

# ETI – Underpinning national energy systems policy and informing effective decision making

through...

System level strategic planning

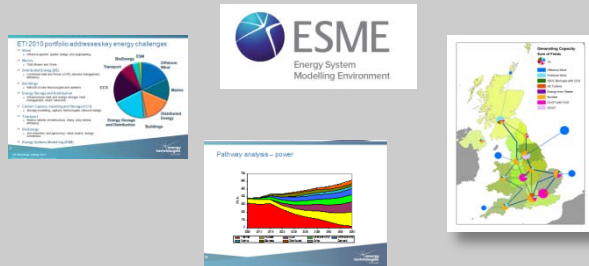
Technology development and demonstration



# ETI - Addressing 2020 and 2050 energy challenges by...

## Setting strategic direction

**World-class ETI capability in energy system modelling and strategic analysis**



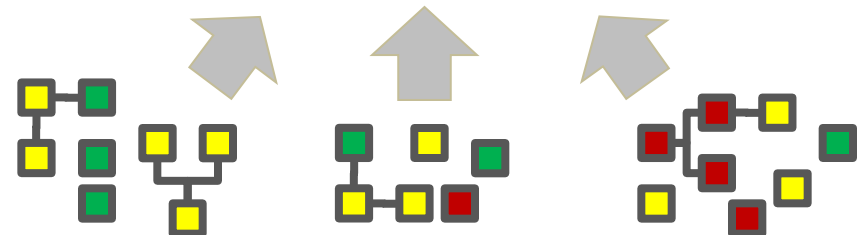
**Focused on the integrated UK energy system – power, heat, transport and associated infrastructure**

**Which energy technologies do we need and when?**

## Creating commercial confidence

**Viable commercial operation**

**ETI Delivery of engineering demonstrations of innovative low carbon energy systems**



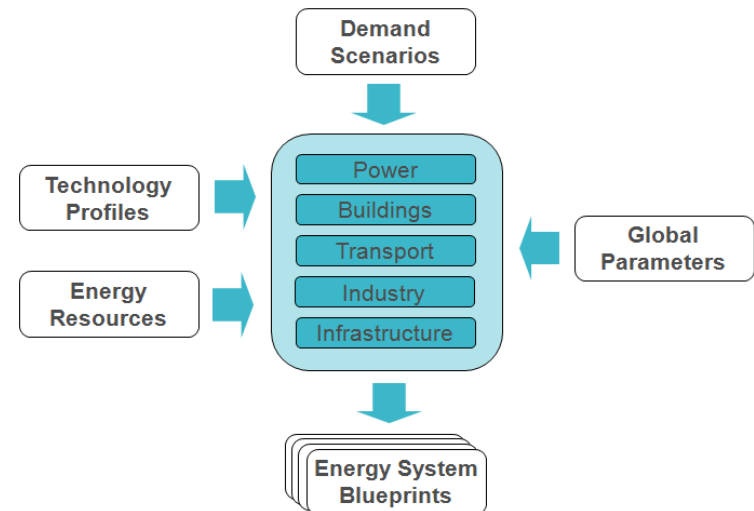
**Innovative technologies, sub-systems and information**



A national energy system design tool  
Integrating power, heat, transport and infrastructure  
searching for the lowest cost solution

# Energy System Modelling Environment

- A national energy system design tool
- Distinctive modelling approach
  - Least cost optimisation (policy neutral)
  - Focus on the “destination” and backcasting
  - Probabilistic treatment of uncertainties
  - Includes spatial & temporal factors
- Informed by ETI members/advisors
- Internationally peer reviewed



