www.eti.co.uk

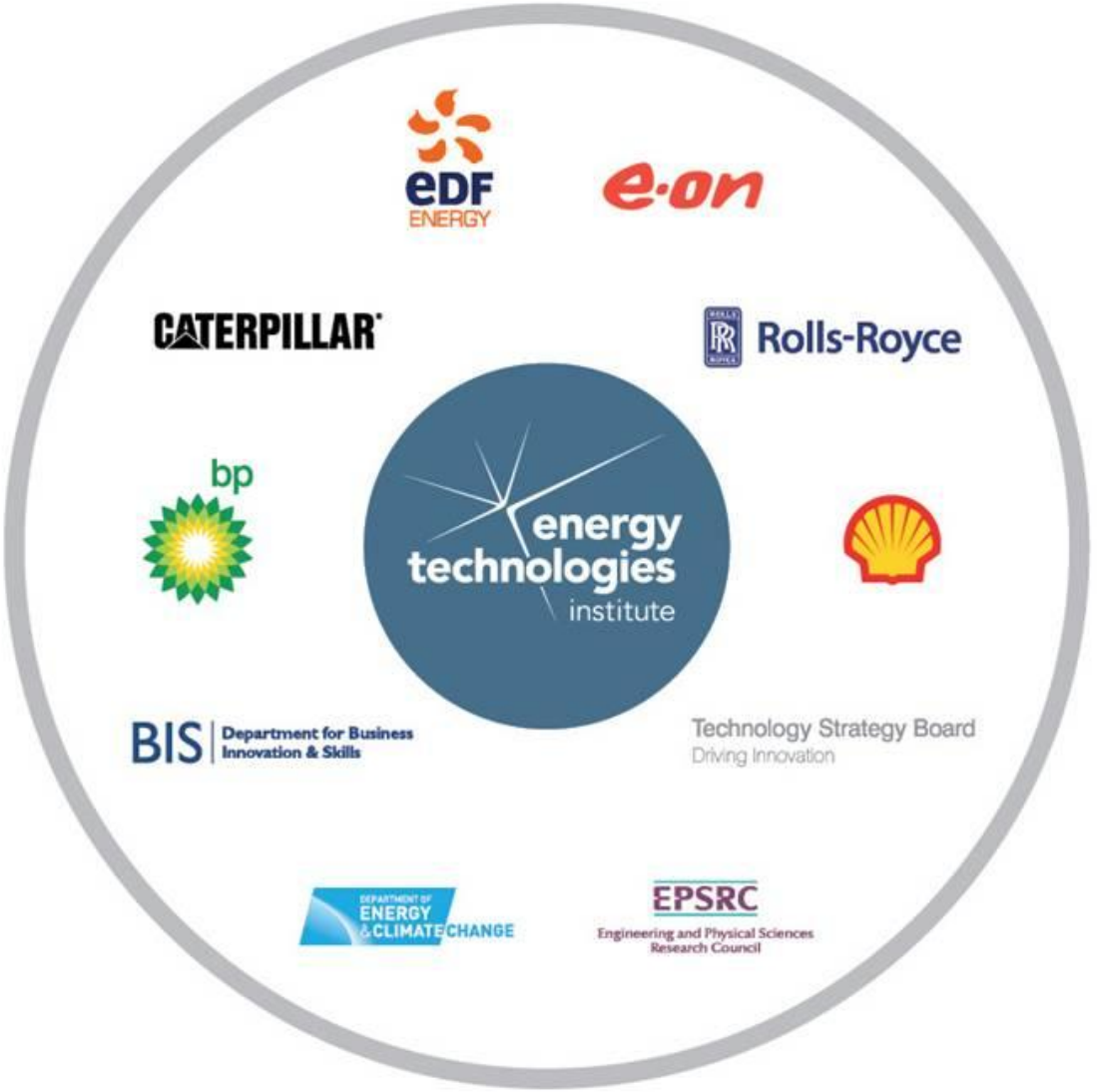
# “Delivering the low carbon energy jigsaw. Will the technology and incentive pieces fit.”

**Peter Dodd**

# Energy Technologies Institute (ETI)

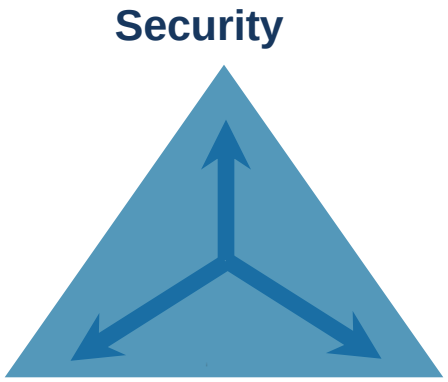
**Addressing the challenges** of climate change and low carbon energy

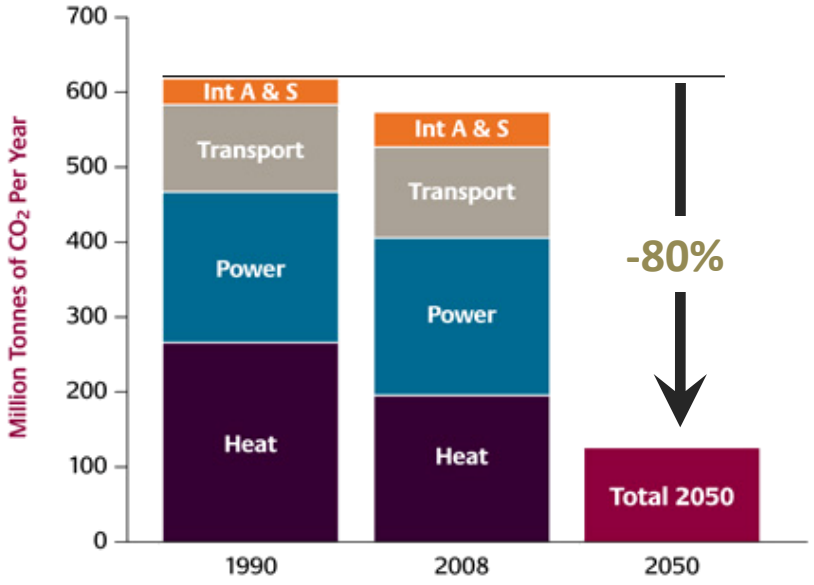
- **Improving energy usage**, efficiency, supply and generation
- **Demonstrating systems** and technologies
- **Developing knowledge**, skills and supply-chains
- **Informing development of policy,** regulation and standards
- **Enabling deployment of affordable, secure, low carbon energy systems**



