IChemE ADVANCING CHEMICAL ENGINEERING WORLDWIDE

IChemE Priority Topic

Responsible Production

Energy Transition in Oil and Natural Gas Climate Change Action Plan

Introduction Overall problem statement	The working group for the Energy Transition in Oil and Gas agrees with the IChemE position on climate change. that we are in the midst of a climate emergency. Human activity is causing the climate to change, with significant adverse consequences. We accept the veracity of the science and its conclusions published by the Intergovernmental Panel on Climate Change (IPCC). To avoid irreparable social, economic and environmental damage, it is essential that we accelerate our efforts to decarbonise our economic systems, stabilise and ultimately reduce the levels of greenhouse gases in the earth's atmosphere. Chemical engineers are uniquely placed to take action and enable decarbonisation efforts. We support IChemE's aims of taking a lead role in tackling climate change, working with all stakeholders, from governments to communities around the world, to deliver a fair, safe and sustainable future, in which we can all thrive. We, as members of the working group for the Energy Transition in Oil and Gas will work collaboratively internally and with the whole IChemE membership; through education, research and sustainable engineering practices, in contributing globally to the transition to a net zero carbon world by 2050.
Specific problem statement	Reducing global anthropogenic Greenhouse Gas (GHG) emissions to meet the aims of the 2015 Paris Agreement will require radical transformation of the energy system over the coming decades. The oil and gas industry will need to rapidly engage and adapt to societal pressures, the changing policy and investment landscape, and play a crucial role in the efforts to decarbonise the global energy system. Oil and natural gas currently provide around of 54% primary energy accounting for 45% of global GHG emissions. Oil products currently provide most of the energy for the global transportation system (90%) and natural gas is mainly used for power generation, residential heating and as the fuel for industrial processes. Both oil and natural gas are also a major feedstock for the chemical industry. While industry change will occur over decades and needs to take account of increasing demand for affordable and reliable modern energy, there is also a sense of urgency. According to the IPCC special report[4] on the Paris 1.5 °C target, the world can only emit a further 420-580 billion tonnes of CO_2-equivalent, (often referred to as the remaining carbon budget) before the target is exceeded. Based on the DNV 2021 Energy Outlook Report[5] the current trajectory shows that the emissions will have reached this level by ~2030, underlining the need for action.

	[1] World Energy Balances 2020 - IEA [2] The Oil and Gas Industry in Energy Transitions - Insights from IEA analysis [3] Data & Statistics - IEA [4] IPCC Special Report Mitigation pathways compatible with 1.5°C in the context of sustainable development [5] DVN 2021 Energy Transition Outlook Report
What actions need to be taken to address the issue?	There are many potential pathways to a low carbon future, most of which share some common elements that include increasing efficiency, reducing emissions, and innovation in the way energy is produced, transported and used. The oil and gas sector is already responding to the need for change, and efforts will need to be accelerated if targets are to be achieved. The sector is engaging on the issue, increasingly pursuing portfolio diversification and low-carbon energy sources and energy carriers, and preparing for a future with a very different energy mix. Some specific activities industry can pursue (some of which may need government or policy support) include: **Decarbonisation of own operations:** ■ continual and transparent progress will be required on reducing direct emissions. This progress is underpinned by continuing development of emissions reporting protocols and technical guidance developed by governments, industry associations and others. Key activities may include: ■ reduction of direct operational emissions (including CO_2 and methane) through actions such as; ■ enhanced operating and energy efficiency; ■ reducing gas flaring and venting; ■ fugitive emissions monitoring and management; ■ greenhouse Gas abatement activities; ■ carbon capture utilisation and storage (CCUS); ■ evaluation and application of alternative energy sources in operations, such as; ■ zero or low carbon electricity for power and heating and hydrogen for duties where electricity cannot be readily used; ■ geothermal sources where available; ■ planning for emerging and future low carbon technology integration into greenfield projects and brownfield expansions. **Decarbonisation across oil and gas value chain:** ■ as the industrial system decarbonises, some oil and gas companies are diversifying into lower carbon and renewable energy technologies. The sector will also need to engage with other industries on new ways of producing, storing, transporting, and using energy and products.

Future activities could include:

- working with energy users to enable the transition to lower carbon energy technologies, such as biofuels, renewable energy, energy storage, hydrogen, carbon capture and storage with customers; and providing firming capacity to intermittent energy production;
- adapting current plants and facilities to produce lower-carbon energy resources and products such as biofuels, synfuels, chemicals and hydrogen;
- working with consumers throughout the supply chain (including end customers) to understand their energy use requirements throughout the decarbonisation process;
- Carbon Capture, Utilisation and Storage development (CCUS) is considered a key technology in the energy transition, and the existing expertise and assets of the oil and gas industry will have a key part to play.

Specific actions for the oil and gas sector could include:

- evaluating the sub-surface and the facilities infrastructure for future CCUS potential;
- where potential for CCUS exists maintain useable infrastructure in a condition for future re-use, rather than let facilities decline in step with end of field life;
- plugging and abandoning wells in such a way as to preserve potential reservoir re-use;
- addressing skills gaps in the areas of decarbonisation of energy systems, implementation of new technologies, and integration of new and legacy energy systems;
- supporting development of favourable technologies to create a circular economy – ie recycling products rather than sending them to landfill, cutting out the emissions produced during material extraction and preventing additional GHGs being released during the landfill decomposition process;
- raising awareness of the carbon footprint impacts for decision making on options throughout asset lifecycle and especially end-of-life decisions. Care should be taken to ensure net emissions are being reduced;
- emphasising the importance of maintaining existing infrastructure in process industries until they are decommissioned.

