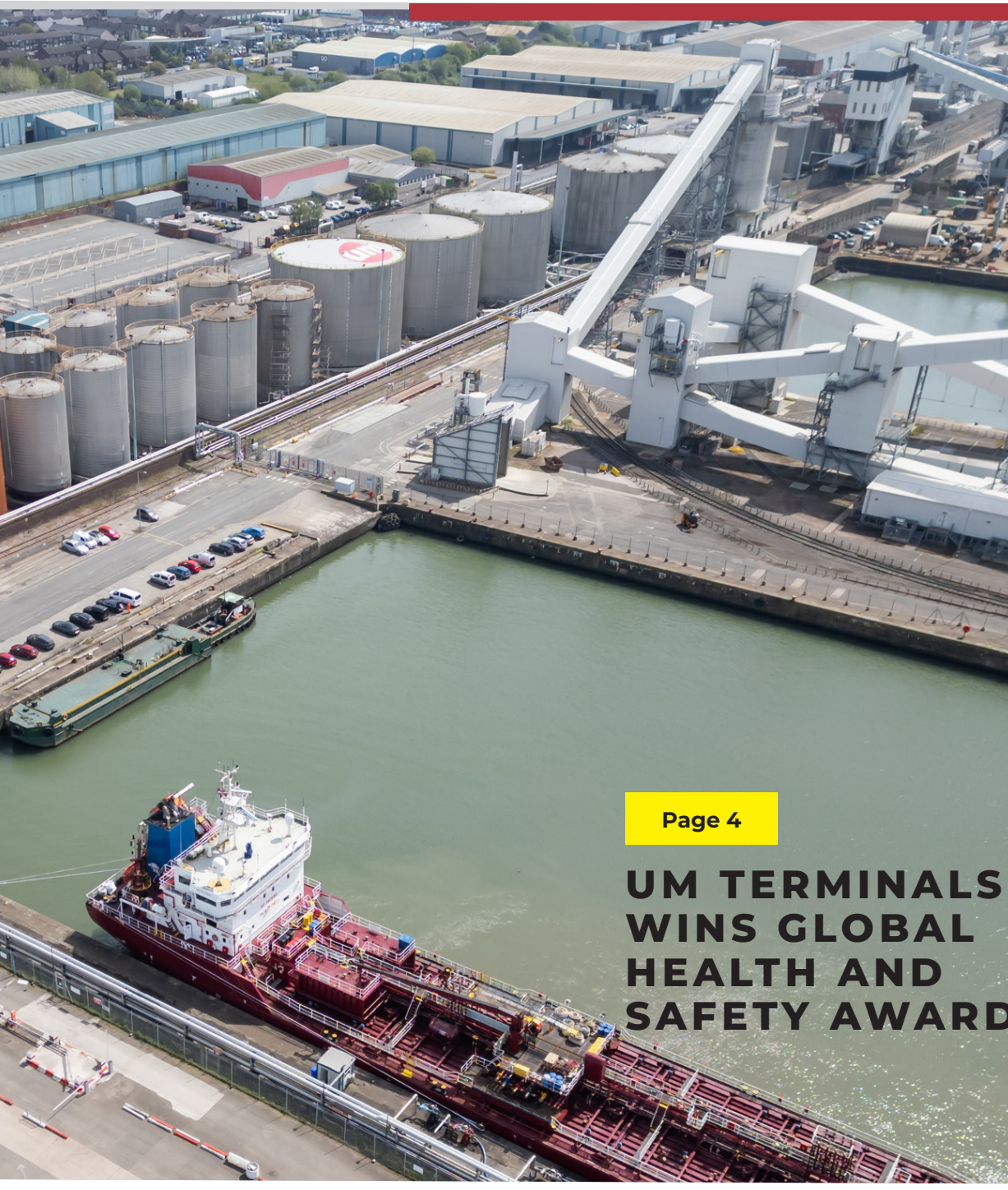
Issue 23 Autumn 2025

INSIGHT



Tank storage provides an essential interface between sea, road, rail and pipeline logistics.

Page 4

UM TERMINALS WINS GLOBAL HEALTH AND SAFETY AWARD

The quarterly magazine from the Tank Storage Association

Also in this issue, we examine the latest sector insights and highlight the innovations shaping the future of bulk storage and energy infrastructure.

Insight is published by the Tank Storage Association, the voice of the UK's bulk storage and energy infrastructure sector.

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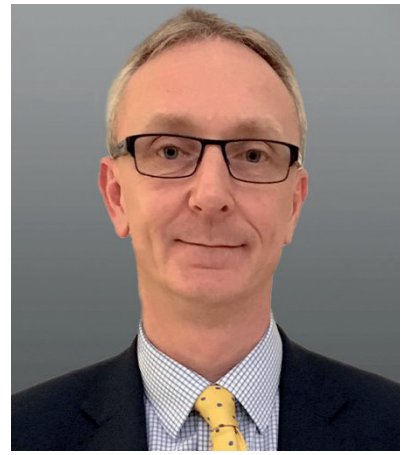

Peter Davidson
Chief Executive, TSA

Welcome to the autumn issue of Insight. In this issue, we feature the recently published Annual Review of the bulk storage and energy infrastructure sector, now in its tenth edition. The publication continues to provide a comprehensive overview of our industry, presenting a broad range of statistics and valuable insights on terminals, process safety, occupational health and safety, and the sector's contribution to the UK economy. It also highlights the trends shaping the sector today and underscores its vital role in driving economic growth, enhancing energy security and resilience, and supporting the transition to net zero. We also shine a light on the proactive steps the sector is taking to unlock new opportunities, as well as the latest projects and innovations shaping its future. I hope you enjoy this new edition of the magazine.

Contents

UM TERMINALS WINS GLOBAL HEALTH AND SAFETY AWARD

UM Terminals, the bulk liquid storage specialist, has won a prestigious Gold Award in this year's RoSPA Health and Safety Awards.

Rebecca Broughton-Lee, EHS Manager, UM Terminals

UM Terminals, the bulk liquid storage specialist, has won a prestigious Gold Award in this year's RoSPA Health and Safety Awards.

Achieving Gold, the highest level possible, comes just a year after the company won a Silver Award – the first time it had entered the awards.

The awards celebrate companies globally which have demonstrated a commitment to health and safety excellence.

Rebecca Broughton-Lee, UM Group's EHS Manager, who oversaw the application, said: "To go from Silver to Gold in the space of a year is a fantastic achievement and recognition of the hard work put in by everyone across our sites in Liverpool, Hull and Portbury. We had to provide detailed submissions and supporting documentation looking at the many different areas of our safety management system. This included how we manage occupational health, risk management, training and our safety record over the preceding 12 months. RoSPA is such a prestigious name in the health and safety industry, and I am delighted that UM Terminals has been recognised with this Gold Award."

Vic Brodrick, UM Terminals' Managing Director, said: "Achieving the RoSPA Gold Award provides external verification that the health and safety processes and systems we have in place within the organisation are of the highest possible standard. Progressing from Silver last time to Gold in 2025 also, importantly, highlights our commitment to the ongoing development and enhancement of these systems."

Now in its 69th year, and with almost 2,000 entries annually from over 50 countries, covering over seven million employees, the RoSPA Awards are the world's largest health and safety awards programme, recognising those organisations and individuals who have set the highest standards in accident prevention.

Julia Small, RoSPA's Growth Director, said: "UM Terminals should be proud of the hard work and commitment to keeping people safe that has resulted in a RoSPA Award, which honours those organisations who have achieved the highest standards in health and safety in the workplace. RoSPA regards UM Terminals as a strong example of the importance of making accident prevention central to any successful organisation, not just for the benefit of employees,

customers and clients, but also society as a whole."

Sponsored by the National Examination Board in Occupational Safety and Health (NEBOSH), the RoSPA Awards scheme is the longest running of its kind in the UK, and receives entries from organisations across the globe, making it one of the most sought-after achievement awards for the health and safety industry.

Dee Arp, NEBOSH Chief Quality Officer and the Head Judge of the RoSPA Awards, said: "These awards serve as a powerful reminder that employee safety and wellbeing transcends borders and looking after our people, so they can go home safe, healthy and happy every day, also drives sustainable success and resilience."

About UM Terminals

UM Terminals provides storage facilities for a wide range of products including vegetable oils, industrial, food and feed, chemical, fertiliser, fuels, biofuels and base oils. UM Terminals' UK facilities are strategically situated at deep water ports with easy access to major road networks.

For more information, please visit www.umterminals.co.uk

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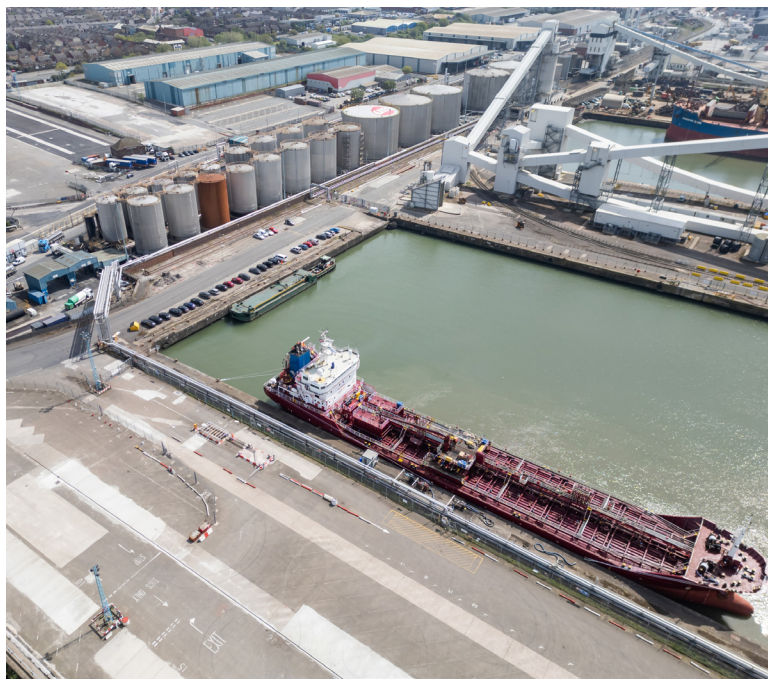


ANNUAL REVIEW OF THE BULK STORAGE AND ENERGY INFRASTRUCTURE SECTOR

The bulk storage and energy infrastructure sector is the pulse of our day-to-day life, facilitating the efficient movement of a wide variety of products from producers to end-users.

