

Insuring a sustainable, greener future

A roadmap for climate action



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1. Foreword



1. Foreword

Insuring a sustainable, greener future

Climate change is the largest, most challenging crisis the world has faced, bringing increasing risk and uncertainty for society, and for the future of our planet. With growing risks that threaten the livelihoods and futures of individuals, communities and entire ecosystems, there has never been a more important time for global collaboration and action on a vast scale.

As a systemic risk like no other, there is an increasing urgency for governments, industries and communities to respond to the challenge, as well as the scale of opportunity it presents. With the world beginning to emerge from the devastation of the COVID-19 pandemic, we have a collective responsibility and imperative to put sustainability and inclusion at the heart of global economic and societal recovery.

Governments and industries across nations are coming together to take action through a number of significant commitments and initiatives to accelerate the transition to net zero. These activities will drive rapid decarbonisation across economies and sectors, alongside the expansion of greener energies and business models worldwide. Delivering climate resilience will require adaptation of our global systems, including our built environment, industry, transportation and energy. All of these changes will need to be paired with concerted action to ensure that the implications of the transition do not leave any person, business or industry behind.

With a unique view of the climate crisis, through its many decades providing support to communities, businesses and economies in the face of increasingly severe and frequent weather events, Lloyd's and the global insurance industry have a critical role to play in building a more sustainable, greener future. Alongside mitigating and managing the impact of these disasters, the industry continues to provide financial support across multiple industries to build greater climate resilience and support the increased scale and speed of the transition.

As risk managers, risk carriers and investors, insurance is a powerful enabler, providing innovative products and services to finance, manage and accelerate the decarbonisation of industries and economies, as well as the growth of greener industry, greener transport and greener energy. This includes using its expertise to help increase levels of safety in managing new fuels and new construction techniques, facilitating increased collaboration between the public and private sector to support vulnerable developing nations, and directing its own capital reserves away from carbon-intensive sectors towards green solutions.

This report sets out the sustainability and decarbonisation ambitions of the sectors that are critical to a successful global transition to a low carbon economy, together with a climate action roadmap that highlights the ways in which the global insurance industry will support and accelerate this transition and the delivery mechanisms which will be deployed.



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1. Foreword

The role of Lloyd's and the global insurance industry in the climate transition constitutes three main areas of action:

1. Pioneer new risk transfer solutions for green innovation.

The scale and pace of green innovation required across multiple sectors and geographies will require new and extensive risk management and transfer solutions.

Lloyd's and the global insurance industry can strengthen its support for private and public sustainability initiatives and innovation by pioneering new risk transfer solutions that empower customers to develop, invest and grow these activities as the world transitions towards a sustainable future.

2. Support and accelerate the transition of carbon-intensive sectors.

As carbon-intensive sectors embark on their respective decarbonisation pathways, the global insurance industry will need to support its customers, and the risk ecosystems they operate in, to actively reduce the carbon intensity of their activities.

Lloyd's and the global insurance industry can achieve this through its unique ability to support customers to unlock the opportunities of the transition and navigate a changing risk landscape.

3. Harness \$30tn capital pool to drive positive change.

Green finance is a critical enabler of the transition. There is a unique opportunity to harness the global insurance industry's more than \$30 trillion capital pool and direct this towards more sustainable investment opportunities.

Lloyd's and the global insurance industry can align its investment activities with the scale and pace of change needed across industries and economies.

To catalyse and deliver action across these three areas, Lloyd's is chairing a newly convened Sustainable Markets Initiative, launched by HRH the Prince of Wales, whose membership comprises many of the world's largest insurance firms. As an influential platform for the global insurance industry to collectively advance the world's progress towards a resilient, net zero economy, the Task Force will drive climate positive action at pace, through a number of key initiatives set out in this report.

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[Andrew Brooks](#), Chair, Lloyd's Market Association

[Sheila Cameron](#), CEO, Lloyd's Market Association

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[Dave Matcham](#), CEO, International Underwriting Association

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At such a critical moment in time, with monumental change and transformation across every industry and economy, the insurance industry's role in accelerating the world's transition to a more sustainable future has never been so important. Lloyd's is proud to be leading the way, in partnership with many of the world's most influential insurance companies, to take action and join the global reset on climate.

Lloyd's climate action roadmap towards a greener future

	Now	Next	Beyond
	<p>Immediate insurance industry action to de-risk critical decarbonisation activities</p> <p>The global insurance industry has an impressive role to play in supporting and accelerating these developments. Lloyd's will:</p>	<p>Further enhance understanding of the evolving risk landscape for priority sectors</p> <p>The global insurance industry needs to understand how these technologies may emerge and the potential impact on the risk landscape. Lloyd's will:</p>	<p>Deepen understanding of the risk ecosystem and stand ready to support emerging technologies</p> <p>The global insurance industry will need to be aware of new technologies and adapt their offerings in the longer term to reflect new risks. This includes:</p>
Greener industry	<ul style="list-style-type: none"> Convene SMI workstream for open source disaster recovery framework Convene stakeholders to understand risk profile of sustainable materials / techniques Convene SMI workstream for green assets Convene SMI workstream to drive innovation across insurance supply chain 	<ul style="list-style-type: none"> Lead a research initiative into construction materials and techniques 	<ul style="list-style-type: none"> <i>Hydrogen power for homes and public buildings</i>
Greener transport	<ul style="list-style-type: none"> Convene SMI workstream and industry stakeholders for a collaborative product design workshop to address potential protection gaps 	<ul style="list-style-type: none"> Facilitate a product design sprint to develop and bring products to market 	<ul style="list-style-type: none"> <i>Development of sustainable fuels (including hydrogen powered aircraft and ships)</i>
Greener energy	<ul style="list-style-type: none"> Convene SMI workstream to focus on green assets (including offshore wind) Work with SMI Hydrogen Task Force to open up discussions with customers Provide a platform to ensure coordinated action between stakeholders to meet capacity demands 	<ul style="list-style-type: none"> Commit to expanding coverage to ensure capacity constraints don't limit growth Lead research into specific risks posed by hydrogen and explore coverage requirements 	<ul style="list-style-type: none"> <i>Next generation nuclear technology</i> <i>Carbon capture and storage technology</i>



1. Foreword

Lloyd's Climate Action Roadmap Overview

For each of the sectors identified in this paper as critical to a successful global transition to a low carbon economy, we have articulated a roadmap for tangible action to accelerate change. We have identified three key enablers to deliver on these actions:

1.	2.	3.
 <p>The global insurance industry</p>	 <p>Lloyd's in its role as chair of the SMI Insurance Task Force</p>	 <p>Lloyd's</p>
<p>Actions which the global insurance industry should collectively take going forward. The global insurance industry refers here to the whole insurance ecosystem spanning across all geographies, lines of business and size of market share.</p>	<p>Actions which will be delivered through the Sustainable Markets Initiative Insurance Task Force which includes representatives across the global insurance industry. Lloyd's will accelerate change in its role as Chair of this Task Force.</p>	<p>Actions which Lloyd's will progress. This refers specifically to actions which the Corporation of Lloyd's will take to accelerate change with the Lloyd's market as part of the wider insurance ecosystem.</p>

We believe these enablers will allow us to strike an appropriate balance between effectively delivering what is within our control and progressing actions where broader industry collaboration and partnership is necessary for success. The colour coding of the roadmap for action described below corresponds with the colours introduced above, to indicate which delivery mechanism will be deployed to progress each action.

1. Foreword

Greener Industry

Green Finance



The insurance industry has a significant opportunity to direct capital towards climate-positive solutions and products. It can achieve this through actively integrating ESG factors into the investment decision making process, proactively making impact investments into areas of the economy which are actively decarbonising and excluding investment from particularly carbon-intensive sectors which are failing to commit to the transition.

There is also a significant opportunity for the global insurance industry to collaborate with investors and governments to provide financing structures to support disaster resilience, response and recovery in developing countries.



Through its role as Chair of the SMI Insurance Task Force, Lloyd's has:

- Convened a workstream focused on supporting and encouraging more sustainable investment. In 2021, the workstream will develop a framework for accelerating and scaling sustainable investment, to help unlock the global insurance industry's more than \$30tn in assets under management, increasingly directing capital towards investments that drive climate-positive outcomes in both developed and developing nations.
- Convened a workstream dedicated to establishing a public-private disaster resilience, response, and recovery framework to help protect developing nations from the evolving economic and societal impacts of climate change, including the effects of increasingly frequent and severe weather events. The framework will combine an insurance product with risk management and loss recovery services. Lloyd's, as part of the SMI, will work closely with key stakeholders including insurers, governments, aid agencies and data providers to deliver a pilot scheme in 2021.

1. Foreword

Homes, Commercial and Public Buildings



The shift towards using more sustainable materials, new construction methods and alternative energy sources has significant implications for the risk profile of a building, which insurers will need to understand. Insurers should explore how to incentivise customers to lower the carbon footprint of their building(s), and/or more readily introduce 'build back better' wordings in policies. This should be balanced with understanding the risk profile of sustainable materials and new construction techniques, to ensure that the application of these does not ultimately result in increased claims exposure.



Through its role as Chair of the SMI Insurance Task Force, Lloyd's has:

- Convened a workstream dedicated to developing and launching an industry-wide framework for greener insurance supply chains to drive sustainable outcomes for customers, including through claims processes.



In addition, Lloyd's will:

- Conduct targeted research to understand the risk profile of new construction materials and techniques, exploring the insurance implications and opportunities for new or evolved risk solutions.



1. Foreword

Greener Transport

Electric Vehicles (EVs)



The business model of automotive companies operating in the EV sector is shifting from manufacturing towards providing full lifecycle solutions to customers. New insurance requirements are emerging as a result of this change in business model, for example an increase in demand for non-damage business interruption cover to protect against enhanced risks of connectivity, and cover for inter-connected global operations (compared to cover for local operations). Insurers will need to refine their product offerings to remain relevant in a changing industry.



To drive innovation and accelerate product development, through the SMI Insurance Task Force Lloyd's will:

- Design an innovative EV insurance product to address protection gaps as new risks emerge and vehicle business models evolve.



Lloyd's will then:

- Facilitate a product design sprint to develop potential products from ideation to commercially viable products.



Jet Zero and Greener Maritime



As the aviation and marine sectors accelerate their efforts to drive sustainability through advancements in technology and alternative sources of fuel, opportunities will emerge for the insurance industry to support their decarbonisation pathway. Insurers should understand the risk implications of technological advancements, including resulting changes in infrastructure such as fuel transportation and storage, to ensure that cover is made available for emerging and alternative marine and aviation risks at the moment it is needed.



To support and drive innovation across the aviation and maritime sectors, the SMI Insurance Task Force will:

- Work closely with the SMI Aviation and Shipping task forces to open up discussion with customers embarking on research and development in this area to identify requisite insurance coverage for emerging risks and new technologies.



In addition, to support and accelerate the growth of greener maritime, Lloyd's will:

- Provide a platform for dialogue between customers and insurers operating in this space to understand the specific challenges customers are facing and develop insurance coverage for emerging risks, in particular those associated with retrofitting of the global fleet to drive operational efficiency.



1. Foreword

Greener Energy

Offshore wind



Offshore wind projects continue to increase in scale and complexity, with advances in turbine technology (with respect to foundation depth, distance from shore and power output of each turbine) evolving rapidly. The global insurance industry has a unique opportunity to further expand the coverage it provides to the offshore wind sector to meet demands for additional insurance capacity, which is being driven by the rapid advancement of new offshore wind technology including turbines and floating wind technology.

In addition, given the size of many offshore wind projects, a blended financing model is necessary which typically requires a combination of investment from private corporates (often large utilities and/or oil and gas companies), overseas investors and large institutional investors to achieve success.



To support and accelerate the growth of offshore wind, the SMI Insurance Task Force has:

- Convened a workstream focused on supporting and encouraging more sustainable investment, including into offshore wind projects. In 2021, the workstream will launch a green investment proposal, outlining the intent and capability of the insurance industry to make resources available to support green investment, and the regulatory changes required to realise this ambition.
- Provide a platform to ensure there is co-ordinated action between the insurance industry, operators in the offshore wind sector and private investors.



In addition, Lloyd's will:

- Commit to expanding its coverage to ensure capacity constraints do not limit the growth of the industry.

Nuclear



The global insurance industry has a unique opportunity to further expand the coverage it provides to the nuclear industry in order to meet demands for additional insurance capacity, which is being driven by anticipated regulatory changes and the development of new nuclear capacity. The Lloyd's market provides significant capacity to nuclear risk specialists NRI (the British Nuclear Insurance Pool) and Northcourt (an independent MGA), who take an active lead in identifying how to increase insurance capacity for the sector, and what combination of government support, risk pooling, and mutual arrangements is needed to ensure adequate protection is available.

1. Foreword



As global leaders in providing insurance for the nuclear energy sector, Lloyd's will support the increase in nuclear insurance capacity through:

- Providing a platform to ensure there is co-ordinated action between the insurance industry, civil nuclear sector and government, and to ensure that nuclear operators are able to meet the additional liability required by regulations.

Hydrogen



Hydrogen is a vector of change and facilitator of decarbonisation for several sectors and significant investment will be required to develop hydrogen infrastructure. The use of hydrogen also introduces unique safety implications which will need to be appropriately identified, measured, monitored and managed, and insurers are well-placed to support customers across multiple industries with this.

Insurers should enter dialogue with corporates operating across the hydrogen value chain to better understand the challenges they are facing in obtaining specialist insurance cover, and consider how cover may need to be segmented or consolidated across components of the hydrogen value chain to prove effective.



To help facilitate the development of hydrogen, the SMI Insurance Task Force will:

- Work closely with the SMI Hydrogen Task Force to open up discussion with customers operating in this space on the specific challenges they are facing to develop insurance coverage for innovative or prototypical hydrogen technologies and infrastructure.



To support this, Lloyd's will:

- Lead research through Lloyd's Futureset into the specific risks posed by hydrogen, including its flammability, and how these risks might emerge in different ways according to how this fuel is used at a sectoral level. This will help corporates and private investors to understand how these risks can be managed and where specialist coverage may need to be introduced or expanded, for example in relation to the transportation of hydrogen.

2. Introduction

2. Introduction

Climate change is a systemic risk which affects financial stability, broader economic resilience, and human prosperity. Extreme weather events, climate action failure and human environmental damage have been recognised as the top three global risks by the World Economic Forum for the past three years¹.

In 2015, 197 countries adopted the Paris Agreement, the central aim of which includes driving efforts to limit global mean temperature rise to 1.5°C relative to pre-industrial levels. The risks posed by global warming, including extreme impacts to natural and human ecosystems and climate-related risks to health, livelihood, food security, water supply, human security and economic growth, are projected to increase with global warming of 1.5°C. Achieving the central aim of the Paris Agreement will require “rapid and far-reaching” transitions in land, energy, industry, buildings, transport and cities².

The International Energy Agency's *World Energy Outlook* for 2020 predicted a rapid growth in renewables across all its modelled scenarios, with the share of coal in the global power generation mix predicted to fall from 37% in 2019 to 28% by 2030 in the stated policies scenario, and to 15% by 2030 in the sustainable development scenario³. To complement the increased use of renewable energy, an integrated transition across multiple sectors will be crucial to enable a low-carbon future.

Technologies such as hydrogen and nuclear power will be critical in providing the stable energy production needed to support an energy system more reliant on renewable energy. In addition, other sectors such as transportation and construction contribute 24%⁴ and 39%⁵ respectively to global carbon emissions, demonstrating that it is not just power generation that has to change but also our built environment, and the way we evolve it.

