ESME presentation for IEA : Energy system modelling at ETI 23/4/14

Chris Heaton - chris.heaton@eti.co.uk

Strategy Manager - Modelling

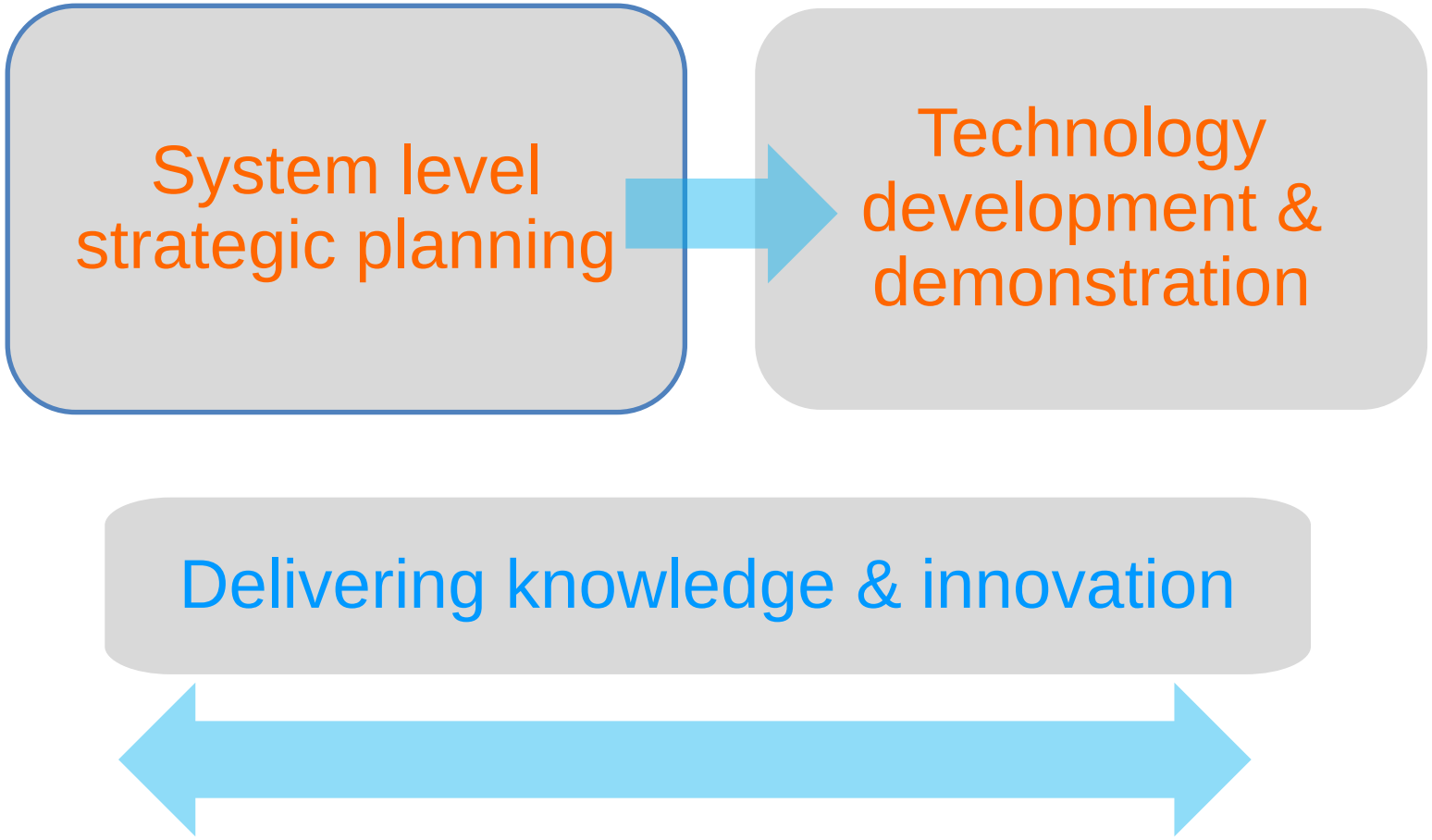
What is the ETI?

- The Energy Technologies Institute (ETI) is a public-private partnership between global industries and UK Government

