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Sustainability in Turbulent Times

Mike Colechin

ETI10 | TEN YEARS
OF INNOVATION
2007 — 2017

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Energy Technologies Institute

The Energy Technologies Institute 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.

We bring together engineering projects that develop affordable, secure and sustainable technologies to help the UK address its 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 members



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Department for
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and skills

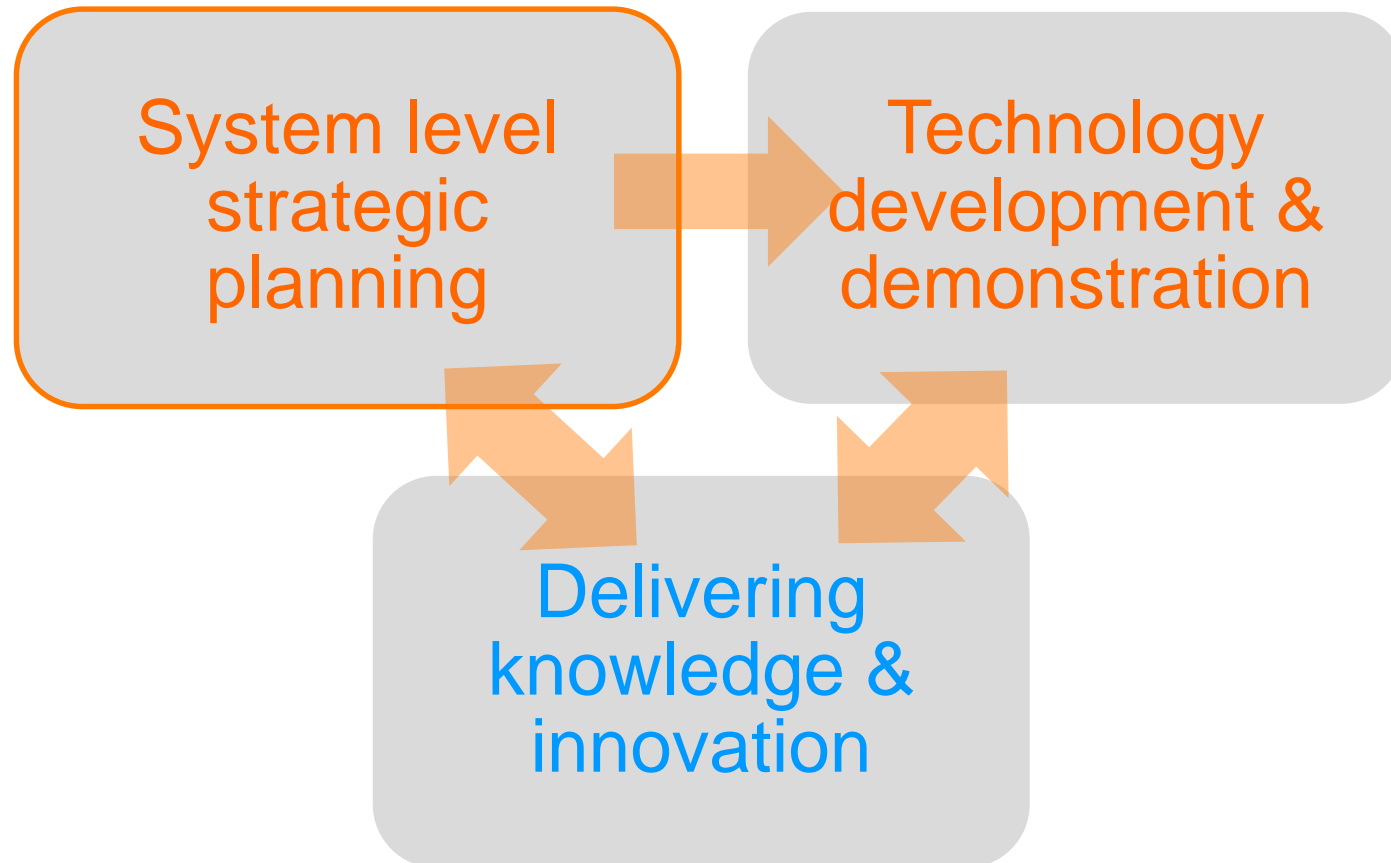
Innovate UK

ETI programme associate

HITACHI
Inspire the Next

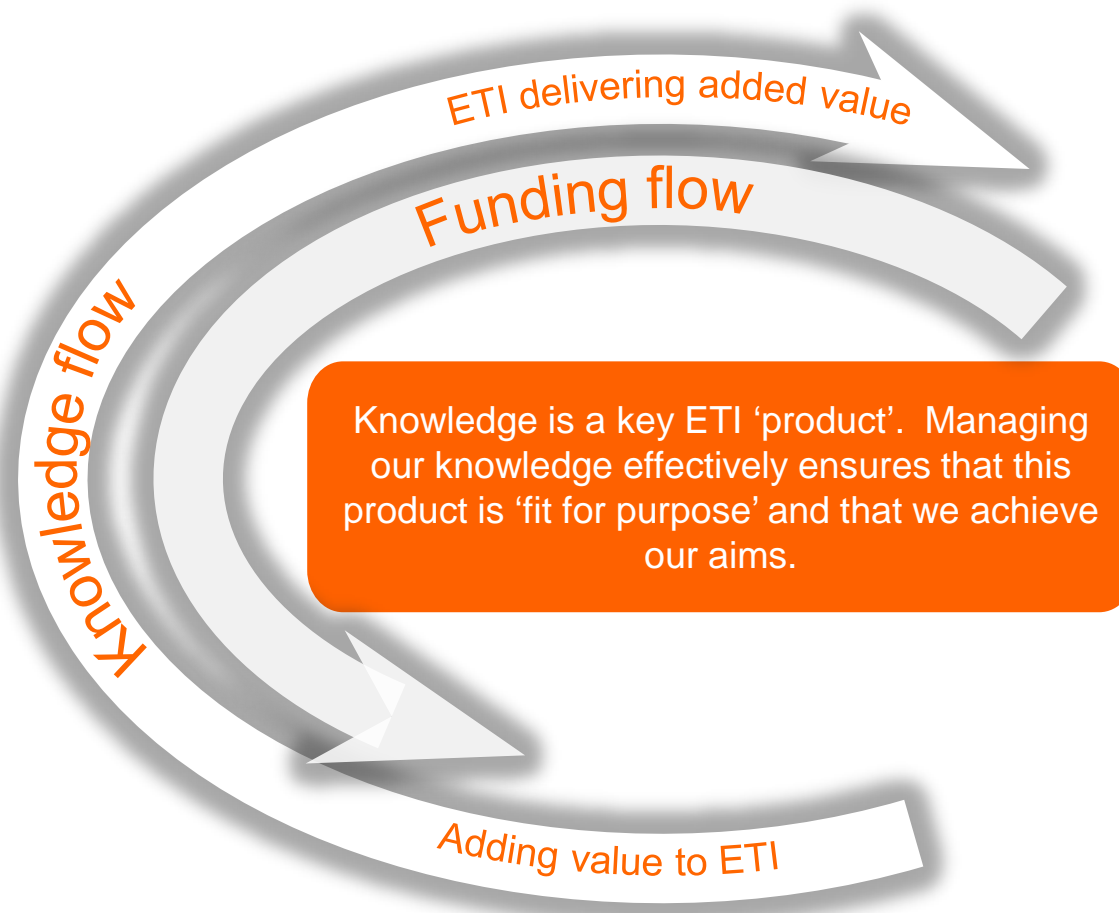


What is the ETI?



