Delivering low carbon energy technologies and supporting economic growth

by...

- Building Partnerships
- Delivering Innovation
- Sharing risk
- Informing Policy
- Creating Affordability

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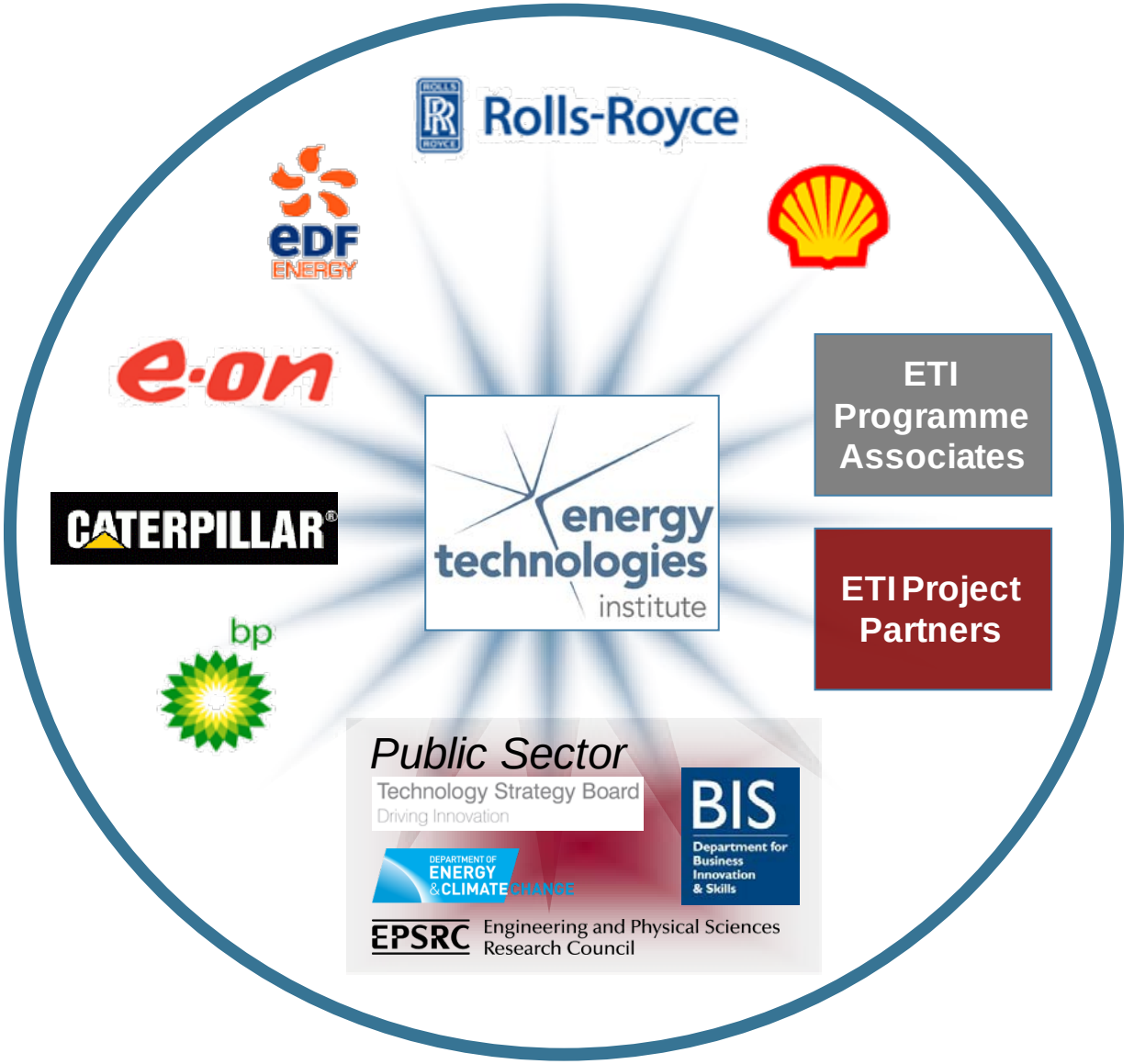
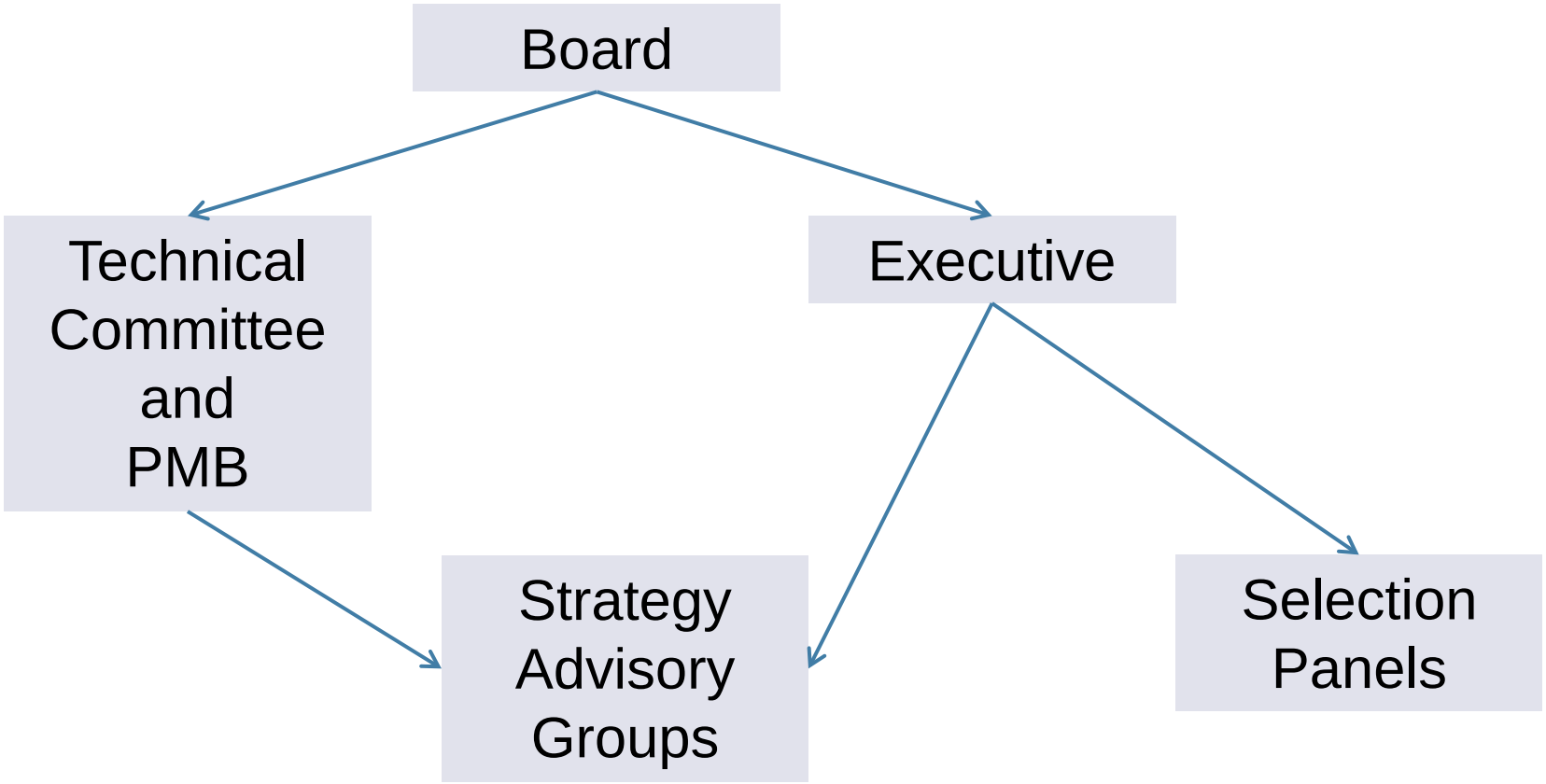
Energy Technologies Institute

