energy technologies institute

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# Increasing UK biomass production through more productive use of land

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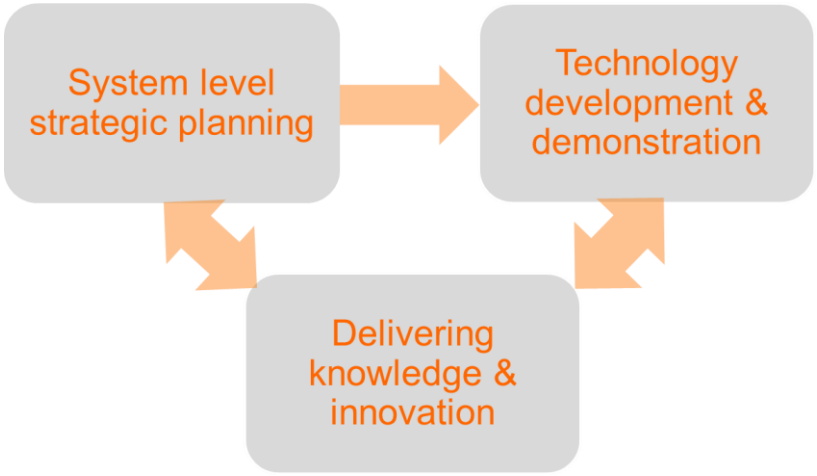
# What is the ETI?

- Public-private partnership
- Set up to identify and accelerate the development and demonstration of an integrated set of low carbon technologies




## ETI members

bp
CATERPILLAR®
EDF ENERGY
Rolls-Royce
Department for Business, Energy & Industrial Strategy
EPSRC Pioneering research and skills
Innovate UK

## ETI programme associate

HITACHI Inspire the Next

# ETI Legacy

ETI10 TEN YEARS OF INNOVATION 2007 – 2017

CATAPULT Energy Systems

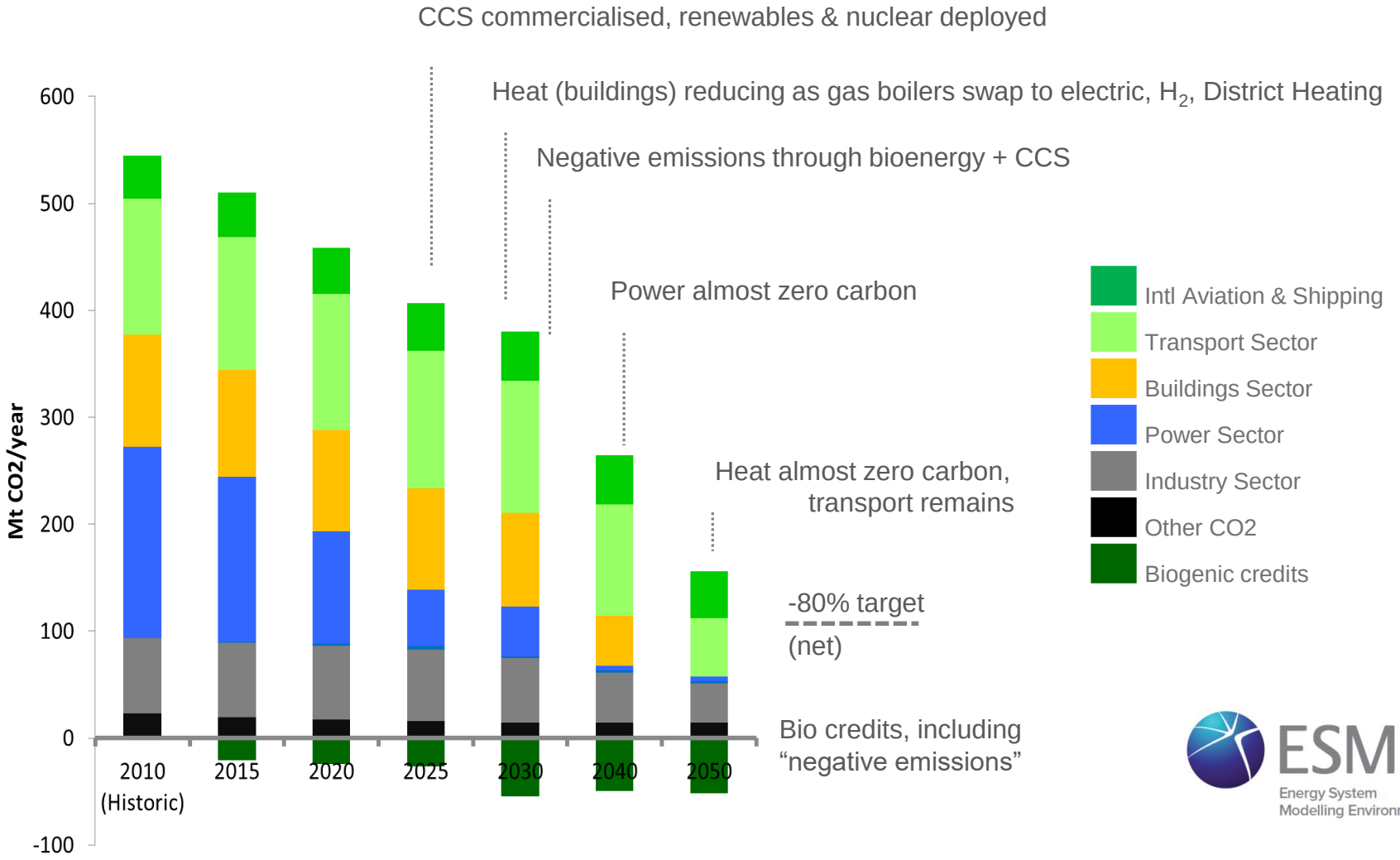
- Innovate UK funded Energy Systems Catapult
- Work with stakeholders across the energy sector (consumers, industry, academia and government) to accelerate the decarbonisation of the energy system
- Taking forward ETI's Smart Systems and Heat (SSH) programme and Whole Systems Analysis capability

