



[www.eti.co.uk](http://www.eti.co.uk)

# Commercialising CCS – models and drivers

George Day, Head of Economic Strategy

A new age for coal with CCS, SCI conference, London

7<sup>th</sup> November 2013

©2013 Energy Technologies Institute LLP

The information in this document is the property of Energy Technologies Institute LLP and may not be copied or communicated to a third party, or used for any purpose other than that for which it is supplied without the express written consent of Energy Technologies Institute LLP.

This information is given in good faith based upon the latest information available to Energy Technologies Institute LLP, no warranty or representation is given concerning such information, which must not be taken as establishing any contractual or other commitment binding upon Energy Technologies Institute LLP or any of its subsidiary or associated companies.

The role of CCS in UK decarbonisation

Mobilising private sector investment

Business models & industry structures

Incentives and regulation

# Energy System Modelling Environment - overview

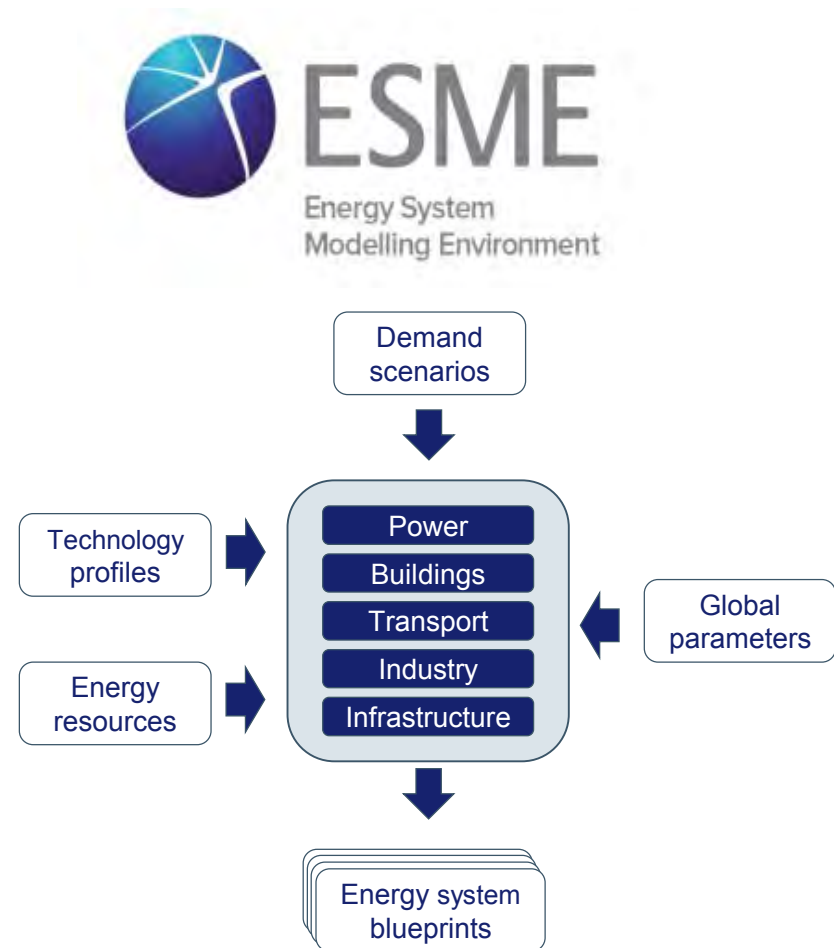
A national energy system design tool, integrating power, heat, transport and infrastructure

## Modelling approach

Least cost optimisation (policy neutral)  
Back-casting from 2050  
Probabilistic treatment of uncertainty  
Spatial & temporal factors

Informed by ETI members/advisors

Internationally peer reviewed



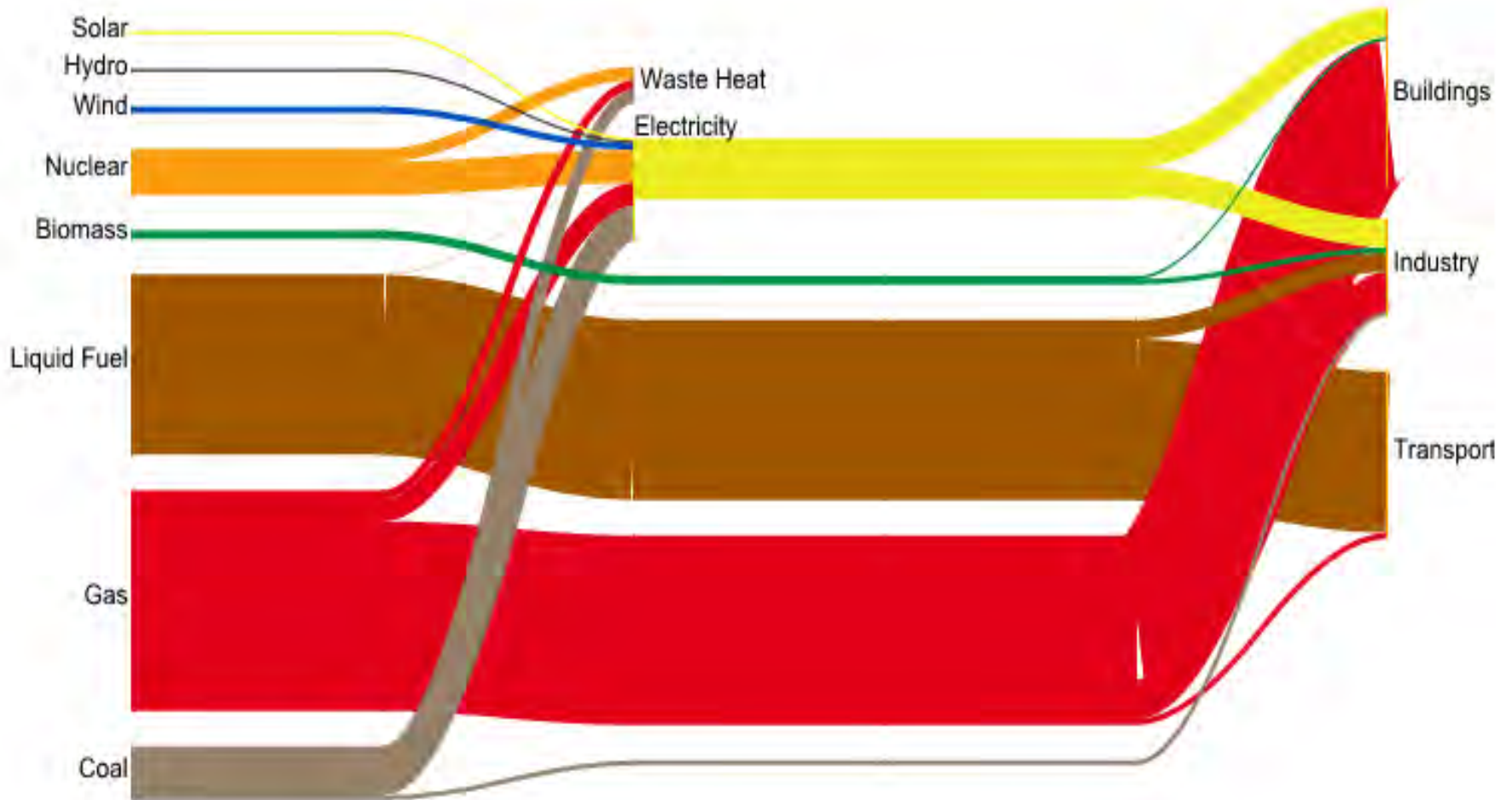
# ESME: credible & used by the ETI, its members, government & partners