Addressing the challenges of climate change and low carbon energy

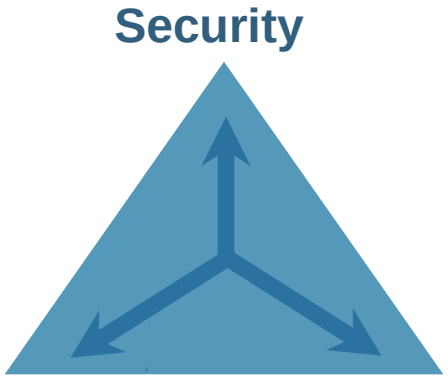
- **Improving energy usage**, efficiency, supply and generation
- **Demonstrating systems** and technologies
- **Developing knowledge**, skills and supply-chains
- **Informing development of policy,** regulation and standards
- **Enabling deployment of affordable, secure, low carbon energy systems**

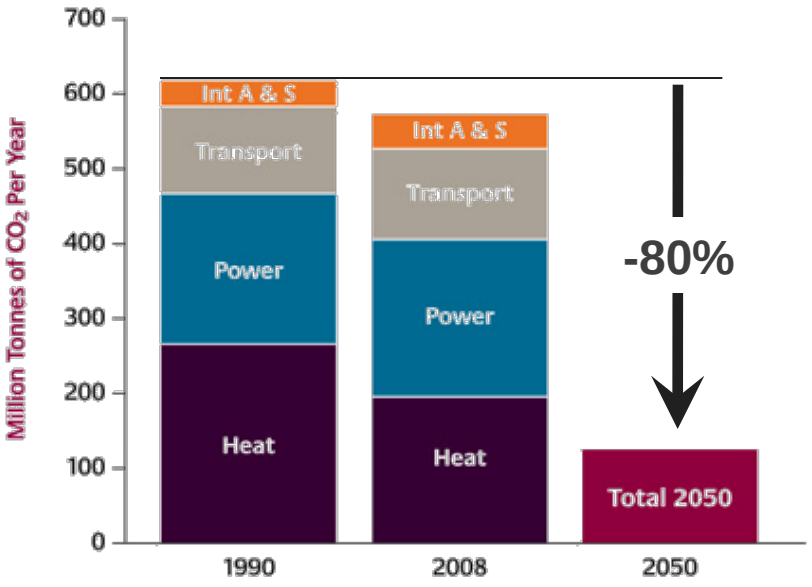


ETI Governance



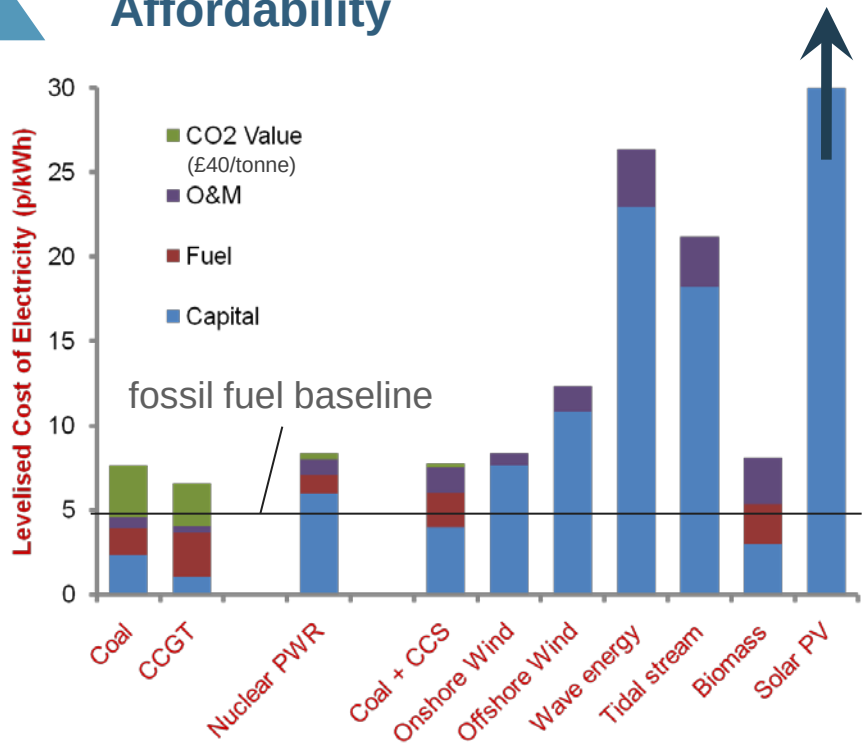
Addressing the UK's energy challenges





Int A & S = International Aviation & Shipping

DUKES data



Addressing the UK's 2020 and 2050 energy challenges requires...

Setting a strategic direction

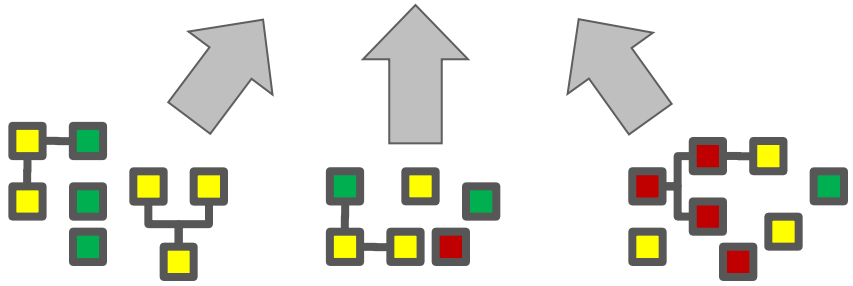
Which energy technologies do we need and when?