From the perspective of the global insurance market, the increasing frequency and severity of natural disasters resulting from climate change have already created increased exposure and vulnerability to loss; and these events also bring devastating impacts to society and the economy, with significant physical risk and transition risk exposures emerging.

1 World Economic Forum – The Global Risks Report 2021

2 Intergovernmental Panel on Climate Change - Global Warming of 1.5 °C – (ipcc.ch)

3 World Energy Outlook, 2020 - World Energy Outlook 2020 – Analysis - IEA

4 International Energy Agency - Tracking Transport 2020 – Analysis - IEA

5 International Energy Agency - Global Status Report for Buildings and Construction 2019 – Analysis - IEA

2. Introduction

As an industry that not only protects against the evolving impacts of climate change, but also provides vital protection to enable cross-industry climate innovation, there is an urgent and once-in-a-generation opportunity for the global insurance industry to support and accelerate the transition towards a more sustainable, greener future. As new markets emerge and new technologies develop, there will be a need for the global insurance industry to innovate in its approach to delivering risk transfer products and services to finance, manage and protect against a rapidly changing risk landscape. This includes:

- Using its expertise to pioneer new risk management and transfer solutions
- Supporting carbon-intensive sectors with an orderly transition to a low-carbon economy
- Directing its own capital reserves away from carbon-intensive sectors towards greener investment opportunities to drive positive change

This paper focuses on a selection of sectors whose individual and combined actions will be critical in the world's united journey and ambition to rapidly decarbonise and protect the future of the planet. For each sector, we have outlined the global pathway towards a lower carbon footprint and explored the challenges on that journey that require solutions and support. We have then set out a roadmap for insurance industry action which will be critical in fast-tracking global decarbonisation efforts and the transition to a low carbon economy.

3. Greener Industry



3. Greener Industry

3.1 Homes, Commercial and Public Buildings

Introduction

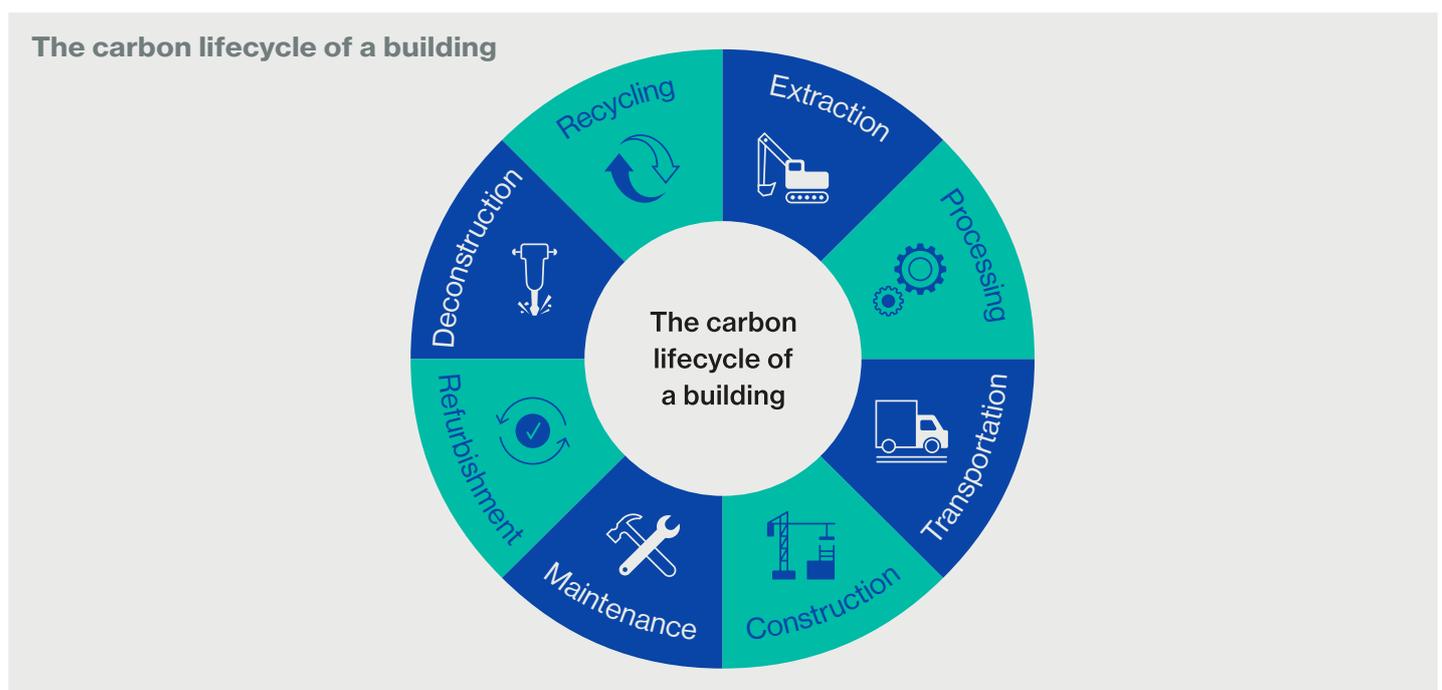
The construction industry accounts for 39% of the world's greenhouse gas (GHG) emissions. The World Green Building Council has called upon businesses, organisations, cities, states and regions to take immediate climate action towards decarbonising the built environment, with the ambition of all buildings being net zero by 2050, including both new constructions and existing building stock⁶.

The Nordic region is a global leader in the development of green buildings; the region uses 30% more energy in buildings compared to the rest of Europe due to its long winters and larger living areas per person, yet the corresponding CO₂ emissions are 50% lower than the EU average. This is due in large part to a larger share of renewable energy use, especially from biomass, together with stringent requirements for developers, contractors and suppliers to put green credentials at the heart of any construction activity⁷.

Decarbonisation of construction

Efforts to decarbonise the construction sector are generally focused on two main avenues:

- Reductions in operational carbon, such as improving the energy efficiency of heating and cooling.
- Reductions in embodied carbon, including energy used to extract and process building materials, assemble and transport components, construct, maintain, deconstruct and dispose of buildings, as well as the lifetime carbon footprint of the materials used.



⁶ World Green Building Council - The net zero Carbon Buildings Commitment | World Green Building Council (worldgbc.org)

⁷ The Explorer - Norway is greening the construction industry - The Explorer

3. Greener Industry

Key obstacles and role of the insurance industry

Evolving construction and property risk landscape

The shift towards using more sustainable materials, new construction methods and energy sources has significant implications for the risk profile of a building, which need to be understood and priced appropriately by insurers.

Building standards are continuing to evolve, with construction firms increasingly seeking to utilise more sustainable materials and manufacturing techniques, in some cases with the ultimate ambition of achieving net zero carbon-building accreditation. Use of such sustainable materials is likely to introduce additional risk factors; for example, concerns that some sustainable materials, including insulation materials, timber-based cladding, laminate timber and green roofing, may be more flammable than traditional materials. The repair risks associated with green buildings and/or sustainable materials can also be very specific and costly to resolve, particularly where sustainable materials may be less durable than traditional alternatives.

Increased awareness of the risks associated with these building methods will be crucial to ensure challenges are properly managed and to improve the resilience of the built environment to these risks. Many property developers are exploring new technologies such as “Internet of Things” (IoT) devices to help understand their buildings’ risk profiles and drive energy efficiency savings through improved consumer habits. Through working with customers, insurers can also help customers to understand the mutual benefits of such devices, such as through supporting early detection of issues which may lead to insurance claims, and help to accelerate their expansion.

Alternative construction methods such as offsite modular construction are growing rapidly. Such construction typically results in increased emphasis on the need for quality control at an early stage of the design process, and increased scrutiny on the interoperability of modular building materials with other construction materials, often resulting in a positive impact from a risk perspective on the safety of construction sites.

A key barrier to construction method innovation is the low profit margins typically achieved by construction companies, which tend to range between 2% and 8%, making it difficult for companies to invest in the critical technology required to innovate⁸.

Changing the energy source of a building also changes its risk profile. The UK Climate Change Committee estimates that around 34% of reductions in carbon emissions within the property sector come from energy efficiency measures, with a growing share attributed to low-carbon heating⁹. The UK Climate Change Committee has recommended the phase out of high-carbon fossil-fuel and gas-powered boilers in new homes, commercial and public buildings from 2025¹⁰.

⁸ Designing Buildings - Top 4 challenges facing the construction industry - Designing Buildings Wiki

⁹ The CCC - Sixth Carbon Budget - Climate Change Committee (theccc.org.uk)

¹⁰ HM Government - The Ten Point Plan for a Green Industrial Revolution (publishing.service.gov.uk)

3. Greener Industry

If these changes to property and construction risks are not understood and managed properly, this can create significant challenges and costs for both insurers and customers. For example, following the Grenfell fire in the UK, the UK building sector experienced a surge in insurance costs, with insurers also increasingly excluding materials such as cladding from professional indemnity policies¹¹. This creates a potential protection gap, acting as a significant deterrent to investment in innovation around greener building materials. Insurers will need to find the balance between providing insurance products that are reflective of the changing risk profile, at a premium which is not prohibitively expensive for new building owners and the construction industry.

The global insurance industry should leverage its data and claims experience to identify crucial gaps in property resilience and ensure these are addressed appropriately, and work with material scientists to properly understand the risk implications. Some insurers are taking steps to get closer to the design phase of buildings to support these challenges. However, given the lack of historic data for new materials and resulting reluctance from the market to provide coverage for certain materials (e.g. timber-based cladding), there could be a role for public-private partnerships to obtain the level of coverage required to facilitate growth of these materials on a meaningful scale.

[Decarbonisation of the existing property stock](#)

A key challenge for the sector is the decarbonisation of existing property stock; around 80% of current UK homes for example will still exist in 2050, therefore there is a significant emphasis not just on new construction but also on retrofitting to improve energy efficiency¹².

Costs and supply chain capacity are key challenges to retrofitting, for example to provide low-carbon heat pumps to existing homes. This challenge is compounded by the balance of policy costs between electricity and gas, which could make low-carbon options less competitive, as well as a potential lack of clarity as to who will bear the cost of retrofitting existing building stock. As a result, incentives to innovate and reduce the carbon footprint of a building beyond what is required by legislation are limited, with retrofitting activities most likely to occur only during major building alterations.

The insurance industry can support with encouraging greater investment in decarbonisation initiatives through adapting insurance products. For example, more readily including green and / or 'build back better' clauses within property wordings can help to ensure that damaged properties can be rebuilt to standards aligned to a net zero transition. This is similar in concept to 'building ordinance and law coverage' present in many property insurance policies, which pays for the additional cost of upgrading property to meet current building regulations.

The industry also has an opportunity to proactively lead the transition, for example by offering policy incentives for clients who decrease the carbon footprint of their home. There is precedent on which insurers can build – for example, many insurers have experience of providing credits to customers who have fitted freeze detection devices and water flow sensors on their pipes. However, it is important that such solutions are balanced with an assessment of risk to ensure they do not lead to increased claims exposure if they are not reflective of the new risk profile.

¹¹ Reuters - UK building sector hit by surge in insurance costs after Grenfell fire | Reuters

¹² Wired - The climate crisis issue that no one is talking about? Your gas boiler | WIRED UK

3. Greener Industry

Common retrofitting activities for existing building stock



Upgrade energy and water systems to reduce consumption



Optimize recycling of demolition debris and construction waste



Consider energy efficient lighting using daylight and light sensors



Consider natural ventilation to reduce heating/cooling loads



Investigate renewable energy options



Replace existing windows with high-performance windows



Consider using a cool roof or green roof



Use a rating system (e.g. LEED) to gauge the building's performance



Install meters for utilities to monitor real-time consumption



3. Greener Industry

Roadmap for action



The shift towards using more sustainable materials, new construction methods and alternative energy sources has significant implications for the risk profile of a building, which insurers will need to understand. Insurers should explore how to incentivise customers to lower the carbon footprint of their building(s), and/or more readily introduce 'build back better' wordings in policies. This should be balanced with understanding the risk profile of sustainable materials and new construction techniques, to ensure that the application of these does not ultimately result in increased claims exposure.



Through its role as Chair of the SMI Insurance Task Force, Lloyd's has:

- Convened a workstream dedicated to developing and launching an industry-wide framework for greener insurance supply chains to drive sustainable outcomes for customers, including through claims processes.



In addition, Lloyd's will:

- Conduct targeted research to understand the risk profile of new construction materials and techniques, exploring the insurance implications and opportunities for new or evolved risk solutions.



Lloyd's and Marsh's commitment to addressing the protection gap for new construction materials and technologies

Lloyd's and Marsh are collaborating on a solution to managing innovation risks in construction through a test and learn strategy.

Lloyd's and Marsh will work closely with an insured party (a large construction company) and its broker to scientifically assess the risk characteristics of a new material or technology. Following an initial research period, coverage for the material will be offered by the market for a limited time, with pricing agreed on risk-based rates.

This experimental approach will provide the required data and knowledge to address the coverage gap in the longer term, forming the basis for new products which can be offered by the market.



3. Greener Industry

3.2 Green Finance

Introduction

Unlocking capital to support the development of new industries and technologies is vital to enable the transition towards a low-carbon economy. Green finance initiatives aim to support the flow of capital into assets which support positive outcomes for the environment and society. These initiatives are not necessarily restricted to climate-related areas but can be much broader in scope to generate material societal benefits. A number of industry bodies in this space are helping to drive change including the Green Finance Initiative and the UN Principles for Sustainable Insurance, whilst several insurers are making impact and long-term value investing central to their purpose.

What is the role of the global insurance industry?

The investments which insurers make are critical to supporting sectors with their decarbonisation objectives, and there is a need to accelerate efforts to direct capital towards climate-positive solutions and products.

There is clear demand from the global insurance market to deploy capital into green investments, with in-flows to such investments increasing significantly in recent months. Morningstar recently reported that global in-flows into sustainable funds reached \$80.5bn in the third quarter of 2020, with sustainable fund assets reaching \$1.2tn globally¹³. The Lloyd's market has substantial capital at its disposal (c.£85 billion¹⁴), demonstrating there is a significant opportunity for the Lloyd's market to make a positive impact through directing capital towards green investments.

What actions can be taken to accelerate the flow of capital into green investments?