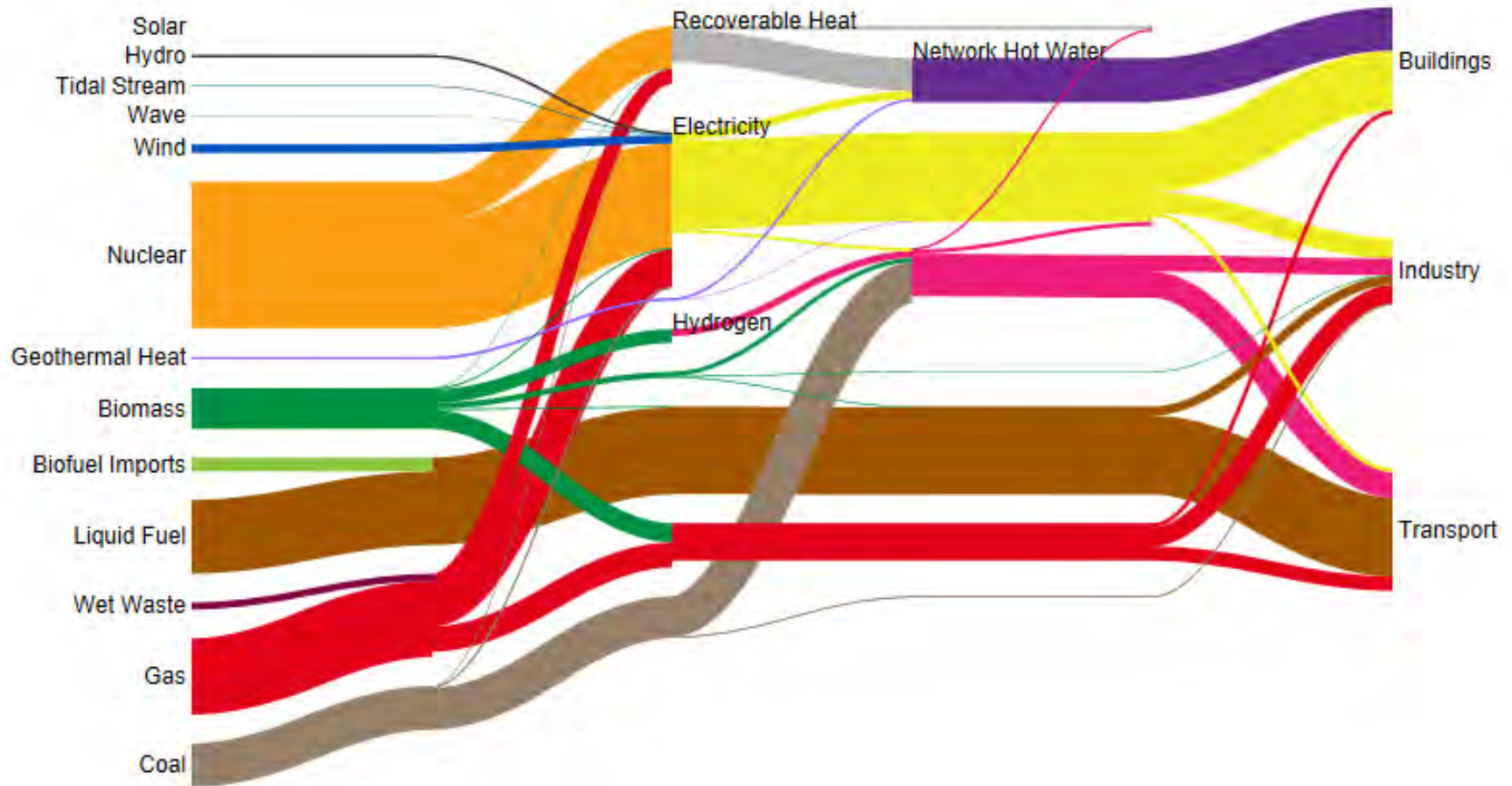
- Inform policy work by DECC and CCC on a range of issues
- Academic research projects ongoing



