energy institute

Technical + Innovation

Scientific and Technical Advisory Committee
2022 Review of the Technical and Innovation Programme

Adding value in the transition to net zero

Contents

A year of collaboration delivering support for the energy transition

I am delighted to welcome you to the Energy Institute's summary of good practice work in 2022. This is my first year Chairing the Energy Institute's Scientific and Technical Advisory Committee (STAC), and I have been struck by the breadth, the relevance and the value the Energy Institute's technical guidance has for the energy industry. The guidance developed through the year is the result of a truly collaborative effort across members, academia, regulators and wider stakeholders. A programme of work devised by the industry, for industry, with the purpose of facilitating a safe, sustainable and efficient transition to a low carbon world.

Collaboration has never been so important as we witness increasing integration of technologies across a diverse and complex energy landscape. I want my time as STAC Chair to see us focus on broadening and diversifying engagement in the technical work of the EI, whether that be by attracting and involving new entrants in the transitioning energy market, or building engagement with existing partners, or diversifying engagement with young professionals, or those working across all global regions. My focus will be on ensuring we tell our story better, and in linking the work of STAC with wider activities across the EI in attracting and equipping the workforce needed to underpin the journey toward net zero.

Lisa Rebora FEI, STAC Chairperson and Senior Vice President of Emerging and Future Business, Equinor

Collaboration has never been so important as we witness increasing integration of technologies across a diverse and complex energy landscape.

Accelerating the transition to net zero

The work of STAC lies at the heart of the Energy Institute and resonates across all of our wider activity, whether that be through events and conferences, our training programme or through our work to equip a global workforce with the skills needed for the transition to net zero. I am immensely grateful to all of our technical partners and members who enable us to undertake this important work on their behalf. We cannot do what we do without your support. I'd like to impress on any company addressing the transition, however large or small, the value of technical membership in the EI, the value of collaboration with peers, and the value that comes from contributing to, and benefitting from this great work .

Nick Wayth CEng FEI FIMechE, Chief Executive at the Energy Institute

I'd like to impress on any company addressing the transition, however large or small, the value of technical membership in the EI, the value of collaboration with peers, and the value that comes from contributing to, and benefitting from this great work .

Partners

ROI

For every £1, $1 or ¥1 invested in EI membership, 50 comes back in added-value impact. We add value by saving lives, mitigating risk, strengthening licence to operate, improving efficiency, bolstering reputation, developing people, and forging the organisational capabilities needed for the energy transition.

energy institute

Technical + Innovation

The Energy Institute exists to:

Create a better energy future for our members and society by accelerating a just global energy transition to net zero

Our focus is on

Attracting, developing and equipping a diverse, visionary and ingenious energy workforce

Informing decision making on energy related issues by convening expertise and advice

Enabling energy to be more sustainable, lower carbon, safer and more efficient

Examples of ways the EI Technical and Innovation Programme is helping to achieve this

Researching and analysing competency and skills requirements for transitioning to a hydrogen based energy system.

Developing a Human Performance Learning Pathway training and qualification for the Energy Sector.

Developing a training syllabus for flow measurement engineers, working in partnership with the Institute of Measurement and Control.

Harnessing the expertise across members and collaborating globally across a wide range of stakeholders, regulators and academia.

Drawing on the EI's 20,000 individual members and using the expertise of over 200 company members.

Supporting activity across more than 100 technical committees and expert forums.

Publishing good practice across a range of topics through the work of STAC.

Generating and sharing trusted guidance and resources to steward our rapidly changing sector towards a safer, lower-carbon future.

Collaborating globally and sharing expertise.

Giving members a voice in the future of the global energy sector and providing opportunities to participate in setting the industry benchmark.

The following pages summarise our achievements in 2022

Our value to net zero

In an uncertain and challenging time of fundamental change, the EI is playing a proactive and leading technical role in accelerating the energy transition to net zero. We are already delivering the technical guidance and resources, and building the capabilities, our industry and society need in order to change quickly, safely and in a just way. This is so much more than just an intention – we are in the thick of delivering the resources and expertise the industry needs, right now.

energy institute

Technical + Innovation

The year in numbers

54
technical publications issued, equivalent to
one per week

Over 50
presentations of EI technical work delivered at third party stakeholder conferences and events

53000
different users of tool box, one every ten minutes

27
test methods published

30
technical workshops

Over
20,000
downloads across
100
countries world wide

Our role

The EI is the independent custodian of technical and innovation expertise for the global energy sector.

We are the memory and the voice of our industry, generating and sharing objective, authoritative and trusted guidance and resources and stewarding our rapidly changing sector towards a safer, lower-carbon future.

energy institute

Technical + Innovation

2022 spotlight

2022 saw our work continue to evolve in three key areas

Carbon capture, utilisation and storage >

Power systems >

Hydrogen >

Carbon capture, utilisation and storage

Addressing scientific and technical challenges to facilitate CCUS deployment globally.

Facilitating the expansion of carbon capture and storage operations

Key highlights:

- Published ground-breaking guidance on modelling the impact of impurities on flow dynamics for CCUS fluids. This work is essential in supporting CCUS operations across industrial clusters by helping to reduce uncertainty in the transportation of CO2.
- The guidance includes a review of equations of state used in commercially available software and looks at their limitations, specified mixtures, pressure and temperature ranges and impurities, with recommendations to support flow assurance analysis.

'For CCUS engineers working in thermodynamics and fluid modelling, the report offers the most complete reference document available.'

– Dr Eduardo Luna-Ortiz (Pace) Chair Flow Assurance work group

Forward programme

Our focus in 2023 and beyond will include:

- updating existing guidance on Hazard Analysis and Good Plant Design.
- developing guidance to facilitate the transport of CO2 through pipelines, including repurposing of pipelines and new pipeline design.
- building understanding on running ductile failure and fracture propagation for onshore and offshore pipelines transporting CO2 and developing good practice on how to calculate propagation accurately and reduce uncertainty and design pessimism.

Throughout our aim will be to engage a wide range of stakeholders to capture and develop knowledge and address the technical challenges that need to be overcome to facilitate global CCUS deployment.

Published in 2022

Review of equations of state and available experimental data for carbon capture and storage fluids >

Hydrogen

Working with stakeholders to better understand and address technical challenges and to facilitate deployment of a hydrogen economy.

Understanding and addressing technical challenges to facilitate deployment of a hydrogen economy

Key highlights:

- Issued guidance on demonstrating the safety case for the production, transportation and storage of hydrogen, ensuring clarity on compliance with existing regulations, addressing gaps in knowledge and providing examples of safety cases for real world projects.
- Finalised research and analysis on competency and skills requirements for transitioning to a hydrogen based energy system. This has highlighted the urgent need for recruitment due to an aging workforce and upskilling requirements within industry.
- Determined the hazardous area zone extents for liquid hydrogen releases, to protect the safety of workers by reducing the risks posed by explosive atmospheres at facilities handling or storing liquid hydrogen.
- Hosted a workshop to explore the '*Future Direction of the EI Hydrogen Programme*' discussing key regulatory, technical, stakeholder engagement and people (public) challenges facing industry.
- Hosted two further workshops to engage stakeholders addressing *'emerging issues around the import/ export of hydrogen and its derivatives'* and *'techno-economic issues facing industry around conversion to hydrogen compression'*.