# ESME is used to inform and answer questions

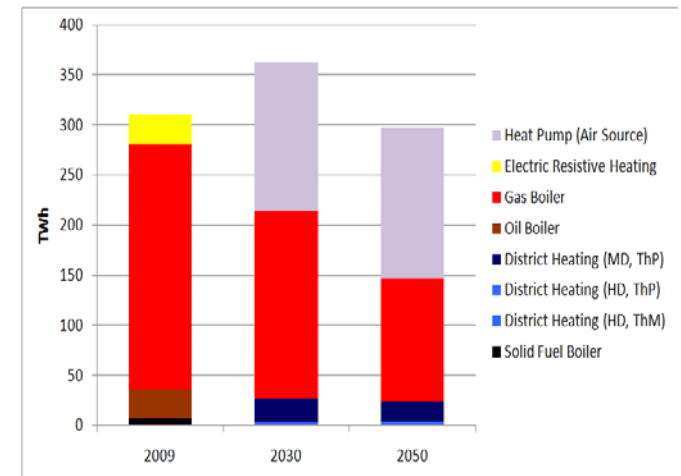
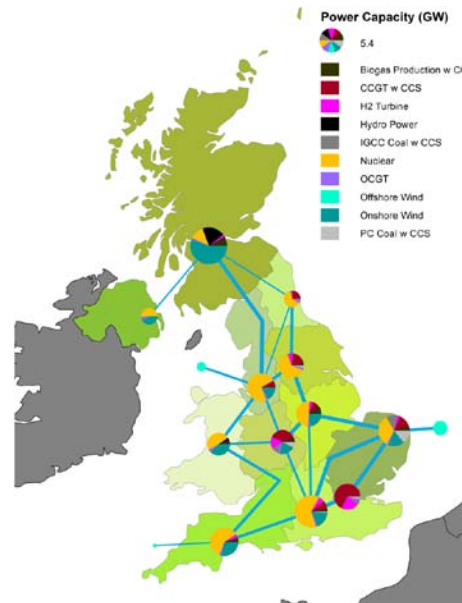
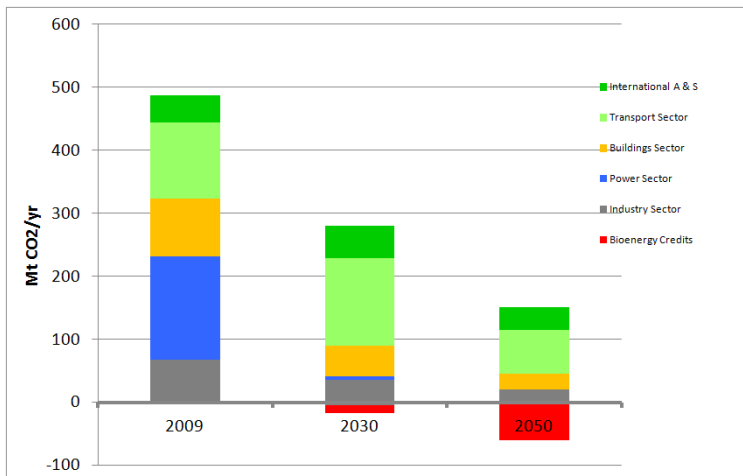
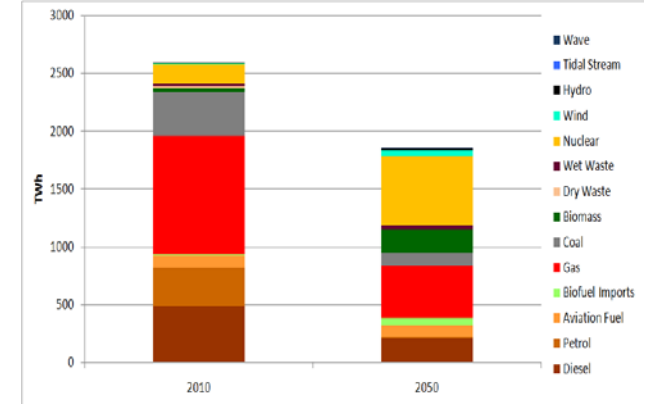
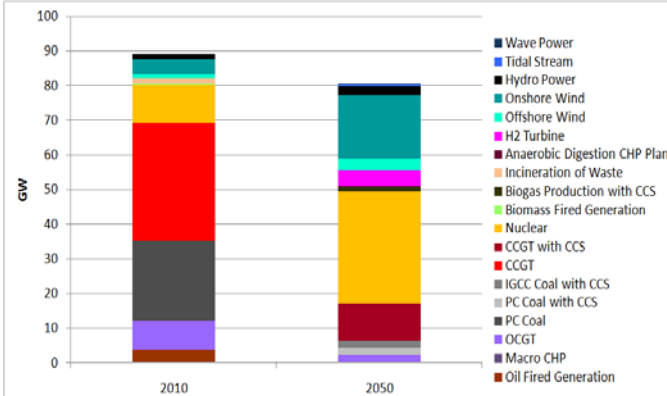
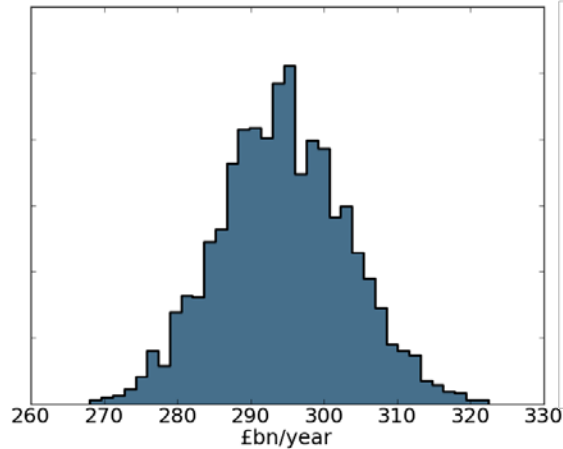
*for example...*



