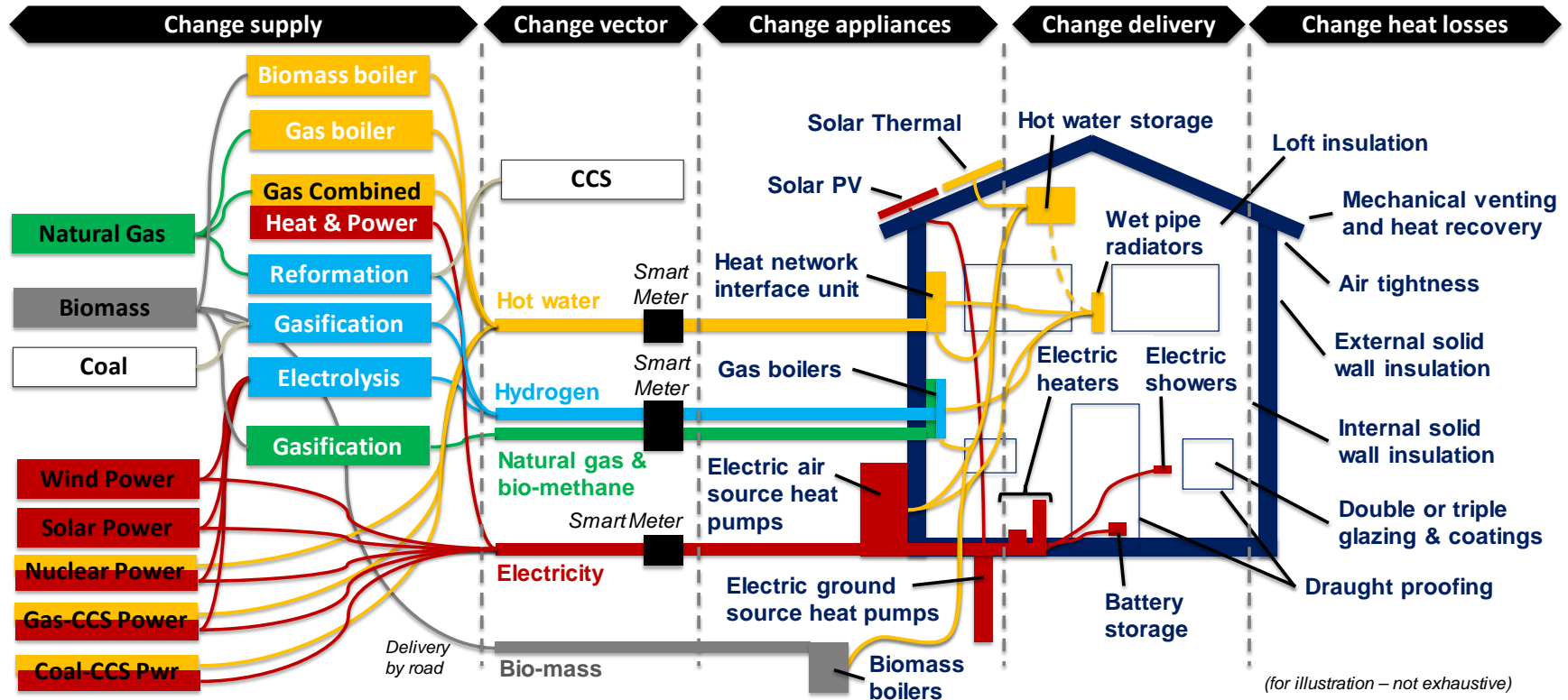# Setting the UK on track to transform a million homes a year to zero carbon energy from 2025