The bulk storage and energy infrastructure sector plays a critical role in complex supply chains by providing storage and logistics solutions for a wide range of substances including animal feed and foodstuffs, chemicals, transport and heating fuels. In the journey to Net Zero, the sector also has a key role to play in providing logistical solutions for energy carriers such as hydrogen, liquid organic hydrogen carriers, methanol, ammonia, low carbon and renewable fuels, as well as CO_2 as part of carbon capture and storage plans.

Against the backdrop of an increasingly volatile geopolitical landscape, terminals and tank farms enhance and contribute to supply chain resilience by providing flexibility to meet demand, especially during periods when domestic supplies of stored products cannot be guaranteed. Around twenty-two of the terminals operated by Tank Storage Association (TSA) members in the UK are designated by the Government as Critical National Infrastructure (CNI) due to their importance in providing energy to industrial, transport and defence markets.

Storage capacity also includes strategic reserves held for emergencies and supply disruptions.

The Tank Storage Association has recently published its tenth Annual Review of the sector. The publication offers a comprehensive overview of key statistics and valuable insights covering terminals, process safety, occupational health and safety, as well as the sector's contribution to the UK economy. This year's review continues to feature a dedicated section on global tank storage assets. It presents data on international expansions and construction projects, regional capacity and market share as well as regional throughput data in collaboration with Insights Global, an independent market research organisation.

Terminals may store either single or multiple products within the same facility and can also offer a range of additional services such as blending, heating, product treatment and analysis, warehousing, and bonded facilities for duty-suspended goods. According to the latest data contained in TSA's Annual Review, terminals in the Middle East have the highest average capacity per facility compared to other regions. In the Middle East, the average capacity per terminal is ~395 kcbm. Asia ranks second with 209 kcbm and North America ranks third with ~195 kcbm.

The average capacity per terminal in Europe is ~160 kcbm. In addition, a significant number of storage projects have been announced globally, with the majority of planned investment concentrated in Asia (17,584 kcbm, accounting for 39% of the total), followed by North America (7,074 kcbm or 16% of the total), the Middle East (6,466 kcbm or 14% of the total), and Europe (5,247 kcbm or 12% of the total). Asia also leads in terms of tank storage capacity currently under construction, followed by North America and Europe. Other regions have less capacity under construction, ranging between 0% and 4%.

Globally, there are also 163 terminal expansion projects currently underway, with the majority taking place in Asia, which accounts for 57% of the total (27,332 kcbm). This is followed by North America with 14% (6,903 kcbm), the Middle East with 12% (5,856 kcbm), and Africa with 11% (5,242 kcbm). In comparison, expansion activity in other regions, including Europe, ranges between 0% and 4% of the total.

Adding up all capacity projects under construction, under expansion or planned, the main growth area is Asia, more than doubling its storage capacity.

In the UK, the bulk storage sector generated over £5 billion in revenue in 2024 and planned investment over the next five years is estimated at around £1.5 billion. TSA members operate 290 terminals and distribution hubs across the UK. Collectively, TSA members have around 14.7 million cubic metres of storage capacity. Well over 500,000 cubic metres of storage capacity is used for low emissions fuels including biofuels, methanol, ammonia, liquid organic hydrogen carriers (LOHCs) and sustainable aviation fuels (SAF). Looking ahead, this figure is projected to rise, reflecting the tank storage sector's key role in the UK's journey toward Net Zero.

TSA members also safely execute over one million movements each year for a range of products. By far the greatest number of movements is carried out by road tanker. However, this is not representative of the volume of product moved by type. For example, there are far fewer movements by ship than road tanker, but the volume of product moved by ship is much higher. In 2024, around 30 million tonnes of product were moved by coastal shipping and around 18 million tonnes by road haulage. Around 3 million tonnes of product were moved by rail and 22,763 tonnes by barge. In addition, a number of TSA members own and operate pipeline networks across the UK. Pipeline throughput reported by TSA member companies in 2024 was well over 19 million cubic metres (this figure excludes regasified LNG). During the same period, the sector had an aggregated throughput of just over 61 million tonnes.

The tank storage sector continued to maintain very high standards of occupational safety during 2024, remaining one of the safest industries in the UK with proportionally fewer injuries than almost all other sectors. Process safety standards continue to be very high, with only two Tier 1 events, and no Tier 2 events reported when measured against the API RP 754 standard. TSA's dedicated Safety, Health and Environment Committee works closely with peers, other industry sectors and regulators to share knowledge and good practice relevant to safe operations.

To monitor performance and highlight potential emerging issues, the TSA collates, shares and discusses process safety and occupational health & safety data quarterly with members. It uses the API RP 754 standard for its process safety performance indicators as well as its own leading indicators. The TSA is also leading and contributing to several strategic and technical working groups in the COMAH Strategic Forum (CSF), the Process Safety Forum, the Chemical and Downstream Oil Industries Forum (CDOIF) and the Energy Institute (EI).

The 2025 Annual Review of the bulk storage and energy infrastructure sector can be found on the Tank Storage Association's website at www.tankstorage.org.uk

20 YEARS OF NAVIGATING HAZARD COMPLIANCE

Former marine apprentice hits major milestone with growing business entrusted to deliver in the most critical of environments.

F.E.S. ATEX SPECIALIST & ELECTRICAL CONTRACTORS

Specialist industrial services provider F.E.S. (EX) Ltd is celebrating 20 years in business as it continues to build its ever-expanding team to shape up for an even stronger future.

The hazardous area consultancy and electrical contractor was launched by Geoff Fulcher in 2005, with the founder now sitting as chair of a 50-strong firm turning over more than £5 million.

Managing director James Ward, commercial director Elle Fulcher-Fenty and finance director Martin Jackson make up the senior leadership team, with three key appointments made two years ago as the forward-thinking operation consolidated in anticipation of further growth. It is now eyeing future industrial markets as it builds on its widening offering across installation, engineering, inspection and process safety disciplines. And with training arm Roxby also hitting £1 million turnover for the first time, and a major new self-developed software roll-out looming, there is much to celebrate. Key to the development has been the founder embracing the opportunity to go further and have faith in the team, where safety, quality, integrity and honesty are at the core.

"I never envisaged it would become this," Geoff said of those early days, proud of the firm's development having taken a step back to chair the company and allow the next generation to thrive when the key roles were defined. "I could perhaps see six or seven of us being the team, but when Martin (Jackson) came on board there was a realisation of what could be achieved, and we grew from there. We pride ourselves on the personal service, and when it comes to business, we thrive when that approach is taken by both sides."

People are indeed at the fore of a process-driven technical operation, where recruitment remains live with demand for electricians and engineers. "One of the biggest highlights for me has been watching how people have come into the company, and really grown," Geoff, an Energy Industry fellow, said. "I've seen it with 'newbies', experienced hires and with family members [Elle is his daughter], and for all of them to come in and care for the company in the same way as I do, has been tremendous. I say a big thank you to them for that."

F.E.S. (EX) Ltd was launched after a period working in contracting management and consultancy, having initially served as an apprentice marine electrician.

F.E.S. (EX) Ltd's senior leadership team, from left, James Ward, Managing Director; Geoff Fulcher, Chair; Elle Fulcher-Fenty, Commercial Director and Martin Jackson, Finance Director.

Launched from a tiny windowless office in Cleethorpes Business Centre, with Geoff having a young family to support, it grew significantly in the managed workspace before branching out to its own substantial unit on the Wilton Road Industrial Estate, where it continues to enhance operations.

Competency in explosive atmospheres specialist, Roxby Training Services was acquired a decade ago, with Humber and Teesside bases, with F.E.S. (EX) then launching another office in Saltend, near Hull, to serve the North Humber Bank, while adding a North East hub too. Further highlights have seen process safety brought into the business, having previously relied on external resources, while self-developed software has propelled its operations, with ExTrace® – F.E.S. (EX)'s own paperless inspection system, about to have a major upgrade take it into its second decade. Strong marketing, wider digital and cyber investments are also being made to ensure it stays at the fore and is future-proofed.

Third party audit support has also emerged as a key revenue stream, supporting leaner client teams to deliver at the most vital of times to meet regulations or address issues.

Elle said there was immense pride in the client base with heavy industrial/manufacturing, energy, water and defence all key sectors.

A notable recent win has been with the world's largest wind turbine monopile factory on the Tees, with the business completing a hazardous area installation for spray booths. Fuel storage distribution, anaerobic digestion and fibre production are all ongoing. And while the business is a specialist in process industry settings, underscoring its growth from its Humber bank origins, it has also worked in Formula One and the cruise ship industry. Looking to the future, the likes of carbon capture and hydrogen are going to be increasingly important, and we have the technical capability to deliver on that too," she said.

Contributing to safer industry standards has also been a feature, with F.E.S. (EX) imparting its expertise as part of the CompEx Technical Advisory Council, Energy Institute and Tank Storage Association. It plays its part in the communities it recruits from too, with Cleethorpes Town FC and Hull Dockers ARLFC supported.

Launched prior to the biggest recession in many a lifetime, F.E.S. (EX) has weathered some of the most dramatic economic periods ever known.

