technical performance the consumer could only dream of, more cost effectively than the current underperforming household system.<br>**Consumer Behaviour:** Most consumers do not understand the link between their energy bill and their domestic activity. Rather than expect the consumer to educate themselves and change their ways: Energy Outcomes uses smart technology to guide behaviour and optimise the system around their needs.<br>**Fuel Price:** Consumers are used to accepting energy price hikes as a fait accompli. A provider who has the capability to minimise the consumers' link to wholesale energy pricing with technology has an opportunity to shift market expectations.<br>The transfer of risk has major impact on operating costs and the other critical factor is the **Energy Outcomes retrofit and smart data installation cost** which needs to reduce considerably to accelerate payback and increase the appeal of the offer.<br>The outcomes based approach has delivered reduced system cost in 'Power by the hour'[146] aero engine contracts.<br>The approach is also migrating to fixed price consumer vehicle servicing, extended warranty and purchase plans. |
| **Global USP** | Reliable comfort. A lower consumption, better performing system with experts optimising my energy use.<br>Energy security, performance and comfort for no more than you pay today, from a brand you trust. |

[146] Performance Contracting in After-Sales Service Supply Chains, S-H Kim, M. A. Cohen and S. Netessine, The Wharton School Pennsylvania, 2006.

| Energy Outcomes | Target Markets |
|---|---|
| **Target Market(s)** | Risk averse owner occupiers (in particular) • Landlords providing improved service to tenants at a fixed price.<br>Households looking for others to take responsibility for their energy system and provide them with comfort security. The majority of consumers will be attracted to the idea, but contract term and monthly costs will be crucial.<br>High Energy users are likely see the greatest reduction and fastest payback for the vendor, offset to some extent by the investment required in hard-to-treat properties. Change instigated at personal trigger points or energy price rises.<br>As a very different approach to paying for energy the early adopters will need to either have a very unsatisfactory current system or have a compelling proposition to change to: Drawn in by the appeal of a trusted consumer brand. |
| **How will the business compete?** | Energy Outcomes passes the system asset problem back to the energy experts and motivates them to save energy on the householders' behalf. In return the householder pays a predictable amount, over a known period, to minimise their concerns over breakdown, underperformance of the system or repair costs.<br>The transformation of the home is bundled with the provision of comfort. Payment can be considered analogous to that of a mortgage with flexible ways to reduce monthly costs including payment of capital up-front. |
| **Spill-over and Synergy outside the Value Chain** | Energy Outcomes encourages the energy and construction sectors to take a systems engineering approach to home energy. As a result, over time, there will be major enhancement of product and installation capability which has the potential to spill-over into the wider construction sector: Enabling the Government's Construction Strategy to deliver 50% lower emissions for 33% less cost. |

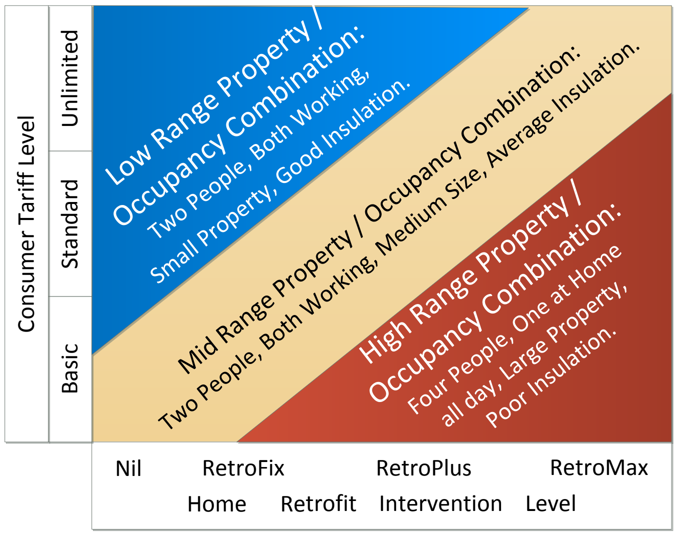
**Suggested consumer options for Comfort and Intervention Level**

Comfort

- **Unlimited** –. Heating anytime to 24°, all Hot Water within fair use policy.
- **Standard** – Typical Daily Use @ 21°
  16hr heating of 75% of the house. Ample Hot Water for washing needs.
- **Basic** – Enough to maintain comfort.
  Sufficient for 8hrs Heating to 21° Enough Hot Water for routine.

Interventions – How much disruption are you willing to tolerate?

- **Nil** – We maintain current systems and replace when obsolete.
- **RetroFix** – Basic level interventions to reduce consumption
  Draught-proofing, wall & loft-insulation, obsolete component upgrade. (This is the intervention which has been reviewed quantitatively with the evaluation tool and is anticipated to account for the bulk of the business)
- **RetroPlus** – Whole house retrofit to a high standard.
  All areas highly insulated and convert to heat-pump
- **RetroMax** – Best in Class and Carbon Neutral. Includes renewables



| Energy Outcomes | Financial Overview |
|---|---|
| **Investment Required**<br>Low initial Capital: Hardware and Office Equipment.<br>Funding for Balance Sheet growth with investment in assets and retrofit.<br>Expert solution system development (Capex) or licencing (Opex):<br>• Detailed survey and data logging tool<br>• Energy use calculator based on property, occupancy and comfort level.<br>• Retrofit optimisation and costing model<br>Equipment manufacturer investment in reliable, capable componentry.<br>• This investment may be based on confidence in being preferred supplier to Energy Outcomes.<br>Website and on-line assessment tool: Customer engagement.<br>Start-up Lag: Up-front investment and timing is crucial for profitability:<br>Brand development and marketing<br>Partner selection: Capability assessment / partnership agreements<br>Legal framework preparation<br>Staff recruitment & training | **Revenue Assumptions**<br>Regular Consumer Payments: Wrapped into monthly charge<br>• Energy element: Current expenditure less expected savings.<br>• Capital repayment: Cost of retrofit and new equipment. Payments spread over a 5yr+ term.<br>• No consumer cost for Smart Data links<br>Single Payments:<br>Consumer up-front capital investment for retrofit measures, in order to reduce monthly repayment (could also be mid-term).<br>Balloon payment for early termination based on house sale.<br>Other Revenue:<br>Commission from Home Transformation retrofit partners.<br>Possible ECO funding or other grant income |
| **Potential Investors**<br>Current energy retail business with ambition to shift the current paradigm. (Big 6 or niche players)<br>Consumer brands capable of stretching to the home energy arena (M&S, Virgin, Direct Line)<br>Equipment and insulation product manufacturers to expand market and generate insight.<br>Specialist investors seeking a reliable return in infrastructure and driven by energy saving investments. | **Baseline Cost Assumptions**<br>New entity costs based on a 70,000 consumer business.<br>Pre-trading set-up costs & (2yrs) £2.1M Estimated<br>(of which approx. £1M Capital)<br>Marketing & brand development (pre-trading) £3.5M Benchmark<br><br>Fixed Opex: Management and Sales (per year) £1.0M Benchmark<br>Variable Opex: (£60 per customer) £4.2M Research<br>On-going marketing of consumer brand £3.5M Benchmark<br><br>Energy costs as per DECC assumptions.<br>Heat pump & Retrofit as per ESME assumptions. |

| Energy Outcomes | Legal Entities & Potential Partners | | | |
|---|---|---|---|---|
| **Legal Entities** | **Activities** | **Resources** | **Processes** | **Values** |
| **Energy Outcomes Ltd**<br>System designer and Integrator: Programme managing delivery and management of whole house energy solutions. | Consumer marketing and engagement with new ideas.<br>Household needs assessment, through smart data, historical use and personal interview.<br>House fabric energy loss survey<br>Retrofit and heating system design and customisation.<br>Clear offer preparation and appealing documentation.<br>Systems Integration: Identifying capable technology and delivery partners.<br>Identifying potential service and performance improvements and challenging the supply chain to deliver improved capability.<br>Access to sources of funding for household capital investment.<br>Remote system interrogation, review and optimisation.<br>Timely maintenance provision, linked with customer care.<br>Remote switching of household energy system and appliances. | Community retail footprint (to give confidence in transition)<br>On-line first-cut modelling tool – *What might I save?*<br>Locally engaged workforce with a detailed knowledge of system solutions and consumer behaviour.<br>Surveyors, equipment & IT.<br>System Modelling software or other tool.<br>Design tools and skills<br>**Energy modelling tool**: Critical to predicting / understanding consumer energy needs and underwriting the offer.<br>Robust pricing options model.<br>Remote Home Energy Control System. | Capability to identify high energy use candidate homes.<br>Rapid assessment of consumer needs from a potentially un-interested initial contact.<br>Preparation of an attractive and appealing initial offer.<br>Professional and authoritative site visit and survey.<br>Ability to refine system operating times / temperatures without adversely impacting household comfort. | Your comfort is our number one priority.<br>We are on your side to help you save energy and money in the medium and long-term.<br>We know our customers and want to help them get a better Energy Outcome<br>Technology enabled home improvement. |
| **Energy Partners Ltd**<br>The supplier of wholesale energy – generator or other market provider. | Provider of wholesale energy or direct from the Generator (including Community Energy)<br>Creative use of tariffs to make the best use of DSR. | Electrical power provision and gas supply through national networks. | Capability to develop new and innovative charging structures to encourage the reduction of system cost. | Reliable energy supply<br>Incremental system improvement. |

| **Energy Outcomes** | **Legal Entities & Potential Partners** | | | |
|---|---|---|---|---|
| **Legal Entities** | **Activities** | **Resources** | **Processes** | **Values** |
| **Smart Data IT Ltd** | Provision of the enabling data for optimising tariffs and interrogating individual homes.<br>Opportunity to upgrade soft/ firmware remotely and control appliances. | IT network architecture.<br>Access to consumer data<br>Connectivity to Outcomes IT systems: Both customer and corporate. | Data analytics capability to turn raw data into information.<br>Right-time data provision. | Integrity of consumer data protection.<br>Provider of enabling data. |
| **Home Transformation Ltd**<br>Liability for performance & lean delivery.<br>Framework retrofit provider | Retrofit and smart energy delivery.<br>Loft conversions and extensions combined or through trusted partners. | Scalable specialist retrofit and home improvement teams.<br>Customer care teams.<br>Plant and machinery. | Installation process excellence to minimise disruption.<br>Lean supply to minimise time.<br>Pre-prepared materials to eliminate waste and site debris<br>Keep customers in the loop | No more disruptive than having the carpets cleaned.<br>It doesn't feel like we've had the builders in – no hassle. |
| **Energy Saving Component Manufacturers:** Tier 1 product / material suppliers. | Develop and supply leading edge technology solutions to meet consumer needs.<br>Adapt products for improved reliability and reduced cost. | Leading materials and engineering capability.<br>Cross fertilisation of ideas from other technology markets. (aerospace / auto) | An innate capability to improve cost and technical performance.<br>An eye for consumer aesthetics in design. | Leading edge and constantly improving technology.<br>Our goal is to reduce whole system cost. |
| Electricity Network Partners Ltd | Local Electricity DNO | Local electrical network with known capacity and characteristics. | Capability to offer incentives for effective DSR | Always available supply.<br>Better to be safe than sorry. |
| **Residential Maintenance Management Ltd;** Home asset care and consumer support. (linked to Home transformation ltd?) | Domestic system maintenance and repair.<br>Customer care and further education. | Consumer friendly repair and maintenance teams.<br>Professionally equipped.<br>Call centre and remote diagnostics. | Fast, efficient and consumer-focused maintenance & repair<br>Ability to up-sell appropriate benefits to householders | You'll always be warm with us.<br>With you in minutes if need be. |

| Energy Outcomes | Combined Option: Energy Outcomes & Additional Storage |
|---|---|

## Energy Outcomes Base Case

The business model provides differing levels of intervention depending on the current household fabric and the occupant / owners appetite for retrofit. Where a heat-pump is specified it includes sufficient heat storage to make the heat pump technically viable

The evaluation tool provides modelling for three offers: (1) Home insulation only, (2) Home insulation with a heat-pump, (3) Heat-pump installation only.

## Energy Outcomes With (Additional) Storage

Storage adds value where a property is subject to variable electricity pricing; as with current Economy 7 tariffs and more sophisticated Time of Use (ToU) tariffs likely to be offered in future. Consumers shifting their usage from peak to off-peak periods reduce their price per unit of energy: This is DSR.

Current Economy 7 rates require approximately 40% of electrical load to be off-peak to be cost neutral vs. single rate electricity tariffs. Even at 100% off peak costs are higher than gas heating equivalent. Under future energy scenarios (high nuclear and intermittent renewables) the price differential is likely to increase.

The **Business Case** incorporating additional home battery or heat storage technology takes advantage of differential electricity pricing by storing energy as follows:

1. **Heat** storage is likely to be in the form of a much larger hot water tank, but thermal mass and phase change material heat storage is also viable. This enables a domestic heat-pump to avoid operation at periods of peak pricing, although this may also require a larger capacity pump with capex implications.
2. **Electrical** storage using a battery or equivalent gives the energy outcomes provider the flexibility to store off peak power in the home for later use in the home and potentially to export to the grid at times of peak pricing.

It may not be viable for the System Operator to trade with individual households, so Energy Outcomes providers add value by offering a pool of DSR enabled by smart data. As the providers learn more about the behaviour of their consumers; the pool of tradable capacity is likely to increase. To be viable: **Storage Revenue or saving ≥ Cost of energy stored ÷ conversion efficiency + Amortised cost of the battery + cost to trade.**

**Sensitivities** which will impact the decision to incorporate storage

- Cost and efficiency of storage technology
- Increasing Time of Use Pricing Differentials
- Access to export trading tariffs
- Cost to trade
- Capability for Outcomes provider to manage storage remotely
- Current prime heat source and its anticipated operating life.

**Balancing Consumer Requirements.** The Energy Outcomes provider has three approaches to balance to meet consumer needs:

**Leadtime:** The consumer may be required to wait for the heat they require (some may choose this for reduced cost, but not considered a mass market solution)

**Capacity:** The outcomes provider installs sufficient capacity to deliver consumer needs on demand, but with the cost of a high capacity heat-pump or boiler.

**Storage:** The provider stores energy in a format that can be instantly converted into the comfort the consumer values (heat or responsive electrical systems).

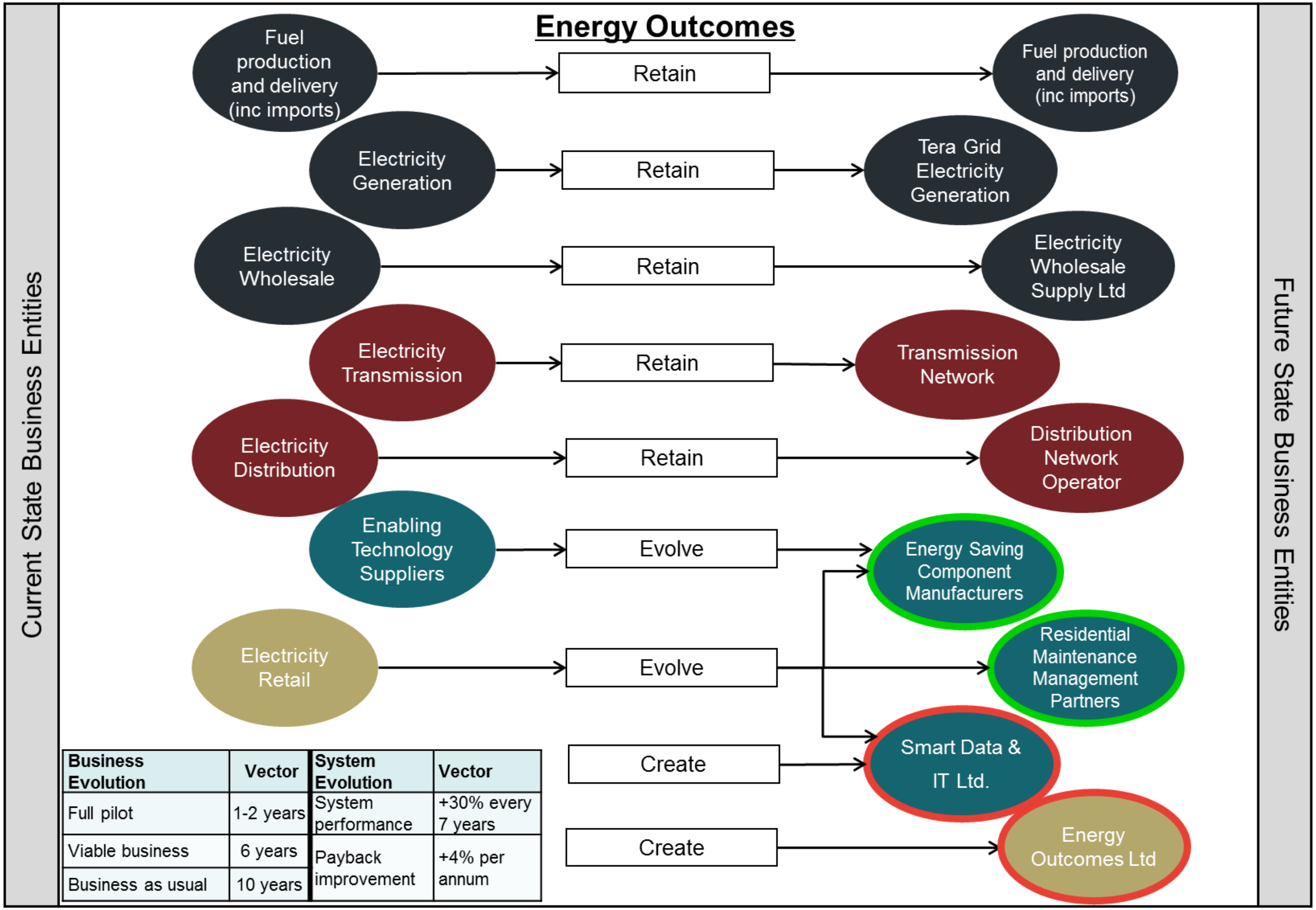
## Consumer Impacts

Consumers opting for Energy Outcomes are unlikely to be interested in the mechanisms of how the benefits they seek are provided. If storage is incorporated in the Energy Outcomes solution they want the minimum sacrifices (loss of space, disruption, operating hassle, cost to switch at the end of contract), but may be willing to offset some of these for a lower monthly cost of energy provision.

In operation the Energy Outcomes provider must make the use of storage virtually invisible to the consumer; using Smart connections to manage it.
If the storage asset has a value beyond the term of the Energy Outcomes contract a clear mechanism is needed to remove it or transfer ownership

| **Energy Outcomes** | **Business Entity Transtion Paths** |
|---|---|

The following diagram shows how the Energy Outcomes business model will develop from evolved existing businesses and new commercial entities:




| **Business Evolution** | **Vector** | **System Evolution** | **Vector** |
|---|---|---|---|
| Full pilot | 1-2 years | System performance | +30% every 7 years |
| Viable business | 6 years | Payback improvement | +4% per annum |
| Business as usual | 10 years | | |

| **Energy Outcomes** | **Key Transition Challenges** |
| --- | --- |
| **Overview** | • System integrators and value chain partners will need to develop the ability to maximise profits whilst minimising energy usage.<br>• Systems integrators will need to take a holistic and strategic whole-systems perspective to performance and consumer engagement, enabling first tier component suppliers to focus on performance, target cost and robust engineered solutions.<br>• Pricing structures and commercial value must be sufficiently attractive for consumers to hand over control. Additional encouragement may be needed for early adopters (e.g. through integrators taking on additional risk to generate consumer confidence).<br>• Consumer attitudes and beliefs need to be developed through education and engagement, including overcoming perceived loss of control and the ability to make immediate changes; new branding and appeal need to be created.<br>• Value chain partners need to adopt new attitudes to managing risks: fuel price risk for long-term fixed price contracts; performance of retrofit technology solutions (e.g. insulation); consumer behaviour risk (e.g. embracing new energy management attitudes). |
| **Activities** | • Design of a system solution with Energy Outcomes taking the role of a Systems Integrator. Equivalent to the Original Equipment Manufacturer in consumer goods (eg: Dell who bring together many components to make a computer, but make very few).<br>• Creating a robust supply chain to deliver the components for the new systems.<br>• Remote control of energy management in consumer homes may require new regulation/controls for consumer protection.<br>• Low cost and minimal disruption home installation retrofits will be required. |
| **Resources** | • Creating or evolving an OEM energy retailer willing to take on the challenge of selling comfort instead of consumption.<br>• Development of the robust energy modelling tools and skills needed to understand and predict consumer energy requirements and underwrite the offer.<br>• Creation of a remote-control home energy system with the ability to change operating temperatures whilst not adversely impacting consumer comfort.<br>• Forming and training a locally engaged workforce with detailed knowledge of the system solution and consumer behaviour.<br>• Development of brand-consistent capability within retrofit partners. |
| **Processes** | • Systems integrators will need system design and integration capabilities; either by leveraging these in existing OEMs or creating them in new entrants.<br>• Creating the ability to survey properties and use the results to create an attractive and appealing consumer offer based on a quick and accurate assessment of their needs.<br>• Creation of remote control technology and systems management solution.<br>• Creating call centre capability to reassure and offer energy management advice in contrast to the traditional hard sales. |
| **Values** | • The concept and pragmatic management/enforcement of “fair usage” needs to be developed.<br>• Extensive programme of consumer education will be needed to help engagement and generate trust in new ideas.<br>• Overcoming current generally low consumer understanding and intimacy in the industry.<br>• Alignment of value chain partners and consumers to commit to a journey of energy reduction without a unsustainable loss of comfort. |

| **Energy Outcomes** | **Transition Challenges: Activities, Resources, Processes & Values** | |
|---|---|---|
| **New Organisation** | **Capabilities existing in current businesses** | **Capabilities requiring enhancement or creation** |
| **Primary Business Vehicle: Energy Outcomes Ltd** | 3. | • Design of integrated energy delivery and control systems intended to minimise consumption whilst maintaining comfort<br>• Consumer intimacy; understanding their needs and usage patterns<br>• Consumer education to encourage adoption of new ideas<br>• Locally engaged workforce able to develop and sell solutions<br>• Consumer needs assessments, house fabric energy loss survey and clear/compelling offer preparation<br>• Energy system modelling software or other tools<br>• Retrofit heating system design and customisation skills<br>• Remote system interrogation, review and optimisation<br>• Remote switching of household energy system and appliances with ability to refines operating times/temperatures |
| **Energy Saving Component Manufacturers** | • Network of independent component manufacturers to build upon. | • Automotive-standard supply chain with robust product engineering, low cycle times, design to target cost, performance, warranty, etc. |
| **Energy Partners Ltd** | • Electrical power provision and gas supply through national networks | • Creative use of tariffs to make best use of DSR<br>• Capability to develop new and innovative charging structures to encourage the reduction of system cost |
| **Electricity Network Partners Ltd** | • Local electricity DNOs | • Capability to offer incentives for effective DSR |
| **Smart Data IT Ltd** | • Consumer data management and protection | • IT network architecture and access to consumer data, with connectivity to Energy Outcomes IT systems<br>• Data analytics capability to turn raw data into information |
| **Home Transformation Ltd** | • Local specialist contractor base to build upon | • Scalable specialist retrofit and home improvement teams<br>• Certification or franchise of retrofit teams with brand-consistent values and behaviours<br>• Installation process excellence to minimise disruption time and hassle to the consumer |
| **Residential Maintenance Management Partners Ltd** | 4. | • Call centre and remote diagnostics<br>• Fast, efficient consumer-focussed R&M teams |

| **Energy Outcomes** | **Transition Challenges and Enabling Policy** | |
|---|---|---|
| **Challenge** | **Business Model Responses** | **Policy and Regulatory Response** |
| **Ofgem plans to limit the range of tariffs that energy retailers can offer households** | **Goal**: Demonstrate the simplicity of payment plans to be offered and the benefits each gives consumers.<br>**Activities**: Cross industry providers work together to give common formats of tariff which are clear and straightforward for consumers to compare.<br>Contracts could be developed which separate the investment payback from energy tariff. | **Goal**: Avoid regulation which inadvertently disadvantages a business model which drives reduction of energy use.<br>**Policy enabler**. Granting an exemption to the Energy Outcomes business model provider to remove the barrier posed by Ofgem's proposed restrictions on tariffs. Based on the business model provider offering a bespoke service over and above electricity and gas supply, requiring more differentiated pricing between different households. |
| **The business model provider may face constraints on its ability to contract with new owners when existing customers move home.** | **Goal**: Create market confidence in multi-year outcomes based contracts.<br>**Activities**: Pre-empt the mid-contract house sale with clear and transparent options for householders to pass on contracts with little risk to the buyer, a balloon payment, or with an insurance backed transfer option. | **Goal**: Make taking on an outcomes contract as easy as for current per kWh energy supply.<br>**Policy enabler**: The Green Deal includes a requirement that the owner discloses Green Deal details on their building before selling. Government support for a similar legal requirement with respect to the Energy Outcome model would help address this barrier<br>**Additional support**: Clarity on Green Deal and Energy Outcomes based home improvement assets from the property conveyancing profession would support this. |
| **Partnering between the Energy Outcomes business model provider and developers of new properties may not be profitable**. | **Goal**: Establish market confidence in multi-year Energy Outcomes contracts.<br>**Activities**: Make use of consumers 'stickiness' to their utility provider by gaining market share through new development. Offering developers a stake if the energy saving upside. | **Goal**: To support consumer choice to switch provider, without penalising multi-year outcomes contracts.<br>**Policy enabler:** Commercially, through providing information on the benefits of the Energy Outcomes model to encourage high customer retention<br>**Additional support:** Ofgem approved contract formats with a "Kite Mark" logo would increase market confidence. |

| Energy Outcomes | Phase 2 Trial: Hypotheses & Pathfinder Opportunities |
|---|---|

## Hypotheses to test

**Demand for Energy Outcomes can be generated with investment in demonstration homes backed by a visible consumer brand.**

However appealing the idea of paying for comfort; consumers will want to see, touch and experiment with an Energy Outcomes home before they sign up.

