EI TECHNICAL

Guiding the energy transition

The Energy Institute is working with industry to develop good practice in support of the energy transition. *Martin Maeso*, Good Practice Director, EI Technical, explains.

As we navigate our way through the COVID-19 pandemic, there remains the need to address the challenge of climate change, a growing global population and how we transition to a low carbon world that is fair and equitable for all.

Responding to the climate emergency while meeting the energy needs of the world's growing population calls for energy to be better understood, managed and valued. This ambition is at the heart of the Energy Institute's (EI) social purpose. How society responds to this challenge, and how the energy industry responds today, will have impact long into the future.

Energy Institute's role

The EI is a global, independent network of professionals spanning the world of energy, convening and facilitating debate, championing evidence and sharing fresh ideas, giving voice to issues of concern and, where necessary, challenging the industry we work with. As a safe collaborative space for industry, academia and policy makers, we deliver standards, guidance, training and knowledge dissemination that raise the bar in operations in almost all areas of the energy system. The EI is a broad church, a science-based learned society, whose remit is ultimately to work, on behalf of its members and the wider industry it represents, for public good.

At the heart of what we do is trust. Trust that the EI is an honest broker, a facilitator of genuine collaboration and an organisation with transparent process, procedure and governance. Through the EI, our members and wider industry can ask questions, challenge the industry and look at issues with honesty and integrity.

Technical partners

This is particularly true for the Technical Partner members of the EI. These companies – who span all of the energy landscape, whether renewables, thermal power or oil and gas; upstream or downstream; in the UK or operating regionally or globally – all engage through the EI in a spirit of collaboration and for the wider benefit of all.

The main deliverable from this process is industry good practice, which is downloaded and used in over 100 countries. The focus of the good practice and the drive behind it comes from the EI Partner companies. It is a programme of work for industry, which is determined and led by industry.

Energy transition

A major focus for this technical work of the EI over the last year has been to address gaps in knowledge and understanding around the transition to a low carbon economy.

The EI organised a broad strategic workshop in 2019, bringing together a wide range of stakeholders from within the membership, and from other organisations and associations across the energy sector. This included industry regulators and government representatives.

The purpose of the workshop was to look at where the EI good practice programme is currently focused, and in particular where the EI could best support industry in the transition to a low carbon economy. The workshop recognised that the existing work undertaken by the EI in support of oil and gas companies is key and will be essential for some time to come. But also recognised the significant and growing volume of work already undertaken through the EI addressing technical good practice for wind, storage and wider renewable issues.

There was also much debate on where the EI could facilitate the uptake of new transition technologies, with much discussion of the unique nature of this support for industry. It was noted that in many countries there is a 'goal-setting' rather than a 'prescriptive' approach to regulation. This is especially relevant to health, safety and environmental (HS&E) legislation. Here, the onus is on operators to demonstrate to the regulators' satisfaction that reasonable steps have been taken to fulfil regulatory requirements. This is easier when the industry and regulators have agreed good practices or guidance and is particularly important for technologies where the existing regulatory framework is evolving alongside the development and deployment of new technologies.

Essentially, the EI acts as an honest broker to facilitate discussion, across all stakeholders, on scientific and technical issues, inputting sound science into regulations, and delivering good practice to support regulators and industry alike. The strategic workshop identified a wide range of issues across transition technologies. EI Technical Partner companies then worked to identify priorities across the wide range of topics identified. It was agreed that the initial focus for the EI technical good practice programme should

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be carbon capture utilisation and storage (CCUS), and hydrogen technologies.

The EI held further dedicated workshops on CCUS and hydrogen in late 2019 and early 2020, focused on bringing together a wide range of stakeholders to discuss and identify non-competitive scientific and technical challenges that need to be overcome to facilitate the deployment of these technologies.

Around 100 participants, from 45 companies representing industry, government, regulators, academia and engineering associations participated in the workshops. Topics were reviewed in terms of their priority (high, medium and low) and also in terms of the likelihood of being able to deliver a tangible, value-adding outcome within a reasonable timeframe. Only projects that scored highly on both counts were put forward for approval by the EI's Scientific and Technical Advisory Committee (STAC) members. These project proposals, based on the needs and experiences of a wide range of key stakeholders, were then validated by the wider EI membership.

CCUS projects

Stakeholders representing businesses that produce bulk CO_2, storage and transport providers, academia and regulators identified priority areas for technical guidance by the EI.

The first is developing equations of state (EoS) for CCS fluids. Thermodynamic predictions of CO_2 with impurities are often inadequate due to a lack of validated modelling information available to the designer. The aim is to provide a list of suitable EoS and their relative strengths and weaknesses, clarifying what impurities are most relevant and assembling a library of existing work.

The lack of a framework for developing a safety case to repurpose existing pipelines, and design new ones for transport of different classification liquids, was also identified as a key gap. The aim will be to assess and build on the work undertaken by others to understand what is available or missing, to develop a non-prescriptive checklist that specifies the steps that should be followed when producing a safety case to repurpose a pipeline, including decommissioning, land management (residential or industrial), material compatibility, and life extension.

The third issue of significant interest was ductile failure and fracture propagation. Though numerous research projects have been carried out on the topic, it is unclear which models are applicable to CO_2 operations, and what is their accuracy as many are based on simulations for hydrocarbons. The aim is to identify and collate in one document existing knowledge in the UK and worldwide, in order to be able to recognise appropriate materials and establish design paths for pipeline construction.

The last work package is to update and revise existing EI guidelines on CCUS, including hazard analysis guidance for onshore pipes and offshore pipelines

Hydrogen focus

A similar hydrogen energy transition workshop was held, involving stakeholders in hydrogen production, storage and distribution. The development of competency, skills and training for a transfer to hydrogen was identified as a priority area in order to address the current lack of suitably qualified/certified technicians, mechanical engineers, electrical engineers, control and instrumentation engineers, project managers and other front line staff to cater for transition from the petroleum-based energy sector to a hydrogen-based energy sector.

Improved understanding of the energy balance for the whole hydrogen energy system could assist in decision making about the relative merits of different methods of hydrogen production, along the value chain to end-use applications. This work will perform an energy balance evaluation for each hydrogen system option, in order to understand relative efficiencies, and to quantify the energy intensity and associated CO_2 emissions.

Currently, there is a lack of knowledge of the relative environmental impacts of the various options for hydrogen production, through the value chain. These environmental impacts include solid wastes, liquid leaks, fugitive emissions and other issues. Lack of knowledge is probably impeding decision making in many hydrogen projects.

In addition, operators wish to introduce hydrogen into the distribution and transmission network and need to demonstrate this can be achieved safely without compromising public safety or causing damage to plant infrastructure. Introduction of hydrogen requires operators to develop a 'safety case' for hydrogen storage and distribution by pipeline, for review by the regulator. The aim is to gain knowledge and experience on building a safety case for hydrogen storage and distribution by pipeline, clearing up any gaps in knowledge.

Similarly, operating companies seeking to introduce hydrogen into existing natural gas infrastructure need to know under what conditions can this be done without compromising asset integrity of existing plant or public safety.

What next?

Work on all these projects is planned for 2021. Significant engagement has already taken place in preparation for this, both within EI member companies and outside the EI, through organisations like the Industrial Decarbonisation Research and Innovation Centre at Heriot-Watt University, who will be working in partnership with the EI on a number of transition issues.

The EI's position as an independent and respected technical authority is helping the energy sector to meet not only its obligations in supporting day-to-day industry operations, but also to ensure a safe and efficient update of transition technologies, with real tangible impact.

For more information on the transition work or the EI's wider technical programme, please contact **mmaeso@energyinst.org**