Creating commercial confidence

Viable commercial operation

Full system demonstration

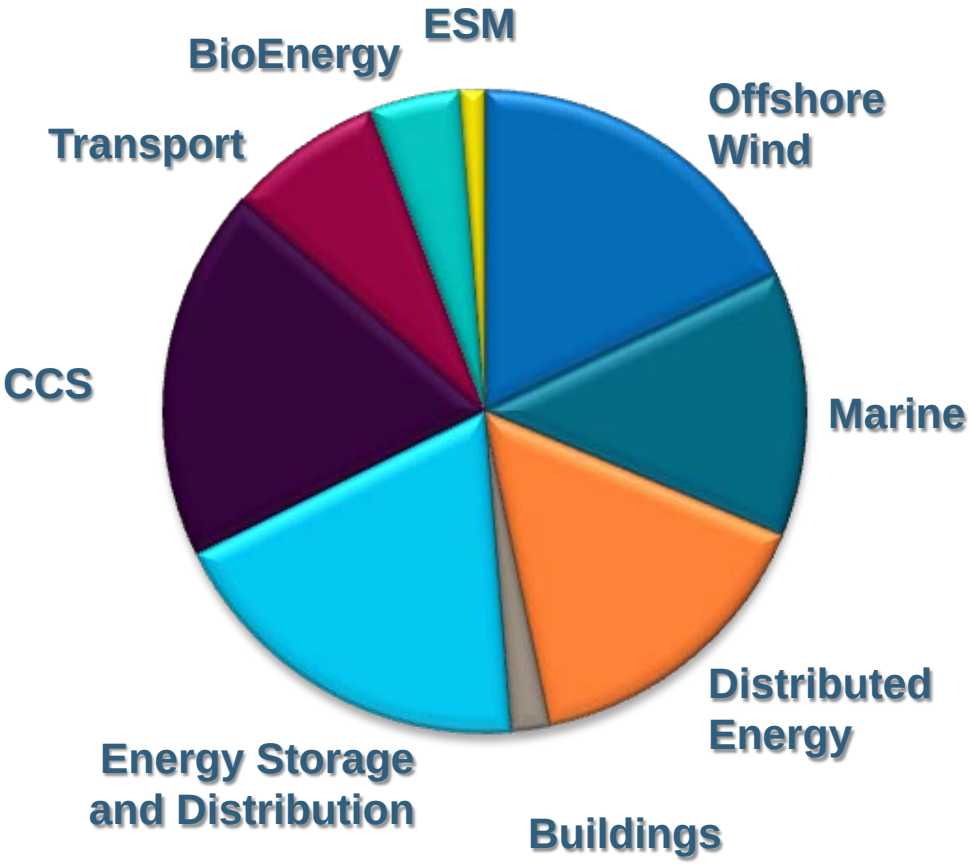
- Reducing risk
- Increasing investor confidence
- Bringing together new supply-chains



Innovative technologies and sub-systems

ETI 2010 portfolio
- addressing key energy challenges

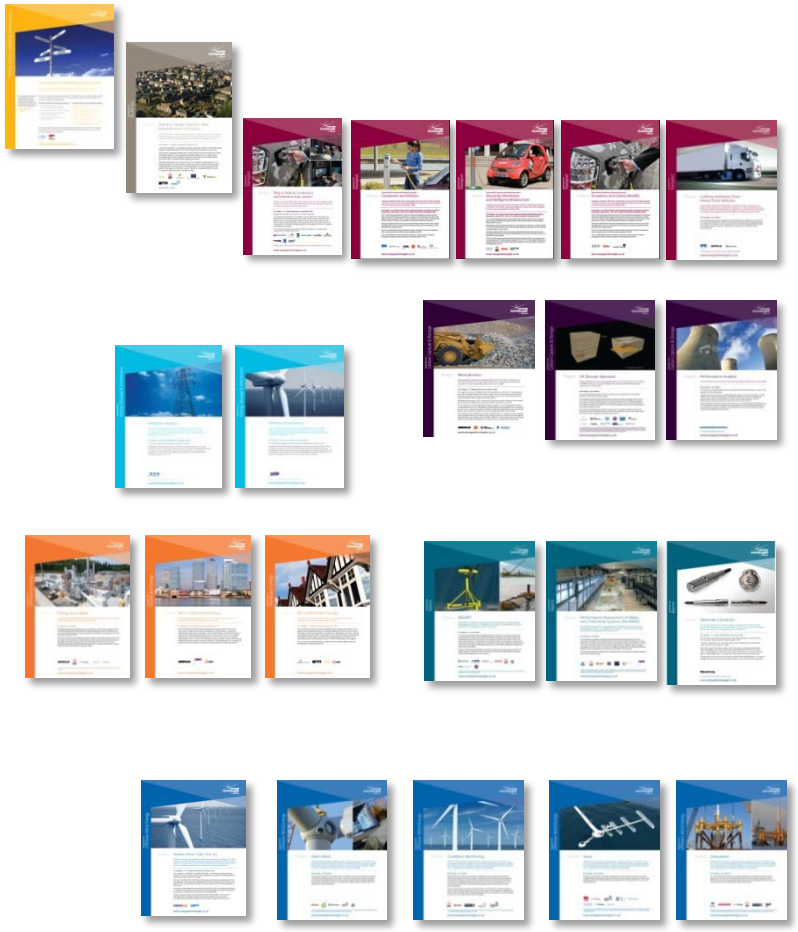
- **Wind**
  - Offshore specific system design and engineering
- **Marine**
  - Tidal Stream and Wave
- **Distributed Energy (DE)**
  - Combined Heat and Power (CHP), demand management, efficiency
- **Buildings**
  - Retrofit of new technologies and systems
- **Energy Storage and Distribution**
  - Infrastructure, heat and energy storage, fault management, smart networks
- **Carbon Capture, handling and Storage (CCS)**
  - Storage modelling, capture technologies, network design
- **Transport**
  - Electric vehicle infrastructure, heavy duty vehicle efficiency
- **BioEnergy**
  - Soil chemistry and agronomy, value chains, energy conversion
- **Energy Systems Modelling (ESM)**



