



# STRATEGIC ANALYSIS CAPABILITY

# AN INDEPENDENT STRATEGIC LOW CARBON ENERGY PARTNER

## STRATEGIC ANALYSIS CAPABILITY

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-  16 Credibility
-  20 Strategic Analysis Capability  
- Leadership Team

  
Department for  
Business, Energy  
& Industrial Strategy

“Analysis work undertaken by the ETI has played a key role in helping to inform our innovation strategy, technology priorities and options across a broad range of energy policy areas. The ETI’s approach combines analytical rigour with a very practical approach based on their broad industrial experience and strong links to industry. This provides a robust evidence base for DECC’s analysts to use to support policy makers”

Craig Lucas  
Director of Science and Innovation (Energy and Climate)  
BEIS - Department for Business Energy and Industrial Strategy



# SERVICES

## OUR SERVICES

### WHAT WE OFFER



#### System Analysis

Whole energy system modelling and analysis



#### Innovation

Technology innovation management and road mapping



#### Delivery

Delivery of complex energy innovation projects

“ The ETI’s deep understanding of the whole energy system, the multiple technology choices and business models has helped influence our thinking and future energy strategy. Their work has challenged our view of the future, helping to identify and articulate risks and opportunities which helps inform our perspectives on the future energy mix ”



Dominic Emery  
Vice President Long Term Planning  
BP



## AN INDEPENDENT STRATEGIC LOW CARBON ENERGY PARTNER

**1**

Energy system modelling and analysis – at international, national, sectoral and local level

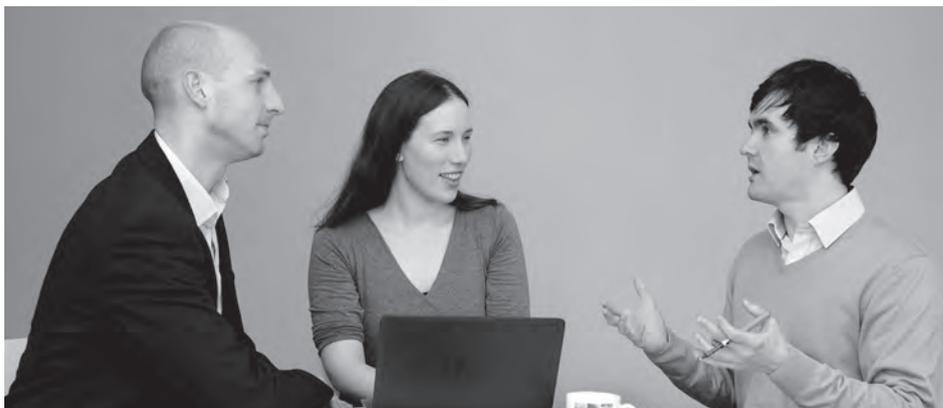


**2**

Expertise and knowledge across multiple technologies and energy vectors

**3**

Engineering, economics and policy experience – working with government, industry and academia on low carbon technology innovation and energy system design



**4**

An evidence base on low carbon technology innovation from a £400m low carbon research and development portfolio

**5**

Modelling of least cost pathways and scenarios to a low carbon energy system that delivers UK climate change targets





# CAPABILITIES



Modelling and analysis across the whole energy system using deep expertise informed by a strong industrial basis and real world application



Identification of where innovation can deliver benefits across the entire energy system recognising the needs of individual technologies and sub-systems



Offering project delivery, engineering and innovation management experience



## OUR CAPABILITIES



## WHOLE ENERGY SYSTEM MODELLING AND ANALYSIS

**Scenario planning** to identify options, choices, opportunities and risks to reduce emissions across the entire energy system

**System design and planning capability** to identify and prioritise innovation opportunities to support emissions reductions across the energy system

£10m modelling portfolio - operational at international, national, sectoral and local levels

“*Research is the lifeblood of academia. The ability to work on ETI research projects has been beneficial to us at Imperial, but perhaps more important has been engaging with their own research and analysis. This has demonstrated the intelligence that ETI has brought to the UK energy debate and also helped to identify further areas of interest for us to investigate and work upon independently*”

