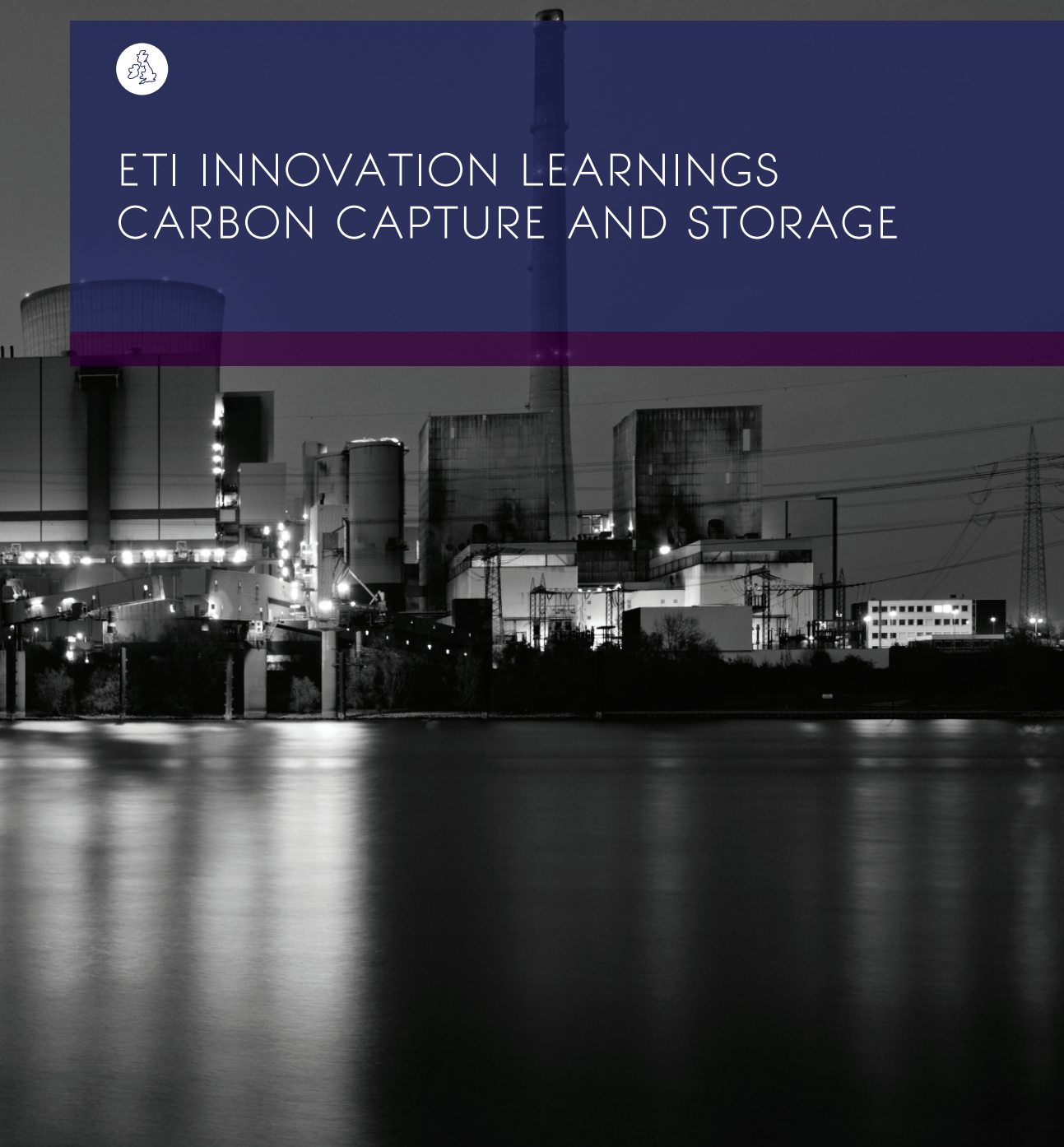
energy technologies institute

ETI INNOVATION LEARNINGS