OGCI OIL AND GAS CLIMATE INITIATIVE

- Oil and Gas Climate Initiatives, Climate Investments
- Acquired the ETI's Clean Gas Project as one of their first investments

# A route to meeting - 80% CO2 for the UK

## Power now, heat next, transport gradual – cost optimal




ESME Energy System Modelling Environment

Chart data from base case v4.3

# ETI's 'ESME' model indicates an important role for bioenergy and CCS in the UK

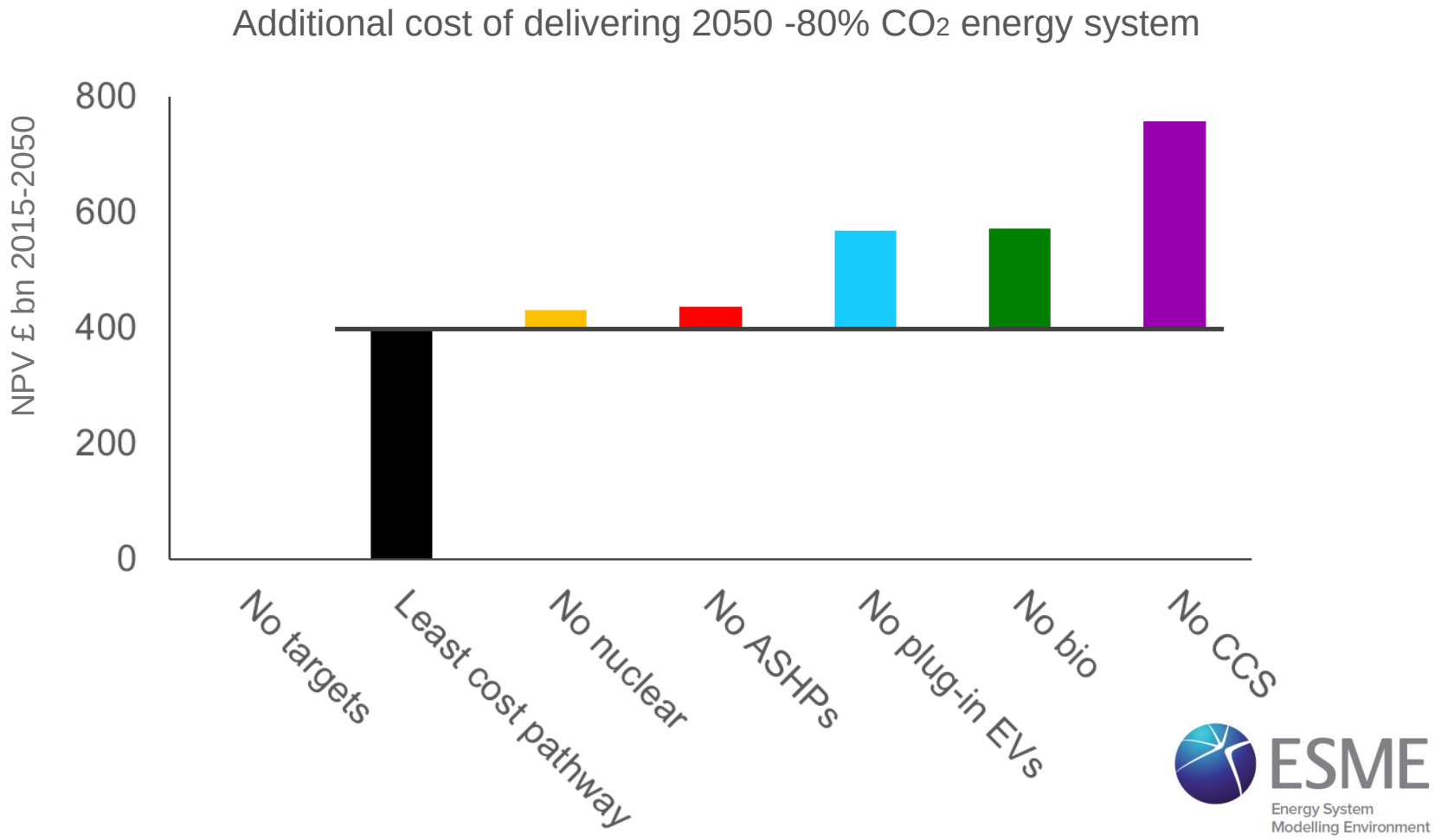
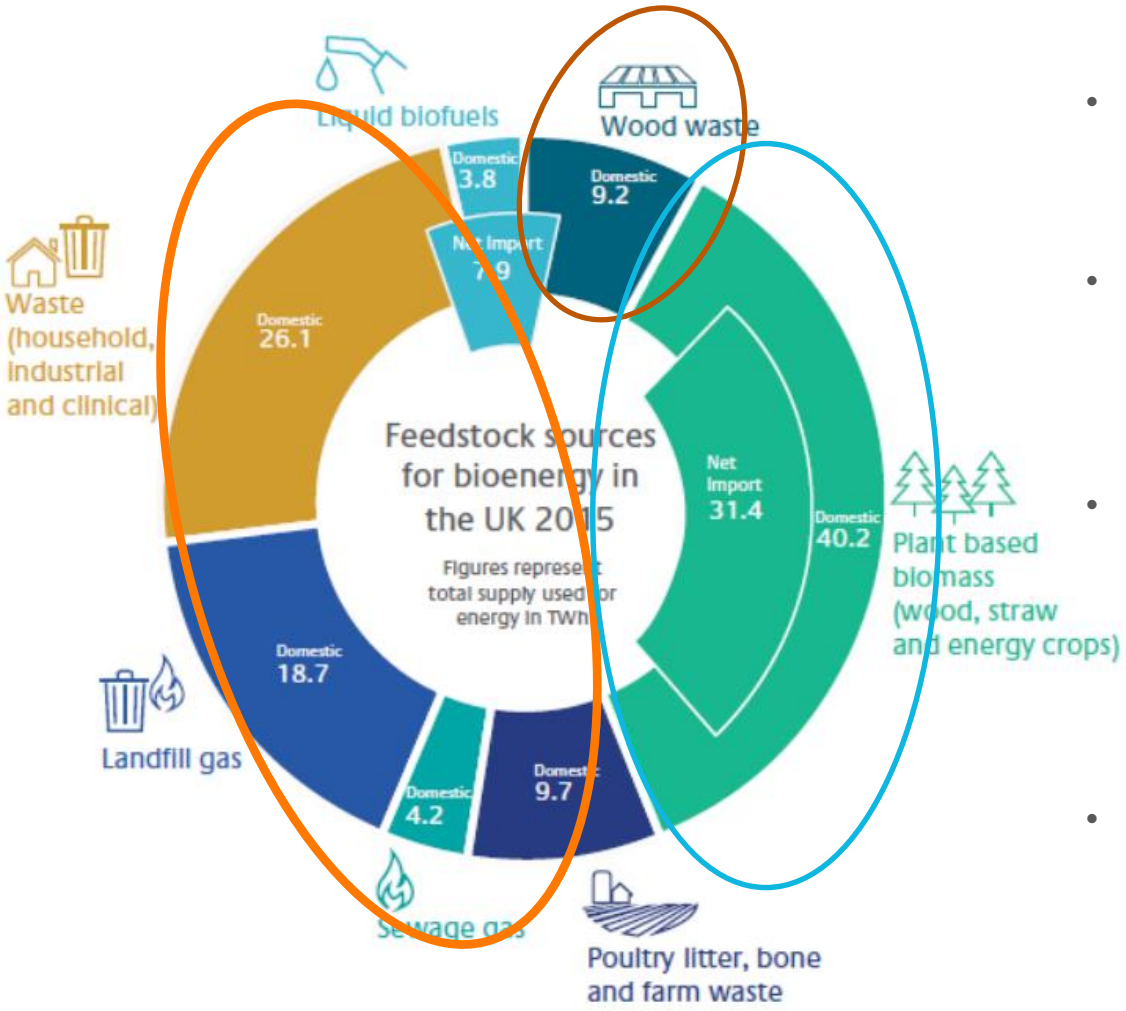