Imperial College  
London

Nilay Shah  
Professor of Process Systems Engineering  
Imperial College



## OUR CAPABILITIES

### TECHNOLOGY INNOVATION AND ROAD MAPPING

#### • Innovation Roadmaps

- Development of innovation roadmaps across multiple UK sectors
- e.g. light duty transport, tidal stream and wave energy, offshore wind, carbon capture and storage, bioenergy

#### • Assessment

- of low carbon innovation opportunities and their routes to commercialisation

#### • Focus

- and accelerate low carbon innovation

#### • Prioritise

- innovation spend to maximise impact

PROVIDING INNOVATION AND DELIVERY

## OUR CAPABILITIES

### DELIVERY OF COMPLEX INNOVATION PROJECTS

#### • £250k

- in house project management software
- system in operation

#### • 11

- commercial products launched to market

#### • De-risking

- of new energy systems technologies

#### • 108

- low carbon energy projects under management

#### • Accredited

- Institute of Project Management accredited

“ ETI’s analysis of the UK energy system and its transition to a low carbon economy has proved extremely informative and valuable to our own work in this area. We particularly value the whole systems approach the analysis is based upon to provide a better understanding of UK energy challenges, when supplemented by the detailed and specific technology options analysis it provides strong evidence that informs our strategy formation ”

Kathryn Magnay  
Energy Theme Lead  
EPSRC



“ ETI’s systems view of CO2 reduction opportunities is a fantastic fit with our Caterpillar research programmes. ETI’s modelling and systems engineering capabilities coupled with Caterpillar’s component and machine design expertise gave us a collective opportunity to explore how to design an articulated truck that would dramatically reduce CO2 and fuel consumption. Our joint ETI Heavy Duty Vehicle Efficiency programme is focused on a complete system optimisation, at both the vehicle and fleet level. This broad scope enabled us to fully explore alternatives that will yield substantial benefit for the environment and our customers ”

Dan Henderson  
Director of Research & Advanced Engineering,  
Caterpillar Inc





# ENERGY SYSTEM MODELLING



## WHY IS SYSTEM LEVEL ANALYSIS IMPORTANT?

Energy systems are characterised by competing and interacting sources of energy and the infrastructure for moving it to the consumer, each with varying cost and performance characteristics. A systems wide perspective is highly relevant because complex energy systems are made more inter-dependent by emissions reduction objectives.



Whole system analysis provides a vehicle for examining the underlying cost and engineering challenges of meeting consumer needs, in a policy-neutral and technology agnostic context. Policy makers can understand and analyse how markets, policies and incentives can be aligned to deliver the future energy system. Participants in the market can test the underlying value of a technology and the potential role it could play in future energy systems.

ETI's whole systems analysis approach builds understanding of the combination of networks and cross vector interactions capable of delivering energy service needs.

## KEY COMPONENTS OF THE ETI MODELLING FAMILY

### ESME

An internationally peer-reviewed national/regional energy system design and planning capability which can be used to explore alternative decarbonisation pathways across an energy system. It takes into consideration the spatial and temporal variations in end-use energy demand, supply and infrastructure. It has the ability to run thousands of simulations exploring variations on cost-optimal designs within a range of assumptions and constraints allowing the ability to identify robust strategies against a broad range of uncertainties.



### INFRASTRUCTURE COST CALCULATOR

A database that provides users with the capability to calculate across a number of scenarios and vectors (electricity, gas, heat and hydrogen) network transition costs out to 2050



### ENERGYPATH - NETWORKS

EnergyPath Networks – a software tool created in partnership with local authorities to design cost-effective local energy systems



### CONSUMER VEHICLES AND ENERGY INTEGRATION

A set of models to understand the required changes to existing infrastructure, as well as consumer response to wider introduction of plug-in hybrid and electric vehicles in the UK

### SMARTtide

A two dimensional hydrodynamic model of the UK continental shelf and North European waters to assess the tidal energy potential around the UK

Available from HR Wallingford



### ELUM

A software model to understand the soil carbon and greenhouse gas fluxes arising as a result of land use change to bioenergy feedstocks



### BVCM

A toolkit for the modelling and optimisation of full-system bioenergy value chains over the next five decades

#### BVCM

Bioenergy Value Chain Model  
Optimising Bioenergy



### GAS WELL TO WHEEL MODELLING

A software model to calculate the well to motion GHG emissions for liquefied natural gas and compressed natural gas HDV's in comparison to diesel fuel infrastructure and technology, applicable to land and marine vessels

### gCCS

A modelling toolkit capable of simulating the operation of all aspects of the CCS chain, from capture and transport to storage.