Consumers want a trusted partner to contract with for such a fundamental change to the way they pay for their domestic warmth and hot water.

**Whole House Retrofit will appeal to consumers if it is an affordable energy saving solution with an aesthetic home improvement appeal.**

Few consumers' investment decisions are energy led today; the Energy Outcomes appeal needs to combine saving with value adding aesthetics and style.

Overcoming the sacrifices they make for current home improvement (disruption, negotiating contracts, cost over-runs) will accelerate the growth in demand.

**Current energy value chain partners are attracted to the business opportunity that Energy Outcomes represents.**

Current partners can develop, or build partnerships to attract, a world class systems engineering capability capable of designing residential energy systems to target performance and cost. Successfully engaging those technology leaders able to drive performance and cost improvement sustainably.

Current partners perceive that the long-term market opportunity outweighs the short term risk of fuel price volatility.

## Pathfinder Projects for Phase 2 trial

**Attract and build potentially competing, branded Energy Outcomes partnerships.**

Select partners with a relevant consumer brand and corporate values which fit the Energy Outcomes ethos (corporate, charitable, government)

Establish financial and brand expectations from their association and other drivers including risks and exit.

**Build best practice demonstration systems solutions from the best of the residential heating, automotive, office air conditioning sectors**

Invite current value chain partners from different sectors investing in thermal efficiency to create their best whole house solution from existing technology and compare and contrast performance.

Execute through life trials for target cost of design, install and through life operation.

**Testing consumer appetite for Energy Outcomes and brand propositions.**

- Test consumer's appetite for outcome based contracts.
- Test consumer's appetite for Energy Outcomes branding e.g. M&S, Audi, Virgin, E-On, EDF Energy Siemens, Local Authorities…etc

**Develop a Smart Systems and Heat Energy Outcomes retail offer and trial all aspects of performance across Phase 2 sites**.

Market test the Energy Outcomes offer based on previous retrofit costs and energy savings.

Develop comfort options: eg: Unlimited, Standard, Basic.  Develop the commercial terms for the Energy Outcomes offer.

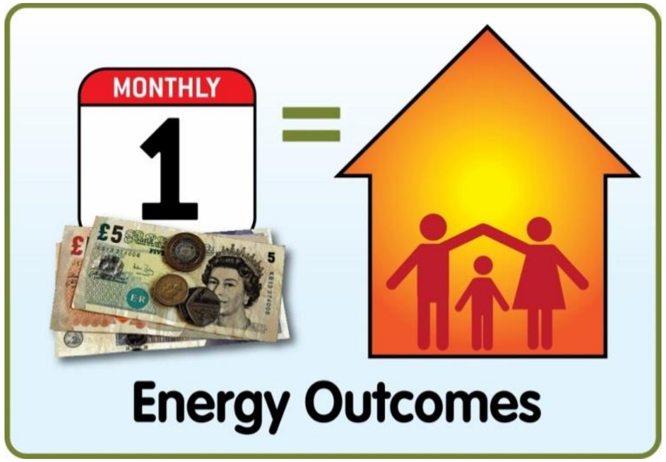
Set a target cost and technical performance requirement for the retrofit and Smart Data delivery.

Develop stock model of the trial area to asses technical challenges an tenure mix.  Identify and secure show-home properties with the Local Authority.

Refine technical offerings – Good, Better, Best. Include consumer added value options to tip the sale – Decoration, landscaping, loft clearance.

Scale up delivery capability – Supply chain contracts – Installation teams of 4 with central technical resource.

## Energy Outcomes Supporting Pages



| **Energy Outcomes** | **Target Markets** | |
|---|---|---|
| **Target Consumer Group** | **The Appeal – Market USP** | **Potential Triggers to Buy** |
| **Stretched Pensioners**<br>1.72M Core 2.2M Extended group | Reliable warmth and comfort, system managed by others.<br>Monthly payment and no system repair / replacement risk. | Instigated by social landlord. Owners at, or close to, the point of system failure looking to spread the cost and risk. |
| **Older Established**<br>0.99M Core 1.7M Extended group | An opportunity to pass the management of an unappealing system to others while giving future cost certainty and reduced personal hassle. Shows others I am saving energy. | The point at which there is recognition that home insulation and/or heating system need investment. Matched with a credible organisation with a compelling offer. |
| **Busy Comfortable Family**<br>0.65M Core 2.73M Extended | Reliable heat for family comfort with the transition and day to day operation managed by others, plus the removal of concerns about repair and replacement cost. | An affordable monthly payment alternative to a current or approaching high capital replacement cost. A means of getting an improved system performance without the hassle. |
| **Transitional Retirees**<br>0.4M Core 0.75M Extended group | Greater cost certainty and a reliable system managed by others.<br>Removing the risk of capital cost of system replacement. | Concern that current system is about to fail (or has done so). An affordable offer which is worth paying to improve the home and remove the burden of maintenance and repair. |
| **Middle Grounders**<br>0.7M Core 1.79M Extended group | A reliable heating system which requires no up-front capital, with payment options which can flex to my changing needs. | An affordable monthly payment alternative to a current or looming high capital replacement cost.<br>Alternatively instigated by my landlord. |
| **Green Renters**<br>0.21M Core 1.4M Extended group | A more reliable heat system which makes me less dependent on my landlord responding quickly to problems.<br>Better heat provision than currently provided. | Not my decision but I will lobby my landlord for a better system if the price is acceptable. Or I select my next rental property based on its Outcome based heating provision. |
| **Private Landlord**<br>1.48M Landlords.<br>3.6M Eng 4.4M UK Households | A reliable low maintenance option which reduces my exposure to the cost and hassle of system failure or tenant complaints. Being recognised for contributing to the community. An attractor for quality tenants. | A compelling business case to improve the yield for one or more properties. Part of a property / portfolio pathway. Current systems approaching the end of their useful life. Changes in legislation for landlords. |
| **Social Landlord**<br>2000 Landlords<br>3.8M Eng - 4.6M UK Households | An offer of a low-risk turnkey investment to give low maintenance energy provision. Reducing my exposure to the cost and hassle of system failure and maintenance cost, whilst giving tenants improved comfort. | Compelling business case with options to split the payments with tenants.<br>Changes in legislation for landlords. |

| **Energy Outcomes** | **Target Markets** | |
|---|---|---|
| | **Value Proposition Considerations** | |
| **Target Consumer Group** | **Benefits Householders *Enjoy* Today That Must Be Preserved** | **Sacrifices Householders *Endure* Today That we Must Overcome** |
| Stretched Pensioners | Time rich. (Potentially asset rich for some Stretched Owners).<br>Flexibility to adjust their behaviour to gain a financial advantage.<br>Fixed levelled income. | Seasonal energy costs (particularly for the vulnerable on pre-pay).<br>Fear of system failure. ( For Owners: system maintenance cost)<br>Cash poor: Possibly making a choice between warmth and food. |
| Older Established | Available disposable income.<br>Willingness to invest in property. | Resentment over paying the rising costs of energy. |
| Busy Comfortable Family | Instantaneous and unlimited hot water and heat. | Concerns over current and future affordability. |
| Transitional Retirees | Some savings with a willingness to invest available funds. | Difficult to optimise energy costs and to know what is best for us.<br>Fear of energy prices outstripping our retirement income. |
| Middle Grounders | An ability to make informed choices.<br>Access to information online. | Ignorance of energy market options and a feeling that there is little I can do to keep bills low without making sacrifices. |
| Green Renters | Instant response at irregular times. | Too difficult and time consuming to work out how to reduce bills.<br>No phone app to enable system to be controlled or optimised. |
| Private Landlord | Tenants pay the energy bill. | Landlord needs to co-ordinate trades and tenants to fix breakdowns and system underperformance; which may be the fault of the tenant. |
| Social Landlord | Below retail pricing from bulk energy purchase. | Landlord carries a heavy administrative burden and cost to manage tenant energy systems. |

| **Energy Outcomes** | **Which of the 6 Core Value Propositions Can This Business Model Offer?** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Attractiveness of Each Proposition to Each Market** | | | | | | | |
| **Additional Value Propositions** | **Older Owners** | | **Middle Owners** | | **Renters** | | **Landlords** | |
| | **Older Established** | **Transit. Retirees** | **Busy Families** | **Middle Ground** | **Stretched Pension** | **Young Green** | **Social** | **Private** |
| Pure Comfort: Fixed future pricing for the term; we manage your fuel and outcomes (as a fixed mortgage) | Better | Better | Good | Better | BEST if affordable | Good | Better vulnerable tenants | BEST if passed to tenant |
| Custom Comfort – Tariffs tailored to provide differing comfort levels and suit householder attitude to risk. | BEST | | Better | Good | | | | |
| Property Pathway – Link your energy system solution with a planned home upgrade (extension / rebuild) | Good | Better | BEST | Good | | | BEST | Better |
| Use Less – If you achieve more savings than anticipated we will share the benefits | Better | BEST | Good | BEST | | | | |
| Use Less – Try a lower level tariff you may be surprised how little you need now. | Good | Better | Good | Better | | BEST | | |
| Extra Comfort Passport – Turn comfort level up /down for pre-arranged cost (visit of relatives, period of home-working or other demand change). | Better | | Better | | | | | |
| Outlook Calendar Credit and Charge – See the saving from hibernating heating (while on holiday) and cost of boosting the system in other periods. | Good | | Good | Better | | Better | | |
| Shift demand – Our system makes the best use of renewable energy on your behalf while you sleep. | Good | Good | | | | Better | | Good |

| **Energy Outcomes** | **Which of the 6 Core Value Propositions Can This Business Model Offer?** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Attractiveness of Each Proposition to Each Market** | | | | | | | |
| **Additional Value Propositions** | **Older Owners** | | **Middle Owners** | | **Renters** | | **Landlords** | |
| | Older Established | Transit. Retirees | Busy Families | Middle Ground | Stretched Pension | Young Green | Social | Private |
| Shift demand – For a modest change in your usage patterns we can reduce your costs further. | | Good | | | Good | Good | | |
| Shift demand – Consistently use Less at peak times, and / or in total, and you receive a rebate. | Good | | | Better | | Better | | |
| Reduce future monthly payments by overpaying if you have spare funds available (Offset mortgage model). | Good | | Good | | | | | |
| Trading Spaces – If you have the resources you could export to your neighbours. (space for renewables) | Good | | | | | | Good | Good |
| Overdraft Charging – Premium pricing for unplanned excess usage – softened for arranged 'overheat' | May not be appealing to the consumer groups, but 'close to limit' advisory notes and warnings of potential penalties will encourage shifts in behaviour, or at least discussion. | | | | | | | |

## Energy Outcomes — Strategic Risk Analysis

### Supplier Pressure

Data Network Partner: No Alternative

- Unwarranted price hikes in the cost of data provision.
- Inability to enable 2-way control of hardware.

Wholesale Energy Suppliers:

- Wholesale market: Failure to make available long-term fixed price contracts could undermine the Energy Outcomes business model.

Retrofit Delivery Partners:

- Retrofit delivery partners unable to achieve anticipated energy reductions.
- Vendor withdraws / becomes insolvent.
- Vendor demands unwarranted price rise.

### Risk of New Entrants

Medium entry barriers: Expert system & brand.

New business taken by a high profile brand:

- New Player eg: Google's success over Yahoo.
- Extended Brand: M&S retrofit.

Low during the asset / retrofit amortisation period (unless incumbent fails on performance)

Easier to dislodge at end of initial term.

- Competition for the follow-on offer

Disruptive Low Cost Entrant as the market matures:

- Retrofit equivalent of EasyJet offer.

### Competitive Pressure

National Players Cross-subsidise with balance sheet mass, to defeat a disruptive proposition.

- Eg: Offering may not be as comprehensive but scale means they can survive a price war longer.
- Short-term, aggressive switching incentives.
- Regulator succumbs to pressure to penalise outcomes tariffs.

### Substitution of Products

Alternative Community Heat offering

- Correctly branded may appeal more, or the offer may include an outcomes based offer.

New disruptive heat technology

- May make the primary Heat source redundant, but the outcomes solution should still appeal.

### Customer Pressure

Customer dissatisfaction looking for early exit:

- Outcomes solutions do not live up to expectations. I'm not as warm as I expected. There is not enough hot water. I am being surcharged for what I wanted included.
- Prices continue to rise, albeit slower than for those without interventions.

Negative Press:

- Consumer death attributed to an Energy Outcomes based contract.
- Increasing levels for fuel poverty.
- Trip Advisor Effect of negative reviews.
- Sensationalist press coverage.
- 'Energy Outcomes ruined my home'.

| **Energy Outcomes** | **Future Proofing & The Assessment of Risk** | | | |
|---|---|---|---|---|
| **Description of Strategic Risk** | **Impact** | **Likelihood** | **Rating** | **Mitigation** |
| Multiple system underperformance:<br>Solutions do not perform Technically<br>Consumer behaviour confounds payment plans: Unanticipated consequences.<br>Consumer system or contract abuse (damage to equipment or failure to meet agreed usage terms). | Medium<br>V. High if unchecked | Possible | Serious | Technical: Close monitoring of system performance in trials to minimise the risk of consumer dissatisfaction and cost/revenue mis-match.<br>Behaviour: Explore possible behaviour when offered ‘unlimited’ use plans (experience from mobile phones). Clarity of Fair Use Tariff. *Avoid mis-alignment of consumer expectations of disruption* |
| Catastrophic loss of consumer confidence | V. High | Possible | Serious | Contingency planning for negative press coverage and rapid response to individual consumers raising concerns. Be prepared to in invest in maintaining market goodwill. |
| Energy Saving Component manufacturers do not engage with Energy Outcomes, because of a lack of a clear market. | Medium | Possible | Manageable | Early engagement with likely technology providers to understand investment criteria. Seek policy support for technology development or market certainty. |
| Delivery Partner Quality failure, insolvency or withdrawal. | V. High | Possible | Serious | As above and additionally dual source delivery capability to mitigate the risk major of brand damage arising from one failing provider. |
| Lack of balance sheet mass to cope with short term pressure. Competitive / cash-flow | Medium | Possible | Serious | Small innovative technology start-ups with larger industrial businesses ready to invest and scale the solutions. |
| Lack of ability to manage long-term wholesale price risk cost-effectively. | Extreme | Possible | Serious | Vertical integration or other effective hedging strategy. |
| The market does not recognise the value from capital replacement costs spread over a 5yr+ period. | V.High | Likely | Serious | Clear worked examples of cost and payback.<br>Continual striving for Design to Target Cost to meet market expectations of monthly system costs. Ensure that aesthetics and branding of solutions give added appeal. |

| Risk Priority | | | |
|---|---|---|---|
| **Impact** | **Likelihood** | **Rating** | **Mitigation** |
| Extreme | Certain | Acceptable | 0-4 |
| V. High | Likely | Manageable | 5-8 |
| Medium | Possible | Serious | 9-25 |
| Low | Unlikely | | |
| Negligible | Rare | | |

| **Energy Outcomes** | **Products and Services Supplied to the Primary Business Vehicle Outside of Strategic Value Chain Partners** | | |
|---|---|---|---|
| Pre Sale | Point of Sale | Through Life | Disposal |
| Website provision and on-line marketing presence.<br>Lead generation for Prospect Households (by geography).<br>Heat map data to identify high energy users.<br>Intelligence of borough initiatives which encourage energy saving – link to community initiatives.<br>Local planning insight (listed buildings, conservation areas).<br>Retrofit “show homes” in target locations. | Conversion, fit out and branding of retail footprint in line with a regional roll-out plan. Franchise?<br>Recruitment and training of business vehicle staff.<br>Technical solutions central hub<br>Regional survey and customer facing teams | Billing and cash collection<br>System review and new assessment:<br>Unpredicted behaviour<br>Better solution<br>Outcomes Assured Lloyds of London backed system warranty as an option to share risk. | Removal of redundant assets. |

| **Energy Outcomes** | **Whose Business Is the Emergence of Energy Outcomes Going to Affect Substantially?** | |
|---|---|---|
| | **Likely to Impact Positively** | **Likely to Impact Negatively** |
| Tera Grid Level | Aggregated DSR reduces System Operator balancing requirement.<br>Reduction in peak electrical demand on the Grid will offset the natural growth in demand to defer Transmission Network upgrade, and reduce the pressure for 'fast build' generation capacity (dash for gas) to bridge with long-term sustainable capacity. | Electricity retailers lose market share unless they become the Energy Outcome providers or a wholesale power partner. |
| Macro City Level | Reduced Electrical peak and total loads at DNO level to postpone distribution system upgrade. | |
| Mini Community Level | Retrofit delivery partners for upgrade and extension of domestic properties.<br>Property Pathways give opportunities for future upgrade business. | Reduced growth in turnover for utility capital contracting businesses. |
| Nano Domestic Level | Metering & Management Partners: Regular service and optimisation work, planned and scheduled with less emergency call-out. | Reduced market share for existing Heating Engineers |
| Energy Supply Chain | Greater predictability and stability of electricity network load as more consumers shift to outcome based energy demand. | National domestic energy retailers will be impacted with a realignment of market share, with some losers. |
| External Supply | Greatly increased take up of smart control systems and data provision.<br>Market growth for Heat Pumps in suitable locations.<br>Increased demand for retrofit materials and integrated solutions.<br>Demand for space-saving heat and water storage solutions.<br>Potential demand for domestic electrical storage capacity. | Reduced demand for domestic gas boilers. |

## 15.2 Energy Mutual

# Business Model Assessment

Energy Mutual- A brokerage enabling households unable or unwilling to invest, to access finance for energy saving improvement.
A mechanism for overcoming householders' inertia to take energy saving action; by developing a compelling business case they or others can invest in.
A web-based trading platform which enables the matching of borrowers with lenders and investors with investment opportunities.

## Partners

**Retrofit & Smart Data Installation Partners Ltd.** Trusted property assessment and delivery partner.

**Safe and Secure Online Payment Partners Limited.** The mechanism for parties to transact.

**Web based Trading Partners Limited.** The brokering tool provider.

**Community Mutual Matching Association** A special interest group to match the Energy Mutual brand and offers with a target market.

**Energy Retailer Ltd.** (Bulk purchase of energy)

## Key Activities and Resources

### Activities

Brokering deals between investors, borrowers and households for energy system improvement.

Inspiring those with potential to improve their energy costs.

Attracting quality investors & high saving retrofit projects.

Unbeatable transaction speed, cost & transparency

### Resources

Strong first to market brand advantage (Ebay / Paypal).

Trading platform and transactional security

High calibre customer service team to explain technical solutions and financial offers.

## Consumer Value Proposition

A branded web-led proposition engaging households, investors and installers on an energy saving journey;

Offers households a clear path to both finance and technical `.

Offers households unwilling or unable to invest to trade their business case to other investors.

A unique web based portal to match energy investors and energy borrowers cheaply, quickly and transparently.

Corporate borrowers may use loans to invest in 3rd party projects. (rent-a-roof)

**"Enabling Investment in all our tomorrows".**

## Relationship and Channels

### Relationship

Respected and valued by borrowers and investors for its clear social purpose.

Acclaimed by consumer champions & money-saving gurus.

Portal for locating approved and reputable vendors.

Great source of advice even without the funding.

### Channels

Web based portal.

Linked to and embedded in provider, government and social enterprise web sites.

Community Group 'Shops'.

Regular media exposure.

## Customers and Market Share

### Customers

**Investors:**

Individuals / Communities.

Charities, Local or National Government, Pensions.

Installers / manufacturers.

**Borrowers:**

Householders, Landlords. Housing / School Trustees, Retrofit businesses.

### Market Share

Removes the financial barrier to householders taking up retrofit, but, requires delivery excellence to grow successfully.