£62m of major projects underway

>£100m of further projects in development

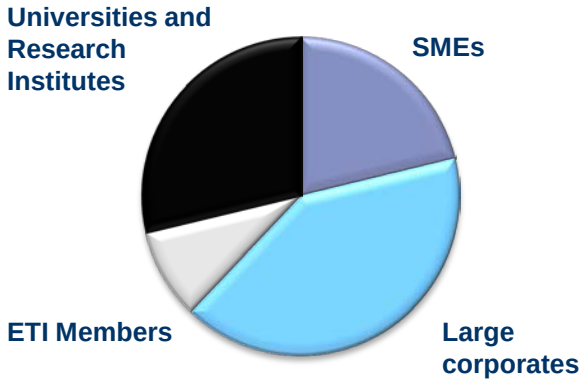
CCS, DE, offshore wind, energy storage and distribution, transport, buildings, marine and bio energy



UK ESM (Energy System Model)

ESD (Energy Storage and Distribution)

Organisations working on ETI projects – July 2010



£62m of projects announced

ETI Project partners

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Outside the UK
Blue H · HORIBA MIRA · MacArtney Underwater Technology

Scotland
EMEC · University of Strathclyde Glasgow · The University of Edinburgh · Heriot-Watt University · senergy alternative energy · Scottish Centre for Carbon Storage · seebyte · University of Aberdeen

North West
The University of Manchester · Shell

North East
SKM · Mott MacDonald · Durham University · cpi ...the future inspired · GRL · ikon science GeoPressure Technology

Yorkshire
University of Leeds · The University Of Sheffield.

Northern Ireland
Queen's University Belfast

East Midlands
Romax Technology · Rolls-Royce · E.ON · The University of Nottingham · British Geological Survey

West Midlands
Converteam · ARUP

East
TotalFlow · Cranfield University · SLP · bre · elementenergy · Caterpillar

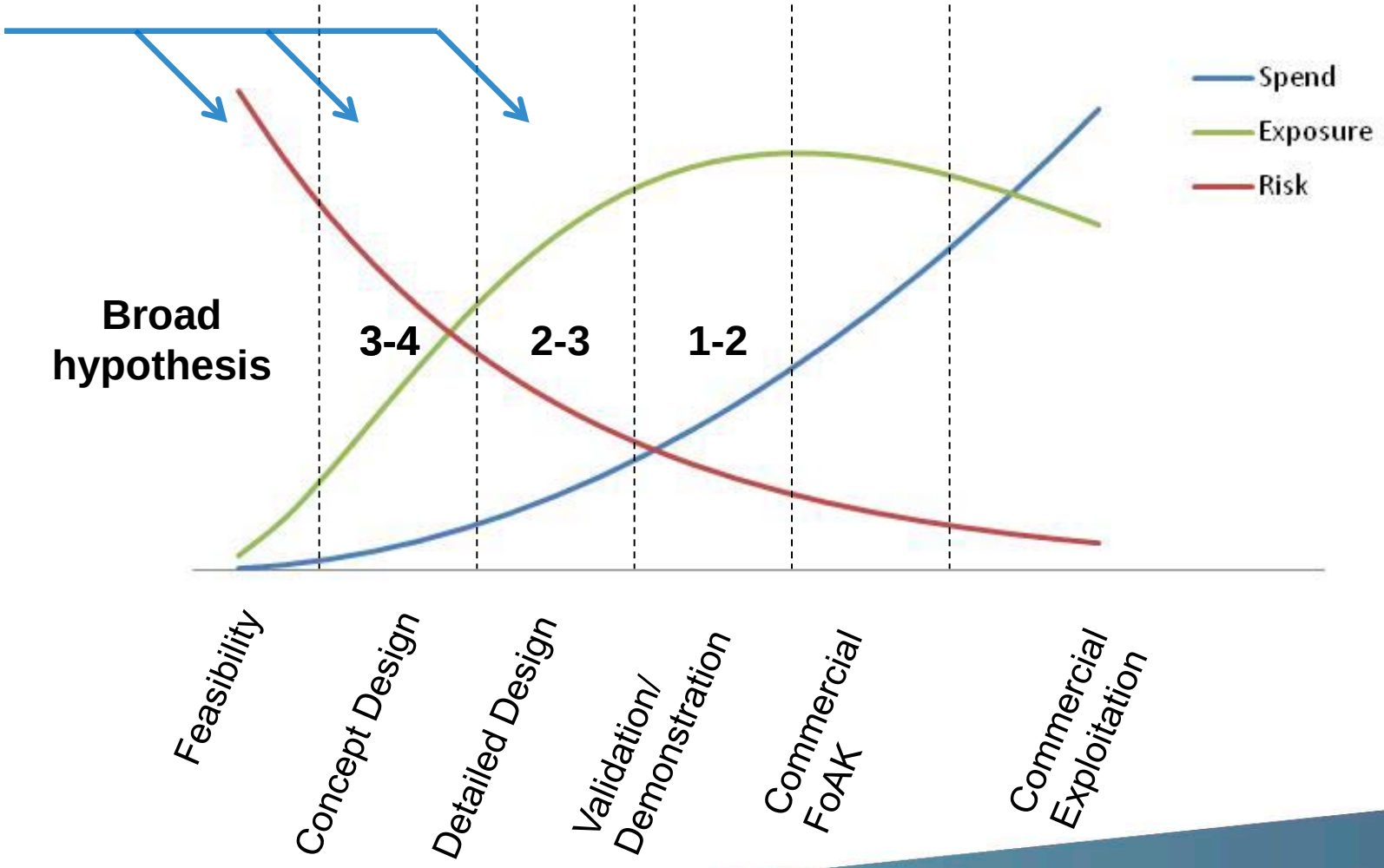
Wales
James Ingram & Associates

London
Imperial College London Consultants · bp · EDF Energy · CRA International · REDPOINT · IBM · PEABODY · PAFA Consulting Engineers · UCL · PRP responsive, intelligent, enduring design