James added: "We've seen industry come back stronger from Covid, and we're seeking to make continuous improvements, ensuring we have the right procedures in place so we can confidently keep growing and looking forward."

For more information, please visit www.fes-ex.com

FUEL FILTRATION & POLISHING: ENSURING BACKUP POWER FOR COMAH REGULATED SITES

FSS showcases its industry-leading fuel polishing systems and maintenance programmes.

Fully automated 50l per minute duplex fuel polisher install with timers fitted to 18,500 litre fuel tank

Fuel quality: the hidden risk in emergency power systems

For large oil storage terminals and other high-risk industrial facilities, power reliability is not a convenience, it is a legal and operational necessity. Under the COMAH (Control of Major Accident Hazards) Regulations, certain industrial sites are required to have robust backup power systems, including standby diesel generators and/or uninterruptible power supplies (UPS), to mitigate the consequences of major incidents.

But there's a catch: backup power is only as reliable as the fuel it runs on. Diesel fuel stored on-site for extended periods can degrade, becoming contaminated with water, microbial growth, and sediment. When emergency strikes and the generator is called into action, poor fuel quality can prevent it from starting, or worse, cause it to fail during operation.

At FSS, we understand the stakes. That's why we have developed and implemented advanced fuel filtration and polishing systems in safety critical power infrastructure across utility, critical service providers and storage terminal sites, ensuring clean, reliable fuel is always available, in full compliance with BS 5410 and SAE J1488_202411 standards.

COMAH compliance starts with reliable fuel

COMAH regulations demand that operators of major hazard sites take all measures necessary to reduce the risk of major accident hazards and their consequences. This includes ensuring critical safety systems such as emergency generators, UPS units, and emergency fire pumps can function correctly in all expected environmental conditions and if there is a loss of utility.

Our fuel management solutions are specifically designed for COMAH-regulated environments, helping sites:

- Maintain 100% generator reliability
- Reduce environmental and safety risks linked to fuel degradation
- Meet stringent fuel storage and maintenance requirements

What is fuel polishing and why does it matter?

Fuel polishing is a proactive maintenance process that circulates and filters stored diesel fuel to remove water, sludge, microbial growth, and particulate matter. Over time, even in sealed tanks, fuel will degrade. This creates risks of clogging fuel lines, damaging injectors, and ultimately

causing generator failure.

Our in-line fuel polishing systems work continuously or on scheduled cycles to:

- Extend fuel shelf life
- Maintain clean, spec-compliant fuel
- Reduce the need for emergency generator repairs or fuel replacement

Built to meet BS 5410-2023 & SAE J1488 standards

At FSS, we've implemented a standardised fuel maintenance programme that complies with:

- BS 5410-2023 – Risk Management for Critical Standby Generators: Focused on ensuring the readiness and safety of backup power systems.
- SAE J1488_202411 – Filtration Standards for Diesel Fuel Water Separation: Ensuring water and particulate contamination are effectively removed.

These standards are central to our approach, ensuring that all stored fuel remains ready for use, especially during power emergencies.

Routine fuel testing: essential to compliance and reliability

To remain COMAH-compliant and maintain reliable backup power:

- Sites with an inline fuel polishing system should test fuel quality every six months
- Sites without fuel polishing systems must test every three months for degradation and contamination

These testing intervals are essential for identifying and correcting issues before they result in generator failure or compliance breaches.

Designed for high-risk, high-stakes environments

As a service provider to bulk liquid storage facilities over many years, we understand the unique risks associated with these environments. Our systems and protocols are tailored to meet the demands of COMAH sites, providing:

- ✓ Assured Compliance with regulatory requirements
- ✓ Enhanced Operational Readiness for power-critical systems
- ✓ Extended Fuel and Generator Life through reduced contamination
- ✓ Reduced Environmental Liability by preventing microbial and water contamination
- ✓ Peace of Mind that when the power goes out, your systems won't

Weather, risk, and the rising need for reliable backup power

The UK is increasingly exposed to extreme weather events, from floods and gales to deep freezes and heatwaves, placing growing pressure on the power grid. For COMAH-designated sites, this means backup power systems are likely to be relied upon more frequently. Recent Environment Agency flood mapping showing flood risk from a 1:1000 year rain event is not just a direct risk to any COMAH site but also a risk to utility infrastructure powering the COMAH sites, a consideration that is likely to be highlighted in Climate Change Adaptation risk assessments.

But many facilities continue to overlook fuel maintenance. Generators are assumed ready, only to fail due to fuel degradation, a critical blind spot that turns into a costly failure when it matters most.

FSS's proactive fuel management strategy removes that risk. We ensure that no matter when an outage strikes, your fuel is clean, compliant, and your generators are ready.

A proven solution for COMAH sites

Our fuel polishing systems are already in use across many critical infrastructure sites. We've seen firsthand the benefits:

- Zero generator startup failures due to fuel issues
- Improved response times during power outages
- Reduced maintenance and fuel replacement costs
- Compliance assurance during COMAH inspections and audits

We offer bespoke installation and support services tailored to the unique operational profiles of large industrial sites. Whether you need a permanent inline system or scheduled mobile

fuel polishing services, we deliver compliant, cost-effective solutions that keep your operations safe and ready.

Take the next step – secure your fuel, secure your site

If you are operating a COMAH-regulated site or any facility with critical safety systems, you can't afford to leave fuel quality to chance.

FSS can support your operations by installing inline filtration and polishing systems. We can help you develop a custom fuel testing schedule, help you meet key compliance standards, including COMAH, BS 5410-2023, and SAE J1488_202411 and keep your fuel – and your generators – ready to perform.

Final thought: power is promise - don't let bad fuel break it

At a COMAH site, every second counts during an emergency. Your generator is your last line of defence. And the only way to ensure it performs is to maintain the fuel it depends on.

With FSS's industry-leading fuel polishing systems and maintenance programmes, you gain more than clean fuel, you gain confidence, compliance, and continuity.

About FSS

With over 40 years of experience in the oil and fuel industries, FSS is a turnkey provider offering complete cleaning, maintenance, and decommissioning services for oil storage terminals. Specialising in product changes, infrastructure maintenance, and decommissioning, FSS provides end-to-end solutions. Its multi-skilled engineers work safely in high-risk environments, delivering cost-effective services for de-sludging, heavy oil resuspension, product recovery, non-man entry tank cleaning, fuel sampling, analysis, and polishing.

FSS also provides pipework chemical cleaning, gas freeing, and safe removal using advanced hot tapping for inspection and product extraction. Additionally, it designs and installs tailored pumping systems for bulk fuel transfers.

For more information, please visit www. fuelspecialistservices.co.uk
Email: info@fuelspecialistservices.co.uk
Phone: 0333 577 0001

Stand-alone automated duplex fuel polisher for install on existing fuel tank

John Songhurst, Training & Compliance Manager, Teamwork Security and Training Services

Teamwork Security and Training Services is proud to welcome John Songhurst to the Teamwork family, stepping into the pivotal role of Training and Compliance Manager. With an impressive and diverse background in both military and civilian security sectors, John brings a wealth of expertise, leadership and insight to the team.

John's journey into security began with the British Army, where he trained as an aircraft technician. His commitment to service and operational excellence led him next to the police force, where he began on patrol and swiftly qualified as a firearms officer, joining a tactical team specialising in high-risk operations.

His dedication to public protection saw him advance further; successfully passing the exams to become a detective. He was subsequently headhunted to join a specialist unit focusing on rape investigations, child protection and vulnerable adult cases, where he served as a trained interviewer. John's career then took him to Special Branch, where he took on vital security duties as a ports officer, working across both airports and seaports.

After a distinguished career in the police, John brought his talents to the private sector, joining Drum Cussac as a security trainer and later rising to team leader for anti-piracy operations. In 2016, he became a Ship Security Officer with Seabourn, managing maritime security while travelling extensively across the globe.

Now, with years of hands-on operational security and investigative experience under his belt, John brings his skills to Teamwork Security and Training Services, where he will lead on training and compliance initiatives, ensuring both excellence and integrity in everything we do.

Welcome aboard John!

Learn more:
www.teamwork-security.co.uk
Email:
enqs@teamwork-security.co.uk
Phone: +44 (0)1752 425424

teamwork security
& training services ltd

LEVERAGING GOOD PRACTICE FOR THE ENERGY TRANSITION

Cairn Risk Consulting (Cairn Risk) joined the TSA in July 2025 to further increase our cross-organisation collaboration and sharing of good practice.

In this article we summarise some key messages on opportunities and challenges for ensuring a safe and sustainable energy transition.

Figure 1 illustrates the pathways associated with the energy transition. Process (i.e. engineered system) hazards can be identified throughout these pathways. The focus of this article is onshore process hazards and in particular Major Accident Hazards (MAH). Process MAH implications are particularly relevant for the following energy transition technologies:

- Hydrogen and hydrogen carriers;
- Battery Energy Storage Systems (BESS);
- Carbon Capture Utilisation and Storage (CCUS); and
- Biofuels.