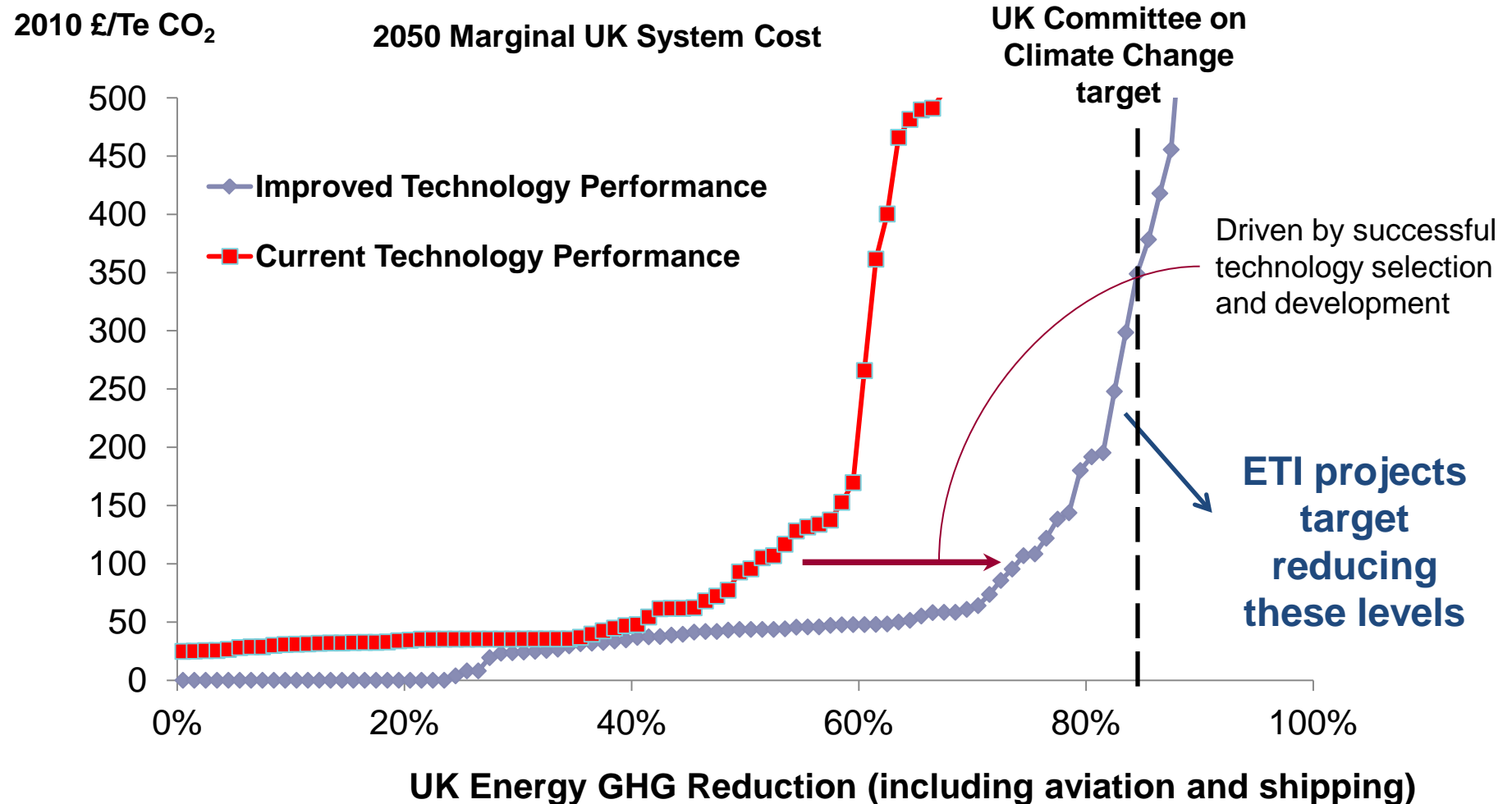
- What might be 'no regret' technology choices and pathways to 2050?
- What is the total system cost of meeting the energy targets?
- What are the opportunity costs of individual technologies?
- What are the key constraints e.g. resources, supply constraints?
- How might uncertainty in resource prices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