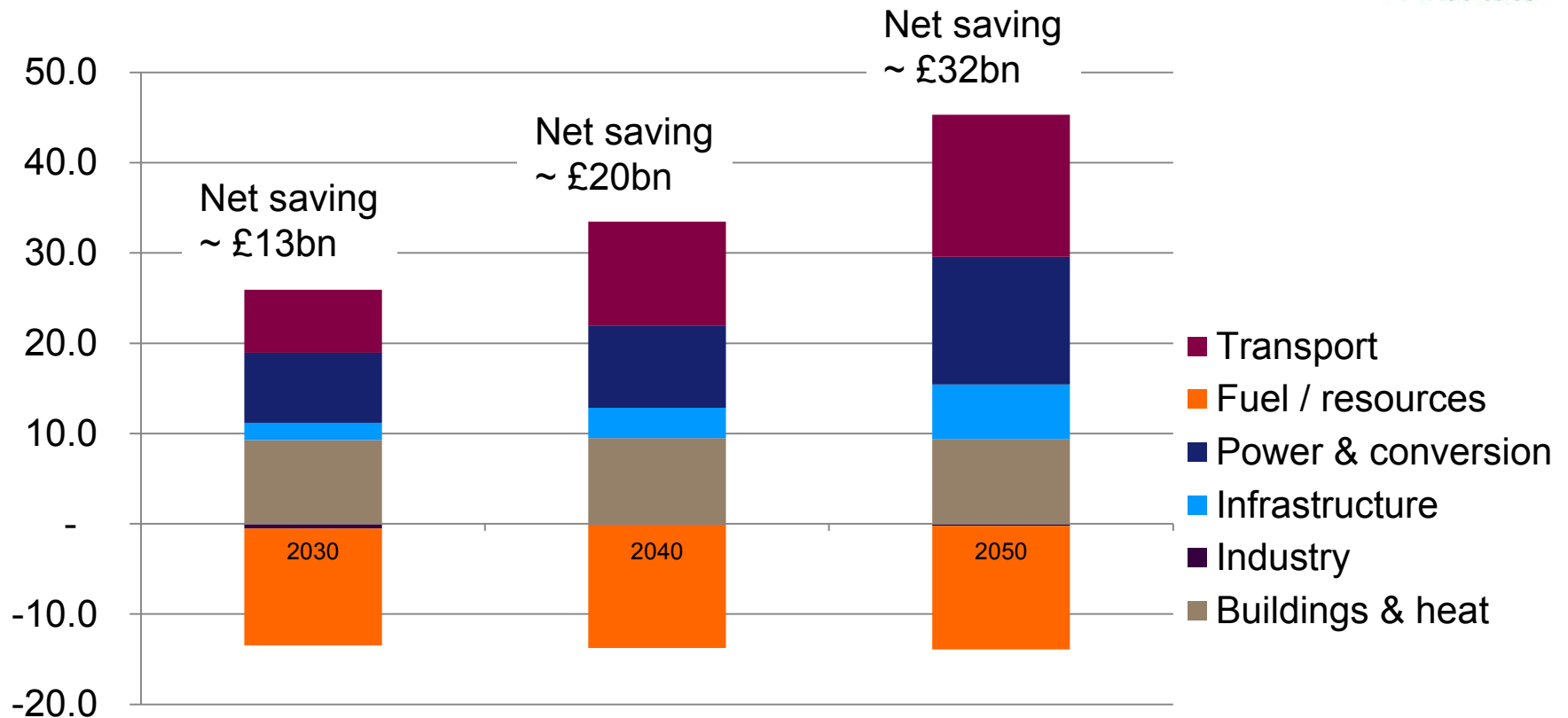
# UK energy system today



# 'Optimal' 2050 energy system

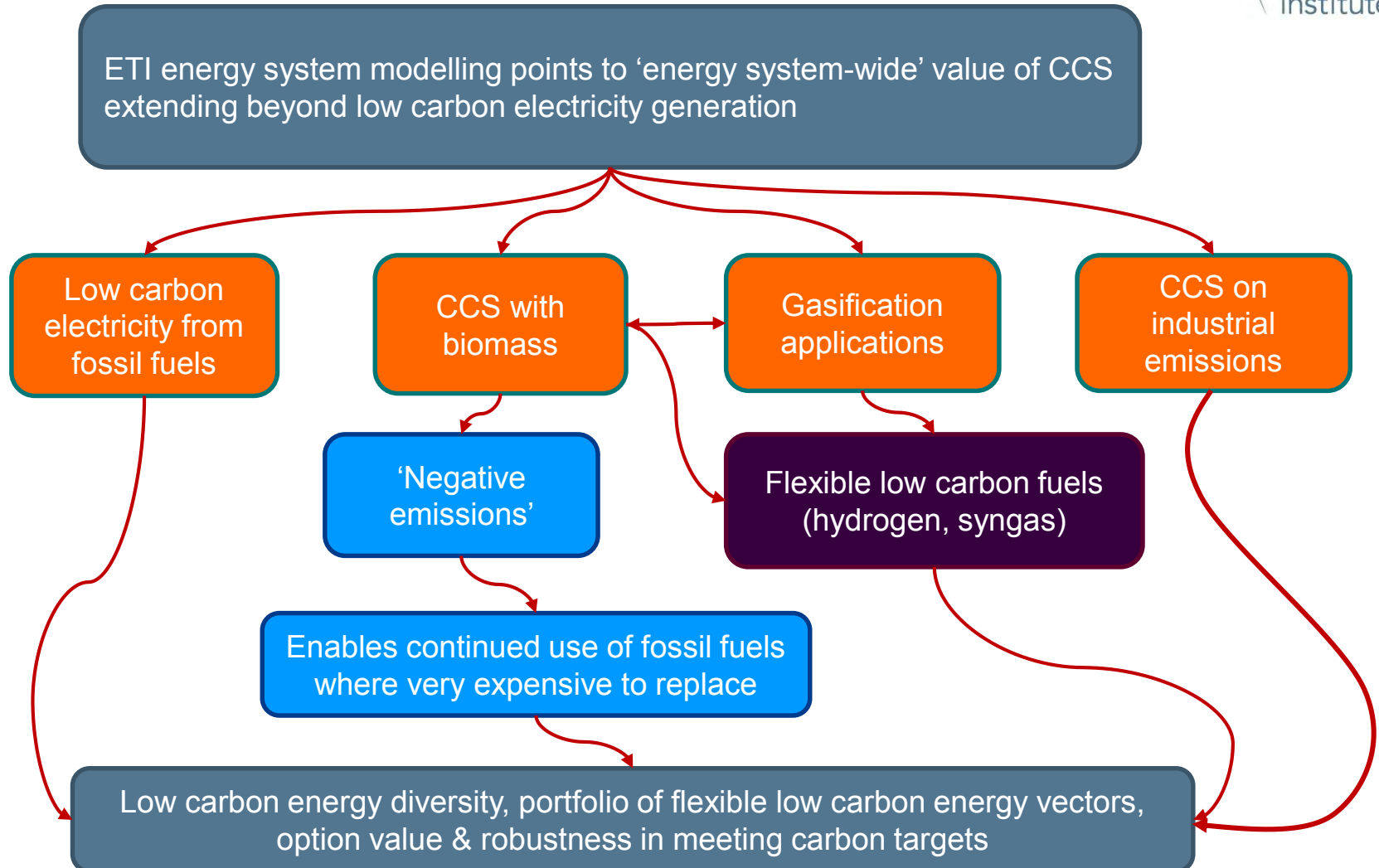


# Impact of CCS on annual cost of energy system (£bn ESME v3.1)



Fuel costs are higher, but there is less need for expensive hybrid vehicles, building retrofits, alternative (intermittent) generation capacity & transmission infrastructure, resulting in net savings which grow over time.