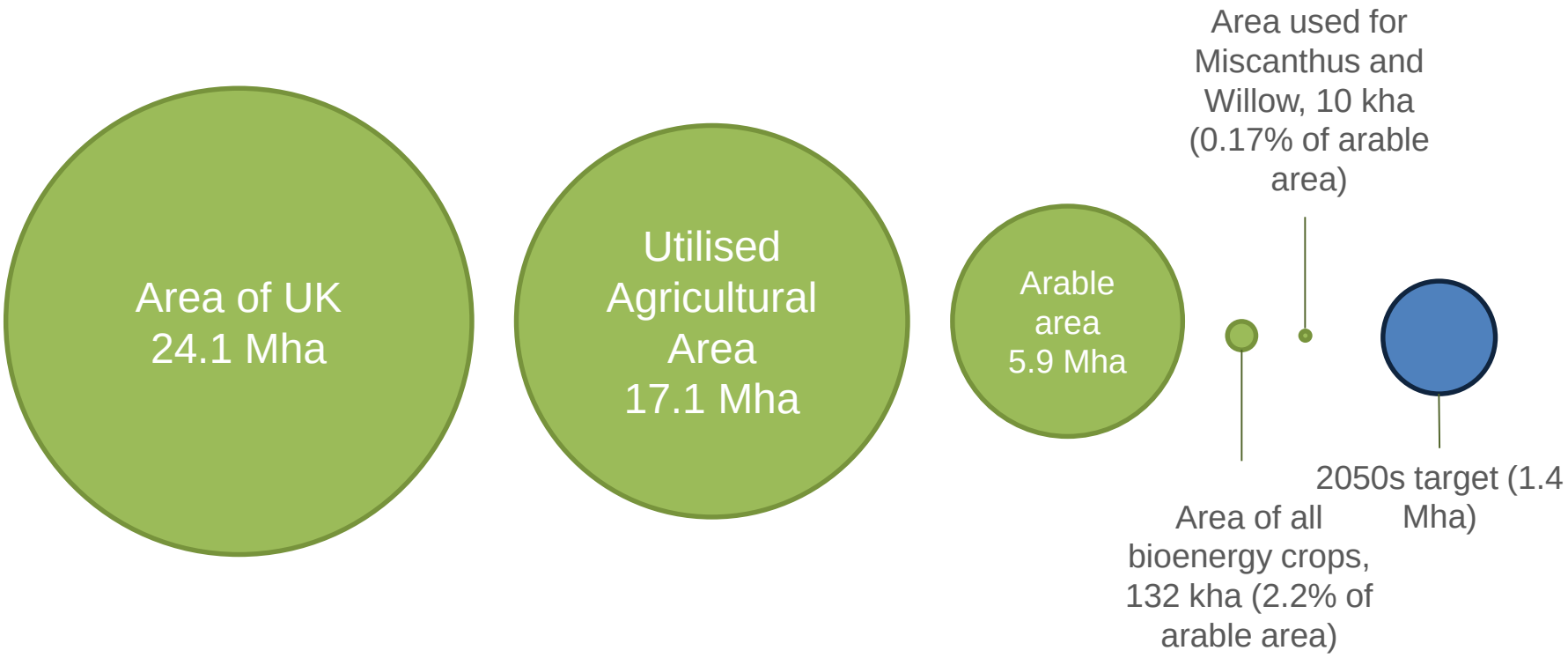

Chart data from base case v4.3 (£(2015), DR: 3.5%)

# How do we produce bioenergy today?




- ~150 TWh/yr inputs, delivering around ~75 TWh/yr bioenergy
- Need 195 – 275 TWh/yr inputs to deliver ~ 130 TWh/yr bioenergy (CCS dependent).
- The majority of feedstocks are currently waste – there are opportunities to increase this by around a further ~20 TWh but the resource is already well utilised.
- Bulk of increase needs to come from plant based biomass – either imports or domestic

# What is the state of the UK energy crop sector?




Defra (2017). Includes all food crops used in transport fuel production and anaerobic digestion, plus second generation crops (Miscanthus and SRC Willow). Excludes forestry.