## Costs

**Start-up : Gaining licence to trade. Brand building.**

**CAPEX**: Integration of off the shelf trading and online transaction vehicles.

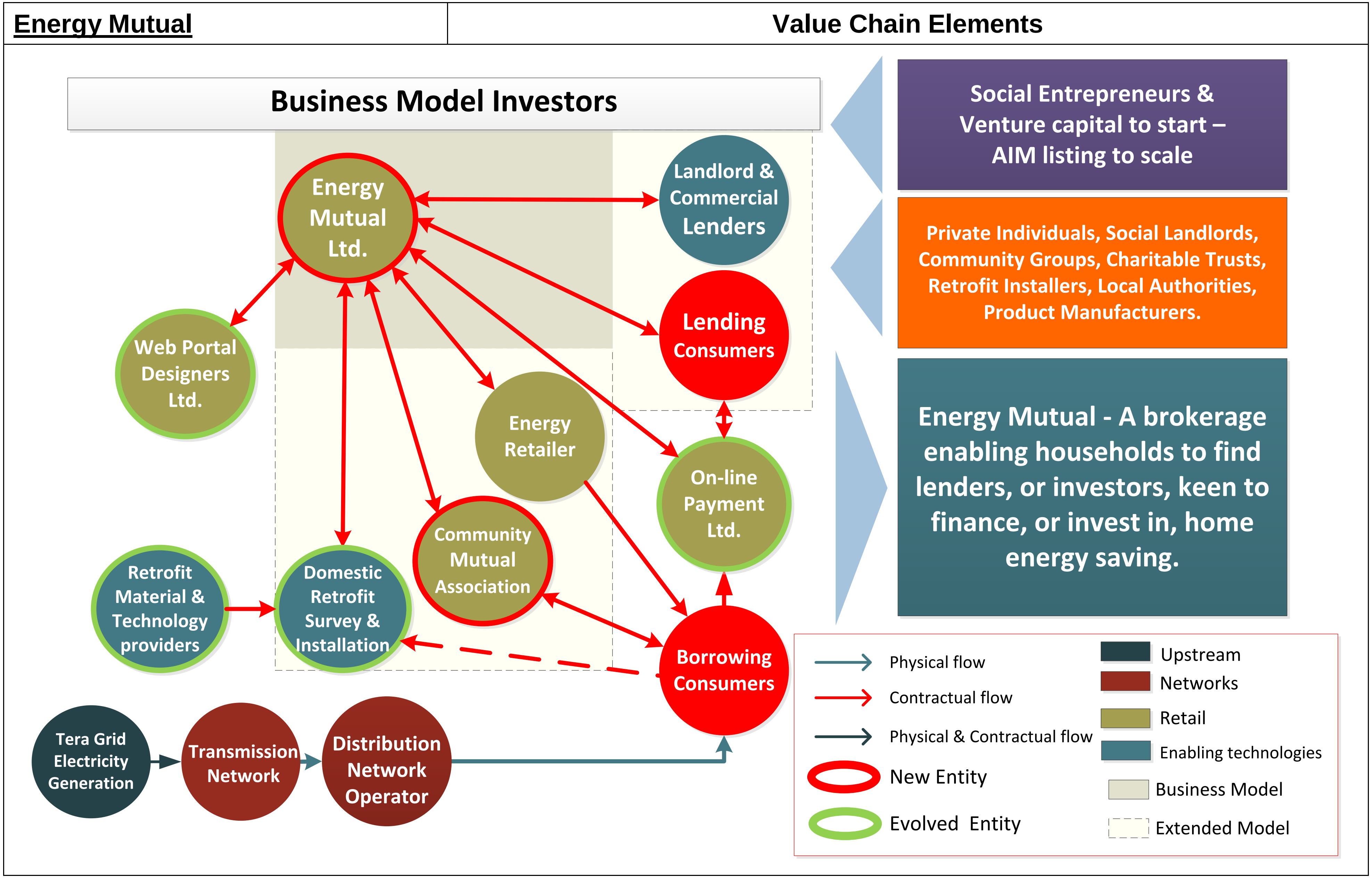
**OPEX**: On-going marketing to consumers, partners and institutional investors

## Revenues

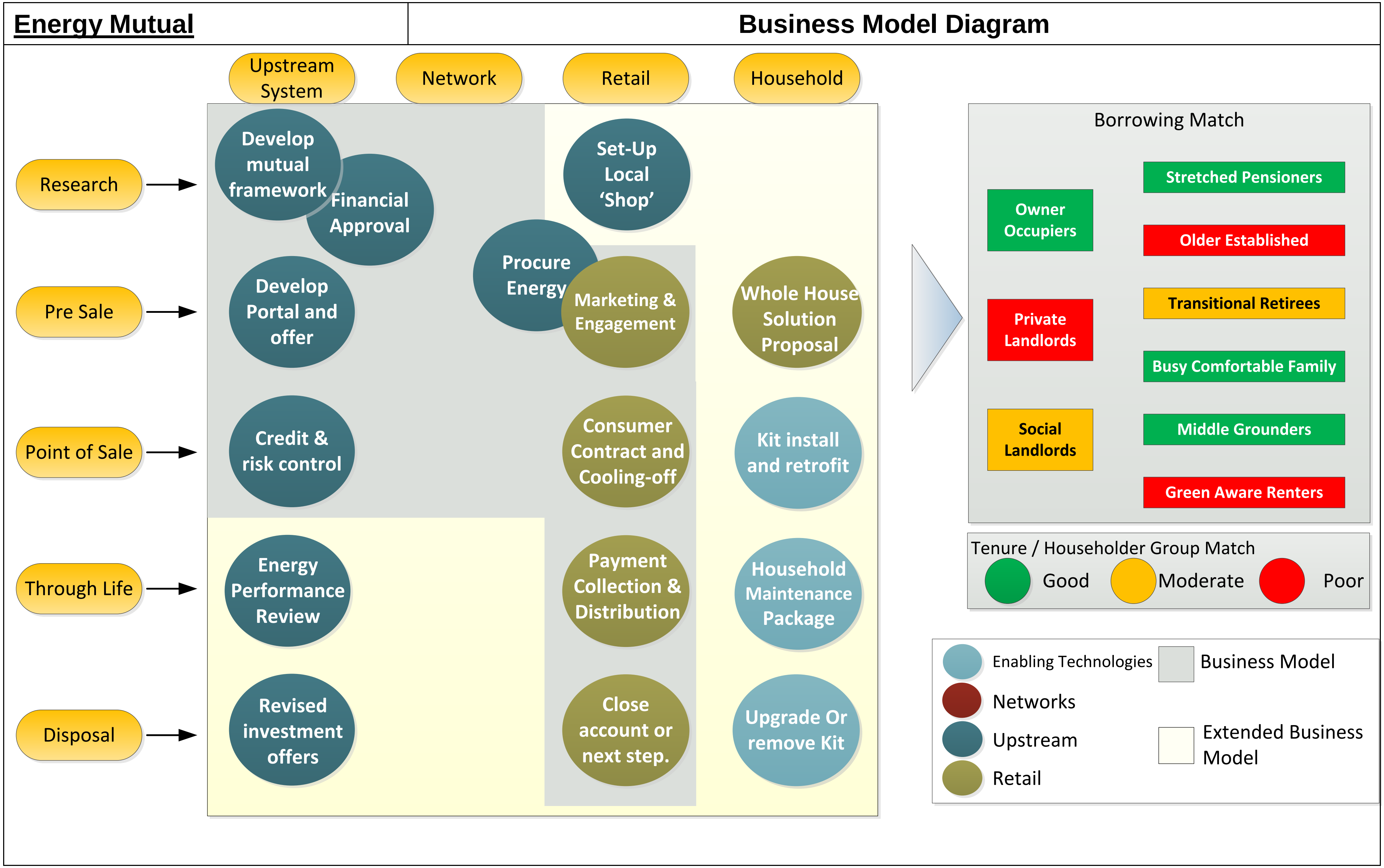
Fixed or % price per trade for borrowers and investors.

Commission from Retrofit Installation team for each Mutual matched contract.

Potential for web based advertising.



Energy Mutual
Value Chain Elements
Business Model Investors
Energy Mutual Ltd.
Landlord & Commercial Lenders
Lending Consumers
Web Portal Designers Ltd.
Energy Retailer
On-line Payment Ltd.
Community Mutual Association
Retrofit Material & Technology providers
Domestic Retrofit Survey & Installation
Borrowing Consumers
Tera Grid Electricity Generation
Transmission Network
Distribution Network Operator
Social Entrepreneurs & Venture capital to start – AIM listing to scale
Private Individuals, Social Landlords, Community Groups, Charitable Trusts, Retrofit Installers, Local Authorities, Product Manufacturers.
Energy Mutual - A brokerage enabling households to find lenders, or investors, keen to finance, or invest in, home energy saving.
Physical flow
Contractual flow
Physical & Contractual flow
New Entity
Evolved Entity
Upstream
Networks
Retail
Enabling technologies
Business Model
Extended Model



Energy Mutual
Business Model Diagram
Upstream System
Network
Retail
Household
Research
Pre Sale
Point of Sale
Through Life
Disposal
Develop mutual framework
Financial Approval
Set-Up Local 'Shop'
Procure Energy
Marketing & Engagement
Develop Portal and offer
Whole House Solution Proposal
Credit & risk control
Consumer Contract and Cooling-off
Kit install and retrofit
Energy Performance Review
Payment Collection & Distribution
Household Maintenance Package
Revised investment offers
Close account or next step.
Upgrade Or remove Kit
Borrowing Match
Owner Occupiers
Stretched Pensioners
Older Established
Private Landlords
Transitional Retirees
Busy Comfortable Family
Social Landlords
Middle Grounders
Green Aware Renters
Tenure / Householder Group Match
Good
Moderate
Poor
Enabling Technologies
Business Model
Networks
Upstream
Extended Business Model
Retail

| **Energy Mutual** | **The Business Idea** |
|---|---|
| **The Idea** | A Mechanism for Energy Investment Brokerage: matching those with a compelling business case with investors.<br>This business provides a platform/brokerage that matches those willing to invest in energy saving with secure competitive sources of funding and expertise. Those who are unable (savings or credit worthiness), or unwilling to invest themselves, but whose property and energy usage offer a strong business case for intervention, are matched with investors who want to make a socially responsible investment for a return. As a social investor they may be willing to accept a rate of financial return that is lower than the general market rate, or be motivated by non-financial returns e.g. charitable donations, carbon offsetting, community investment etc.<br>The business case is developed via a survey from an expert partner, introduced by Energy Mutual as the preferred supplier for the retrofit work.<br>A loan contract is struck between a borrower and lender(s) via the platform/brokerage. Deals are made between households and institutional or peer lenders or retrofit companies or technology providers or installers. Alternatively it might be a simple investment with a return designed to reduce total energy consumption and demand shift in exchange for enabling investment. Lenders may spread their risk by investing small amounts in multiple households. Where a household's investment opportunity is being traded then the brokerage matches the property with investors. The broker (or platform) receives commission, either a fixed or variable fee, to enable and administrate the contract.<br>The contract encourages behaviour change on behalf of the householder and may require a third party to underwrite the performance of the retrofit system. Smart data monitoring gives Energy Mutual feedback on system performance and household behaviour; assuring on-going compliance and returns. Energy Mutual uses its collective buying power to negotiate lower energy pricing as additional value to the householder.<br>Where payback based on energy saving is compelling the investment or lending is repaid through the energy bill (as for the Green Deal). Where the investment has a non-financial benefit (home improvement etc.), or the savings are more marginal, a regular payment from the householder, through Energy Mutual, repays the investor based on an agreed term and the householders demonstration of their ability to pay.<br>Household business cases could be fixed price or bid for as a reverse auction (EBay). Interest rates might be low, nil or negative depending on the motivation of the investor to invest.<br>Investors will have the option of investing in one or more properties as a single or joint investor. Householders might also invest in neighbours' or other properties if they offer a more compelling business case. Business cases could be presented as a single household, a whole community, a block of flats or a private / public estate. Investors may be consumers, school classes, charities, equipment manufacturers (looking to grow market share), owners of generation capacity (looking to avoid capital expenditure at the network level) or government looking to generate momentum, grab headlines and address fuel poverty. Investments could be backed by a finance guarantee scheme.<br>Energy Mutual will grow rapidly if: 1) retrofit opportunities provide sufficient returns (at acceptable risk) to a range of social and financial investors through reductions in consumers' energy bills. 2) It is easy and very engaging to participate in; giving compelling home improvement stories. |
| **Strategic Value** | An enabling investment vehicle to stimulate domestic energy change as a one-stop-shop for finance, business case, installation, energy retail and maintenance. Enables every property in the UK to enter the energy saving market irrespective of the householder's capability to invest.<br>With low or no minimum investment; micro investors with only modest amounts of capital could take a stake in their community. The model enables manufacturers and installers to invest and get a return in their own leading edge technology and processes. Crowd investment helps minimise risk. Seed-corn capital would enable community investment and reinvestment developing a community balance sheet over times. Schools could use the scheme to explain the value of energy saving; enabling a class to invest a few hundred pounds and track their return. This both educates and inspires children on the importance of energy whilst getting them involved in the reality of the investment market. Institutions as borrowers (e.g. Schools, Care Homes), being good causes would attract additional social investment above their current government funding. Energy Mutual could be a commercial business, or a not for profit backed by government to build profitable growth in the value chain. |

| **Energy Mutual** | **Target Markets** |
|---|---|
| **Target Market(s)** | Investors: An individual, community or legal entity that has capital to invest, a desire to invest in worthy social and environment projects, manufacturers looking to demonstrate value of their products or gain market share. Energy retailers or others looking to meet their carbon abatement obligations. Businesses which have developed a capability which enables householders to deliver greater savings than predicted – giving the business good PR and a share in the upside.<br>Business Cases: Households, communities or landlords whose properties offer a reliable return on retrofit and technology investment, but need to be matched with sources of funding because:<br>• Engaged householders unable to find funding to carry out retrofit work, or have identified Energy Mutual as the most attractive source of funds.<br>• Households unwilling to invest time and effort in their own properties, but who are keen to trade the opportunity to an investor, provided the household sees some benefit from the transaction (eg: Solar 'rent a roof' schemes). |
| **How will the business compete?** | By matching committed energy investors who seek a financial, social or environmental reward with a corresponding project business case whose characteristics match the target profile of the investor.<br>By providing a single portal for householders to be engaged and have their business case developed without risk; then be matched with prospective lenders, investors and delivery partners.<br>A mechanism for matching delivery organisations with their potential clients through their close links with, or own investment in, Energy Mutual. |
| **Spill-over and Synergy outside the Value Chain** | Energy Mutual has the potential to stimulate growth in the retrofit supply chain with a spill-over benefit in the wider building supply chain – Giving consumers access to finance which is not limited to energy payback (as the Green Deal is). Extensions and remodelling could be included, with the caveat that Energy Mutual only lends based on improved energy performance. Consequential improvements (Part L regs) achieved without legislation. |
| **Global USP** | A unique web based market place which matches energy investors, energy borrowers and retrofit delivery providers cheaply, quickly and transparently. |

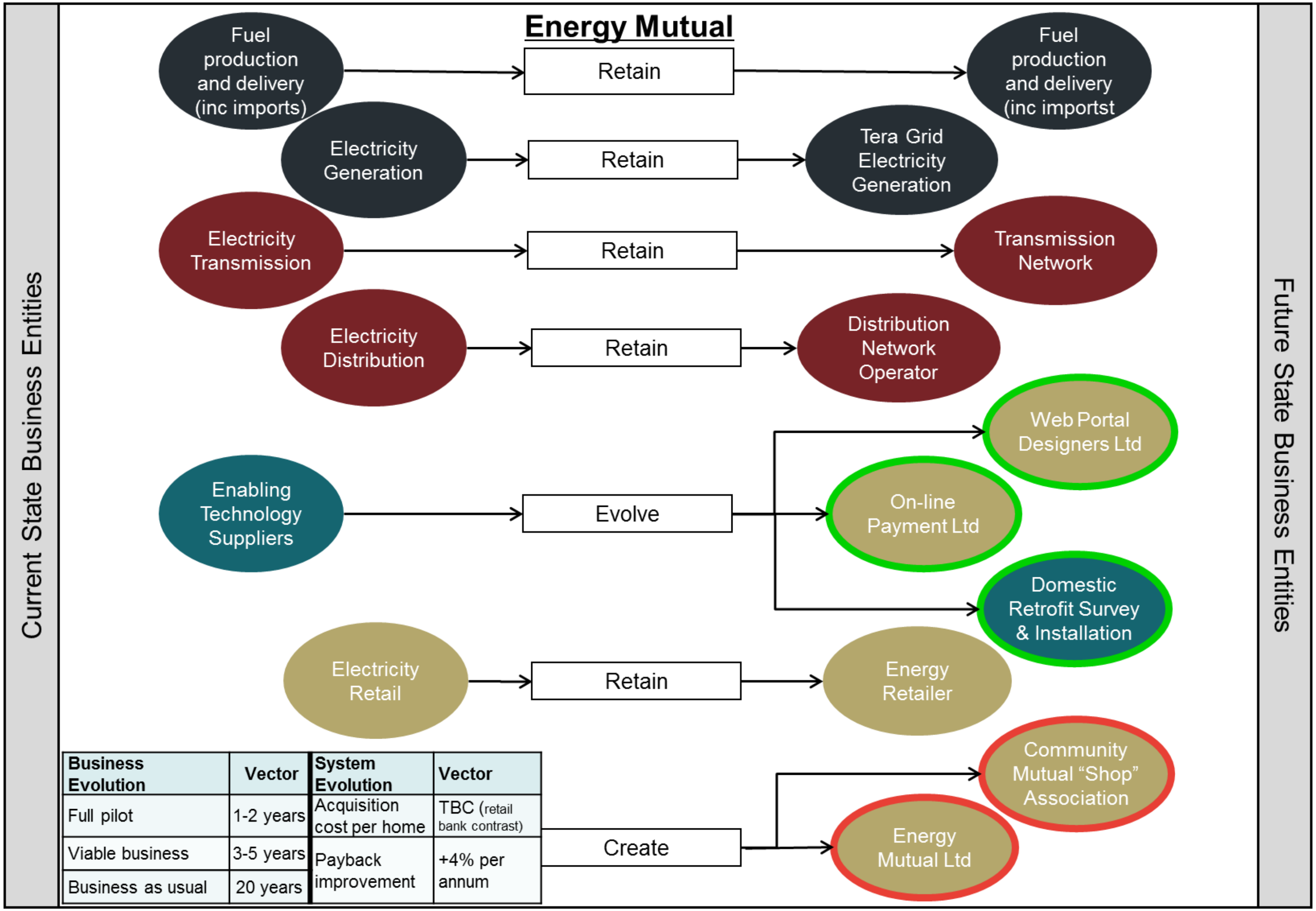
| **Energy Mutual** | **Financial Overview** |
|---|---|
| Investment Required<br>Small scalable unit with a 'mutual-in-a-box' template.<br>Low Capital: Hardware and Office Equipment<br>Start-up Lag: The time between up- front investment and trading is crucial for profitability. 2yr financial accreditation timescales are common.<br>• Brand development and marketing<br>• Legal framework preparation<br>• Financial and trading accreditation<br>• Staff recruitment & training<br>Special interest group engagement: Find the community groups who can generate the start-up mass.<br>Modelled launch costs: £770k based on new business. 50% marketing potential to reduce cost and start-up lag. | Revenue Assumptions<br>Trading Fees.<br>• Trades per year 1,000<br>• Typical loan / retrofit value £7,500<br>• Fee basis minimum £50 or 1% of trade value paid by lender<br>Installer<br>• Enquiry / lead commission £50<br>• Retrofit / install sale 5%<br>Advertising on website<br>• Click through links from approved manufacturers and installers<br>Profitability<br>Energy Mutual model can be built on either of two underlying principles:<br>• As a business making profit from enabling energy investments.<br>• As a not for profit portal which enables investors to make a return from other aspects of the value chain.<br>The business model investors will determine the option chosen. |
| Potential Investors in the business model<br>• Venture Capital - Benchmark Capital (the investors in Google) have backed similar businesses<br>• Entrepreneurial investors.<br>Once the business is established an AIM listing will enable the model to scale rapidly.<br>Other alternative potential investors could be:<br>• Existing financial institutions looking to expand their offering, both mutual and limited company businesses.<br>• Energy system partners looking to offset carbon commitments.<br>• Equipment manufactures looking for an opportunity to develop market mass, or increase share value and brand reputation. | Operating Costs<br>Low operating cost based on small scalable office with a potential central franchisor providing the operating template and systems.<br>• Marketing and maintenance of brand<br>• Acquisition cost to find new borrowers and investors.<br>• Commodity IT server and portal costs<br>• Pay per click transactions and marketing costs.<br>• High calibre retail staff for consumer facing brand<br>On-going cost of assuring system robustness and security. |

| **Energy Mutual** | Legal Entities & Potential Partners | | | |
|---|---|---|---|---|
| | **Activities** | **Resources** | **Processes** | **Values** |
| Primary Business Vehicle:<br><br>Energy Mutual | • Facilitating matching and trading.<br>• Creation of business cases.<br>• Collective energy purchase<br>• Designing, building, maintaining and improving web presence.<br>• B2C & B2B Marketing<br>• Assuring timely payments of capital and returns.<br>• Educating investor community.<br>• Educating borrower community.<br>• Lobbying local and national government and regulator.<br>• Reporting on investment performance.<br>• Locating, coaching and approving vendors.<br>• Use of Smart meter data to develop business case. | • Sophisticated, flexible and robust IT platform.<br>• Staff with deep expertise of our markets:<br>• Energy procurement expertise.<br>• Personal finance expertise<br>• Home improvement<br>• An instantly recognisable brand: Saga, Compare the Meerkat, Go Compare.<br>• Financial contract expertise. | • Designing maintaining and refreshing the web presence.<br>• Educating & marketing to investors and borrowers.<br>• On-boarding of investors and borrowers.<br>• Refining and innovating the value proposition to target clients.<br>• Capability to offer regular return, dividend or profit re-investment.<br>• Real-time presentation of household financial and energy data to evaluate investment performance.<br>• Risk profiling.<br>• Keeping abreast of emerging technology innovations. | • Customer confidence and satisfaction above all things<br>• We are not in this for a quick return.<br>• Protecting the interests of:<br>• The purity of the model<br>• Our borrowers<br>• Our investors<br>• Approved vendors<br>• Zero tolerance of anything undermining our corporate values. |
| Safe and Secure Online Payment Partners Limited | • Designing, building, maintaining and improving payment engine.<br>• Transactional clearing | • Proven platform<br>• Clearing bank | • Secure, low-cost, fast, defect free transactions.<br>• Rapid query resolution. | • We are so good at what we do you forget we exist. |

| **Energy Mutual** | Legal Entities & Potential Partners | | | |
|---|---|---|---|---|
| | **Activities** | **Resources** | **Processes** | **Values** |
| Web based Trading Partners Limited | • Designing, building, maintaining an attractive and intuitive trading engine which evolves seamlessly to meet investor and project needs. | • Robust & invisibly scalable high speed servers and networks.<br>• Rich expertise in web trading portal design and site robustness. | • System design & integration.<br>• Seamless system upgrade<br>• Low cost transactions | • We keep your trading brand fresh and up to date with intuitive web design and structure. |
| Retrofit & Smart System Survey, Installation and Maintenance Partners Limited | • Retrofitting solutions. | • Consumer focused technical delivery team.<br>• Best in class retrofit capability.<br>• Accredited | • Survey and design capability<br>• Integrated systems solution<br>• Deliver on time to standard<br>• Certify the result.<br>• Maintain through-life | • Audi technical competence delivered with Disney obsession for customer experience. |
| Community Mutual Matching Association | • White-Label provision of a branded service for special interest groups:<br>• Bristol energy fit<br>• Village heat save<br>• Thatch Cottage Group | • Community linked staff<br>• Drop in shop for personal conversations<br>• | • Ability to attract investors and borrowers with a common ethos to engaging special interest events. | • Benefit for our locality; enabled by Community Energy. |

| **Energy Mutual** | **Business Entity Transition Paths** |
|---|---|

The following diagram shows how the business model will develop from evolved existing businesses and new commercial entities:




| Business Evolution | Vector | System Evolution | Vector |
|---|---|---|---|
| Full pilot | 1-2 years | Acquisition cost per home | TBC (retail bank contrast) |
| Viable business | 3-5 years | Payback improvement | +4% per annum |
| Business as usual | 20 years | | |