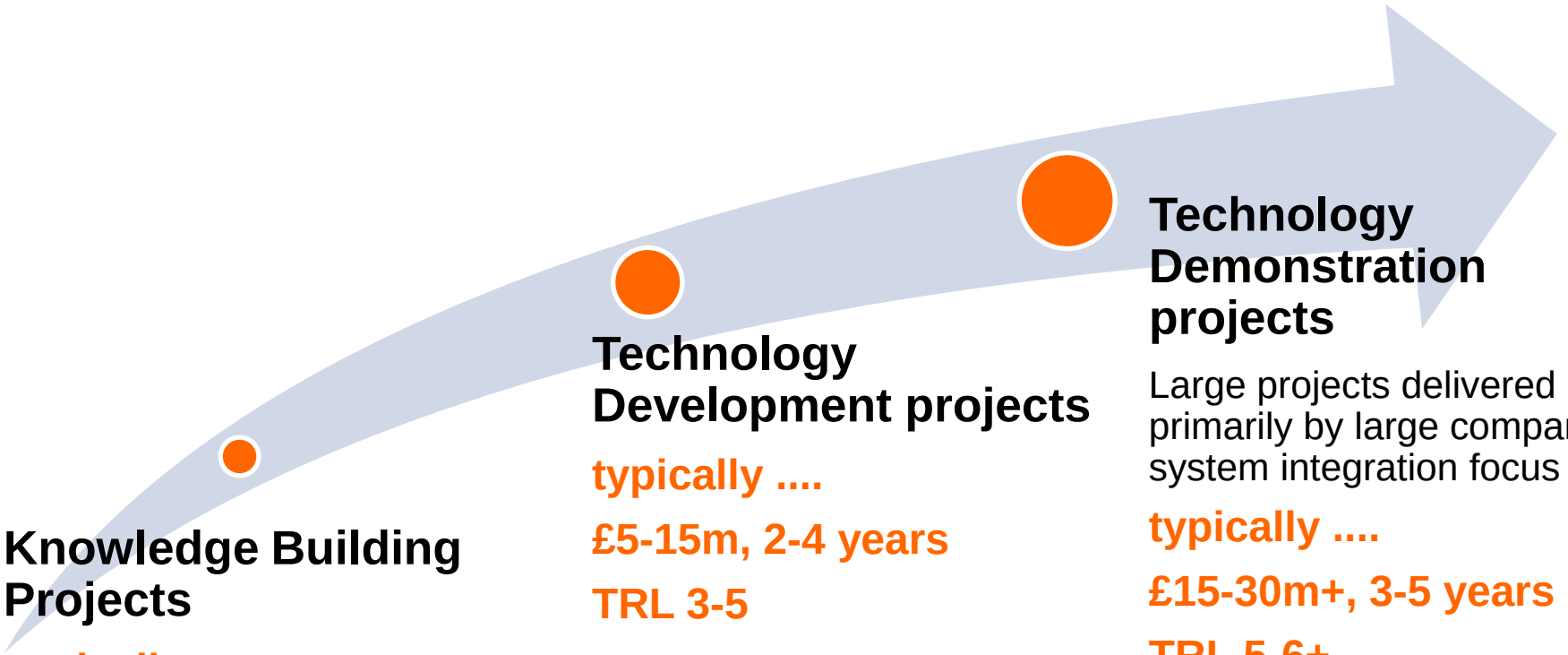
Delivering...

- Targeted development, demonstration and de-risking of new technologies for affordable and secure energy
- Shared risk

What we do...



ETI Invests in projects at 3 levels



Knowledge Building Projects

typically ....

up to £5m, Up to 2 years

Technology Development projects

typically ....

£5-15m, 2-4 years

TRL 3-5

Technology Demonstration projects

Large projects delivered primarily by large companies, system integration focus

typically ....

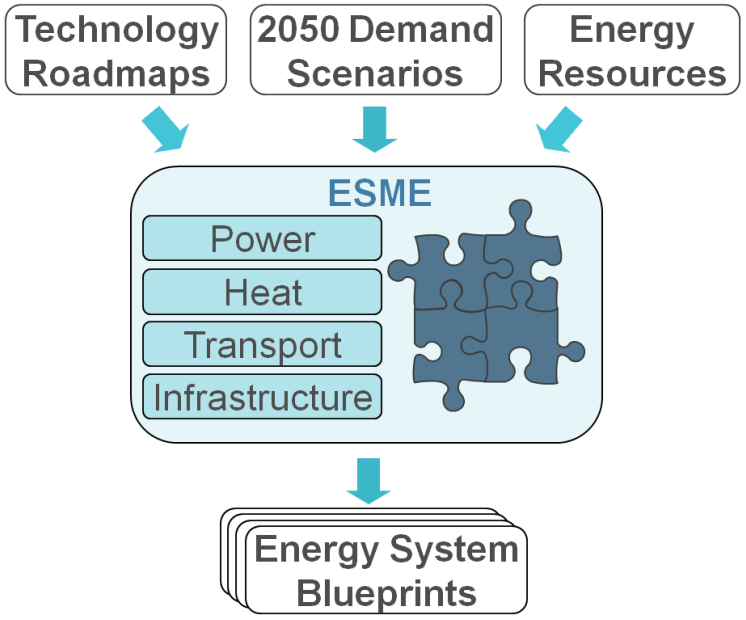
£15-30m+, 3-5 years

TRL 5-6+

ESME

A peer-reviewed national energy system design tool

- Least cost optimisation, policy neutral
- Deployment & utilisation of >250 technologies
- Probabilistic treatment of key uncertainties
- Pathway and supply chain constraints to 2050
- Spatial and temporal resolution sufficient for system engineering