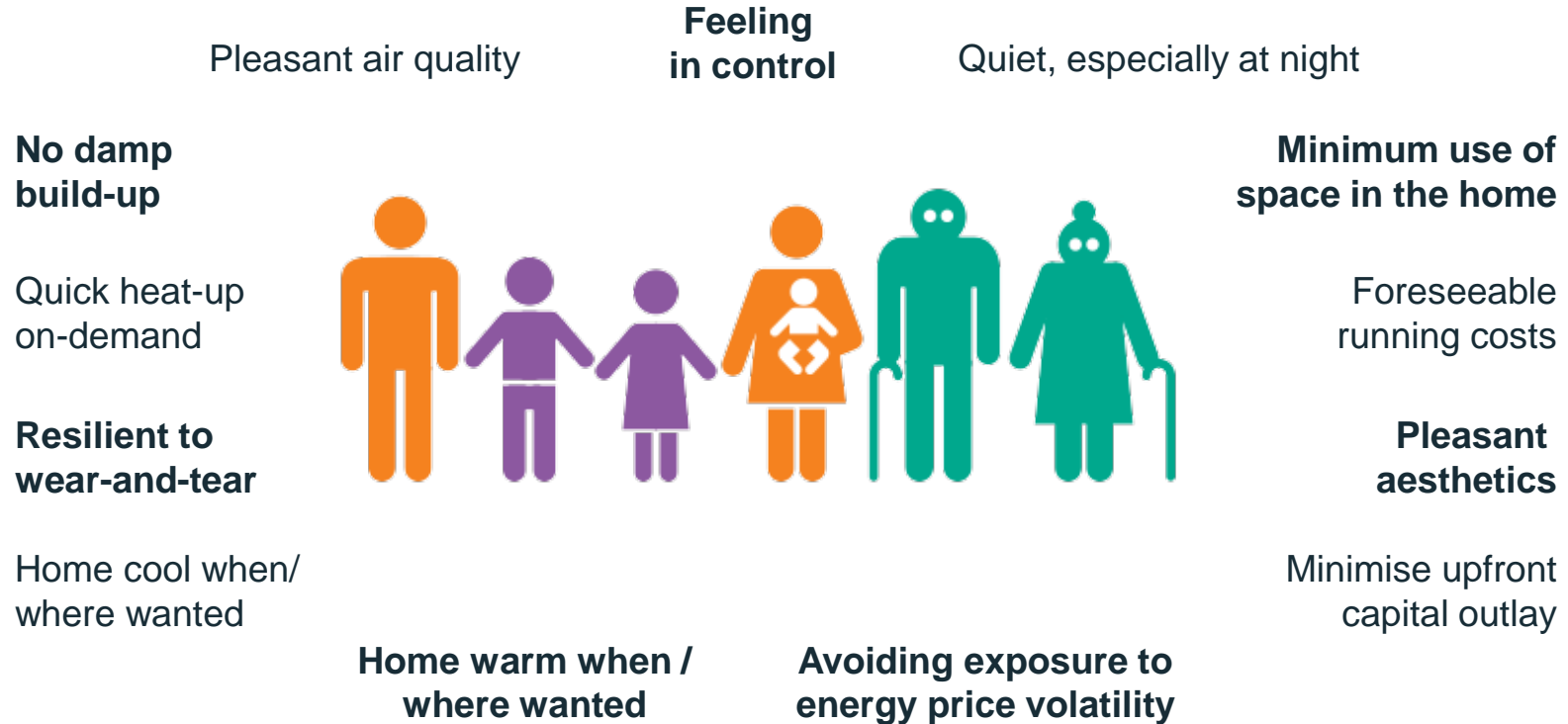
"a clean, intelligent, energy system that works for people, communities and businesses"