| **Energy Mutual** | **Key Transition Challenges** |
|---|---|
| Overview | • Simple communication with target-appropriate media will be needed to explain the Energy Mutual concept and attract lenders, investors and consumers.<br>• Development of compelling financial and non-financial business cases with robust contracts and the means to evaluate performance through life.<br>• Determining the impact of projects on property values, and how to manage any outstanding loans or investments when a property is sold.<br>• Despite a compelling business case, property owners may be insufficiently motivated to take action.<br>• Creating the regulatory framework for the model, including integration with existing personal finance legislation.<br>• Developing trust in borrower, lender and investor markets as to the integrity of energy saving forecasts and energy savings as an investment opportunity. |
| Activities | • Development of compelling business case scenarios to attract investors based on their individual priorities.<br>• Future-proofing investment projects; designing systems with consideration for service/maintenance, end of life disposal or asset transfer, and with future hardware and software upgrade paths.<br>• Developing guidelines for warranties on system solutions, including which value chain partner will own and insure the integrated system risk. |
| Resources | • The technology to deliver improvements must be both capable and reliable.<br>• IT infrastructure and systems to match lenders, investors and consumers and to manage project/asset lifecycles.<br>• A network of expert partners to conduct surveys and prepare business cases for retrofit work<br>• High calibre retail presence and call centres that will enhance Energy Mutual brand reputation. |
| Processes | • Creating a low cost, minimum disruption process to develop individual property business cases, with a particular challenge for non-financial business cases.<br>• Bullet proof on line trading experience.<br>• Engaging web tool to guide the consumer to the point of requesting a survey and business case. |
| Values | • A passion to broker trades to enable energy saving.<br>• Integrity.<br>• Creating the best possible trading environment for lenders/investors and borrowers and guiding them to a low-cost accurate trading decision.<br>• Ensuring appropriate balance of regulation and control whilst safeguarding a flexible and attractive consumer system. |

| **Energy Mutual** | **Transition Challenges: Activities, Resources, Processes & Values** | |
|---|---|---|
| **New Organisation** | **Capabilities existing in current businesses** | **Capabilities requiring enhancement or creation** |
| Primary Business Vehicle: Energy Mutual Ltd | • Consumer finance knowledge and risk management expertise e.g. credit profiling<br>• Designing, building and enhancing the internet presence | • Facilitating matching of borrowers and lenders/investors and enabling their subsequent trading through an attractive web presence<br>• Educating lender/investor and borrower communities<br>• Creation of robust business cases for home energy improvement<br>• Use of smart meter technology to aid development and management of individual business cases<br>• Sophisticated, flexible and robust IT platform for matching lenders/investors and consumers<br>• Creating an instantly recognisable brand for lending/investing and borrowing |
| Safe and Secure Online Payment Partners Ltd | • Designing, building and maintaining secure consumer payment systems<br>• | • Customised web interface |
| Web Based Trading Partners Ltd | • High quality and innovative consumer web design | • Attractive system for aligning lenders/investors and borrowers and facilitating low cost energy investment transactions |
| Retrofit & Smart System Installation and Maintenance Partners Ltd | • Local specialist contractor base to build upon | • Best in class, consumer-focused technical delivery teams with high technical expertise<br>• Survey and design capabilities with certified results<br>• Through-life asset and system maintenance processes<br>• High technical expertise able to give reliable and repeatable outcomes |
| Community Mutual Matching Association | • Local/community interest groups | • Ability to attract investors and borrowers with a common ethos to engaging special interest events<br>• Community linked staff<br>• Drop-in shops for personal conversations |

| **Energy Mutual** | **Transition Challenges and Enabling Policy** | |
|---|---|---|
| **Challenge** | **Business Model Responses** | **Policy and Regulatory Response** |
| Returns from retrofit investments can be low.<br>(20yr payback) | Goal: Confirm the genuine need for the retrofit proposition. Develop and execute a business plan which delivers retrofit profitably.<br>Activities: Establish market price expectations and their drivers. Design the proposition to achieve a target cost (profitably). Set a development plan to meet the cost and understand how the transition cost gap can be bridged. Target niche markets which are less price-sensitive. Make good use of incentives and other policy stimuli. | Goal: Give policy clarity that there is a need for a viable retrofit market. Encourage supply chain innovation. Support the transition with incentives to give the supply chain time to respond to market pricing levels.<br>Policy enabler. Incentives to take up energy saving measures (for example the RHI). Providers will need a degree of certainty that incentives will remain in place whilst the market develops and technology costs reduce.<br>Additional support: Incentives should taper in-line with a pre-agreed formula. Enhanced R&D tax allowances for energy saving innovation. Setting a carbon price on domestic energy if long-term viability cannot be established. |
| There is lack of information on the returns from retrofit investments. | Goal: Establish in-house capability.<br>Activities: Establish market price expectations and their drivers. Design the proposition to achieve a target cost (profitably). Set a development plan to meet the cost and understand how the transition cost gap can be bridged. Target niche markets which are less price-sensitive. Make good use of incentives and other policy stimuli. | Goal: To demonstrate the business case for retrofit and stimulate an investable market.<br>Policy enabler: A common accreditation scheme for installers that certified and guaranteed energy savings. This could be jointly driven by industry and Government.<br>Additional support: Continued investment in demonstration projects at increasing scale to give clear energy saving potential and build consumer acceptance. |
| Green Deal Experience suggests demand for retrofit may be low, even when upfront costs are covered | Goal: Generate consumer demand for retrofit.<br>Activities: Invest effort up-front in selecting consumer niches and appeal to their needs and wants and dissatisfaction with the status quo.<br>Invest in 'consumer friend' or 'consumer champion' type branding, with the capability to live up to the brand.<br>De-complex the idea, simplify the process, socialise through national media and market the merits of financial and societal returns. | Goal: Raise awareness and interest in home energy with a clear and consistent top-down message and supporting actions.<br>Policy enabler. Government funded information campaigns on the benefits and process of different energy efficiency interventions, standardised performance labelling on low-carbon technologies such as heat pumps, and Government mandated training and accreditation of installers. |

| **Energy Mutual** | **Transition Challenges and Enabling Policy** | |
|---|---|---|
| **Challenge** | **Business Model Responses** | **Policy and Regulatory Response** |
| The platform provider must be licensed and adhere to financial services regulation. | Goal: Develop consumer and investor confidence in the financial security of Energy Mutual.<br>Activities: Ensure the business is affiliated to relevant membership bodies and endorsed wherever possible by money-gurus and home improvement advisors. | Goal: To give consumer confidence with fully regulated and businesses.<br>Policy enabler. Provision of simple guidelines on compliance in the context of online financial services provision. |
| Investors may require some protection, such as that currently provided by the Financial Services Compensation Scheme (FSCS). | Goal: Remove potential anxiety from investors (consumer and business) that there is a risk of losing their investment.<br>Activities: Two Streams:<br>*Business Investment:* Energy Mutual develops a business ranking model based on a capability audit, backed by performance data over time.<br>*Householder Lending*: Energy Mutual invests up-front in a direct and personal screening programme, getting higher risk future borrowers to save in a Credit Mutual before they are eligible to borrow. | Goal: To give consumer confidence with fully regulated and businesses.<br>Policy enabler. This could be removed through Government providing a guarantee to investors that they could recover their funds in case of default by the business model provider. This would be likely to require a state aid exemption. Alternatively if the business model provider was authorised by the FCA or PRA, then investors could be protected under the FSCS, though this may not be compatible with the peer to peer lending model. A further option is for the barrier to be removed by the business model provider itself, by making provisions to be able to offer a similar guarantee to investors, for example as in the case of the Zopa peer to peer lending site.. |

| Energy Mutual | Phase 2 Trial: Hypotheses & Pathfinder Opportunities |
|---|---|

## Hypotheses to test

By demonstrating a business case for home energy retrofit, Energy Mutual will be able to generate a diverse pool of potential investors.

- With an on-line portal as the home of domestic energy investment Energy Mutual will be able to showcase innovative and tried and tested business cases.
- Investors can choose both their risk profile and whether they want to invest in a business or consumer proposition before committing finance to a project.

Owner Occupiers value a one-stop-shop for arranging finance and energy focused refurbishment of their property from a trusted broker.

- Demonstrate a business case and consumer benefits for investment in a property and householders will borrow against the value of their home.
- Make the transaction clear and straightforward; matching the borrower with both a source of finance and a trusted delivery partner and Energy Mutual will fly.

Capable retrofit and smart systems installers can grow their business rapidly with alternative routes to enable property transformations.

- Installers can prepare a convincing business case but are not always able to help the householder find the funding that will enable the work to start.
- Energy Mutual can match them with investor(s) who will invest in the specific business case and back the property transformation installer to deliver a return.
- Energy mutual gives the supply chain an opportunity to invest in their own technology or capability.

## Pathfinder Projects for Phase 2 trial

Develop a localised portfolio of investable property business cases.  Promote them to investors through the Energy Mutual portal.

- Identify an experienced domestic energy refurbishment designer to prepare robust property business cases in a standard format.
- Invest in a broad range of property pathway surveys & proposals with landlords and owners across the Phase 2 trial area.
- Present the ideas in a clear and appealing format to the property owners and a pool of potential investors; both commercial and private.
- Seek feedback on the business case appeal and any misalignment between investors' expectations and the offer.
- Develop mitigation strategies to bridge the gap; either through improved returns from process improvement or through temporary subsidy.

Deliver Energy Mutual funded property transformations with subsidised funding costs if required.

- From the business cases above identify those with a compelling, or close to compelling, proposition for the householder or other investor.
- Energy Mutual matches the household with capable retrofit and smart systems delivery partners and acts as the home transformation broker.
- Where the consumer values the offer, but there is a bridgeable gap between their willingness to pay and the installers target cost; SSH programme finance (in the guise of Energy Mutual) funds the gap, with the rider that any upside in return is to Energy Mutual's benefit.
- Where the consumer is not interested in a clear business case the opportunity is presented to the pool of investors identified above, identifying any gap between the investors' expectations and the cost of the works.  The SSH programme could provide funding, but the proposal is to do so to a level where it just bridges the gap between current and predicted cost.  Reducing the risk of devaluing energy improvement measures.
- All properties invested in in this way have additional performance monitoring funded by SSH in order to build an evidence base for the retrofit.

## Energy Mutual Supporting Pages

| **Energy Mutual** | **Borrower USP and Triggers for Investment** | |
|---|---|---|
| **Target Borrowers** | **Market USP** | **Potential Triggers to Seek Investment** |
| Stretched Pensioners | Not applicable for tenants. Enables owner occupiers who are asset rich and cash poor to liberate the latent value in their property. | Vulnerable pensioners may need family, friends or community services able to facilitate the trade on their behalf. |
| Older Established | Gives the borrower an alternative source of funding to compare with traditional lenders.<br>Gives the borrower access to alternative investors, other than themselves, who might consider the returns their business case offers more attractive than they do. | Free or discounted property energy review to assess its potential. The opportunity posted for Energy Mutual investors to bid for; at no cost to the householder.<br>Positive recommendation from respected other. |
| Busy Comfortable Family | 4 clicks to post opportunity online. | Change in personal circumstances, house extension or additional child. |
| Transitional Retirees | Access to favourable outcomes for a long period of foreseeable time without taking the funding risk in its entirety. Gives wavering retirees confidence to invest because of the confidence demonstrated by co-investors. | Retiring.<br><br>Positive recommendation from respected other. |
| Middle Grounders | Outcomes from enabling investments they would not otherwise be able to access. | System near end of life (beyond economic repair nest time), house move, additional children. |
| Green Renters | Not applicable | Not applicable |
| Private Landlord | Access to funds at competitive rates. | Change of tenant, system failure, tenant pressure, entering the market, additional property purchase. |
| Social Landlord | Rapid access to multiple investors who can be selected/deselected based on their stated ambitions. | Capability to seek large scale funding with significantly less sacrifice. |

| **Energy Mutual** | **Borrower Value Proposition Considerations** | |
|---|---|---|
| Target Borrowers | Benefits Borrowers *Enjoy* Today That Must Be Preserved | Sacrifices Borrowers *Endure* Today That we Must Overcome |
| Stretched Pensioners | Retain control and ownership of their property where relevant. | Lack of assets give stretched pensioners no access to capital.<br>Payback exceeds householder life expectancy.<br>Fuel poor so suffer rather than consume invalidating business case returns. |
| Older Established | Freedom to invest in their property.<br>Freedom to choose. | Complexity to engage in home improvement: Arranging Funding, survey and many installers.<br>Risk is borne entirely by borrower. |
| Busy Comfortable Family | Access to investment capital. | Shortage of time.<br>Market complexity.<br>Ignorance of systems and technology. |
| Transitional Retirees | Ability to contribute to the investment from savings, select interest rates and borrowing term. | Lack of confidence<br>Ignorance of market and system performance.<br>Lack of trust. |
| Middle Grounders | Ability contribute to the some investment , select interest rates and borrowing term | Lack of confidence<br>Ignorance of market and system performance.<br>Lack of trust.<br>Access to capital. |
| Green Renters | Not applicable | Not applicable |
| Private Landlord | Access to funds at competitive rates. | Finite borrowing potential irrespective of merit. |
| Social Landlord | Access to significant funds at competitive rates. | Complexity<br>Transaction cost.<br>Management fees. |

| **Energy Mutual** | **Investor USP and Triggers for Investment** | |
|---|---|---|
| **Target Investors** | **Market USP** | **Potential Triggers to Invest** |
| Stretched Pensioners | Not applicable | Not applicable. |
| Older Established | Investing spare capital if other properties offer a greater return than their own property, or after they have exhausted the improvement potential of their own property. | Downsizing.<br>Maturity of investments. |
| Busy Comfortable Family | Unlikely as cash strapped and spare money is more likely to be invested in their family's requirements. | Not applicable. |
| Transitional Retirees | Possibly: Because of their ability to secure top up funding. | Transparency of comparable sources of funding and alternative investment opportunities. |
| Middle Grounders | Unlikely. | Not applicable. |
| Green Renters | Opportunity to selectively invest variable amounts into the property of others. Opportunity to demonstrate the value of energy investment to a landlord. | Social media trending and peer recommendation. |
| Private Landlord | Unlikely. More likely to invest in additional property or estate improvement. | Not applicable. |
| Social Landlord | Unlikely. More likely to invest in additional property or estate improvement. | Not applicable. |
| Equipment Manufacturers | Great opportunity to increase sales and show case capability by getting high performance technology retrofitted into a large number of target customer households. | Fuel energy increase.<br>Our disruptive technology enables a faster return.<br>Cost of technology fell below enabling target cost. |
| Installers | An ability to invest labour time and cost for a share in a long-term investment vehicle (labour and skills in kind).<br>Brand enhancing. | Ease and simplicity.<br>Low or no transaction cost.<br>Tax relief. |
| Social enterprises | Simple mechanism to enable a social enterprise to reach and improve the lives of many people cost effectively. | If the platform enabled the social enterprise to reach more people, more effectively, than could be reached before. |
| Special interest groups e.g. 'Village heat Save'. | Enables a self-selected interest group to locate and invest in fellow members of their community. | Identification of borrowers.<br>Speed and ease of new platform.<br>Marketing of success stories. |

| **Energy Mutual** | **Investor USP and Triggers for Investment** | |
|---|---|---|
| **Target Investors** | **Market USP** | **Potential Triggers to Invest** |
| Independently wealthy individuals | Gives wealthy investors the opportunity to contribute some of their spare capital in socially rewarding schemes with very low risk and modest returns. | Potential tax relief incentive for energy efficient investment.<br>The arrival of the system as a viable investment vehicle. |
| Energy retailers and other supply chain players | Popular measure to support the fuel poor and meet carbon reduction obligations while generating good will.<br>Enables higher levels of investment in smaller numbers of properties than is currently driven my ECO obligations. | Change in carbon tax.<br>Change in public and political attitudes toward fuel poverty and corporate responsibility. |
| Schools | Education vehicle to teach children the value of energy investment. | Availability of the system.<br>Near zero cost to trade. |
| Micro crowd funding | No minimum or maximum threshold to investment, potentially with conversion to a donation rather than investment. | Social conscience.<br>Feel good marketing.<br>Effortless. |
| Governments | Enables governments and social services to contribute or fund outright interventions to support the most socially disadvantaged. | Political capital.<br>Seed corn investment.<br>Media pressure.<br>Increasing mortality in the fuel poor. |

| **Energy Mutual** | **Target Markets** | |
|---|---|---|
| | Investor Value Proposition Considerations | |
| **Target Consumer Group** | **Benefits Investors *Enjoy* Today That Must Be Preserved** | **Sacrifices Investors *Endure* Today That we Must Overcome** |
| Older Established | Security and transparency of unit trusts.<br>Ability to identify and invest in preferred investment risk profile.<br>Regular reporting and an ability to track performance through life. | Market complexity.<br>Transactional cost and management fees. |
| Transitional Retirees | Security and access to their nest egg.<br>An ability to exit with all/some cash if their circumstances change. | Speed to invest and divest.<br>Fear of loss |
| Green Renters | Financial freedom to invest when and where they choose. | Ignorance and apathy. |
| Original Equipment Manufacturers OEM's | Tax relief on investment in Energy Efficient Product and Process R&D tax credits. | Poor market uptake.<br>Consumer ignorance.<br>A lack of integrated system solutions.<br>A poor return on emerging technology.<br>Market fear and distrust. |
| Installers | Not applicable. | No mechanism for installers to invest. |
| Social enterprises | Freedom to choose the level of investment, term of investment and who to invest in. | Well intended but obstructive regulation and policy. |
| Independently wealthy individuals | Financial freedom.<br>Potential new Tax relief for energy efficiency investments.<br>Gift aid. | Effort to assure monies can be invested in the right vehicles.<br>Opacity on how much of their money finds its way to those intended to receive it. |
| Special interest groups e.g. Village heat Save' | Freedom to choose when and where they invest and who they invest in. | Cost of transaction.<br>Effort.<br>Reach limited to known contact group. |

| **Energy Mutual** | **Target Markets** | |
|---|---|---|
| | Investor Value Proposition Considerations | |
| **Target Consumer Group** | **Benefits Investors *Enjoy* Today That Must Be Preserved** | **Sacrifices Investors *Endure* Today That we Must Overcome** |
| Energy Retailers | Carbon credits.<br>Tax relief. | Current regulation caps investment per household encouraging cosmetic retrofits rather than whole house efficiency.<br>A lack of recognition for investing in fuel poor. |
| Schools | Educated and inspired children, keen to do their bit for the planet and energy saving. | Limited practical mechanisms to actively learn about investment markets through making trades and tracking returns. |
| Micro crowd funding | No minimum or maximum threshold to investment.<br>Social conscience.<br>Feel good factor. | Complexity and cost of investment. |
| Governments | An ability to contribute or fund outright interventions to support the most socially disadvantaged.<br>An ability to combine private and public investment. | Difficult to demonstrate the value of governmental investment.<br>Difficult to enjoy political capital due to lack of integrity and trust.<br>Electorate unconvinced in government's commitment to stay the course.<br>Cynical media.<br>Pay back and transformation timescales exceed parliamentary life.<br>Unintended consequences. |

| **Energy Mutual** | **Which of the 6 Core Value Propositions Can This Business Model Offer?** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Extended Value Propositions** | **Older Owners** | | **Middle Owners** | | **Renters** | | **Landlords** | |
| | **Older Established** | **Transit. Retirees** | **Busy Families** | **Middle Ground** | **Stretched Pension** | **Young Green** | **Social** | **Private** |
| Borrow: Deeper retrofit than you could fund alone. Delivered by an expert partner focused on your case. | | Good | Better | Better | BEST | N/A | | |
| Borrow: Property Pathway – Top-up funds to add the energy upgrades to my stretched construction budget. | | Good | BEST | Better | | N/A | Good | Better |
| Borrow: Trading spaces: Crowd funding for creation, or expansion, of a Community energy project. | | Good | Good | Good | | N/A | BEST | |
| Borrow For schools to educate and inspire kids in real energy solutions business case and investment. | Good | Good | Good | Good | | N/A | | |
| Lend: For schools to educate kids in energy finance and investment and returns. | | | BEST | Better | | N/A | | |
| Borrow: Payback options: Faster payback or short-term saving for over-performance vs. budget. Offset mortgage. | | Better | Good | BEST | | N/A | Good | |
| Lender: Hedging: Spread my investment to reduce my exposure. | BEST | Good | | | | BEST | | |
| Lender: Personal Matching: Individual investment in a specific household. Sponsor a Congo Child. | | | | | | | | |
| Lender: Sweat for investment: I'll install at no cost for a return on the outcome. | | | | | | N/A | | |

## Energy Mutual — Strategic Risk Analysis

### Suppliers Pressure

Cost increases demanded by IT Providers

- Finance Portal – multiple options
- Hardware providers: Server space & technology – commodity items.
- Web interface – should be owned and can be updated by others

Technical Delivery Partners

- Commercial demand for increased margin on product and installation costs where there is limited capability or scarce resource.
- Failure to perform – service and delivery

### Risk of New Entrants

High unless first to market advantage is established and preserved.

Low barriers to entry:

- Minimal Capital
- Relatively simple regulatory compliance.

### Competitive Pressure

No apparent existing competitors

Risk from migration

- Just giving – match.com!

Other uses for investor and borrowers funds

- Traditional investment and lending
- Easier ways to spend / borrow money
- Better returns elsewhere.

### Substitution of Products

Better terms, higher returns, less management fees offered by other channels.

### Customer Pressure

Negative press from poor experience.

- Trip advisor factor:
- Crucial for borrowers – important for lenders.
- No returns.

Consumer Default

- Inability to pay despite credit test
- Fraud and default

Mortgage market rejection.

House buyer rejection.

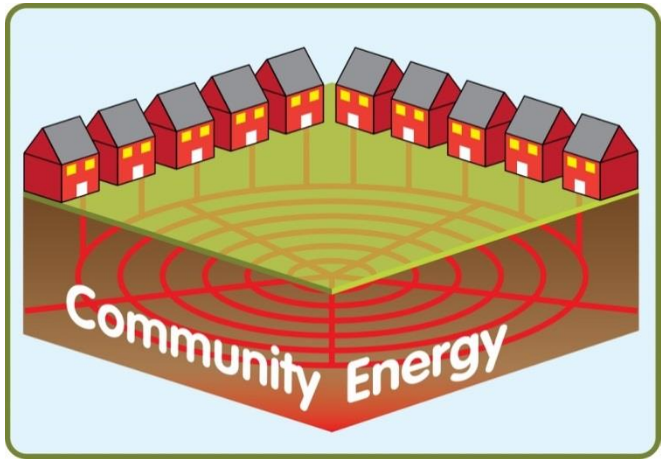
| **Energy Mutual** | **Future Proofing & The Assessment of Risk** | | | |
|---|---|---|---|---|
| **Description of Strategic Risk** | **Impact** | **Likelihood** | **Rating** | **Mitigation** |
| New Entrants | Medium | Likely | Serious | Build brand and preserve first to market advantage. E.g. EBay / Paypal.<br>Assure transaction costs are lowest in the industry e.g. Amazon. |
| Consumer Default | Low | Likely | Manageable | Partner with specialist debt management organisation that shares values<br>Include a Credit Union saving vehicle for consumers to prove their ability to save in advance. |
| Key supplier pricing pressure. | Medium | Likely | Serious | Partnering with suppliers based on long-term business and market growth. Selecting partners with values that match a long-term view of adequate profitability rather than a short-term bonanza. |
| Negative Press Coverage | V.High | Possible | Serious | Invest significant time and effort to engage influential media voices, interests groups and regulators in the process of product and service design.<br>Early resolution of individual disputes. |
| Lending / Investing Imbalance | Medium | Likely | Serious | Seed corn scheme with government funding. Secure small numbers of high quality business cases to create success stories and demonstrators. Leverage peer marketing to both borrower and investor markets. |
| Technology Platform Failure, cyber attack, data hacking. | Low | Possible | Manageable | Robust back up facility – as part of outsourced provision.<br>State of the art security systems.<br>Share with other commercial or governmental institutions. |

| Risk Priority | | | |
|---|---|---|---|
| **Impact** | **Likelihood** | **Rating** | **Mitigation** |
| Extreme | Certain | Acceptable | 0-4 |
| V. High | Likely | Manageable | 5-8 |
| Medium | Possible | Serious | 9-25 |
| Low | Unlikely | | |
| Negligible | Rare | | |

| **Energy Mutual** | **Whose Business is the emergence of community energy going to affect substantially?** | |
|---|---|---|
| | **Likely to Impact Positively** | **Likely to Impact Negatively** |
| Tera Grid Level | Reduction in energy consumption growth rate making electricity generation and supply constraints easier to manage. | If highly successful as an enabler of domestic energy reduction Energy Mutual could reduce peak demand to an extent that some peaking capacity is prematurely obsolete. (Low risk) |
| Macro City Level | Energy Mutual as a pilot or scaled to the city level could engage a significant local supply chain for retrofit activity.<br>If targeted on areas of weak infrastructure Energy Mutual could reduce DNO pressure points (particularly if combined with schools as larger power users) | Reduced rate of infrastructure investment affecting local capital delivery partners. |
| Mini Community Level | Reduced impact on DNO pressure points as above. | |
| Nano Domestic Level | New Retrofit Businesses or evolved jobbing builders / home improvement franchises: Regular source of business leads with high potential of conversion for good business cases. | Existing businesses which don't evolve may have a reduced scope for their offers. |
| Energy Supply Chain | Somewhat smoothed demand with lower domestic heat loss from retrofit.<br>Increased electricity demand per household from shift to Heat Pumps | Lower per-capita gas consumption per household. |
| External Supply | Greatly increased market for heat pumps and smart controls.<br>Demand for easy fit insulation systems with good aesthetics.<br>Potential increased demand for heat storage capacity. | Reduced demand for domestic gas boilers. |

## 15.3 Community Energy

# Business Model Assessment



**Community Energy & Storage - A community scale energy supplier with high fuel efficiency and a strong local brand.**
Generating locally required heat & electricity with CHP/Heat Pumps, distributing heat, selling power at scale to the grid and customers.
A locally driven Special Purpose Vehicle created between a broad range of partners. Distribution level electrical and heat storage.