# Why is CCS so valuable?





The role of CCS in UK decarbonisation

Mobilising private sector investment

Business models & industry structures

Incentives and regulation

# Mobilising private sector investment to realise this value?

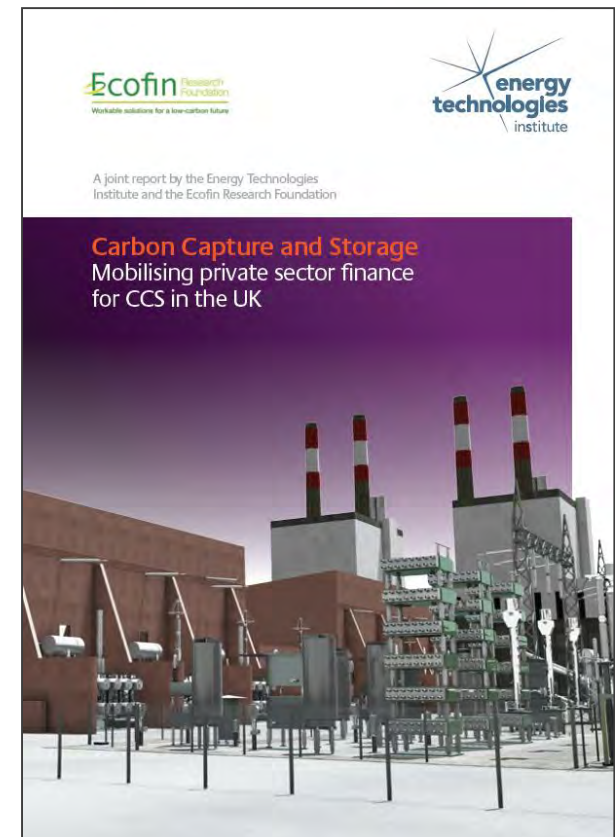
Mitigate  
and  
manage  
risks for  
investors

## Create rewards

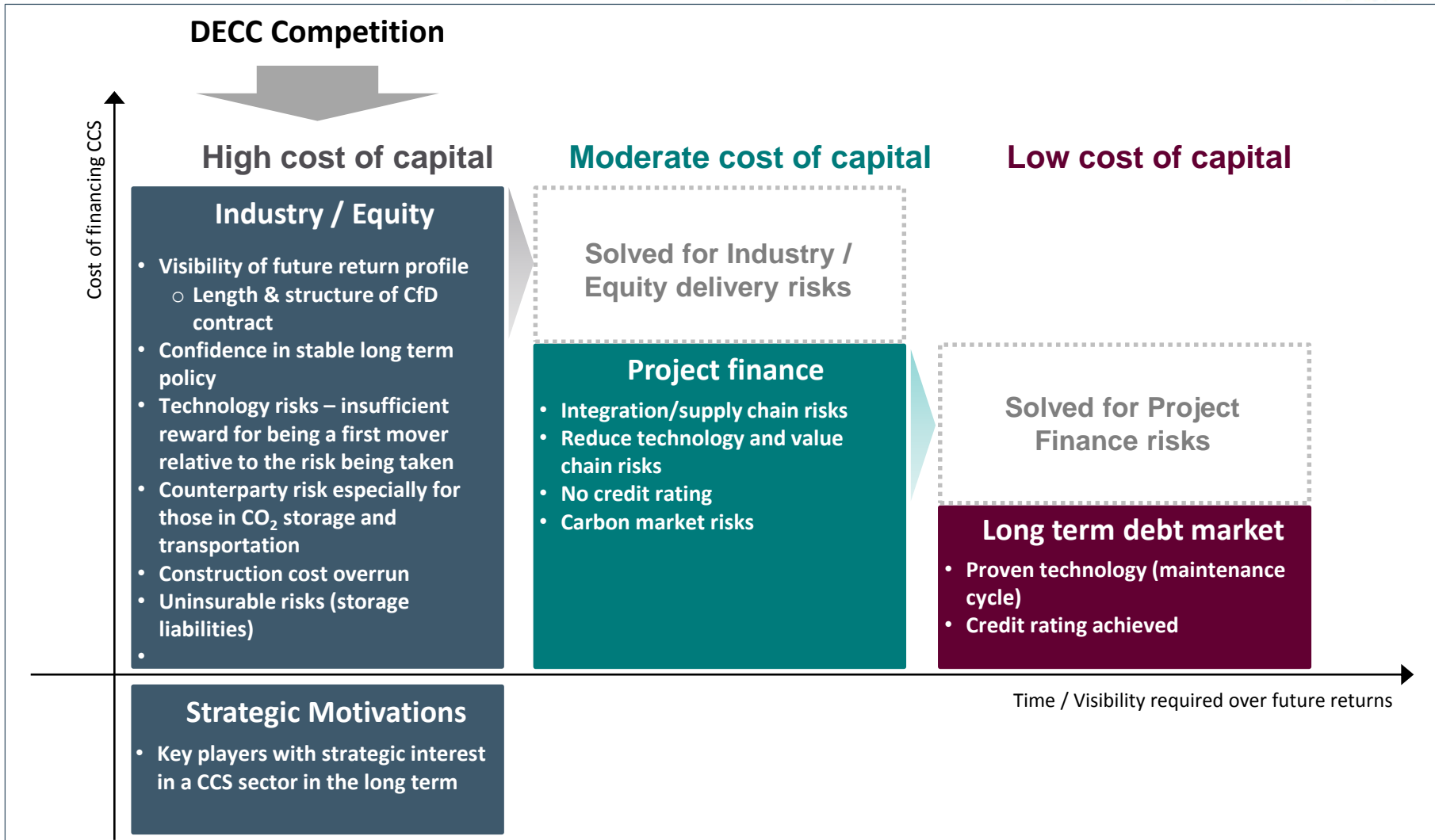
- UK will be competing for investment
- confidence and clarity
- Rewards for non-power applications?