ESME is a central part of ETI's energy system analysis

Insights from modelling are combined with evidence from technical experts

A view is taken on ETI "additionality" for all investments

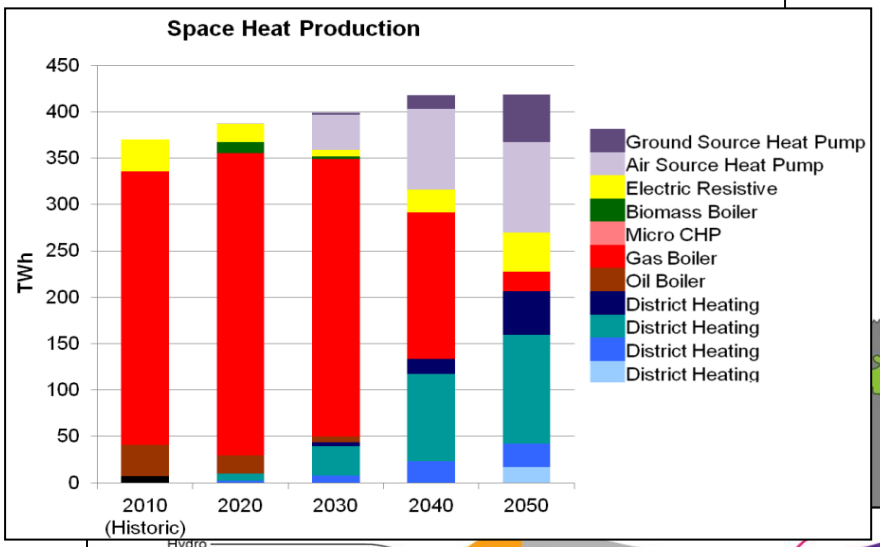
ESME in use by ETI, its members and partners

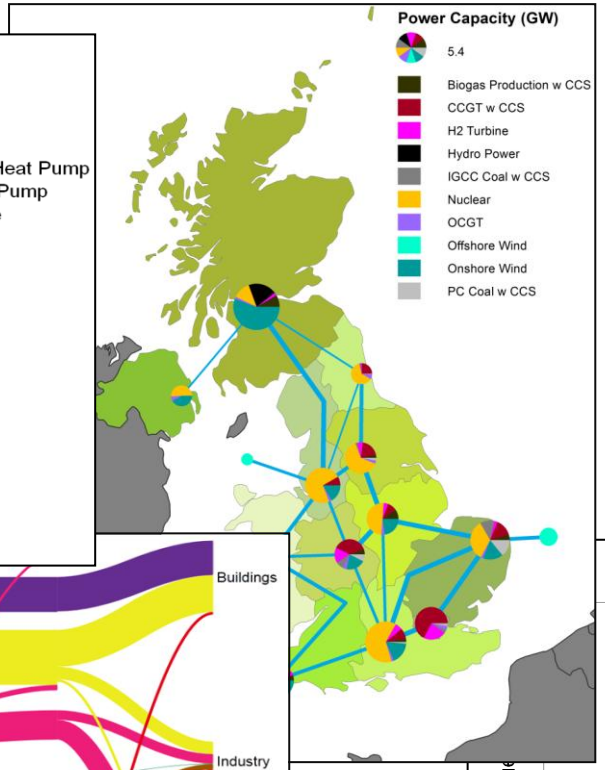
- ESME developed to inform technology development choices and targets for ETI & members
- ESME used to inform policy work by DECC* and CCC+ on a range of issues
- ETI Members are developing own versions for specific countries of interest
- Academic research projects ongoing. ESME software licence available to academics.

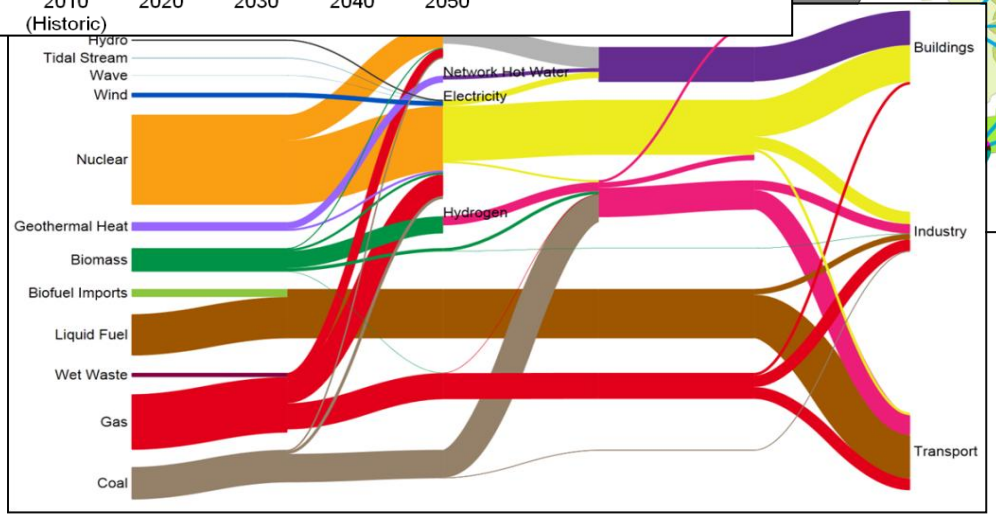
* UK Government Department of Energy & Climate Change