John Batterbee
Head of Technology Strategy & Planning

Decarbonising domestic energy is a very complex systems integration challenge

(for illustration – not exhaustive)

Consumers have little interest in that complexity…
…they care about the experiences energy affords

Pleasant air quality

Feeling in control

Quiet, especially at night

No damp build-up

Quick heat-up on-demand

Resilient to wear-and-tear

Home cool when/ where wanted

Minimum use of space in the home

Foreseeable running costs

Pleasant aesthetics

Minimise upfront capital outlay

Home warm when / where wanted

Avoiding exposure to energy price volatility

There are few actors today providing the integration to help people achieve the experiences they value

CATAPULT
Energy Systems

Social
housing

New
build

Private rent &
owner-occupier

Local Authorities and Housing Associations

Housing Developers

?

Without such actors, policy makers are left with little choice to decarbonise but to subsidise components

Whilst there is a niche that loves tinkering….

Everyone else just wants the experience and to trust promises will be delivered…

Top Features, for illustrative reference:
Active Park Assist - Let the computer parallel park for you
Reverse sensing - Helps you not back into things
MyKey - Parents can limit the vehicle's top speed and audio volume
Capless fuel-filler - Just open door and insert nozzle
**Also** – Leather, moonroof, navigation, heated front seats

The big idea is turning energy retail into an experiential service, not billing for units of commodity consumed

Customer satisfaction, cost, etc

Carbon, energy security, etc

This revolution would create major benefits:

- More **focus on customer** value, to understand it, shape it and deliver it

- Retailers **earn customers' trust** to be able to promise performance for low carbon heat

- Revealed consumers' preferences can drive **evolution of the whole energy value chain**

- Opens a new option to **deliver low carbon,** setting long-term technology-neutral limits

  - *Retailers compete* *through long-term innovation & supply chain investment to* ***find the best path to low carbon***

- Opens a new option to **reduce fuel poverty,** via performance contracts with public sector

SSH is creating an ecosystem to help the energy sector make a customer-centric market really work
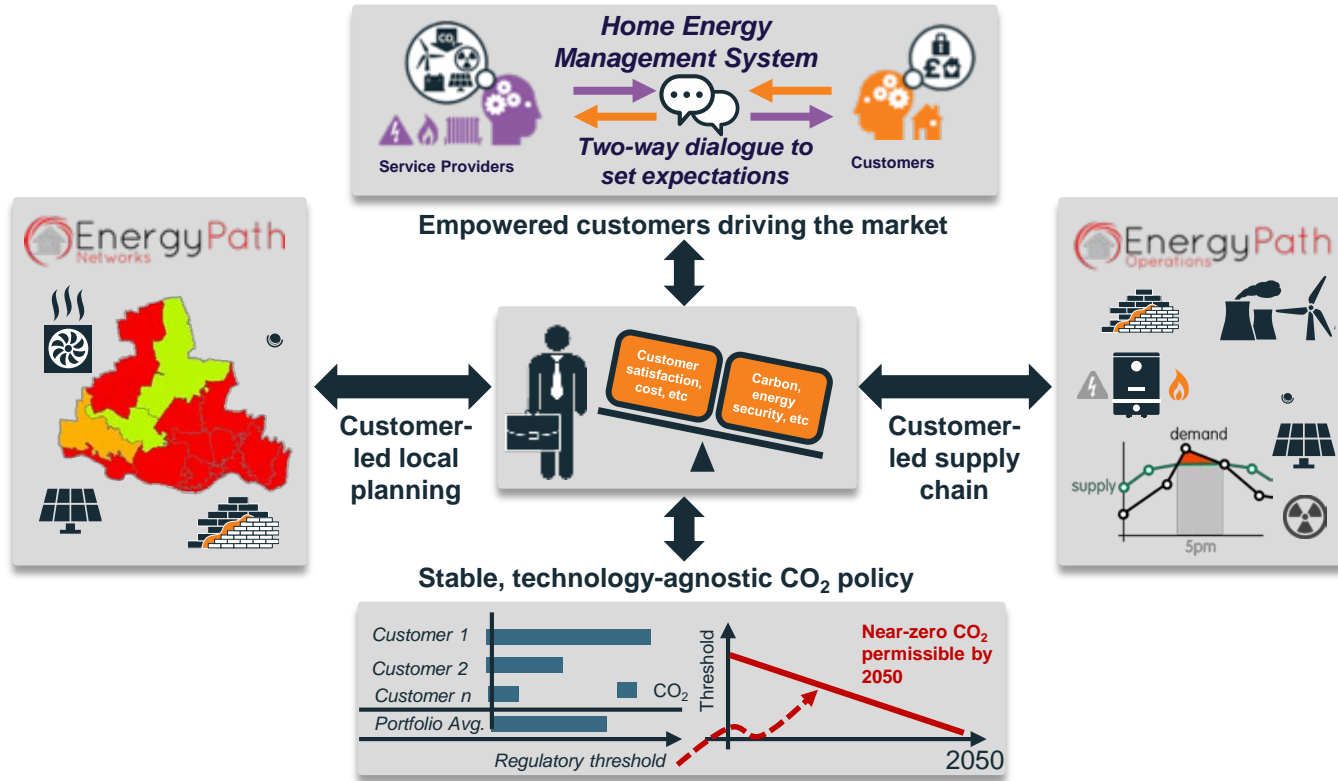
SSH (funded by the ETI) is establishing capabilities that the Energy Systems Catapult is working to make available to support the sector