The insurance industry is taking steps to support the flow of capital into green investments through the use of different levers:

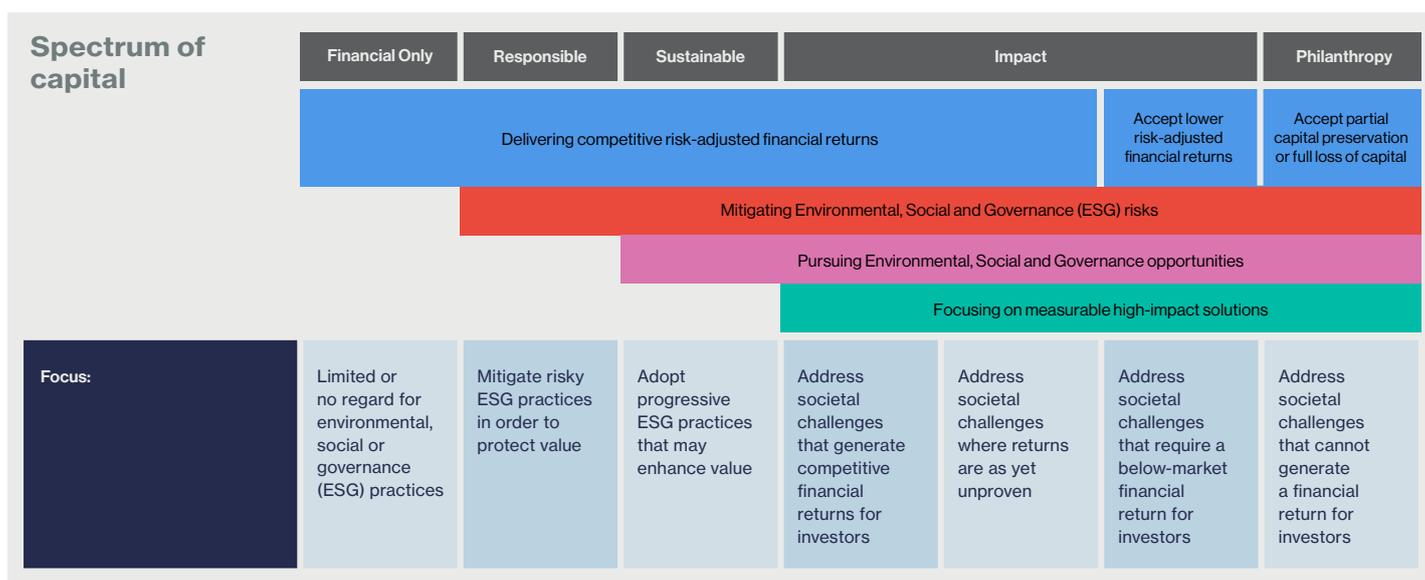
- In the first instance, applying exclusions is seen as an effective approach to shifting investments away from particularly carbon-intensive sectors, however it does forego the opportunity to engage with corporates involved in such sectors on their respective transition pathways.
- We are starting to see investors complement exclusion policies with structured voting and engagement activities, particularly in the equities market. Insurers have a role to play in helping industries with their transition and leveraging their influence as a capital provider to put pressure on companies around the actions they are taking to support decarbonisation.
- The integration of ESG (environmental, social and governance) factors can help to embed non-quantifiable risks into the investment decision making process and support identification of opportunities to actively invest in corporates and sectors critical to the transition.
- Some insurers are actively making 'impact' investments, which are investments made with the intention to generate positive, measurable social and environmental impact alongside a financial return. This is a way in which the industry can therefore take affirmative action to proactively invest in parts of the economy that are actively decarbonising.

¹³ Sustainable assets reach \$1.2 trillion in Q3 | ESG Investing

¹⁴ Lloyd's of London proprietary market data (accessed 30 March 2021)

3. Greener Industry

There are several challenges to overcome to increase insurance investors' allocation to green assets. This includes the availability of such assets to achieve the necessary scale to drive the low carbon transition, a consistent taxonomy to define "green", and data availability to test the green credentials of assets. A strong understanding of the contribution of different sectors towards decarbonisation pathways will be crucial, in order to ensure investments are directed towards the parts of the economy where they will have the greatest positive impact.



Green finance initiatives within the Lloyd's market

Recognising the acceleration of activities across the global insurance industry in this space, the Lloyd's market has taken positive steps through its recent commitments. This includes the allocation of 5% of the Corporation of Lloyd's Central Fund to impact investments by 2022, the phase out of new investments in thermal coal-fired power plants, thermal coal mines, oil sands and new Arctic energy exploration activities, and the commitment to develop guidance on impact investing to support participants in the Lloyd's market to create their responsible investment strategies.

Lloyd's market participants typically invest in shorter-dated assets, in line with respective liability profiles. It is therefore unrealistic to expect the Lloyd's market to invest substantially in long-dated assets such as infrastructure loans, for example, however there is still a considerable universe of shorter-dated green investments which also satisfy the market's broader liquidity and solvency requirements.

These activities are, in part, driven by a number of broader initiatives seeking to accelerate the drive towards greener finance. For example, as part of the United Nations-convened net zero Asset Owner Alliance, 35 institutional investors including insurers, representing \$5.5 trillion assets under management¹⁵, have pledged commitment to transitioning their investment portfolios to net zero GHG emissions by 2050. In addition, signatories to the UN's Principles for Responsible Investment have committed to a set of investment principles and associated actions for incorporating ESG issues into investment practice.

¹⁵ UN-convened net zero Asset Owner Alliance – Introduction to the Alliance



3. Greener Industry

Lloyd's case study

The Corporation of Lloyd's is exploring a range of investments as part of its allocation to impact investing, and groups such investments into three key categories: green bonds, social bonds and sustainable investments. Examples of each include:

- **Green:** The Corporation invested in an International Development Association (IDA) bond, the proceeds of which will support the financing of green projects and programs in eligible IDA countries to advance Sustainable Development Goals. This offers investors an efficient way to contribute to development in the world's poorest countries.
- **Social:** The Corporation invested in a social bond issued by the National Australia Bank, which is aligned to the International Capital Market Association's Social Bond Guidance. Proceeds are earmarked for (re)financing a portfolio of organisations across Australia that hold the Employer of Choice for Gender Equality citations from the Workplace Gender Equality Agency.
- **Sustainable:** The Corporation invested in a sustainable bond whose proceeds are allocated to (re)finance existing and/or future projects or businesses which meet eligibility criteria as defined in the issuer's sustainability bond framework. This framework, developed post the outbreak of COVID-19, has been expanded to focus on climate change mitigation, disaster resiliency, healthcare and social well-being.

Roadmap for action



The insurance industry has a significant opportunity to direct capital towards climate-positive solutions and products. It can achieve this through actively integrating ESG factors into the investment decision making process, proactively making impact investments into areas of the economy which are actively decarbonising and excluding investment from particularly carbon-intensive sectors which are failing to commit to the transition.

There is also a significant opportunity for the global insurance industry to collaborate with investors and governments to provide financing structures to support disaster resilience, response and recovery in developing countries.



Through its role as Chair of the SMI Insurance Task Force, Lloyd's has:

- Convened a workstream focused on supporting and encouraging more sustainable investment. In 2021, the workstream will develop a framework for accelerating and scaling sustainable investment, to help unlock the global insurance industry's more than \$30tn in assets under management, increasingly directing capital towards investments that drive climate-positive outcomes in both developed and developing nations.
- Convened a workstream dedicated to establishing a public-private disaster resilience, response, and recovery framework to help protect developing nations from the evolving economic and societal impacts of climate change, including the effects of increasingly frequent and severe weather events. The framework will combine an insurance product with risk management and loss recovery services. Lloyd's, as part of the SMI, will work closely with key stakeholders including insurers, governments, aid agencies and data providers to deliver a pilot scheme in 2021.

Key: ■ The global insurance industry ■ Lloyd's in its role as Chair of the SMI Insurance Task Force ■ Lloyd's

4. Greener Transport



4. Greener Transport

4.1 Jet Zero

Introduction

Aviation is one of the fastest-growing sources of global GHG emissions, with direct emissions from aviation accounting for 2.4% of global emissions in 2018 and pre-COVID-19 forecasts from the International Civil Aviation Organisation suggesting that emissions could triple by 2050¹⁶.

International collaboration will be key to achieving decarbonisation of the aviation sector, and Destination 2050, a European aviation sustainability initiative, is one of a number of global/regional groups to set the ambition for all flights to be net zero by 2050 through a combination of improvements in aircraft and engine technology, operational improvements, use of sustainable aviation fuels and carbon removal projects¹⁷. The European Green Deal sets out the need to reduce transport emissions by 90% by 2050 (compared to 1990 levels)¹⁸, and the aviation sector, as the second largest source of transport emissions after road transport, will have a vital role to play.

Global carbon markets are recognised as an important decarbonisation enabler. For example, the International Civil Aviation Organisation's Carbon Offsetting and Reduction Scheme (CORSIA) is a market-based mechanism for carbon offsetting which was agreed by the UN, with 78 countries participating in a voluntary pilot phase from 2021 representing 75% of international flights¹⁹.

The aviation industry has already seen significant evolution over recent years driven by the desire to create faster, lighter and more fuel-efficient aircraft, which ultimately delivers commercial benefits through lower costs. For example, the use of next-generation materials such as carbon fibre, combined with changes in aircraft design to make aircraft more aerodynamic, have delivered significant emissions savings with the amount of fuel burned per passenger reducing by 24% between 2005 and 2017. However, this has been accompanied by rapid growth in passengers of 60% across the same period, with the net result that direct emissions from aviation in 2017 accounted for 3.8% of total global CO₂ emissions²⁰.

Key challenges

Challenges from COVID-19

The primary focus of the aviation industry in the short term is on restoring and maintaining viability due to the significant challenges resulting from COVID-19. According to recent analysis, passenger levels are not projected to return to pre-pandemic levels until 2024, and several European airlines have ceased operations as a result of the challenges²¹. Baselines for carbon offsetting set by the CORSIA scheme were adjusted in light of COVID-19, increasing the baseline by around 30% and signalling the importance of supporting recovery ahead of pursuing net zero targets in the immediate term²². As such, the industry at present has limited capital available to commit to new technologies and innovation to support longer term decarbonisation objectives.

¹⁶ The International Council on Clean Transportation - CO₂ emissions from commercial aviation, 2018 | International Council on Clean Transportation (theicct.org)

¹⁷ GOV.UK - Prepare for lift-off: Jet Zero Council to deliver carbon-free flight - GOV.UK (www.gov.uk)

¹⁸ European Commission Mobility and Transport - Sustainable transport

¹⁹ Carbon Brief - Corsia: The UN's plan to 'offset' growth in aviation emissions (carbonbrief.org)

²⁰ Europa - Reducing emissions from aviation | Climate Action (europa.eu)

²¹ International Air Transport Association - IATA - Recovery Delayed as International Travel Remains Locked Down

²² Financial Times - Grounding a global fleet: Boeing faces its greatest challenge | Financial Times (ft.com)

4. Greener Transport

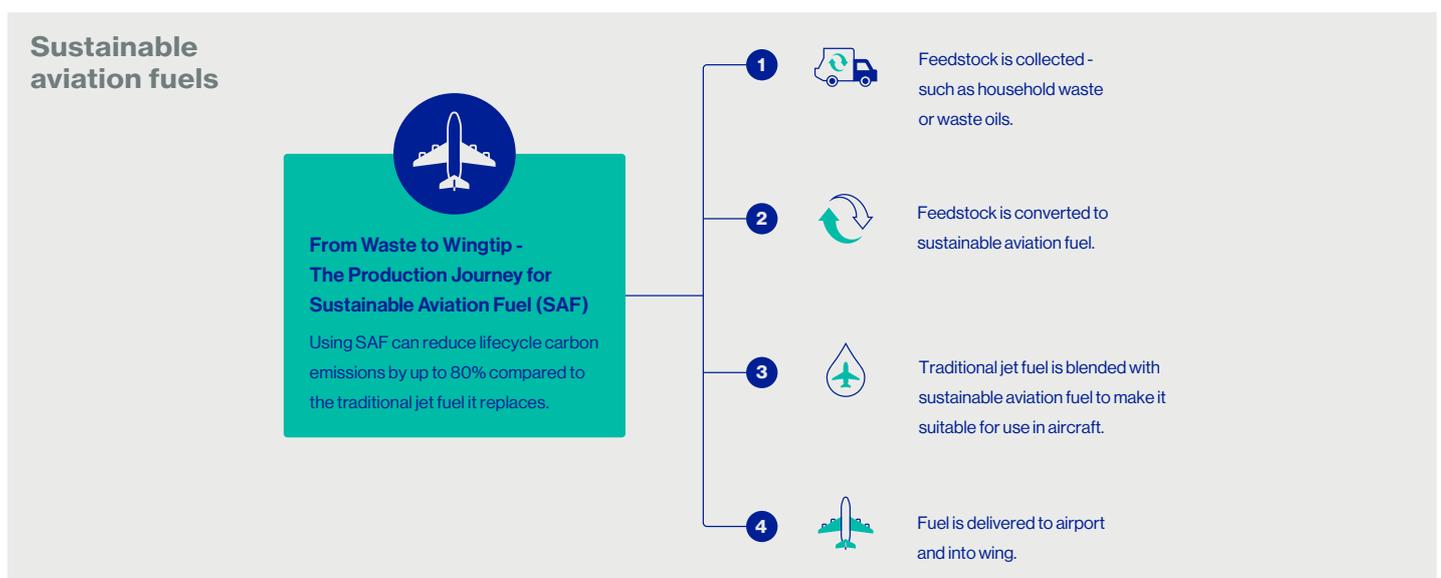
The challenges posed by COVID-19 for the aviation sector follows a long sequence of disasters for airlines, including the Boeing catastrophes and subsequent grounding of the Boeing 737 Max fleet²³. This series of events has resulted in a challenging environment for the insurance industry, with some providers withdrawing from the market.

Nevertheless, the aviation sector is still incentivised to accelerate the low carbon transition, with consumer pressure and broader societal expectations pushing operators towards low carbon means of transportation. As the sector emerges from the pandemic and looks towards opportunities for a green recovery, we expect to see a collective industry pivot towards the advancement of new technology to support decarbonisation.

Pathways to decarbonisation

The use of sustainable airline fuels (SAF), including biofuel and synthetic fuels, to replace fossil-fuel based jet fuel, could achieve up to a 32% reduction in emissions from the UK aviation industry by 2050 according to estimates from UK Sustainable Aviation²⁴. Biofuels rely on residues (e.g. used oils and waste) or biomass (e.g. plant products) for production, the latter requiring significant land use. Conversely, synthetic fuels have the potential to be zero-carbon if renewable energy is used in the production process.

Globally SAF is nearing a tipping point, with several projects on the verge of commercial-scale production, and fourteen airports now supplying sustainable aviation fuels, albeit in low volumes²⁵. However, a key constraint on the development and commercialisation of SAF on a meaningful scale is the need for an integrated transition. The key challenge which remains is the need to ensure new supporting infrastructure such as re-fuelling capabilities is globally available, and fuel types are globally certified to facilitate re-fuelling at different locations. It will be also be vital that there is collaboration between airlines, airports, aerospace manufacturers and infrastructure providers to enable a co-ordinated transition. Given that aviation emissions are largely recognised as belonging to the airline rather than airports, in the absence of partnerships there is limited incentive for airports to invest in the necessary infrastructure to support this change.



²³ Financial Times - Grounding a global fleet: Boeing faces its greatest challenge | Financial Times (ft.com)

²⁴ Sustainable Aviation - SustainableAviation_FuelReport_20200231.pdf

²⁵ Sustainable Aviation - SustainableAviation_FuelReport_20200231.pdf

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Fleet optimisation can also play a significant role in delivering carbon reductions for the aviation industry, through a combination of operational optimisation, aircraft design and new engine efficiency improvements. In the medium term, hybrid-electric aircraft, which take advantage of batteries or hydrogen fuel cells, could replace conventional turbine powered planes, especially on smaller aircraft and shorter flights²⁶. However, as with all new technologies, there remain technical obstacles to navigate, for example storage complexity and how best to balance the use of low energy density batteries with the additional weight that this introduces. This means that in the short-term jet-fuel will continue to be required for long-distanced commercial operations.

National governments have several policy actions at their disposal which could drive a shift in passenger demand and consequently reduce carbon emissions. This could consist of a combination of carbon pricing, frequent flier levies, fuel duties and VAT, which all have the potential to alter incentives and reduce the number of annual airline passengers. International market-based mechanisms such as CORSIA's carbon off-setting scheme and the EU Emissions Trading System are also a key part of the comprehensive approach required to reduce emissions in the aviation industry beyond what can be delivered by technological and operational measures alone²⁷.