# The Objective

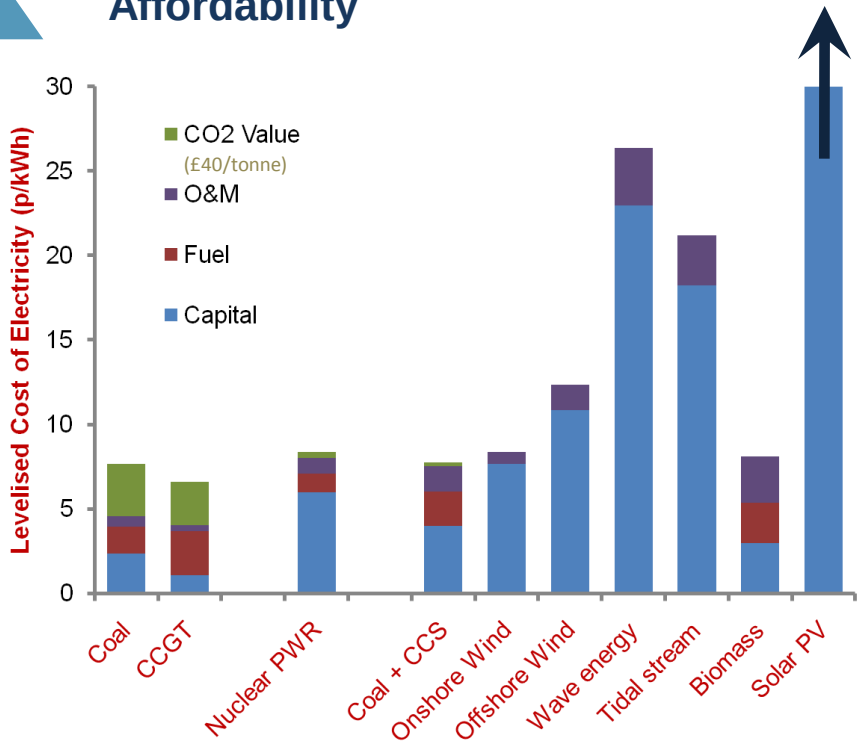
# UK energy challenges



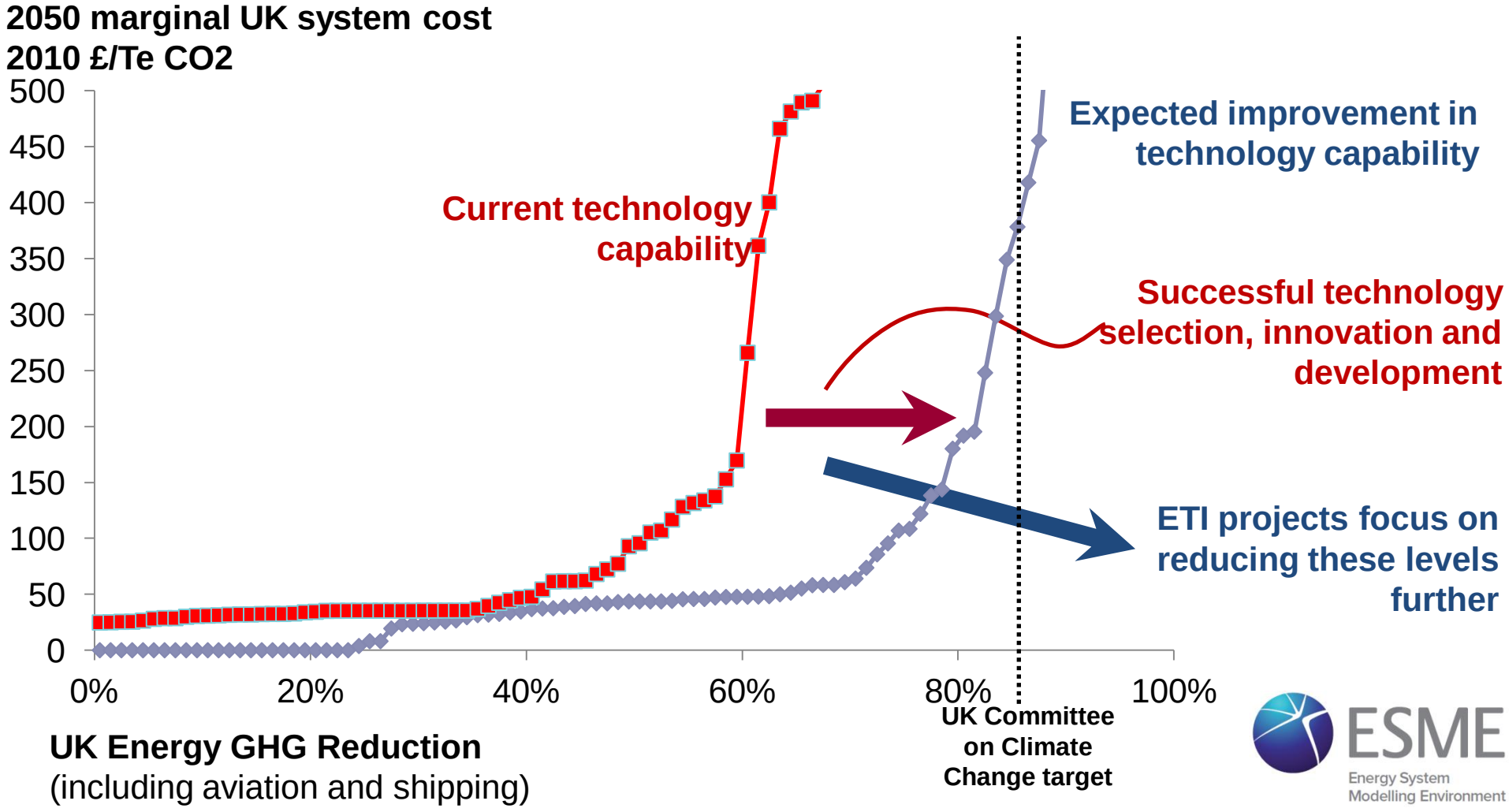




Int A & S = International Aviation & Shipping

DUKES data

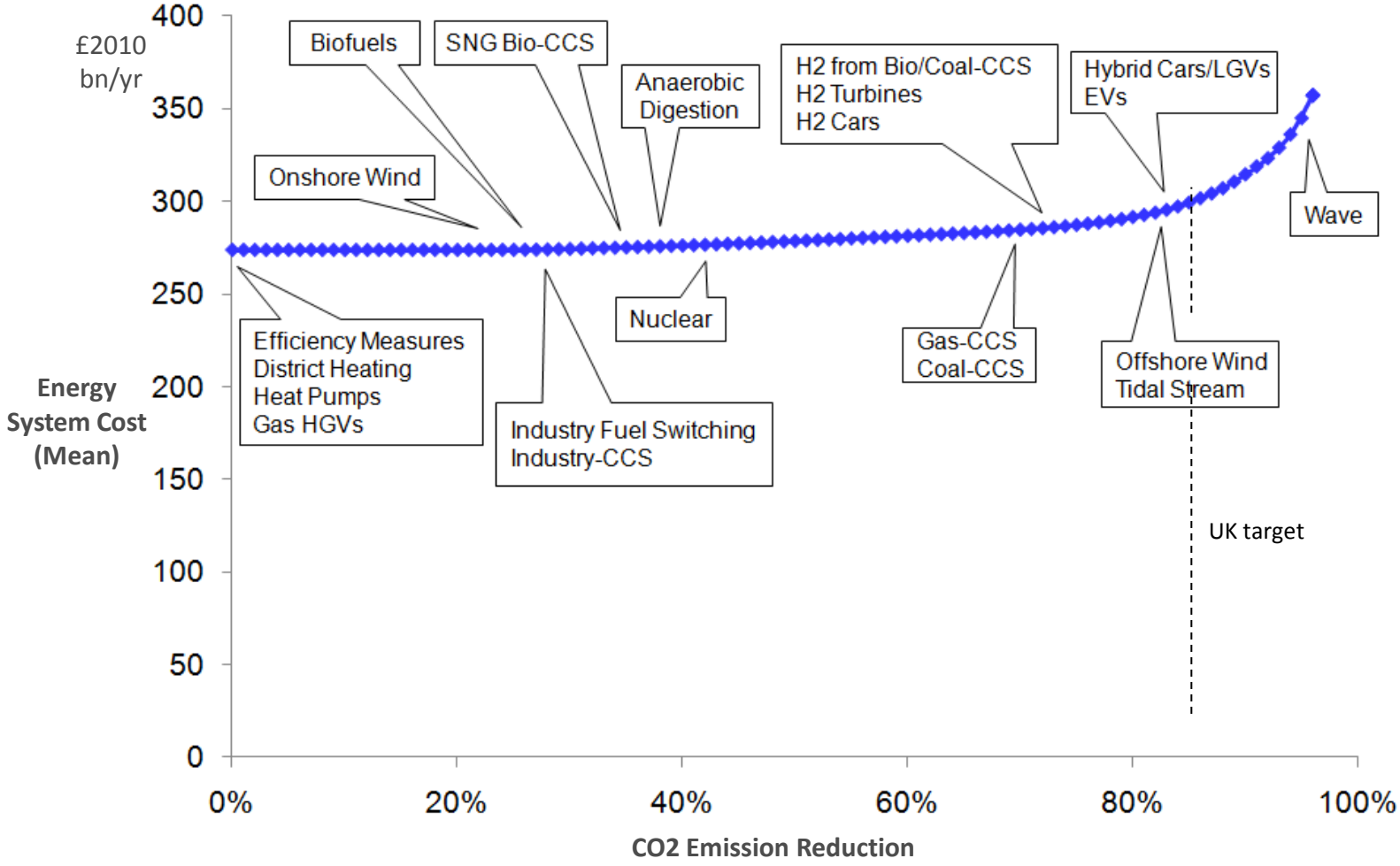


# 2050 abatement costs **can** be acceptable **if**...we **develop** and **apply** the optimum