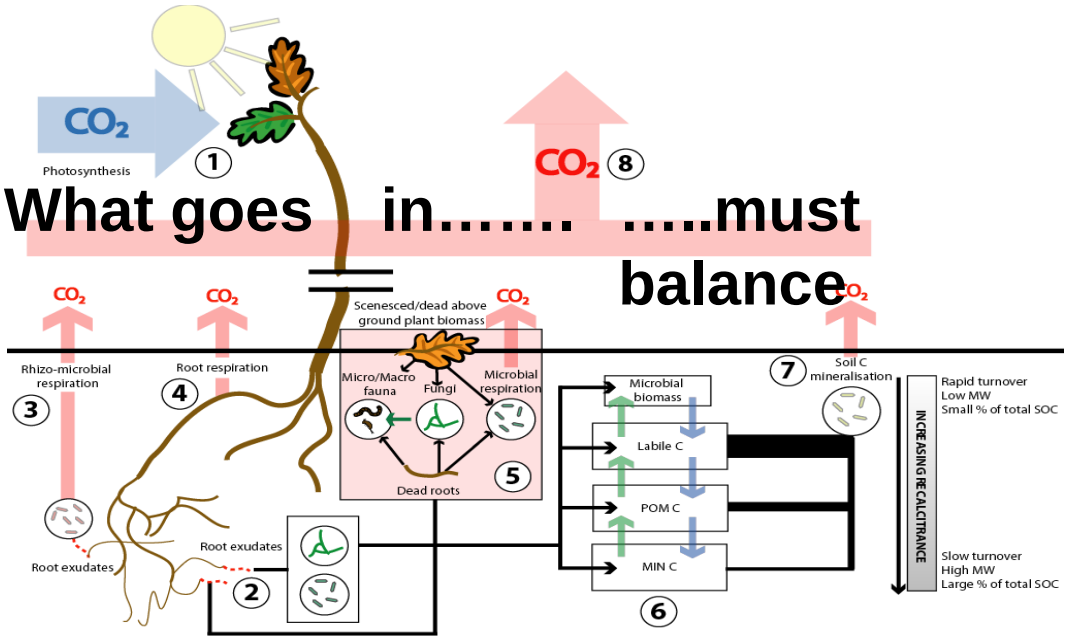
South West
Garrad Hassan · Tidal Generation · PML Plymouth Marine Laboratory

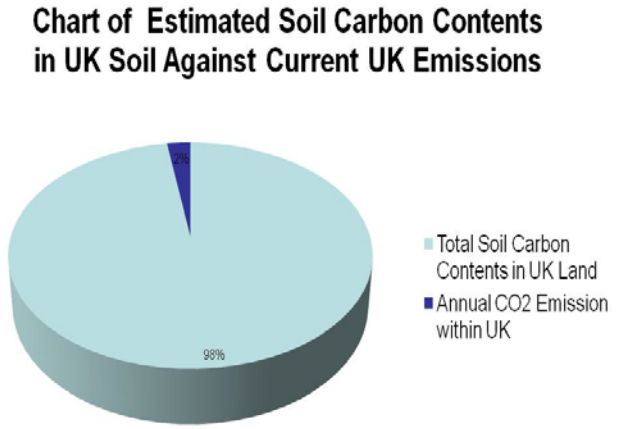
South East
insensys · otm · Ricardo · wates · University of Oxford · Wind Power · Cefas · TRL · shanks. waste solutions. · QinetiQ · BAE SYSTEMS · RPS Energy · Foster Wheeler · passivSYSTEMS · US University of Sussex

De-risking Commercial Deployment



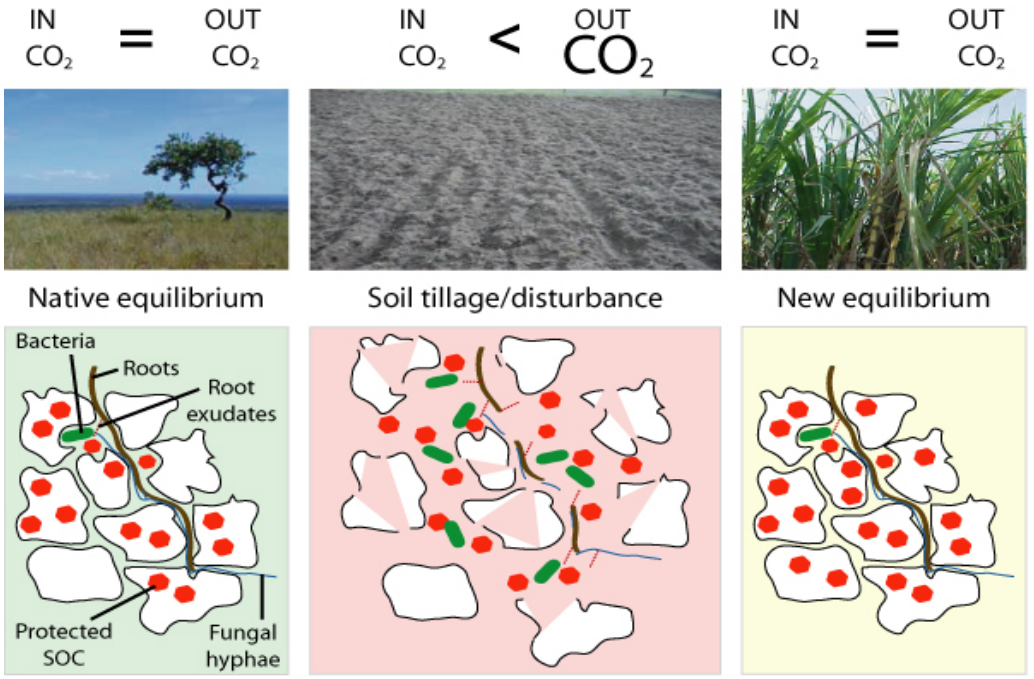
Soil carbon cycle





According to DEFRA, there are 36 billion tonnes of CO_{2e} in UK soil, which represents **50 times current emissions and 250 times emissions in 2050.** What we grow, where we grow, and how we plough and till could affect the degree of stable, meta-stable and unstable carbon in the soil

