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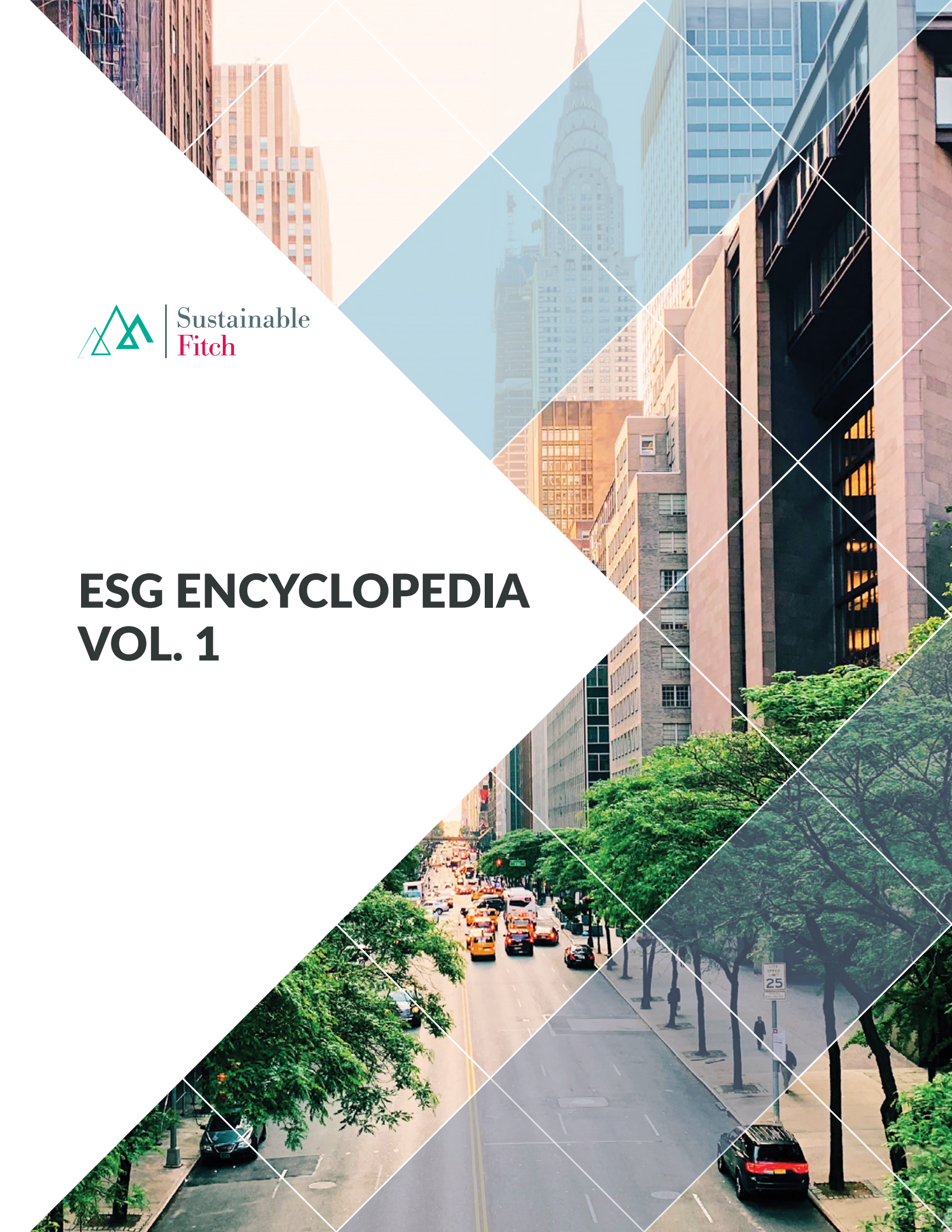
ESG ENCYCLOPEDIA VOL. 1