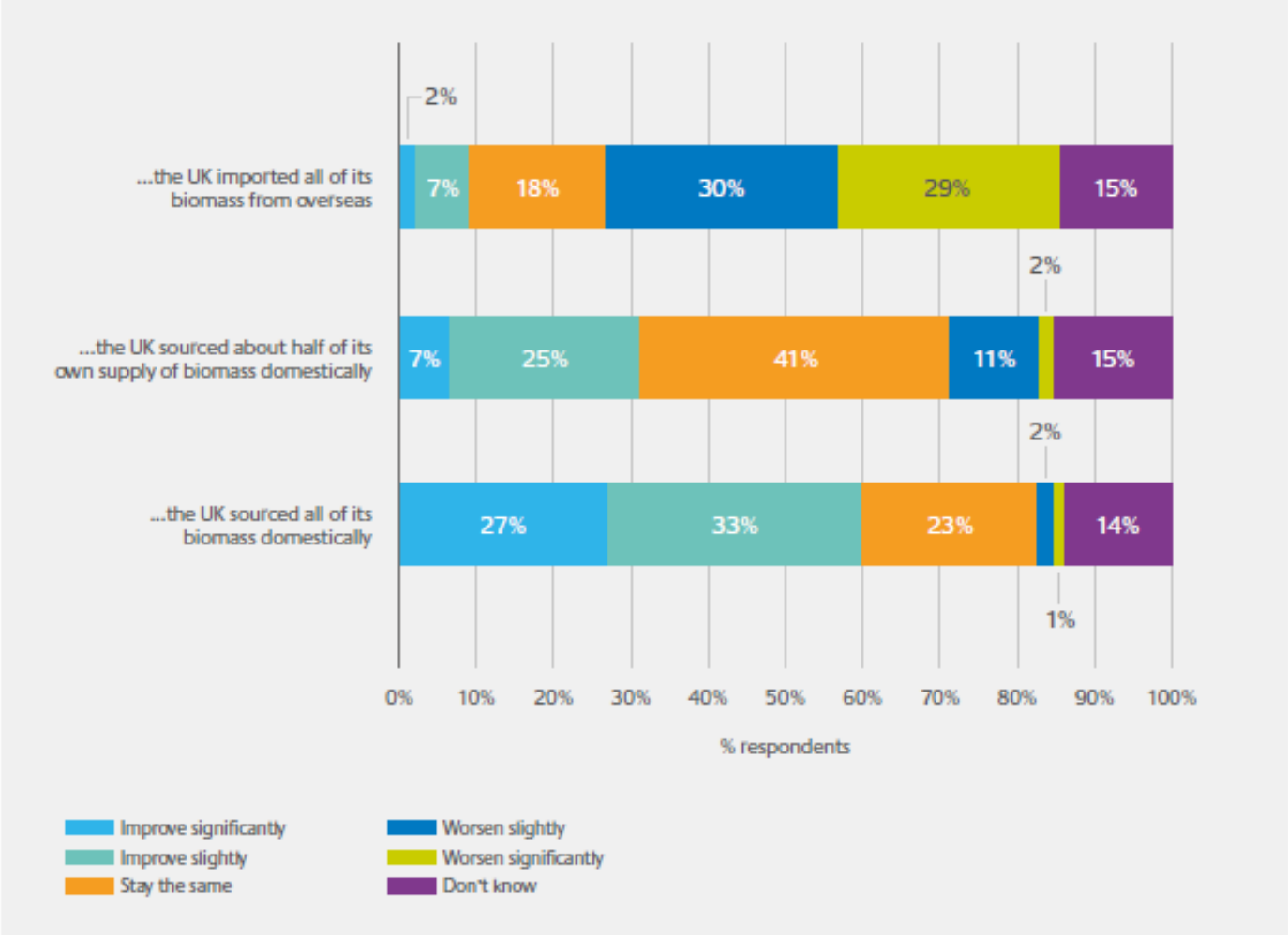
# Why can’t we just import it?

Imports will be an important part of the mix, however relying on them entirely brings risk and misses opportunities to improve the UK environment

- Energy Security – diversity of supply increases security
- Other countries are increasing use of bioenergy – competition for feedstock could lead to higher prices
- Greater transparency over supply chain impacts in UK (both environmental and wider)
- Opportunities to improve soil carbon and land productivity in the UK as well as additional ecosystem services
- Opportunity for farmers to diversify their income
- Reduces risk of public backlash – ETI/YouGov Survey consistently shows that public opinion of bioenergy would worsen if entirely reliant on imports

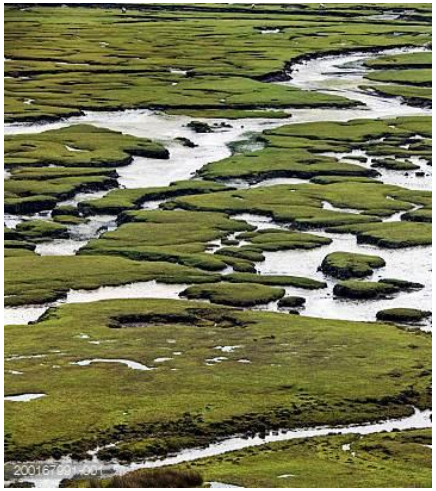
# Why can’t we just import it?