## Partners

**Community Base-load**
The key customer RSL/LA

**System Partners Ltd**
CHP / electrical storage manufacturer / installer.

**Network Capital Delivery Partners Ltd.**
Heat network installers.

**Electricity Retail Partners Ltd.** Customer for exported power.

**Community Retrofit Ltd**
**Home system installer.**

Fuel Partners Ltd.
Gas or other fuel supply.

**Residential Maintenance Management Ltd:**
Home asset care and consumer support.

## Key Activities and Resources

### Activities

Specify, commission and operate a community scale heat, power & electrical plant. Manage a heat network and storage, with plans to grow the system & capacity.

Trade with energy retailers for the import/export of lower carbon power.

Deliver home retrofit at scale and / or HEMS.

### Resources

Local (multiple) CHP plants operating 24/7 in winter, scaled back for summer.

Community retail team for direct engagement with owner occupiers for network expansion.

## Consumer Value Proposition

A competitively priced heat and electricity solution; with a compelling community brand appeal.

Provision of responsive heat and hot water to all consumer groups.

Managed and maintained by others, to minimise cost and householder hassle.

A step change in fuel efficiency, designed to scale as demand grows.

Options to increase scale:

- Key offer retrofit and heat
- Energy outcomes plans
- Just energy outcome and retrofit for households too isolated to join heat grid.

## Relationship and Channels

### Relationship

1:1 relationship with a key customer (Local Authority).

Close personal links with the community served: A living community partnership.

Must gain, maintain and protect consumer trust at all costs

Stimulate local interest.

### Channels

Show property presenting the solutions and benefits.

Directly at the "come and see our site" outlet.

Partner locations: Local Authority or Landlord sites.

## Customers and Market Share

### Customers

All Consumer Group types

Technically possible for up up-to 7.5m households in urban centres above 50k.

Of which high potential:

- 2m off gas urban.
- 2.3m Urban Social Housing
- 1m in other target flats.(some overlap)

### Market Share

An excellent base load development can generate demand from private house-holds to accelerate expansion of the network.

## Costs

**CAPEX**: Capital delivery of community heat network (£6k-£10k per home), Connection to the electricity grid (and possible local grid). Future expansion.

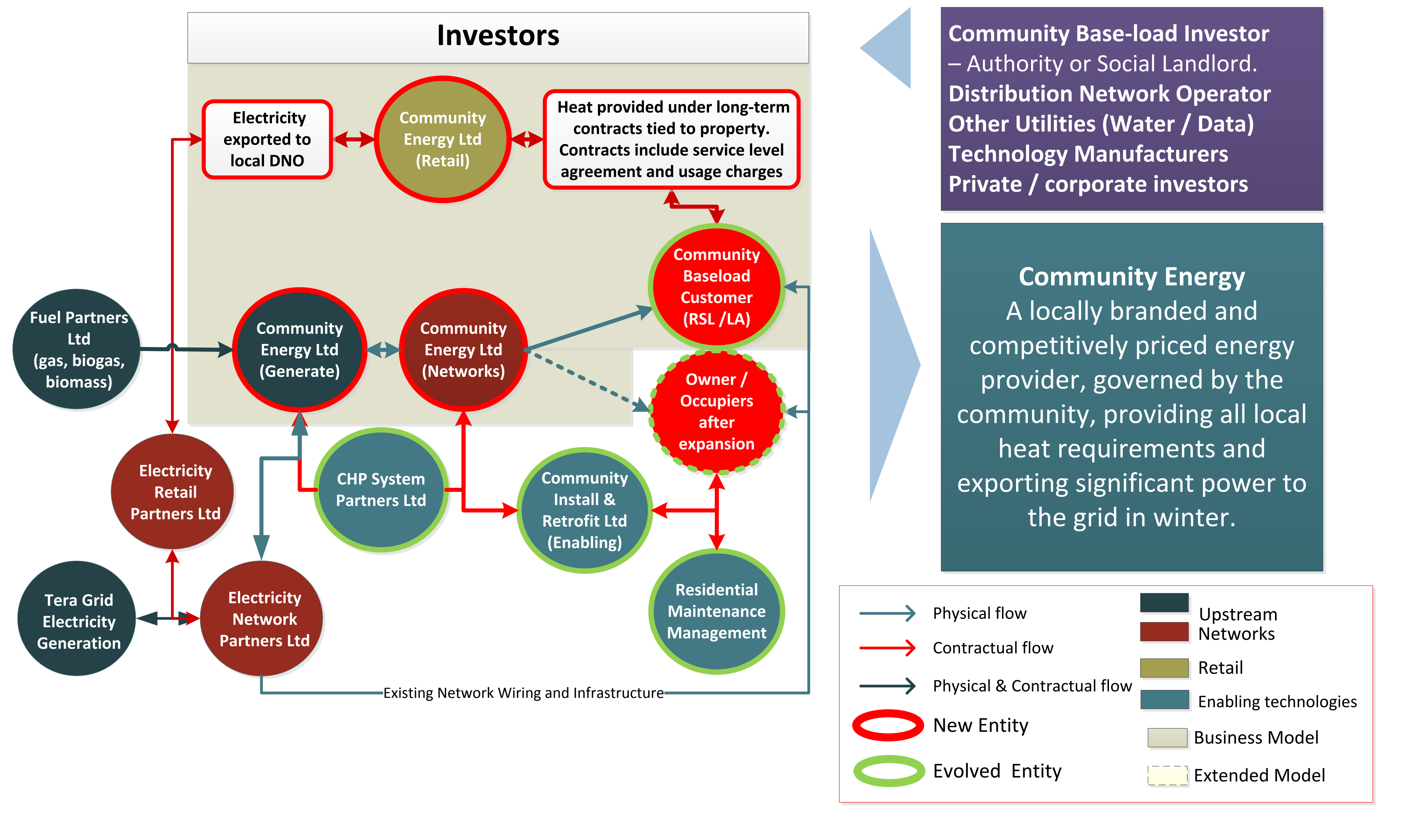
**OPEX:** Power by the hour, billing, customer acquisition, system maintenance.

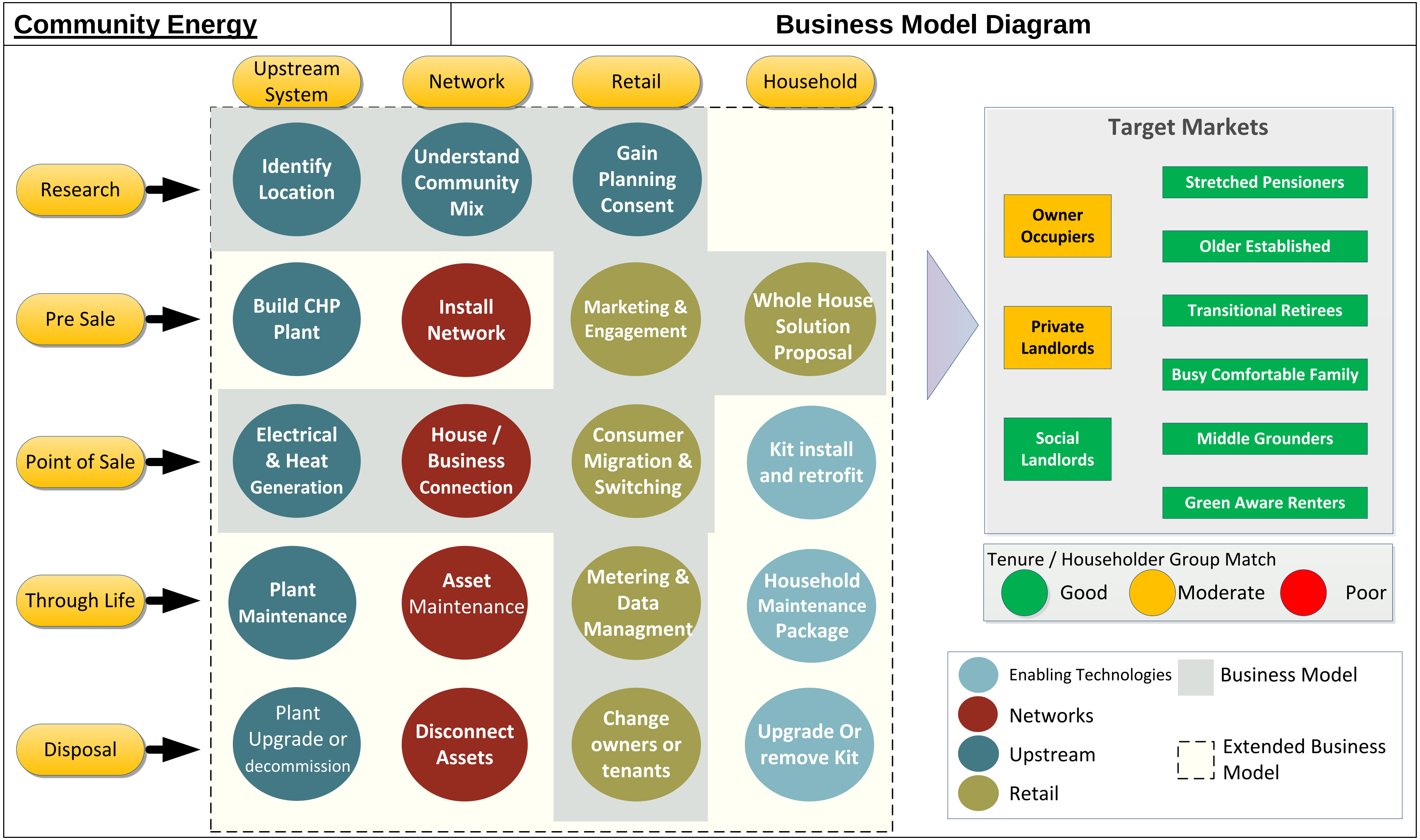
## Revenues

Monthly bill based on per kWh tariff, or unmetered restricted flow charge. plus metered electricity and repayment of retrofit investment cost.

Option to include Outcomes based payment for comfort.

| Community Energy | Value Chain Elements |
| --- | --- |





Community Energy
Business Model Diagram
Upstream System
Network
Retail
Household
Research
Pre Sale
Point of Sale
Through Life
Disposal
Identify Location
Understand Community Mix
Gain Planning Consent
Build CHP Plant
Install Network
Marketing & Engagement
Whole House Solution Proposal
Electrical & Heat Generation
House / Business Connection
Consumer Migration & Switching
Kit install and retrofit
Plant Maintenance
Asset Maintenance
Metering & Data Managment
Household Maintenance Package
Plant Upgrade or decommission
Disconnect Assets
Change owners or tenants
Upgrade Or remove Kit
Target Markets
Owner Occupiers
Private Landlords
Social Landlords
Stretched Pensioners
Older Established
Transitional Retirees
Busy Comfortable Family
Middle Grounders
Green Aware Renters
Tenure / Householder Group Match
Good
Moderate
Poor
Enabling Technologies
Business Model
Networks
Upstream
Extended Business Model
Retail

| Community Energy | The Business Idea |
|---|---|
| **The Idea** | A Special Purpose Vehicle to Generate and supply Heat and Electricity at Mini (Community) level.<br>A business that generates heat (hot water) and electricity at a community level to increase efficiency and reduce grid network load.<br>The business invests in and operates a Combined Heat & Power (CHP), large scale Ground Source Heat Pump plant and a heat distribution network. It sells the heat from this plant to consumers and electricity to the wholesale market. The system needs initial critical mass: Driven by a 'prime mover' social landlord or other community level group who develops the base case with an 'anchor load'. The system scales with right-sized increments of capacity as local demand is stimulated.<br>In operation waste heat of electricity generation, recovered with CHP, takes fuel efficiency from 40% to 70%+, by capturing and distributing heat to domestic properties and local small non-domestic loads, through an insulated pipe network.<br>The CHP is heat led – CHP electrical output is directly linked to total local customer demand for heat. In winter, when CHP is running hard electricity is sold to the grid at scale or used to drive Community Energy Heat Pumps. When heat demand reduces; CHP earnings are maximised by generating power & heat only at times of peak electricity pricing; using Community level heat storage to match household demand. In warm seasons with low heat demand; the business needs to balance the 'generate vs. buy equation'; reducing or stopping CHP plant output and purchasing off-peak wholesale electricity for community level Heat Pumps to provide hot water supply.<br>Electrical storage is an additional offer to protect against peak pricing and provide flexibility services as an additional revenue stream.<br>Community Energy uses the existing electricity distribution network rather than creating its own, but there may be circumstances when creating a parallel grid, as the heat piping is laid, has benefit for Community Energy and the DNO. Community Energy is rewarded for its ability to provide load balancing to the System Operator and DNO; giving fast response by adjusting the CHP / Heat Pump mix.<br>Initial domestic installation is as simple as replacement of a boiler with a heat exchanger. Community Energy could provide homes and businesses with a range of tariffs. The core offering is selling energy by the kWh, but should include Retrofit and Pay for Comfort Offers.<br>The provider will benefit from consumers' and businesses' attraction to a local energy model; a local Biomass supply would enhance this.<br>Efficiencies are passed on to consumers with energy bills having reduced impact from fuel price volatility. |
| **Critical Success Factors** | • Costs: As a capital intensive business there is significant potential for increasing profitability by reducing the investment in plant and increasing efficiency of capital delivery. With industrialisation savings in excess of 30% should be achievable vs. current.<br>• Take-up: Once the prime mover infrastructure is in place the scale is dependent on generating sufficiently 'dense' demand for the expanded network to avoid disproportionate network costs. This will require a compelling consumer proposition,<br>• Trading: Generating excess power is at the core of the Community Energy model with the ability to trade surplus power with other retailers. Time of Use pricing will have a major impact on the viability of having, in effect, winter peaking capacity installed in a community plant. Cost and ease of connection to the grid, combined with straightforward power trading, will play another key role in determining the viability of the business. |

| **Community Energy** | | **The Business Idea** |
|---|---|---|
| **Strategic Value** | A step change in fuel efficiency through an sophisticated blend of Combined Heat and Power, large sale Ground Source Heat Pumps and community scale energy storage which reduces emissions versus separate heat and electricity generation.<br>Transforms the relationship between energy supplier and communities; giving consumers a greater stake in their energy supply performance and engaging them in the evolution of their system.<br>As the Network grows and more members join the cost to connect individual customers reduces: Improving investors' return. At the limit of the Network range the financial return from a new household may be diminished (lower housing densities), but the sense of community ownership and spirit will remain profound. | |

| **Community Energy** | **Target Markets** |
|---|---|
| Target Market(s) | 7.5M homes in high density urban centres. Another 7.5M in Urban centres above 50k population . Estimated that only 50% of these properties will be feasible to connect so we estimate the Total addressable market at 7.5M<br>• 15% of housing stock managed by Registered Providers (Social Landlords). 2.25M Urban Social Housing and these are often in densely packed estates making them likely to be suitable for Community Energy<br>• 50% of 4M off–gas properties are urban and 90% of these are electrically heated and paying a price premium as a result. Making the Community Energy offer attractive based on system performance and cost.<br>1.8M households. Particularly compelling in 310k Pre-1980 High rise flats.<br>• 1.7M older, purpose-built low rise flats as second potential [say 60%] landlord owned = 1M |
| How will the business compete? | Community Energy will compete by providing customers with a cost competitive, responsive and more reliable heating solutions, supplied by an organisation with a compelling community brand appeal. **Option to consume community waste (incineration and anaerobic digestion) as a source of fuel + locally produced biomass (green & brown field willow). |
| Spill-over and Synergy outside the Value Chain | The installation of heat pipes has major cost synergy for the installation or renewal of any domestic utility. The local generation of power for export will support the increase in electrical demand for those outside the Community Energy network who switch to heat-pump solutions. Community Heat installation in the home is likely to be a trigger for home retrofit increasing the scale and take-up of building fabric improvement. |
| Global USP | A locally branded and competitively priced low carbon solution which is governed by the community, in the community, for the community. |
| Branding Examples: | Local brand: Bristol Energy Co-op. Large-scale partner: Powered by Rolls-Royce. Community Engagement: Supporting Local Schools. |

| Community Energy | Financial Overview |
|---|---|
| Investment Required Single digit million pound investment for prime mover. (Larger scale possible but require strategic plan from local municipality)<br>High capital cost of community energy network.<br>• Combined heat and power plant sized for winter heat load. ≈ 40% of £<br>• Insulated Heat network and domestic connections. ≈ 35% of £.<br>• Project set-up, design, management and commercial ≈ 15% of £<br>• Grid power connection infrastructure potentially as high as ≈ 10% of £<br>Modelled Launch costs: £4.2M capital = £5,850 per domestic consumer.<br>Start-up Lag: The time between up- front investment and operation is multiple years and 4yrs typical. (based on Bunhill Islington 4.5yrs / £4.2M, 720 homes)<br>Expansion and enhancement: Lower costs and development times.<br>• Greatly reduced set-up burden<br>• Scalable heat provision (pre-planned)<br>• Higher per home connection costs (lower density of take-up)<br>• Target £3-£5k per domestic customer for expansion. | Revenue Assumptions Three main revenue streams:<br>Domestic consumers:<br>≡ Typical domestic bill for operation cost and capital repayment.<br>• Basel / load project 200 – 1000 consumers<br>• Pay per kWh, or Outcomes (pay for comfort) based tariffs.<br>• Could mandate maintenance charges separately.<br>• Consumer capital investment for retrofit measures.<br>Trading<br>• Export power to other retailers.<br>• Electrical storage gives higher potential to maximise revenue.<br>• Trading needs to cover investment in export 'node' and larger CHP.<br>Non-domestic<br>• Local amenities (swimming pool etc.), SMEs and council offices.<br>• Other high heat requirement businesses – shopping centres./ offices.<br>• Tariffs set based on current provision equivalence with reduced future exposure to fuel price. |
| Potential Investors<br>• Local Authority (reserves, pension funds, or targeted borrowing)<br>• Equipment manufacturers to expand market and generate insight.<br>• Specialist investors seeking a reliable return in infrastructure<br>• Other Utilities – water, gas, data<br>• Special interest group engagement: Local interest in a local energy scheme. Bristol Green Doors, Lions Club, National Trust<br>• Domestic users with willingness and ability to invest in their own system.<br>• EU Funding: FP7 / JESSICA as additional finance. | Operating Costs<br>Power by the hour, not asset ownership of generating plant. ≈ 20% of £<br>Capital funding of heat network, control centre and connection. ≈ 15% of £<br>Fuel hedged through wholesale energy market, ≈ 50% of £.<br>Acquisition cost per consumer minimised by Local Authority partnership.<br>Customer care costs: Call centre, billing and maintenance: ≈ 15% of £<br>• Could be through sub-contract partner; but brand building is crucial to the Community Energy model and not be put at risk with out-sourcing.<br>• Brand development and marketing for expansion.<br>• Technical and project management for expansion. |

| Community Energy | Legal Entities & Potential Partners | | | |
|---|---|---|---|---|
| **Legal Entities** | **Activities** | **Resources** | **Processes** | **Values** |
| Community Energy Ltd<br><br>A Generator, Distributor and Retailer of Heat & Electricity which is produced in a Locally Operated Combined Heat and Power Plant. | • Heat Generation<br>• Heat Storage (buffering)<br>• Heat Distribution (through insulated pipes)<br>• Electrical Generation<br>• Purchase of electricity from the wholesale market<br>• Marketing and consumer engagement<br>• Procurement – Fuel hedging<br>• Capital Construction<br>• Power by the Hour<br>• Secure planning consent<br>• Consumer migration and switching | • Community retail footprint<br>• Community energy plant building (open to the public for community engagement)<br>• Locally engaged workforce<br>• Heat Network piping<br>• [Electrical power network in collaboration with DNO] | • Capability to identify locations where Community Energy can become a viable competitive proposition.<br>• Capability to build and sustain a reliable value chain of partners.<br>• Ability to attract and retain retail customers (domestic and commercial)<br>• Arrangement of 'On-Supply' electrical contracts<br>• Instant consumer switching | • Profitability with a community ethos.<br>• Delivery of long-term sustainable value with a local and global perspective.<br>• In the community for the community.<br>• Trusted member of the community; earned by our pride in, and care for, the people we serve. |
| Community Base-load.<br>The 'mass' load of housing and heat. | • Collating sufficient mass of heat demand for the Prime Mover CHP system.<br>• Engaging the community, (tenants and owners) in the vision of Community Energy | • Active in the community<br>• Decision making authority to select the heating provision for a significant number of households<br>• Resident-liaison Staff who know the locality and can connect with residents.<br>• Sites / offices for drop-in visits or education events. | • Mechanisms for communicating with large proportions of residents.<br>• Means to arrange external investment and build project partnerships. | • Ambition to provide the best energy solution for our locality.<br>• Green and affordable not one or the other. |
| Fuel Partners Ltd | • Fuel source provider<br>• Fuel delivery partner | • Fuel supply and storage<br>• Distribution capability | • Supply chain optimisation<br>• Strategic partnering. | • Long-term stable, profitable relationships with partners. |

| **Community Energy** | **Legal Entities & Potential Partners** | | | |
|---|---|---|---|---|
| **Legal Entities** | **Activities** | **Resources** | **Processes** | **Values** |
| CHP System Partners Ltd | • Integrated CHP Plant, GSHP, Heat storage and System Provider<br>• Business case development<br>• Whole system solution design.<br>• Maintenance Provider | • Generation assets<br>• CHP operation and maintenance staff. | • System Design for<br>• – target capital cost<br>• – target operating cost<br>• – through life service<br>• Operation at/above availability and system performance.<br>• Operation at or below target cost. | • Growth from technology and innovation led value.<br>• Long-term stable, profitable relationships with partners. |
| Network Capital Delivery Partners Ltd | • Heat network installer<br>• [Option for simultaneous private power network installation] | • Project managers, delivery teams, construction plant. | • Pipe laying capability | • Striving for lowest system delivery cost & quality. |
| Electricity Network Partners Ltd | • Electricity DNO<br>• Import / export metering | • Electrical network & import / export metering.<br>• [shared parallel network] | • Meet availability regulations<br>• Improve system reliability | • Long-term dependability<br>• Prudent service provision |
| Residential Maintenance Management Ltd: Home asset care and consumer support. | • Residential Installation Heat exchanger and metering.<br>• Domestic Heat Exchanger repair and maintenance. | • Customer facing technicians<br>• Tools and diagnostics. | • Low disruption installation, consumer education.<br>• Rapid consumer response. | • Committed to customer care and service excellence. |

| Community Energy | Combined Option: Community Energy & Energy Outcomes & Storage |
|---|---|

**Base Case**

The base Community Energy offer is a CHP generating plant sized for peak winter heat demand and incorporating heat and electrical storage. Supplying heat through its network and exporting power to the grid. The Community Energy operator has scope to:

- Provide household heat requirements either metered (by the kWh) or capped (variable, fixed) as a means of shifting demand away from peak.
- Export Electricity to the grid, sell to an Electricity Retail partner, before buying back under a 'white label' agreement to sell to their consumers.
- Generate maximum heat and power at peak to sell to the electricity grid; whilst increasing stored heat for use when electricity demand is low.
- Trade stored Electrical power (as Power Buffer business) to level demand spikes on the network (provided the store is responsive enough) or as a '*store at off-peak sell at peak'* trading proposition if price differentials are sufficient.
- Promote Home retrofit to reduce unnecessary heat-loss and support rapid network growth by reducing demand on the central system.