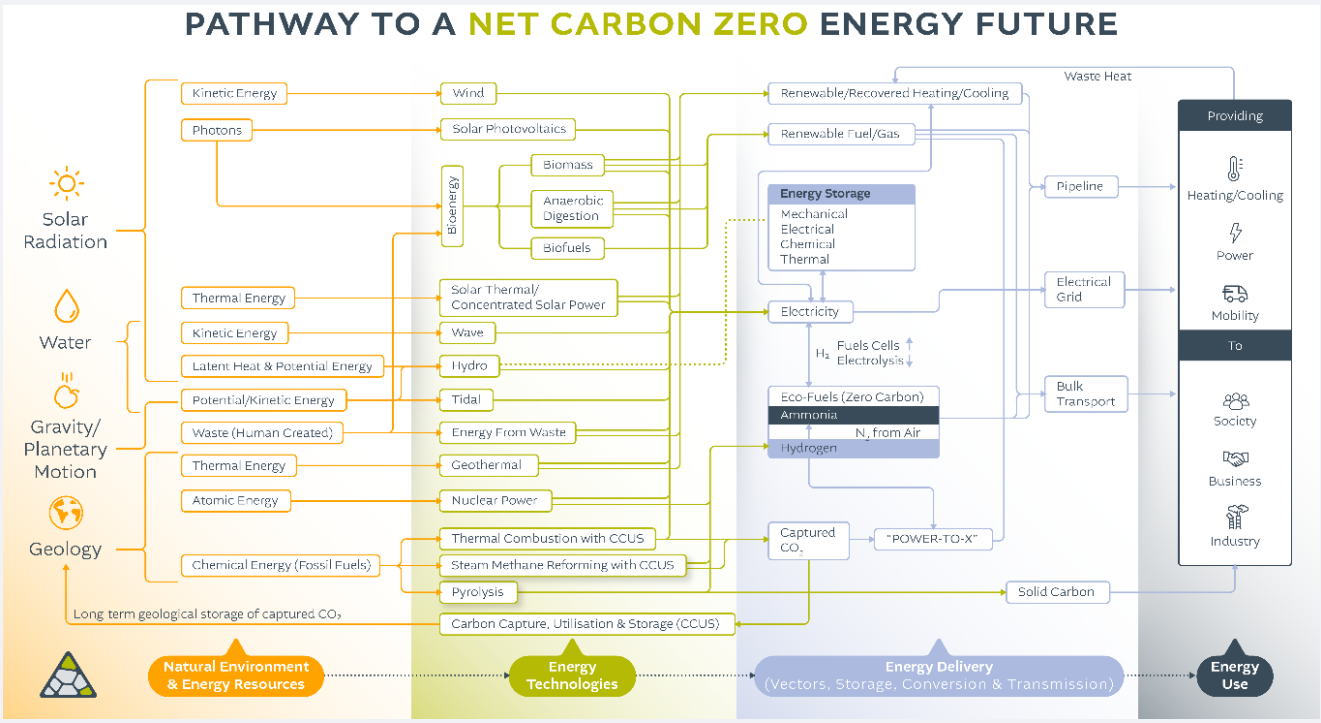
There are limited process hazard implications for the following technologies:

- Hydropower /pumped storage;
- Wind turbines e.g. dropped object hazards and fire safety cases;
- Solar has limited scope and tends to have electrical focussed hazards.

Why is Process Safety relevant?

Process safety is a key enabler for the energy transition and although

Figure 1: Energy Transition Pathways Illustration



there are often limited major hazard related permissioning requirements e.g. under COMAH or Hazardous Substances Consent (HSC); other key stakeholders such as insurers, investors, employees and neighbours, do want assurance that the residual risk has been reduced to ALARP. The major hazard implications of such technologies are relevant for:

- Renewable energy facilities; and
- Existing COMAH Establishments that have such facilities proposed for development within their HSC consultation zones or are developing such technologies themselves.

Learning Points

Case Study Examples

A BESS facility developer approached Cairn Risk for advice when an existing Upper Tier COMAH Establishment objected to their development within the COMAH Establishment's HSC consultation zones. In this case, there are defined and established Land Use Planning (LUP) arrangements to evaluate MAH implications for the existing Upper Tier COMAH Establishment from or to the BESS development.

A BESS facility developer wanted to locate a large BESS facility close to residential housing. In this case, there are limited LUP arrangements defined and established to ensure that MAH implications are identified and evaluated adequately.

A hydrogen refuelling facility developer wanted to increase daily tube trailer deliveries (typically each trailer contains approx. 1 tonne (te) of hydrogen at approx. 380 barg) to avoid exceeding the 2te HSC threshold, which would ensure LUP MAH implications evaluation. The MAH potential is similar whether the hydrogen inventory is 1te or 2te.

Having supported many energy transition projects and clients since our creation in March 2022, we have gained extensive experience of the practical implementation of energy transition technologies.

Key observations and learning points are summarised in Table 1.

Table 1: Summary of Key Observations and Learning Points

Aspect	Observations and Learning Points
Maturity	Many energy transition technologies and the companies implementing them have limited maturity.
Funding	The funding is often heavily reliant on government policy decision and /or grants and this significantly affects when and how companies incorporate process safety within their design and project processes.
Multiple stakeholders	Projects tend to have multiple stakeholders such as developer, technology integrator, engineering contractor, Original Equipment Manufacturers, owner(s), planning advisor and often they work in silos with a lack of a joined up approach.
Regulatory framework	Most developments sit outside the existing MAH regulatory regime and, at most, require an HSC for over 2te hydrogen storage. Therefore, there tends to be a lack of LUP process safety focussed scrutiny and after planning permission is granted, it is assumed by stakeholders that the project can continue rapidly through design into construction. It can be challenging to explain how and why MAH require suitable and sufficient risk assessment and ALARP demonstration outside a clear MAH regulatory framework.
Organisational competence	Many of the developer /operator companies have limited occupational /personal safety competence with no or minimal competence in engineering system hazards and safety.
Package equipment	There is often limited information available for package equipment and this makes it challenging to evaluate their: • Application of inherent safety principles; • Basis of design; • Basis of safety; and interactions with the balance of plant engineering contractor.
Diverse backgrounds	Entrants, companies and their employees, have diverse backgrounds, which can be a benefit or a pitfall depending on the specific situation.
Process safety networks	Trade association representation is fragmented across the renewables sector and, in particular, for technologies such as hydrogen and hydrogen carriers. This has stifled learning and adoption of Relevant Good Practice (RGP) and development of links into established process safety networks.

Aspect	Observations and Learning Points
Risk management tool limitations	There are limitations associated with existing risk management tools such as widely used consequence modelling software. Therefore, such tools must be used with caution and interpreted based on deep understanding of the physical hazards and behaviour of substances during hazardous events.
Migration from offshore oil and gas	Large numbers of people have been and are migrating from the offshore oil and gas sector and are unaware of the status of the onshore regulatory framework, expectations and RGP. This has led to inappropriate application of offshore oil and gas approaches, tools and techniques.
Learning from experience	There is an opportunity for such technologies to learn from mature MAH sector experience, whilst being flexible and adaptable to maximise benefits
Lifecycle approach	Due to various novel aspects when such technologies are implemented, it is essential and critical to understand the project /facility lifecycle. Plus, how planning and permissioning relates to design /project steps and identification and evaluation of associated hazards. Therefore, as for other novel applications, a lifecycle approach to process safety and sustainable design is required, starting at the conceptual design stage.

How is Process Safety applied?

The overall Process Safety Management (PSM) approach for energy transition technologies is the same as for any other MAH application. Therefore, well established tools and techniques, skills and experience are available for effective and successful risk management. These can be summarised by the three questions asked by HSE's Gordon MacDonald post the Buncefield 2005 incident investigation:

1. **Risk Assessment** – Do we understand what could go wrong?
2. **Risk Treatment** – Do we know what our systems are to prevent this happening?
3. **Risk Monitoring** – Do we have information to assure us that they are working effectively?

These three fundamental steps change and develop during the project /design /facility lifecycle. The steps develop in the order of Risk Assessment followed by Risk Treatment and then Risk Monitoring.

To enable energy transition companies, projects and facilities to address the observations and learning points from Table 1, Cairn Risk applies a lifecycle based approach to PSM. This approach structures support provided using the applicable Hazard Study, which comprises tools and techniques selected for the associated lifecycle stage and specific situation:

- **Hazard Study 1** – Conceptual Design;
- **Hazard Study 2** – Basic Design (FEED);
- **Hazard Study 3** – Detailed Design;
- **Hazard Study 4** – Construction;
- **Hazard Study 5** – Commissioning;
- **Hazard Study 6** – Operation;
- **Hazard Study 7** – Decommissioning.

The tools and techniques applied at each lifecycle stage are selected to fulfil the requirements of the PSM model shown in Figure 2.

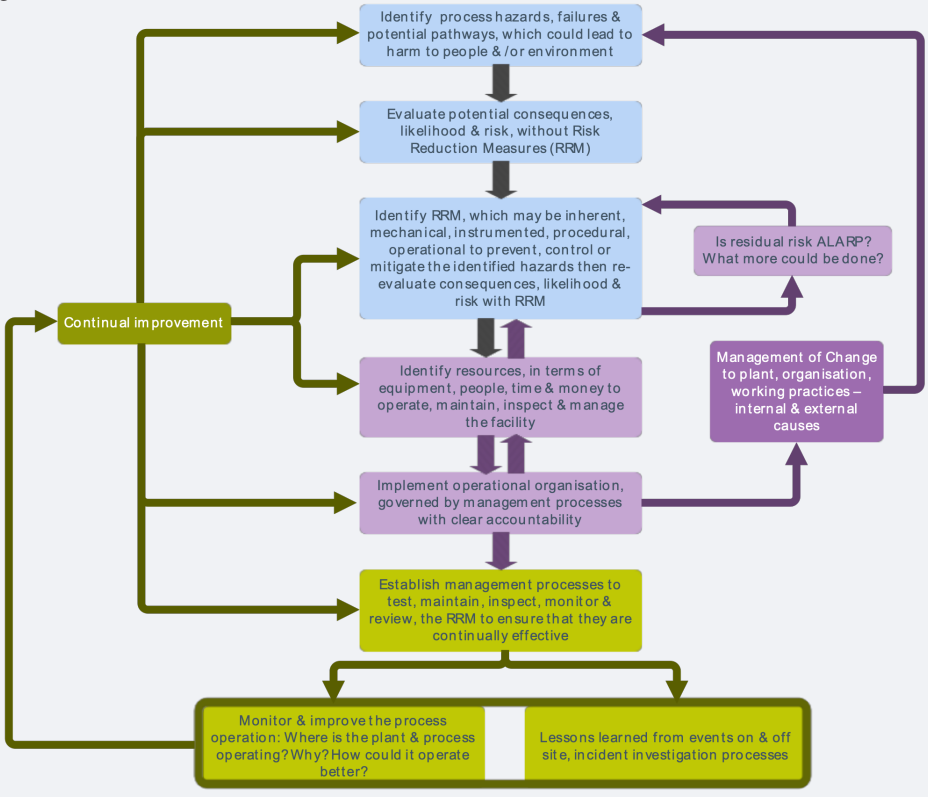
In future articles, we will explore what application looks like in practice for energy transition technologies.