technologies



# How to do it

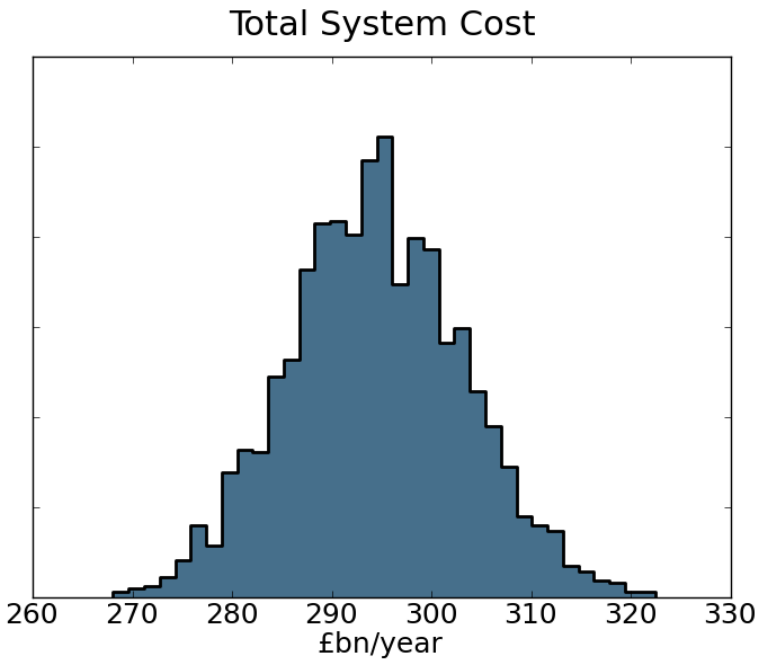
# 2050 abatement costs are broadly flat through 50% with fuel switching increasingly highlighted



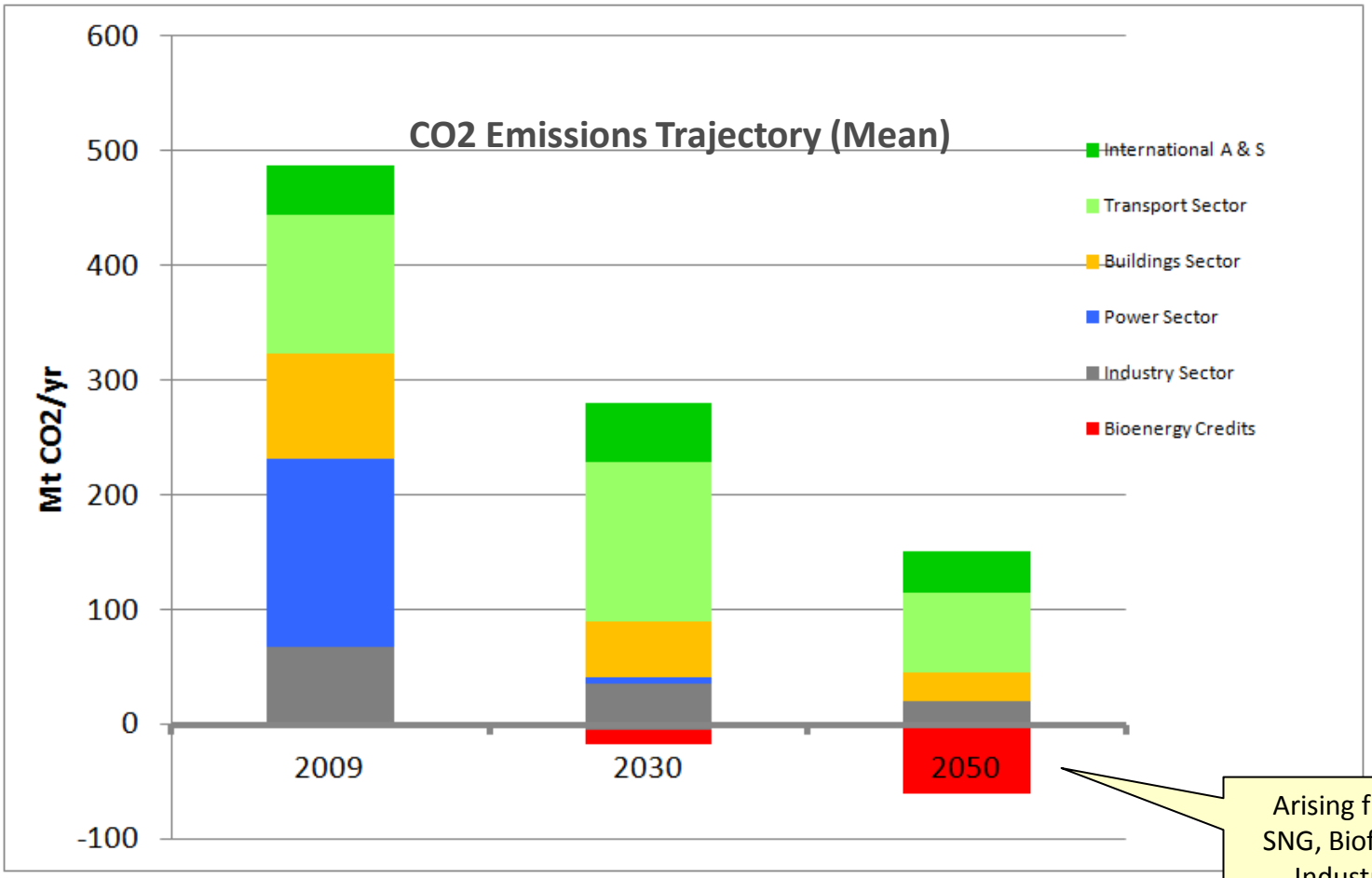
# **With innovation 2050 abatement costs are affordable** (0.7% GDP/year) with biomass and CCS as key levers