Effects of global land use change on soil carbon

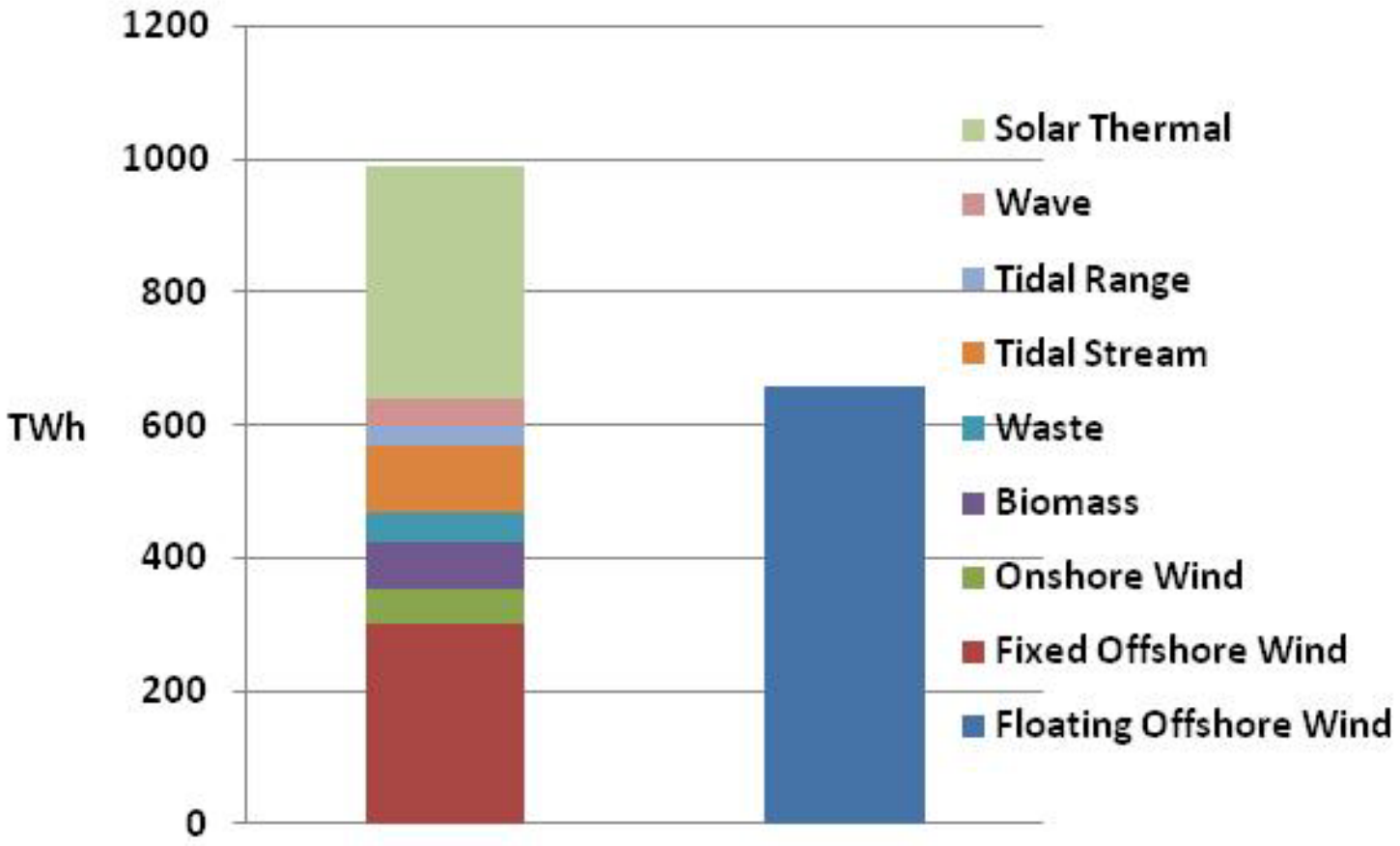


Global soil carbon loss due LUC

Report	Pg C yr^{-1}(range)
Smith (2008)	1.6 (± 0.8)
IPCC (2008)	1.6 (0.5 – 2.7)

Loss of carbon is large
Recovery is long...
How to get round this?

UK Renewable Resource Potential



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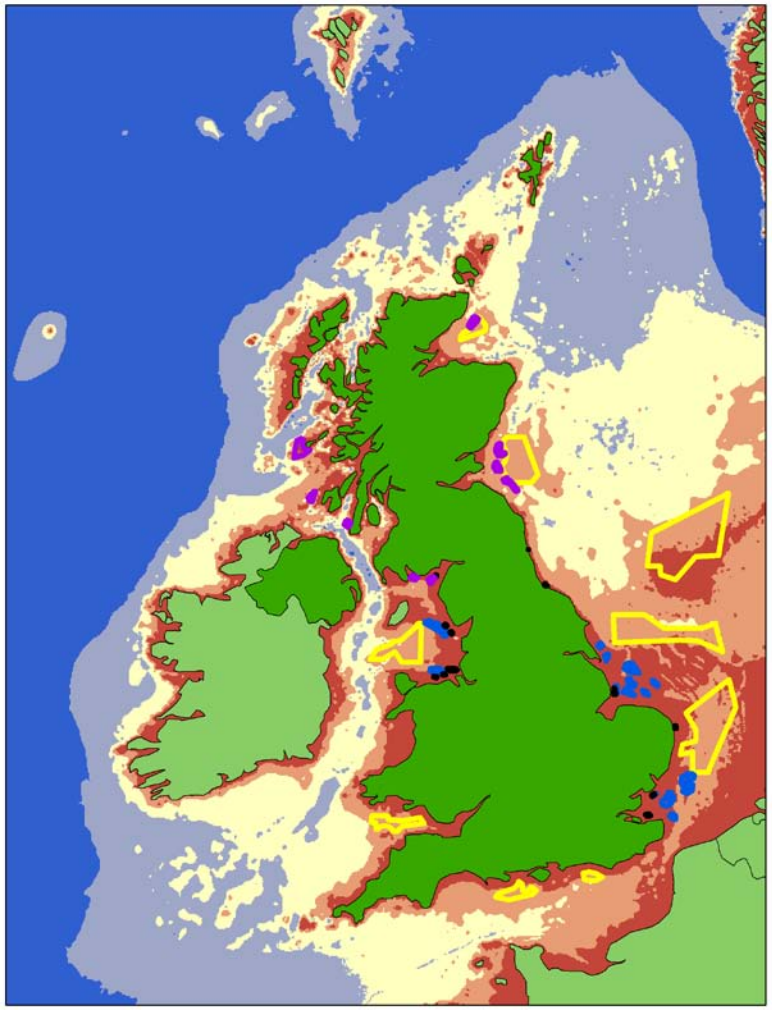
Water Depth and Current Licenses



- <30m monopile
- 30-60m structure
- 60-200m TLP
- 100-200m spar-buoy

- Statoil believe spar-buoy more cost-effective >100m
- Rounds 1,2 & 3 and Scottish Waters

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Programme Area: Offshore Wind Energy

Nova (Novel Offshore Vertical Axis Demonstrator)

The NOVA project has established the technical and commercial feasibility of a 5MW and 10MW vertical axis turbine

ETI funding – £2.8 million. Completing autumn 2010

Energy costs 9 – 14p /kWhr

The main innovation is the utilisation of a vertical axis turbine to reduce CAPEX and OPEX.