Collaboration with key stakeholders:

- working with industry associations and others to enable transparency and consistency in reporting through provision of standards and industry guidance;
- evaluating and responding to potential biodiversity, workforce and community impacts from the energy transition; and working towards a just transition in collaboration with governments and others;
- working with others in the wider energy supply system industry to enable decarbonisation, including electricity providers, gas and hydrogen networks, and the transportation industry;
- enabling collaboration between existing industries and emerging technology to enable repurposing of equipment. Also recognising the skills of the current oil and gas workers, especially chemical engineers, and how they might be transitioned to zero or low carbon industries;
- enabling collaboration with universities and research institutes through the energy transition;
- engaging with industry, governments and regulators to establish appropriate policy settings with respect to decarbonisation and safety requirements for the energy transition and the alternative fuels of the

	future. An effective policy environment could drive technology innovation, development and deployment, as well as the infrastructure necessary to transform the system in the most economical way.
What skills, training gaps or facilitation requirements need to be addressed?	Chemical engineers have unique knowledge and expertise to address the challenges represented by climate change. The transferable skills in the oil and gas industry, and of chemical engineers more broadly, will be key to the transformation to a net-zero carbon economy. The IChemE has a part to play in building awareness, stimulating innovation, and in the education, training and lifelong development of engineers. It is also recognised that workforce skills will also need to evolve in line with the rapidly changing technological picture. Key activities may include: ■ working with Education Special Interest Group (EdSIG) to equip educators to prepare the next generation of engineers for the changing industry and technology landscape; ■ providing Continuing Professional Development (CPD) for chemical engineers to highlight transferable skills and support a transition to lower carbon technologies and industries; ■ developing new ways to engage the upcoming generation of chemical engineers.
What actions should IChemE, its SIGs, CoPs and members take to support delivery of the above actions?	IChemE special interest groups (SIGs), communities of practice (CoPs) and other knowledge communities can support the energy transition in several ways: ■ building awareness in problem definition, current solutions, future opportunities, and transferrable skill recognition and development through events and publications; ■ development of training in partnership with IChemE's existing and developing formal skill and knowledge focal points as appropriate; ■ making technical guidance available and accessible. This includes signposting members to existing best practice references published by governments, regulators, industry associations and others; ■ encouraging IChemE members in the industry to engage in activities aligned with our net zero commitment; ■ developing a pool of talent to advise IChemE policy and provide IChemE response to external consultations and advice requests.
What actions do you think IChemE and its members in the oil and natural gas sector should encourage others to take?	■ encouraging involvement in a wide range of IChemE groups and activities, and with other Professional Engineering Institutions and industry organisations involved in development of technical support for the carbon transition; ■ engage with policy-makers and opinion-formers on relevant approaches, such as science-based decision making, lifecycle assessment and systems thinking; ■ policy development efforts should also recognize that the energy transformation will not be achieved through technology alone, and that the needs, behaviours, values and culture of consumers will have a key role to play. This underpins a recognition that government, industry and civil society must all work together to achieve the common goal of decarbonisation.
Next steps	In the next 12 months, IChemE will work with members to: Develop a programme of awareness building and professional development events that include climate risks and lower carbon technologies relevant to the oil and gas sector, such as: ■ energy efficiency and plant optimisation;

- emissions monitoring and reduction technology, including methane emissions;
- alternative energy and carbon mitigation technologies, such as wind, solar, hydrogen, electrification, geothermal, nuclear and CCUS;
- emissions and technology evaluation techniques to support decision making;
- emissions and sustainability reporting;
- career development for oil and gas engineers and technicians;
- promote and develop the new Carbon Capture Technology journal and seek other opportunities to publish and promote lower carbon technology information relevant to oil and gas;
- assess options (including website development) for sharing case studies and facilitating knowledge transfer on lower carbon technology within IChemE;
- evaluate some of the external guidance available from other organisations and identify potential collaborative efforts;
- be an advocate for technological development and policy changes whilst providing competent, independent and scientific based input to government and other organisations based on chemical engineering expertise, and consistent with our commitment to net zero carbon and the UN Sustainable Development Goals.

By 2024, in line with IChemE strategy, the institution will work with members to:

- grow awareness understanding of climate and sustainability issues, and lower carbon technologies for engineers in the oil and gas sector;
- establish relevant training and CPD to support the energy transition in partnership with others;
- promote lower carbon technologies through journals and external events;
- provide access to technical guidance on relevant lower carbon technologies and practices, and evaluation methodologies;
- assess the available guidance and consider whether the IChemE could add to or enhance the body of material (for example, developing guidance on enhancing existing facilities).

Beyond 2024 the Institution will work with members to:

- assess the impact / output of the plan over the previous multi-year cycle and identify future focus areas to try and maximise impact by the membership of the IChemE;
- feed into the IChemE development of strategy beyond 2024.

Note: Any opinions are those of the authors and do not necessarily represent those of IChemE.