CARBON CAPTURE AND STORAGE



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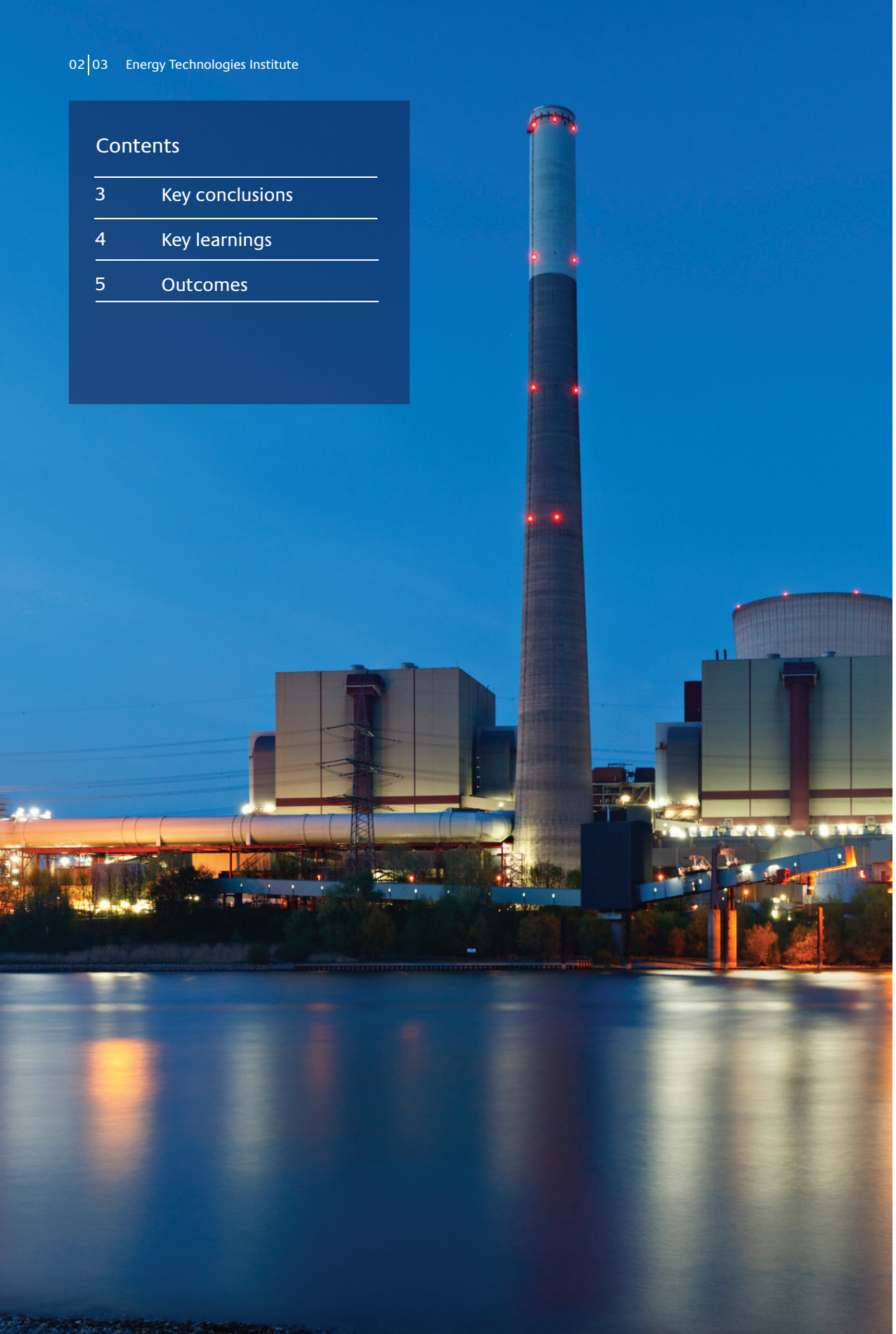