## Enabling regulation and governance

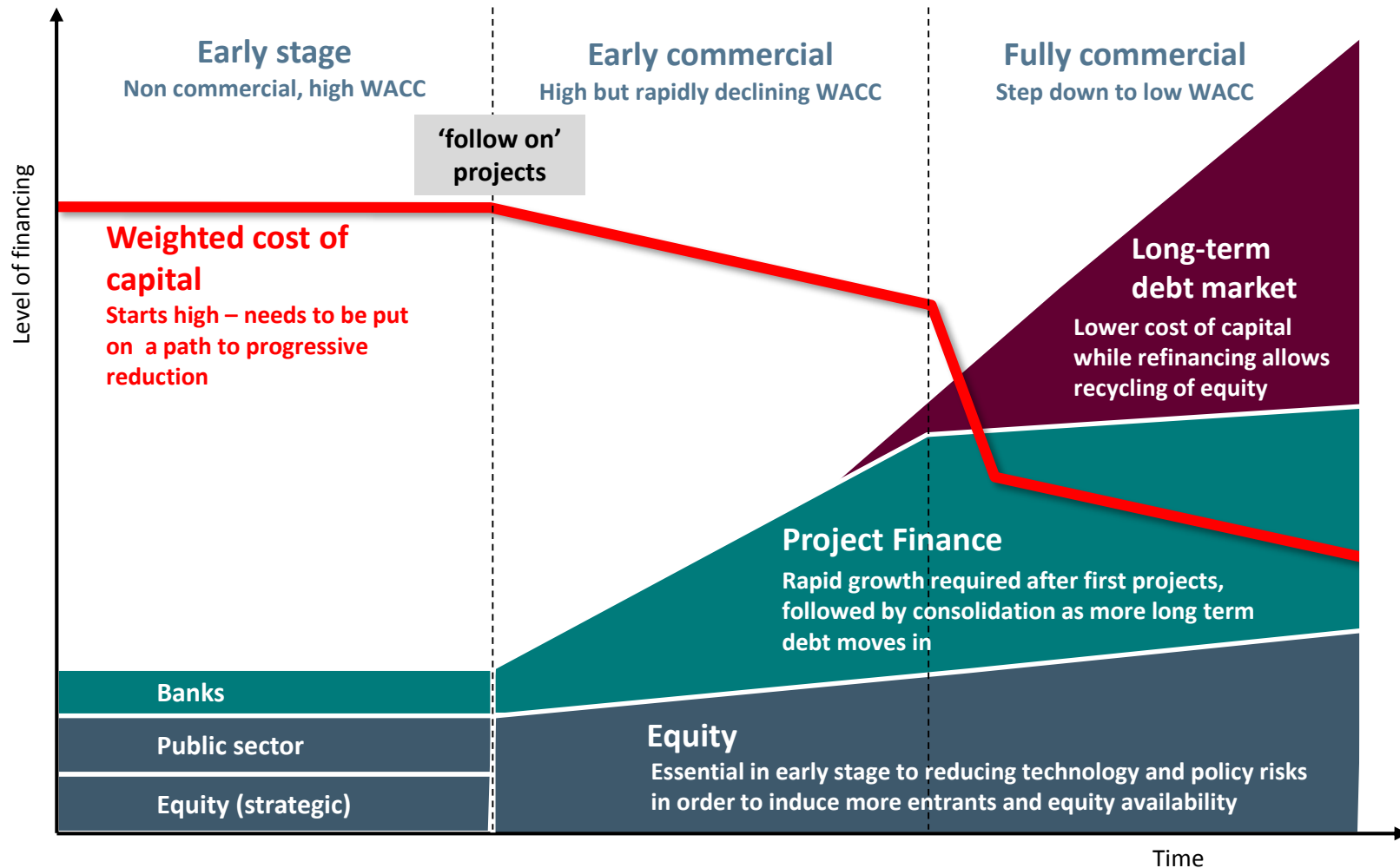
- complex new value chains
- Inter-dependency of projects – networks & clusters