Insights

Concept design is technically and commercially feasible

Currently not enough commercial benefit to warrant development

otm · Cranfield University · University of Strathclyde Glasgow · The University Of Sheffield. · Wind Power · James Ingram & Associates · Cefas · QinetiQ

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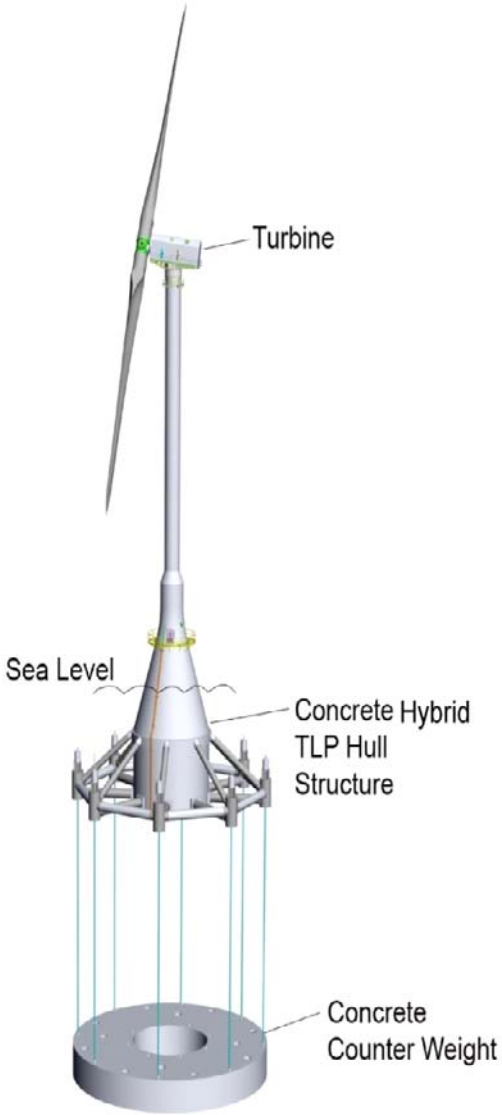

Deepwater

An economic and technical feasibility study of a novel floating Tension Leg Platform (TLP) offshore wind turbine

ETI funding – £3.3 million. Completed in Summer 2010

Electricity costs 11-14p/kWhr

Insights

- A floating Tension Leg Platform is feasible
- Current software tools cannot analyse the behaviour of a wind turbine on a dynamic floating structure
- Significant opportunity to 'value engineer' a floating solution and further reduce cost of energy

Blue H · BAE SYSTEMS · Cefas · EDF ENERGY · Romax TECHNOLOGY · SLP · PAFA CONSULTING ENGINEERS

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Programme Area: Offshore Wind Energy

Helm Wind

Helm Wind provides the design of an optimised offshore wind turbine and likely energy cost

ETI funding – £2.5 million. Completing autumn 2010

Energy costs 9-11p/kWhr

Insights

- Optimum drives towards larger downwind turbines with big blades
- Lowest CoE with gearless drives
- Includes a cost model to evaluate concepts

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Key Insights from the Offshore Wind Programme

- Provided designs that lower 2020 cost of energy by ~25%; 9 -12p/kWhr
- Shown that floating structures in higher wind areas are feasible, cost competitive and have a large global market
- Optimum solution drives towards fewer, larger gearless turbines with big blades.
- Optimum rotor for far offshore turbines in deep water
  - faces downwind
  - Is of the order of 40-50% larger

- These designs are available on the Member Portal

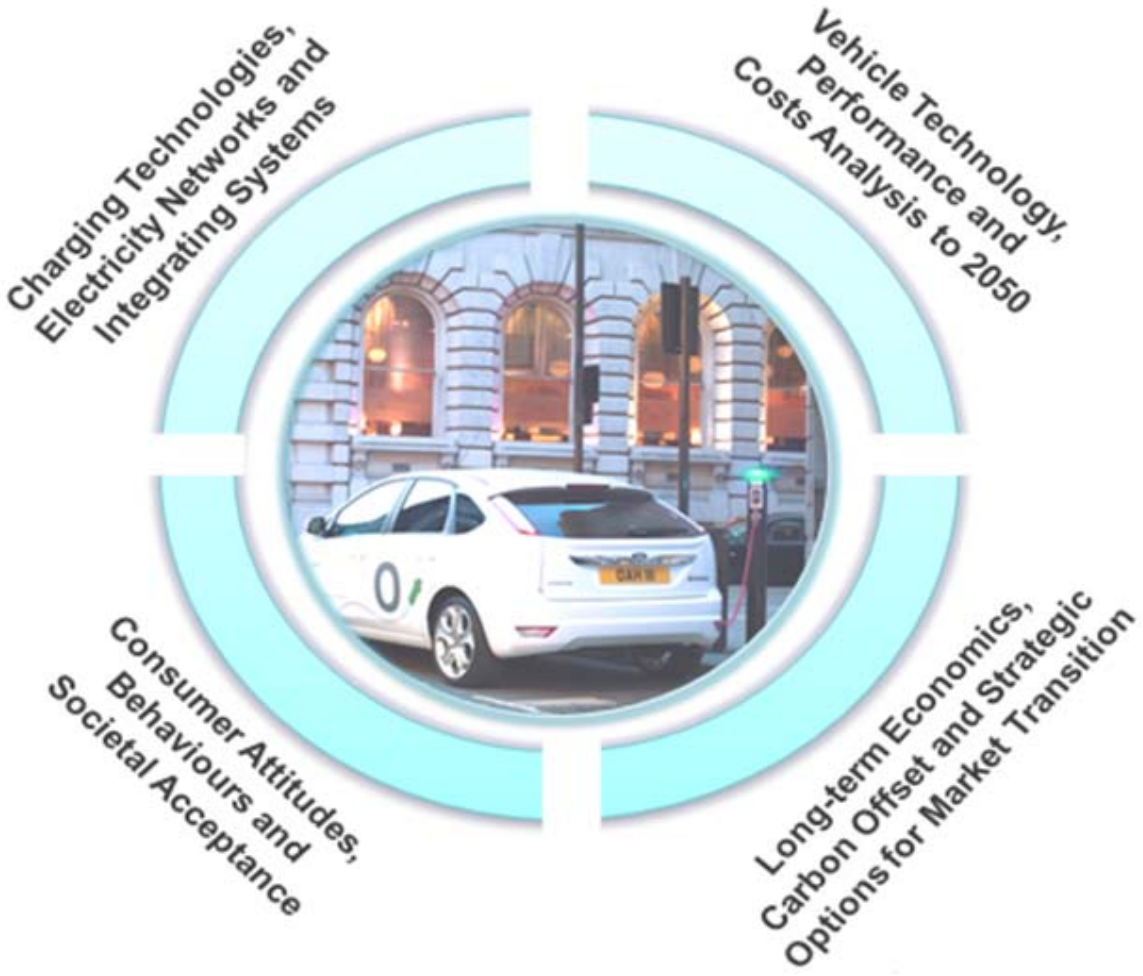
  The ETI is now evaluating options to demonstrate a ‘big bladed’ turbine, potentially on a floating platform

Vehicle Electrification

- **Plug-in Vehicle Economics and Infrastructure**

A robust large scale consumer trial for plug-in vehicles

Comprehensive and World-class Sub-Projects



ETI Members Collaborating to Shape and Review

- “....has pulled together consortia with respected international credentials and capabilities. Together these organisations are producing a **much needed comprehensive and integrated analysis**, the scope and quality of **which is world class and has not been delivered elsewhere.**

  This work **could not have been delivered by any individual member organisation alone**, or with such level of stakeholder challenge and review.”