Author: Helen Conlin, Principal Consultant, Cairn Risk Consulting

For more information, please visit: www.cairnrisk.com

CAIRN RISK CONSULTING
Reducing risk for a sustainable future

Figure 2: PSM Model



UM team completes epic Three Peaks Challenge in memory of Melissa

A team from across the UM Group battled tough conditions to successfully complete the Three Peaks Challenge in memory of much-loved former colleague Melissa Bryers (nee Childerley).

Their magnificent achievement helped to raise £30,850 (including £11,675 of match-funding from UM's holding company W&R Barnett and a generous donation from a major customer). The funds raised are sufficient to purchase two 'cuddle beds' for St Michael's Hospice (North Hampshire) where Melissa spent her final days. On top of this, Melissa's family and friends have raised over £17,000 to fund the purchase of a further cuddle bed.

The challenge, which the UM team completed in June, saw them navigate their way up and down the three famous peaks in less than 24 hours – beginning with the ascent of Ben Nevis (1345m), followed by the climb of Scafell Pike (978m) in the Lake District the same evening and Snowdon (1085m) in North Wales in the early hours of Sunday, June 15th. Those taking part included Agnieszka Sriskanthan-Reksa, Harry Lawson, Jake Ellis, Felicity White, Tate France, Lewis Chambers, Jamie Clintworth, Robbie Flynn, Niall O'Donnell, Mark Few, Andrew Creasey and Tom Prior along with support team members Joanne Winning and Bernie Wilson.

Jake, UM Group Asset Integrity Manager and one of the principal organisers of the challenge along with Harry, Agnieszka and Geraldine Carroll, said: "We had set ourselves an ambitious target of £16,000 for a hugely worthwhile cause and in memory of Melissa, who was part of the UM family. All these things help to propel you up the three mountains. It's incredible to think we have ended by raising almost double our target amount. Apart from running the London Marathon, I had never taken on a physical challenge like this. It was ridiculously hard, not just the climbs but also the travel between the different locations and the lack of sleep. Our three mountain leads, led by experienced mountain leader Stuart Beeston, did a great job of keeping us going, even in the face of some horrific weather. Scafell Pike was the worst with sideways winds and a steep gradient from start to finish. By the time we got to Snowdon for the final climb, your legs are spent, and you are feeling groggy. The wind at the summit was intense, but coming down the sun came out which was a great way to finish. Being greeted by the support team with bacon and sausage butties was just what we all needed."

Harry Lawson, an IT Systems Administrator for UM Group, said: "It was the hardest thing I have ever done, but it was a great team effort by everyone involved. Probably the toughest section was trying to get down Scafell in the dark."

Agnieszka, Group Financial Controller, UM Trading & Marketing, commented: "I couldn't make one of our practice climbs before the challenge which was probably a good thing as it might have put me off! Scafell was the toughest moment with the awful weather and steep incline and Snowdon the most enjoyable, being able to savour what we had achieved as a group, take photos and let it all sink in."

Geraldine, Group HR, Training & Office Manager, said: "We are big believers in the importance of working as a team and colleague collaboration and this challenge was an extreme example of this. It's an opportunity for people from different parts of our Group to spend time together, supporting one another and celebrating success together. This was a big commitment for everyone involved in this challenge, giving up weekends to train, fundraising and then the event itself. Once we have had the chance to celebrate this success, we'll be turning our attention to 2026 and our next challenge!"

DRIVING EFFECTIVE RISK MANAGEMENT FROM THE BOARDROOM

Process safety risk management is good for business.

RAS

Safe | Smart | Sustainable

Carolyn Nicholls, Managing Director, RAS Limited

20 years on from the Buncefield incident, one of the key lessons learnt that still resonates with industry today is the importance of leadership in process safety management. The safety culture of an organisation begins at the top. This relationship is well established by the PSLG within the principles of process safety leadership.

Yet, there are still gaps.

There is awareness of the PSLG findings across the chemical and energy sectors - where the lessons learnt from the Buncefield incident are more directly applicable and the incident feels more tangible and relatable. But they are not always thoroughly applied.

Furthermore, there is a lack of awareness of the PSLG principles other sectors within the major accident hazard industry which would equally benefit due to an incorrect assumption that the findings only apply to fuel storage businesses. Sharing and learning good practice across the high hazard sectors is the best way to advance, irrespective of the exact technologies, processes or materials handled. The newly published standard on the business risk management competency for board members of high hazard industries from the Institute of Directors (IoD) and the Process Safety Forum (PSF), promotes this common way of thinking across the wider industry. The standard establishes good practice expectations for board members of businesses with major accident hazards, underscoring the pivotal role they play in managing risks.

For businesses operating high hazard functions, board level decisions will directly influence the management of major accident hazard risks. Hence, this new standard is a welcome addition to promote good practice and to establish the expectations for high hazard businesses.

Competence

For high hazard sites, risk should be a factor in all decision making due to the influence upon the effective management of major accident hazards. Board members must be sufficiently competent, having the required knowledge and experience to make informed decisions on a risk basis.

If board members recognise that they do not meet the required competence level, for example if they have moved across from a non-high

hazard company, they should actively seek further knowledge. This may include completing relevant training courses, shadowing members of their team to learn from their experience, engaging with collaborative industry bodies, and consulting relevant expert. Note: there is an expectation that board members do not rely on external consultants to 'provide' their competency; they must be acting as an intelligent customer with sufficient knowledge to question the work presented to them, such that they are not reliant upon external guidance.

Risk Literacy

At a foundation level risk literacy means understanding what major accidents are and how they may impact their business. Board members should take this one step further with an understanding of the key factors which influence their particular major accident hazard risks. This must be established upon thorough hazard identification and comprehensive risk assessment – to understand the unique risk profile of the business.

A thorough understanding of the risk drivers and key risk critical control measures will support wider risk management and help to prioritise the critical aspects. This enables leaders to pinpoint priorities and fully recognise the outcomes of their decisions. The board set the risk appetite and the risk management expectations for their business.

All board members should maintain

For businesses operating high hazard functions, board level decisions will directly influence the management of major accident hazard risks.

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sufficient risk literacy to understand the overall perspective, regardless of their subject matter expertise.

Prioritisation

Board members should manage expectations top-down to ensure that risk management is a business priority. During board meetings, process safety should be high on the agenda. Whilst there is an understanding that they will be competing against other concerns including profit and quality for attention, it must be recognised that effectively managing risk is central to the continuing operation of the businesses.

Board members and senior leaders should actively engage with the workforce on major accident hazards to influence a positive safety culture and lead by example to demonstrate the importance of risk management. It should also be understood that major accident hazards are not comparable to day-to-day hazards such as slips, trips and falls - they are a distinct category which should be allocated their own attention and resources.

The success of a high hazard business relies on safety and managing the inherent hazards associated with the process.

Sufficient Information

Board members should receive sufficient information on major accident hazard risks to stay sufficiently informed. The level of information to be provided should be carefully considered, there should be enough to gauge their decision making but not excessive to overwhelm their already busy schedules.

Process Safety Performance Indicators (PSPIs) are frequently used monitor the ongoing performance of the risk management at a high-hazard businesses. Implementing leading PSPIs to provide a forward looking picture of the businesses performance can be an effective means of keeping the board abreast of the current risk management picture without overwhelming with excessive detail.

Putting risk management at the heart of leadership makes good business sense, especially for high-hazard industries. Board members play a critical role in the management of major accident hazards. The publication of the new standard by the IOD and PSF is a welcome addition to the toolkit, propelling good practice and support consistency across the wider industry.

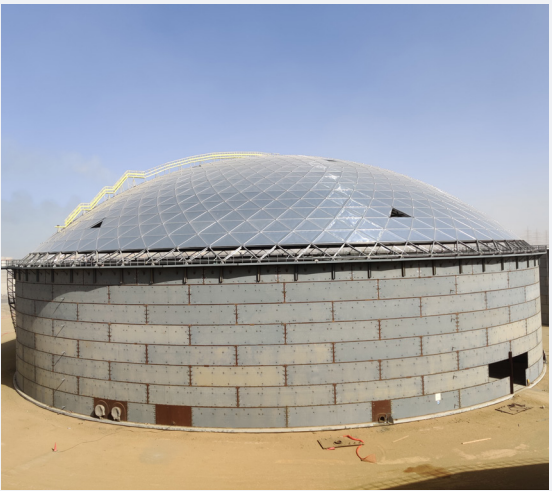
How can we help?

At RAS, we have a wealth of experience in supporting high hazard industries with their major accident hazard awareness and wider risk literacy, including at board level. Our capabilities include process safety leadership coaching, development of bespoke training programmes or workshops on the unique risks at each establishment and generating high-level risk profiles to communicate the overall picture to board members. If you would like to get in touch, please email us at enquiries@ras.ltd.uk or go to our website: https://ras/ltd.uk

ATECO GLOBAL INDUSTRIES – INNOVATIVE ENGINEERING FOR THE STORAGE TANK INDUSTRY

Ateco delivers comprehensive, end-to-end solutions for the oil, gas, petrochemical, water, and industrial sectors.