We help innovators understand their customers, enabling them to design better products & services

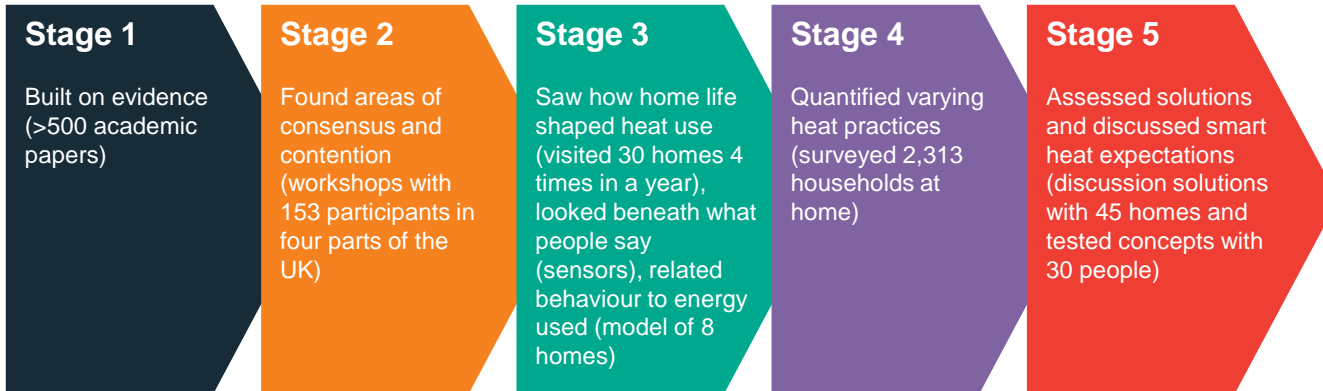**CATAPULT** Energy Systems

We help organisations:
- Understand their customers;
- Discover innovation opportunities;
- Design delightful experiences; and
- Improve products and services.

We have a track record of:
- Blending customer research with sensor data to see how energy fits into home life
- Showing households their personal data is managed securely and respectfully

Customer satisfaction, cost, etc

Carbon, energy security, etc

Five stages of research (£3.5m) over two winters:

Stage 1

Built on evidence (>500 academic papers)

Stage 2

Found areas of consensus and contention (workshops with 153 participants in four parts of the UK)

Stage 3

Saw how home life shaped heat use (visited 30 homes 4 times in a year), looked beneath what people say (sensors), related behaviour to energy used (model of 8 homes)

Stage 4

Quantified varying heat practices (surveyed 2,313 households at home)