# Typical ESME Outputs

Total System Cost



2050 abatement costs are acceptable, provided we **develop** and **apply** the appropriate combination of technologies



# Potential implications for the UK...

## Abatement costs

UK 2050 target appears affordable with intelligent 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 'Smart' (including vehicle electrification infrastructure and HDV 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 – H<sub>2</sub>, SNG, process heat

*ETI investing in science, logistics and value models*

## Offshore Wind

the marginal power technology and an important hedging option

*ETI developing over £30m of investments 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*

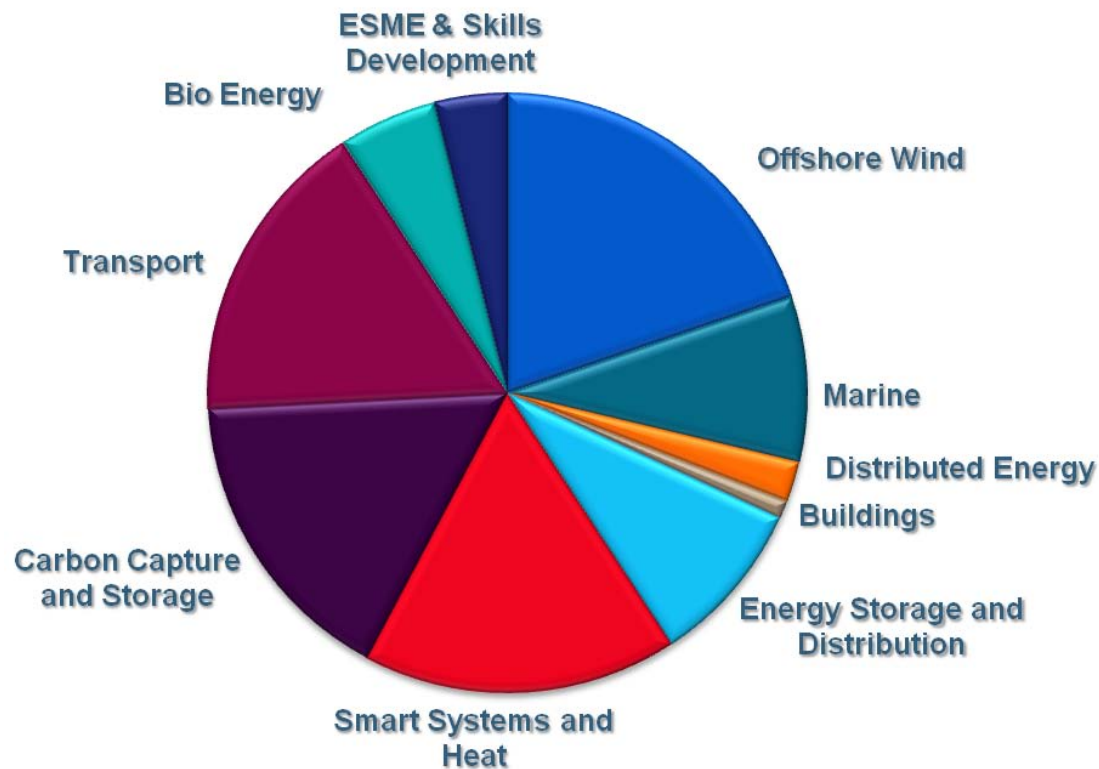
## Natural gas

potentially a material role as a 2050 destination fuel including power, space heating, transport and process heat applications

## Hydrogen

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





## ETI Project Portfolio

Delivering .....

New knowledge