ATECO GLOBAL INDUSTRIES
"World-Wide Integrated Engineered Solutions"



In an industry where safety, reliability, and efficiency are non-negotiable, Ateco Global Industries has positioned itself as a trusted engineering partner for storage tank solutions worldwide. With headquarters in Istanbul, Turkey, and strategically located manufacturing facilities in Kütahya, Kocaeli, and Riyadh, along with a regional office in Dubai, Ateco delivers comprehensive, end-to-end solutions for the oil, gas, petrochemical, water, and industrial sectors.

From the earliest stages of design to final installation, our projects are executed with 100% in-house engineering expertise. Every component we deliver—whether a geodesic dome roof, an internal floating roof, a floating roof seal, or specialized tank equipment—is designed and manufactured in strict accordance with API 650, API 620, and Eurocode standards. This ensures not only compliance but also long-term operational performance in the most demanding environments.

Our approach combines advanced engineering calculations, cutting-edge manufacturing technologies, and rigorous quality control processes to achieve a single objective: delivering storage tank solutions that meet and exceed global expectations. With more than two decades of engineering excellence and a growing portfolio of high-profile projects, Ateco continues to set new benchmarks for safety, durability, and sustainability in the storage terminal industry.

Engineering and Manufacturing Excellence

At Ateco Global Industries, engineering is not a supporting function—it is the foundation of everything we do. Each project begins with a thorough evaluation of client requirements, operational conditions, and applicable industry standards. Our engineering team conducts detailed feasibility studies, structural analysis, and mechanical calculations to ensure every design delivers optimal performance and safety.

Leveraging advanced 3D modeling and finite element analysis (FEA) software, we simulate real-world conditions to refine each design before manufacturing begins. This allows us to anticipate potential challenges, optimize material usage, and achieve superior structural integrity while maintaining cost efficiency.

Our manufacturing facilities are equipped with CNC machining

centers, automated welding systems, and precision forming equipment, enabling us to produce complex geometries and large-scale components with exceptional accuracy. We employ strict process controls at every stage-cutting, forming, assembly, and finishing - ensuring that each component meets the exact specifications outlined in our engineering documentation.

Quality assurance is embedded in our workflow. Every product undergoes rigorous dimensional checks, material testing, and non-destructive examination (NDE) procedures, in compliance with international codes. Our ISO-certified management systems ensure traceability from raw material procurement to final delivery, giving our clients full confidence in the reliability of their equipment.

By maintaining 100% in-house production, we eliminate dependency on third-party manufacturers, ensuring consistency, flexibility, and shorter lead times. This integrated approach allows us to adapt quickly to project changes, deliver custom solutions, and maintain complete oversight of quality and safety standards.

Product Portfolio and Technical Advantages

Aluminum Geodesic Dome Roofs
Ateco's aluminum geodesic dome roofs are engineered to combine lightweight construction with exceptional structural integrity. Manufactured from high-strength, corrosion-resistant aluminum alloys, these roofs are ideal for harsh environments, including coastal and desert regions where steel structures are prone to deterioration. The modular, bolt-connected design enables rapid on-site assembly without hot work, minimizing installation time and operational disruption.

Our domes are designed in full compliance with API 650 Appendix G and Eurocode standards, ensuring long service life with minimal maintenance. Advanced load analysis and wind resistance calculations are performed during the design phase, guaranteeing stability even under extreme weather conditions. By eliminating the need for internal support columns, our geodesic domes maximize usable tank volume and improve safety by reducing vapor emissions.

Internal Floating Roofs
We design and manufacture both full contact and pontoon-type internal floating roofs, tailored to the storage product and operational requirements. These systems are critical in reducing evaporative losses, lowering VOC emissions, and maintaining product quality. Constructed from high-grade aluminum or stainless steel, our internal floating roofs feature precision-welded components and advanced sealing systems to ensure complete vapor containment.

Our designs incorporate structural reinforcements to withstand fluctuating liquid levels, thermal expansion, and chemical exposure, ensuring reliability throughout the operational lifecycle. Every internal floating roof is factory-assembled and tested to ensure perfect fit and function before shipment.

Floating Roof Seals
Ateco's floating roof seals are developed to meet the most stringent environmental regulations, providing exceptional sealing performance across a wide range of operating conditions. We offer primary and secondary seals compatible with both internal and external floating roofs, designed for durability, chemical resistance, and adaptability to tank shell irregularities.

Utilizing advanced polymer materials such as EPDM and PTFE, our seals maintain flexibility and integrity even in extreme temperature variations. The result is reduced emissions, enhanced operational safety, and extended service life for storage assets.

Tank & Terminal Equipment
Beyond our core product lines, Ateco supplies a wide range of tank and terminal accessories, including roof drains, manways, level gauges, and venting systems. Each component is engineered to integrate seamlessly with new or existing infrastructure, optimizing operational efficiency and safety.

Our engineering team works closely with clients to design custom solutions that address unique site conditions, whether for retrofitting aging infrastructure or developing new-build storage terminals. All equipment is manufactured to the same rigorous standards as our primary products, ensuring consistent performance and reliability.

Global Project Experience
Ateco Global Industries has successfully delivered storage

tank solutions in some of the most demanding environments across the Middle East, Europe, and Asia. Each project reflects our ability to adapt engineering principles to diverse operational, climatic, and regulatory conditions.

One of our most notable achievements is the completion of four large-scale aluminum geodesic dome roofs in Riyadh, Saudi Arabia - two with diameters of 106 meters and two with diameters of 81 meters. Designed and manufactured entirely in-house, these domes were engineered to withstand high wind loads, extreme temperature fluctuations, and corrosive desert conditions. The modular design allowed for rapid installation, minimizing downtime for the client's operations.

In the petrochemical sector, we have delivered internal floating roof systems for major terminals in the UAE and Turkey, each tailored to meet strict VOC emission regulations and customized for compatibility with stored chemical products.

Our work in the water industry includes floating cover solutions and associated equipment for large municipal treatment facilities, where odor control, evaporation reduction, and structural longevity are paramount.

Across all sectors, Ateco's hallmark is the same: precise engineering, robust manufacturing, and meticulous quality assurance.

Sustainability and Future Vision

Sustainability is not an afterthought at Ateco-it is a core design principle

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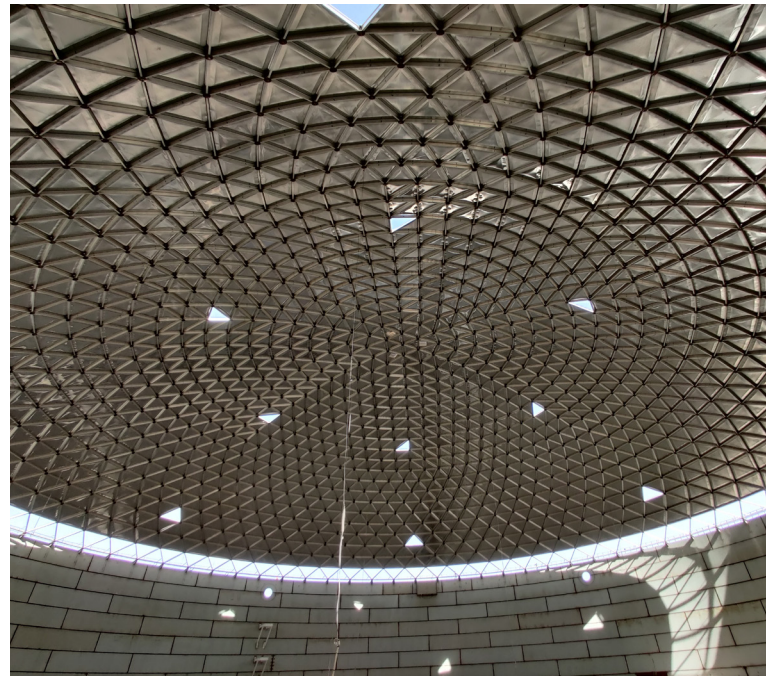

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embedded in every project we undertake. Our engineering philosophy prioritizes solutions that extend product lifespan, reduce environmental impact, and improve operational efficiency for our clients.

By manufacturing products that minimize vapor losses, prevent contamination, and optimize energy use, we help operators meet and exceed increasingly stringent environmental regulations. Our geodesic dome roofs and internal floating roofs are proven to significantly reduce VOC emissions, contributing directly to cleaner air quality and reduced greenhouse gas output.

We continuously invest in research and development to explore advanced materials, new fabrication techniques, and digital integration technologies. This includes investigating smart monitoring systems, predictive maintenance tools, and AI-supported inspection processes.

Looking ahead, Ateco's vision is clear: to remain at the forefront of storage tank innovation by combining engineering excellence with environmental responsibility.

Conclusion

For over two decades, Ateco Global Industries has delivered engineering-driven solutions that stand the test of time. From concept to commissioning, every project reflects our dedication to precision, quality, and sustainability. With a proven track record across oil, gas, petrochemical, water, and industrial sectors, we are committed to shaping the future of storage infrastructure.

Ateco Global Industries – Engineering Excellence, Trusted Worldwide.

For more information, please visit:
www.atecoindustries.com

CHOOSING THE RIGHT LININGS IN THE BIOFUEL TRANSITION

How SAF feedstocks and refined fuels challenge tank protection and product integrity.

SHERWIN WILLIAMS®

As the energy industry ramps up sustainable fuel production, refiners are confronting new questions about whether their storage tanks can handle both shifting raw materials and the refined products they yield.

Keeping tanks in peak condition is essential to maintaining the flow of refining and fuel distribution. Yet with lipid-based feedstocks varying by market availability, producers must ask: will existing linings stand up to these commodities – both before and after refining?