Forward programme

Our focus in 2023 and beyond will include:

- Understanding the Health, Safety, Security and Environment (HSSE) issues associated with large scale use of ammonia and methanol in maritime transport fuel as well as transported commodities.
- Providing guidance on green energy production, guidance on the design, construction, operation and maintenance of green hydrogen production plant, and co-location of green hydrogen production with renewable plant (being delivered under the Power Systems programme).
- Hosting webinars to disseminate knowledge on energy balance and efficiency of hydrogen value chains, safety case development and asset integrity in repurposing natural gas infrastructure.
- Addressing broader industry issues around 'incident data' availability for hydrogen and ammonia to assist in safety case development .
- Engaging stakeholders both within the UK and internationally to understand the range of challenges faced by companies integrating into the hydrogen space and how such challenges can be resolved.

Published in 2022

EI Research report: Review of directives/ regulations relevant to the safe and environmentally compliant production, transportation and storage of hydrogen >

Research report: Application of life cycle assessment methodology to the understanding of the energy balance and efficiency of hydrogen value chain building blocks >

Research report: Literature review of asset integrity in repurposing existing natural gas infrastructure for hydrogen >

Power systems

Working with global stakeholders to facilitate the transition to a low carbon power system.

Decarbonising power generation

Key highlights:

- Developed guidance on large scale solar photovoltaic (PV) systems to facilitate a safe and rapid role out for large scale solar power plant.
- Published a report on repurposing used electric vehicle batteries for grid-scale electricity storage, reducing the environmental impact of battery disposal and mining for raw materials.
- Published guidance to help companies select, manage and engage with contractors during major projects – including contractors building new generating plant and co-locating renewable and storage technologies.
- Reviewed the comparative sustainability of energy storage technologies, including batteries, compressed air, pumped hydro, and thermal storage.

Forward programme

Our focus in 2023 and beyond will include:

- Guidance for gas-fired power station operators assessing readiness to accept blends of 20-100% hydrogen.
- Guidance on green hydrogen production – design, operation, maintenance, and co-location with generating plant.
- Hosting a series of seminars for the energy from waste and biomass sectors, and updating our guidance on safe biomass handling.
- Establishing a Safe System of Work group for the power sector.
- Updating guidance on arc flash risk assessment and continued work on safe and efficient operation of solar PV systems and energy storage systems.

Published in 2022

Battery storage research report: Using second-life electric vehicle batteries for stationary storage >

Engaging contractors: Partnership approaches to improving safety in the power industry >

A year in review: our work areas

- Ageing and life extension >
- Aviation fuel handling >
- Corrosion management & asset integrity >
- Environment >
- Fuels distribution >
- Health >
- Human factors >
- Hearts & Minds >
- Toolbox >
- Tripod >
- Hydrocarbon management >
- Offshore wind (G+) >
- Onshore wind (SafetyOn) >
- Process safety >
- Test methods standardization >
- Correlation schemes >

Ageing and life extension

Championing age and life extension and asset integrity management for structures and structural components.

Supporting the global industry with a focus on structures, rotating equipment, the influence of the (extreme) offshore environment, the negative impacts of climate change, and corrosion under insulation (CUI).

Championing climate resilience

Key highlights:

- Published new guidance for structural integrity management of decommissioned offshore structures in 'Lighthouse Mode'.
- Published new Performance Standards for Structural Critical Elements.
- Published new guidance on the management of hazards associated with vessel impact on offshore structures.
- Developed guidance to support deferral decision making for asset integrity management.
- Developed new guidance considering asset integrity management for the critical area of any offshore structure, the 'Splash Zone'.
- Developed new guidance on ageing and life extension (ALE) for offshore structures supporting wind turbines.
- Hosted MetOceaN – a forum for the global industry to address asset integrity management in context of extreme environmental loading of Offshore Energy Structures.
- Hosted NSeaREUN a forum that provides a platform for operators to discuss rotating equipment in the offshore environment.

Forward programme

Our focus in 2023 and beyond will include:

- Providing a platform for EI members and the global industry to address ALE and Asset Integrity Management (AIM) for Offshore Energy Structures and structural equipment.
- Developing new guidance for performance based design/assessment for age and life extension in offshore structures– to publish early 2023. This work will feed into work to assess the findings of an industry JIP (LOADS) for operator integrity management strategies and then initiating further work comparing the approaches of LOADS with AWARE.

Published in 2022

Guidance for the structural integrity management of decommissioned offshore structures in 'lighthouse mode' >

Performance standards for structural safety critical elements >

Guidance on the management of the hazard of vessel impact with offshore structures >

Corrosion management & asset integrity

Corrosion is estimated to cost companies, and nations, around 2-4% of annual turnover. The Corrosion Management and Asset Integrity Committee leads research and guidance development to help the global industry achieve the estimated 25% in cost savings possible through appropriate and proactive management.

Corrosion and wider Asset Integrity Management

Key highlights:

- Published new guidelines on managing corrosion of subsea structures (including pipelines), effectively a subsea 'sister' document to the existing overarching 'surface' guidance.
- Published new guidance on applying a Cost-Benefit Analysis for asset integrity management.
- Published a second edition of the widely used *Guidelines for the management of coatings for external corrosion protection.*
- Published new guidance addressing use of non-metallics in the offshore oil and gas industry.
- Published new guidance on applying cathodic protection to offshore energy structures, covering oil and gas installations and offshore wind turbines.
- Developed new guidance on asset integrity management of offshore wind turbines.
- Developed new guidance for asset integrity management for LNG operations and guidelines on use of polymer based repair compounds in integrity management.
- The Corrosion Under Insulation Network and Forum continued to bring the industry together to explore key issues and successfully expanded into regular meetings with colleagues in Norway.

Forward programme

Our focus in 2023 and beyond will include:

- Providing a platform for EI and the global industry to address Corrosion Management and Asset Integrity for Offshore Energy Structures and Operations.

Published in 2022

Guidance for subsea (including pipelines) corrosion management >

Handbook for valve integrity management >

Guidance on cost-benefit analysis for asset integrity: Cost-benefit analysis for repair and rectification of identified inspection anomalies >

Guidelines for the assessment of ageing and life extension of non-metallic components in the offshore oil and gas industry, volume 1: subsea flexible pipes and offshore marine hoses >

Guidelines for the assessment of ageing and life extension of non-metallic components in the offshore oil and gas industry, volume 2: composite equipment and repairs >

Guidelines for the management of coatings for external corrosion protection >

Design and operational guidance on cathodic protection of offshore structures, subsea installations and pipelines >

Aviation fuel handling

Working with global aviation fuel quality/handling specialists to develop and maintain EI resources that underpin the safe and efficient handling of aviation fuels worldwide.