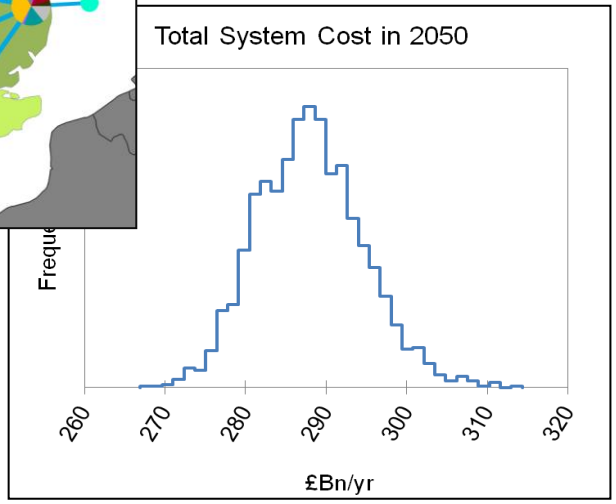
\+ Committee on Climate Change, a statutory UK body

Typical ESME Outputs







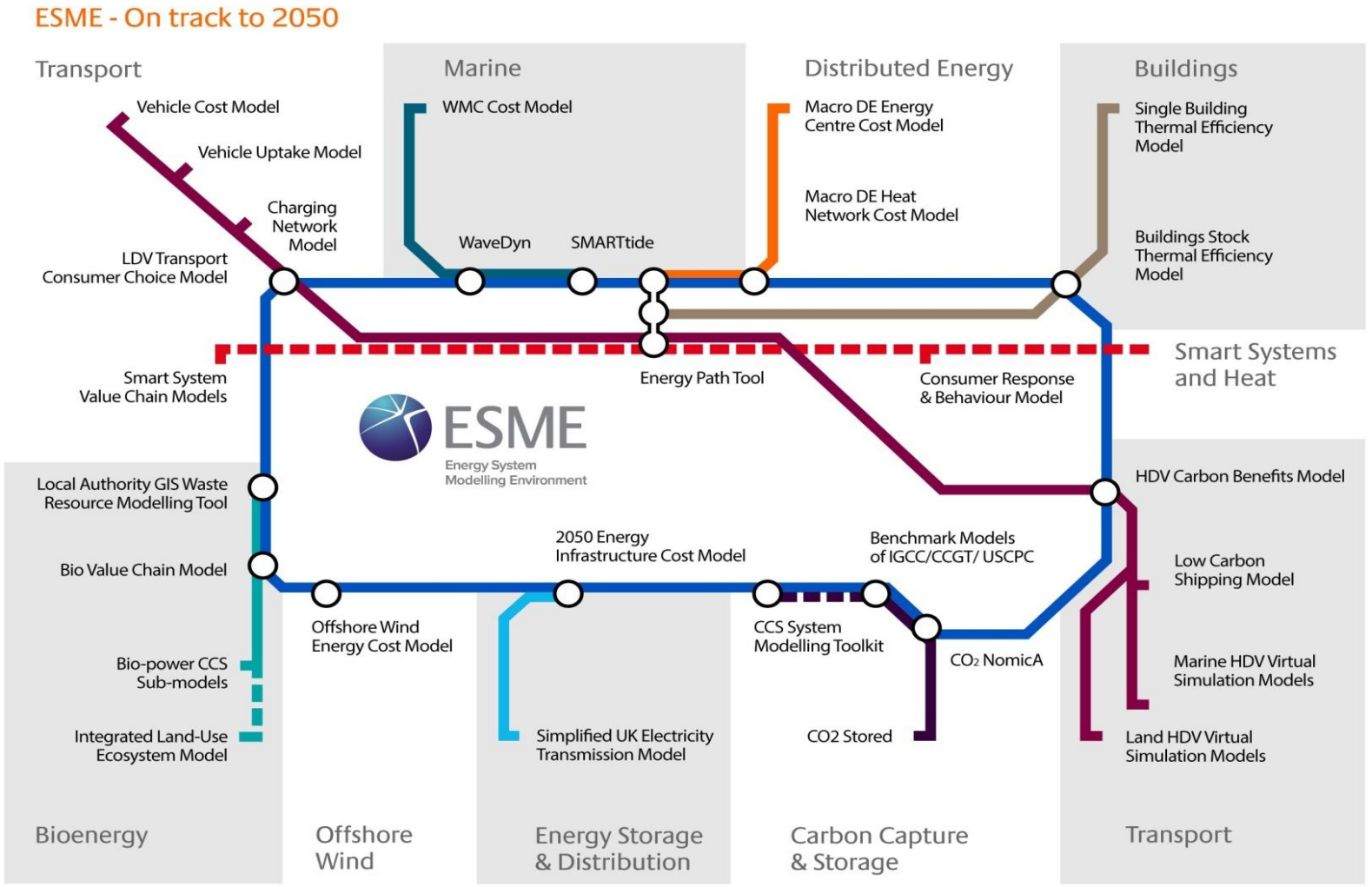


Types of Debate that ESME is used to inform

- What might be ‘no regret’ technology choices and pathways to 2050?
- What is the total system cost of meeting the energy targets?
- What are the opportunity costs of individual technologies?
- What are the key constraints e.g. resources, supply constraints?
- How might accelerating the development of a technology impact the solution?
- How might uncertainty in resource prices and availability influence system design choices?
- Where should new generating capacity optimally be located?
- How might policies and consumer choices influence technology development?

ETI projects & models informing ESME

ESME is a platform for consolidating knowledge across technology areas



Potential implications for the UK...

Abatement costs

UK's challenging 2050 CO2 target appears affordable with intelligent national energy system design and investment in technology development

Efficiency measures

waste heat recovery, building insulation, and efficient vehicles make a contribution under all emission reduction scenarios

ETI targeting through SSH (£100m) and HDV (£40m) projects

Nuclear

mature technology and appears economic under most emission reduction scenarios - primarily an issue of deployment (planning / licensing, supply-chain, finance etc)

Cost impacts post-Fukushima need clarification – international approach needed