Implications of new technologies and fuels on the aviation risk landscape

Recognising that these factors are key to enable the low-carbon transition of the aviation industry, the biggest constraint on decarbonisation is the capital investment required to facilitate the industry's transformation. The need for significant changes to jet engine, aircraft and supporting infrastructure design to allow the use of alternative fuels or hybrid technologies, presents substantial upfront capital costs. Furthermore, such new technology, including hybrid-electric aircraft and sustainable aviation fuels, is also likely to introduce increased complexity and potential safety implications which could hinder private investment into these technologies.

Any modifications to the way in which an aircraft operates, and the infrastructure needed to service such new technology, will in turn have an impact on the risk landscape. There will therefore be a key dependency on the insurance industry to be able to understand and respond to increased demand for new or adapted insurance coverage and linked risk management solutions, to encourage investment and facilitate this transition.

The key challenge which insurers will face is the need to find the balance between providing cover that is reflective of the risk profile of new technology and availability of historic data, at a premium that is not prohibitively expensive for the aviation industry. Loss data for new technologies is usually very limited, however it is important to recognise that the aviation industry has experienced significant changes over recent years with fleet renewal and introductions of new-age aircraft, and insurers have been able to overcome the challenges of a lack of historic data. For example, the insurance industry is currently providing insurance to a selection of prototypical developments, including commercial spacecraft, hydrogen-powered aircraft and autonomous air ships.

²⁶ IATA - [technology20roadmap20to20205020no20foreword.pdf](https://www.iata.org/en/pressroom/2020/05/20/technology20roadmap20to20205020no20foreword.pdf) (iata.org)

²⁷ Europa - [Market-Based Measures | European Aviation Environmental Report](https://ec.europa.eu/euro-observatory/en/aviation-environmental-report) (europa.eu)

4. Greener Transport

There has also been a strong correlation in the aviation industry between aircraft innovation and improvements in safety. The industry's excellent health and safety focus, combined with the fact that aviation is a heavily regulated sector, has alleviated some concerns around potential risks.

Early signals from the insurance market show appetite to support the aviation industry through its transition and to provide the specialist insurance coverage required. A strong partnership already exists between the aviation industry, regulators and insurers, and this partnership will be pivotal if rapid innovation and an acceleration of the decarbonisation pathway is to be successful.

Roadmap for action



As the aviation and marine sectors accelerate their efforts to drive sustainability through advancements in technology and alternative sources of fuel, opportunities will emerge for the insurance industry to support their decarbonisation pathway. Insurers should understand the risk implications of technological advancements, including resulting changes in infrastructure such as fuel transportation and storage, to ensure that cover is made available for emerging and alternative marine and aviation risks at the moment it is needed.



To support and drive innovation across the aviation and maritime sectors, the SMI Insurance Task Force will:

- Work closely with the SMI Aviation and Shipping task forces to open up discussion with customers embarking on research and development in this area to identify requisite insurance coverage for emerging risks and new technologies.



In addition, to support and accelerate the growth of greener maritime, Lloyd's will:

- Provide a platform for dialogue between customers and insurers operating in this space to understand the specific challenges customers are facing and develop insurance coverage for emerging risks, in particular those associated with retrofitting of the global fleet to drive operational efficiency.

4. Greener Transport

4.2 Greener Maritime

Introduction

There is significant international dependence on shipping to facilitate world trade and, according to a study by the International Maritime Organisation, carbon emissions from shipping could increase between 50% and 250% by 2050²⁸. The maritime industry moves approximately 80% of world trade by volume, therefore, as the world moves towards a low-carbon economy there will be an increasing need for the shipping industry to transition, not only due to direct emissions but also to help other industries decarbonise their supply chains²⁹.

Per tonne of goods moved, the shipping industry is the most efficient way to move products³⁰. This has been driven in large part by containerisation, allowing more goods to be transported with fewer journeys and reducing the time required to load and unload vessels. In addition, a larger volume of local distribution centres has also driven efficiency, with the COVID-19 pandemic accelerating the localisation of supply chains.

However, whilst efficiency has improved, the vast majority of ships are powered by combustion engines which are a significant emitter of GHG emissions and contribute to air pollution in congested port locations. Moreover, regulation of maritime emissions is uniquely challenging because of the international cooperation required in setting limits, and the difficulty of global enforcement.

Global targets for decarbonisation

The International Maritime Organisation (IMO) has set clear global targets for reducing the shipping industry's GHG emissions by at least 50% by 2050 (compared to 2008 levels)³¹. To meet these targets close collaboration and deliberate collective action will be required between the maritime industry, the energy sector, the financial sector and government, to set up the infrastructure that will be needed to support this transition.

The global insurance industry is well-placed to play its part, and can draw on the critical role it played in helping clients to meet the introduction of the IMO's sulphur emissions regulations in 2020 as a successful example of coordinated action across the marine sector.

Key challenges

Maritime insurance landscape

Marine insurance is one of the oldest classes of business and is the foundation block on which Lloyd's of London is established. Typical insurance policies provide cover for physical loss or damage, split across hull (covering damage to the vessel, propulsion machinery and equipment used for activities such as cargo handling), cargo (loss or damage to freight), fine art and specie (high-value goods), liability (including personal injuries, pollution and collision) and yacht insurance.

²⁸ European Commission - Reducing emissions from the shipping sector | Climate Action (europa.eu)

²⁹ UNCTAD - Review of Maritime Transport 2018 | UNCTAD

³⁰ Modes of Transportation: What method is best for cargo and freight? (forto.com)

³¹ Shell - https://www.shell.com/promos/energy-and-innovation/decarbonising-shipping-all-hands-on-deck/_jcr_content.stream/1594141914406/b4878c899602611f78d36655ebff06307e49d0f8/decarbonising-shipping-report.pdf

4. Greener Transport

Types of marine insurance

Types of Marine Insurance

 <p>Hull</p> <p>Covers damage to the vessel, propulsion machinery and equipment used for activities such as cargo handling.</p>	 <p>Cargo</p> <p>Covers loss or damage to freight.</p>	 <p>Fine Art & Specie</p> <p>Covers loss or damage to high value goods.</p>	 <p>Liability</p> <p>Includes personal injuries, pollution and collision.</p>	 <p>Yacht</p> <p>Specialist cover for private, commercial and competitive racing yachts including hull, liability and personal belongings.</p>
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Global marine insurance premiums are c.£21bn per year, £4bn of which is cover obtained through the Lloyd’s market³². The two main drivers of the marine market are cargo and hull, and it is these two areas that will likely be most impacted by the coming changes to how ships are powered and fuelled.

[New technologies to drive operational efficiency](#)

Reductions in GHG emissions can be made in the maritime sector through operational and technological improvements to drive efficiency, and offer an essential short-term bridge whilst more complex solutions such as low carbon fuels are developed in the medium term. For example, air lubrication technology is being deployed on eight of Shell’s ships, which is expected to deliver a 5-8% reduction in fuel consumption³³. In addition, operational improvements such as speed adjustments can also deliver emission reductions, and smart port technologies are being explored to enhance co-ordination between ship and port call activities to optimise voyage speeds.

The introduction of new technologies is expected to present a range of enhanced environmental, health and operational risks. It is vital that insurers stand ready to support clients in the sector with the insurance cover it needs as new technologies emerge. The insurance market is starting to innovate in this space, for example through leveraging artificial intelligence techniques to analyse voyage planning and cargo optimisation data, to better understand the evolving risk landscape.

³² Lloyd’s of London marine sector data (accessed 29 March 2021)

³³ Shell - Decarbonising Shipping: Setting Shell’s Course



4. Greener Transport

[Insuring future marine fuels](#)

Though operational improvements play an important role in supporting the reduction of maritime emissions, it is widely recognised that in the longer term, the use of low carbon fuels is the biggest opportunity for the maritime industry to transition towards net zero. Some projections indicate that developing and implementing a sustainable shipping fuel would drive as much as 87% of future emissions savings in this sector³⁴.

To enable the transition to a low carbon economy, commercially viable zero-emission vessels must start entering the global fleet by 2030³⁵. Currently there is no single fuel source that is universally agreed to be the 'right' maritime fuel of the future, with fuels such as biofuel, liquid natural gas, and hydrogen being explored. A 'poly-fuel' scenario may emerge across different shipping segments, for example electrification may work for short voyages including ferries and cruise ships however it may be less appropriate for deep-sea shipping.

Before alternative fuels can be used on a meaningful scale, a significant amount of infrastructure needs to be developed globally to enable transportation and storage of fuels, both onshore and offshore. According to University Maritime Advisory Services, infrastructure development costs to support alternative fuels are estimated to be between \$1-1.4 trillion, presenting a significant barrier for the sector³⁶. Additional challenges are posed by logistics and scale; for example, current total global capacity for bio-methanol is only 100 million tonnes annually to serve multiple purposes, of which a single shipping company such as Maersk would require approximately 10% to power its fleet for one year³⁷.

The insurance industry must remain close to developments in alternative fuels as the future fuel pathway for the sector becomes clearer. Each of the possible alternative fuels for the sector introduce important risk considerations, including for example:

- The use of hydrogen (and ammonia as a vehicle for storing and transporting hydrogen) poses enhanced safety risks due to flammability and corrosive properties.
- Biofuels have been found to cause potential damage to ship engines which could impact operational performance³⁸.
- The potential release of GHGs such as methane from the combustion of liquefied natural gases would need to be appropriately managed.
- The use of low carbon nuclear power propulsion using liquid fuelled micro-reactors is a potential medium-term solution, and naturally gives rise to unique safety and operational risks.

Whilst the future fuel scenario is still uncertain, what is evident is that insurance products and risk management solutions will need to be developed to support the industry's transition and anticipate both interim and longer-term needs. This includes supporting the development of new fuelling infrastructure, helping ports manage their emissions both onshore and offshore, and supporting with revisions to cover for the retrofitting of a global fleet to reflect engine modifications and changing fuel storage requirements.

³⁴ The CCC - Sixth Carbon Budget - Climate Change Committee (theccc.org.uk)

³⁵ Global Maritime Forum - Getting to Zero Coalition (globalmaritimeforum.org)

³⁶ Bloomberg Quint - What's the Green Fuel of the Future for Shipping? (bloombergquint.com)

³⁷ Indicative calculation based on Maersk Sustainability Report 2020

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Alternative aviation fuels in development		 Global Fuel Availability	 Long-Term Solution	 Established Infrastructure	 Safe to Handle	 High Fuel Cost	 Increased CAPEX	Advantages	Disadvantages
		Carbon Fuels		Liquefied Natural Gas (LNG)	✓	✓	✓		
		Liquefied Petroleum Gas (LPG)	✓		✓			Low CO ₂ emissions	-
		Methanol / Ethanol				✓	✓	Easy-to-handle, well developed terminal oil	-
Carbon Neutral		Biofuels / Biomethane			✓	✓		Increasingly used as marine fuel, can be used as drop-in-fuel	Sustainable scaling up needed
		Synthetic Methane (SNG)			✓	✓		Easily adapted to LNG infrastructure, can be used as drop-in-fuel	Large-scale production challenges, requires renewable energy source to be carbon neutral
Zero Carbon		Hydrogen	✓			✓	✓	Low energy density per volume and favourable specific density by mass	Storage challenges, particularly flammable
		Ammonia	✓			✓	✓	Solution for internal combustion engine and fuel cells	Limited bunkering, toxic effects on human health

Roadmap for action



As the aviation and marine sectors accelerate their efforts to drive sustainability through advancements in technology and alternative sources of fuel, opportunities will emerge for the insurance industry to support their decarbonisation pathway. Insurers should understand the risk implications of technological advancements, including resulting changes in infrastructure such as fuel transportation and storage, to ensure that cover is made available for emerging and alternative marine and aviation risks at the moment it is needed.

Key: ■ The global insurance industry ■ Lloyd's in its role as Chair of the SMI Insurance Task Force ■ Lloyd's

38 European Parliamentary Research Service - Decarbonising maritime transport: The EU perspective (europa.eu)



4. Greener Transport

4.3 Electric Vehicles

Introduction

[The shift towards electrification and alternative propulsion systems](#)

The transportation sector contributes 24% of global carbon emissions (as at 2019)³⁹ and within that road transportation (including cars, trucks, buses and two- and three-wheelers) is the biggest contributor. It is unsurprising therefore that the electrification of the automotive industry and the development of the supporting infrastructure required features prominently in the decarbonisation pathways of many countries.

Today, China is leading the electric vehicle market, accounting for the largest share (40%) of global sales of electric vehicles (EVs). We are, however, starting to see rapid growth in other regions including Europe and the US⁴⁰. Projections by BloombergNEF suggest that the global EV fleet could reach 116 million by 2030 from 8.5 million today⁴¹. In the UK, the National Grid suggests that the UK stock of electric vehicles could reach up to 10.6 million by 2030 and could increase to as high as 36 million by 2040, representing over a third of the total UK vehicle stock⁴².

There are a range of low or zero carbon propulsion systems offering more carbon efficient alternatives to traditional combustion engines, including electric batteries, fuel cells and renewable biofuels. In the near and medium term, battery driven electric vehicles are expected to see significant rates of growth⁴³. Hydrogen fuel cell vehicles represent an alternative solution, in particular for commercial vehicles carrying heavier loads or driving longer distances, though challenges remain including accommodating heavy onboard storage systems, fuel cell durability and reliability in extreme weather, and establishing the requisite network to produce, transport and dispense hydrogen to consumers⁴⁴.

The transition to more carbon efficient propulsion systems is being supported by rapidly accelerating customer demand as well as regulatory change. As a result, participants in this sector are competing to rapidly gain market share across the value chain, including in electric vehicle (EV) production, smart charging solutions, electric charging infrastructure, and innovative vehicle to grid solutions.

In parallel the popularity of diesel and petrol cars is declining rapidly, driven in part by new regulations and standards such as the expansion of low emission zones, as national governments look to reduce noise and air pollution in densely populated areas. To date, 17 countries have announced plans for the phase out of internal combustion engine vehicles through to 2050, including setting targets for 100% zero-emission vehicles⁴⁵. For example, the UK Government has stated that all new vehicles will be required to have significant zero emissions capability from 2030 and be 100% zero emissions from 2035⁴⁶. Up to £1 billion has been committed by the UK Government to support the electrification of UK vehicles and their supply chains, recognising the key reliance on supporting infrastructure to be able to facilitate this transition.