Stage 5

Assessed solutions and discussed smart heat expectations (discussion solutions with 45 homes and tested concepts with 30 people)
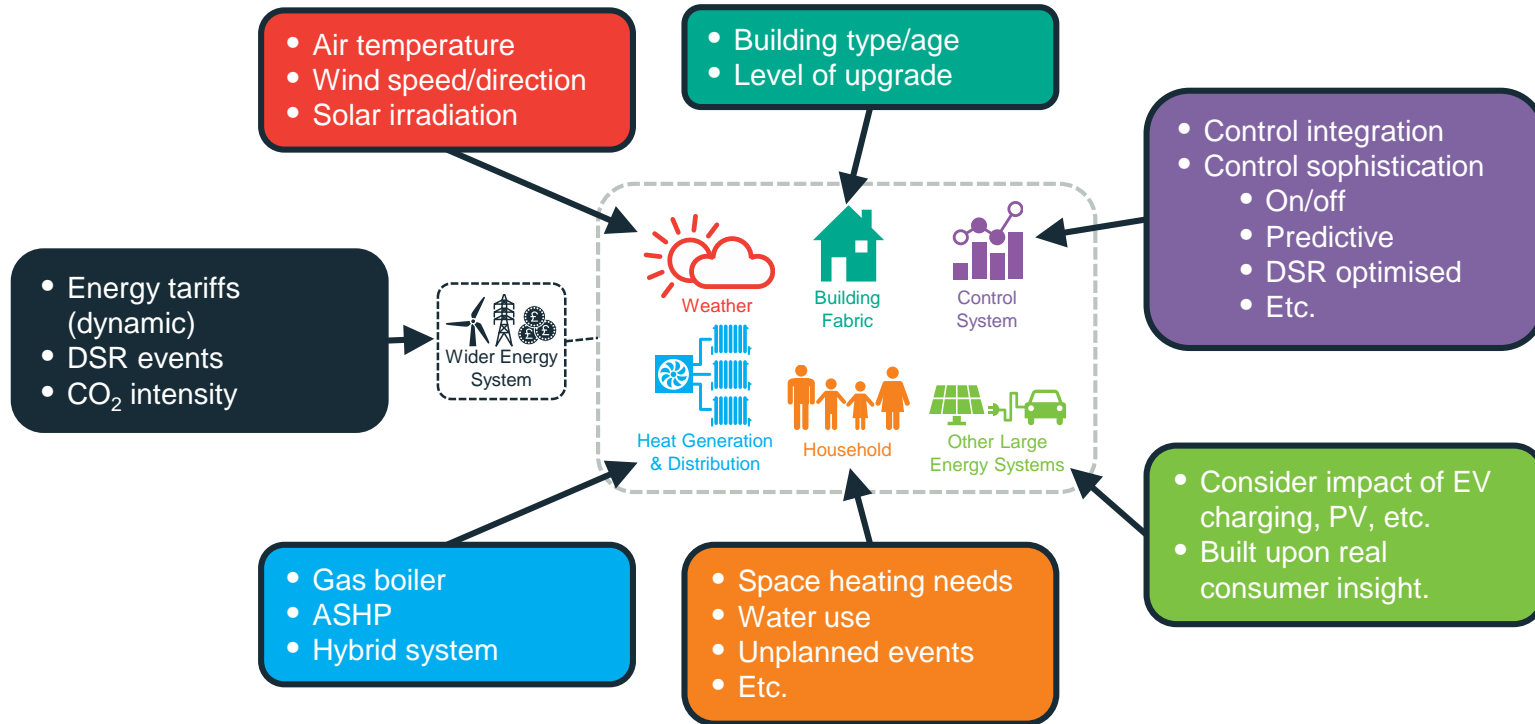
Produced a robust foundation:
- Households' energy needs
- Key challenges to tackle
- Segmentation
- Design tools

We help product and service innovators via integrated domestic energy system analysis

- Air temperature
- Wind speed/direction
- Solar irradiation

- Building type/age
- Level of upgrade

- Control integration
- Control sophistication
  - On/off
  - Predictive
  - DSR optimised
  - Etc.

- Energy tariffs (dynamic)
- DSR events
- CO_2 intensity

Weather

Building Fabric

Control System

Wider Energy System

Heat Generation & Distribution

Household

Other Large Energy Systems

- Gas boiler
- ASHP
- Hybrid system

- Space heating needs
- Water use
- Unplanned events
- Etc.

- Consider impact of EV charging, PV, etc.
- Built upon real consumer insight.