Bioenergy

major potential for negative emissions via CCS and might include a range of conversion routes – H2, SNG, process heat

ETI investing in science, logistics and value models

Offshore Renewables

the marginal power technology and an important hedging option

ETI investing in next generation, low cost, deepwater platform and turbine technology demonstrations

CCS

a key technology lever given potential wide application in power, hydrogen and SNG (gas) production, and in industry sector

ETI investing in separation, storage and system design – for coal, gas and biomass

Natural gas

a key 2050 destination fuel for power, space heating, industrial process heat and potentially for heavy duty vehicle transport applications

ETI addressing through SSH and HDV efficiency programmes

Hydrogen

potentially important energy vector providing system flexibility (CCS and storage) and light vehicle transport applications

ETI determining energy system flexibility benefits of using H2

SSH – Smart Systems and Heat programme

HDV – Heavy Duty vehicle Efficiency programme

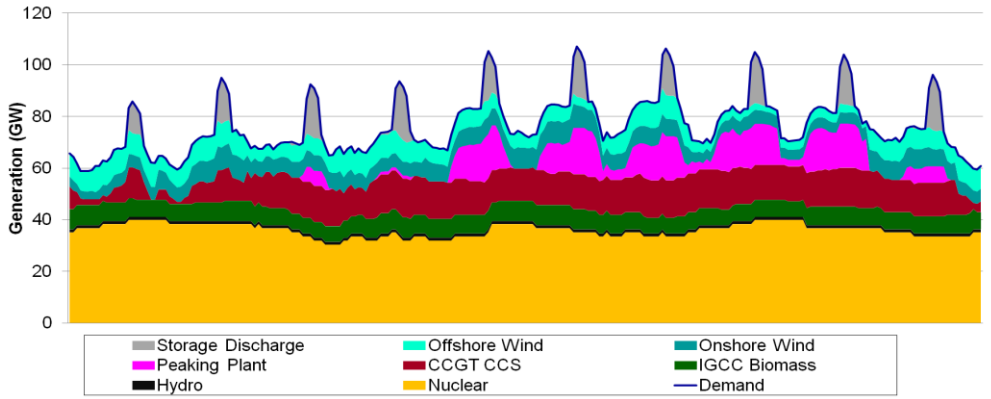
More detail on model operation...

Using the core ESME model:

- Monte Carlo results – ‘no-regret’ options, marginal choices
- 3 future UK demand cases – alternative socio-economic pathways for the UK
- Long list of “No technology X” sensitivities – opportunity cost metric
- Sensitivity to different CO_2 targets
- Sensitivity to improved/accelerated technology development