Related Research

- Constraints to Growth in Water-Stressed Regions - Many More Regions Will Become Water-Stressed, Imposing Substantial Adjustment Costs (October 2020)
- Emerging ESG Risks in the Metals and Mining Value Chain (June 2020)
- ESG in Credit - Relevance and Materiality of Water Issues for Economies and Entities (November 2020)
- Growing Protection Gap for Physical Climate Risks (November 2020)
- Increasing Water Risks in Metals and Mining - Low-Carbon Technology Supply Chains Face Growing Constraints (July 2020)
- Tightening Climate Policy to Drive Carbon Offsetting and Emissions Trading (September 2020)
- Water Risk Relevance for Sovereign Ratings to Increase (September 2020)
- Water Risks and Sovereign Ratings (September 2020)
- Financial Sector Confronts Deforestation as a Key ESG Risk (September 2020)
- Water Risk in the Agricultural Supply Chain (June 2020)

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CONTENTS

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Introduction

This volume of Fitch's ESG Encyclopedia provides insights on the credit relevance and materiality of all sector-specific environmental credit issues, namely

- Greenhouse Heating Gas emissions and air quality
- Energy and fuel management
- Water
- Biodiversity and waste
- Exposure to environmental impacts

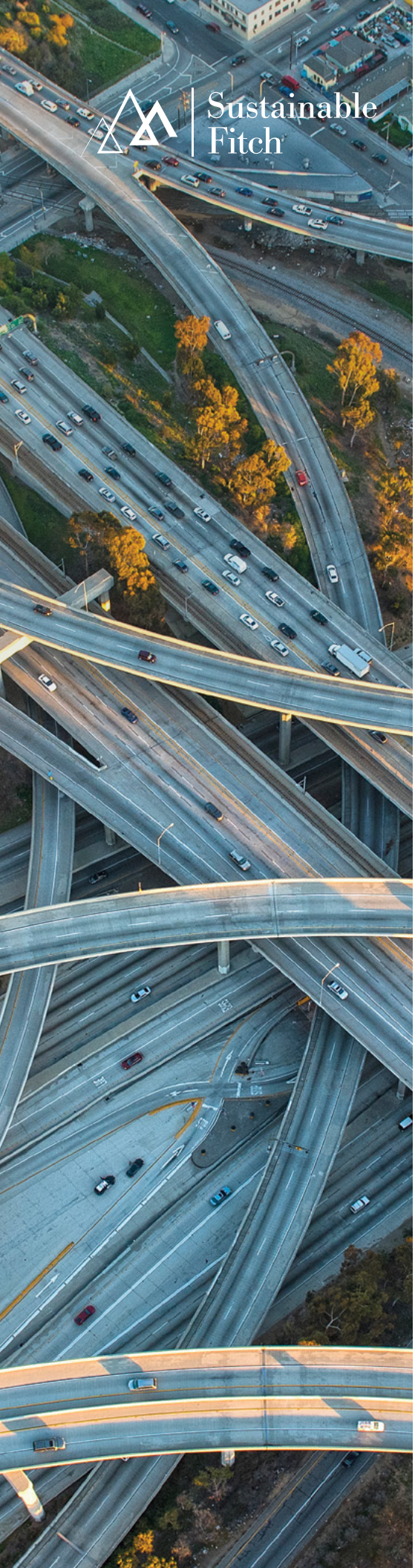
It explains how these issues can translate into relevant credit issues and materialise as credit risks. As such, it constitutes an absolute reference for investment professionals who need to integrate ESG in their credit investment or risk management processes.

For more information on Fitch's approach to integrating ESG in credit, see our white paper.