Q. Would your opinion of the use of bioenergy in the UK improve, worsen or stay the same if you were told that…..



# Have we got enough room in the UK?

## Step 1 – Exclude unsuitable areas

# Have we got enough room in the UK?

## Step 1 – Exclude unsuitable areas

**17.10 Mha → 10.95 Mha**

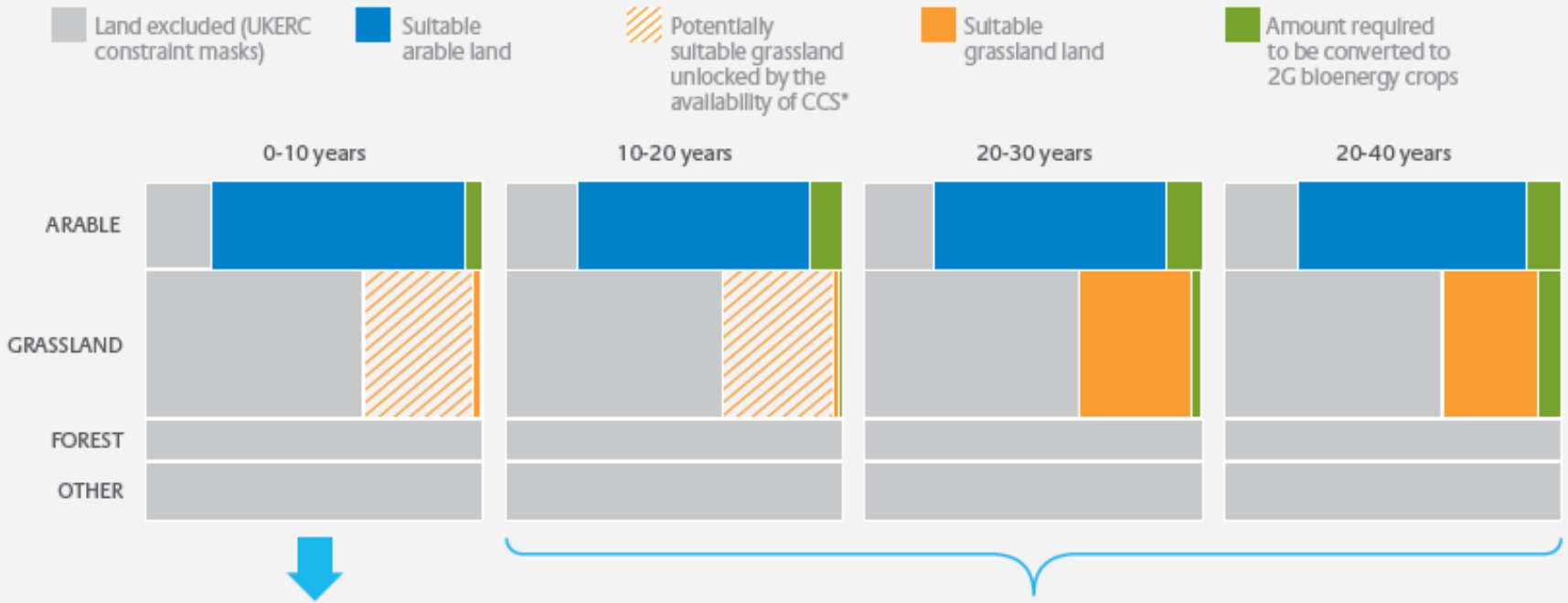
RELB fieldwork found additional constraints which had a impact at a local level, but were not significant at a national level.

ELUM found that transitions from arable generally increased soil carbon levels.

Transitions from permanent grassland were more mixed but still deliver carbon savings in the context of the whole value chain.

# Have we got enough room in the UK?

## Step 2 – Identify the land that could be made available




**Short-term opportunities**

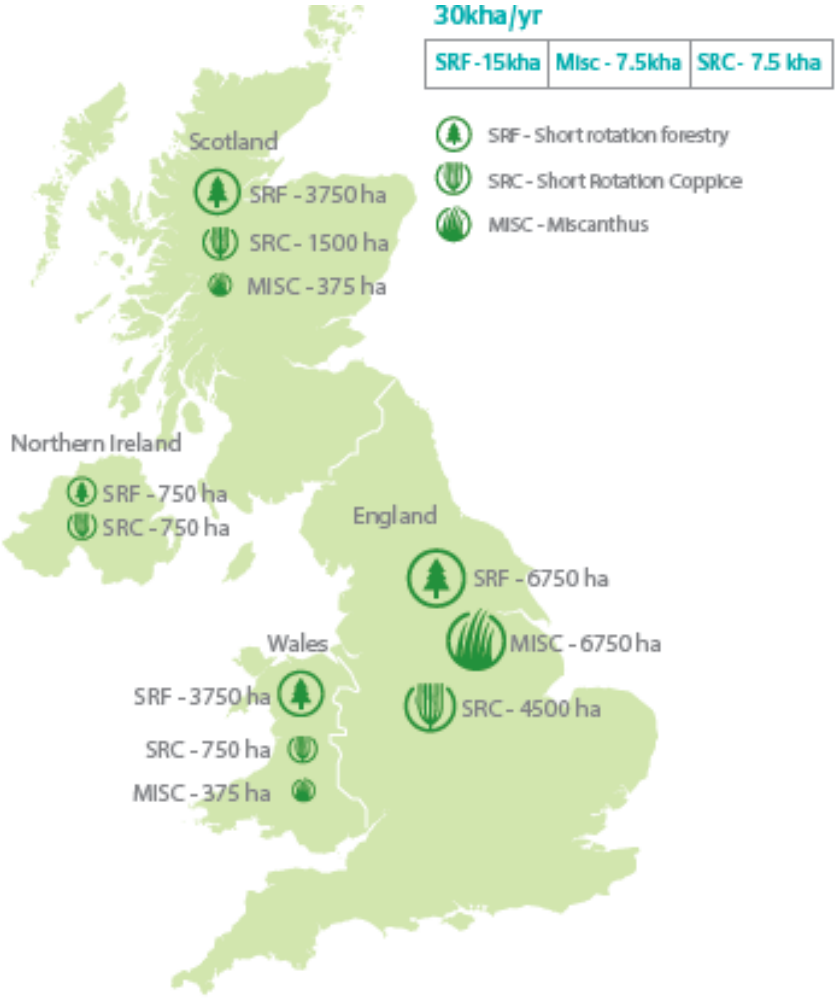
- Economically marginal land
- Permanent fallow land
- Cereal overproduction

**Longer-term opportunities**

- Reducing on-farm and consumer food waste
- Improving grassland management

An average planting rate of 30-35 kha/yr could deliver up to 1.4 Mha of second generation energy crops in the 2050s.