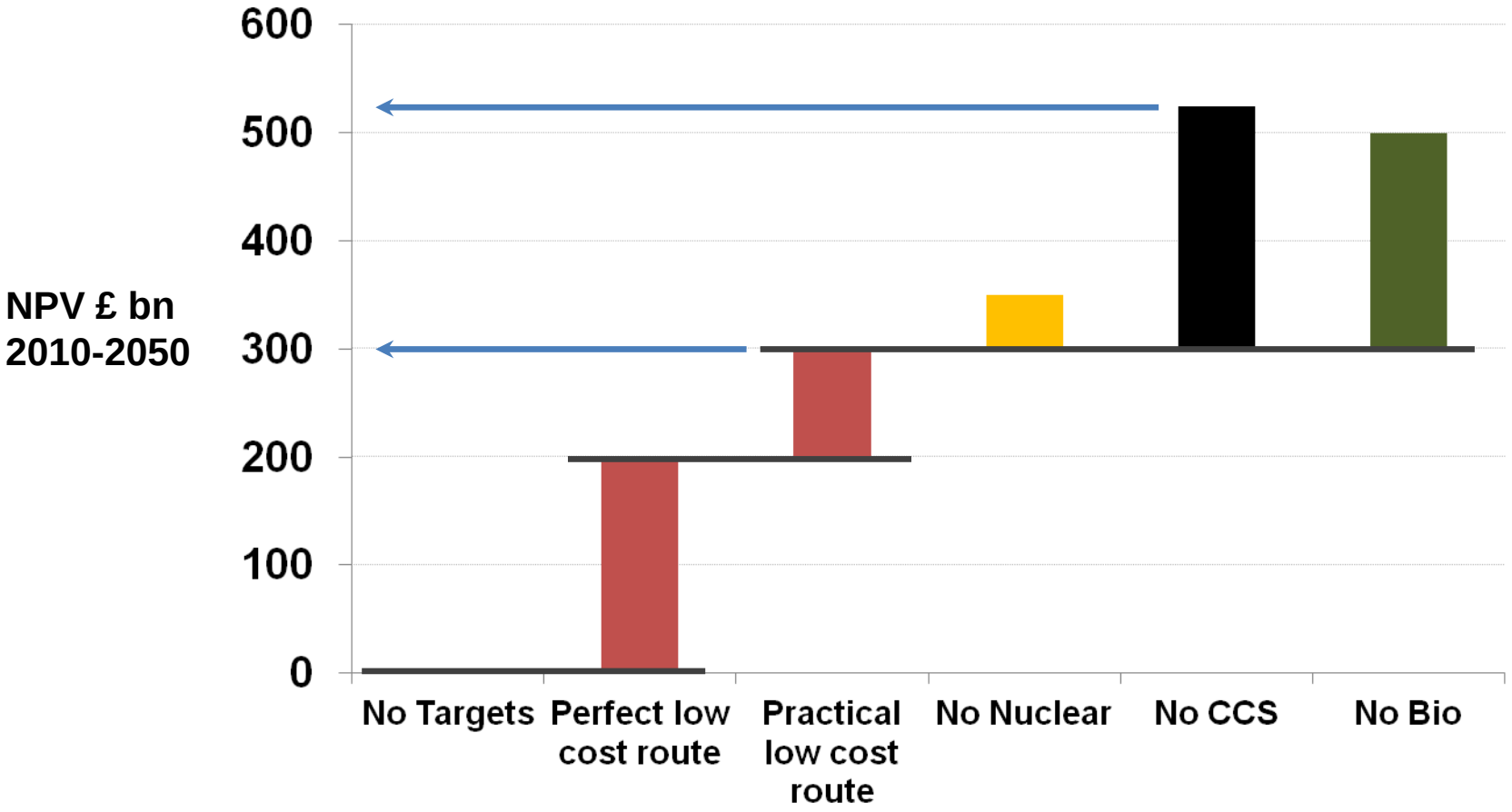
Beyond the core ESME model:

- Dispatch of the ESME electricity system is studied in PLEXOS
- Switch for more detailed buildings & heat optimisation
- Switch for more detailed peak day modelling