We help product and service innovators develop and test new business models and technologies

CATAPULT Energy Systems

Status quo is not conducive to service-led innovation

Households

Limited value for integrated 'smart' devices

Device Vendors
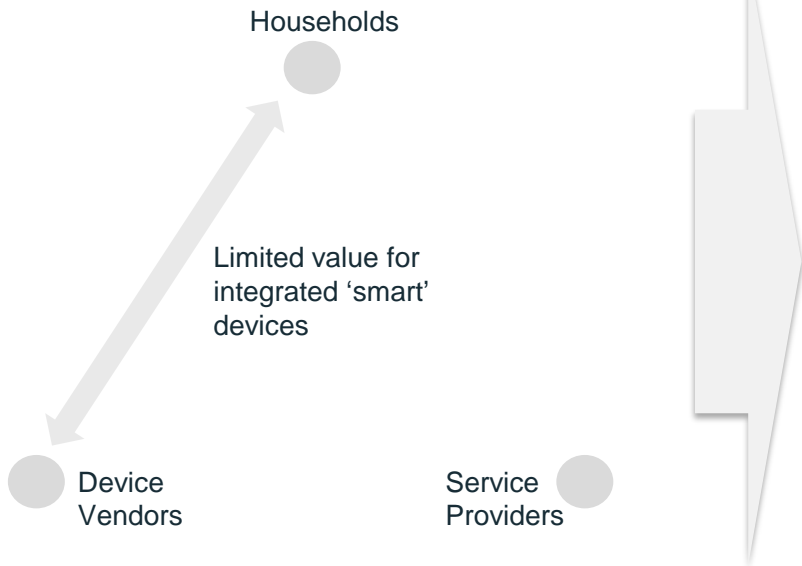
Service Providers

The Home Energy Management System is an intermediary to connect up the dots…

Households

Clear value from integrated 'smart' devices

A market navigation agent to transform the way people buy energy at home

Creating a virtuous circle of innovation

Device Vendors

Service Providers

A facilitator for connecting service providers and device vendors to execute services
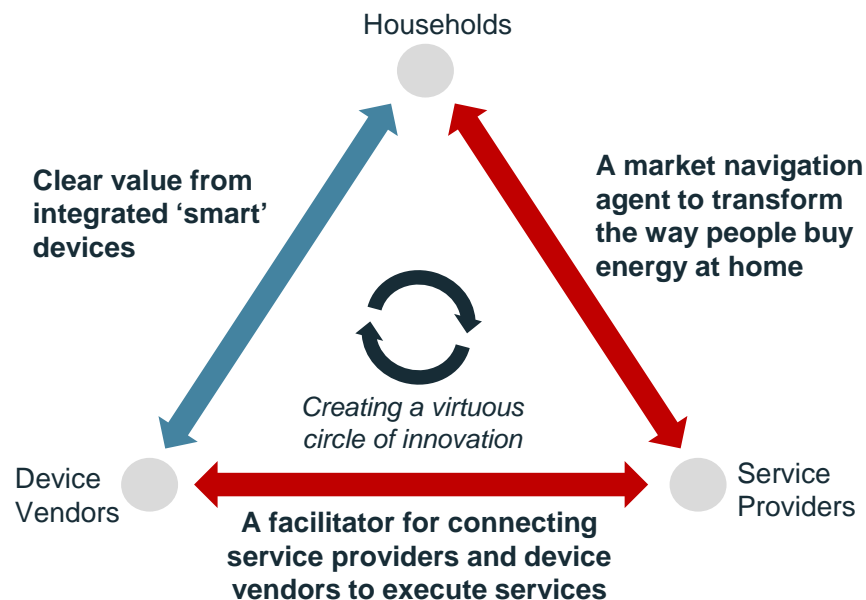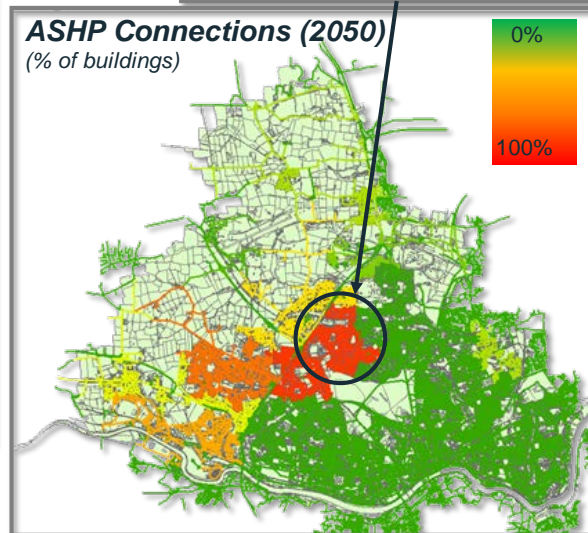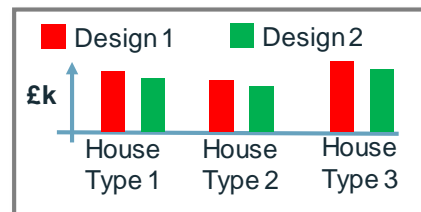
It will be established in real homes with real consumers to provide third party innovators with the ability to use in-depth data to design new services and then trial their offers with those consumers