Managing aviation fuel – safety, efficiency and quality – from refineries to aircraft worldwide

Key highlights:

- Published EI Standard 1533 *Quality assurance requirements for semi-synthetic jet fuel and synthetic blending components (SBC)* to remove potential technical barriers in supply chains to the widescale deployment of 'sustainable aviation fuel'. EI 1533 sets the global benchmark for quality assurance.
- Published a comprehensive study of GHG emissions associated with aircraft fuelling (applicable to commercial hub and regional airports) and the likely impact of emission reduction strategies. The work sets out decarbonisation pathways – highlighting significant lifecycle reductions achievable with the use of HVO (short term) and electric hydrant dispensers/refuellers (short to mid-term).
- Published a second edition of EI 1588, the qualification specification for water barrier filters, to enable first-article qualification of a larger range of cartridge diameters to cover all aircraft fuelling applications (including rotary aircraft and General Aviation).
- Completed a significant evaluation of a proposed aircraft fuelling filtration technology, concluding that it would be inappropriate to develop a qualification specification for it.
- Updated EI 1535 *Minimum criteria to determine acceptability of additives for use in multi-product pipelines co-transporting jet fuel* and issued publicly for stakeholder review.

Forward programme

Our focus in 2023 and beyond will include:

- Commencing work to update EI/JIG Standard 1530 *Quality assurance requirements for the manufacture, storage and distribution of aviation fuels to airports*, soliciting global input to the revision process. All stakeholders are invited to participate.

Published in 2022

EI 1533 Quality assurance requirements for semi-synthetic jet fuel and synthetic blending components (SBC) >

EI Research Report: Reducing GHG emissions from aircraft refuelling >

EI 1588 Laboratory tests and minimum performance levels for aviation fuel water barrier filters, 2nd edition >

EI Research report: Electrostatic charging tests for aviation fuel filter/water separators (FWS) >

Environment

Bringing experts together to minimise the potential environmental impact on receptors from the production, generation and consumption of energy.

Supporting the transition to a low carbon and sustainable future for all

Key highlights:

- Developed guidance to quantify greenhouse gas (GHG) emissions related to soil and groundwater management activities, providing industry with a standardised methodology as reduction in emissions becomes an increasingly high priority for companies, governments, and society in general.
- Developed guidance with the Environment Agency to help fuel storage facilities meet European Sustainability Goals and to explore environmental aspects of renewable technologies.
- Developed an animation to raise awareness of the net zero emissions future, demystifying net zero terminology used in monthly KPI reports, promoting a net zero philosophy and culture and to provide guidance on changes that can result in reduced energy consumption and emissions.
- Developed guidance on how to implement a circular economy and sustainable business models to maximise the potential to reduce emissions and contribute to net zero targets.
- In partnership with CONCAWE, progressed research on waste-to-fuel feedstock markets to better understand availability of feedstocks that could help Europe to decarbonise fuel production processes and reach a net zero economy by 2050 within the concept of a circular economy.

Forward programme

Our focus in 2023 and beyond will include:

- Continuing support for the Global Methane Pledge agreed at COP26 to drive action to reduce methane emissions, developing an extensive database of global engagement on methane, capturing data on geographic location, value-chain impact and KPIs for measuring success and developing a recommended practice for methane detection and quantification.
- Developing guidance on design and manufacturing for offshore wind operations to maximise environmental performance and circularity.
- Assessing the environmental impacts of the large-scale deployment of hydrogen value chain encompassing production, distribution, storage, and utilisation.
- Convening an exploratory workshop to understand knowledge and gaps associated with ammonia and methanol, both as a marine transport fuel and cargo.

Published in 2022

Waste to products – technology and economic assessment Phase 1 >

Best available techniques (BAT): Good practice for the oil and gas industry >

Our difference

The EI's purpose to create a better energy future for our members and society is lived through our open and collaborative approach to global sharing of comprehensive, objective expertise. As a non-commercial organisation, we bring the whole energy industry together in a network of trust to share knowledge solely for the greater good of the industry.

energy institute

Technical + Innovation

Fuels distribution

Ensuring the fuel supply chain continues to operate efficiently and safely from refinery to forecourt. The committee consists of senior safety representatives from all aspects of the supply chain along with representatives from industry trade associations.

Supporting the fuels value chain

Key highlights:

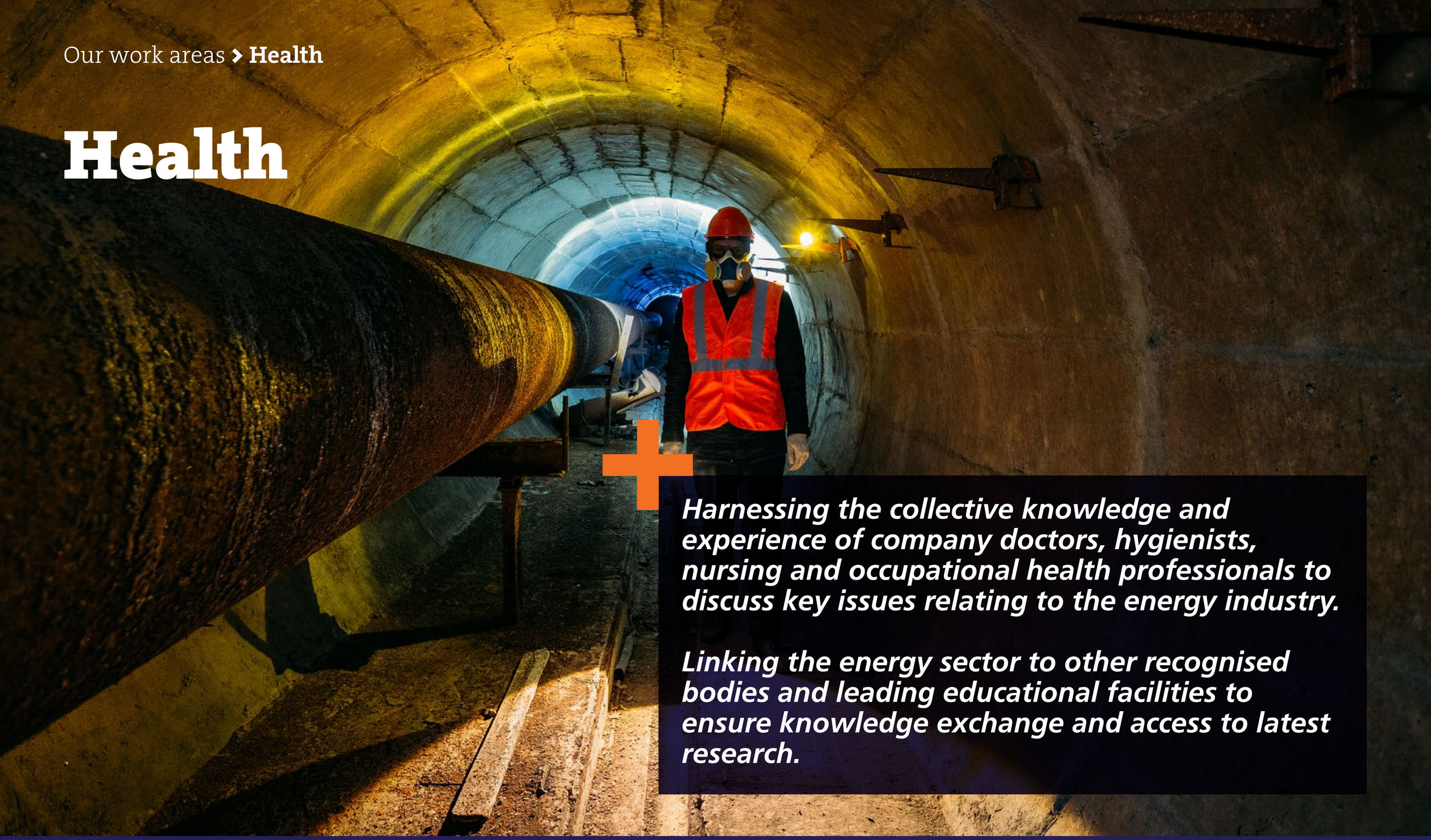
- Providing a forum for operators to engage with key stakeholders, including the UK Health and Safety Executive, environment agencies and petroleum enforcement agencies.
- Developing guidance on the *"Investigation into the risk and impact associated with non-diesel fuel engine vehicles, by type, whilst entering or working within hazardous storage locations"*.
- Worked with a wide range of stakeholders to establish the development plan for preparation of a new edition of *Design, construction, modification and decommissioning of petrol filling stations*.