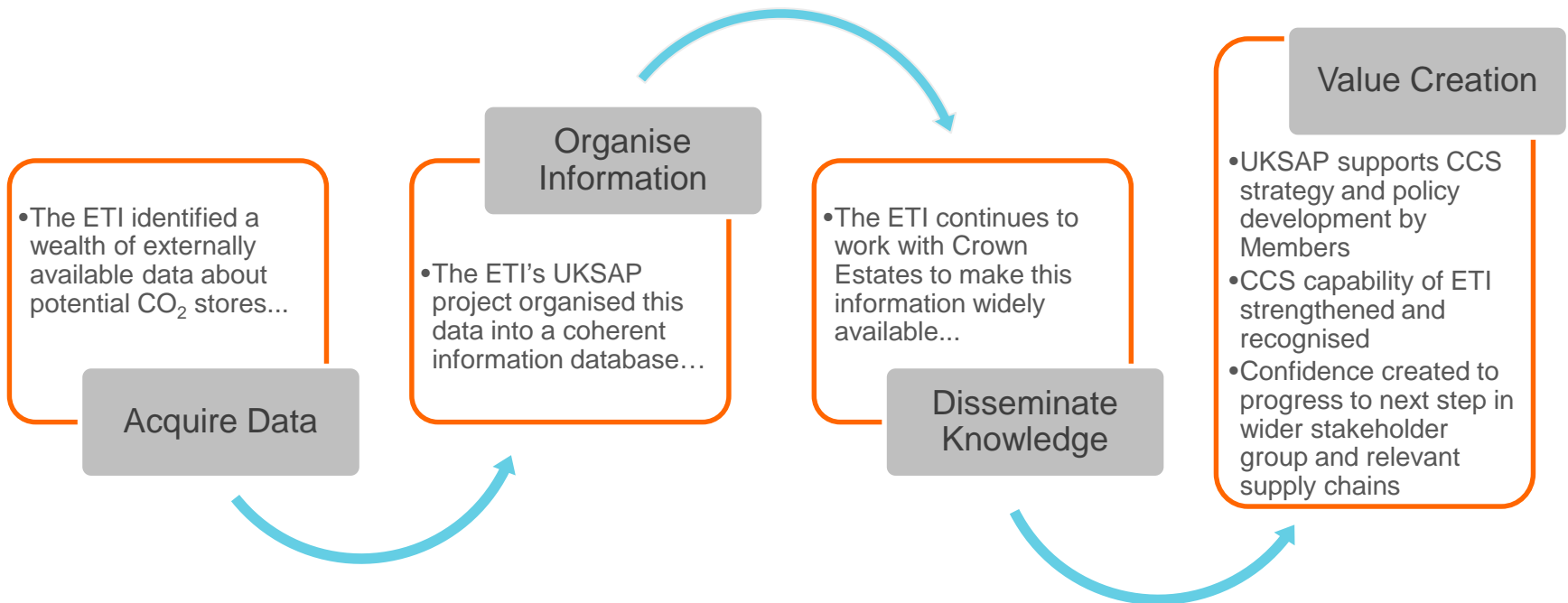


Knowledge is key to the way ETI operates



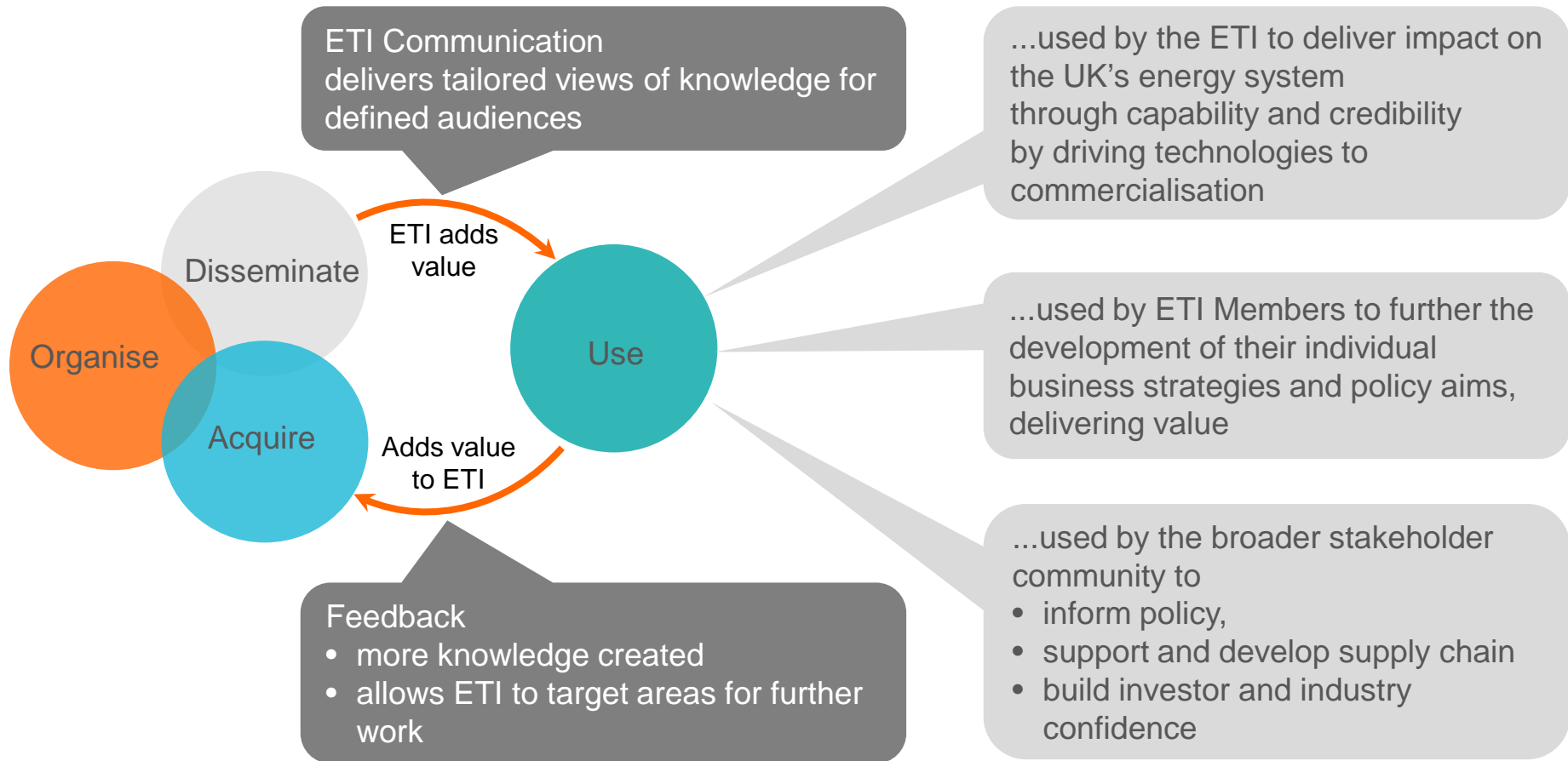


CO₂ Storage Appraisal as an example of ETI knowledge as a product...





'Closing the loop' to deliver the ETI's outcomes





Influence

“ 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



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

“ 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



EPSRC
Engineering and Physical Sciences
Research Council



The ETI Cycle

Strategic Analysis

- **Independent strategic expertise in the low carbon energy sector:**
 - Whole energy system modelling and analysis (£10M invested)
 - Technology innovation management and road mapping
 - Delivery of complex innovation projects in energy sector
- **Over 60 highly qualified and experienced staff:**
 - Core strategy team of twenty people
 - Subject matter experts across all aspects of the UK energy system
- **Advisors to Government, Industry and Investors**

Investments

Budget of £400M over ten years:

- RfP process to invest in projects based on insights from our Strategic Analysis
- Partnerships with over one hundred corporates, SMEs, universities and consultancies
- 106 investments to date
 - *Non commercial* – for data or knowledge
 - *Commercial* - equity, loan, royalty structures

Resulting insights from all our investments are fed back into our strategic analysis and/or disseminated throughout the sector