Getting the UK energy system to 2050

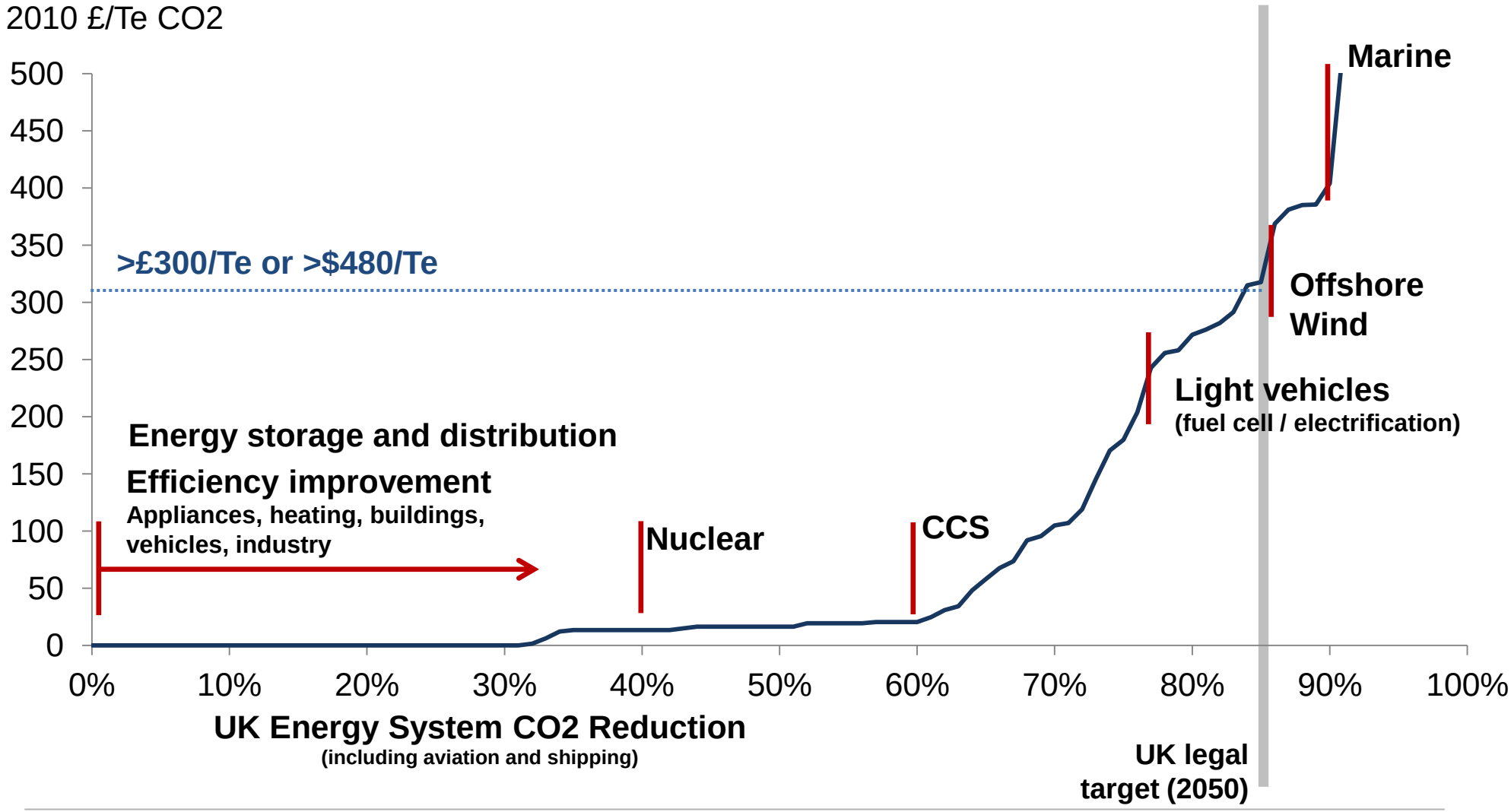
Incremental 2010-2050 cost of delivering national energy system which meets CO2 targets