Forward programme

Our focus in 2023 and beyond will include:

- A review and development of guidance on "Design, construction, modification and decommissioning of Petrol Filling Stations". This guidance is produced collaboratively with the Association for Petroleum and Explosives Administration (APEA) and looks to include transitional fuels including hydrogen and electric vehicles.

Health



Harnessing the collective knowledge and experience of company doctors, hygienists, nursing and occupational health professionals to discuss key issues relating to the energy industry.

Linking the energy sector to other recognised bodies and leading educational facilities to ensure knowledge exchange and access to latest research.

Protecting worker health

Key highlights:

- Worked with the wind industry to identify key occupational health hazards during the construction of wind farms. This will inform the development of a guidance document in 2023.
- Finalised Phase 1 of *Investigation into exposures associated with diesel engine exhaust emissions from fixed and mobile installations and equipment used across the energy industries*. This provides a reference methodology for the assessment of diesel exhaust emissions.
- Continued work to provide a framework approach and good practice guidance on mental health and wellbeing, addressing some of the most pressing, and newly emerging issues around mental health.
- Some preparatory work was also done in support of a 2023 literature review on the burden of occupational respiratory disease in the energy industry.

Forward programme

Our focus in 2023 and beyond will include:

- A review of respiratory health surveillance methods, to assist occupational health professionals in establishing a respiratory health surveillance programme that ensures employees receive the appropriate surveillance for different work-related exposures.
- Developing *Guidance on selection and deployment of wearable technologies for occupational health and exposure monitoring*.
- Completing the final phase of *Investigation into exposures associated with diesel engine exhaust emissions from fixed and mobile installations and equipment used across the energy industries*, to collect work and living space exposure monitoring data and to develop a risk-based methodology for health assessment of the dangers these emissions pose, and development of appropriate management strategies. This work will inform future decisions on what, if any, workplace exposure limits may be required.
- Work with the HSE on a research study on low-dose benzene exposure assessment, supporting the regulator in defining benzene occupational exposure levels in the United Kingdom and the European Union.
- Continuing to provide a focus on health aspects of the energy transition.

Managing human performance

Hazardous industries rely on human performance to improve safety and reliability. EI develops resources on how people interact with plant, processes and each other, addressing fatigue, ergonomics, staffing levels, task analysis, and learning.

Managing risk by supporting human performance

Key highlights:

- Developed a Human Performance Learning Pathway training and qualification for the Energy Industry – collaborating with the Chartered Institute of Ergonomics and Human Factors (CIEHF). This includes a free introductory e-learning element.
- Developed *QUESTOR: Question-sets for understanding and evaluating socio-technical organisational resilience*, a practical tool to benchmark organisations against the contributing causes of major incidents. Collaborated with Bristol and Bath Universities.
- Undertook research into how we can integrate human factors into energy transition projects, to avoid costly redesigns and incidents caused by poorly designed systems and plant.

Forward programme

Our focus in 2023 and beyond will include:

- Developing a handbook on human factors design standards – helping organisations make sense of pertinent standards for key equipment and plant items.
- Developing a human performance foundation course – including videos and e-learn materials to support competence in managing human performance.
- Developing guidance on using human error probabilities in quantitative risk assessment.

Published in 2022

Research report: Human factors guidance and checklists to improve procurement of goods and equipment >

Guidance on quantified human reliability analysis (QHRA) >

Learning before incidents: What we can learn from understanding variation in performance >

Guidance on ensuring control room operator (CRO) competence >

Human Factors Handbook for Process Plant Operations: Improving Process Safety and System Performance >

Hearts & Minds: Driving cultural change through better safety behaviour and performance

Hearts & Minds is a toolkit to help organisations improve their safety culture by involving the workforce in improving the way health, safety, and environment (HSE) is managed.

Key highlights:

- EI-funded research continued at Aberdeen University into cognitive bias and the normalisation of risk.