Preparing for the Energy Transition: Context

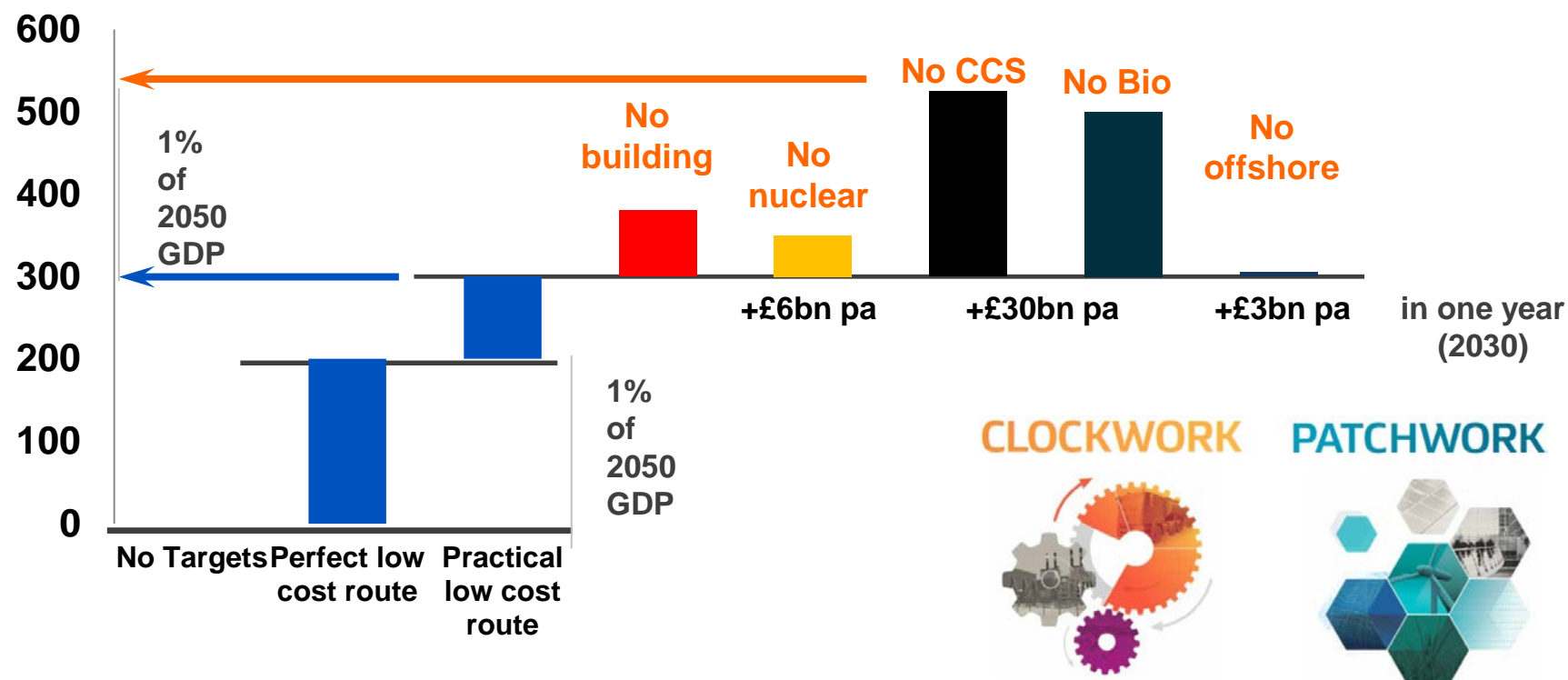
- **Increasing demand to 2050**
 - Population: 65 to 77-79 million
 - Vehicles: 24 to 35-43 million cars
 - Housing: 24 to 38 million houses,
(80% of current stock still in use in 2050)
- **Action to date**
 - Beginning to decarbonise power sector
 - Increasing energy efficiencies (especially in cars)
- **UK energy system is a unique and complex set of interlinked assets and infrastructure**
 - Ageing power plants need replacing
 - Significant wind (and marine) energy potential
 - Significant offshore CO2 storage potential
 - Significant opportunity for UK biomass
 - Reasonable public support for all low carbon options
 - But, poor housing stock and a very significant heating challenge





The UK can achieve an affordable transition (1-2% of GDP) - system optimisation is key

Additional cost of delivering -80% GHG energy system
NPV £bn 2010-2050





The next decade is critical in preparing for transition

- The UK can implement an affordable (~1% of GDP) 35-year transition to a low carbon energy system by developing, commercialising and integrating known - but currently underdeveloped - solutions
- We need to focus deployment on a basket of leading contender technologies
 - Efficiency of vehicles, efficiency and heat for buildings, Nuclear, CCS, Bio, Offshore Wind, Gases
- There is enormous potential and value of CCS and bioenergy
 - The ability (or failure) to deploy these two technologies will have a huge impact on the cost of achieving the climate change targets and the national architecture of low carbon systems and future infrastructure requirements
- To avoid wasting investment, crucial decisions must be made about the design of the future energy system, driven by choices on infrastructure

Conclusion: Opportunities exist NOW to invest and develop solutions



Opportunities – Waste Gasification

THE UK GENERATES
AROUND 330 MILLION
TONNES OF WASTE
EACH YEAR

.....