KEY CONCLUSIONS

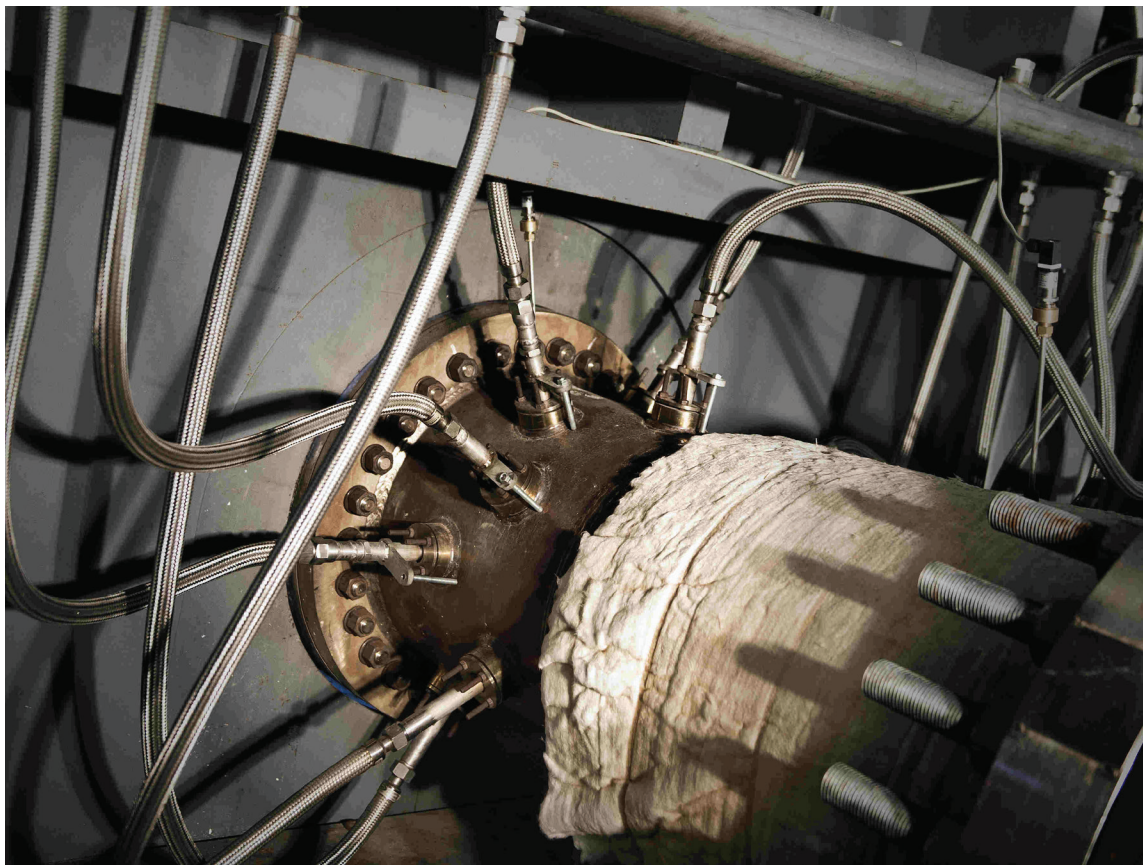
Since low carbon markets are almost entirely driven by public policy but delivered by private sector firms, industry and government should work together to set strategic priorities, particularly for new capital intensive technologies like Carbon Capture & Storage (CCS).

The ETI's analysis of the UK energy system points to the central importance of CCS in enabling the UK to meet its carbon targets efficiently. CCS could save tens of billions of pounds (up to circa 1% of GDP by 2050) from the annual cost of meeting UK Climate Change targets, compared with alternative approaches to reducing emissions which do not deploy this capability.

The ETI has carried out techno-economic and project investment level modelling of CCS at both process plant and energy system levels in order to build knowledge of the role and value of the technology and to better understand the barriers facing the industry. Much of the work has been on risk and cost reduction in CO_2 transportation and storage, but has also covered the cost of capture, which is the largest single cost element in CCS operations and which, unlike transportation and storage infrastructure, often cannot easily be shared across multiple emissions sites.

Apart from its role in power generation, CCS can capture industrial emissions at low cost; provide flexible low carbon energy for industry, transport and heat through gasification; and, in combination with bioenergy, deliver high value negative emissions.

These outcomes can be delivered by creating a supportive policy environment with early action on critical issues to bring forward timely investment.