³⁹ International Energy Agency - Tracking Transport 2020 – Analysis - IEA

⁴⁰ Forbes - Plugging Into The Future: The Electric Vehicle Market Outlook (forbes.com)

⁴¹ BloombergNEF - BNEF EVO Report 2020 | BloombergNEF | Bloomberg Finance LP

⁴² UK Parliament - Electric vehicles: driving the transition - Business, Energy and Industrial Strategy Committee - House of Commons (parliament.uk)

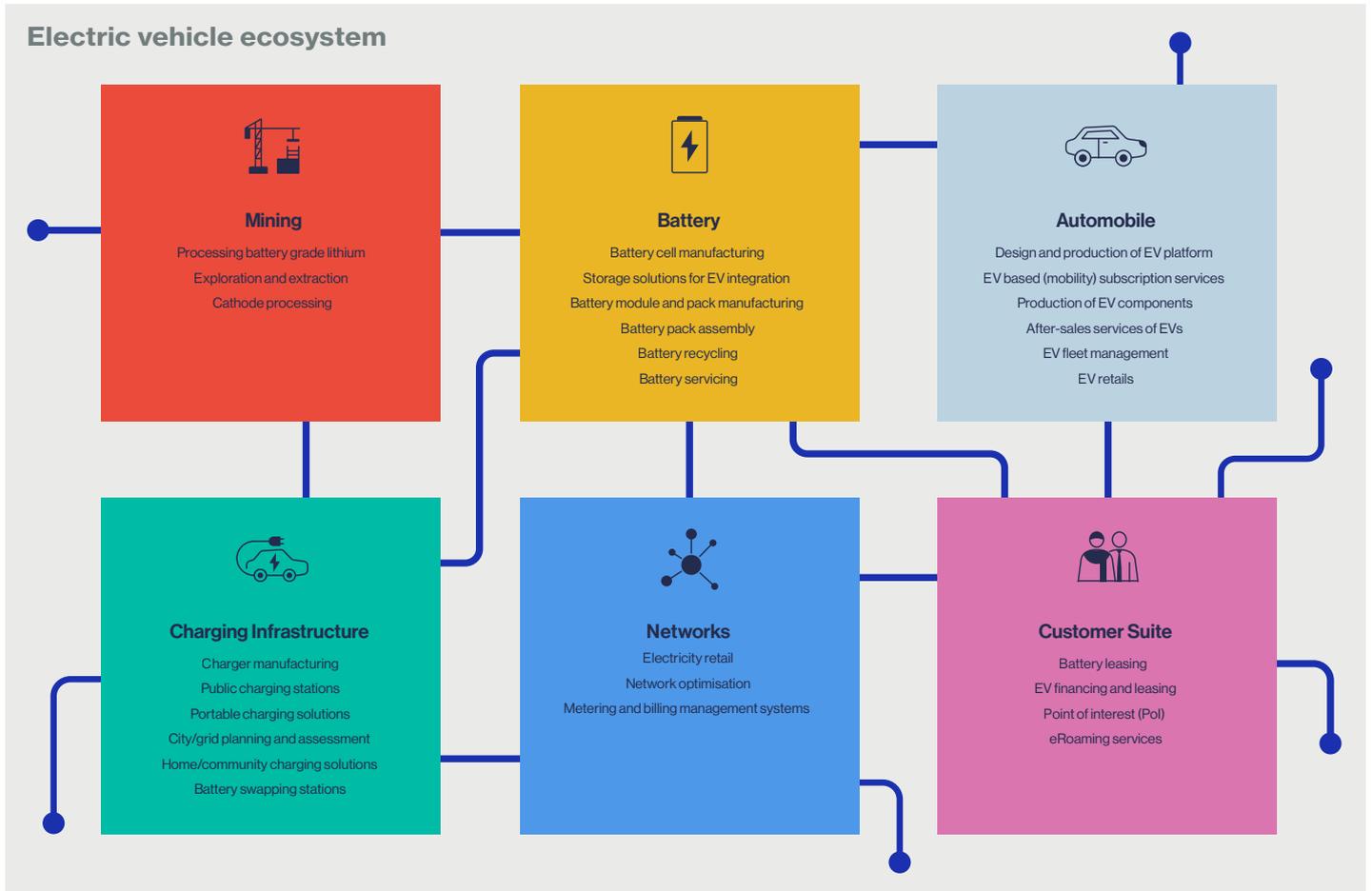
⁴³ BloombergNEF - BNEF EVO Report 2020 | BloombergNEF | Bloomberg Finance LP

⁴⁴ Fuel Cell Vehicles: Challenges (fueleconomy.gov)

⁴⁵ International Energy Agency - Global EV Outlook 2020 – Analysis - IEA

⁴⁶ HM Government - The Ten Point Plan for a Green Industrial Revolution (publishing.service.gov.uk)

4. Greener Transport



On the commercial side, manufacturers and large fleet operators are accelerating their investments in EVs as part of their long-term climate commitments, as well as to meet near-term policy requirements. Over 20 companies with operations in the UK have now committed to fully electric fleets by 2030, including the UK’s four biggest fleet operators: BT, Centrica, DPD UK and Royal Mail⁴⁷. Heavy-duty road freight has experienced faster growth than other modes of road transportation due to increased demand for goods, therefore this segment of the market plays a vital role in the decarbonisation of the transportation sector⁴⁸.

⁴⁷ The CCC - The-UKs-transition-to-electric-vehicles.pdf (theccc.org.uk)

⁴⁸ IEA - Tracking Transport 2020 – Analysis - IEA



4. Greener Transport

Key obstacles and role of the insurance industry

The shift towards electrification and alternative propulsion systems

In order to accelerate growth in the use of EVs, there is a significant reliance on the infrastructure transformation to facilitate this growth, particularly charging infrastructure across a broad range of locations including motorways, streets and private charging points. This will be a key driver of consumer demand for EVs going forwards, with a particular focus on the speed at which batteries can be charged, capacity of batteries to cover long distances, and cost. As of April 2020, there were approximately 18,000 public charging points in the UK, however projections by the UK Government Climate Change Committee estimate that nearly 325,000 will be needed by 2032 in order to grow the UK's EV fleet to 23.2 million by 2032⁴⁹.

Infrastructure availability is also a significant barrier to success for commercial fleet electrification. Corporates can incur significant charging infrastructure installation costs, and the scale of infrastructure may introduce limits on their operating models and capacity planning, for example through integrating charge point availability and recharge time into their planning. These costs will be significant for any individual company to bear, and the insurance industry can support by providing policy structures that put financial protections around these risks to encourage the flow of capital into infrastructure projects.

Not only is the availability of infrastructure important, but improvements in the interoperability of charging networks will be crucial to delivering a future-proof charging infrastructure. This will require collaboration between industry participants as well as governments, in order for consistent standards to be adopted.

Heightened risks of electric vehicles

Analysis of recent insurance claims by Allianz has indicated that, whilst electric vehicles are less likely to be involved in accidents due to shorter distances travelled, any damage sustained can be more expensive on average than for conventional cars. Whilst there is insufficient density of data to draw comprehensive conclusions at this stage⁵⁰, this is an area that the insurance industry will need to be cognisant of as the use of EVs continues to grow. It is critical that insurers are able to understand and respond to these changes in the risk landscape and refine the coverage they provide accordingly.

⁴⁹ Climate Change Committee - The-UKs-transition-to-electric-vehicles.pdf (theccc.org.uk)

⁵⁰ Allianz - AGCS-Electric-Vehicles-Risk-Report.pdf (allianz.com)

4. Greener Transport

[The battery supply chain](#)

As the global EV market continues to grow, there will also be a critical dependency on battery manufacturing capacity. The electrification of cars is a crucial driver in reducing battery manufacturing costs through economies of scale, and the cost of lithium-ion batteries has fallen by approximately 87% since 2010⁵¹. The UK is seeking to develop 'gigafactories' across the country in order to produce batteries at larger volumes, however there is currently limited capacity to extract and process enough raw materials such as lithium, nickel and cobalt to meet the anticipated requirements. The supply of some of these materials is also highly concentrated, with the Democratic Republic of Congo currently responsible for approximately 70% of global cobalt supply and China responsible for around 80% of all commercial-grade refined cobalt⁵². There is currently no commercial production of battery quality lithium raw materials in Europe, however research in the UK led by the Li4UK project is finding ways to produce lithium carbonate from UK-based raw materials, potentially providing a more sustainable supply chain as the EV industry gains momentum⁵³.

The demand for these materials has grown sharply over the last decade, particularly for metals used in the manufacturing of electronics such as lithium and cobalt. The extraction and ultimate disposal of these metals has a potentially harmful environmental impact; 100-120 GWh of electric vehicle batteries are estimated to retire by 2030, a volume roughly equivalent to current annual battery production⁵⁴. In addition, the restricted supply of raw materials will mean that manufacturers are exposed to heightened risks across their supply chains, for example due to geopolitical disputes. The insurance industry, which for decades has insured physical assets globally against loss due to political instability, can help vehicle manufacturers understand where these key dependencies lie in their supply chains and support to manage these risks.

[The risks of increased connectivity](#)

The growth in EVs is closely correlated with the growth in autonomous vehicles. The resulting increased connectivity and reliance on data has the potential to make the electricity system more vulnerable to cyber-attacks; an attack on EVs and fast charging stations could cause significant disruption to local power supply, with a central pool potentially required to cover catastrophic risks such as total outages of services and systems. Insurers will need to reflect on the increased inter-connectedness of infrastructure networks, to the extent that it may increase exposure to cyber-related claims.

⁵¹ Bloomberg NEF - BNEF EVO Report 2020 | BloombergNEF | Bloomberg Finance LP

⁵² NS Energy - China, cobalt and the Congo: Why Xi Jinping leads the batteries arms race (nsenergybusiness.com)

⁵³ Li4uk - lithium 4 UK | Securing Domestic Lithium Supply Chain for UK (li4uk.co.uk)

⁵⁴ International Energy Agency - Global EV Outlook 2020 – Analysis - IEA

4. Greener Transport

Roadmap for action



The business model of automotive companies operating in the EV sector is shifting from manufacturing towards providing full lifecycle solutions to customers. New insurance requirements are emerging as a result of this change in business model, for example an increase in demand for non-damage business interruption cover to protect against enhanced risks of connectivity, and cover for inter-connected global operations (compared to cover for local operations). Insurers will need to refine their product offerings to remain relevant in a changing industry.



To drive innovation and accelerate product development, through the SMI Insurance Task Force Lloyd's will:

- Design an innovative EV insurance product to address protection gaps as new risks emerge and vehicle business models evolve.

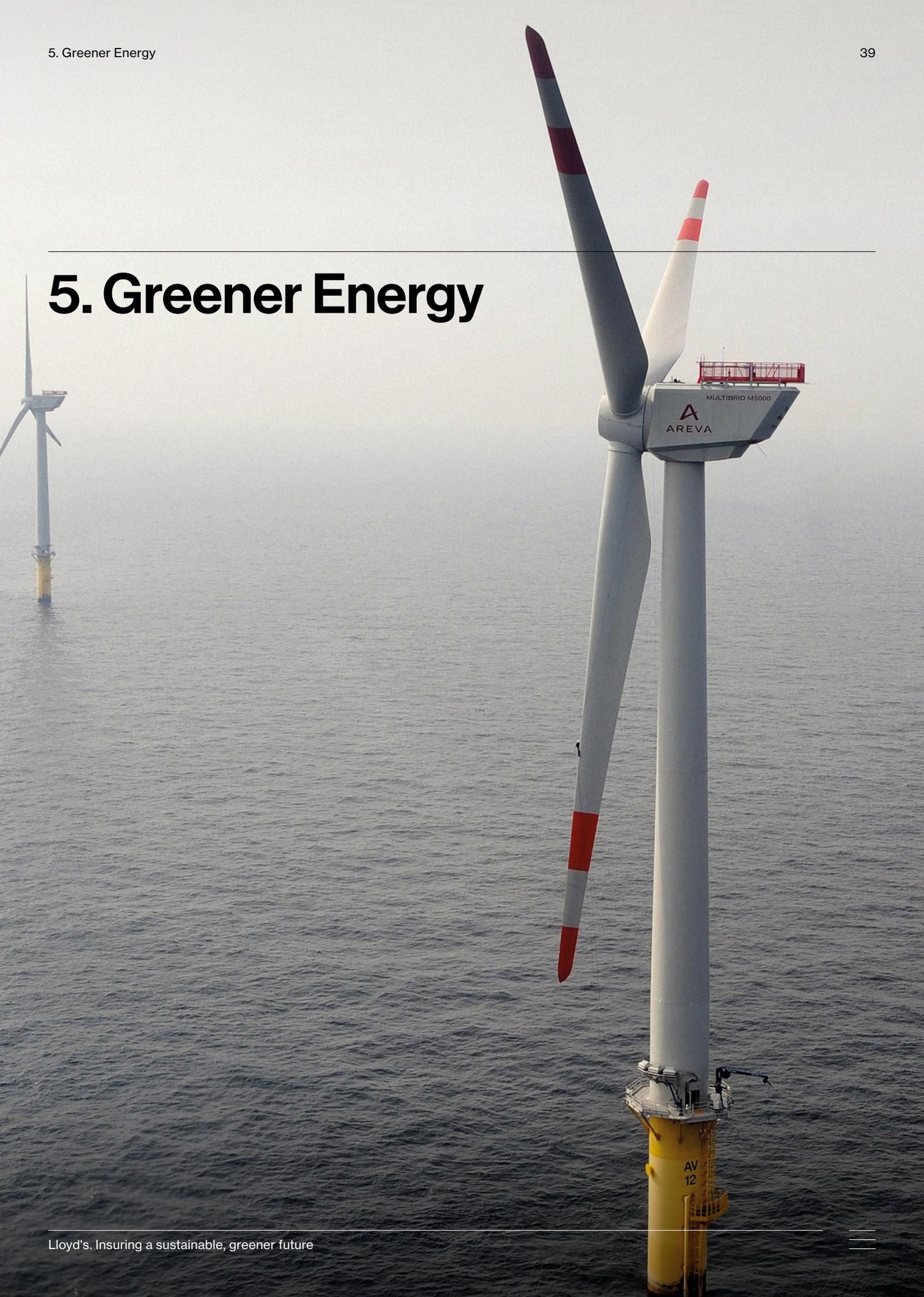


Lloyd's will then:

- Facilitate a product design sprint to develop potential products from ideation to commercially viable products.



5. Greener Energy



5. Greener Energy

5.1 Offshore wind

Introduction

Wind energy is central to facilitating a global transition towards a future-proof energy system. China, Germany and the UK were the world's largest offshore wind producers in 2020, and China is leading on new capacity installations⁵⁵. In the last thirty years, Britain's reliance on coal for electricity has decreased significantly from 70% in 1990 to less than 3% today⁵⁶. A major part of this transition has been driven by the growth in electricity generation from wind energy, with 9.9% of the UK's electricity in 2019 being generated by offshore wind⁵⁷.

The future of offshore wind

The global offshore wind market is evolving rapidly, and technology innovation will be key to driving growth as the sector matures. Advancements in floating wind technology are helping to accelerate growth in areas further from shore and in deeper waters. This in turn is unlocking wind energy generated in regions previously considered unsuitable for fixed-base offshore wind installations, posing a significant growth opportunity for the sector. This is driving the emergence of new offshore wind markets outside Europe, which previously dominated the market. At the end of 2018, 83% of the world's offshore wind capacity was produced in Europe; over the next decade, however, it is anticipated that Asia and the US will account for 48% and 11% of new offshore wind development respectively⁵⁸.

Turbine technology is evolving, with blades continuing to increase in size and energy production from a single turbine also continuing to increase. New drone technologies are being tested and are expected to play a vital role in the inspection and maintenance of these larger wind turbines, given they are typically positioned in less accessible locations further offshore.

Key commitments to offshore wind development

Significant commitments have been made globally to increase offshore wind production. The UK Government, for example, has stated its ambitions to increase offshore wind production to 40GW by 2030. This includes 1GW of innovative floating offshore wind, which is equivalent to over fifteen times current worldwide volumes of production⁵⁹. It is this backdrop of a substantial growth trajectory combined with a changing risk landscape that paves the way for insurers and their distribution partners to play a critical role in driving the success of the sector.