Societal level discount rate 3.5%

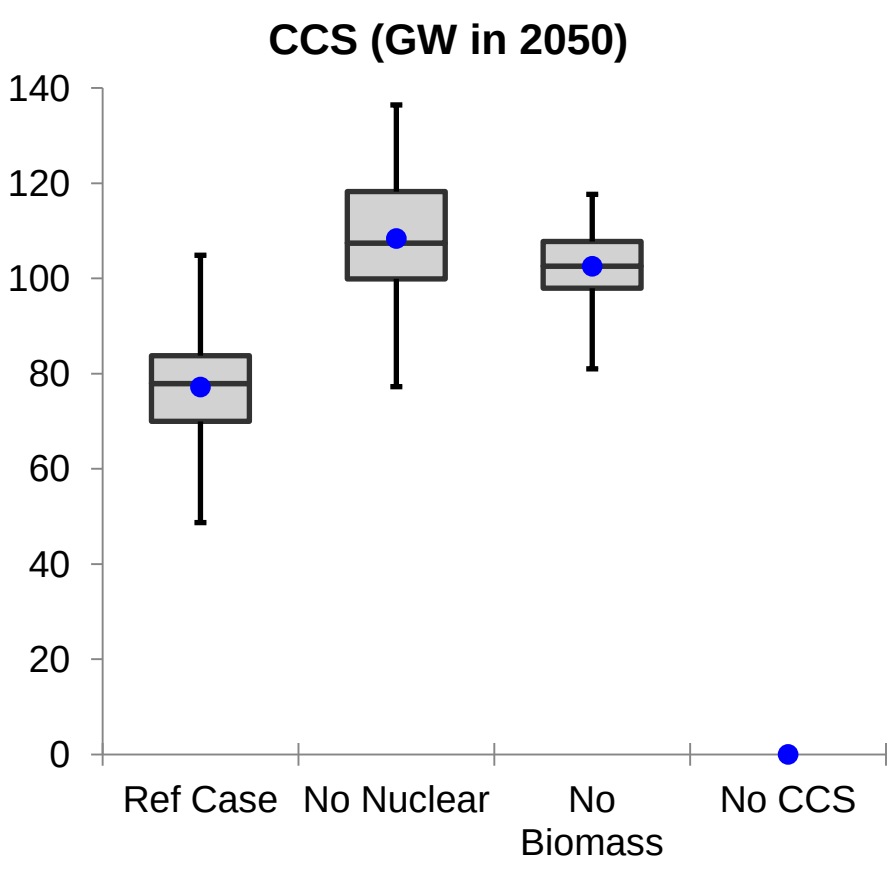
2050 UK system cost

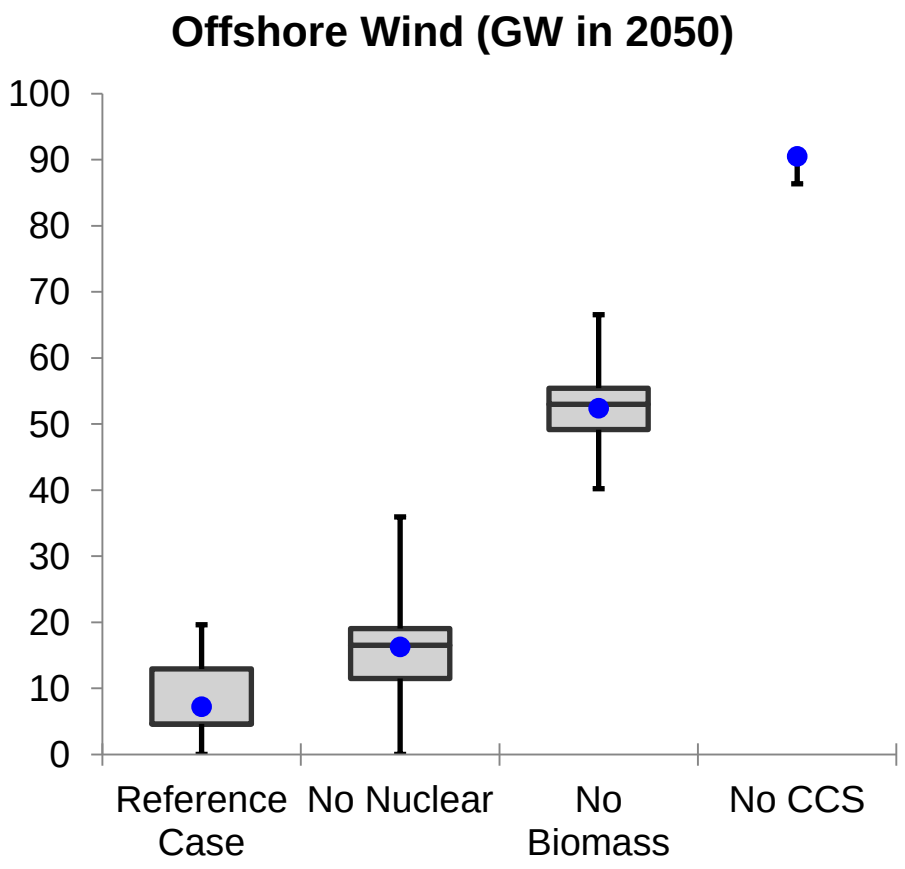
first appearances of major technologies, in order of increasing effective carbon price



Technology deployment

CCS appears a mainstay, offshore wind a critical hedge





Potential implications for the UK...

Abatement costs

UK's challenging 2050 CO2 target appears affordable with intelligent national energy system design and investment in technology development

Efficiency measures

waste heat recovery, building insulation, and efficient vehicles make a contribution under all emission reduction scenarios

ETI targeting through SSH (£100m) and HDV (£40m) projects

Nuclear

mature technology and appears economic under most emission reduction scenarios - primarily an issue of deployment (planning / licensing, supply-chain, finance etc)

Cost impacts post-Fukushima need clarification – international approach needed

Bioenergy

major potential for negative emissions via CCS and might include a range of conversion routes – H2, SNG, process heat

ETI investing in science, logistics and value models

Offshore Renewables

the marginal power technology and an important hedging option

ETI investing in next generation, low cost, deepwater platform and turbine technology demonstrations

CCS

a key technology lever given potential wide application in power, hydrogen and SNG (gas) production, and in industry sector

ETI investing in separation, storage and system design – for coal, gas and biomass

Natural gas

a key 2050 destination fuel for power, space heating, industrial process heat and potentially for heavy duty vehicle transport applications

ETI addressing through SSH and HDV efficiency programmes

Hydrogen

potentially important energy vector providing system flexibility (CCS and storage) and light vehicle transport applications

ETI determining energy system flexibility benefits of using H2

SSH – Smart Systems and Heat programme

HDV – Heavy Duty vehicle Efficiency programme

Energy Technologies Institute
Holywell Building
Holywell Park
Loughborough
LE11 3UZ

For all general enquiries telephone the ETI on 01509 202020.

For more information about the ETI visit www.eti.co.uk

For the latest ETI news and announcements email info@eti.co.uk

The ETI can also be followed on Twitter at twitter.com/the_ETI