If interested in Fitch's ESG Relevance Scores Data, see https://www.fitchsolutions.com/products/fitch-ratings-esg-relevance-scores-data

CREDIT ISSUES

GHG emissions and air quality issues	Energy and fuel management issues	Water issues	Biodiversity and waste issues	Environmental impacts issues
GHG emissions and air pollutants from manufacturing process	Energy and fuel consumption in manufacturing process	Water usage in the manufacturing process	Waste and hazardous materials management and ecological impacts of manufacturing process/operations	Environmental impacts on product and material sourcing
GHG emissions and air pollutants from operations	Energy and fuel consumption in operations	Water usage in operations	Ecological impact of manufacturing and operating incidents and spills	Environmental impacts on assets and inventory
GHG emissions and air pollutants from product	Energy and fuel consumption of product	Water usage of product	Waste and lifecycle management of product and services	Environmental impacts on operations
GHG emissions and air pollutants in economic development	Energy resource management in economic development	Water supply in economic development	Ecological impacts in supply chain	Environmental impacts on economic development
			Biodiversity and natural resource management in economic development	



PART ONE: GHG AND AIR QUALITY ISSUES

CREDIT FOCUS MOVES TO LOW-CARBON TRANSITION IN 'HARD-TO-ABATE' SECTORS

"GHG and other air emissions have a growing financial materiality for corporates and investors, and this is increasingly translating into credit impact. This will intensify as regulations tighten and data improve, with a growing focus on the financing and costs of decarbonisation in hard-to-abate industrial and transport sectors."

David McNeil, Sustainable Finance, Fitch Ratings

This report focuses on emissions – specifically, the greenhouse gas (GHG) emissions and Air Quality general issue within Fitch Ratings' ESG Relevance Score (ESG.RS) framework and scoring templates. It explains how these issues can translate into credit issues and potentially materialise as credit risks.

Climate Risks Span the Value Chain

Investors are increasingly pushing for more widespread and comprehensive reporting of climate risk, including GHG emissions data and in company strategies. Many companies looking to implement emissions-reduction strategies will find that the bulk of their emissions profile is outside their direct control, requiring them to engage with their suppliers and customers to reduce emissions.

Similarly, climate considerations are likely to require deeper integration into company procurement decisions and financing decisions for banks and financial institutions.

Carbon Pricing Most Material Risk

Five years on from the Paris Agreement, many countries have tightened climate regulations across a swathe of activities to align with their emission-reduction pledges.

Carbon pricing, which has increased in sectoral and geographical coverage as well as in average prices, remains

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the preferred lever for policymakers, although there are major differences between schemes, leading to competitive pressures. Energy-intensive industries are the most directly affected, but expansion of carbon pricing to other activities is likely to follow.

Focus Moves to Transition Finance

Many regulatory actions and investment strategies have focused on the power sector. Increasingly, investor scrutiny is shifting towards the implications of decarbonisation in hard-to-abate industrial and transport sectors.

The low-carbon transition here will be more costly and complex, and the recent trend towards sustainability-linked debt could increase scrutiny of management strategy and spending plans for the low-carbon transition.

Core Emissions-Related Credit Issues

Fitch has identified the sectors and activities most heavily affected by emissions from a credit perspective. These can be categorised under four core air emissions-related credit issues: GHG and air quality in the manufacturing process; emissions of products; emissions in operations and fuel consumption in operations; and emissions in economic development.

Defining GHG Emissions and Air Quality

Air emissions – whether GHG or other air pollutants – have physical, financial and economic impacts on borrowers. While the consequences of these issues can be clear (see table *GHG and Air Quality Issues and Their Physical, Financial and Economic Impacts*), it can be difficult to attribute an ESG impact to a specific credit driver, as aspects of GHG emissions and air quality are often linked to several different ESG credit issues.

GHG emissions and air quality issues can materialise in and overlap with other ESG issues. There are connections between these credit issues and the following general issues:

Energy Management: This addresses the issuer's ability to manage risks associated with the procurement or management of energy sources in operations. Carbon-related considerations inform energy-management decisions in most regions, but may be influenced by regional or sectoral trends and needs, such as the increasingly prevalent view of natural gas as a 'transitional' energy source in Asia or ongoing requirements for coal as a feedstock into industrial processes. Availability and access costs of energy resources are also important factors, as shown by the strong competitive positioning of low-cost Arabian Gulf oil producers in the global cost curve – this partly insulates them from risks of asset stranding, which is likely to be a more immediate risk for high-cost producers.