Forward programme

Our focus in 2023 and beyond will include:

- Forming a Safety Culture Sub-Committee to continue to develop the Hearts and Minds tools and resources to help organisations develop their safety cultures.

https://heartsandminds.energyinst.org/

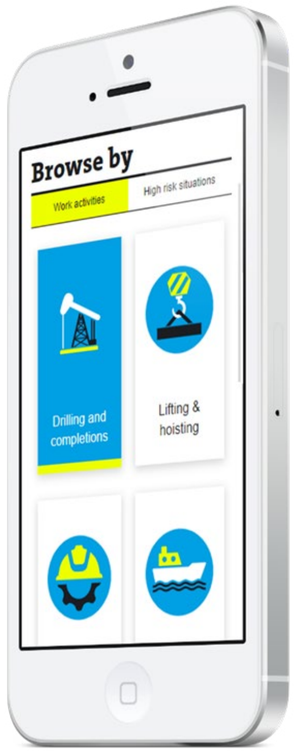
Toolbox: Sharing lessons from incidents across industry

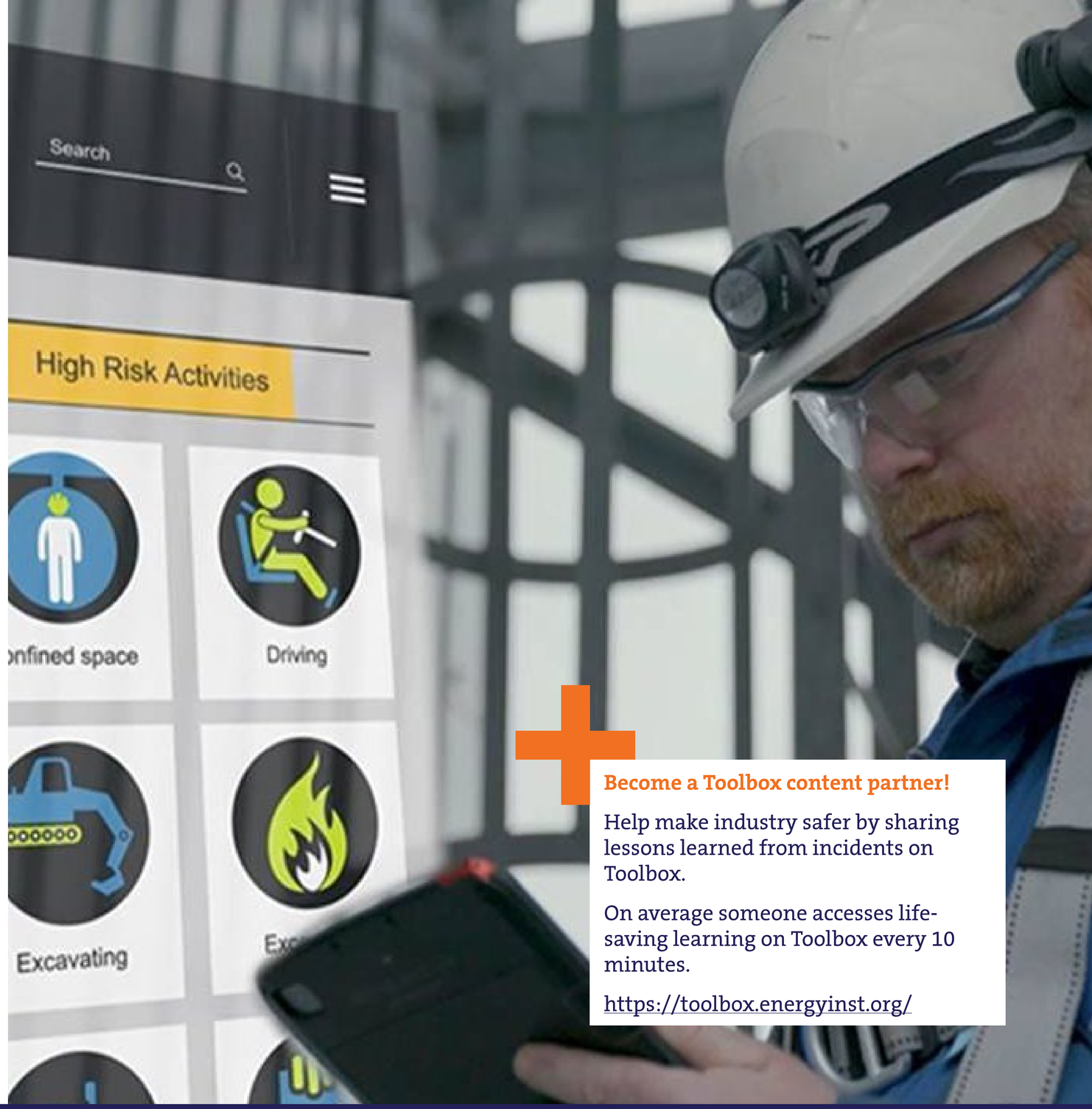
Toolbox is a free to use web app delivering just in time learning to frontline operators and supervisors. Containing over 500 learning resources and available in 10 languages.

Key highlights:

- 81 new learning resources, including 40 new videos, added to Toolbox in 2022.
- Translated 150 learning resources into Chinese, French, German, Japanese, Portuguese, Malay, Russian, Spanish. Over 400 learning resources now available in these languages.
- European Process Safety Centre (EPSC) is now a Toolbox content partner.
- Toolbox user base grew 24% in 2022, with over 53,000 different users.

toolbox





Become a Toolbox content partner!

Help make industry safer by sharing lessons learned from incidents on Toolbox.

On average someone accesses life-saving learning on Toolbox every 10 minutes.

https://toolbox.energyinst.org/

Tripod: Supporting organisational learning

The Tripod Foundation leads a growing community of Triopd practitioners and trainers. With the Energy Institute we provide thought leadership and tools to improve how organisations learn from, and prevent, incidents

Key highlights:

- *Investigation insights: A toolkit for leaders and investigators*. New toolkit launched to help leaders to get the most out of accident investigations, and to make remedial actions effective.
- *Tripod lite* – developed and piloted a brand new, free to use, accident investigation tool, requiring minimal training. This aims to make accident and near miss reporting more consistent, higher quality, and better for organisational learning.

Forward programme

- Developing a short, online training course to help companies roll-out Tripod Lite to frontline workforce.

Published in 2022

Tripod Lite >

Investigation insights: A toolkit for leaders and investigators >

Investigation insights – Tool 1: A leader's role >

Investigation insights – Tool 2: An investigator's role >

Investigation insights – Tool 3: Better insights workshop >

Investigation insights – Tool 4: Better learning outcomes >

Your logo here!

Your voice as a member

EI technical membership gives organisations a real voice in the future of the global energy sector. It provides unique opportunities to actively participate in setting the industry benchmark, to learn from peers and to forge relationships with other leading organisations and stakeholders.

Hydrocarbon management

Working with global measurement and fuel handling specialists to develop and maintain a portfolio of EI guidance to safely and efficiently manage products the across industry.

Measurement – the essential tool for management

Key highlights:

- Established a new work group for sampling alternative fuels, including ammonia, hydrogen, and methanol.
- Developed guidance on measurement and inspection of liquid nitrogen gas cargoes.
- Developed a training syllabus for flow measurement engineers, working in partnership with the Institute of Measurement and Control. This will help engineers understand the concepts of dynamic measurement.
  The framework of this syllabus has been applied to the English Apprenticeship scheme to produce the basis of the level 5 Apprenticeship ST0283; *Senior Metrology Technician*.
- Established a number of measurement work groups aimed at supporting the measurement aspects of the transition. This includes work to support measurement for cargo inspection and transportation of new and alternative fuels.
- Published guidance on volume correction factors by velocity of sound to support more accurate accounting and better loss control when correcting ambient measurements to standard conditions for trade accounting and loss control purposes.
- Published guidance on laboratory test methods for the determination of density, water content and sediment content for use in the quantity measurement of crude oil and residual fuel oils.