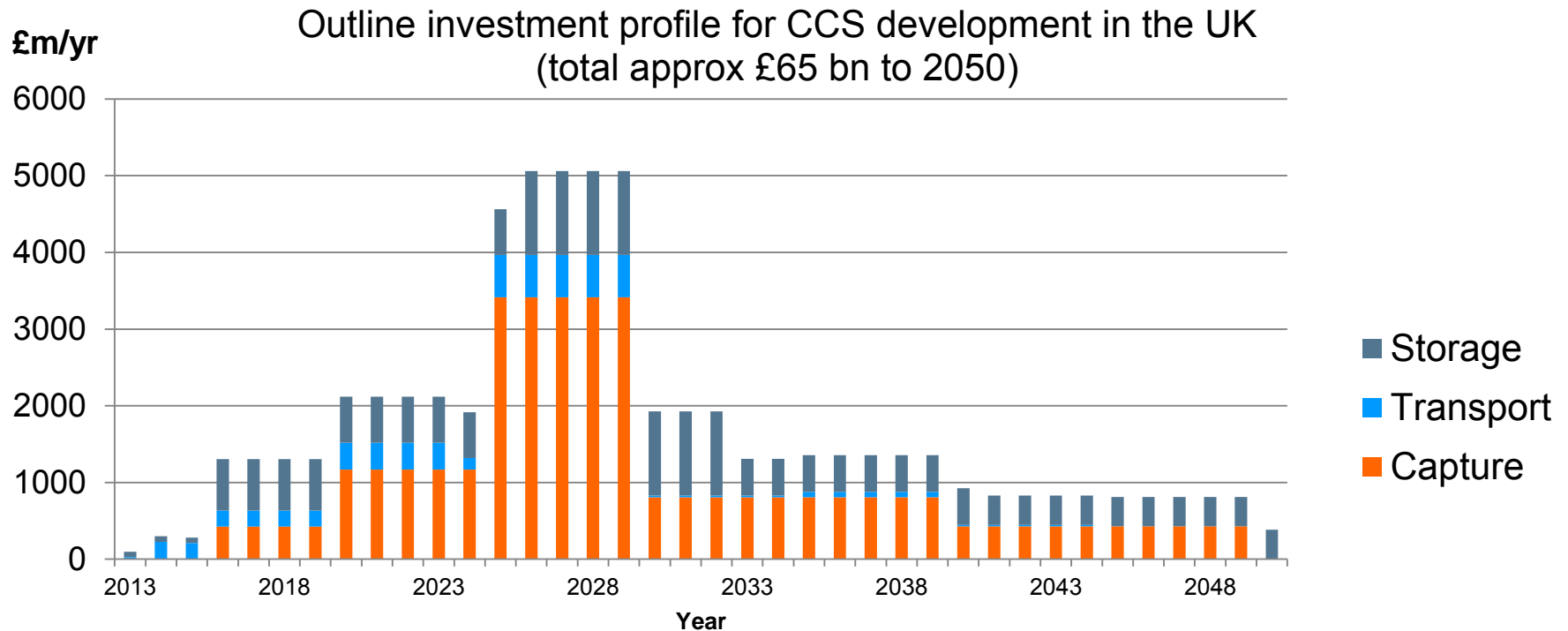
# Financing pathway to a low cost industry



# The way ahead



# The scale of investment to deploy CCS



Overall investment required for a CCS sector capable of delivering maximum value (storing 100M tonnes pa) is ~ **£65 bn** by 2050.

Upfront investment to 2030 is ~ **£40 bn** (peak ~ £5bn pa in late 2020s).

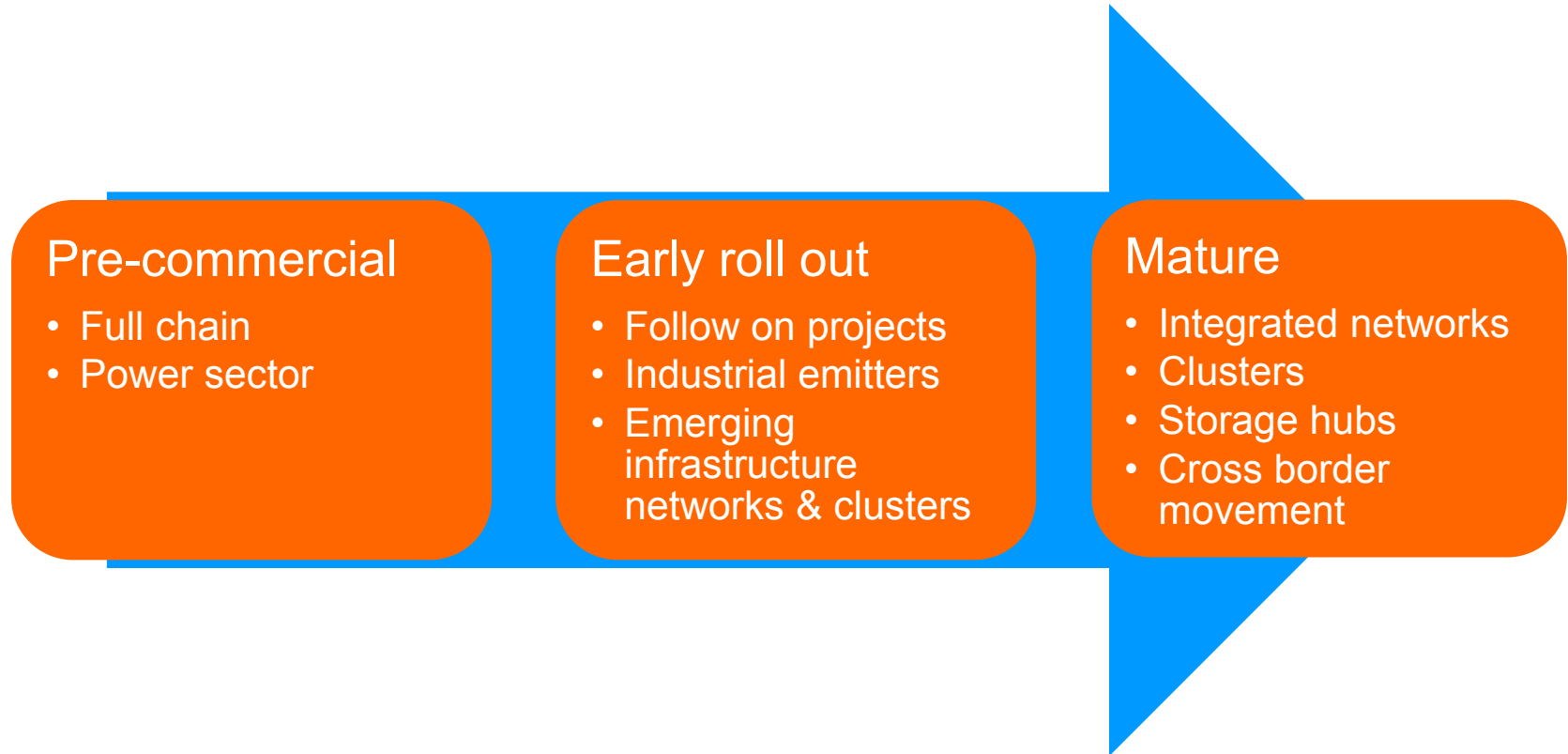
The role of CCS in UK decarbonisation

Mobilising private sector investment

Business models & industry structures

Incentives and regulation

# Potential evolution of a UK CCS sector



The profile of projects likely to evolve as a CCS sector develops to maturity – needs a strategic approach to policy and business models/structures likely to evolve.

# Value chain components – differing characteristics

Capture

Transport

Storage

Competing capture technologies and multiple applications served by a global supply chain

Geographically specific, integrated transport networks

Shared access to infrastructure

May require co-ordination, regulation or governance

Geographically specific, high risk, geological externalities.