  Mike Garwood, E.ON Engineering

- "By conducting an extensive evaluation of consumer attitudes and behaviours, we expect the project to **pave the way to a suitable, open and interoperable architecture**."

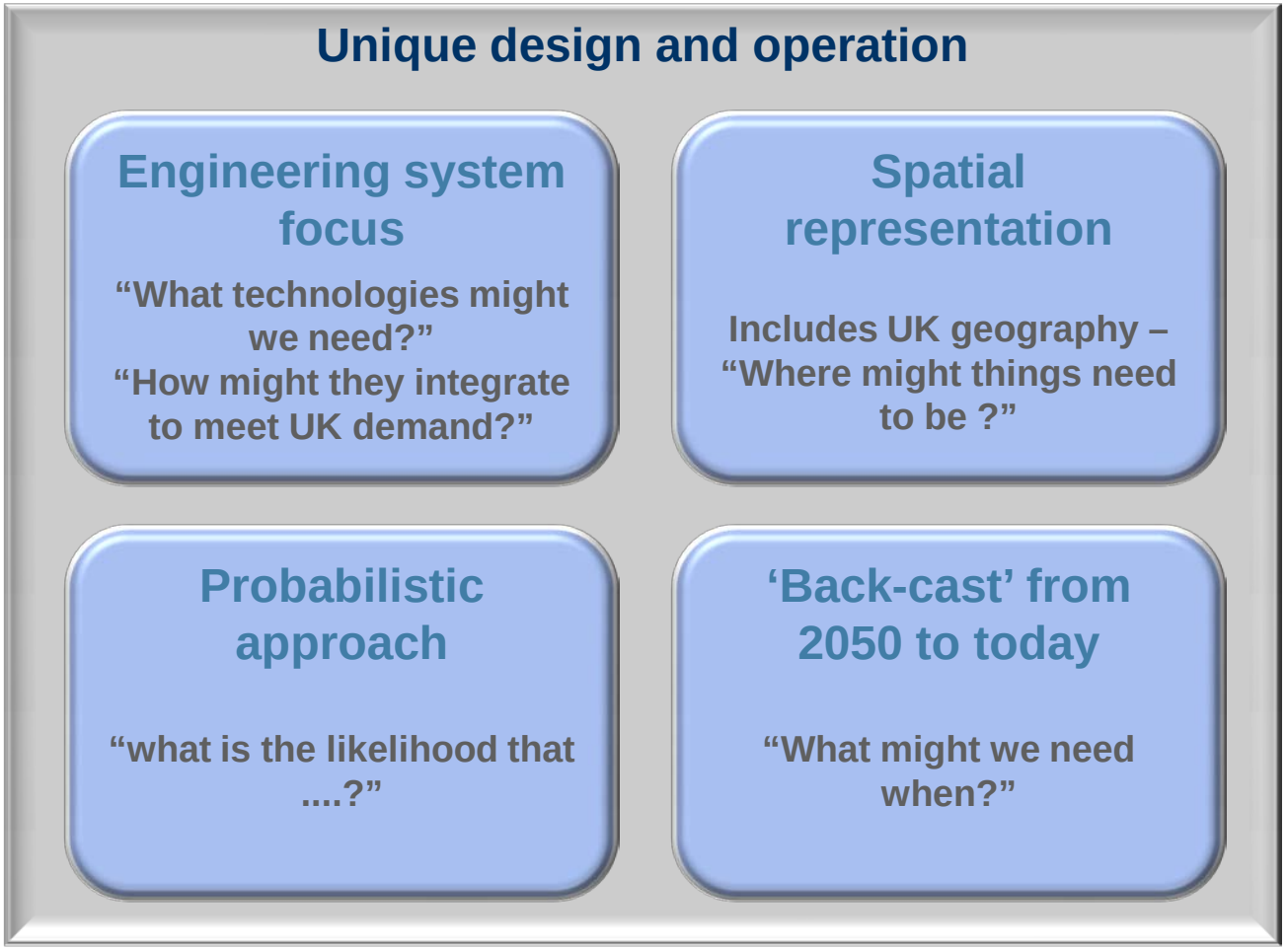
  Sébastien Pelissier, EDF Energy

The ETI's UK Energy System Model

PC based mathematical model identifying and evaluating **options for design of the future UK Energy system**

- **Generation and Demand**
- **Power, Heat, Transport and Infrastructure**

Enables decision making on investment and prioritisation



Complementary but distinctive capabilities

Area	Carbon Trust	Energy Technologies Institute	Technology Strategy Board
Why? [Core Driver]	**Accelerate carbon reductions**	**Develop new energy technologies**	**Drive UK wealth creation**
What? [Core Activity]	Build **commercial propositions** for low-carbon technologies	Build new **engineering capability**	**Connect** stakeholders and **catalyse** investment in innovation
When? [Timescale]	From today towards 2050	From 2050 backwards to 2020	From today towards 2050
Where? [Breadth]	Whole business environment including policy and market diffusion **TRLs: 3-9**	Integration of the UK energy system and the roles of key actors, especially end users **TRLs: 3-6**	Applied research, knowledge and skills transfer in UK business and academia **TRLs: 2-7**
Natural Owner	For innovations requiring commercially focussed support which is independent from industry	For large engineering system challenges that require significant industrial support	For innovations requiring collaboration to bring together diverse skills, knowledge and types of organisation
Policy Interactions	Pushes boundaries of the existing policy framework to accelerate progress	Anticipates future policy framework and focuses on long-term needs to 2050	Innovates within current policy framework to unlock business opportunities and feed ideas back to Government
Distinctive Strength	**Commercialisation**	**Engineering technology**	**Supply chain collaboration**

TRLs: Technology Readiness Levels

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Enabling….

Large-scale deployment through **major industries**

Innovation pulled through from **smaller enterprises and academia**

Sustained support for **long-term incentives, skills development** and **regulatory frameworks**

 Subject to notes on page 1

Building Partnerships

Delivering Innovation

Sharing risk

Informing Policy

Demonstrating Affordable systems

for Secure, Low Carbon Energy

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