# What impact could this have on jobs?

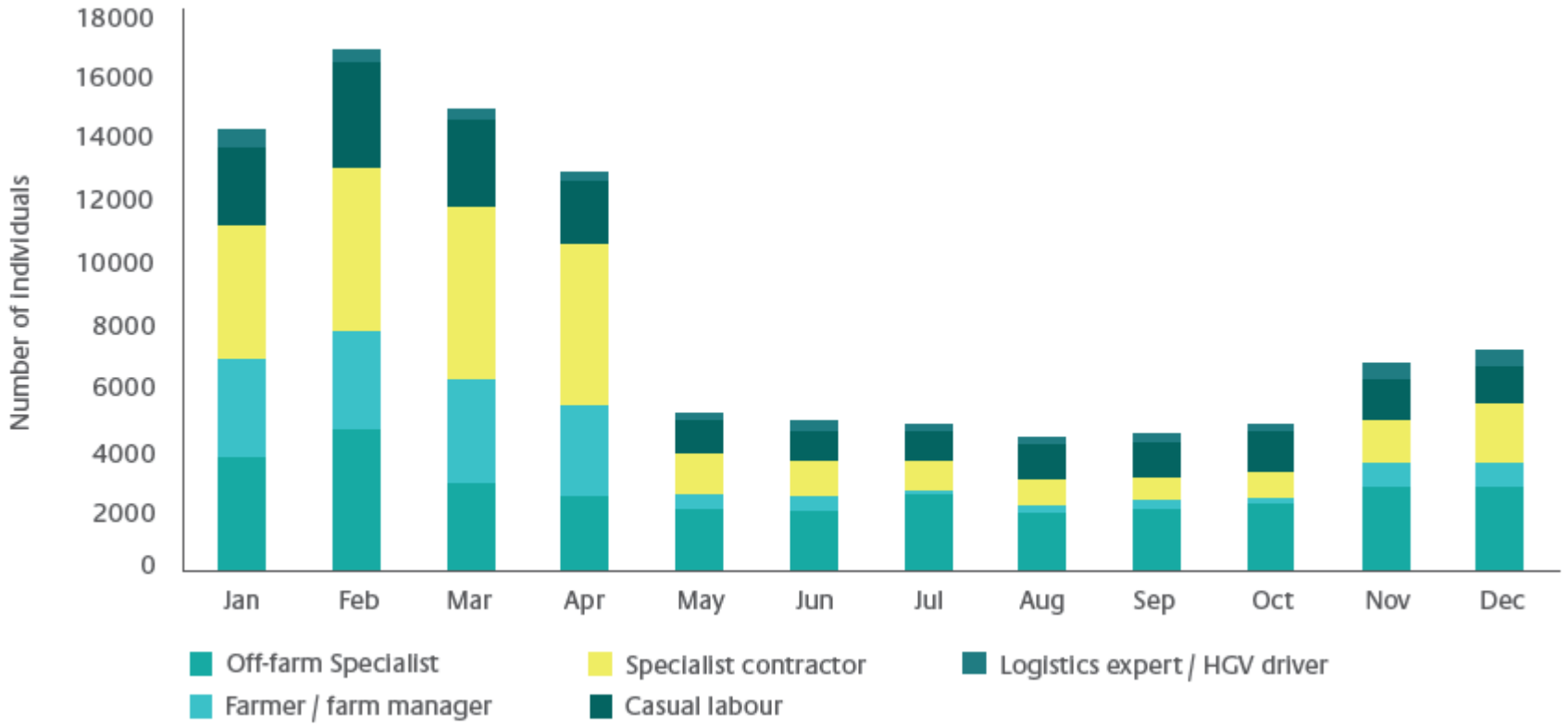



Considered jobs from production of planting material through to first transport off-farm:

- Planting material production
- Advice and technical support on land preparation and crop management
- Ground preparation, fencing and crop establishment
- Annual management of the crop
- Harvest and on-site processing and storage
- Crop removal and land clearance at end of lifespan
- Transport off-farm

# What impact would this have on jobs?

2050s - 16,700 opportunities could be created in the peak period reducing to 4,300 between July and October (equivalent to 9,100 FTE)



# Why are farmers growing energy crops?

| | Abbey Farm |
|---|---|
| Farmer | Bill Lewis |
| Location | Norfolk |
| Size of Farm (ha) | 473 |
| Crop Planted | Miscanthus |
| Area (ha) | 30.0 |
| Year planted | 2013 & 2015 |
| Previous land use | Sheep |