Technology development

Technology demonstration

# ETI invests in projects at 3 levels

## Knowledge Building projects

**ETI additionality:** ability to target and specify project effectively and provide integration of outputs, connection to policy development

**<£5m, 6-24 months**

## Technology development projects

Frequently focused around SMEs

**ETI additionality:** project targeting and specification and integration, skilled inputs for business development, governance and technical support for start-ups, potential market access routes

**£5-15m, 2-4 years**

## Technology demonstration projects

Large projects delivered primarily by large companies, system integration focus.

**ETI additionality:** project targeting, specification and integration, skills, technologies, market access routes, policy development influence, effective risk management through scale of financial and technical leverage, engineering leadership

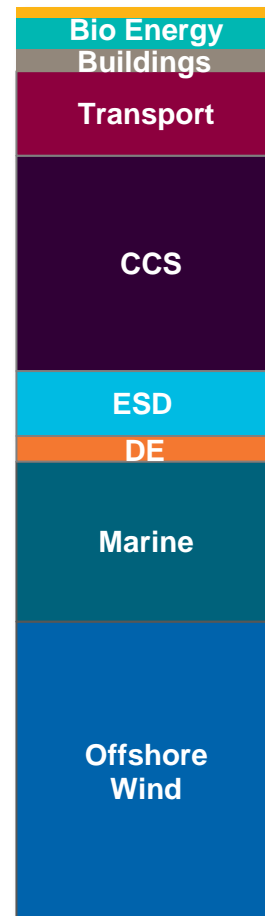
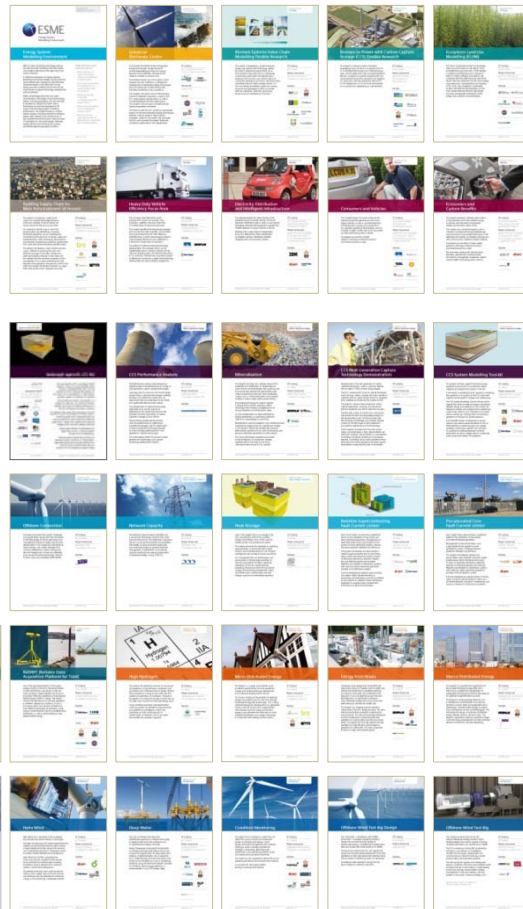
**£15-30m+, 3-5 years**