| £2010(Mean)/year | v2.0 |
|---|---|
| Total system cost | £294bn |
| | |
| Abatement cost | £26bn |
| Average cost | £51/tCO2 |
| Marginal cost | £360/tCO2 |
| | |
| No biomass | +£44bn |
| No CCS | +£42bn |
| No nuclear | +£4bn |
| | |
| No tech devt* | +£106bn |

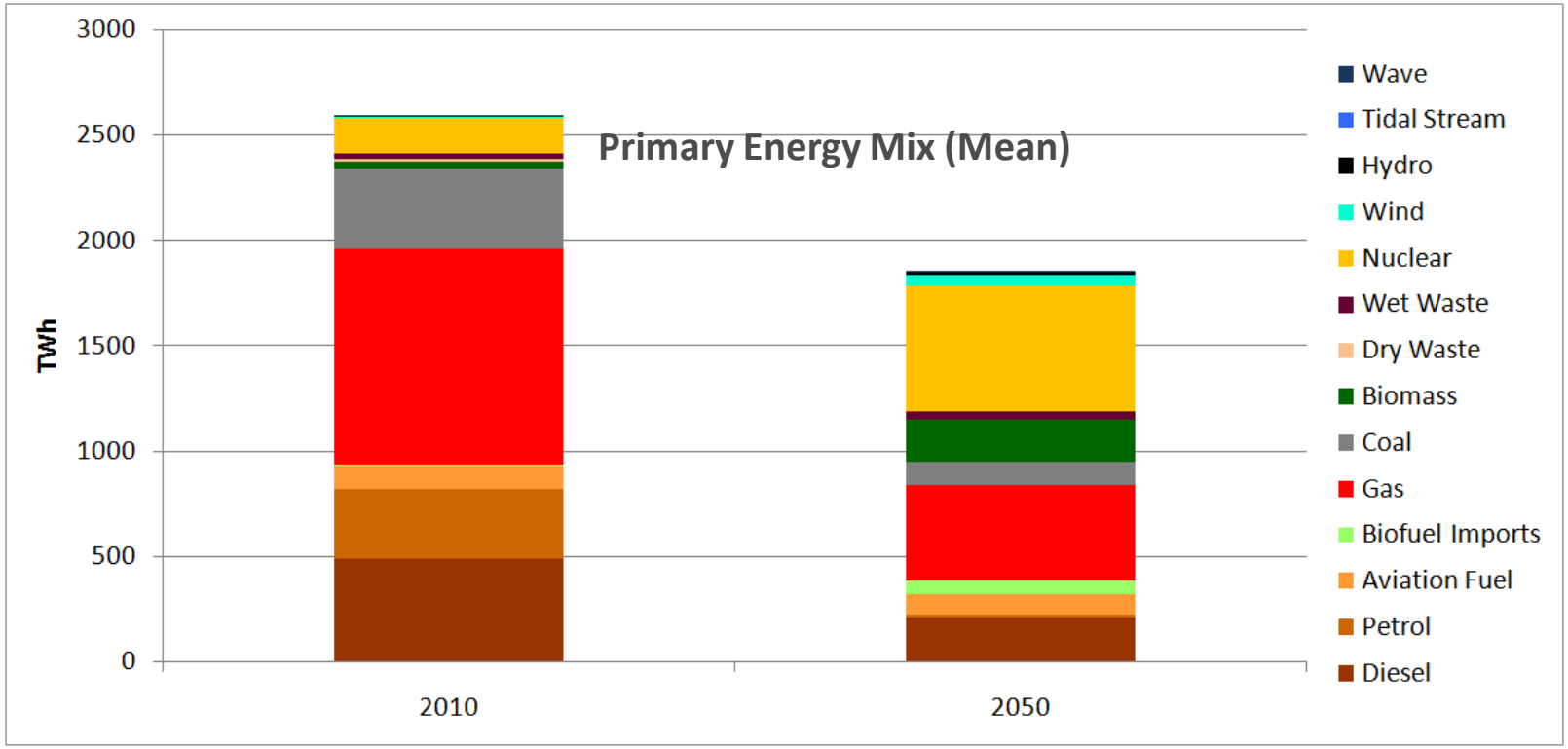
*Assumes current technology cost/performance