⁵⁵ REVE - World Gets 2.5 GW of Offshore Wind Energy in H1 2020 | REVE News of the wind sector in Spain and in the world (evwind.es)

⁵⁶ Department for Business, Energy & Industrial Strategy - End of coal power to be brought forward in drive towards net zero - GOV.UK (www.gov.uk)

⁵⁷ GOV.UK - Wind_powered_electricity_in_the_UK.pdf (publishing.service.gov.uk)

⁵⁸ EY - Which Direction Is Offshore Wind Blowing? | Discover (ey.net)

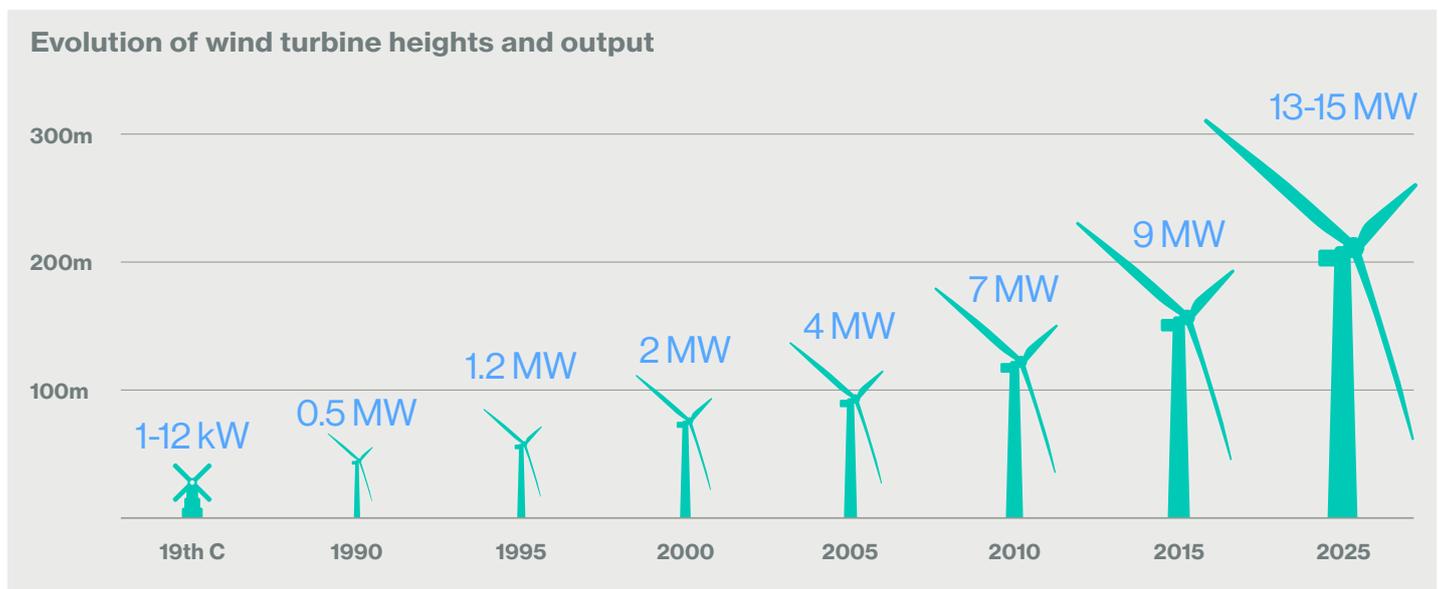
⁵⁹ GOV.UK - New plans to make UK world leader in green energy - GOV.UK (www.gov.uk)

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Key challenges

Turbine infrastructure and new technologies

In order to achieve continued growth in the offshore wind sector, supporting infrastructure must be transformed with significant investment in bigger turbines, cabling and transmission infrastructure to connect new wind farms to the onshore electricity grid. The cost of installing this infrastructure will be a key barrier to success in this sector. In order to overcome this, corporates are increasingly seeking economies of scale by developing turbines with bigger capacities; 15MW turbines are expected to be standard by 2030, compared with an average capacity of 4MW ten years ago⁶⁰, in turn resulting in increased need for significant investment from a breadth of capital providers and private investors. These investments must be backed by insurance programmes that can help to de-risk these investments and facilitate the necessary capital flows.



It is also important to reflect on historic wind energy assets currently in operation. The lifespan of wind farms is much lower than coal-fired power stations, with a wind farm typically considered to have a design life of 20 years⁶¹. A growing number of turbines are thus reaching the end of their operational lifetimes, and in 2021 we expect owners of around 4.8GW of onshore capacity to be faced with end-of-life decisions on the assets⁶². This creates challenges with respect to the decommissioning and recycling of materials, with the high price of decommissioning acting as a deterrent for some insurers entering the market⁶³.

⁶⁰ ORE Catapult - Delivering 40GW - Accelerating the UK's Transition to net zero (catapult.org.uk)

⁶¹ ClimateXChange - Life Cycle Costs and Carbon Emissions of Offshore Wind Power (climatexchange.org.uk)

⁶² Bloomberg NEF - Energy, Transport, Sustainability – 10 Predictions For 2021 | BloombergNEF (bnf.com)

⁶³ Lloyd's of London Emerging Risk Report 2017 Innovation Series - <https://www.lloyds.com/-/media/files/news-and-insight/risk-insight/2017/stranded-assets.pdf>

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This brings into focus the full carbon life cycle of wind farms, including the use of carbon intensive materials such as concrete for turbine construction. The carbon payback period, defined as the time for the carbon emissions displaced by wind power to equal the life cycle carbon emissions of the wind farm, is an average of 0.6 years for an offshore wind farm, therefore significantly lower than its design life⁶⁴.

[Evolving risk landscape](#)

As offshore wind farms become bigger and move further from shore, the risk landscape in this sector is evolving. The development of larger wind farms, both in terms of size as well as turbine capacity, is likely to result in new claims challenges, including increased mechanical breakdowns, cable faults resulting in lapses in power generation, and foundation-related damage, particularly at deeper-water sites. In addition, there will be heightened exposure to natural catastrophe risk at deep-water sites, both in terms of physical damage as well as potential project delays caused by extreme weather events. Furthermore, operational floating windfarms in deeper locations could have their own unique risk profile, one that does not necessarily match any existing claims data, although it is already clear that there will be an increased probability of cable damage due to the longer cables required to transmit energy back to shore.

Claims losses for the offshore wind sector have so far primarily been driven by cabling and foundation-related risk events, with analysis from California-based GCube, a leading insurance provider in the renewable energy market, indicating that these accounted for 55% and 35% of total claims respectively over the past 10 months⁶⁵. There have also been significant mechanical breakdown losses incurred at all but one of the worldwide floating wind installations currently in operation.

Insurers will ultimately need to understand the changes to the risk profile of offshore wind assets and respond with appropriate insurance cover that is reflective of the changing risks, as well as supporting corporates in managing them. There is an opportunity for the insurance industry to work closely with energy companies and share their expertise in modelling natural catastrophes. This would ensure a consistent and deeper understanding of risk across the sector, and establish a successful platform to provide specialist cover for natural catastrophe and extreme weather events. This is particularly the case in emerging markets in Asia-Pacific, which face more volatile weather conditions combined with less history in the sector relative to established markets.

[Variability in energy generation](#)

As wind energy contributes to an ever-increasing proportion of global electricity generation, there are concerns around the variability of electricity generation from wind and the extent to which this may complicate the case for further investment. Part of the solution may lie in expansion of offshore wind farms to locations further offshore, where wind conditions are more consistent. New technologies are also being explored, such as hydrogen fuel cells, which harness and store excess offshore wind energy for when generation is reduced.

⁶⁴ ClimateXChange - Life Cycle Costs and Carbon Emissions of Offshore Wind Power (climatexchange.org.uk)

⁶⁵ GCube - Claims: Offshore wind must quickly respond to changing global risk profile : GCube Insurance Services » Renewable Energy Insurance Coverage (gcube-insurance.com)

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Financial guarantees will be necessary to solve the complex issues of variability in electricity generation; national governments in regions such as the Nordics, for example, provide availability guarantees to protect operators in this sector from the revenue risk associated with this variability. For those who do not benefit from such government guarantees, the insurance market has taken some steps to provide operators with protection against variability in wind volumes in the form of index-based parametric cover, which goes some way to mitigating this risk.

Roadmap for action



Offshore wind projects continue to increase in scale and complexity, with advances in turbine technology (with respect to foundation depth, distance from shore and power output of each turbine) evolving rapidly. The global insurance industry has a unique opportunity to further expand the coverage it provides to the offshore wind sector to meet demands for additional insurance capacity, which is being driven by the rapid advancement of new offshore wind technology including turbines and floating wind technology.

In addition, given the size of many offshore wind projects, a blended financing model is necessary which typically requires a combination of investment from private corporates (often large utilities and/or oil and gas companies), overseas investors and large institutional investors to achieve success.



To support and accelerate the growth of offshore wind, the SMI Insurance Task Force has:

- Convened a workstream focused on supporting and encouraging more sustainable investment, including into offshore wind projects. In 2021, the workstream will launch a green investment proposal, outlining the intent and capability of the insurance industry to make resources available to support green investment, and the regulatory changes required to realise this ambition.
- Provide a platform to ensure there is co-ordinated action between the insurance industry, operators in the offshore wind sector and private investors.



In addition, Lloyd's will:

- Commit to expanding its coverage to ensure capacity constraints do not limit the growth of the industry.

Key: ■ The global insurance industry ■ Lloyd's in its role as Chair of the SMI Insurance Task Force ■ Lloyd's

5. Greener Energy

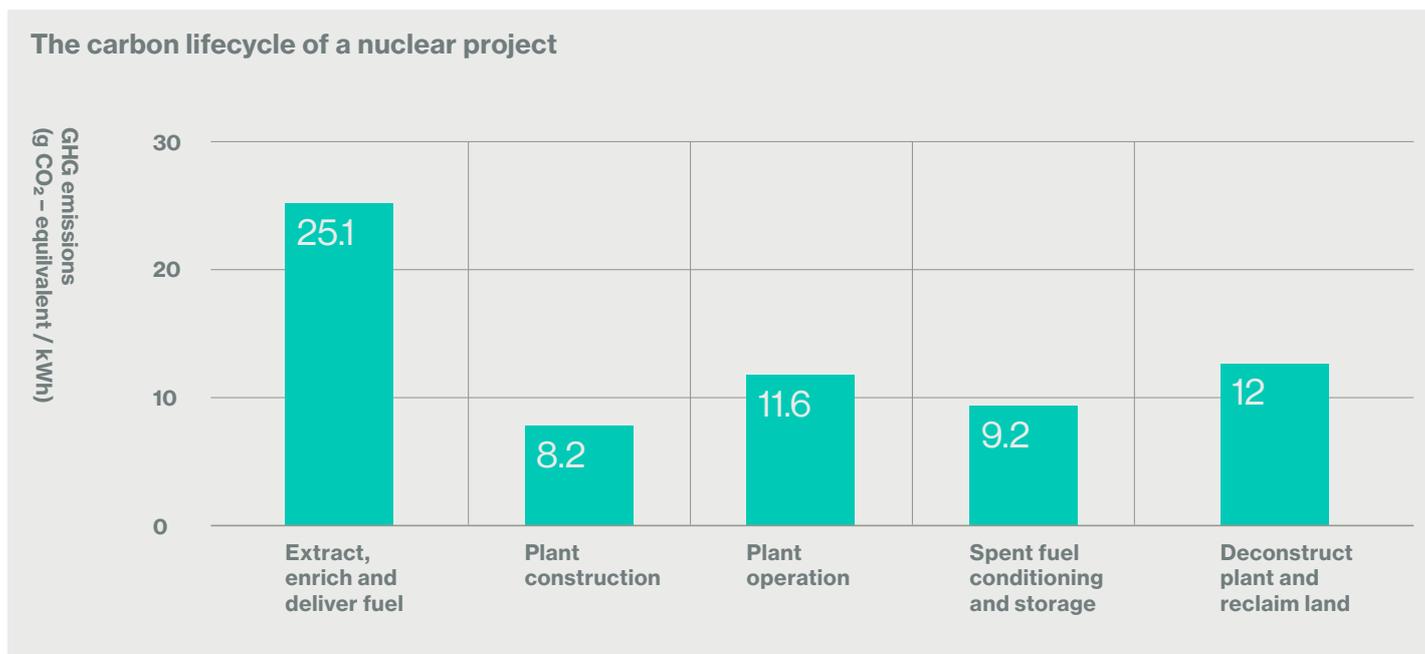
5.2 Nuclear

Introduction

Since the origins of nuclear power generation in the 1950s, the global insurance industry has provided insurance for the unique needs of nuclear energy projects through risk pooling, alongside public-private partnerships. Nuclear pools were formed to insure civil nuclear risks within their national market and provide inter-pool reinsurance. They were created in the spirit of a bilateral relationship between the newly forming sector, governments and the insurance market.

As the second largest source of low-carbon energy, nuclear energy now provides around 10% of global electricity supply, generated from around 440 power reactors across 31 countries⁶⁶. Predictions from the 2020 World Energy Outlook suggest electricity generation from nuclear could increase by almost 55% by 2040 in its sustainable development scenario⁶⁷. Nuclear energy provides many developed and developing countries with a reliable source of energy that complements more intermittent renewable energy which relies on external conditions such as weather. A blend of both nuclear and renewable energy sources therefore enables cities and countries to achieve a stable supply of low-carbon power to their electricity grids.

Although some scepticism remains as to whether nuclear energy should be a long-term solution, owing to the carbon intensity of the construction and decommissioning of nuclear power plants and the safety of nuclear waste disposal, emissions during the construction period are typically offset between 18 months and five years of operation. Over the 60 to 80-year lifespan of a nuclear power plant, it is therefore expected to generate a negative carbon footprint.



⁶⁶ World Nuclear Association - <https://www.world-nuclear.org/information-library/current-and-future-generation/nuclear-power-in-the-world-today.aspx>

⁶⁷ The International Energy Agency – The World Energy Outlook Report 2020

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[Development of global nuclear capacity](#)

The US is currently leading the nuclear energy market, accounting for more than 30% of worldwide nuclear generation of electricity⁶⁸, closely followed by France⁶⁹. Nuclear power capacity worldwide is increasing steadily, with around 50 reactors currently under construction⁷⁰, in countries including China and the United Arab Emirates. In the UK, nuclear power stations are amongst the highest performing in the world, generating 20% of the country's electricity⁷¹. This impressive output provides carbon savings equivalent to taking one third of all cars off UK roads. This nuclear power capacity is being further developed through new large-scale nuclear projects, including Hinkley Point C, the first nuclear power station to be built in the country in over two decades⁷².

[The future of nuclear technology](#)

The next generation of nuclear technology is also being actively explored. For example, the Advanced Reactor Demonstration Program in the US provides initial funding to develop, test, licence and build advanced nuclear reactors. These technologies potentially address several challenges of larger nuclear power plants, by reducing upfront capital investment and build time while simultaneously enhancing efficiency and maintaining high levels of safety standards and protection.

Nuclear applications also extend beyond its direct use as a low carbon energy source. There is a potential future role for nuclear technology in powering the production of green hydrogen, which could act as a key enabler in facilitating decarbonisation across a range of sectors. In addition, nuclear technology has potential applications in the maritime industry through the use of low carbon nuclear propulsion on ships using liquid fuelled micro-reactors.

Key obstacles and role of the insurance industry

[The nuclear insurance landscape](#)

Nuclear insurance typically includes first-party liability covering property, machinery and business interruption, and third-party liability covering site and transit liabilities. The complex, large-scale and catastrophic risks that nuclear projects present have meant that commercial insurance markets have not been able to provide the net capacity to insure civil nuclear industry risks. In addition, since the formation of the sector in the 1950s, general insurance policies have applied a nuclear exclusion clause to exclude damage caused by nuclear or radiation⁷³. These two factors combined have created the need for bespoke and innovative coverage solutions.