- ETI additionality increases with progress towards 'big projects' - impact is significant at all levels
- Additionality is delivered at all levels through depth of engineering, technology and policy engagement – *at system integration level* – coupled with involvement of ETI Member's staff

# £136m of major projects underway

> £139m of further projects in development

CCS, DE, offshore wind, energy storage, smart systems, transport



ESME  
(Energy  
System  
Model)

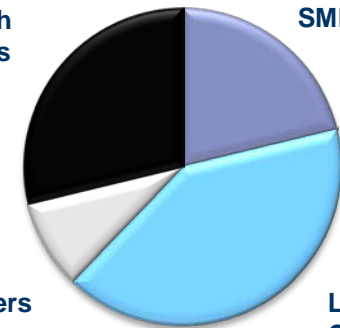
Organisations working on ETI  
projects – April 2012

Universities and  
Research  
Institutes

SMEs

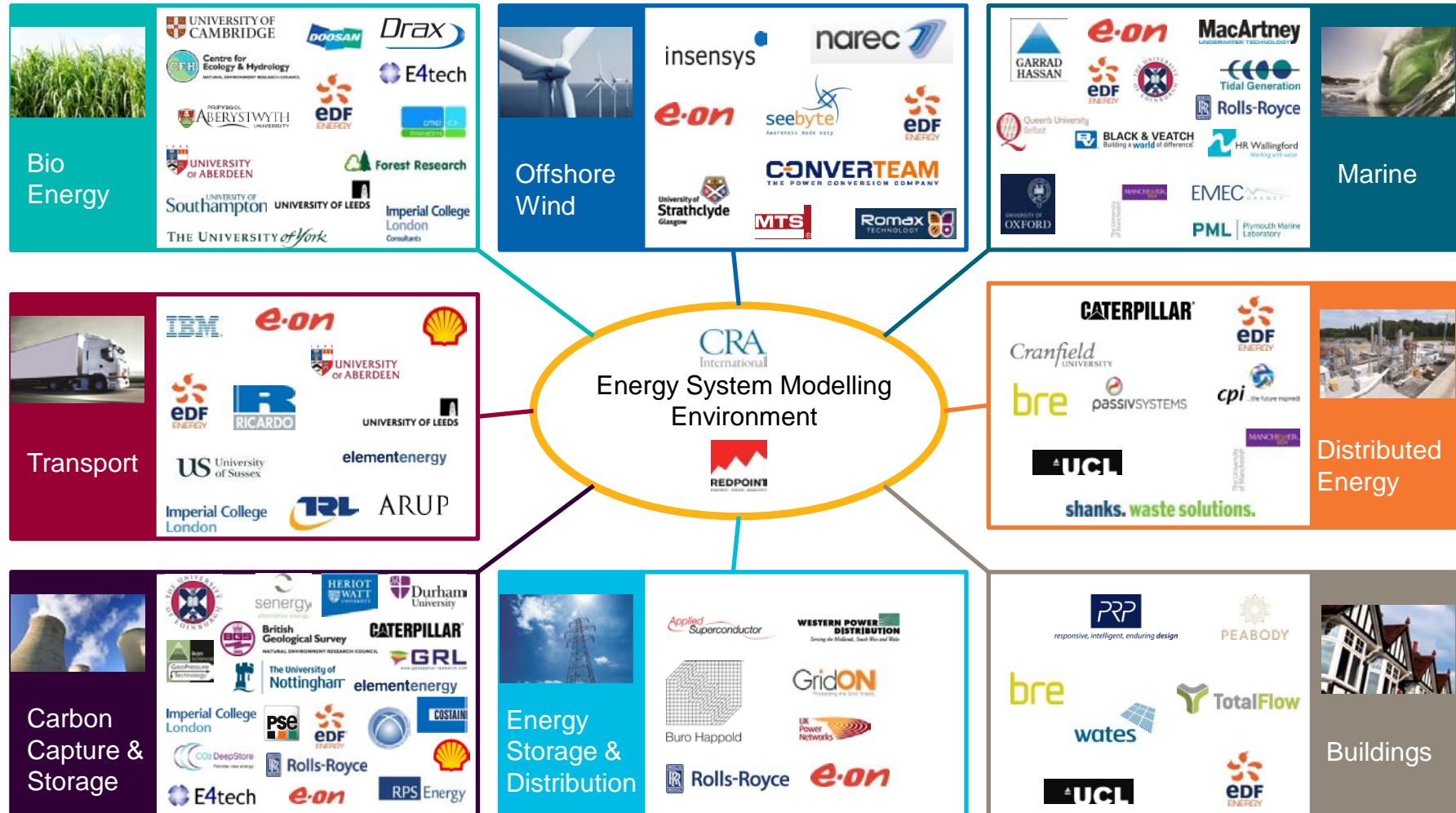
ETI Members

Large  
Corporate  
Organisations



£136m of projects announced

# Current Project Partners





# 11KV wet-mate connector

*Certified and deployable from low cost vessels  
£1.5m development and test contract led by MacArtney*



# Integrated Condition Monitoring systems

*Installed on E.ON and EDF turbines*

*£5m contract led by Moog Insensys*



# 15MW drive train test rig

*In supply from Converteam (UK) and MTS (USA)*

*£25m contract from ETI*

*Commercial operation 2013 at narec*



Images provided courtesy of Converteam UK Ltd  
& MTS System Corporation, USA

# Major project achievements from the first 4 years



- **Knowledge building**

- Understanding of future UK waste scenarios and opportunities for improved processing technology
- First major study of mass market segmentation for all-electric and plug-in hybrid passenger vehicles
- Definitive study of risked capacity for all 60GTe of UK offshore saline aquifer storage
- Performance and cost benchmarking of a wide range of CCS Separation systems
- ESME - national energy system modelling toolset developed and now in wide use

- **Technology development**

- Advanced wind turbine condition monitoring system on test in UK and France
- Optimised engineering concepts for fixed and floating offshore wind, with detailed installed and operating cost model
- Beta versions of improved tidal and wave array modelling tools
- Reduced cost 11KV underwater connector designed, built and demonstrated in open water tests

- **Technology demonstration**

- 1MW Tidal turbine in assembly
- 15MW drive train test rig for wind turbines designed and in assembly - world's largest open access rig





## Delivering low carbon energy technologies

## Supporting economic growth

by...