Available from Process Systems Enterprise (PSE)



### CO2 STORED

The UK's first CO2 storage appraisal database licensed to The Crown Estate and the British Geological Survey





# CREDIBILITY



## WHO WE ARE

A PARTNERSHIP BETWEEN GLOBAL ENERGY AND ENGINEERING COMPANIES AND THE UK GOVERNMENT



The ETI is a partnership between global energy and engineering companies and the UK Government.

Our role is to act as a conduit between academia, industry and government to accelerate the development of low carbon technologies to aid the transition of the UK to a future low carbon energy system.

We bring together engineering projects that develop affordable, secure and sustainable technologies to help address long-term emissions reduction targets as well as delivering nearer term benefits.

We make targeted investments in a portfolio of technology programmes across heat, power, transport and the infrastructure that links them.

# ETI IMPACT



**STRATEGY** ^

Fully cost optimised UK energy system model to 2050

**BIOENERGY**

Field trial data, modelling and analysis to assess the potential availability of sustainable biomass in the UK

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**OFFSHORE RENEWABLES**

Technology platform to build world's largest offshore wind turbine blades sold to GE

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**OFFSHORE RENEWABLES**

Design of next generation lower cost tidal energy foundations

**OFFSHORE RENEWABLES**

Design of next generation lower cost offshore wind floating platforms

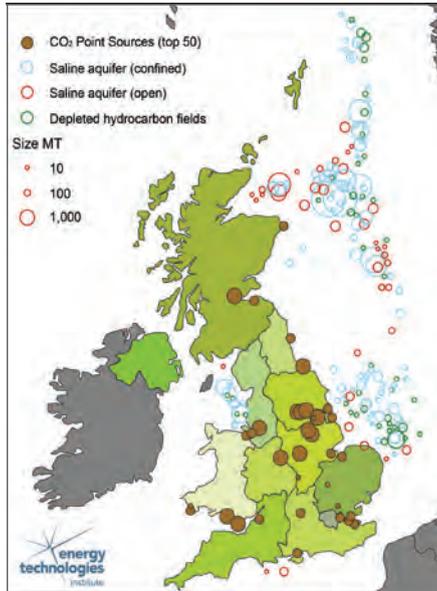
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**TRANSPORT**

Systems designs for 34% fuel efficiency improvement across UK land and marine heavy duty transport fleets

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**CARBON CAPTURE AND STORAGE**

First UK commercial CO<sub>2</sub> storage site appraisal drilling with National Grid

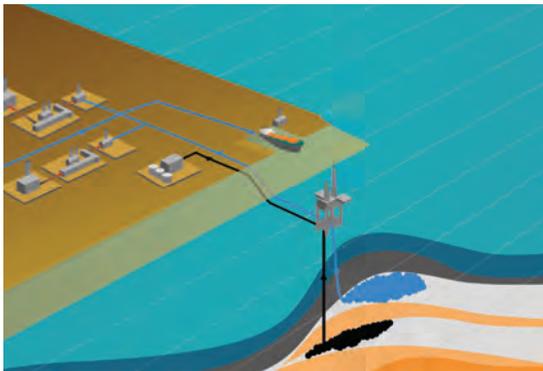
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**CARBON CAPTURE AND STORAGE**

First whole chain CCS system modelling software package

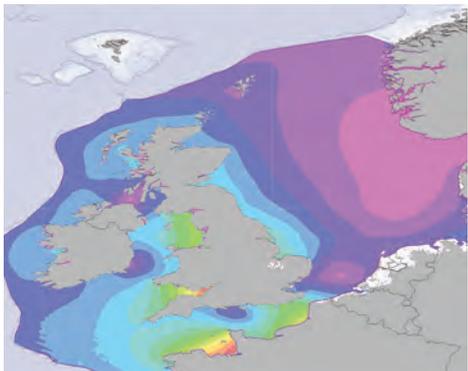
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**CARBON CAPTURE AND STORAGE**

First UK national database created for offshore CO<sub>2</sub> storage

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**OFFSHORE RENEWABLES**

Most highly resolved modelling software publicly available for tidal energy extraction in UK and North European waters