Management Strategy:
The management strategy addresses market and technology risk for goods and services and operations stemming from GHG and air emissions standards, as well as litigation, reputational and regulatory compliance risks. Corporates and financial institutions are being particularly scrutinised on management strategy by activist investor coalitions and civil society groups. There are increasing requests for detail on capex and opex spending plans, product portfolios and other aspects of management strategy and their contribution to emission-reduction targets or the Paris Agreement trajectory.

Exposure to Environmental Impacts:
This relates to physical climate risk and other aspects of exposure to natural disasters. There is some degree of interplay between the physical and transitional aspects of climate risk – for instance, the frequency and severity of extreme weather events is expected to increase in the coming decades due to GHG emissions. Pressure on policymakers to further tighten GHG emissions policies will increase in response to these events, giving rise to new risks as companies are obliged to transition towards new policy targets.

While GHG emissions and air quality issues are inter-related to other general issues in our scoring templates, we only consider issues to be credit-relevant, and therefore a GHG or air emissions-related credit issue, when emissions are a key output of an economy, management strategy, product, manufacturing process, operation or project.

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GHG AND EMISSIONS TO AIR (EAQ) ISSUES AND THEIR OPERATIONAL, FINANCIAL AND ECONOMIC IMPACTS

Environmental impacts issue	Affected sectors	Operational/regulatory impact	Financial and economic impact
Rising carbon prices	• Energy-intensive industries • Metals and mining • Utilities • Transport • Commodities	• Lower output • Higher operating costs • Competitive pressures or tilt towards low-carbon producers	• Penalties and fines for non-compliance • Lower profit margins or revenue • Varying levels of cost pass-through • Large investments needed in new capital and operational expenditure • Decreased economic activity in exporting markets due to lower demand for fossil fuels
Tightening emissions standards	• Energy-intensive industries • Metals and mining • Utilities • Transport • Commodities • Auto producers • Shipping	• Lower output • Higher operating costs • Regulatory asymmetry • Competitive pressures or tilt towards low-carbon producers	• Lower profit margins or revenue • Varying levels of cost pass-through • Penalties and fines for non-compliance • Large investments needed in new capital and operational expenditure • Decreased economic activity in exporting markets due to lower demand for fossil fuels
Litigation and liabilities	• Energy-intensive industries • Mining • Utilities • Transport • Commodities • Auto producers	• Local community protests and associated bad press coverage, political intervention and regulatory pressure • Business shutdown, interruption, slowdown and relocation • Loss or refusal of licence to operate due to community unrest and political response	• Lower revenue due to operating restrictions and rationing • Additional investments in capex and opex • Lower economic activity due to less favourable business environments

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Environmental impacts issue	Affected sectors	Operational/regulatory impact	Financial and economic impact
Investor and regulatory demands for wider disclosure and target setting on emissions	• Energy-intensive industries • Metals and mining • Utilities • Transport • Commodities • Financial institutions • Telecoms and technology	• Costs of data collection and verification • Time and resources for engagement • Some operationally sensitive data may need to be disclosed • Increased citation of GHG issues in proxy voting, resolutions • Investor scrutiny, engagement	• Potential increases in financing/refinancing costs • Large investments needed in new capital and operational expenditure to transition to lower carbon assets
Changing demand for energy and commodities, resource consumption	• Energy-intensive industries • Mining • Utilities • Transport • Commodities • Auto producers	• Lower production output or capacity utilisation	• Possible erosion of cash position, credit deterioration if costs cannot be passed on or goods and services adapted to fit market needs • Need for additional capex and opex in technology improvements
Supply chain – Increased scrutiny of GHG and air quality issues in supply chain	• Energy-intensive industries • Mining • Utilities • Transport • Commodities • Auto producers • Financials	• Costs of data collection and verification • Time and resources for engagement • Further investor scrutiny and engagement	• Additional purchasing criteria beyond price competitiveness may need to be introduced
Risk of stranded assets	• Energy-intensive industries • Mining • Utilities • Transport • Commodities • Auto producers • Financials • Sovereigns, Subsovereigns • Governments	• Early asset retirement	• Revenue forgone from early closure/lost returns on investment in productive assets • Additional capex and opex costs on asset closures and new assets