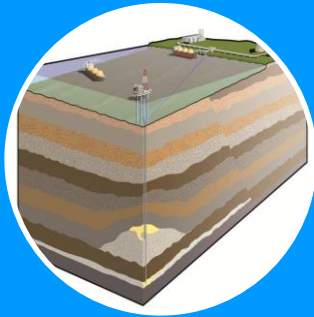
Interaction with hydrocarbons (EOR & decommissioning)

Eventual state liability

May require strategic shaping

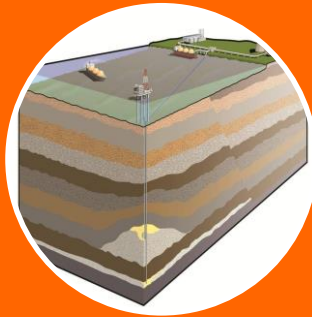


# Spectrum of market & regulatory models for transport & storage



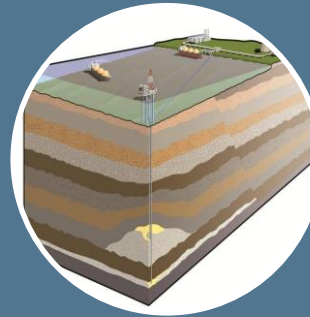
## “Planned economy”

- Public sector mandates & invests



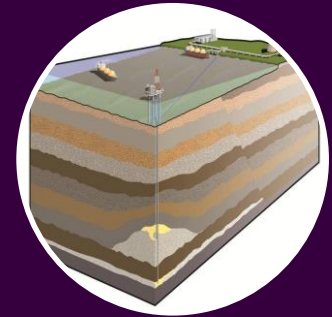
## “Tightly regulated”

- Statutory monopoly / contracting authority



## “Co-ordinated”

- Variety of co-ordinated contracting models

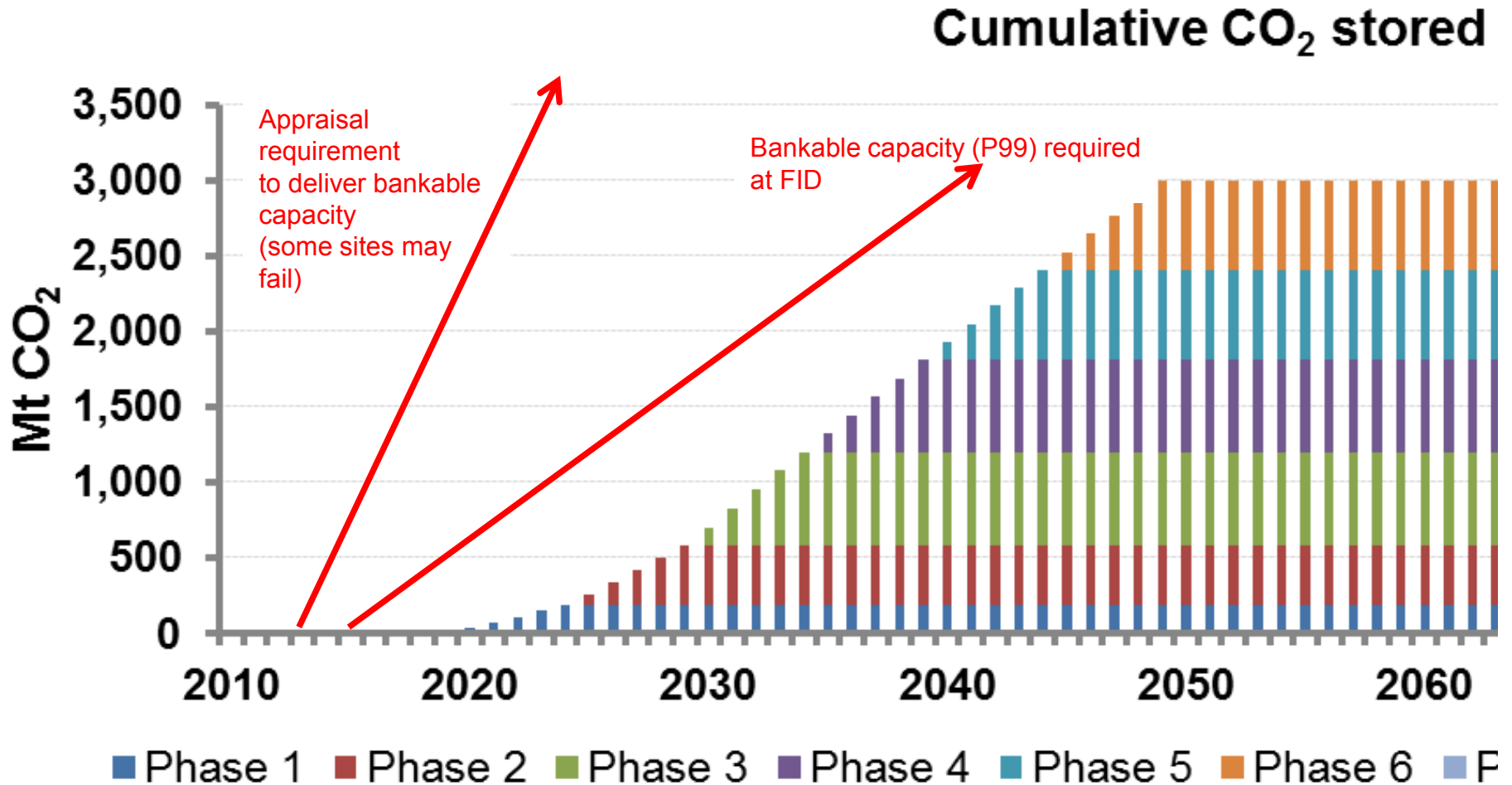


## “Free market”

- Leave market to drive efficient contracting & co-ordination



# Storage needs: we need serious appraisal activity now



# Immediate need is for a business model to drive investment in storage appraisal

ETI modelling suggests rapid ramp up of CCS volumes in the 2020s is optimal for UK energy system

Saline aquifer storage is needed to give sufficient capacity – but up to 10 years lead time for appraisal & development