With Energy Outcomes 'pay for comfort' option included.

The outcomes 'pay for comfort' offer gives householders comfort & peace of mind for a fixed fee:

- This encourages take-up of retrofit with Community Energy for some consumers and achieves greater scale for heat-loss reduction work.
- With the sponsorship of the trusted Local Authority or Social Landlord; the adoption of an Outcomes based contract is likely to achieve greater take-up, leading to more retrofit, which means providing community heat to more homes for the same size installed CHP capacity.
- Engaged consumers who are currently too far from the heat network can take-up the Energy Outcomes offer: Using alternative heating systems (Heat Pumps) to provide the outcomes they seek. This also increases the known local load for the electrical output of the CHP. Ensuring that consumers in streets where the tipping point for heat supply has not been reached are not disenfranchised by the model.

**Consumer Impacts**

Consumer benefits from Community Energy include a responsive and reliable system with the provider managing the system on behalf of the householder. If costs can be kept on a par with consumers' current energy spend the proposition should be viable.

From the consumer perspective; adding the Outcomes offer could be seen both as an asset or a hindrance to the Community Energy approach:

- For those who are attracted to Community Heat the addition of Outcomes contracts may appeal as the next logical step. *"If I've got a new heating system I may get additional benefit paying for comfort'.*
- Those who are on the cusp of a decision to join the Community Energy scheme may be put off by yet another choice to be made when they are feeling uncertain. *"I'm not too sure about the technology and now they're asking me if I want to pay for comfort – it's all too difficult"*
- Home storage of heat and electricity is an additional option, but where connected to the carefully designed heat network the storage and responsiveness can be better managed at the community level than numerous individual storage facilities. Each of which requires some maintenance and also requires the consumer sacrifices of loss of space and disruption during installation.

| Community Energy | Combined Option: Community Energy & Energy Outcomes & Storage |
| --- | --- |

**Other options.**

- Developing a Community Energy Private Electrical Network at the same time as laying the heat pipes.
  This has the advantage of reducing the complexities of exporting power to the grid and then buying back for domestic supply: Avoiding DNO / TNO charging. A parallel supply gives opportunity for competition, but also adds to systemic costs with redundancy of the existing network infrastructure. The match between power network architecture and heat network layout will have a significant impact on cots and viability.
- Phasing heat network expansion with other infrastructure renewal or upgrade gives a major capital delivery cost advantage. Currently 80% of the cost of laying new, or upgrading ageing water pipework, is in the cost of excavation and reinstatement of pipe / cable runs[147]. The spill-over value for combining infrastructure delivery with water, data/telephony and other utilities is likely to shift the business case significantly.

### Impact on Business Case

The Private Network becomes viable under two scenarios:

- Where Community Energy can supply its customers with electricity more cost effectively than by making used of grid infrastructure. Offsetting the capital investment against the grid connection capital and operating costs of network usage charges and energy trading costs.
- Where the local DNO has a need for additional capacity in the locality a parallel network can alleviate network pressure. The parallel network may be part funded by the DNO from their capital allocation, but the asset ownership and maintenance will need careful contracting.

An alternative is for Community Energy and the DNO to take a bi-lateral approach to upgrading the network: The DNO to enjoys reduced cost of network upgrade as a result of the link with Community Energy heat pipe installation. Community Energy receives a contribution from the DNO to offset their Capex. This maintains the clarity of network ownership and avoids the duplication of assets.

The integrated infrastructure delivery option is highly appealing for reducing systemic delivery cost, but also brings with it challenges::

- Each utility brings with it, its own regulatory challenges and drivers and although all will be about delivering the greatest consumer value, the delivery mechanism, timings and metric may not align.
- Whilst the ambition to combine street works and new investment seems obvious; the difficulty of coordinating: Timing, technical standards, delivery organisational capability and contractual terms for shared investment should not be underestimated. Having said that: Many of the capital delivery contractors provide similar services across different utilities and could proactively offer a combined solution.

Alignment of utility regulation requirements would support this integrated approach.

### Hybrid Option Approach

The Energy Outcomes addition to the Community Energy model provides a good mechanism to increase take-up, particularly in the expansion phase. However it brings with it a greater complexity for the business model and increased risk. The proposal is that the Outcomes model is added only once a stable base load business is in operation. As the Community Energy business expands to new districts; the Outcomes offer may become part of the core offer.

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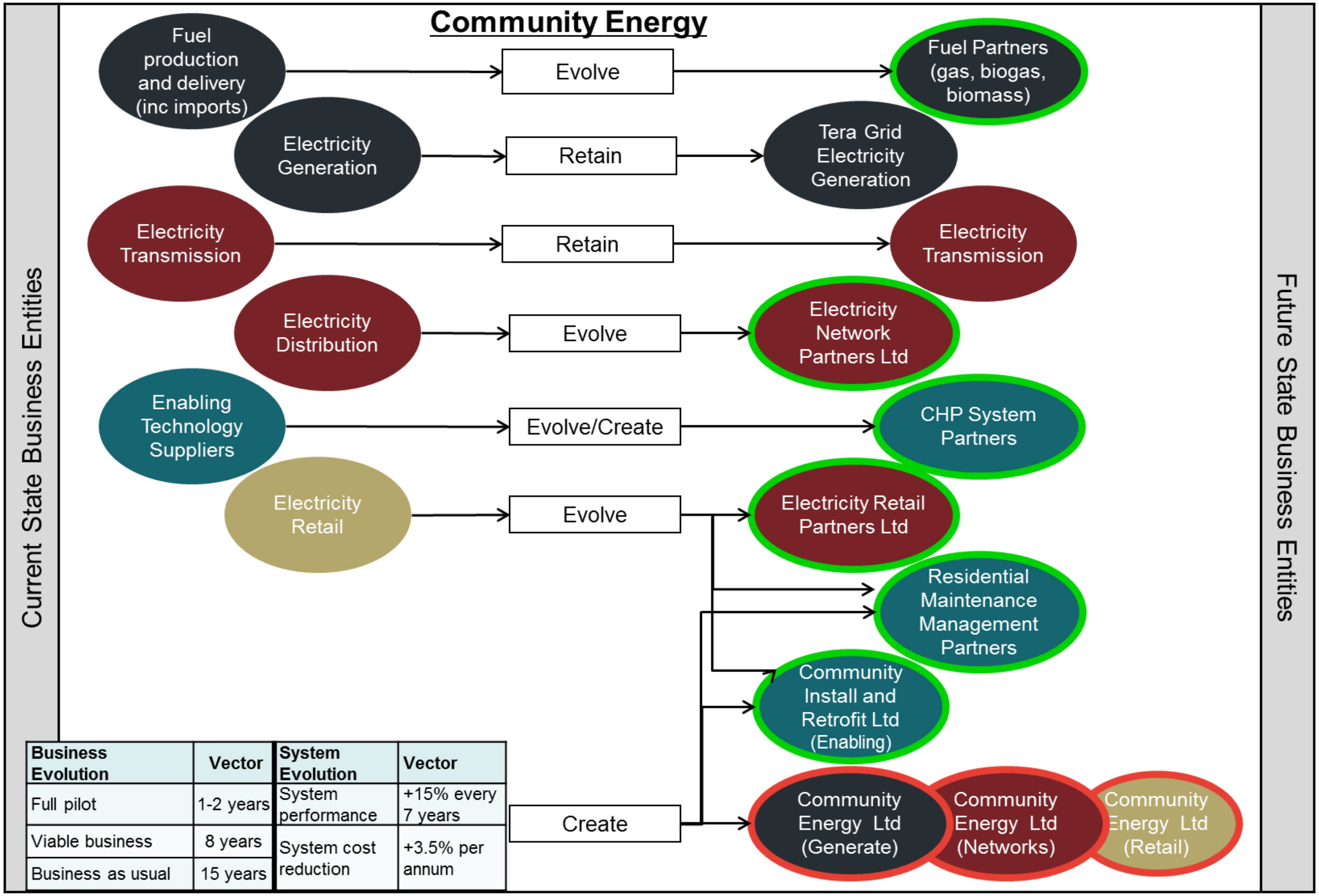
[147] United Utilities / Southern Water construction director interviews Total flow 2013.

The following diagram shows how the business model will develop from evolved existing businesses and new commercial entities:




| Business Evolution | Vector | System Evolution | Vector |
|---|---|---|---|
| Full pilot | 1-2 years | System performance | +15% every 7 years |
| Viable business | 8 years | System cost reduction | +3.5% per annum |
| Business as usual | 15 years | | |

| **Community Energy** | **Key Transition Challenges** |
|---|---|
| Overview | • Creation of heat distribution network within target cost.<br>  ○ Retrofitting/installation within existing urban infrastructure and residential buildings.<br>  ○ Balancing risk and reward to attract investors for both new installation and retrofit.<br>  ○ Acquiring planning consents and political support.<br>• Consumer branding and appeal.<br>  ○ Establishing commercial value versus acceptable price, potentially in a not for profit environment.<br>  ○ Creating a local brand and community appeal.<br>  ○ Establishing and sustaining brand identity, integrity and trust.<br>• Reducing or eliminating barriers to entry.<br>  ○ Regulation may be required to ensure fair purchase price from current incumbents to purchase excess electricity. |
| Activities | • Community heating currently not heavily regulated in the UK; increasing activity may require/attract new regulation.<br>• Planning consent for community energy factory would require strong support and alignment from local councils. |
| Resources | • Retrofitting of heat distribution network into existing urban infrastructure and residential buildings not originally built for community heat distribution<br>  ○ Tax incentive schemes to make risk vs. reward attractive to early investors.<br>  ○ Relatively high cost and installation of domestic heat exchangers and metering.<br>  ○ Bilateral agreements may be needed for sharing of existing pipe networks.<br>• High cost export connection to existing electricity distribution network required with two-way metering. |
| Processes | • Community energy companies would be new entities with associated start-up challenges such as funding, recruitment, etc. |
| Values | • To capture the imagination of local consumers the energy brand owner would either need to be a local champion, recognised by, and fully integrated with, the local community akin to a local football team. Alternatively the brand would need to be a national and recognised consumer brand skilled in thinking global and acting local e.g. Post Office, Co-op.<br>• Remote ownership or bland corporate brands will struggle to convey integrity and win trust. |

| **Community Energy** | **Transition Challenges: Activities, Resources, Processes & Values** | |
|---|---|---|
| **New Organisation** | **Capabilities existing in current businesses** | **Capabilities requiring enhancement or creation** |
| Primary Business Vehicle: Community Energy Ltd<br>• Generate<br>• Networks<br>• Retail | • Electrical generation and supply to the community heat area<br>• Procurement and fuel hedging<br>• Purchase and sale of electricity to/from wholesale market | • Marketing and consumer engagement; ability to attract and retain retail customers<br>• Heat generation, storage and distribution network<br>• Community energy generation facilities – open to the public.<br>• Community retail footprint<br>• Community ethos; recognising what the local community values and "in the community for the community"<br>• Capability to build and sustain reliable value chain of partners |
| Fuel Partners (gas, biogas, biomass) | • Fuel supply and storage | • Optimised distribution network to local power factories<br>• Long-term, profitable and strategic relationships with partners<br>• Strategy for low carbon fuel sources in the future |
| CHP System Partners & | • CHP plant design and provision; | • CHP business case development and whole system design<br>• Local skilled CHP operation and maintenance staff<br>• Long-term, profitable and strategic relationships with partners |
| Electricity Network Partners Ltd | • Electrical network and service provision | • Import/export metering<br>• Rapid & cost effective connection of new capacity to the grid |
| Network Capital Delivery Partners Ltd | • General pipe laying capability | • Heat pipe laying capability; project managers, delivery teams and construction plant<br>• Heat network installation |
| Residential Maintenance Management Partners Ltd | 5. | • Low disruption residential heat exchanger installation<br>• Domestic heat exchanger repair and maintenance with customer-facing technicians, tools and diagnostics<br>• High customer care and service excellence; rapid response |
| Community Install and Retrofit | 6. | • Local heat network design and installation<br>• Heat exchanger and metering installation |

| **Community Energy** | **Transition Challenges and Enabling Policy** | |
|---|---|---|
| **Challenge** | **Business Model Responses** | **Policy and Regulatory Response** |
| District heat schemes such as Community Energy are relatively new in the UK context | Goal: Develop consumer, Local Authority and Network Operators' confidence in the model of centralised heat generation and distributed electricity generation.<br>Activities: Technology and Capital Delivery partners can become investors in full scale pilots to demonstrate their confidence in the technology and Business Model. CHP / Heat Pump Trade organisations should develop common standards as trusted benchmark of performance and best practice. | Goal: Give National level leadership for an approach which could play an important part in the urban energy mix.<br>Policy enabler. Government (DECC/BIS) provide a platform or link to industry portals which match developers with community groups. UK specific best practice guides for developing and implementing district heat schemes posted on the same portal. eg: '*the District Heating Manual for London'*, |
| There is uncertainty around the potential for district heat schemes such as Community Energy in the UK | Goal: Create a compelling business case which overcomes the concerns of capital cost/payback and future fuel source.<br>Activities: Demonstrate the potential for capital delivery costs to be reduced to shorten payback periods. Invest in parallel technologies for future fuels – energy from waste, locally generated and / or network fed Hydrogen. | Goal: Be clear of the challenges of Community Energy models and invest in research to prove whether they can be overcome.<br>Policy enabler. HMG to sponsor research in this area, building on existing enabling actions (UK CHP Development Heat Map.) In addition further feasibility work to clarify opportunities for improving rates of return from community energy projects.<br>Additional support: HMG led challenge to industry for a target cost solution: A competition to develop Community heat and power schemes delivered and operated for £5k per home. |
| The costs of heating networks are high in the UK relative to Europe. | Goal: Technology and capital delivery providers striving to meet an economically viable target cost per home for capital delivery and operation of a Community Energy scheme.<br>Activities: To understand the Automotive industry concept of *Design for Target Cost* and adopt it as a key driver for the take up of their solutions at scale. | Goal: Encourage investment in technology and process to make delivery of Community Energy solutions more affordable.<br>Policy enabler. Continued subsidies to encourage uptake of Community Energy schemes. There are also policy measures to support CHP installations, for example via exemption from the Climate Change Levy, and through the Renewables Obligation for installations fired by biomass or waste.<br>Additional support: Ensuring support is appropriately tapered. |

| Community Energy | Transition Challenges and Enabling Policy | |
|---|---|---|
| **Challenge** | **Business Model Responses** | **Policy and Regulatory Response** |
| Heating networks are associated with high installation costs resulting in lengthy payback periods, potentially of around 20 years. | Goal: Seek standardisation of approaches and process to create common platforms with lower costs to trade.<br>Activities: Adopt a Community Energy Industry code of practise which removes the uncertainty of like for like contracting for community level buyers. | Goal: Remove contractual variety which clouds the investability<br>Policy enabler. Provision of standardised contractual frameworks for heating networks, to be adopted by developers providing the Community Energy model. This aims to improve access to finance by making it easier for investors to assess risk associated with heating networks. |
| District heat schemes like Community Energy require planning approval. | Goal: Create standardised community proposals which meet planning requirements.<br>Activities: Research / discuss reasons for planning objections or challenges and build the technical or process responses into the standard offering. | Goal: Shorten non-value adding aspects of the planning process.<br>Policy enabler. A mechanism to fast track planning, with provision of standardised guidance and information sharing between local authorities on planning issues associated with heating networks, to build local authority expertise. |
| A connection to the distribution network is required which may be subject to high costs and extended contracting times. | Goal: To minimise the cost of effective connections to the electricity grid.<br>Activities: Establish a close working relationship with DNOs and build their requirements into the project design. This will help remove/reduce potential opposition and turn the local DNO into an advocate for Community Energy schemes.. | Goal: Ensure that the regulated monopolies do not put artificial barriers in the way of community energy programmes.<br>Policy enabler. Regulatory requirements that DNOs set access terms and costs consistently, and that the same rules apply for CHP as for renewable generation being connected to the distribution network. |
| District heating is not currently regulated in the UK, but increasing adoption may lead to new regulation being introduced. | Goal: Demonstrate that only 'light-touch' regulation is needed<br>Activities: By working with key stakeholders, including the regulator, Community Energy businesses develop codes of practice which are financially transparent giving the regulator confidence that regulation can be kept to a minimum. | Goal: Set a clear policy direction for Community Energy.<br>Policy enabler. Clear statements on regulatory intentions around heating networks, backed up by regulation which does not overly disadvantage heating networks relative to heating supplied through the electricity or gas networks. |
| District heating schemes have not always provided a good service in the past. | Goal: Develop market confidence in Community Energy.<br>Activities: Develop common standards of performance which have the goal of setting exemplary standards of service and technical performance through the Combined Heat and Power Association or other trade body. | Goal: Market confidence from unbiased performance data.<br>Policy enabler. Providing national resources and performance information to communities to help them understand the benefits and costs of new heating networks could also act as an enabler.<br>Additional support: Manage consumer protection issues through a recognised trade body. |

| **Community Energy** | **Phase 2 Trial: Hypotheses & Pathfinder Opportunities** |
|---|---|

## Hypotheses to test

Owner Occupier demand for Community Energy can be generated from a Local Base-load system and a compelling Local Brand.

- Linked to a community focal point – school or community centre
- Backed by a trusted and appealing consumer brand investing in CSR

The current need for subsidy of Community Energy Networks can be eliminated with industrial systems design to target cost.

- Streamlined capital delivery with standardised processes and lean systems design
- Combining heat network installation with other utility renewal enables a step-change in network delivery cost

Existing energy retailers could play a lead role in a Community Energy consortium if they are able to realign their business values.

- The consortium needs to align behind the goal of lowest system cost as a guiding principle; rather than business model profit maximisation.
- Aligning the retail business to take responsibility for, and manage risks associated with, domestic energy reduction, fuel price risk and consumer behaviour.

## Pathfinder Projects for Phase 2 trial

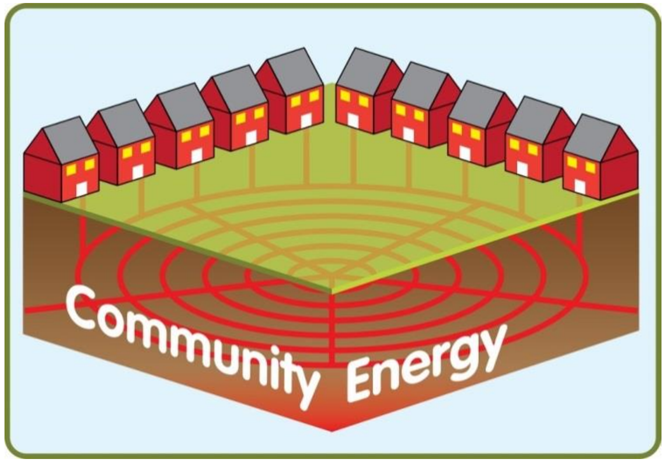
Develop an existing Energy/Heat network to Improve and Expand a current system and create an enhanced consumer offering.

- Identify a location with potential and ambition to scale an existing network and play a larger role in local energy infrastructure.
- Work with community groups to develop added value consumer propositions for energy tariffs, home retrofit and smart controls (HEMS)
- Develop links with local DNO to understand strategic power network challenges and synergies from CHP and network installation.
- Create a proposal for existing network expansion and upgrade; use as a draft template for the SSH demonstration Community Heat Network.

Develop a scalable Smart Systems & Heat demonstration Community Heat network integrated with infrastructure renewal.

- Identify Local Authority and/or Social Landlord with a location that has potential for a Large Scale (1000+ home) Community Heat network with an identified Base-load (≈ 200 homes), suitable for a scalable CHP and GSHP system. . Key selection drivers:
  - The opportunity to build on an existing or emerging community spirit; with an ambitious Local Authority keen to implement a network.
  - A mix of household tenures (social, private landlord and owner occupier), demographics and house types at medium or high density.
  - Develop links with local DNO for power export and network partnership.
  - Potential for infrastructure synergy for renewal or upgrade (water, power, sewage, data services, gas, road surface)
- Develop a top level strategic scheme for roll-out from the Base-load to cover adjacent owner-occupier streets.
- Select technology and delivery partners with experience, but crucially with ambition to deliver a quality system at an affordable cost.
- Market the Community project and enable local residents to engage off-plan
- Plan the development of the Community Infrastructure to deliver the Base-load development, as a minimum, within the SSH timescales.