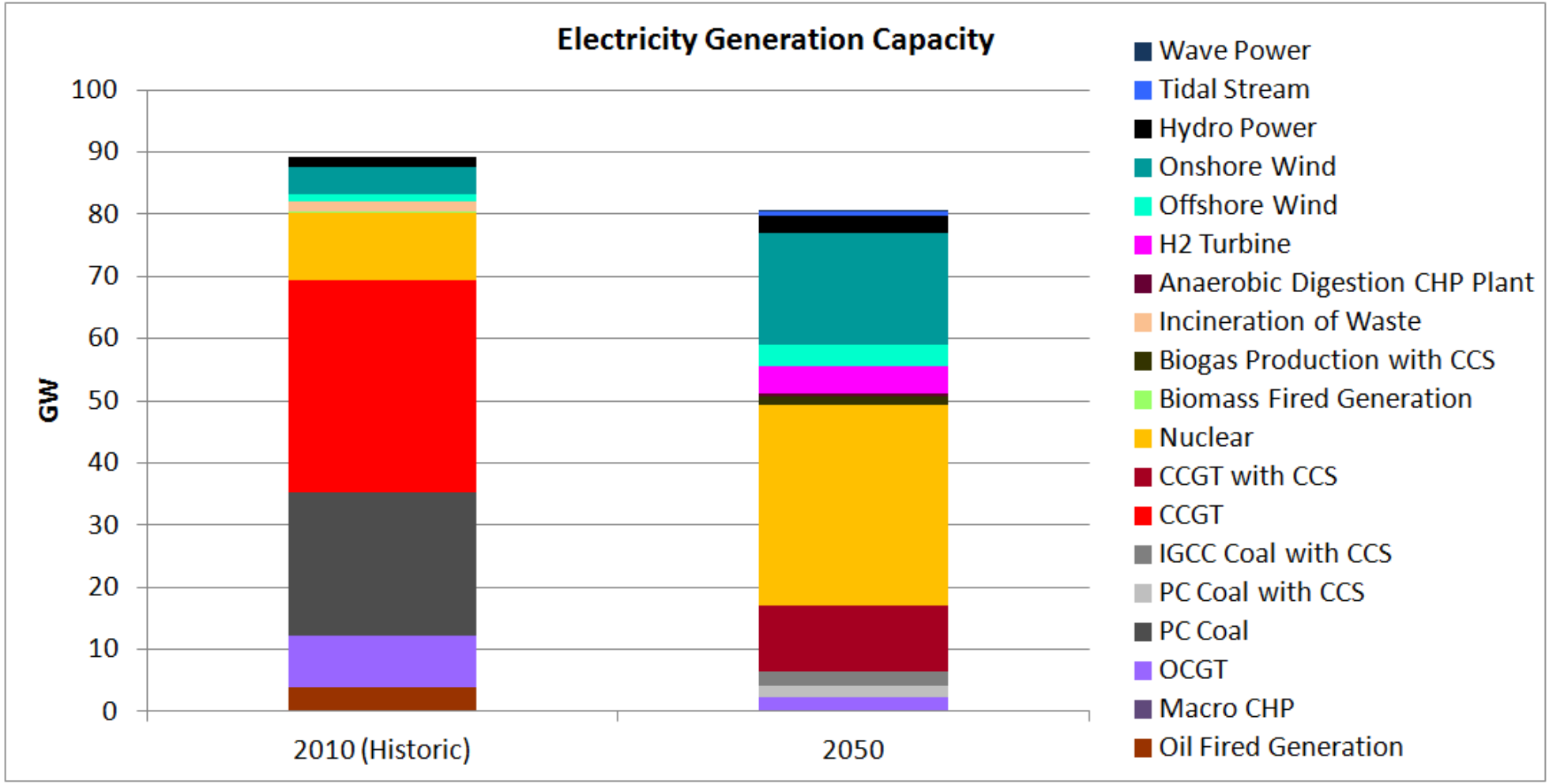
# $CO_2$ emissions trajectory – end use sectors bear unequal burdens, led by the power sector



# 2050 primary energy diversifies, with nuclear and gas as pillars, and 50% of energy imported

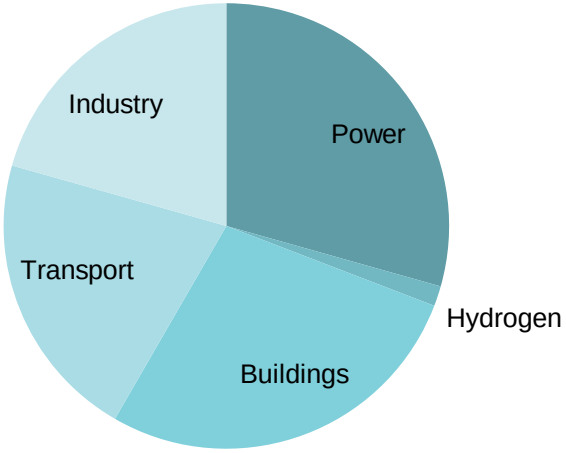


# Nuclear, Onshore Wind and CCGT CCS will provide the bulk of Generating Capacity



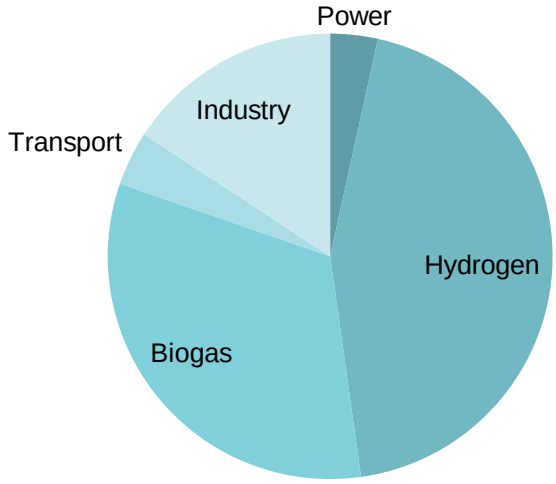
# There appear more diverse roles for natural gas and biomass (in conjunction with CCS)