The answer starts with careful material selection. Linings for raw material tanks must resist the aggressive acids in biofeedstocks, while those for refined biofuels must be compatible enough to avoid product contamination. An additional complexity in play is that tanks may also be needed for traditional (fossil) feedstocks as demands fluctuate.

These priorities are especially critical in aviation, where sustainable aviation fuel (SAF) demand is growing. Recent testing has assessed how different lining materials perform with both lipid-based feedstocks and SAF. While focused on aviation, the findings apply broadly across biofuel processing – offering refiners a clearer path to selecting linings that protect both their assets and their products.

In addition to safeguarding performance, selecting the right lining early in a project can prevent costly midstream retrofits. Replacing or repairing tank linings often requires taking critical storage assets offline, which can disrupt supply chains and fuel delivery schedules. A thorough review of lining compatibility up front helps tanks stay in service longer and maintenance intervals stay predictable.

Changing Feedstocks Bring New Lining Challenges

Biofuels have a much lower carbon footprint than fossil fuels, with a net reduction in carbon dioxide (CO_2) emissions when burned. That environmental advantage – and the push for industry-wide emission cuts – is driving demand. The International Energy Agency (IEA) reports that the biofuels market is expanding by roughly 6% each year.[1]

This growth, however, brings operational realities. Biofuel feedstocks behave differently from traditional crude oils. Fossil fuels are corrosive because of inorganic sulfurous and sulfuric acids, while lipid-based feedstocks are even

more aggressive due to fatty acids. Their corrosivity increases at higher storage temperatures and with longer storage times. Linings in biofeedstock tanks must be compatible with these conditions to avoid costly, premature failures.

At the opposite end of the process, corrosion risk is minimal – but product purity is a topmost consideration. In refined biofuel storage, the priority is to prevent the lining from leaching contaminants into the fuel. Following API RP 652: *Linings of Aboveground Petroleum Storage Tank Bottoms*, Fifth Edition (2020), Section 6.7.1 – *Selecting Internal Linings for Tanks Storing Alternate Fuels* – can help specifiers address both scenarios. A new edition is expected in late 2025.

Still, because biofuels introduce feedstocks and products not seen in conventional oil service, decades of data for crude oil exposures do not directly apply. Proven long-term performance records for biofeedstocks remain limited, so updated testing and specifications are necessary to guide decisions on whether a tank should be relined.

Time and Temperature Effects on Lining Performance

The surest way to determine if a lining can handle an unfamiliar biofeedstock is to test it – both in the lab and in operating conditions – to see how it performs in theory and in practice.

Sherwin-Williams Protective & Marine recently carried out laboratory testing on three of its linings to measure corrosion resistance in different lipid-based feedstocks: vegetable oil, beef tallow and vegetable oil with free fatty acids (FFAs) added to simulate the higher acidity of waste cooking oil.

The products included:

- Nova-Plate® UHS – a solvent-free, ultra-high-solids novolac amine epoxy, traditionally rated for crude oil exposure up to 266˚F (130˚C)
- Magnalux™ 2100FF – a novolac glass flake-reinforced vinyl ester, acid-resistant, rated to about 212˚F (100˚C) for crude oil
- Nova-Plate® 360 – a high-performance, inert, flake-reinforced novolac tank lining

An isothermal test following NACE TM-0174, Procedure B, immersed coated steel panels for 15 months at 140˚F (60˚C), 160˚F (71˚C), and 180˚F (82˚C) (Figure 1). The results showed a direct relationship between temperature and degradation rate. Higher storage temperatures accelerated lining breakdown, confirming that heat intensifies the corrosive effects of lipid-based feedstocks.

Exposure duration was equally important. At all temperatures, none of the linings showed degradation after six or 12 months. By 15 months at higher temperatures, however, some systems displayed varying levels of damage. In nearly all cases, deterioration began at the vapor-liquid interface – an area where vapors, heat and oxygen combine to create a particularly aggressive environment.

The differences in performance reflected each product's chemistry and tolerance for alternative acidic conditions. Lipid-based feedstocks naturally change composition when stored, becoming more acidic over time – a process accelerated by elevated temperatures. As FFAs increase, they can eventually surpass the lining's resistance threshold, leading to failure if tanks are not maintained or cycled frequently enough.

These findings underscore why time and temperature are critical factors in lining selection, especially for facilities storing feedstocks in warmer climates or for extended periods. They also help explain why laboratory data must be paired with realistic field conditions to give owners the clearest picture of expected service life.

Partnering closely with lining manufacturers during the specification phase can help in consideration of key details about anticipated feedstocks, storage durations and operating temperatures. Owners can draw on both laboratory data and field experience to select the most resilient option. These collaborations can improve confidence in the chosen system and streamline inspection and maintenance planning over the tank's service life.

Cyclical Testing Mirrors Field Realities

In service, biofeedstocks are rarely stored for months on end. Tank turnover often occurs within 30 days, meaning linings are not subjected to the prolonged, static exposures of long-term lab tests. To better reflect real-world conditions, Sherwin-Williams conducted cyclic testing alongside static exposures.

Over six months, steel panels coated with the three test linings – plus an uncoated grit-blasted control – were

immersed in vegetable oil and water at 180˚F (82˚C). Every 30 days, 75% of the oil was replaced, for a total of 16 cycles to date. A control set was left in continuous exposure at the same temperature for comparison. The cyclic test panels performed significantly better than those under continuous exposure (Figure 2).

Corrosion was most severe in the vapor space above the oil, where uncoated panels developed pitting from rancid oil vapors – a common threat to internal tank roofs. At the oil-water interface near the panel bottoms, FFAs concentrated in the aqueous layer, accelerating corrosion on unprotected steel. These conditions highlight why both the underside of roofs and tank floors require careful protection.

Detailed analytical testing of the oils throughout the program also measured how oil chemistry changed. In cycled exposures, FFA concentrations rose only slightly compared to the steep increases seen in static exposure. This difference helps explain the improved performance in the immersed portions – and supports expectations of better results in the field when tanks are regularly emptied and refilled.

Specifying Linings for Both Parts of the Process

The purpose of lining storage tanks in biofuel service is twofold – to protect the steel and to protect the stored material. The priority changes depending on whether the tank is holding aggressive biofeedstocks or refined biofuels. Some linings can perform well in both environments, while others are suited only to the

Figure 1. Isothermal testing per NACE TM-0174, run for 15 months, showed a direct link between exposure time, temperature and lining degradation – with damage appearing first at the vapor-liquid interface. These panels, coated with three different linings, were immersed in vegetable oil (+DI water) at varying temperatures. No degradation was observed at any temperature after six or 12 months.

Exposure: 140˚F (60˚C)

Exposure: 160˚F (71˚C)

Exposure: 180˚F (82˚C)

Figure 2. In cyclical testing (top), panels were immersed in vegetable oil and water at 180˚F (82˚C) for 30 days, then had 75% of the mixture replaced before the next cycle. A control set in continuous exposure with no cycling (bottom) showed much greater corrosion damage – even after shorter total exposure times.

Exposure: Eight months of cyclic exposure

Exposure: Six months of continuous exposure

cleaner, less corrosive refined fuel side. API RP 652, Section 6.7.1, outlines how to verify compatibility for a given product and service.

Front-end feedstock storage: Among the three tested products, the novolac glass flake-reinforced vinyl ester offered the strongest resistance in both continuous and cyclic exposure, typically showing only discoloration. This is due to its high tolerance for organic acids, which are more aggressive than the FFAs formed during lipid degradation. The ultra-high-solids novolac amine epoxy and the flake-reinforced novolac both performed well under cyclic exposure but showed reduced tolerance in continuous testing, where rising FFA concentrations at elevated temperatures led to significant corrosion. In the cyclic testing that more closely reflected field conditions, the flake-reinforced novolac was the clear second-best performer, with no degradation in the cyclic exposures.

Refined fuel storage: Independent testing confirmed that the flake-reinforced novolac does not contaminate SAF or other fuels. It exceeded the stringent requirements of EI Standard 1541 for SAF, passing resistance and purity evaluations (including gum formation, corrosivity and thermal stability). Its long history of success with conventional aviation fuels further supports its suitability for refined SAF storage.

These results give tank owners clear options. The vinyl ester delivers the highest resistance to aggressive feedstocks across a wide temperature range. The flake-reinforced novolac's strong cyclic exposure performance and proven refined fuel compatibility allow operators to simplify specifications – in some cases using one lining across both ends of the process – provided service conditions are suitable.

Specifying for Service with Certainty

As aviation and other industries work to reduce net fuel-related emissions, biofuel production will continue to expand. That growth makes it necessary for processors to equip tanks for both ends of the refining process that can safely store raw and refined biobased materials.

The test results outlined here – along with EI Standard 1541 certification for SAF – give operators confidence that the recommended linings will resist corrosion and avoid product contamination.

That assurance supports more precise specifications, whether it means selecting a glass flake-reinforced novolac vinyl ester for the most aggressive feedstock service, or using a flake-reinforced novolac across both ends of the process to streamline maintenance and simplify lining strategies.

By applying these lessons, operators can reduce uncertainty, extend maintenance intervals and keep fuel moving to where it's needed most.

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1. IEA (2023), Tracking Clean Energy Progress 2023, IEA, Paris https://www.iea.org/reports/tracking-clean-energy-progress-2023, License: CC BY 4.0

About the Authors

Michael Harrison, Global Product Director – Linings, has more than 30 years in the development and support of linings in all protective segments with a specific focus on the oil and gas, mining, power generation, and water and wastewater markets. He supports the global business offering for protective tank and pipe linings for terminal and refinery installations in the oil and gas market, among other markets. Harrison has met the requirements of the Coating Inspector Program (CIP) Level 2 Certification from NACE International and has presented at a variety of coatings conferences. He has a degree in applied chemistry from Northumbria University.