We need investment to start flowing now

- to start proving major saline aquifers

Market failures and regulatory issues could block this if not resolved

The role of CCS in UK decarbonisation

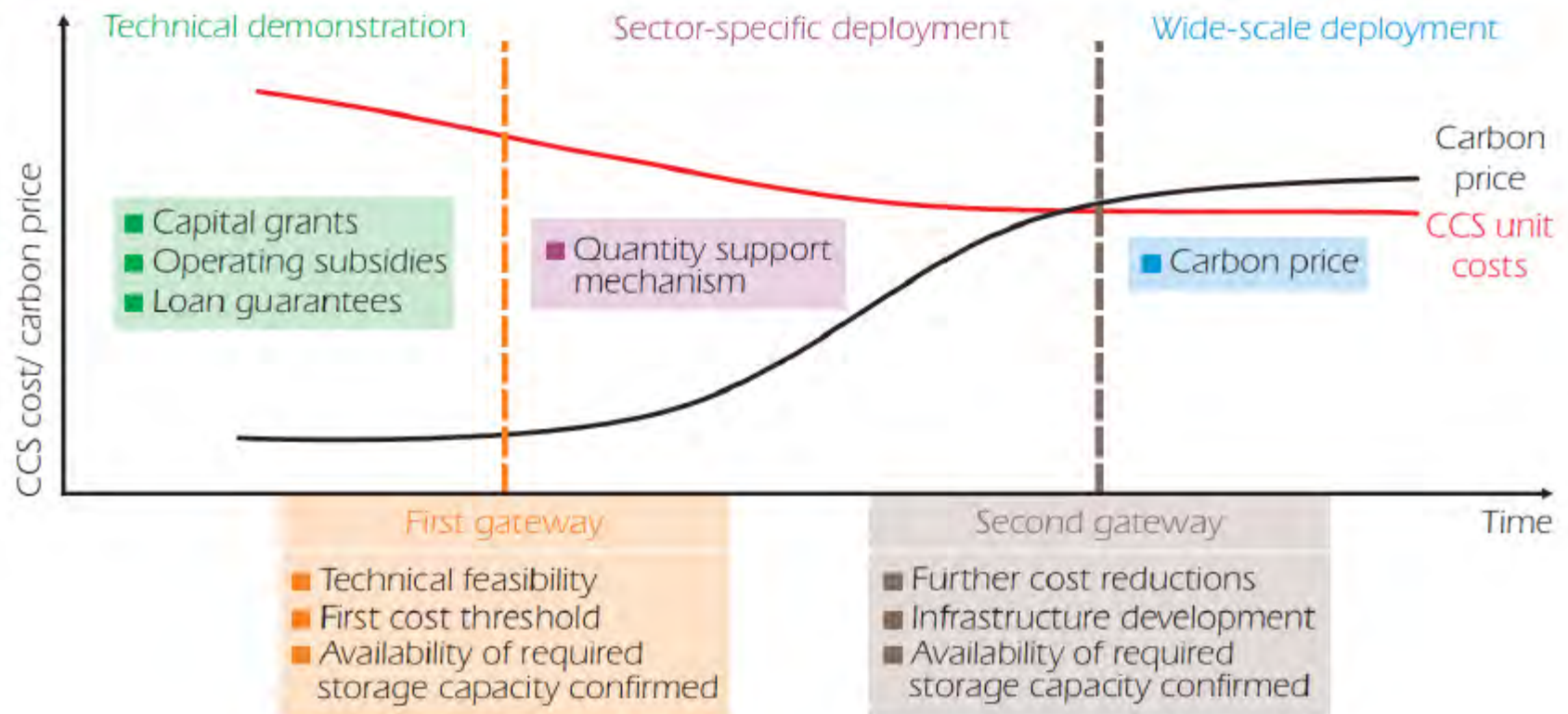
Mobilising private sector investment

Business models & industry structures

Incentives and regulation

# Evolution of CCS support - IEA policy strategy view

**Figure 4** Possible gateways within a CCS policy framework



# Current reward mechanisms for CCS in UK

## Carbon price

- Low and volatile, politically risky
- UK floor price (only electricity sector)

## Feed in tariffs

- Premium for low carbon electricity

## Other revenues

- EOR / other industrial uses?

# Detail of approach to contracting for CCS electricity will determine risk allocation (& shape business models)



Key contract terms

EMR 'delivery plans'

Strike and reference prices

Length of contract

Risk mitigants?

Resource allocation between technologies

Signals to market & supply chain

Fuel price indexation

Commissioning risk

Despatch risk

Others?

Learn lessons from network utility regulators - have developed sophisticated tools to limit long-term exposure to unpredictable risks, while retaining incentives on operators

# Creating an enabling framework for CCS in the UK

## Manage & mitigate risks for investors

- Design in long term reliability to incentives
- Ensure risk profile is acceptable to investors
- Adapt CFD mechanism to risks and strategic value of particular projects (cf. oil & gas fields)
- Adapt risk mitigant tools from utility regulation?

## Create rewards

- For industrial: subsidy or tax breaks funded through carbon floor tax proceeds (cf UK Climate Change Levy)?
- For BECCS: premium CFD, tax breaks or tradable instrument?

## Enabling regulation & governance

- More active government role in shaping & enabling transport & storage investment (cf. offshore wind), & creating governance arrangements



# To conclude: key immediate needs

Use EMR to drive early 'post-competition' projects

- target strategic value to CCS sector not simply lowest £/MWh

Attract investment into storage appraisal & derisking

- Make the storage opportunity more attractive
- Address market failures

Recognise the high value & strategic role of CCS

- Cut annual cost of low carbon energy by up to 1% of GDP!
- strengthen signals of policy commitment



Energy Technologies Institute  
Holywell Building  
Holywell Park  
Loughborough  
LE11 3UZ



For all general enquiries  
telephone the ETI on  
01509 202020.



For more information  
about the ETI visit  
[www.eti.co.uk](http://www.eti.co.uk)



For the latest ETI news and  
announcements email  
[info@eti.co.uk](mailto:info@eti.co.uk)



The ETI can also be  
followed on Twitter at  
[twitter.com/the\\_ETI](https://twitter.com/the_ETI)