# Community Energy Supporting Pages



| Community Energy | Target Markets | |
|---|---|---|
| Target Consumer Group | The Appeal – Market USP | Potential Triggers to Buy |
| Stretched Pensioners<br>1.72M Core 2.2M Extended group | Simple operation, reliable heat, system managed by others. Monthly payment and no system repair / replacement risk. | Instigated by social landlord.<br>Or Owners opting in to a local scheme to mitigate concerns of system replacement cost. |
| Older Established<br>0.99M Core 1.7M Extended group | An opportunity to choose an energy provider offering greater cost certainty and managed by others to reduce personal hassle. | An opportunity to opt in to a local scheme with a compelling business case. |
| Busy Comfortable Family<br>0.65M Core 2.73M Extended | A well-priced, low disruption, reliable, unlimited and cost competitive energy provision, managed by others. | A compelling business case, property extension, system failure or a step change in energy consumption (birth of a child, working from home). |
| Transitional Retirees<br>0.4M Core 0.75M Extended group | Greater cost certainty and a reliable system managed by others. Removing the risk of capital cost of system replacement. | Concern that current system is about to fail (or has done so). A compelling business case to join a local network. |
| Middle Grounders<br>0.7M Core 1.79M Extended group | A reliable heating system which requires no up-front capital, with tariffs which can flex to my changing needs. | Opportunity to reduce the risk of unaffordable system failure. Or instigated by my landlord. |
| Green Renters<br>0.21M Core 1.4M Extended group | A more reliable heat system which make me less dependent on my landlord. Local and more sustainable solution competitively priced. | Not my decision but I will lobby my landlord to join the scheme. Or I select the property based on its heating provision. |
| Private Landlord<br>1.48M Landlords.<br>3.6M Eng 4.4M UK Households | A reliable low maintenance option which reduces my exposure to the cost and hassle of system failure or tenant complaints. Being recognised for contributing to the community. An attractor for quality tenants. | A compelling business case to improve the yield for one or more properties. Part of a property / portfolio pathway.<br>Current systems approaching the end of their useful life.<br>Changes in legislation for landlords. |
| Social Landlord<br>2000 Landlords<br>3.8M Eng - 4.6M UK Households | An offer of a low-risk turnkey investment to give low maintenance energy provision. Reducing my exposure to the cost and hassle of system failure and maintenance cost, whilst giving tenants improved comfort. | Compelling business case: Sought out by Landlord or presented by an astute vendor.<br>Changes in legislation for landlords. |

| **Community Energy** | **Target Markets** | |
|---|---|---|
| | Value Proposition Considerations | |
| Target Consumer Group | Benefits Householders *Enjoy* Today That Must Be Preserved | Sacrifices Householders *Endure* Today That we Must Overcome |
| Stretched Pensioners | Time rich. (Potentially asset rich for some Owners).<br>Flexibility to adjust their behaviour to gain a financial advantage.<br>Fixed levelled income. | Seasonal energy costs (particularly for the vulnerable on pre-pay).<br>Fear of system failure. ( For Owners: system maintenance cost)<br>Cash poor: Possibly making a choice between warmth and food. |
| Older Established | Available disposable income.<br>Willingness to invest in property. | Resentment over paying the rising costs of energy. |
| Busy Comfortable Family | Instantaneous and unlimited hot water and heat. | Current and future affordability. |
| Transitional Retirees | Willingness to invest available funds. | Difficult to optimise energy costs and to know what is best for us.<br>Fear of energy prices outstripping our retirement income. |
| Middle Grounders | An ability to make informed choices.<br>Access to information online. | Ignorance of energy market options. |
| Green Renters | Instant response at irregular times. | No phone app to enable system to be controlled or optimised. |
| Private Landlord | Tenants pay the energy bill. | Tenant has to wait for the Landlord to act to fix breakdowns and system underperformance. |
| Social Landlord | Below retail pricing from bulk energy purchase. | High cost to serve their tenant base through life with maintenance and repair from vulnerable and demanding tenants. |

| **Community Energy** | Attractiveness of the Core Proposition and Options to Each Market | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Value Propositions | Older Owners | | Middle Owners | | Renters | | Landlords | |
| | Older Established | Transit. Retirees | Busy Families | Middle Ground | Stretched Pension | Young Green | Social | Private |
| Core Community Energy Proposition | Better | BEST | Better | Better | BEST | Better | Better | Good |
| Energy Outcomes based payment also avoids the cost and maintenance of a heat meter. | | | Better | | | Good | | |
| Use less - The more you reduce consumption vs. our baseline the lower the price per kWh. | BEST | Good | | | May drive under heating | Good | Better | |
| Shift demand – Discounted off-peak electricity & leased Nano (domestic) storage | Better | Better | Good | | | | Good? | |
| Shift demand – Discounted off peak electricity consumption (wash / electric vehicles / cook) | Good | Better | | Good | Good | Better | | |
| Shift demand – Discounted off-peak hot water | Good | Better | | Good | Better | | | |
| Use Less peak and total – Low cost for 'throttled' pipe | BEST | Better | | Better | | | | |
| Marketing Value - Bonus for introducing a friend | Good | Good | Good | Good | Good | Good | Good | Good |
| Engage the community: The local school gets a £100 energy voucher for every new parent who signs-up to community energy. | Good | Good | BEST | Better | | | Good | |
| Dividend as our Membership Grows (Co-op) | Good | Good | Good | Good | Good | Good | Good | Good |
| Levelled Payment for variable use | Good | Good | Good | Better | BEST | | | |
| Fixed future pricing (akin to fixed mortgage) | | Better | Better | Good | Better | | Good | ? |

| **Community Energy** | **Strategic Risk Analysis** | |
|---|---|---|
| Supplier Pressure<br>Fuel Suppliers: No alternative<br>• Step-change in market demand/supply which inflates whole market price.<br>• Targeted pricing to undermine a specific business model to assure cost parity with historic heat providers.<br>Power by the hour Provider: No alternative<br>• Vendor withdraws / becomes insolvent.<br>• Vendor demands unwarranted price rise. | Risk of New Entrants<br>Race to be first to prime sites:<br>• eg: supermarkets' land grab.<br>Low risk once established<br>• High cost/risk of entry.<br>• High customer acquisition cost and even higher to dislodge – disruptive proposition.<br><br>Competitive Pressure<br>Other Providers Cross-subsidise<br>• Leveraging balance sheet mass, at a local level to defeat a disruptive proposition.<br>• Short-term, aggressive switching incentives.<br><br>Substitution of Products<br>Step change in electricity supply cost<br>• More risk of reduced growth than customer loss<br>New disruptive heat technology<br>• Low risk as Community Energy system response is not a sacrifice. | Customer Pressure<br><br>Community collective bargaining.<br>• As a response to poor service or a feeling of unfair pricing compared to (new) alternative offers. |

| **Community Energy** | **Future Proofing & The Assessment of Risk** | | | |
|---|---|---|---|---|
| Description of Strategic Risk | Impact | Likelihood | Rating | Mitigation |
| Majors system Outage<br>• Technical system failure<br>• Fuel Supply | Extreme | Possible | Serious | Technical: Robust emergency connection to grid supply<br>Fuel: Back-up fuel bunkering |
| Catastrophic loss of community confidence | V. High | Possible | Serious | Maintain community goodwill at almost any cost: Community representation on Supervisory Board. Robust disaster planning for broad ranges of community impacting failure. |
| System Supplier Withdrawal or Profiteering | V. High | Possible | Serious | Select robust suppliers with mass and long-term brand value which dwarfs their exposure. |
| Environmental Pollution | V. High | Possible | Serious | Robust Health and Safety culture of any supplying organisation and high safety factors on all critical elements. Rapid response plans for incidents. |
| Lack of balance sheet mass to cope with short term pressure. Competitive / cash-flow | Medium | Possible | Serious | Emergency facility from parent company or pre-arranged bank or local-authority facility. |
| Lack of availability of a low carbon fuel substitute leading to a stranded asset. | Extreme | Possible | Serious | Partnering with technology providers to develop options for alternative fuel sources; retrofit. Blend of future fuel across the networks to avoid single source risk. |
| Fuel costs escalating faster than our ability to pass on to consumers. | Extreme | Possible | Serious | Careful attention to range of cost and revenue scenarios when setting tariffs. Mixed portfolio of income pricing to spread risk. |
| Withdrawal of planning support | Medium | Unlikely | Manageable | Close involvement of Local Authority on the Supervisory Board to ensure no surprises down the line. |

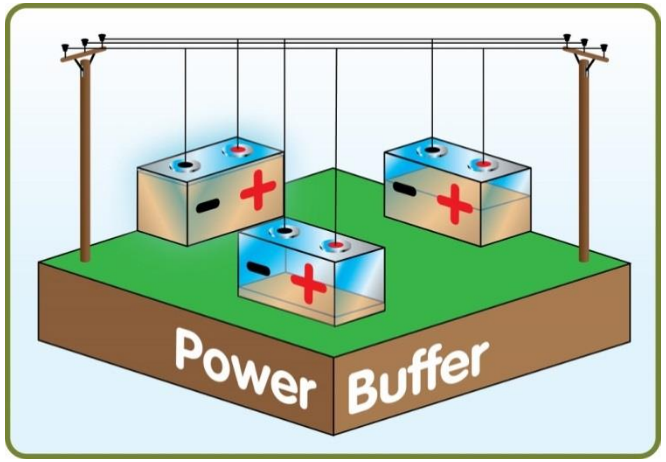
| Risk Priority | | | |
|---|---|---|---|
| Impact | Likelihood | Rating | Mitigation |
| Extreme | Certain | Acceptable | 0-4 |
| V. High | Likely | Manageable | 5-8 |
| Medium | Possible | Serious | 9-25 |
| Low | Unlikely | | |
| Negligible | Rare | | |

| **Community Energy** | **Potential Suppliers to the Primary Business Vehicle: Outside the Value Chain** | | |
|---|---|---|---|
| Pre Sale | Point of Sale | Through Life | Disposal |
| Agency assessment of viable locations for CHP plant and network.<br>Agency analysis of householder mix within a target town/city.<br>Construction consultant planning and infrastructure requirements specification.<br>Agency analysis to inform how core market propositions could be tailored to the local market requirements.<br>Construct “show homes” in target locations. | One off plant building construction.<br>One off conversion, fit out and branding of retail footprint.<br>Recruitment and training of business vehicle staff. | Metering and data management.<br>Billing and cash collection | Removal of redundant assets. |

| **Community Energy** | **Whose Business is the emergence of community energy going to affect substantially?** | |
|---|---|---|
| | Likely to Impact Positively | Likely to Impact Negatively |
| Tera Grid Level | Reduced Network Operator balancing requirement:<br>Increased Mini Level power generation at peak heat demand will reduce / eliminate local electrical demand on the Grid.<br>Locally generated power will offset the natural growth in demand to delay or avoid Transmission Network upgrade, and reduce the pressure on ‘fast to build’ generation capacity to bridge with long-term sustainable capacity. | Slower increase in demand to fund national grid investment.<br>If highly successful some existing generation capacity may become obsolete before their business plan. (Unlikely?)<br>National electrical wholesale/resale operations will lose market share. |
| Macro City Level | Reduced pressure on electrical Network ‘pinch points’ with targeted siting of Community Heat. | Local waste / incineration operators if Community Energy provides an alternative use for waste. |
| Mini Community Level | Offset costs for Utilities: Shared investment for new capacity /upgrade / replacement of water, sewerage, electricity, gas & data infrastructure.<br>Capital delivery partners to build and maintain local energy distribution networks. | Reduced total turnover for utility capital contracting businesses. |
| Nano Domestic Level | New Heating Businesses: Lower barriers to entry to install and service domestic systems: No gas skills and minimal electrical capability required. | Reduced revenue per visit for existing Heating Engineers |
| Energy Supply Chain | Demand for Local producers of biomass and alternative low carbon fuels to substitute for gas in future. | National domestic retailers will lose market share. |
| External Supply | Increased demand for Combined Heat and Power OEM’s<br>Greatly increased market for water/water heat exchangers.<br>Demand for easy fit highly insulated heat pipe & storage systems.<br>Potential increased demand for electrical storage capacity. | Reduced demand for domestic gas boilers. |

## 15.4 Power Buffer

# Business Model Assessment



**Power Buffer - Provider of electrical storage capacity to balance network load and trade power on a variable price basis.**

The business designs, procures, installs and commissions storage capacity across technologies at distribution scale.
The services from this capacity are traded with the System or Network Operator or Retailer as a managed service, or pay per use facility.

## Partners

**Distribution Network Operator (DNO)** at the point of connection

**Storage Technology Partners :**
Original Equipment Manufacturers (OEMs Siemens, Hitachi, GE, ABB, Isentropic )

**Network Storage Installation Partners:**
Capital delivery of large assets (where not plug and play)

## Key Activities and Resources

### Activities

Design, procure, install and commission electricity storage capacity connected at multiple points and different voltages on the distribution network.

Sell flexibility services to DNOs and System Operator

An arbitrage mechanism to buy low priced power and sell at a profit to retailers.

### Resources

System design capability at distribution scale (ie City-community) across storage technologies.

Creation and successful management of JV's

## System Value Proposition

An energy storage solution which provides the electricity network with a mechanism for levelling the load on the local and national grids and back-up for power outages.

This acts as extra capacity and can be traded on an annual facility, or pay per use basis.

This postpones the need for investment in increased distribution network capacity

Off-peak power bought and stored until it can be used/ sold more profitably.

Rental or temporary capacity to protect consumers from network upgrade or repair.

## Relationship and Channels

### Relationship

Joint Venture with DNO or TNO or large power user and a technology provider.

Multiple year contracts for (semi) permanent storage assets on the basis of:

- leased asset.
- managed service
- pay per use facility

### Channels

Business to Business-

- Energy Buffer direct approach to DNOs
- Direct offer to energy retailers
- Market research for large power users

## Customers and Market Share

### Customers

DNOs seeking to level peak loads in near capacity network links / nodes.

Energy Retailers for peak capacity.

National Grid for balancing function.

Community Energy plants

Large energy generators / users for trading ToU.

### Market Share

A new market, separated from the network operators by regulation. Or

A specialist storage provider sub-contracted to network operators.

## Costs

**CAPEX:** Battery or other technology. Network connection cost.

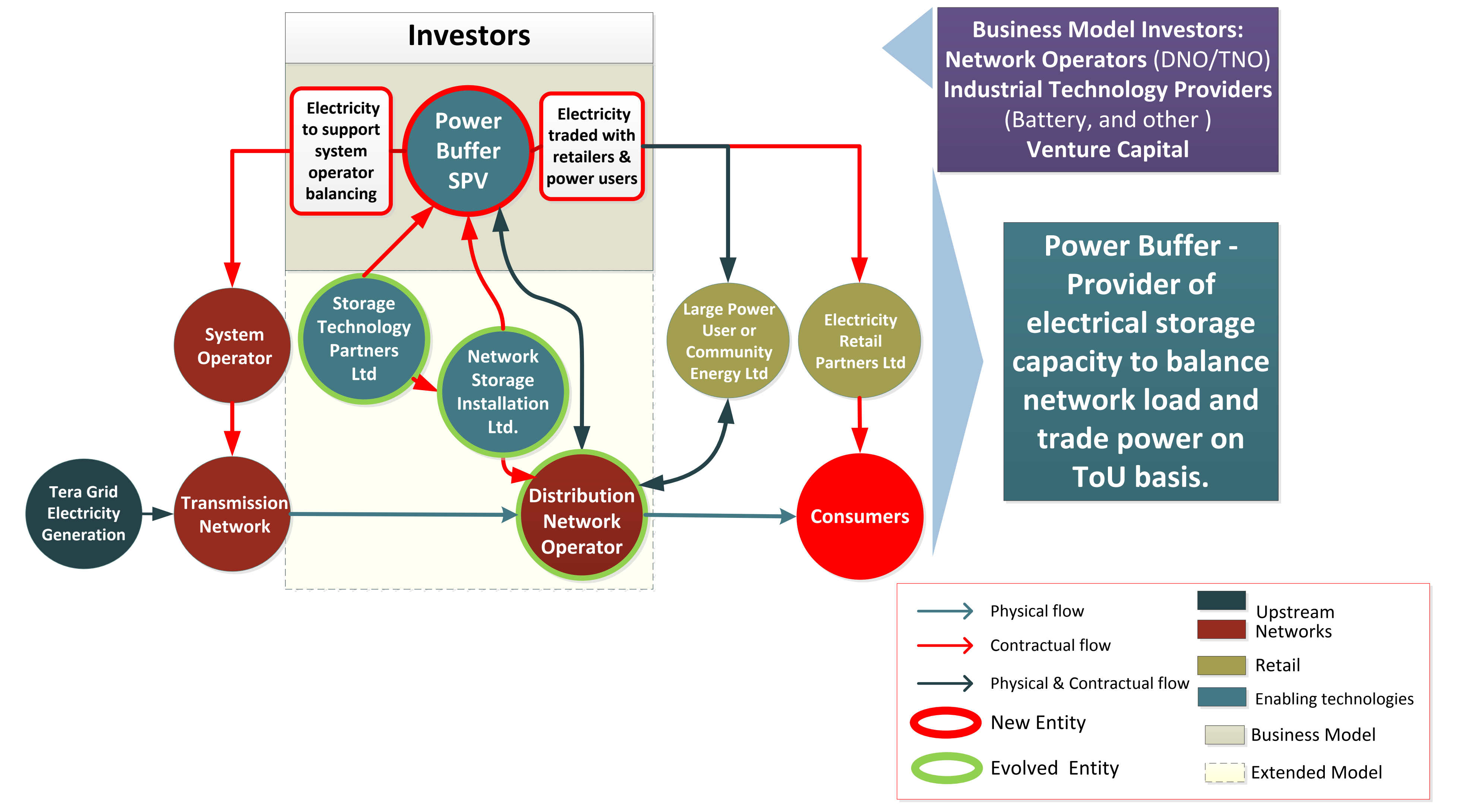
**OPEX:** Off peak electrical power purchase price. Arbitrage trading costs.

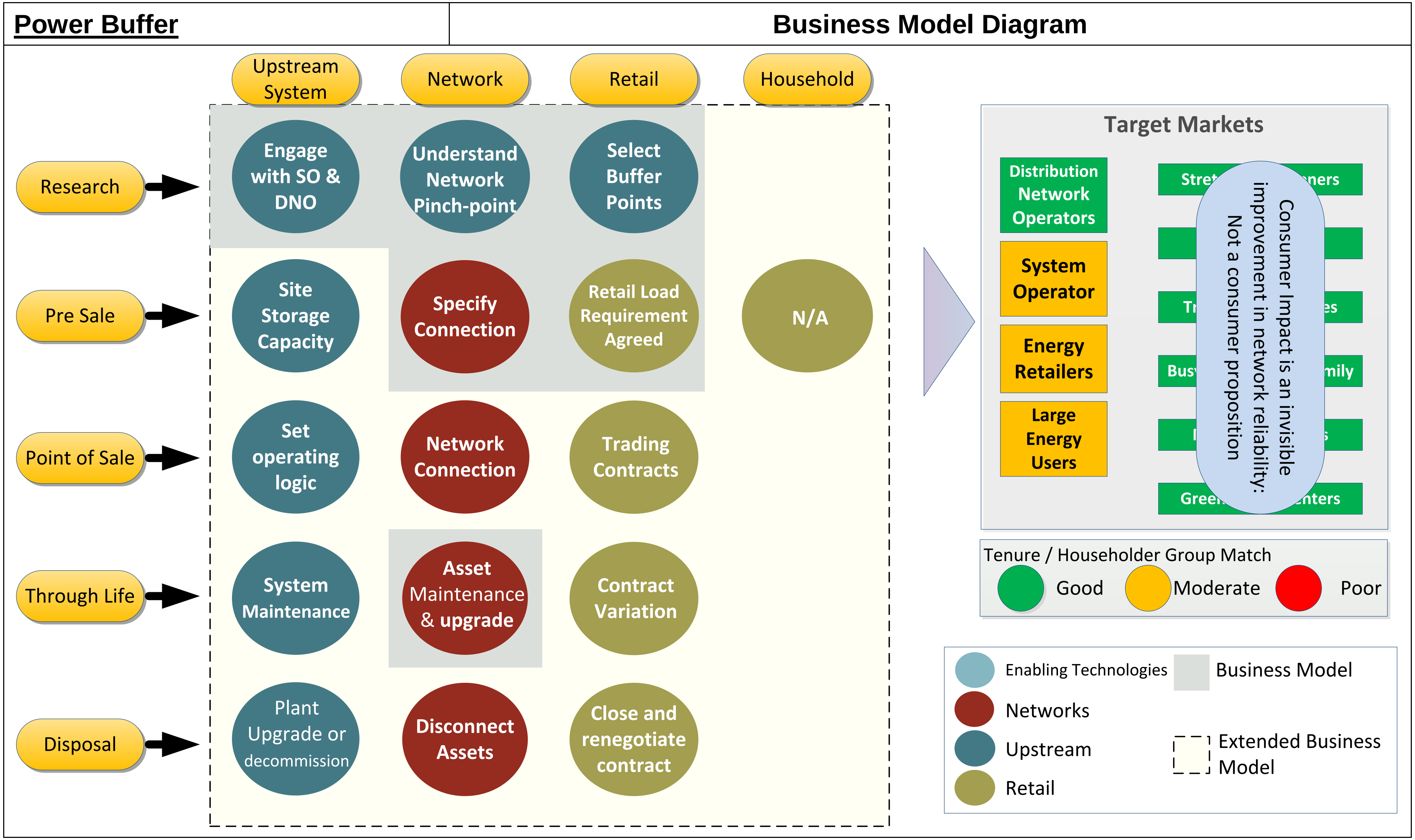
## Revenues

Arbitrage trading payments per kWh and kW.