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# STRATEGIC ANALYSIS CAPABILITY -LEADERSHIP TEAM



## JO COLEMAN

MA, MBA, FIMechE, CEng

Director - Strategy Development

### Areas of expertise

Oil & Gas, Energy system analysis

### External posts of responsibility

Chair of the wholeSEM (Whole Systems Energy Modelling) Consortium Advisory Board, Member of the RCUK Energy Strategy Fellowship Advisory Group

### Published Reports



> Targets, technologies, infrastructure and investments – preparing the UK for the energy transition

# RICHARD KNIGHT

BEng, MIET, CEng

Deputy Director, Engineering and Strategy

### Areas of expertise

Low carbon research, development & innovation, Energy systems engineering and analysis, Technology management and roadmapping, Strategic analysis

### External posts of responsibility

Member of the European Commission's Horizon 2020 Advisory Group on Energy, Member and Former Chair of the UK Low Carbon Innovation Co-ordination Group

### Published Reports



> Marine Energy Technology Roadmap 2014 in partnership with the UK Energy Research Centre



# GEORGE DAY

MSc, MA

Head of Economic Strategy

### Areas of expertise

Energy economics, Market, policy and regulatory analysis, Economic regulation, Energy systems analysis, Environmental economics, Incentive design

### External posts of responsibility

Council Member British Institute of Energy Economics, Member of the Committee on Climate Change's Advisory Panel on Carbon Capture and Storage, Member of the Carbon Capture and Storage Commercial Development Group



### Published Reports



Optimising the location of CCS in the UK



Modelling the UK energy system: practical insights for technology development and policy making



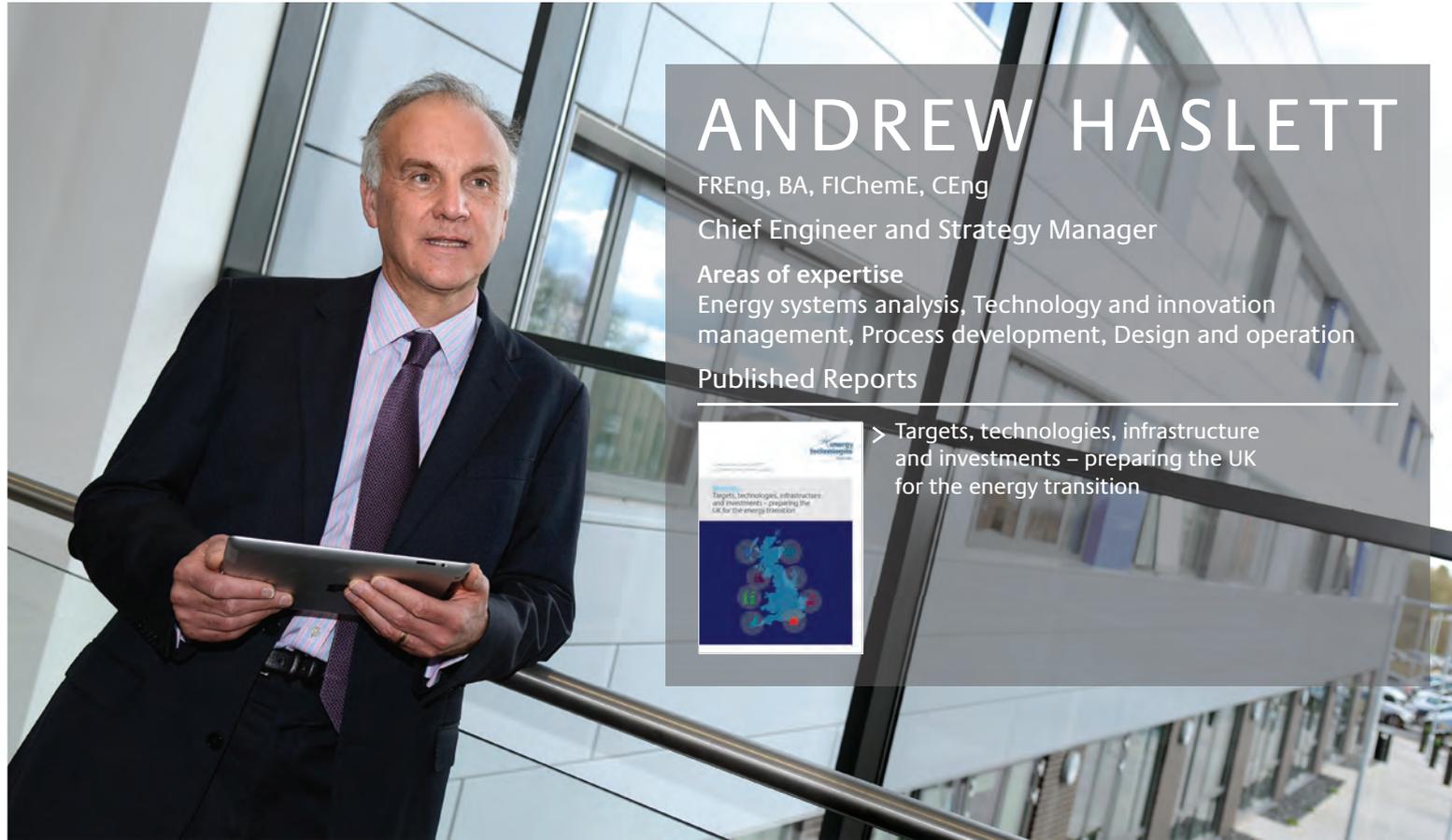
Carbon, Capture and Storage – Developing a commercial and financial framework in partnership with Ecofin Research Foundation