**Natural Gas Consumption (Mean)**




Total 450TWh

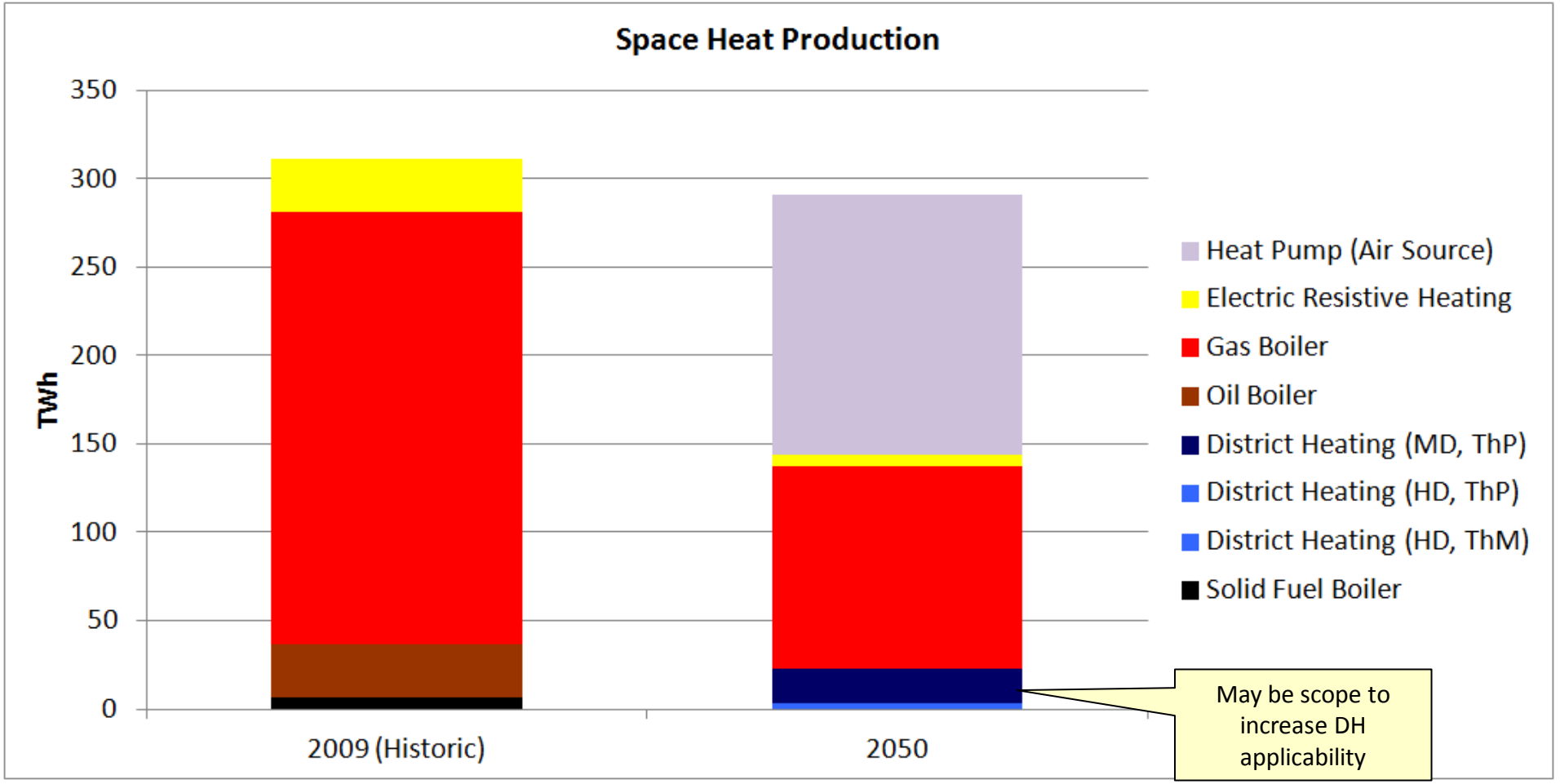
**Biomass Consumption (Mean)***




Total 203TWh

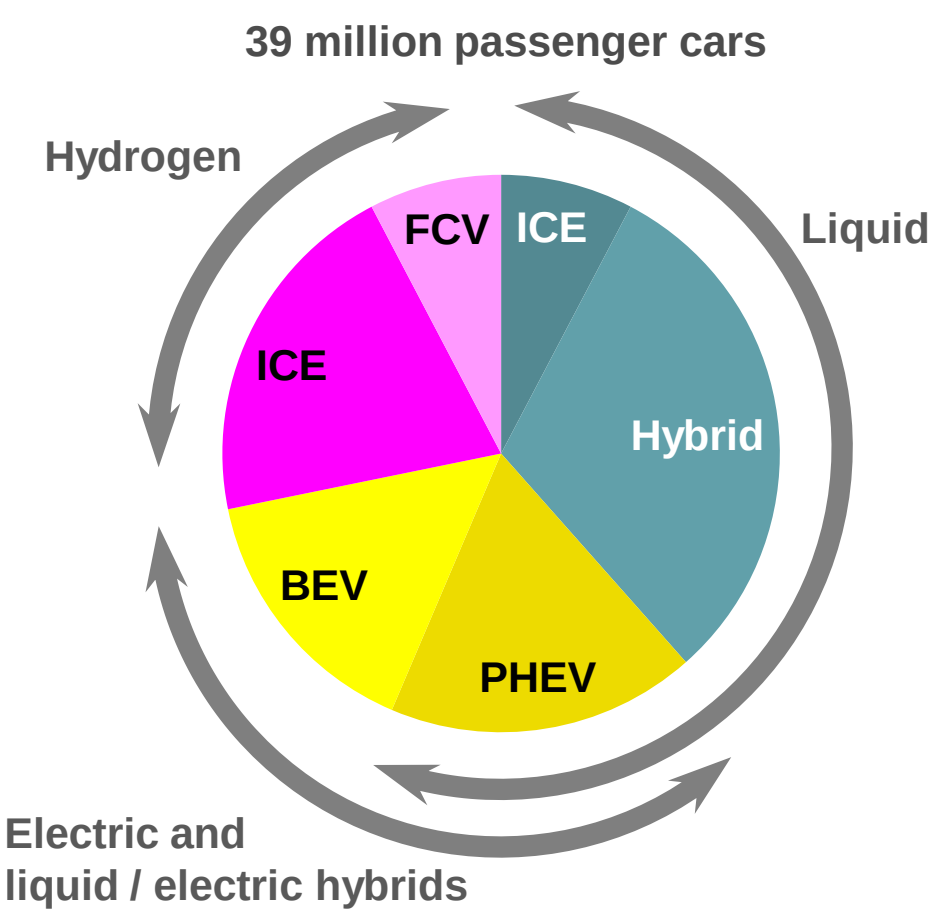
*To be informed by the ETI bio energy value chain modelling project

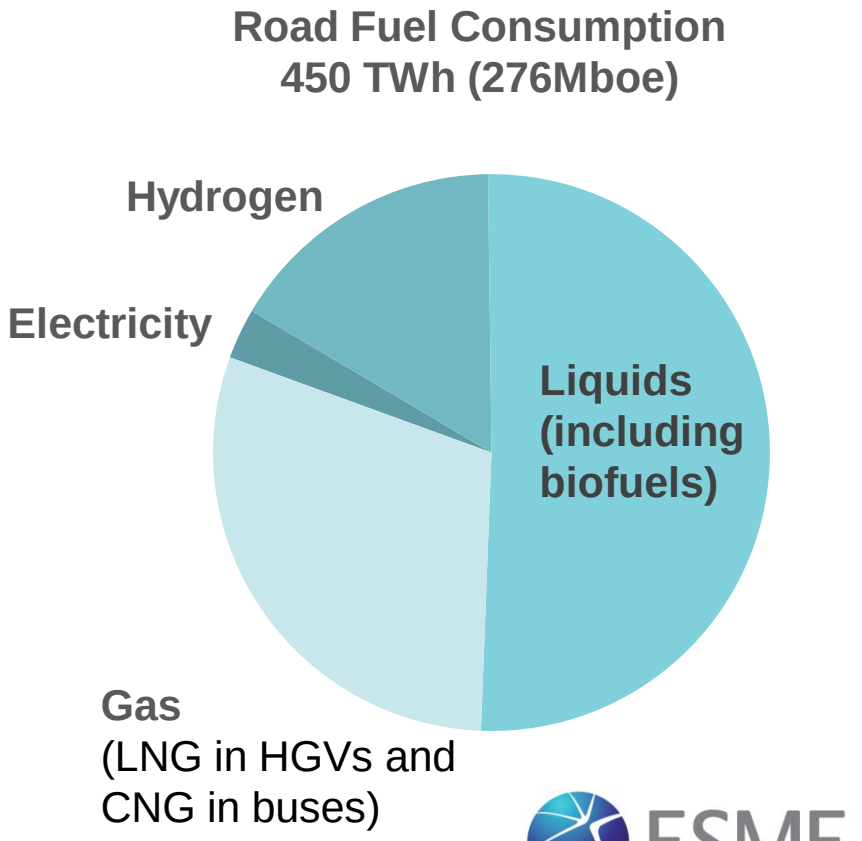
# **2050 Space heating** : Gas likely to persist , but the majority of dwellings are likely to be heated by electricity (heat pumps)