We help local area stakeholders decide on their spatial infrastructure planning to drive change

EnergyPath Networks

District Heat Connections (2020)
(% of buildings)

0%

0MW

CHP

80MW

100%

Peak network demand; zone interconnections
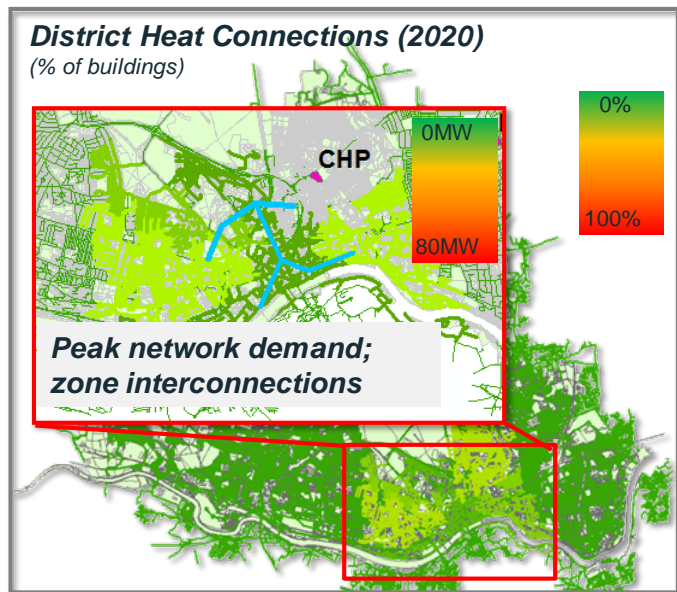
(graphics for illustration only)

Design 1   Design 2

£k

House Type 1   House Type 2   House Type 3

ASHP Connections (2050)
(% of buildings)