Building the UK carbon capture and storage sector by 2030 – scenarios and actions in partnership with Element Energy and Poyry



Enabling UK Biomass



# ANDREW HASLETT

FREng, BA, FIChemE, CEng

Chief Engineer and Strategy Manager

**Areas of expertise**

Energy systems analysis, Technology and innovation management, Process development, Design and operation

**Published Reports**



> Targets, technologies, infrastructure and investments – preparing the UK for the energy transition

# LIAM LIDSTONE

BEng, EngD, MIMechE, CEng

Light Vehicle Integration and Energy Storage and Distribution Strategy Manager

**Areas of expertise**

Transport decarbonisation, Energy storage and energy networks, Smart energy systems, Building design and modelling, Sustainability, Marine energy



# CHRIS THORNE

BEng, MSc, AMIMechE

Chief Technical Officer - HDV

**Areas of expertise**

Heavy Duty Vehicles, Product development, Systems engineering



# GERALDINE NEWTON-CROSS

BSc, MRes, PhD

Bioenergy Strategy Manager

**Areas of expertise**

Energy systems analysis, Research and innovation management, Programme and project management

**Published Reports**



> Delivering greenhouse gas emission savings through UK bioenergy value chains  
 > Insights into the future UK Bioenergy Sector, gained using the ETI's Bioenergy Value Chain Model



# CHRIS HEATON

BA, MMath, PhD, MIMA, CMath  
Modelling Strategy Manager

**Areas of expertise**  
Mathematical modelling, Energy systems analysis

**Published Reports**



- > Modelling low carbon energy system designs with the ETI ESME model
- > Options, Choices, Actions – UK scenarios for a low carbon energy system transition



# DENNIS GAMMER

BSc, Dip, MChemE, CEng  
Carbon Capture & Storage Strategy Manager

**Areas of expertise**  
Technology development, management and licensing, Carbon Capture Processes, Storage

**Published Reports**



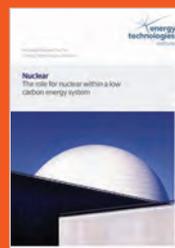
- > The role of hydrogen in a low carbon energy system
- > A picture of CO<sub>2</sub> Storage in the UK
- > Potential for CCS in the UK

# MIKE MIDDLETON

BA, MSc, FIMechE, CEng  
Nuclear Strategy Manager

**Areas of expertise**  
Nuclear operations – waterfront submarine support, liquid and solid waste processing, construction, decommissioning and new nuclear power

**Published Reports**



- > The role for nuclear within a low carbon energy system

# STUART BRADLEY

BEng, PhD, MIET  
Offshore Renewables Strategy Manager

**Areas of expertise**  
Marine engineering, technology management, innovation and manufacturing engineering, miniaturisation

**Published Reports**



- > Tidal Stream Energy
- > Wave Energy
- > Floating Wind Technology



## STRATEGIC ANALYSIS CAPABILITY

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