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Justin Hair is a Key Account Manager for Sherwin-Williams Protective & Marine based in Tulsa, Oklahoma. With approximately 30 years of service dedicated to the oil and gas coatings industry, both as an industrial painting contractor and a Sherwin-Williams oil and gas team member, he has specialized in multiple subject matters related to aboveground petroleum storage tank industry challenges.

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FUEL DEMAND EVOLUTION AND THE ROLE OF THE STORAGE SECTOR

The shape and role of the independent storage sector is set for a significant shift over the next 15-20 years.

Mark Waddington, CEO, Channoil Energy

We have grown used to a world where forecasts were basically an incremental increase on the past. Energy transition has the potential to change that. Making the world's energy supply CO_2 neutral by 2050 or thereabouts, will require radical change in energy use and a steep decline in fossil fuel consumption.

The target for many is 2050, the "thereabouts" reflects uncertainty and differing views on the deadline date.

With these changes, the shape and role of the independent storage sector is set for a significant shift over the next 15-20 years.

What needs to happen?

In the short term, energy transition targets will be met by lower carbon fuelling solutions that work with existing vehicle technology.

This includes biofuels and bio-based middle distillates (BBMDs), such as renewable diesel and sustainable aviation fuel (SAF). Longer term, new drivetrains and technologies will lead to new fuels being used (e.g. methanol, biogas, hydrogen) or to zero emission vehicles through battery technology and hence no longer requiring a liquid fuel.

However, the economics need to be viable, and more capacity to meet the targets still needs to be built. Investors need to achieve the required rate of return.

If the price conditions do not provide the incentive, Governments will need to provide support or enforce the change. If it is the latter, then global competition needs to be considered. Hence, the fuels industry is now lobbying for the refining sector to be included in legislation for the UK Carbon Border Adjustment Mechanism (CBAM).

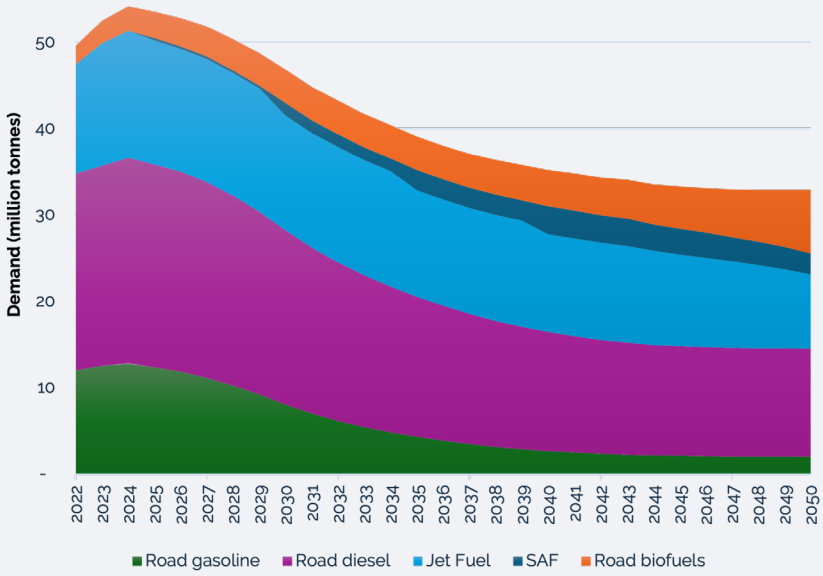
The right investment environment will also need to be consistently available: infrastructure investors need 20+ year planning horizons. It can be difficult to get consistent direction from Governments over such timelines.

Demand projections and implications

The UK has set out its ambitions to achieve net zero by 2050 and these are now incorporated into the projections that are used by the Department for Energy Security and Net Zero (DESNZ).

These are summarised in the figure below.

Figure 1. UK liquid fuels demand projections 2025 (Source: DESNZ, International Energy Agency (IEA))



DESNZ assume a steep decline in passenger road transport fossil fuel demand from today onwards to 2050, driven by electrification of the passenger vehicle fleet and increased renewable fuels use. A long-term demand for diesel remains for road haulage, which will be difficult to abate with no obvious technology alternative. Passenger transport fuel requirements will increasingly be met by biofuels and renewable fuels as the mandates move upwards and availability of such fuels continues to increase. By contrast, jet fuel demand has grown strongly since recovery from the slump in air travel during the pandemic. The DESNZ projection shows a modest decline from the 2040s. We doubt this will occur – strong global growth might be balanced by increased aircraft efficiency, leaving us at around today's levels. There will be some substitution of fossil jet fuel in line with the SAF mandates.

We do not expect the industry to go any further than they must – the cost of producing of SAF versus the fossil alternative is high and must be absorbed by increases in airline fares. Therefore, for the tank storage sector, the message is "be prepared to diversify" because eventually there will be more conventional storage capacity than the market demands. Furthermore there will need to be a greater diversity of stored type of fuels. Sites that are dedicated to gasoline and diesel will be severely challenged.

But, do we believe that these projections will materialise? In Europe, transport fuel demand growth is flat, even slightly declining for diesel. However, global oil demand has continued to grow. So has supply, with a "glut" of oil supply expected by some in 2026, which does not help to incentivise consumers to switch to more expensive renewables. Also, the pace of decline in gasoline and diesel may not be as rapid as shown in the DESNZ projections. The average age of a UK car is around nine years. The DESNZ projections show an 80% decrease in gasoline consumption by 2040, less than 15 years from today. With the ban on new internal combustion engine vehicles not starting before 2030 at the earliest, this looks highly ambitious. The current investment environment for renewable liquid fuels is depressed. Carbon prices are too low to provide sufficient incentive without additional support. The European market has, for the last three years, been targeted by cheap biodiesel imports from Asia. Global competitivity is a major concern for energy intensive industries. Of course, this can all change. Furthermore, there are potential new roles emerging for the tank storage sector.

Upsides and risks for the bulk liquids storage sector

Refinery closures – resilience or flexibility?

The recently announced closure of Petrolneos Grangemouth and the collapse of the Prax Group, who owned the Lindsey Oil Refinery has brought about a big shift in the UK's supply chain. Unless any interest is shown in the LOR refining asset in the near future, it is likely that the refining process will close, leaving the UK with only four major fuel refineries, rather than six. Nonetheless, we expect that the tankage and logistics assets will remain for the time being. Some would consider the decline of indigenous refining capacity a worry. We consider it an inevitable

outcome of global trade dynamics, as more efficient large-scale refineries in the Middle East, Africa and Asia will balance demand and supply, at ultimately lower costs. Closure of a refinery creates an abrupt change of supply, whereas demand changes more gradually. Here, the tankage sector plays a vital role to ensure supply continuity.

Petrochemicals

Oil companies are shifting their interests away from fuels and towards petrochemicals. The new and growing petrochemicals sector – much of which will still be based on crude oil derived feedstocks – will require increased logistics infrastructure. We see the greatest opportunity for the UK petrochemical industry in specialist niche grades, as bulk petrochemicals margins are currently depressed by global overcapacity and slow economic growth.

Biofuels and renewable fuels

Biofuels and renewable liquid fuels such as HVO or SAF have huge advantages in the energy transition. They are produced from established technology. They can be deployed in today's drivetrains. The industry is already invested in them, and their expansion is a continuation of that existing investment. SAF mandates are increasing steadily. This will require diversified and potentially increased tankage and logistics for aviation fuel supply. The biggest challenges for these fuels are feedstock availability and new production pathways during capacity expansion. However, both these challenges create a role for the bulk storage sector. So-called "advanced feedstocks" are frequently far from advanced in their composition. They are called advanced because they require advanced technologies to convert them into usable fuels. They often require purification, pre-treatment or blending before they can be used – all important functions performed by the storage sector.

The production pathways may also require intermediate storage and transportation. As renewable energy mandates continue to be developed and enter their next phases, further changes in the requirements for the fuel sector can be expected, changing roles for the storage sector as a consequence. Emerging fuels like hydrogen, ammonia, LNG, RNG, e-fuels, and methanol present key storage opportunities. Hydrogen and CO_2 for e-fuels, ammonia for maritime, and LNG/RNG for transport, all need specialized storage. As IMO regulations push for cleaner marine fuels, the storage sector has a chance to innovate and meet growing demand with advanced solutions.

The overarching role of the storage sector

This shift in the energy system will require complex logistics, a core competency of the bulk liquids storage sector. The shifting demand pattern will require the storage sector to show greater flexibility, efficiency and adaptability. An uncertain future presents the requirement for building, for flexibility and versatility. Best practice for future-proofing a terminal investment is likely to require any or all the following:

1. Smaller tanks, giving greater options for receiving smaller parcels or handling multiple grades of fuel product or blend components into finished grades.
2. Heating: this applies to bunker fuel oils, but equally to many fat and oil feedstocks as well as some finished grades of FAME biodiesel.
3. Use for alternative grades and the ability to be versatile in switching tankage use from one service to another depending on the incumbent company's exact needs.
4. Versatile linework, to provide further adaptability in use, either for blending or for import/export.

These measures can not only enhance versatility in providing services to the fuels sector but also will allow it to broaden its capabilities in the storage of other hazardous bulk liquids.

Observations and conclusions

Hence, while the projections for liquid fuel demand up to 2050 are in steep decline, and we see challenges ahead, we are far from pessimistic for the storage sector in the short term. The expected trends forecast have not yet materialised, and it may be that they cannot realistically be achieved by the 2050 target date. Recent changes in the refining sector will increase the requirement for independent storage. There are upsides in petrochemicals and renewable fuels.

However, conventional fossil-based fuel volumes will eventually decline and the products requiring storage will diversify. Operators should be prepared to adapt because eventually the change will be real.

Flexibility will be key throughout the transition period.

The voice of the bulk storage and energy infrastructure sector

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