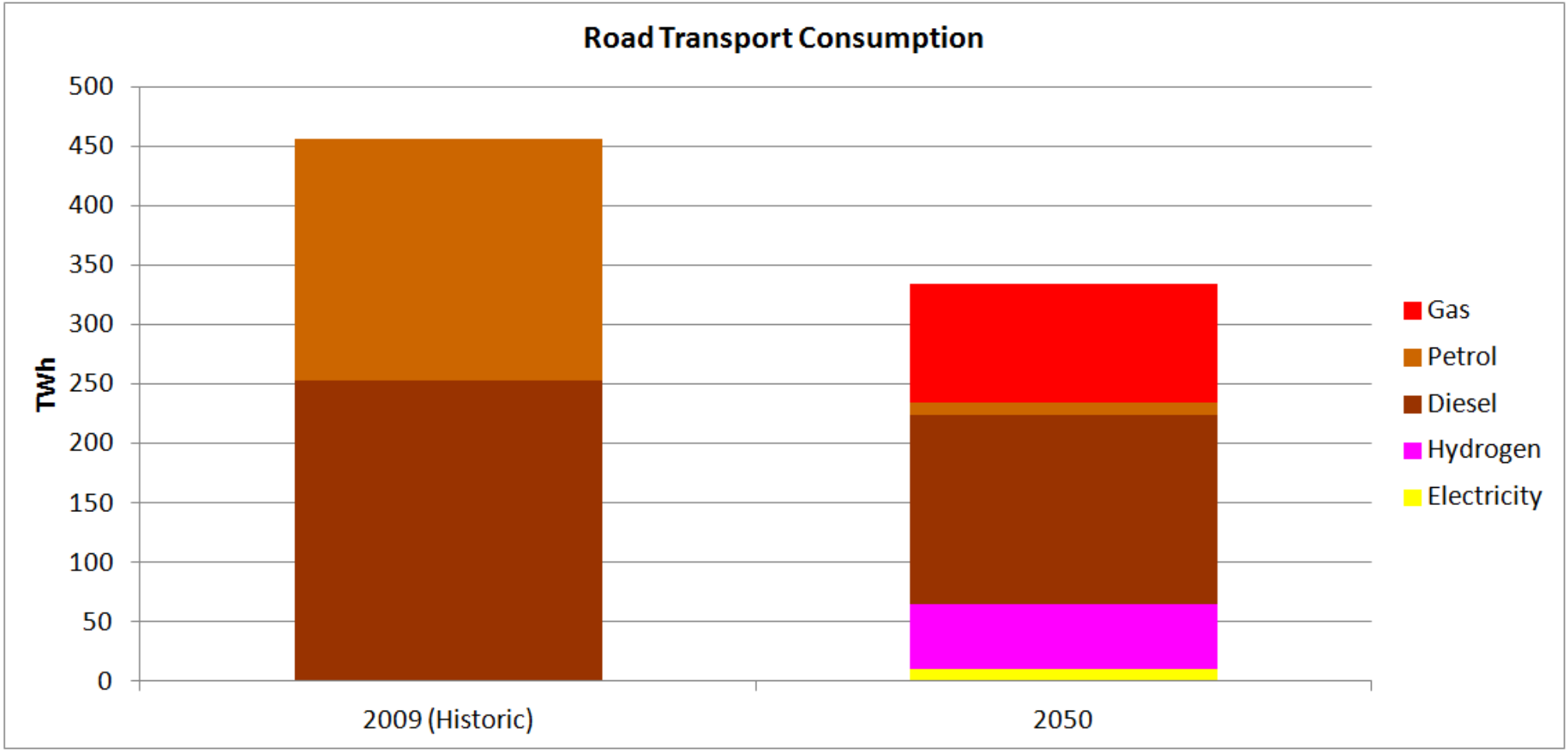
# 2050 road transport

## Potential significant use of gaseous fuels... hydrogen (cars) and hydrocarbon gas (HDVs)



# Fossil Fuels will be the mainstay of transport



# Technology strategy vs reality

- The technology “engineering” story is logical and complete.
- A system wide approach
- Least cost
- Knows where it wants to get to starts in the right place.

But

- Unlikely to happen in that way in a messy world
- Can’t predict disruptive technologies
- Can’t guarantee innovation will be adopted
- Cant predict regulatory and financial constraints very well.

# Can we get there?

# What the energy sector in 2050 might look like depends on

- Technology Innovation can change things
- Regulation Drives and shapes investment
- Investment The key constraint

Economics should help us assess what will happen

1. What kind incentives for innovation?
2. Regulation can enable or prevent investment
3. critically determine where the investment goes

# Innovation Economics

**1) How does innovation happen**

**2) How to make it happen faster**

**3) More efficiently**

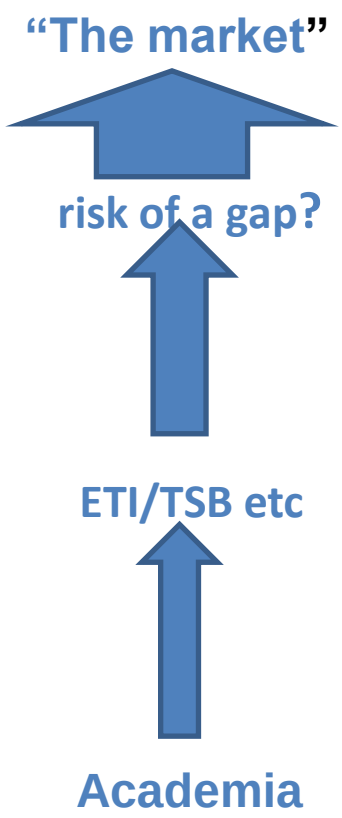
# Incentives to Innovate in energy?