Forward programme

Our focus in 2023 and beyond will include:

- Continuation of our engagement with global stakeholders – via the Asian Region Sub-Committee, American Petroleum Institute (API) and International Organisation for Standardisation (ISO) – the EI provides the secretariat for ISO Technical Committee 28 / Sub-Committee 2 – *Measurement of petroleum and related products*.

Published in 2022

HM4 – Manual level measurement for hydrocarbon liquids – 3rd Edition >

HM7 – General guidance on test methods for density, water and sediment determination 3rd edition >

HM 70/API Manual of petroleum measurement standards chapter 17.6 – Guidelines for determining the fullness of pipelines between marine vessels and shore facilities 3rd Edition >

HM1901 – Liquid hydrocarbon measurement – Volume correction factors by velocity of sound >

Guidelines for a training syllabus – Flow measurement engineer's course >

Process safety

Enabling effective process safety management to prevent and control major accident hazards, thereby protecting workers, the public, the environment, and assets.

Prevention and control of major accident hazards

Key highlights:

- Published *High level framework for process safety management*, 2nd edition, which provides enhanced guidance on how to implement the framework across a company/organisation.
- Developed an animation on *Guidelines for offshore oil & gas installations that are not permanently attended*.
- Completed *Guidance on critical equipment and plant operator fire and blast protection risk reduction options for existing bulk petroleum and fuels storage installations* – Phase 2. Publication is expected in Q1 2023.
- Completed HSE-EI research into flammable mists hazards (a.k.a. MISTS2).
- Published *Model code of safe practice Part 19: Fire precautions at petroleum refineries and bulk storage installations*.
- Developed existing creeping change hazard identification methodology process safety threats and their management in the context of extreme weather due to climate change.

Forward programme

Our focus in 2023 and beyond will include:

- Continuing efforts to adapt key process safety publications to the needs of the energy transition.
- Continuing development of Lloyd's Register-funded work on the structural integrity management of offshore oil and gas platforms during decommissioning.
- Development of new guidance on management of technical change.
- Undertaking research into the conduct of remote hazard studies.
- A research study into how contractual arrangements impact the standing of process safety.
- Revising guidelines for the avoidance of vibration induced fatigue failure in subsea systems ('Subsea AVIFF guidelines') to 2nd edition.

Published in 2022

High level framework for process safety management, 2nd edition >

Research report: The assurance of liner integrity during tank floor works on above-ground storage tanks holding petroleum, petroleum product or other fuels >

Test method standardization

Developing analytical test methods for hydrogen, ammonia and methanol as transport fuels and for use in power cells, as well as maintaining the portfolio of methods critical to existing petroleum products.

Standardizing low carbon sustainable fuels analysis

Key highlights:

- Supported the transition through development of test methods using readily accessible, infra-red technology, to measure trace amounts of contaminants in hydrogen that may affect fuel cells.
- Developed work to enable synthetic aviation fuel (SAF) to be safely combined with existing fuels in larger quantities, by developing precision methods for the newly published IP-PM-FC, a test method to measure the permittivity of synthetic aviation fuels using a small-scale automated instrument.
- Published an updated kinematic viscosity test method (IP 71 and ISO 3104) supporting the use of renewables (biofuels) in road and marine fuels.
- Underpinned existing operations by publishing the 2022 edition of the 'Standard Test Methods' books (3 vol set) that included 16 methods that were new or significantly amended in this edition.
- Further studies on IP 630, a test method to measure the amounts of abrasive particles that can contaminate diesel fuel and lead to the early failure of modern high pressure injection systems. Incorporation of the test method into the UK specification for diesel fuel.

Forward programme

Our focus in 2023 and beyond will include:

- Continued work to support the uptake of transition fuels through development of testing methods for fuel quality.

Published in 2022

IP 71: Section 1: Petroleum products – Transparent and opaque liquids – Determination of kinematic viscosity and calculation of dynamic viscosity >

IP 630: Determination of the concentration of dispersed particles in diesel fuel – Automatic Particle Counter (APC) Light Obscuration Method >

Correlation schemes

The EI runs a well-established and globally recognised suite of testing schemes, participation in which is critical to optimise operations by correcting biases and drift in analytical measurements.

Engine Correlation Scheme (ESC)

The Engine Correlation Scheme (ESC) is specifically aimed at laboratories determining the Research Octane Number (RON), Motor Octane Number (MON) and Cetane numbers of gasoline and diesel fuels.

These laboratories may be using the traditional single cylinder engines to determine the RON, MON, and Cetane numbers or more modern alternative instruments, the scheme caters for all types.

In 2022, over 40 laboratories worldwide received the same set of fuels to test, distributed on a monthly basis, with their data correlated with other scheme participants by the EI and anonymously reported each month.

The report gives the mean RON, MON and Cetane values for the fuels and tells each laboratory how far they are away from the mean using a Z score metric. This allows them to benchmark against peers.

RON, MON and Cetane number are vital parameters in the trading of fuel, with small biases in their measurement at any location potentially leading to a "giveaway" resulting in significant financial implications for the operator.

The EI Proficiency Testing Scheme (EI PTS)

With over 70 laboratory participants worldwide in 2022, the EI PTS is one of the largest such schemes available. Laboratories received monthly samples of gasoline, diesel, jet fuel and fuel oil. Participants had the option to take over 90 different tests on these fuels, addressing specifications and important physical and chemical properties.

Each laboratory receives a bespoke report which not only contains the Z score for each test for benchmarking but also other statistical metrics including standard deviation and method reproducibility.

The reports also contain graphs which show long term trends for each test they have conducted allowing, for example, instrument drift to be spotted.

The reports are used to demonstrate to management, customers, and auditors that the laboratory processes are under control and are essential evidence for accreditation to international standards such as ISO 17025.

Analysis of the data generated by the scheme is used by the EI, CEN and ISO standardization bodies to monitor how their standards are performing in all laboratories and over a long period of time.

Meeting energy demand

The world needs hydrocarbon energy sources to keep society functioning normally through the energy transition and to support funding for the development of low-carbon technologies. Our work underpins continued safe and efficient oil and gas industry operations and, critically, helps minimise their greenhouse gas emissions.

energy institute

Technical + Innovation

Offshore wind (G+)

G+ is the global health and safety organisation for the offshore wind industry, bringing together business leaders, health and safety experts and organisations operating in offshore wind. It works in partnership with the EI and is committed to promoting and maintaining the highest possible health and safety performance.