0%

100%

We help local areas identify three types of project:
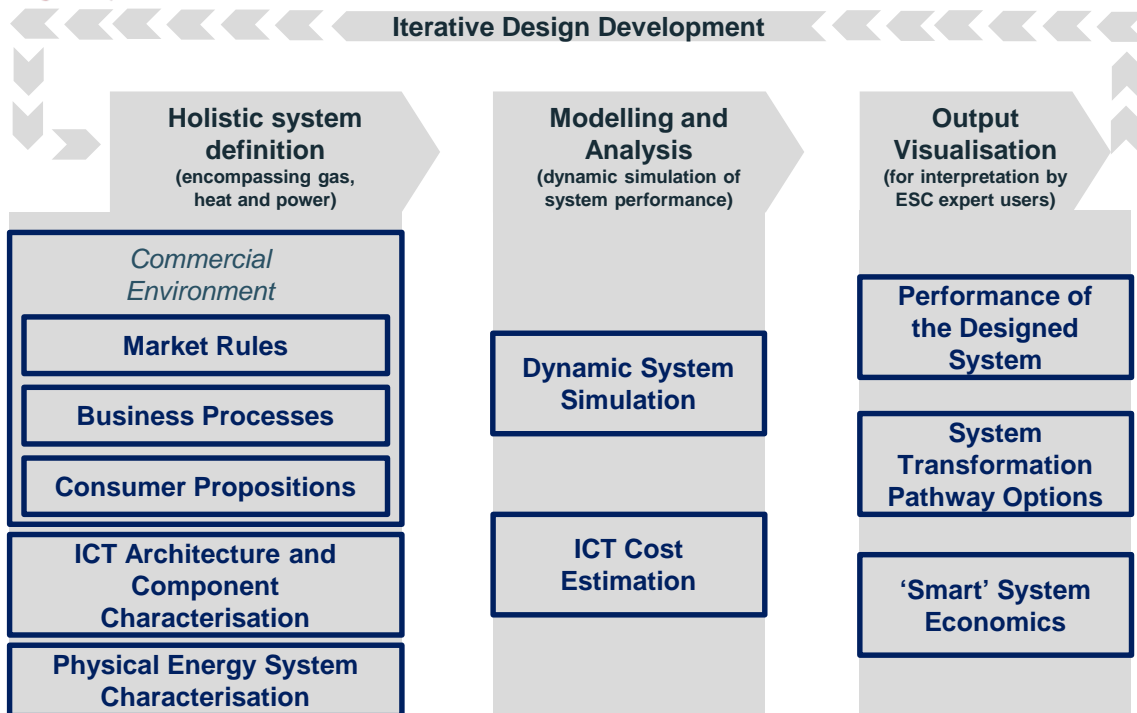
1) Low regret deployment which can be executed with high confidence as it has been done before elsewhere

2) Development and Demonstration where the technologies appear low regret choices, but there are major integration, consumer or commercial unknowns

3) Research where there may be a game changer but only if certain performance or cost targets can be met

We help all stakeholders position for the future 'smart' energy system via holistic architecture

Policy and Regulatory Regime (Technology and Business Model Neutral as Possible to Maximise Innovation)

Competitive Services Market

Data and Control Device Vendors[1]

[1] Includes heat pumps, electric vehicles, radiator valves, temperature sensors, solar PV, movement sensors, etc

Home Energy Services Gateway

Data and Control Device Vendors[2]

[2] Includes large industrial processing plant, commercial refrigeration, office cooling, on building solar PV, etc

Industrial & Com'l Services Gateway(s)

Service Applications and Service Providers

Consumers

Energy Resource Services Gateway

Reserves Operator

Stabilisers and Contingencies

Energy Producers

Energy Distributors

Storage Providers

Non-physical Traders

Smart Meter Operators

Standard Measurement

Data Comms Company

Standard measurement infrastructure for trading

Competitive Resources Market

We help industry innovate in business models and processes via whole systems simulation

CATAPULT
Energy Systems

EnergyPath Operations

Iterative Design Development

Holistic system definition
(encompassing gas, heat and power)

Commercial Environment

Market Rules

Business Processes

Consumer Propositions

ICT Architecture and Component Characterisation

Physical Energy System Characterisation

Modelling and Analysis
(dynamic simulation of system performance)

Dynamic System Simulation

ICT Cost Estimation

Output Visualisation
(for interpretation by ESC expert users)

Performance of the Designed System

System Transformation Pathway Options

'Smart' System Economics

The simulation tool is currently in early stage development

It will enable each actor in the architecture framework to input options for their **future business models and processes**

It will enable each actor to understand how their new **models and processes could interact with other actors'** new models and processes

It will produce key **performance indicators to reflect physical constraints** (frequency, pressure, voltage, etc); and **commercial KPIs** (risk exposure, service quality, etc)

Thank you

CATAPULT
Energy Systems

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