Existing waste to
energy plant are on a
very large scale and
serve larger
conurbations and
energy users

EUROPEAN LEGISLATION
INCENTIVISES THE
DIVERSION OF WASTE TO
LANDFILL.

.....

These plant are large footprint, high cost and
low efficiency, generally requiring waste from
more than one region to be economic.

This

- increases “waste miles”,
- increases local impact,
- makes using heat a challenge and
- makes waste contracting (post PFI) difficult.



Opportunity:

- Smaller, highly efficient waste gasification plants (5-20MW) - providing low carbon energy for small towns and industrial estates.
- Could unlock 10GW of additional energy resource in the UK from 90million tonnes of waste per annum at a highly competitive cost.



Opportunities – Heat



OUR CONSUMER RESEARCH HIGHLIGHTS PEOPLE WANT BETTER CONTROL OF TIME, EFFORT AND MONEY

Few consumers are presently engaged to change their heating systems to combat emission reductions



£100 BN COST OF COMPREHENSIVE LY RETROFITTING SEVEN MILLION HOMES

Eliminating emissions from buildings is more cost-effective than making deeper cuts in other sectors



TWO PRINCIPAL PATHWAYS FOR DE-CARBONISING DOMESTIC SPACE AND WATER HEATING

1. Individual home systems using electric heat
2. Local area schemes using heat networks



30% CARBON ABATEMENT COSTS

Carbon abatement costs increase around 30% if electric heat systems are not used in any transition

Opportunities:

- Advanced integrated Home Energy Monitoring Systems (HEMs) – ETI developing technology
- Cost effective home energy retrofitting solutions
- District heat networks
- Heat Pumps (Air source, ground source etc.)



Opportunities – Energy Storage and Distribution

Problem

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The intermittent nature of many renewable energy sources puts increasing pressure on the network operators to balance supply and demand

Solution

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New approaches to distribution scale energy storage are needed to enable balancing.

The ETI has supported the development of Pumped Heat Electricity Storage (PHES) technology. It converts electrical energy to heat, stored in low cost gravel storage vessels with an achievable round trip efficiency of ~75%.



Opportunities:

- A wide range of opportunities from home-scale to distribution scale
- Distribution scale needs to be large capacity, high efficiency and rapid response – but cost effective

ETI Projects:

- Review of all energy storage options and their potential uses and impact
- CVEI – Study of consumer behaviour re electric cars and the impact on infrastructure requirements
 - **Indicates that Smart Systems for Demand Side Management can be key in reducing system costs and allow for viable Aggregator Business Models**



Accelerating Low Carbon Energy Innovation In The UK

The UK needs innovation to help it meet its carbon targets



Successful innovation has several critical components: market confidence, finance, public policy and the capability to innovate

Collaboration and shared understanding is required to help the innovation process



Involving interactions across science, business and government to facilitate knowledge transfer and learning

It is easier to achieve a transition with a shared understanding of the drivers of new low carbon energy technologies



Most low carbon markets are almost entirely driven by public policy but delivered by private sector firms.



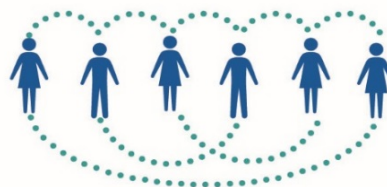
Policy interventions are required to drive innovation in energy and low carbon



business needs certainty so policy stability matters

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Successful innovation systems often involve open and iterative processes, which are complex



They depend on multiple interactions between different actors

Successful innovation in low carbon energy requires new technology capabilities, new markets, new business models together with appropriate changes to the regulatory framework



The slower the pace of energy innovation



the less time the UK will have to transition to a low carbon economy and the more expensive it will be to do so





Registered Office
Energy Technologies Institute
Holywell Building
Holywell Park
Loughborough
LE11 3UZ



For all general enquiries
telephone the ETI on
01509 202020



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about the ETI visit
www.eti.co.uk



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