Driving world class health and safety performance in offshore wind

Health and safety statistics

The backbone of the work. All G+ members provide their health and safety incident data for all their offshore wind farm sites across the world, from development to decommissioning stage. Data are analysed by the EI to monitor performance and trends and identify risks. This is the evidence base for the G+ work programme.

Good practice guidelines

Driven by the incident data and drawing on knowledge and expertise from G+ members, subject matter experts, academia, regulators, and industry stakeholders.

Examples in 2022 include Good practice guidelines for hazard identification in floating offshore wind projects, and publishing a case study and video to provide a detailed ergonomics assessment and identifying the key risks to technicians associated with ladder climbing.

Safe by design workshops

Held a workshop addressing transfers to/from floating offshore wind structures, as well as access and egress within the turbine and materials handling, to review the current design controls and potential failures, identify opportunities for improvement and demonstrate the potential for risk reduction throughout the lifecycle of a floating offshore wind farm.

Incident Learning

Sharing learnings from incidents is a key pillar of the G+ and is delivered through Toolbox. Learnings from incidents contained within Toolbox play a key role in identifying the G+ workstreams.

Forward programme

Our focus in 2023 and beyond will include:

- Topics such as floating wind and capability assessments for offshore wind technicians, as well as improving and building on our process for data collection and incident analysis and learning. Work will also continue to engage the offshore wind industry globally, in particular building on activity already established in the US and Asia Pacific region.

Published in 2022

Case Study and Video: LADDER CLIMBING: A Detailed Ergonomic Assessment >

Floating offshore wind hazard identification, 1st edition >

Improving compliance workshop: basic lifting operations, 1st edition >

G+ 2021 incident data report, 1st edition >

Onshore wind (SafetyOn)

SafetyOn is the health and safety organisation for the onshore wind sector ensuring transparency on performance, promoting good practice and assisting in mitigating key emerging risks through cooperation and shared learning. SafetyOn works in partnership with the Energy Institute.

Leadership in health and safety for a dynamic and innovative onshore wind industry

Key highlights:

- Incident data gathering and reporting through SafetyOn provides a comprehensive view of health and safety incidents across the industry, enables sharing of learning and ensures transparency across the membership and with stakeholders. The data informs the development of good practice and the wider work of SafetyOn.
- The Wind Turbine Safety Rules are a model set of rules and procedures to help formalise a safe system of work to manage the risks associated with a wind turbine, both onshore and offshore. They have been developed by wind farm owners and operators for the purpose of achieving both general safety and safety from the system – a process that safeguards persons from the mechanical plant and LV apparatus and the associated system derived hazards.

Forward programme

Our focus in 2023 and beyond will include:

- Guidance development on topics such as electrical safety: hierarchy of control and competence, safe management of life extended wind turbines, and the role out of an awareness campaign to assist with mitigating hand injuries.

https://safetyon.com/work-programme#active

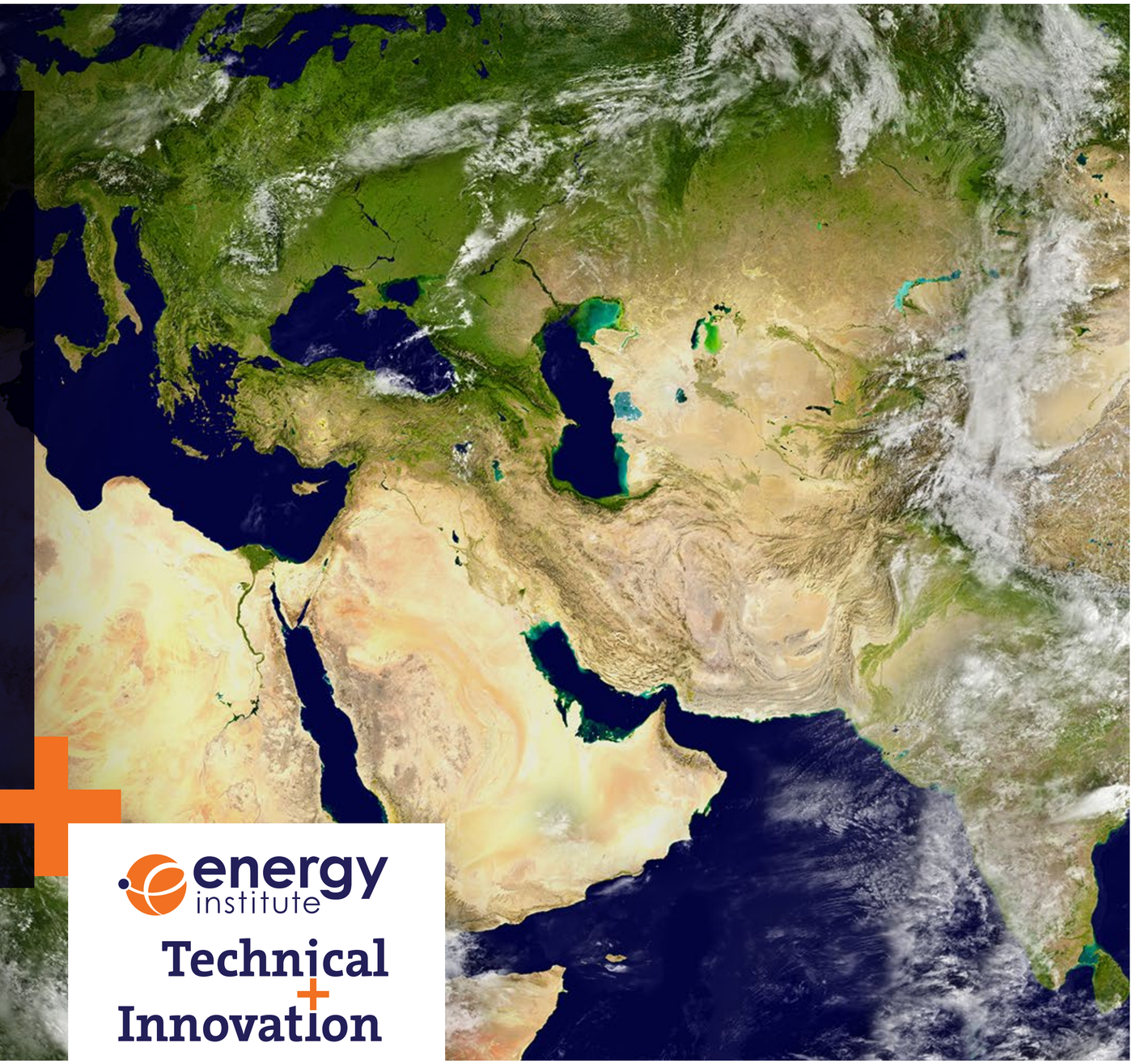
Published in 2022

2021 Onshore Wind Health and Safety incident data report >

Wind turbine safety rules >

Global reach

In setting the technical benchmark for the energy sector, we mobilise the diverse perspectives and voices of stakeholders from around the world. The global input we receive ensures our resources can be adopted worldwide. Our consistent technical and innovation expertise supports all countries and operators to embed safer, more efficient and more sustainable operations.



energy institute

Technical + Innovation

Be part of something amazing

The achievements highlighted in this report show the benefit of collaboration between our technical partners, regulators, trade bodies, academia and wider stakeholders. The opportunity to work with others and share intellectual resource and learn from the wider experience of peers is a powerful driver for membership of the Energy Institute. Nothing in this report would be possible without the support of our technical members, project sponsors and committee volunteers. On behalf of my colleagues at the EI, I would like to thank all for their support and commitment throughout 2022. For those of you in organisations that are not currently technical partners of the EI (page 5), with experience to offer across any of the topics included in this report, please do get in touch to discuss the benefits of engagement with the EI.