**Informing policy**

**Building partnerships**

**Delivering innovation**

**Sharing risk**

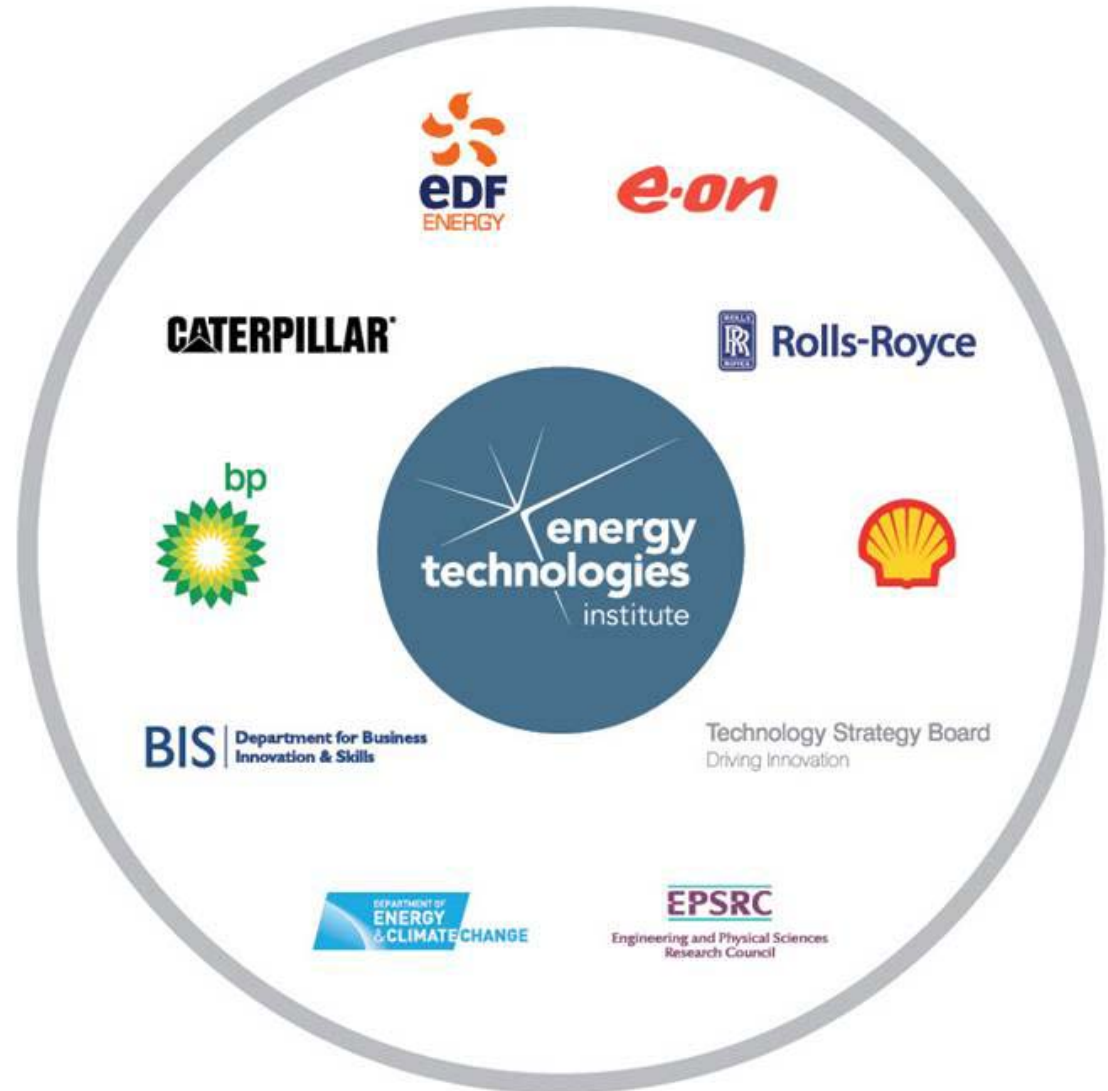
**Creating affordability**



# Energy Technologies Institute (ETI)

## 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



# Creating additionality - the ETI Board



Sir Rob Margetts

Chairman

David Clarke

Chief Executive

## Industry Members

David Eyton

Group Vice President Technology

BP

Lou Balmer-Millar

Director research & Technology

Caterpillar

Jörg Kruhl

Head of New Technologies

E.ON New Build and Technology

Peter Hofman

Director of Company Shared Services & Integration

EDF Energy

Paul Stein

Chief Scientific Officer

Rolls-Royce plc

John MacArthur

VP CO<sub>2</sub> Policy

Shell International

## Public Sector representatives

John Dodds

Director of Innovation

HMG - BIS

David Delpy

Chief Executive Officer

EPSRC

Iain Gray

Chief Executive Officer

Technology Strategy Board

## Observers

Sir John Beddington

Chief Scientific Adviser to UK Government

Paul Hollinshead

Director, Science and Innovation

HMG - DECC

Peter Bance

Chief Executive

P+M intellectual Capital

Sue Armfield

ETI Secretariat

HMG - BIS

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