⁶⁸ International Energy Agency - Nuclear - Fuels & Technologies - IEA

⁶⁹ World Nuclear News - Macron stresses importance of nuclear energy for France : Nuclear Policies - World Nuclear News (world-nuclear-news.org)

⁷⁰ World Economic Forum - Where are the world's 449 nuclear reactors? | World Economic Forum (weforum.org)

⁷¹ World Nuclear Association - Nuclear Power in the United Kingdom |UK Nuclear Energy - World Nuclear Association (world-nuclear.org)

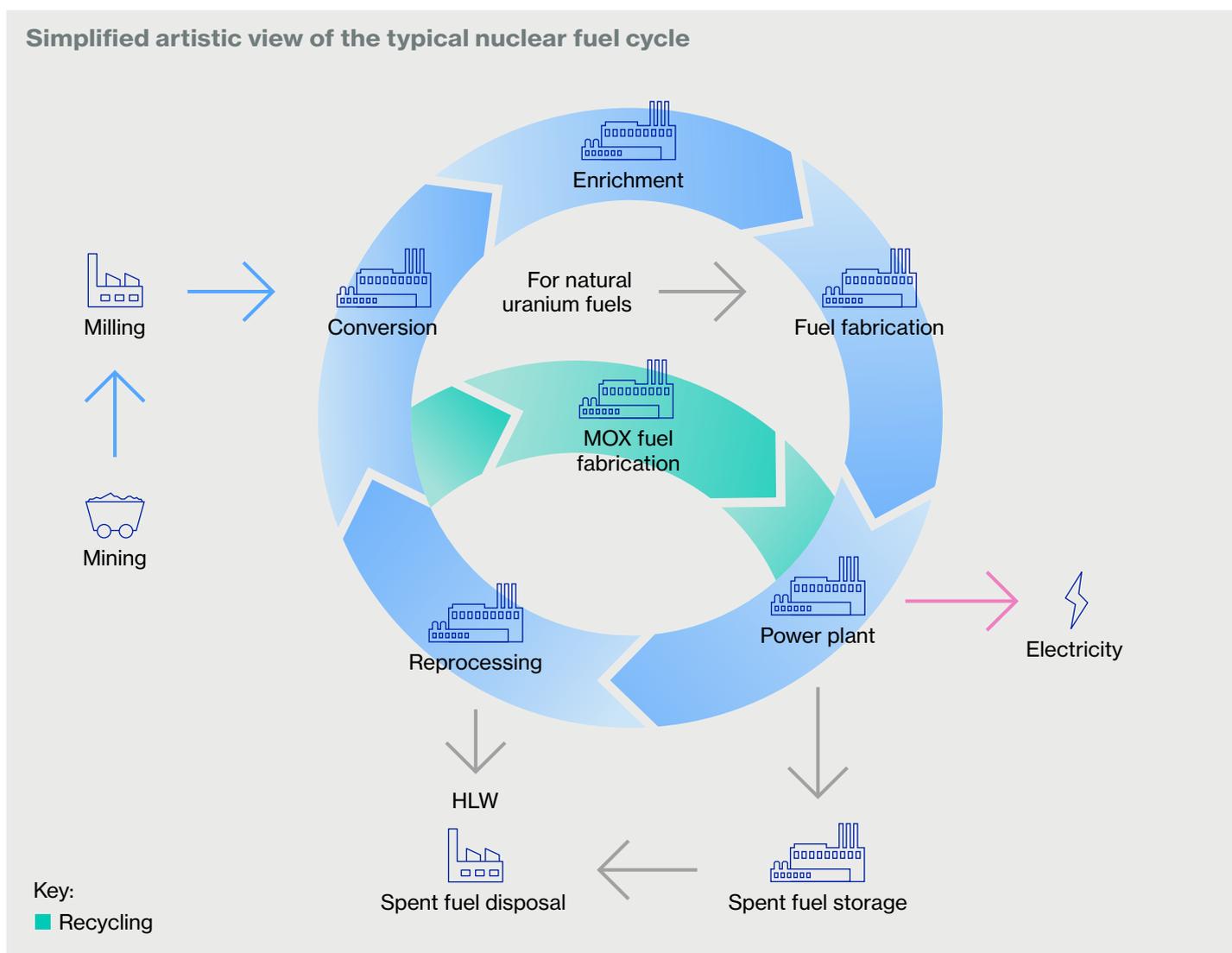
⁷² Nuclear Industry Association - Fortyby50_TheNuclearRoadmap_201009.pdf (niauk.org)

⁷³ LMA5202 Nuclear Risk Exclusion Clause (Property Reinsurance) (lmalloyds.com)

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Globally, there are 28 government insurance pools for nuclear risks, 19 of which are in Europe⁷⁴. These offer reciprocal reinsurance capacity to reach the required level of cover for nuclear power plants (NPPs) and the wider civil nuclear industry fuel cycle (see infographic below), and enable both governments and the insurance industry to work together to provide accessible solutions for the civil nuclear industry. In doing so, they can protect the communities in which NPPs are situated and provide a large part of the social licence for nuclear operators to operate.

This is an example of the insurance industry collaborating to create a successful insurance solution to a regionally systemic risk, something which Lloyd's has been involved in from the establishment of the British Insurance (Atomic Energy) Committee in 1956, the forerunner of NRI. Lloyd's is aiming to replicate this approach more broadly through Futureset, its global platform and community to create and share risk insight, expertise, and solutions to our most challenging insurance problems.



⁷⁴ Nuclear Risk Insurers - Nuclear Pools

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The other major sources of insurance capacity for nuclear risks are through captives and mutual insurance entities of which there are several operating today – providing nuclear first and third-party liability capacity in partnership with commercial insurers, of which the Lloyd's market is the global leader.

The nuclear industry has traditionally been excluded from the mainstream insurance markets of most countries, creating the specific need for bespoke coverage. A significant proportion of this is provided through the Lloyd's market, with a number of syndicates providing specialist coverage for civil nuclear installations, property damage, machinery breakdown, business interruption, nuclear third-party liability, nuclear transit liability and construction. The Lloyd's market remains involved in the provision of insurance on new projects such as Hinkley Point C in the UK and other builds internationally, during construction through to operation and eventual decommissioning.

Nuclear development costs

While nuclear power generation offers significant benefits in providing low-carbon and consistent energy to the grid, the lifecycle of a nuclear project is a costly endeavour which requires both significant up-front investments to fund the design and construction of a plant, together with the eventual and time-consuming decommissioning of the site once the reactor has reached its useful limit. Currently, the majority of decommissioning costs in the UK are met by the Government through the Nuclear Liabilities Fund, however this approach differs by country. In France, for example, decommissioning costs are primarily met by the nuclear industry.

The significant cost of capital represents a key challenge for the expansion of the sector, requiring an appropriate funding model for new nuclear capacity that drives a better return on investment. The high upfront costs of new nuclear and long construction timelines mean that new financing models have been required to make projects more viable – notably the regulated asset base (RAB) model of financing, which the UK Government has backed as a “credible model for large scale nuclear projects”⁷⁵.

Another related issue is the extent to which investors are willing to take on the unique risks that nuclear power brings, such as the potential to cause long-term, catastrophic health and environmental impacts, for example as a result of improper disposal of nuclear waste. A key dependency will be on whether nuclear energy is included in the EU's sustainable finance taxonomy, a decision on which is expected soon by the European Commission, which will impact whether nuclear energy is considered a sustainable investment. The global insurance industry via the nuclear pools has a role to play in providing sufficient coverage to ensure private investors are comfortable with the residual risk to which they are exposed.

Attempts to minimise construction risks and costs are also being actively explored by the nuclear sector, for example through replication of existing designs as well as increasing the use of Small Modular Reactors. In the UK, the Government is targeting a 30% reduction in the cost of new nuclear projects by 2030⁷⁶. Nuclear energy providers are also working to reduce the environmental impacts of the construction and decommissioning phases by reducing volumes of materials used, reducing and reusing waste, and effectively managing water resources.

⁷⁵ Department for Business, Energy & Industrial Strategy - Regulated Asset Base (RAB) model for nuclear - GOV.UK (www.gov.uk)

⁷⁶ Nuclear Industry Association - [Fortyby50_TheNuclearRoadmap_201009.pdf](https://www.niauk.org/fortyby50) (niauk.org)

5. Greener Energy

[Nuclear liability capacity](#)

Several barriers exist to limit the expansion of insurance capacity, including the inherent volatility of nuclear insurance claims, given the low frequency and high severity that losses can present. Despite strong safety and performance records of the nuclear industry, the perceived risk of nuclear energy remains a key barrier to entry for many insurers and investors, and a greater level of education will be required to address these existing concerns.

Nuclear operators' third-party liabilities are governed through a number of international conventions. Under revisions to the Paris Convention that are expected to come into force from January 2022, third-party liability limits will increase significantly for operators in participating countries. The amended Paris Convention will cover a broader range of damage than it does today, and the claims period for nuclear damage in relation to life and personal injury will be extended from ten to 30 years⁷⁷, significantly increasing the scope and complexity of claims and impacting some insurers' appetite to offer the increased insurance coverage that many operators will be seeking. In particular, an increase in the mandated claims period could significantly increase the loss of life and personal injury claims incurred by nuclear operators, as an extended claims period will consequently capture claims from those suffering from longer term illnesses or the delayed effects of harmful nuclear exposure.

Losses due to nuclear site accidents are generally covered by very few policies, with liability channelled through the site operator, creating further concentration risk and increasing the volatility of outcomes for insurers. In addition, despite a few significant nuclear accidents in recent years, the availability of comprehensive actuarial data from the nuclear industry is low because of the low incidence of losses.

However, there is an opportunity for insurers to support the future development of low carbon nuclear projects through the provision of cover for tranches of construction risk relating to new nuclear capacity. With statutory third-party liability cover for the nuclear industry expected to increase substantially due to a pending change in regulations, combined with new nuclear capacity being developed, there is demand on the non-mutual insurance market to alleviate some of these pressures by providing the requisite additional capacity. Given the scale of the risks, this will likely need to be in parallel with government support packages.

⁷⁷ Nuclear Energy Agency – 2004 Protocol to Amend the Paris Convention

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Insuring the future of nuclear technology

Nuclear power technologies have been evolving in recent years and new innovations such as passive safety systems and digital continual plant assessment are significantly reducing nuclear risks. Small Modular Reactors also contribute to lowering risks, as they contain smaller quantities of radioactive materials and are designed to rely more on inherent safety characteristics rather than operational measures and human intervention.

Another emerging technology is nuclear fusion which, in contrast to nuclear fission, carries no risk of nuclear reactor meltdown (as it produces no chain reaction) or high activity, long-lived nuclear waste. As a result, the type and level of third-party liability insurance will inevitably need to be tailored.

Critically, there will be a need in the immediate term for innovation and customised solutions to provide protection for such new technologies, from construction through to operation.

Roadmap for action



The global insurance industry has a unique opportunity to further expand the coverage it provides to the nuclear industry in order to meet demands for additional insurance capacity, which is being driven by anticipated regulatory changes and the development of new nuclear capacity. The Lloyd's market provides significant capacity to nuclear risk specialists NRI (the British Nuclear Insurance Pool) and Northcourt (an independent MGA), who take an active lead in identifying how to increase insurance capacity for the sector, and what combination of government support, risk pooling, and mutual arrangements is needed to ensure adequate protection is available.



As global leaders in providing insurance for the nuclear energy sector, Lloyd's will support the increase in nuclear insurance capacity through:

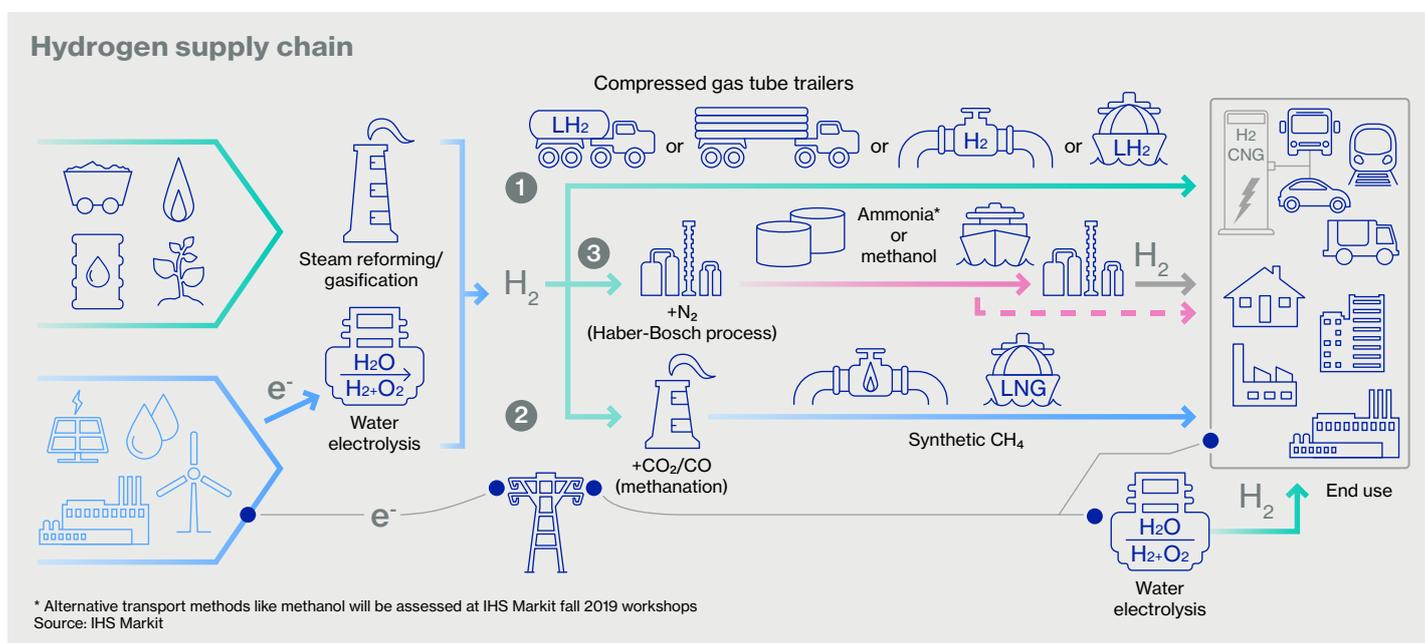
- Providing a platform to ensure there is co-ordinated action between the insurance industry, civil nuclear sector and government, and to ensure that nuclear operators are able to meet the additional liability required by regulations.

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5.3 Hydrogen

What is Hydrogen?

Hydrogen is a fuel that produces no direct GHG emissions or other pollutants when combusted. Its lightness and energy density, combined with its ability to act as an energy carrier that can be used to store, move and deliver energy produced from other sources, makes it a key enabler in accelerating the decarbonisation of a range of sectors, including metals and mining, chemicals, domestic and international freight, heavy transportation, cement and agriculture. In addition, as a liquid fuel, hydrogen has key advantages in storage and transportation.



How is Hydrogen produced?

Hydrogen can be produced from a variety of sources, such as natural gas, biomass, and renewable power, and this in turn informs its classification – grey, blue or green. Currently, the majority of hydrogen is grey hydrogen, which has a high carbon footprint and is often produced using fossil fuel inputs.

Blue hydrogen, on the other hand, has a lower expected carbon footprint and uses natural gas and carbon capture and storage as feedstock for its production; it is typically generated at historic oil and gas production sites.

Green hydrogen goes one step further and has an even lower carbon footprint than blue hydrogen. It is produced by splitting water by electrolysis using electricity that has been produced using excess energy from renewable energy sources such as wind and solar. The most critical factor driving the cost of green hydrogen is the price of the renewable energy used as an input; in the first instance, it is likely that the majority of growth in clean hydrogen production will be driven by blue hydrogen until renewable energy achieves sufficient scale to make production of green hydrogen economically viable⁷⁸.