To find out more and be involved, contact

Martin Maeso, Technical and Innovation Director
mmaeso@energyinst.org

'The opportunity to work with others and share intellectual resource and learn from the wider experience of peers is a powerful driver for membership of the Energy Institute.'

energy institute
Technical + Innovation

Published in 2022

Aviation

EI Research report: Electrostatic charging tests for aviation fuel filter/water separators (FWS)

The quality of aviation fuel available in the United Kingdom Annual survey 2016-2017

EI 1533 Quality assurance requirements for semi-synthetic jet fuel and synthetic blending components (SBC)

The quality of aviation fuel available in the United Kingdom Annual survey 2015

EI 1588. Laboratory tests and minimum performance levels for aviation fuel water barrier filters

EI Research Report: Reducing GHG emissions from aircraft refuelling.

Asset integrity

Design and operational guidance on cathodic protection of offshore structures

Guidance on cost-benefit analysis for asset integrity: Cost-benefit analysis for repair and rectification the of identified inspection anomalies

Guidelines for the assessment of ageing and life extension of non-metallic components in the offshore oil and gas industry, volume 1: subsea flexible pipes and offshore marine hoses

Guidelines for the assessment of ageing and life extension of non-metallic components in the offshore oil and gas industry, volume 2: composite equipment and repairs

Guidance on the management of the hazard of vessel impact with offshore structures

Guidelines on managing microbiologically influenced corrosion (MIC) in Water Injection Systems

Guidelines for the management of coatings for external corrosion protection

Guidance for subsea (including pipelines) corrosion management

Performance standards for structural safety critical elements

Guidance for the structural integrity management of decommissioned offshore structures in 'lighthouse mode'

Handbook for valve integrity management for the upstream and downstream Industries

CCUS

Review of equations of state and available experimental data for carbon capture and storage fluids

Electrical safety

Investigation into the degradation of Ex ‘e’ enclosures manufactured from glass reinforced polyester/polymer (GRP)

Guidelines for managing ignition risk by inspection of Ex electrical equipment in hazardous areas (including support of IEC 60079-17)

Environmental

Waste-to-products – Economic and technology assessment (Phase 1)

Best available techniques (BAT): Good practice for the oil and gas industry

Human factors

Learning before incidents (animation)

Research report: Human factors guidance and checklists to improve procurement of goods and equipment

Published in 2022

Guidance on ensuring control room operator (CRO) competence

CCPS/EI Human factors handbook for process plant operations: Improving process safety and system performance

Guidance on quantified human reliability analysis (QHRA)

Investigation insights: A toolkit for leaders and investigators (1st edition) (developed by the Tripod Foundation)

Hydrocarbon Management

Guidelines for a training syllabus – Flow measurement engineer's course

HM 70/ API Manual of Petroleum Measurement Standards Chapter 17.6: Guidelines for determining the fullness of pipelines between marine vessel and shore facilities

HM 7. General guidance on test methods for density, water and sediment determination in crude oil and residual fuel oils

HM 4. Manual level management measurement for hydrocarbon liquid

HM 1901. Volume correction by velocity of sound

Hydrogen

Research report: Literature review of asset integrity in repurposing existing natural gas infrastructure for hydrogen

Research report: Application of life cycle assessment methodology to the understanding of the energy balance and efficiency of hydrogen value chain building blocks

EI Research report: Review of directives/regulations relevant to the safe and environmentally compliant production, transportation and storage of hydrogen

Microbiology

Guidance on the use of biocides in the oil industry

Offshore Wind

G+ Safe by Design Workshop Report: Blades access, repair and maintenance

Traditional Mandarin translation – G+ Global Offshore Wind Health and Safety Organisation Brochure

German translation – G+ Global Offshore Wind Health and Safety Organisation Brochure

G+ incident data 2021 report

G+ Improving compliance workshop: basic lifting operations

G+ Floating offshore wind hazard identification (HAZID)

Case Study and Video: LADDER CLIMBING: A Detailed Ergonomic Assessment – Raising awareness of key risks and issues and referring to the research report published in 2019 – Resource/Video

Offshore safety

Model Code of Safe Practice Part 17: High pressure and high temperature (HPHT) well planning, control, completions and interventions

Published in 2022

Onshore wind

SafetyOn 2021 Incident data report

HAND INJURY CAMPAIGN – SafetyOn Hand Injury – YouTube – Video

SafetyOn 2022 Stakeholder Day Presentation – PowerPoint Presentation (safetyon.com)

https://safetyon.com/work-programme/statistics

https://www.energyinst.org/industry/wind-turbine-safety-rules

https://safetyon.com/work-programme#publications

Petroleum storage and distribution

Back into service checklist

Research report: The assurance of liner integrity during tank floor works on above-ground storage tanks holding petroleum, petroleum product or other fuels

A site operator's guide to electric vehicle charging equipment at filling stations

Investigation into the risk and impact associated with non-diesel fuel engine vehicles, by type, whilst entering or working within hazardous storage locations (Phase 2)

Power generation

Engaging contractors: Partnership approaches to improving safety in the power industry

Minimal staffing and lone working: ensuring employee safety and wellbeing

Battery storage research report: Using second-life electric vehicle batteries for stationary storage

Process safety

High level framework for process safety management

Research report: Modelling toxic hazards of sour water releases – consolidated knowledge of sour water releases physics and chemistry

Standard Test Methods

IP Standard Test Methods for analysis and testing of petroleum and related products, and British Standard Parts. 2022

IP 627/22 Determination of cloud point – Automatic stepwise cooling method.

IP 635/22 Determination of composition of refinery heating gas and calculation of carbon content and calorific value – Gas chromatography method.

Tripod

Tripod Lite

Investigation insights: A toolkit for leaders and investigators

Investigation insights - Tool 1: A leader's role

Investigation insights - Tool 2: An investigator's role

Investigation insights - Tool 3: Better insights workshop

Investigation insights - Tool 4: Better learning outcomes