KEY LEARNINGS

- There is wide industry support for the conclusion that CCS is crucial to the cost-effective delivery of government emissions reduction targets. However, this view is not consistently held by all parts of the public and private sector, which acts as a barrier to innovation.
- Experience with CCS illustrates the importance of industry and government working together to set strategic priorities, deal with coordination problems, allow for experimentation, manage vested interests, and improve innovation performance.
- For CCS, government policy has a critical role to play in building innovation capability, delivering cost reductions and facilitating the transition to new low carbon outcomes which the market will not deliver on its own.
- Business seeks certainty ahead of investment so policy stability matters – recent changes in government support for CCS has delayed commercial implementation, exposing the UK to substantial cost and deployment risks in meeting carbon budgets.
- Specifically, with capital intensive technologies like CCS, government commitment is required to drive 'first of a kind' and early commercial projects that give the private sector the confidence to invest.

OUTCOMES

The ETI began work on CCS in 2009 focusing on the storage elements of this process – recognising that unless the UK had adequate cost-effective storage available there was little point in investing in technology for capturing and transporting CO_2.

The ETI's £3.8m storage appraisal project used industry groups and government funded research teams to deliver a joint view on the significant quantity of offshore CO_2 storage around the UK and also to identify the lowest risk sites for early development. The ETI then part-funded drilling in the North Sea by National Grid to assess a preferred site ready for linking to a future pipeline network.

By 2012, the ETI had created a robust evidence base on all aspects of CCS, capturing this in a suite of economic models for the industry covering emissions capture, CO_2 transport network development, system operation and offshore storage. This is now used widely in UK government policy development and has led to the clear conclusion that the success or otherwise in implementing early deployment of CCS should determine the overarching strategy, design and cost for implementing the other key aspects of the UK's future energy infrastructure – including heat and transport where failure to implement CCS will mean difficult choices have to be made sooner about how to cut emissions cost effectively in these 'hard to treat' sectors.

OUTCOMES
Continued

Enabling CCS to realise its potential and play this key role in UK decarbonisation will require developing around 10 GW of CCS abated power generating capacity by the early 2030s. This level of ambition is consistent with the governments Electricity Market Reform Delivery Plan and with the Committee on Climate Change (CCC) scenarios for curbing power sector emissions. Capital investment required to deliver this would be equivalent to around 10 to 12% of total power sector investment as estimated by the CCC.

Achieving these targets will require momentum in the sector to stimulate a robust CCS project development pipeline – multiple, sequential projects to prove technology and business models and to enable cost reduction. Whilst there is an argument that delay would enable the UK to take advantage of cost reductions delivered by CCS investment globally, many of the costs and risks of early deployment are UK-specific and early cost reduction opportunities depend on early infrastructure investments being shared across emissions sites to achieve capacity advantages.

A delay in CCS deployment would require accelerating the uptake of a range of other low carbon technologies (e.g. replacement of gas heating) during the 2020s to fill the gap left by CCS. With strong policy support and the building of investor and industry confidence through successful early commercial scale projects, the private sector could take investment decisions by the mid-2020s to build CCS equipped fossil fuel power stations, under existing market mechanisms for delivering low carbon generation technologies.

Despite wide sectoral support for these benefits of CCS deployment, existing market signals have not been strong enough to initiate commercial-scale private sector led CCS projects in the UK. For over a decade the UK government has been engaging with the industry to address this issue, but without success. The most recent attempt, a CCS Commercialisation Competition, was cancelled in the government's 2015 autumn budget statement.

There is a risk that this setback, and the presumptions about the lack of government support for CCS it creates, will permanently stunt the growth of the technology in the UK. This has significant cost implications for the UK economy, since failing to deploy CCS would imply close to a doubling of the annual cost of carbon abatement to the UK economy from circa 1% to 2% of GDP by 2050 (or roughly £1000 extra on average annual household energy related bills). The public and private sector need to continue to work together to develop that elusive first commercial project that can both stand on its own feet and form the basis for cost-effective, investable roll out of CCS.

Failing to deploy CCS would double the annual cost of carbon abatement in the UK by circa

1-2% GDP by 2025

ABOUT THE AUTHOR

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Mike Colechin joined the ETI as Partnership Manager in 2011. He is a Chartered Mechanical Engineer with over 20 years experience in the energy sector and is responsible for ensuring that the ETI's work delivers impact with a wide range of stakeholders

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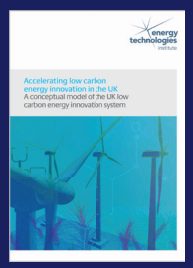
FURTHER READING



Accelerating low carbon energy innovation in the UK

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