⁷⁸ IEA - The clean hydrogen future has already begun – Analysis - IEA

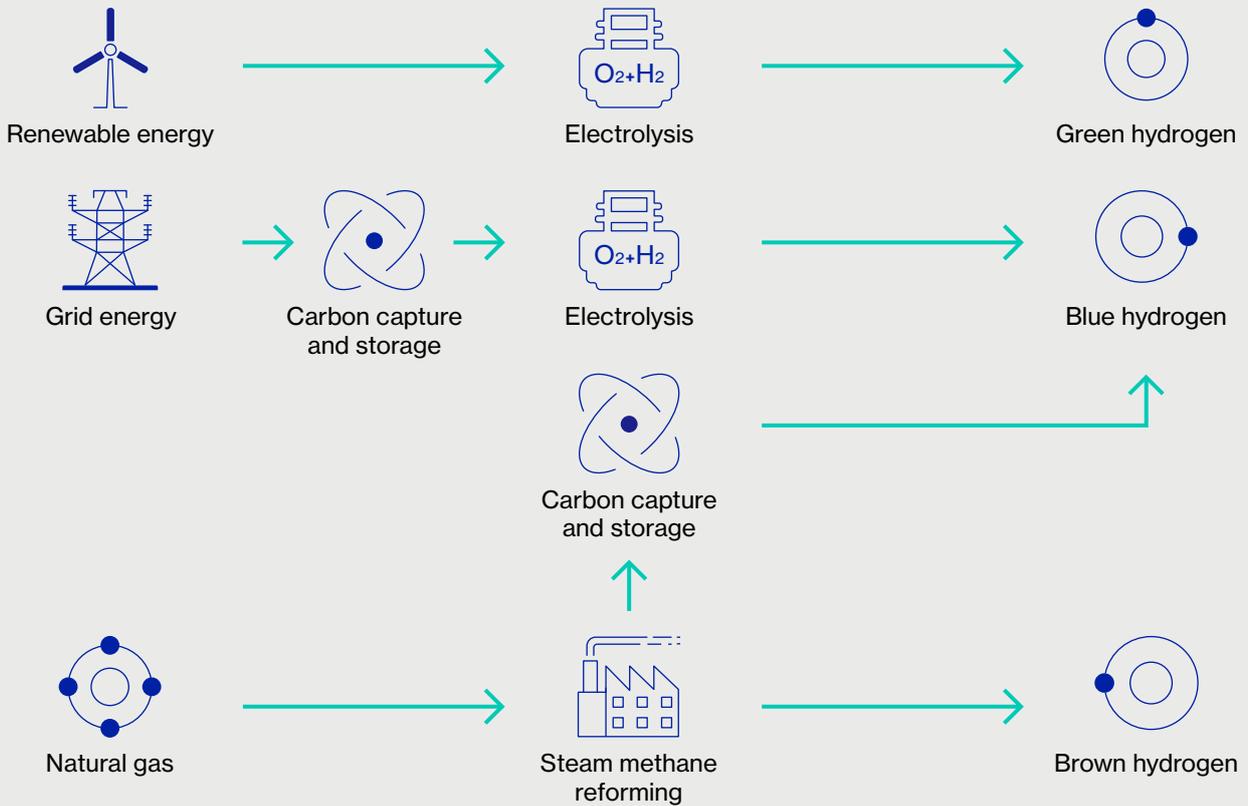
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Green hydrogen

Green hydrogen is produced by using electricity to split water (H₂O) into its component parts – hydrogen and oxygen. If the electricity is produced by renewable power, such as solar or wind, the resulting hydrogen is carbon-free.

Green hydrogen has the potential to play a particularly prominent role in the storage and transmission of excess energy output from intermittent renewable energy assets, which can then be redeployed globally for heat, electricity and as a key energy input for industry.

Hydrogen process



5. Greener Energy

[How can hydrogen be used to support decarbonisation?](#)

Hydrogen is widely used as a low-carbon alternative in many industrial applications as a fuel which is burned with oxygen. It can be used in fuel cells, internal combustion engines and industrial heating processes.

Hydrogen use today is mainly dominated by industry, however its potential uses span across the entire value chain from renewable energy generation, through to transportation, and homes and buildings. Hydrogen fuel cell technology can be used to power anything that uses electricity, with applications across transportation such as electric vehicles and aviation, and offers the benefit of higher energy efficiency than traditional combustion engines. Hydrogen can also be blended into existing gas networks to provide power to homes and public buildings.

Green hydrogen goes one step further and has an even lower carbon footprint than blue hydrogen. It is produced by splitting water by electrolysis using electricity that has been produced using excess energy from renewable energy sources such as wind and solar. The most critical factor driving the cost of green hydrogen is the price of the renewable energy used as an input; in the first instance, it is likely that the majority of growth in clean hydrogen production will be driven by blue hydrogen until renewable energy achieves sufficient scale to make production of green hydrogen economically viable .

In addition, hydrogen can be a leading option for storing renewable energy when converted into a carrier such as ammonia, helping to manage both the variable output from renewables as well as the transportation of renewable energy over long distances, such as from offshore wind farms.

Green steel

Steel is traditionally produced using iron ore and/or scrap metal as a basic material, together with a reducing agent which removes oxygen from the iron ore. Traditional manufacturing uses coke as a reducing agent, which emits carbon dioxide when it reacts with the oxygen in the iron ore.

Green steel is produced using hydrogen instead of coke as the reducing agent. While hydrogen also reacts with oxygen in the iron ore, the result is water vapour rather than carbon dioxide.

Plans are underway to build a green steel production facility in Sweden, using a fossil-free manufacturing process which will be powered by the world's largest green hydrogen plant. The size of H2 Green Steel's hydrogen plant is expected to be around 800 megawatts, with its end-product replacing coal and coke in the steel manufacturing process. Steel production is expected to begin in 2024, and by 2030 the aim is to have the capacity to produce 5 million tonnes of steel per year.

5. Greener Energy

[Hydrogen strategies](#)

The EU has put hydrogen at the heart of its green recovery, with a target of 40GW of electrolyser capacity by 2030⁷⁹. It also has ambitions to strengthen the hydrogen transportation network in the region, working with gas grid operators to develop the 'European Hydrogen Backbone' which leverages existing gas transmission pipelines to connect the demand and supply of hydrogen.

Similarly, the UK Government has identified the growth of hydrogen as a strategic imperative and aims to develop 1GW of low carbon hydrogen production capacity by 2025 (increasing to 5GW by 2030). It also plans to launch a £240m net zero hydrogen fund to promote low carbon hydrogen production in the UK, and will release its formal hydrogen strategy later in 2021⁸⁰.

The Sustainable Markets Initiative has established a Hydrogen Taskforce to support and accelerate the deployment of hydrogen globally as one of the decarbonisation tools critical to facilitating net zero emissions. The Task Force, chaired by Shell, has committed to a number of actions ahead of COP 26 in November 2021 including: creating a template for a hydrogen ecosystem to act as a basis for a hydrogen energy-based economy, developing formal pledges with participating companies committing to the use of clean hydrogen in their supply chains, and identifying policy and regulatory levers needed to accelerate the adoption of hydrogen fuel cells in transportation.

Key challenges

[Hydrogen infrastructure networks](#)

A key obstacle to the success of hydrogen is the infrastructure required to achieve scale. Though the technology to use hydrogen for heat, electricity and as an input for industry has existed for some time, infrastructure is essential to enable the hydrogen economy to operate across its full value chain from upstream production, to midstream storage and transmission to downstream fuelling and distribution.

Any development should enable hydrogen to be transported at scale through the existing gas transmission network or via the use of specialised vehicles that can transport hydrogen safely. The conversion of existing natural gas pipelines to deliver hydrogen is a significant and costly undertaking as hydrogen's potential to embrittle steel pipelines above a certain concentration threshold will result in the need for pipeline modification.

In addition to the cost of any hydrogen transportation infrastructure modification or introduction, hydrogen itself is currently costly to produce. Green hydrogen production costs could fall by up to 30% by 2030 according to some projections, however such a reduction would be dependent on a decline in the cost of renewable energy, an increase in production to benefit from economies of scale, and significant investment to achieve economic viability⁸¹.

⁷⁹ Environment Analyst - Environment Analyst Global | Environment Analyst Global (environment-analyst.com)

⁸⁰ HM Government - The Ten Point Plan for a Green Industrial Revolution (publishing.service.gov.uk)

⁸¹ International Energy Agency - The Future of Hydrogen – Analysis - IEA

5. Greener Energy

The production of low-carbon hydrogen is in its early stages, with less than 0.7% of hydrogen production globally currently “clean” (i.e. blue or green hydrogen)⁸². There is an expectation that this proportion will grow significantly should national governments achieve the ambitions contained within their respective hydrogen strategies, however it remains to be seen whether these obstacles to success can be overcome collectively by industry, insurers and government.

The insurance industry can help to de-risk investment into hydrogen infrastructure and incentivise private-sector investment. This will ultimately enable the hydrogen economy to achieve scale and therefore drive down production costs. This will, however, require a long-term government policy framework to give investors the certainty they require, connectivity between individual projects and a broader infrastructure network to ensure the hydrogen economy can operate across its entire value chain, and a clear risk allocation mechanism between governments, the private sector and insurance providers where such risks are too great for one stakeholder to carry alone.

[The nature of hydrogen risks](#)

As the hydrogen economy continues to grow, there will likely be significant changes to the risk landscape of the industries looking to utilise this energy source, which may naturally give rise to additional safety risks, for example due to its flammability and explosive properties. These risks exist across the entire hydrogen value chain, including during transportation and storage at the point of use, where leakages can be catastrophic. The insurance industry therefore needs to understand, and then help companies operating across the hydrogen economy to better understand the changing risk profile and subsequent coverage requirements. The insurance industry is uniquely placed to support this centrally, using its experience across multiple industries to create global best-practice guidelines.

The Lloyd's market is already providing specialist insurance cover for safety risks associated with the transportation of hydrogen. Such cover will likely need to be scaled, particularly as the modification of existing gas transmission pipelines continues to gather pace.

Insurance cover is already relatively well established for offshore wind projects involved in green hydrogen production (recognising that this subset of the offshore wind market is still in early stages of development). There is a precedent on which the insurance industry can build to provide broader coverage to other segments of the hydrogen economy and its value chain.

⁸² EUI Florence School of Regulation – Clean hydrogen

5. Greener Energy

Roadmap for action



Hydrogen is a vector of change and facilitator of decarbonisation for several sectors and significant investment will be required to develop hydrogen infrastructure. The use of hydrogen also introduces unique safety implications which will need to be appropriately identified, measured, monitored and managed, and insurers are well-placed to support customers across multiple industries with this.

Insurers should enter dialogue with corporates operating across the hydrogen value chain to better understand the challenges they are facing in obtaining specialist insurance cover, and consider how cover may need to be segmented or consolidated across components of the hydrogen value chain to prove effective.



To help facilitate the develop of hydrogen, the SMI Insurance Task Force will:

- Work closely with the SMI Hydrogen Task Force to open up discussion with customers operating in this space on the specific challenges they are facing to develop insurance coverage for innovative or prototypical hydrogen technologies and infrastructure.



To support this, Lloyd's will:

- Lead research through Lloyd's Futureset into the specific risks posed by hydrogen, including its flammability, and how these risks might emerge in different ways according to how this fuel is used at a sectoral level. This will help corporates and private investors to understand how these risks can be managed and where specialist coverage may need to be introduced or expanded, for example in relation to the transportation of hydrogen.

6. Committing to action

6. Committing to action

Lloyd's and the global insurance industry are uniquely positioned to facilitate efforts across communities, businesses and governments around the world to drive a transition to a lower carbon economy.

Lloyd's and the global insurance industry are uniquely positioned to facilitate and accelerate efforts across communities, businesses, and governments around the world to drive the transition to a lower carbon economy.

We have engaged with a range of insurers, Lloyd's market participants and corporates operating in the identified sectors to assess the scale and complexity of decarbonisation ambitions, and to identify ways in which the insurance industry can act as a facilitator and convenor to drive change.

We believe the Lloyd's climate action roadmap will accelerate change across all of the sectors discussed in this report, leveraging a range of delivery mechanisms which strike the balance between effectively delivering what is within our control and progressing actions where broader industry collaboration and partnership is necessary for success.

In particular, within this roadmap we have identified areas in which Lloyd's specifically will drive forward action to catalyse change within the Lloyd's market, alongside actions which will be accelerated through the SMI Insurance Task Force and collectively taken forward by the global insurance industry.

The actions can be summarised across these delivery mechanisms as follows:



Actions to be delivered by the global insurance industry

- Direct capital towards climate-positive solutions through integrating ESG factors into investment decisions and identifying impact investment opportunities.
- Work with investors and governments to provide financing structures to support disaster resilience, response and recovery in developing countries.
- Incentivise customers to lower their buildings' carbon footprint, and introduce 'build back better' wordings in policies.
- Refine insurance products to reflect evolving business models of automotive companies, covering full-lifecycle solutions for electric vehicles.
- Understand the risk implications of technological advancements and alternative fuel sources for the aviation and marine sectors to ensure that insurance products can evolve in tandem.
- Expand offshore wind sector coverage to meet additional demands driven by technological advancements.
- Further expand nuclear coverage to meet demands for additional capacity driven by emerging regulation and growth in nuclear capacity.
- Work with corporates across the hydrogen value chain to better understand key challenges and opportunities for specialist cover.

Key: ■ The global insurance industry ■ Lloyd's in its role as Chair of the SMI Insurance Task Force ■ Lloyd's

6. Committing to action



Actions to be delivered through the Lloyd's-chaired SMI Insurance Task Force

- Develop a consolidated industry-wide framework to accelerate investment in long-dated green assets, supporting climate innovation and the transition to renewable energies.
- Develop and pilot a framework to provide financing structures to support disaster response and recovery in developing countries.
- Develop and launch an industry-wide framework for greener insurance supply chains to support customers in shifting towards sustainable construction.
- Design an innovative EV insurance product to address emerging protection gaps as new risks emerge and vehicle business models evolve.
- Work closely with the SMI Aviation and Shipping task forces to identify requisite insurance coverage for emerging risks and new technologies.
- Develop a consolidated framework to accelerate and scale insurance industry investment into long-dated green assets to support offshore wind.
- Provide a platform for a co-ordinated financing approach for offshore wind projects between the insurance industry, offshore wind operators and private investors.
- Work closely with the SMI Hydrogen Task Force to develop insurance coverage for innovative or prototypical hydrogen technologies and infrastructure.



Actions to be delivered by Lloyd's

- Conduct targeted research to understand the risk profile of new construction materials and techniques, exploring the insurance implications and opportunities for new or evolved risk solutions.
- Facilitate a product design sprint to develop an innovative EV insurance product from ideation through to commercial viability to address emerging protection gaps.
- Provide a platform for dialogue between the insurance industry and customers operating in the marine sector to develop insurance coverage for emerging risks.
- Commit to expanding coverage to ensure capacity constraints do not limit the growth of the offshore wind industry.
- Provide a platform for co-ordinated action between the insurance industry, civil nuclear sector and government to meet the additional nuclear liability required by regulations.
- Lead research into hydrogen risks to identify where specialist coverage is needed across the value chain.

In mobilising, co-ordinating and delivering on these actions, the insurance industry has the unique opportunity to accelerate the global transition towards a more sustainable world. The actions taken by the insurance industry today to support the scale and pace of ambition from both governments and businesses will be critical in driving positive, long-term change.

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