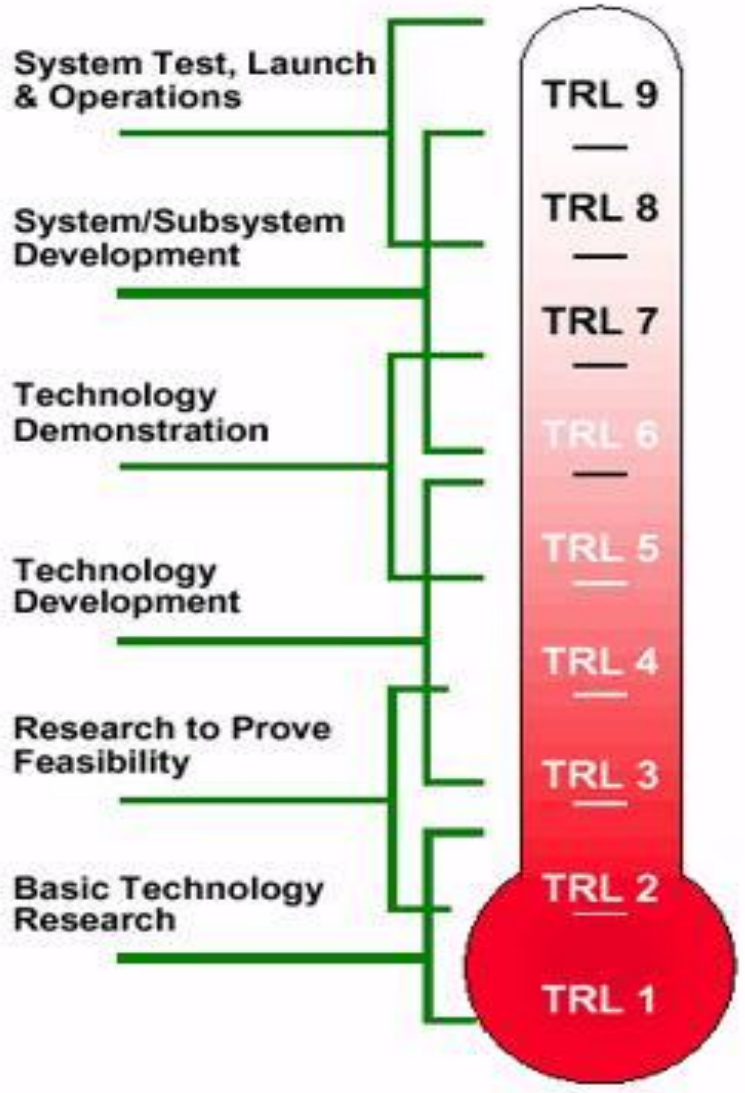
Pattern of innovation depends on characteristics of markets and returns they offer.

Cars vs Power Stations

| | Cars | Power stations |
|---|---|---|
| Lifespan | 10- 15years | 40-50+ years |
| Numbers | Hundreds of thousands | Dozens at most |
| Regulation | Predictable | Unpredictable |
| Market | Global | National + |
| Payback | < 5 years | >20 years |
| Innovation | High mkt driven, continuous | Slow not incentivised |

# Technology development takes time



# Applied Innovation, what ETI does..

**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

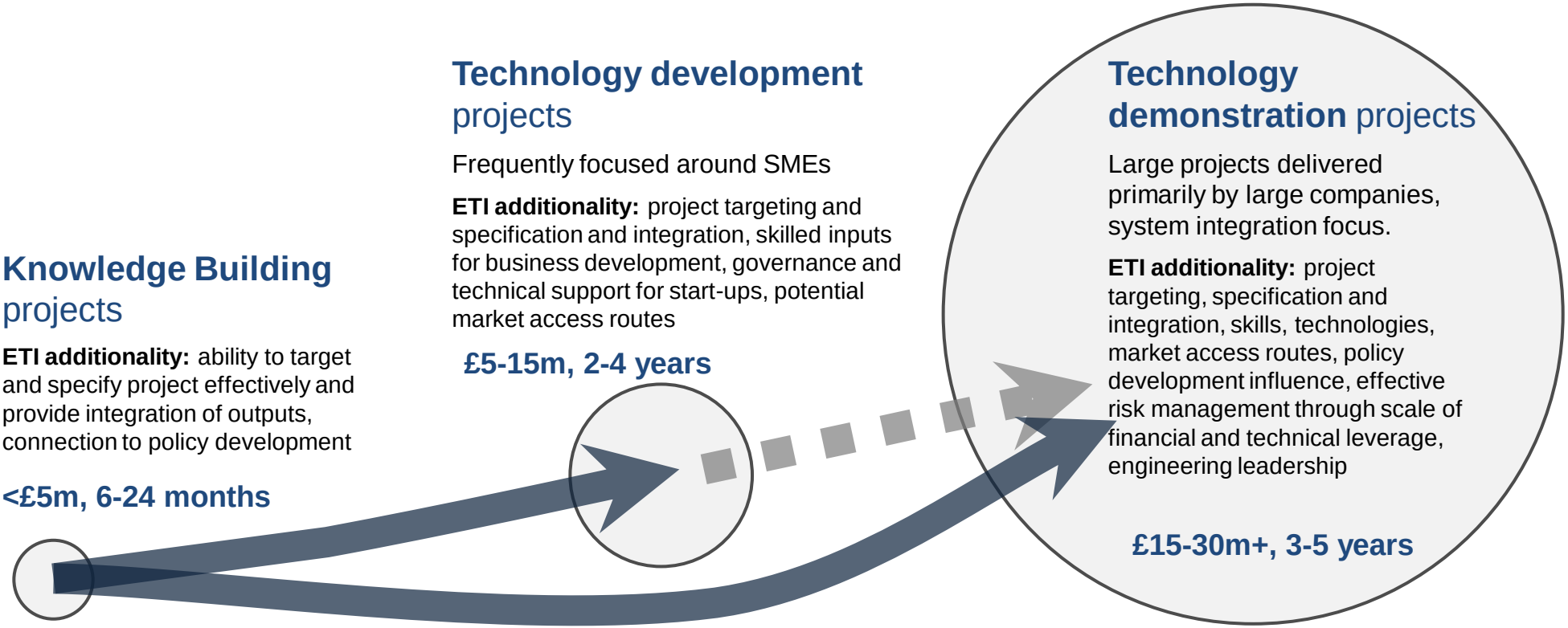
**£5-15m, 2-4 years**

**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

# Technology: Investment in innovation matters

# Regulation

## Traditional

- Regulators understand established sectors
- Regulation of individual markets, not system –wide , doesn't capture externalities effectively.
- Lowest overall system cost is not a determining factor.
- Aim to be predictable and offer incentives for incremental change not big jumps

## Low carbon policy

- Incentivise new technologies with short term subsidies/requirements
- Many different kinds of intervention, quite confusing
- What is next EMR or something else?

# Incentives to invest: Future regulatory regime

Mixed signals

deter innovation
deter investment

# Incentives to invest, or not?

- Expected Returns
- Cost of capital govt vs private
- Long term regulatory certainty
- Low demand risk
- Low technology risk
- Ability to enter and exit Market exposure
- Capital requirements

# Summary:

The pieces can fit together. We can hit 2050 carbon targets if :

## 1) Strategy and innovation

- We know what we are trying to achieve
- Invest in Innovation and encourage its development and implementation in time.
- We minimise costs of decarbonisation through understanding the energy system and objectively investing in viable technologies.

## 2) Regulation

- The policy and regulatory regime is predictable in the long term and friendly

## 3) Capital

- We drive out risk to drive down expected rate of return.
- We acknowledge new types of investment and investor will be needed in energy and act to attract them.

Energy Technologies Institute
Holywell Building
Holywell Park
Loughborough
UK
LE11 3UZ

For all general enquiries telephone the ETI on
+44 (0)1509 202020.

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

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

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