- Bill was looking for opportunities to improve on-farm efficiency and reduce overall workload
- Chose to plant 30ha of low lying grassland (prone to flooding) with Miscanthus (Terravesta contract) whilst intensifying sheep production elsewhere on the farm
- 10-yr index-linked contract with Terravesta. The farmer is responsible for planting, harvesting, baling and loading the crops. Terravesta arrange for haulage and provide advice on establishment and management.
- Over a 23-yr period, Miscanthus is expected to increase the equivalent annual net margin of the land by £214/ha/yr.
- Establishment costs were £2,151/ha. Payback period is expected to be 6 yrs
- Food production impacts have been minimised by intensifying livestock management elsewhere

# Why are farmers growing energy crops?

| | Brackenthwaite Farm |
|---|---|
| Farmer | Terry Dixon |
| Location | Cumbria |
| Size of Farm (ha) | 323 |
| Crop Planted | SRC Willow |
| Area (ha) | 29.5 |
| Year planted | 2015 |
| Previous land use | Dairy (surplus) |

- The farm had surplus land following a switch from organic to non-organic dairy farming
- The Dixons wanted to diversify their income sources. They choose to plant Willow under a contract with Iggesund
- Iggesund offer 23-yr index-linked contracts. The farmer is responsible for land preparation, planting (by contractor), first year cut back and ongoing management. Iggesund arrange for harvesting and haulage
- Over a 23-yr period, planting SRC Willow is expected to increase equivalent annual net margin of the land by £185/ha/yr
- Establishment costs were £1,739/ha. Payback period is expected to be 7yrs
- No direct food production impacts

# How do we deliver 30 kha/yr?

## What are the challenges?

- Lack of plant breeding material
- Lack of harvesting and planting equipment (and skilled operators)?
- Lack of contract opportunities
- Case studies of three farms, all cited the importance of long-term, index linked contracts given that the industry is nascent with a limited number of buyers

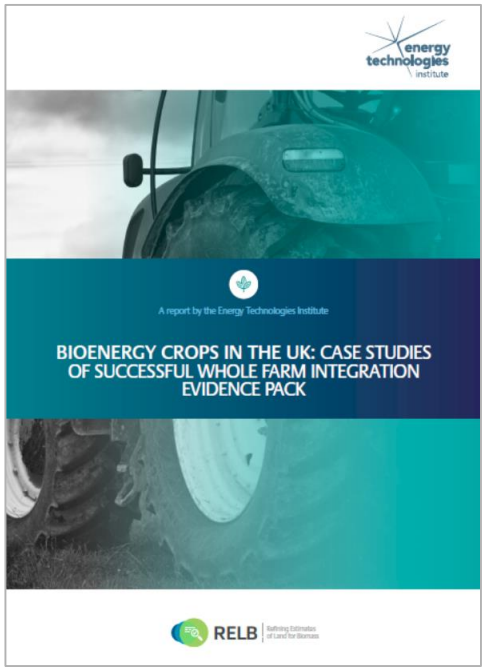
## What are the opportunities?

- Reform of CAP – presents an opportunity to reform agricultural subsidies, to support the productive use of land and value the multiple benefits of second generation crops

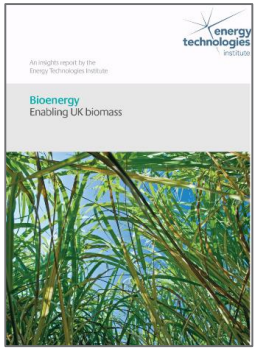
## Summary

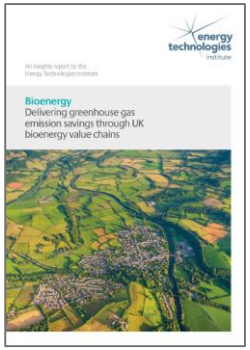
- We need to increase production of domestic biomass feedstock to meet our carbon targets cost effectively, but we are starting from a very low baseline.
- 2nd generation crops present opportunities to improve land productivity, deliver ecosystem services and diversify farmer income, but investment in skills and equipment is needed if we are to scale up in time

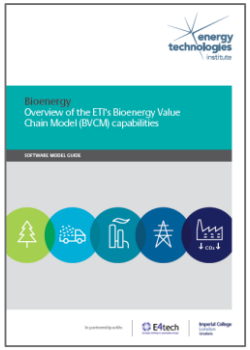
# Thank you for listening



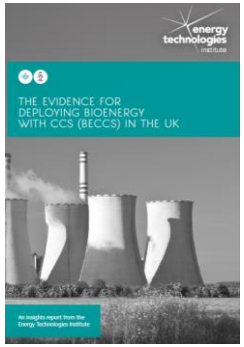


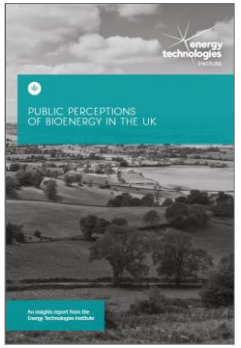





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