Network balancing payments from DNO / System operator per kW reduction of peak demand.

| Power Buffer | Value Chain Elements |
| --- | --- |





Power Buffer
Business Model Diagram
Upstream System
Network
Retail
Household
Research
Pre Sale
Point of Sale
Through Life
Disposal
Engage with SO & DNO
Understand Network Pinch-point
Select Buffer Points
Site Storage Capacity
Specify Connection
Retail Load Requirement Agreed
N/A
Set operating logic
Network Connection
Trading Contracts
System Maintenance
Asset Maintenance & upgrade
Contract Variation
Plant Upgrade or decommission
Disconnect Assets
Close and renegotiate contract
Target Markets
Distribution Network Operators
System Operator
Energy Retailers
Large Energy Users
Consumer Impact is an invisible improvement in network reliability: Not a consumer proposition
Tenure / Householder Group Match
Good
Moderate
Poor
Enabling Technologies
Business Model
Networks
Upstream
Extended Business Model
Retail

| Power Buffer | The Business Idea |
|---|---|
| **The Idea** | A business to business provider of electrical storage capacity.<br>Power Buffer provides technical solutions for storing power: Charging at times of low grid demand and feeding back at peak.<br>The storage unit can be connected directly to the grid or through another entity with an agreement to export power to the grid.<br>The business is technology agnostic and could be based on batteries, pumped heat electrical and emerging storage technologies.<br>Short term storage capacity is valuable to smooth the 'noise' of local instantaneous demand variation; easing the requirement for network balancing. By placing storage at heavily loaded points on the network it enables the Network operator to defer capital investment in network upgrade as demand grows. The storage installation may be on a temporary or permanent basis.<br>The business model targets the distribution network level, although the idea could perform technically at any scale from domestic to HV grid, reducing the risk of network failure. Core customers for this capability are (1) the local DNO who will value the reduction in peak load on their infrastructure. (2) National Grid as the System Operator which will benefit from the reduced upstream impact on the Transmission Grid as Power Buffer smoothes the instantaneous shifts in demand which would otherwise need balancing at grid level. (3) The DNO from providing power back-up for planned and unplanned outages.<br>Medium term, High power level (>1MW) and high capacity (>1MWh) storage enables the levelling of network load over longer periods of peak demand. This has the potential to further reduce the investment in transmission level networks and ultimately in generation capacity as storage capability stretches from minutes to multiple hours and days. This aspect is also valuable to Community Energy schemes or larger energy users who may also have their own CHP capacity.<br>The combination of conversion efficiency of the storage and pricing differential between off-peak charging and peak sale is crucial. To be viable: Sale price must be ≥ Charging price ÷ efficiency + required return (based on capital, connection and operating costs). With current storage efficiency around 80% (depending on technology) the starting point for peak pricing needs to be 25% higher than charging cost before capital and operating costs – this is close to the spread between system sell and system buy price for 2010.<br>Customers for this capability are energy retailers with a short-term need to balance their consumers' actual use to the retailer's contracted supply from the wholesale market. High electrical energy users may choose to include a Power Buffer facility within their premises to shift their demand away from peak pricing. Either as a capital asset or a pay per use basis managed by Power Buffer.<br>For a network operator the ability to call in temporary storage to reinforce local networks during upgrade or emergency repair work could be a valuable alternative to customer outages or bringing in temporary generation capacity. |
| **Strategic Value** | To provide network levelling capacity which responds to:<br>• Variations in consumer demand, both predictable (evening peak) and instantaneous (sudden news event)<br>• Variations in generation output from intermittent renewables<br>Increase network resilience to cope with unexpected events (cabling damage, network node failure and demand / capacity spikes)<br>Smooth demand on transmission infrastructure to reduce the need for large increases in network capacity.<br>Stimulate further development of electrical storage capacity which could ultimately be capable of inter-seasonal demand levelling. |

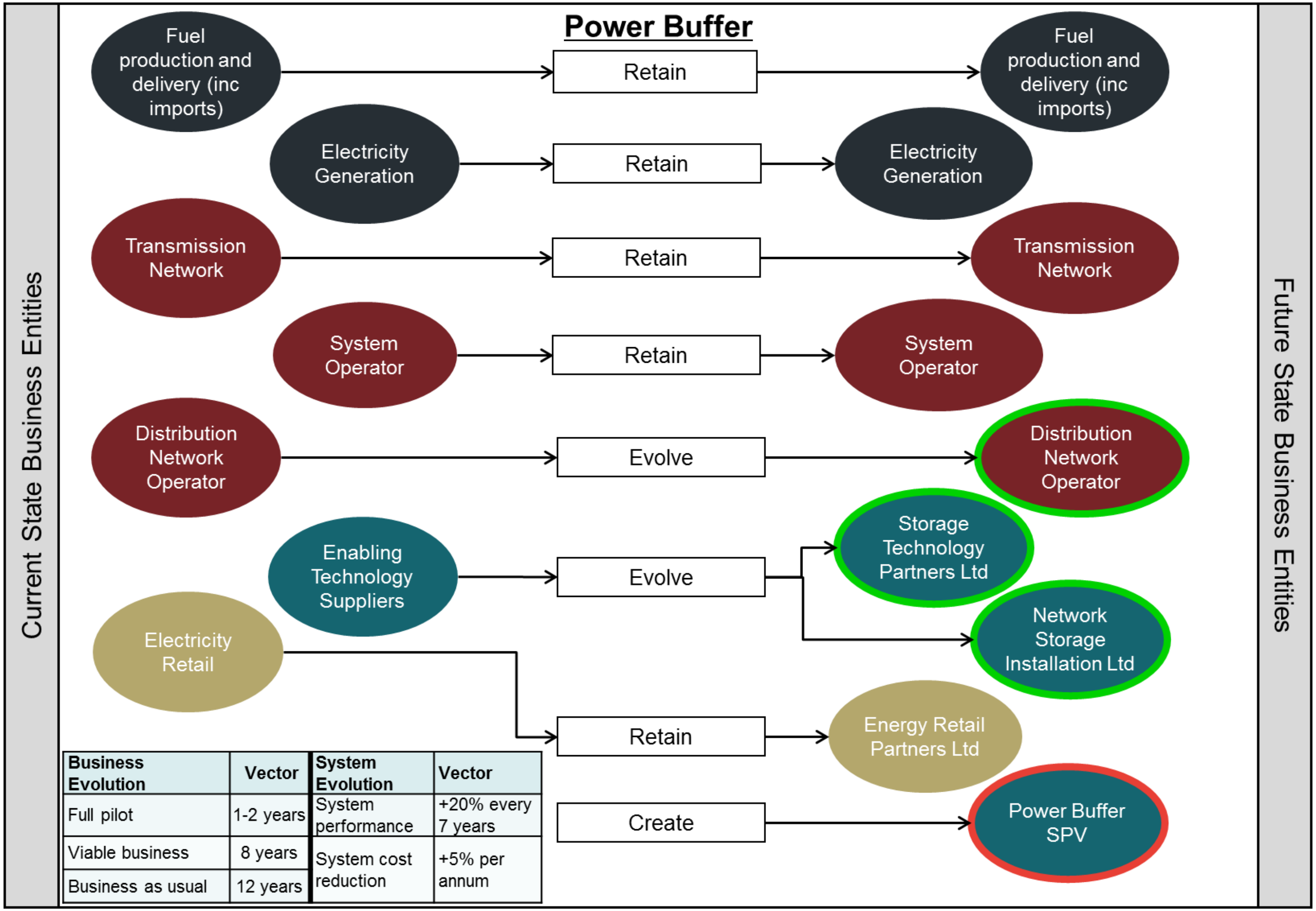
| **Power Buffer** | **Target Markets** |
|---|---|
| Target Market(s) | Power Buffer's core offering is network balancing capability which has value to the fourteen Distribution Network Operators (operating as only six branded businesses).<br>Western Power Grid • UK Power Networks<br>Scottish Power • Scottish & Southern<br>Northern Power Grid • Electricity North West<br>These businesses are not in direct competition with one another, but are incentivised to improve performance, as measured by Ofgem, by improved financial settlement for the highest performing operators.<br>National Grid, SSE (Transmission) & Scottish Hydro are also potential customers at the high voltage transmission level.<br>For the power trading offering the market is widened to include the energy retail businesses and although dominated by the 'Big 6' (EDF, E-On, Centrica, SSE, N-Power, Scottish Power) there are emerging businesses including: Co-op energy, Ecotricity, Good Energy and others all of whom will have a need to buy (and potentially sell) to match their contracted demand position.<br>In addition corporate power users may benefit from an ability to reduce their exposure to peak prices using Power Buffer technology, although these businesses are outside the scope of this project. |
| How will the business compete? | Power Buffer will compete by providing customers with a highly responsive and cost effective mechanism for levelling network load and a very straightforward trading proposition. |
| Spill-over and Synergy outside the Value Chain | The focus for Power Buffer is the storage of energy at distribution level and its demand for a range of technologies will have spill-over value at other scales: Encouraging innovation and sales for domestic and grid level storage and as a result increasing the viability of intermittent renewables.<br>Power Buffer could play an important role for Community Energy installations to enable more profitable trading and local demand buffering – linking the same Power Buffer unit to the grid for DNO balancing has the potential to serve two customers with the same asset reducing capital cost, installation cost and potentially maintenance cost.<br>Mobile Power Buffer technology has potential for benefit in the realms of disaster relief in the UK or worldwide. |
| Global USP | A provider and operator of self-contained electrical storage technology to level distribution network loads and trade power more cost effectively than the alternative of increasing network and generation capacity. |
| Branding Examples: | Reliable technology brand: Siemens / Hitachi / GE. Corporate Leaership: Marks & Spence Plan A. Community Engagement: Supporting Local Schools. |

| **Power Buffer** | **Financial Overview** |
|---|---|
| **Investment Required**<br>High capital for storage technology (currently). Possibly requiring joint up-font investment with the technology manufacturer to develop the technical solution for network buffering.<br>• LV rural / suburban / urban: 100kW/200kWh £280,000<br>• 20 facilities across the system (scaling up from first pilot node) £5.6M<br>• Technical staff costs to design and manage Network £235k/yr<br><br>Potentially high network connection costs (unless part funded by the DNO if it is in their interests to connect.)<br>Overhead to include for administration, trading and business development (reduced as part of a larger business model) £300k/yr | **Revenue Assumptions**<br>Regular contract for provision of flexibility services for DNO / TNO or pay per use for balancing services.<br><br>Sale of power to electricity retailers to protect the retailer from 'Cash out' costs. |
| **Potential Investors**<br>Network Operators themselves may be investors in the Power Buffer business: The ability to level network load instantaneously and at the right point on the network is of great value to the operator.<br>Regulations preventing DNOs investing in generation capacity may also preclude them trading energy from Power Buffer, but there should not be a restriction on investing in an independent business model.<br>With a long-term strategic need for storage across the network returns for the Power Buffer model are likely to be highly reliable making it attractive for low risk pension fund investment. However in the start-up and business model phases the risk profile may fit better with venture capital. | **Operating Costs**<br>Staff costs estimated for core competencies:<br>• Technical staff for system design and proposition development. £175k/yr<br>• Operating staff for system control and maintenance in collaboration with client networks. £ 60k/yr<br>• Outsourced maintenance costs (20 buffers) "£100k/yr<br>• General marketing finance and administration costs.. £200k/yr<br>• Relatively low commercial staff cost with 17 key accounts. Future potential to roll out to industrial clients (beyond current scope) £100k/yr<br>• No consumer engagement costs. |

| **Power Buffer** | **Legal Entities & Potential Partners** | | | |
|---|---|---|---|---|
| | Activities | Resources | Processes | Values |
| Power Buffer Ltd. Provider of electrical storage capacity to balance network load & trade power on ToU basis. | Electrical storage capacity operation and maintenance<br>Network power balancing and peak/off-peak trading.<br>Identification, design and development of suitable Power Buffer locations.<br>Storage technology procurement and system development.<br>Capital delivery contracting and process improvement to reduce costs. | Capital Assets installed in the field either:<br>- On owned sites close to network nodes<br>- On DNO sites with customer agreement.<br>- On other private key account sites<br>Commercial team skilled at identifying Buffer potential and negotiating contracts.<br>Technical design expertise | Capability to work with key accounts to identify high potential Power Buffer sites<br>Creative ability to identify opportunities for low cost delivery of assets.<br>Understanding of 'design for target cost' driver to minimise whole life cost. | The viable alternative to increased generation capacity.<br>An essential component in a low carbon electricity network.<br>Technology led with a clear purpose to enable energy security, affordability and sustainability. |
| Storage Technology Partners Ltd. Original equipment manufacturer. | Technology provision.<br>Product innovation to:<br>- increase capacity and conversion efficiency.<br>- reduce cost per kW & kWh<br>- design for fast deployment<br>Refurbishment of end of life storage and components. | Leading edge electrical storage technology<br>Capability for product and installation innovation.<br>Manufacturing capability to deliver at scale.<br>Cost focused to enable market growth. | Robust engineering design and change control management (as new versions are designed)<br>Remote interrogation of system performance for operation and design optimisation. | Technical excellence in everything we do.<br>Practical solutions designed to meet the network price points. |
| Network storage Installation Ltd. Capital delivery partner for assets. | Capital delivery of battery connection to network and associated infrastructure.<br>Focus on speed and cost reduction. | Programme managers<br>Delivery teams<br>Capital delivery process innovators | Network connections<br>Creative power buffer enclosure installation. | Minimal disruption to customers or the public.<br>Unsurpassable capital delivery performance. |
| (Distribution Network Operator Ltd. Customer and potential partner) | Customer of and potential investor in Power Buffer.<br>Provision of trading signals<br>May seek to operate Buffer if regulation allows. | Network operation and maintenance expertise.<br>Network design expertise | Network balancing<br>System optimisation | The network that is always there for your power needs<br>Unsurpassable network resilience. |

**Power Buffer** | **Business Entity Transition Paths**

The following diagram shows how the business model will develop from evolved existing businesses and new commercial entities:




| Business Evolution | Vector | System Evolution | Vector |
|---|---|---|---|
| Full pilot | 1-2 years | System performance | +20% every 7 years |
| Viable business | 8 years | System cost reduction | +5% per annum |
| Business as usual | 12 years | | |

| **Power Buffer** | **Key Transition Challenges** |
|---|---|
| Overview | • Creating compelling business cases for the solution to attract DNOs globally<br>• Creation of the necessary regulatory framework for the new operating model<br>  ○ To minimise network connection costs<br>  ○ To permit those DNOs wanting to participate in the Power Buffer market to trade capacity, storage and demand<br>• Designing and manufacturing buffering technology solutions with efficiencies >95% irrespective of scale and with linear operating cost per kWh stored and per kW output power<br>• Overcoming the potentially high cost of entry and long investment pay-back through incentives such as tax breaks for the new Power Buffer companies or to encourage the formation of JVs |
| Activities | • Developing viable business models for the Power Buffer companies, for example<br>  ○ Provision of either an instantaneous energy buffer and/or longer-term energy warehousing<br>  ○ Creating attractive offerings such as “pay per use” or “pay for service-level provision”<br>Developing approaches to help DNOs minimise both financial and non-financial impact on performance during connection to the grid |
| Resources | • Access to technology for robust and reliable high power and high capacity storage solutions<br>• Access to reliable and robust installation capabilities<br>• Robust connections to electricity distribution networks are required with import/export metering |
| Processes | • Creating new energy trading relationships between power buffer value chain participants<br>• Developing and manufacturing new power buffer technologies at target cost and performance<br>• Capital delivery, installation and maintenance capabilities |
| Values | • Innovation to develop reliable, effective technology solutions<br>• A passion for using technology to enable energy security, affordability and sustainability |

| **Power Buffer** | **Transition Challenges: Activities, Resources, Processes & Values** | |
|---|---|---|
| New Organisation | Capabilities existing in current businesses | Capabilities requiring enhancement or creation |
| Primary Business Vehicle: Power Buffer SPV | • Capital delivery contracting with cost and service (low disruption) focus | • Installed base of Power Buffer capital assets<br>• Electrical storage capacity operation and maintenance<br>• Network power balancing & peak/off-peak arbitrage strategy<br>• Identification, design and development of suitable Power Buffer locations in collaboration with DNOs<br>• Storage technology system design expertise and procurement skills<br>• Commercial teams skilled at identifying Power Buffer potential and negotiating contracts<br>• Identification and marketing of opportunities to reduce whole system costs |
| Storage Technology Partners Ltd. | • Advanced technology and engineering design and change control management | • Leading edge manufacturing capability for delivery at required costs and scale<br>• Product innovation to increase capacity and conversion efficiency, long-term reliability and minimal maintenance.<br>• Design Power Buffer technology for rapid deployment; reducing installation cost and as disaster recovery offer.<br>• Refurbishment of end-of-life storage assets and components<br>• Remote interrogation of system performance for operation and design optimisation |
| Network Storage Installation Ltd | • Programme managers and capital delivery teams<br>• Reliable and safe deployment of medium voltage power infrastructure | • Capital delivery of Power Buffer connection to the network and associated infrastructure, with a focus on cost reduction and speed to minimise disruption to the network and consumers |
| Distribution Network Operator Ltd | • Network operation and maintenance expertise, including network balancing<br>• Network balancing at the local and regional level. | • Provision of trading signals to Power Buffer SPV<br>• Network balancing and optimisation in a power buffer environment<br>• Identification of the most appropriate locations for power buffer and other related technologies |

| Power Buffer | Transition Challenges and Enabling Policy | |
|---|---|---|
| Challenge | Business Model Responses | Policy and Regulatory Response |
| Restrictions on DNOs owning and trading from EES, as it classed as a generation assets | Goal: Enable DNOs to benefit from the advantages of Power Buffer model, whilst meeting their regulatory requirements.<br>Activities: Establish contractual agreements between Power Buffer and DNO which can minimise costs (of capital delivery and operation) as separate entities, but also do not preclude the Network Operators acquiring the asset if regulation changes. | Goal: Give network operators scope to reduce capacity requirements, without jeopardising consumers' expectations of a fair regulated price.<br>Policy enabler. In the case of the Power Buffer model, current regulatory restrictions may act as an enabler by limiting the extent to which DNOs can trade in storage themselves.<br>Additional support: Creating a framework where Network Operators are permitted to trade services from storage, whilst remaining a regulated natural monopoly. |
| Lead times associated with EES may be long | Goal: Create a responsive supply chain for electrical energy storage.<br>Activities: To reduce lead-times the Power Buffer supply chain needs to create a common platform of components so that each system is assembled rather than bespoke engineered. Once platform manufacture is established capable supply chains will be able to deliver a 75% reduction in leadtime. | Goal: Encourage manufacturer and installer investment in Power Buffer supply chain improvement.<br>Policy enabler. A stable policy environment is likely to encourage investment. In turn this may lead to lower relative costs of EES over time, making the business model more viable<br>Additional support: Mandating common technology architectures and key components, to minimise leadtime for maintenance and repair. |
| DNOs need guidance for the use of storage in network planning and design. | Goal: DNOs/ TNOs and the system operator have great clarity of how Power Buffer can support their goals<br>Activities: A Cross industry working group to develop the Power Buffer offering. Manufacturers working in close partnership with all network operators and stakeholders to ensure industry standards meet the technical, operational and contractual requirements of the sector | Goal: Smooth the technical and contractual path to installing buffering technology<br>Policy enabler. Testing of the potential for DNOs to use storage is underway and planning guidance could be reformed on the basis of this testing<br>Additional support: If Ofgem set a clear strategy for electricity storage the network operators and power buffer providers can present a more cost effective roll out plan |

| Power Buffer | Solutions to Develop Phase 2 Trial |
|---|---|

## Hypotheses to test

Power Buffer can play a significant role in levelling localised / regional network load to improve network reliability and defer investment.

- Where local networks are running at near capacity; sudden demand spikes may trip network points to fail
- With a Power Buffer to level network load; the same infrastructure can supply greater total power to end consumers without cabling and node investment

Localised generators (Community Energy) and large power users will benefit from Power Buffer capability to manage energy import export.

- Community Energy generates power for export and values Power Buffer capability to store and feed into the grid at peak times to maximise export revenue
- Large power users may also have generation capacity and will value Power Buffer capability to store electricity to avoid peak pricing and network charges.

The transmission network can benefit from Power Buffer smoothing DNO network load and reducing need for short term peaking capacity.

- Contrast current DNO/TNO flows and peaks with modelled flows using Power Buffers across the DNO. From this the reduction in network balancing activity can be predicted and the impact of more levelled network load on peaking capacity and cost can be quantified

Where the local network has intermittent renewable generation capacity Power Buffer will aid the balancing of generation and demand.

- For solar installations Power Buffer will be able to store midday peak generation for feeding back to supply evening peak demand
- With less predictable wind output more sophisticated store / hold / export algorithms for Power Buffer will be required

## Pathfinder Projects for Phase 2 trial

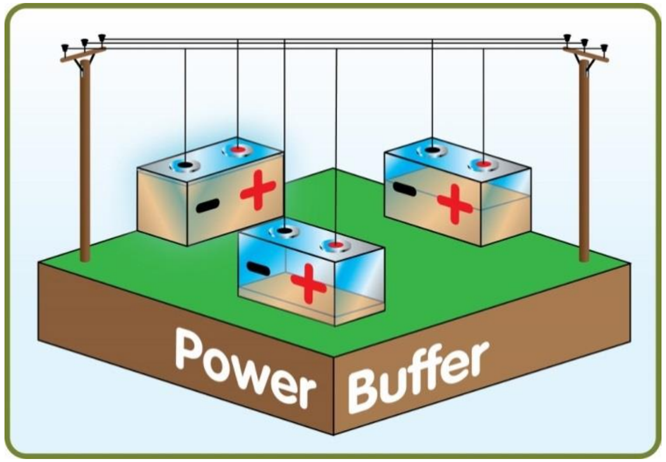
Review a current Electrical Energy Storage facility to examine the potential for performance and cost improvement.

- Work with a current EES facility to identify performance characteristics, operating, capital and capital delivery costs as a baseline for future systems.
- Review each element with a design to target cost approach and establish an evolved future cost model for Power Buffer across scales of storage
- Take the greatest opportunities and work with manufacturers or capital delivery teams to design a future state and transition path to deliver target cost
- Create a proposal for existing storage facility expansion and upgrade; use as a draft template for the SSH demonstration Community Heat Network

Deliver a Power Buffer solution within the Community Energy model, or a large power user or distribution level generator.

- In a Community Energy Phase 2 trial; incorporate Power Buffer technology at sufficient scale to support DNO and Community Energy needs
- For the DNO; size and connect the Power Buffer to level existing demand spikes irrespective of Community Energy operation
- For Community Energy; design the Power Buffer to have sufficient capacity to trade based on modelled heat demand and peak pricing
- For capacity which is common to both requirements create a shared asset. For specific needs create independent, but connected assets
- Develop the capability to control / operate the Power Buffer as a solely DNO facility, a Community energy facility or a Hybrid facility
- Identify the cost and operating challenges to establish the viability of a Hybrid Power Buffer for DNO and generator balancing

# Power Buffer Supporting Pages



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# Power Buffer — Strategic Risk Analysis

## Suppliers Pressure

Cost Pressure from Technology Providers

- Multiple technology options and providers to select from.
- While Power Buffer may not be expert in all; a range of technology options should be part of the offer to spread the technology risk.
- Technology providers focus on unaffordable technical perfection at the expense of affordable solutions.
- A supplier reluctance to engineer technology to target cost.

Capital Delivery Partners

- Pressure on price in a booming market with limited capability.
- Failure to perform – service and delivery with key accounts

## Risk of New Entrants

High with multiple technologies and companies large / small investing in technology development.

Low/Medium barriers to entry:

- Good access to capital to fund Power Buffers
- Small staff and marketing risk.
- Limited regulatory requirements.

## Competitive Pressure

No apparent existing competitors, but the technologies are being trialled so delivery and operating models must be in the process of being developed.

## Substitution of Products

More affordable mass storage capability at the Tera level (eg: Dinorwig pumped storage) or domestic level through home batteries may reduce the market requirement significantly.

Customer DSR and peaking generation plant can also substitute.

## Customer Pressure

Ambition from DNOs to become the storage operator as well as the network manager.

- Difficult to compete if regulation gives them licence to operate storage.

Price pressure on trading models based on alternative options.

| **Power Buffer** | **Future Proofing & The Assessment of Risk** | | | |
|---|---|---|---|---|
| Description of Strategic Risk | Impact | Likelihood | Rating | Mitigation |
| New Entrants | Medium | Likely | Serious | Limited industrial players worldwide capable of providing the technology at scale. Partner with a leading brand to secure market share |
| Competitive pressure<br>Potential price pressure from competitors with similar offer | Medium | Likely | Serious | Establish close partnerships with DNO customers based on service as much as cost.<br>Maintain cost focus and scan the technology horizon for disruptive technology. |
| Negative Press Coverage | Low | Possible | Manageable | Not a visible technology and non-polluting. Not a consumer issue so unlikely to be a high profile press story. |
| Customer pressure<br>A limited customer base which might take on the Power Buffer if regulation permits. | V.High | Likely | Serious | Close working relationship with DNO customers to establish business value of technology and service. A clear voice in the regulatory debate, with a contingency plan of shifting business model boundary if DNOs become the operating entity. |
| Technology Platform Failure, cyber attack, data hacking. | Low | Possible | Manageable | Working with leading industrial technology providers to minimise risk. Contracting of technology on a service by the hour, rather than capital asset, basis. |
| | | | | |

| Risk Priority | | | |
|---|---|---|---|
| Impact | Likelihood | Rating | Mitigation |
| Extreme | Certain | Acceptable | 0-4 |
| V. High | Likely | Manageable | 5-8 |
| Medium | Possible | Serious | 9-25 |
| Low | Unlikely | | |
| Negligible | Rare | | |

| **<u>Power Buffer</u>** | **Whose Business Is the Emergence of Community Energy Going to Affect Substantially**? | |
|---|---|---|
| | Likely to Impact Positively | Likely to Impact Negatively |
| Tera Grid Level | Reduced demand noise and spikes on transmission network – allowing System operator to reduce the balancing load. | Less demand for peaking plant. |
| Macro City Level | Increased robustness of DNO network as pressure points and hot-spots can be reduced with Power Buffer nodes. | Reduced demand for network cabling and other distribution infrastructure in the long-term. |
| Mini Community Level | Increased robustness of DNO network as pressure points and hot-spots can be reduced with Power Buffer nodes | Reduced demand for network cabling and other distribution infrastructure in the long-term. |
| Nano Domestic Level | Minimal domestic impact although perhaps a noticeable improvement for areas currently at high risk of power outage from fragile network infrastructure | N/A |
| Energy Supply Chain | Increased options for retailers and large power users to trade for to balance their contracted position in the energy market | |
| External Supply | Major opportunity for technology providers to expand their sales long-term scalable growth | Potentially reduced demand for traditional network switchgear. |

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