Source: Fitch Ratings

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Abatement costs refer to the costs borne by producers of these emissions when they are compelled by regulators, investors or reputational concerns to remove or reduce greenhouse gas emissions or other unwanted emissions as by-products of economic activity, usually through technological or process changes. These costs may be significant, and technically difficult to achieve, leading to potential credit impacts.

Sector-Specific Credit Issues

Fitch analysts evaluate whether a GHG emissions and air quality issue is credit-relevant and material for all its rated issuers and transactions. Within their ESG scoring templates, Fitch analysts allocate a score between '1' and '5' for the general issue GHG Emissions and Air Quality.

The sector-specific ESG credit issues for GHG emissions and air quality can be categorised into four core air emissions-related credit issues:

1. **GHG emissions and air pollutants from manufacturing processes** – where GHG emissions and air pollutants occur from the processing, fabricating, washing or cooling of a final product;
2. **GHG emissions and air pollutants from products** – where GHG emissions and air pollutants are generated by the product itself;

FITCH'S DEFINITION FOR GHG EMISSIONS AND AIR QUALITY

Our overarching definition of GHG Emissions for the ESG.RS is, "This category addresses direct (Scope 1; defined under the Kyoto Protocol) greenhouse gas (GHG) emissions that an issuer generates through its operations. This includes GHG emissions from stationary (e.g., factories, power plants) and mobile (e.g., trucks, delivery vehicles, planes) sources, whether a result of combustion or fuel or non-combusted direct releases during activities such as natural-resource extraction, power generation, manufacturing process, land use, or biogenic processes, such as those found in the agricultural industry particularly related to farming. The category further includes management of regulatory risks, environmental compliance, and reputational risks and opportunities, as they relate to direct GHG emissions. Carbon dioxide (CO_2) is by far the most common GHG, followed by methane (CH_4); there are seven GHGs identified under the Kyoto Protocol and the Doha Amendment. Scope 2 and energy/fuel-related components of Scope 3 GHG emissions are addressed in Energy Management".

Aspects of Scope 3 relating to product use and transport ('Use of Sold Products', 'Upstream Transportation and Distribution' as per the GHG Protocol) are addressed here as emissions within an entity's direct control. Disclosure to CDP indicates that supply chain emissions are, on average, 5.5 times that of a company's direct emissions, and a growing number of corporates are integrating carbon-intensity targets into their procurement policies. As such, GHG-related procurement issues for one company can become a material operational issue for its providers of goods and services. CDP disclosures have led to large corporate buyers such as IKEA, AB InBev, Microsoft, Accenture, BT and LEGO integrating climate targets into their procurement policies and engaging with suppliers to encourage renewable energy investment and other mitigation measures.

The overarching definition of Air Quality for the ESG.RS is; "This category addresses management of air quality impacts resulting from stationary (e.g., factories, power plants) and mobile sources (e.g., trucks, delivery vehicles, planes) as well as industrial emissions. Relevant airborne pollutants include, but are not limited to, oxides of nitrogen (NO_x), oxides of sulphur (SO_x), volatile organic compounds (VOCs), heavy metals, particulate matter, and chlorofluorocarbons."

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3. **GHG emissions and air pollutants from operations** – where GHG emissions and air pollutants are generated from resource production, power generation, logistics, transportation and other business activities;

4. **GHG emissions and air pollutants in economic development** – where GHG emissions and air pollutants are generated from national, regional and local economic growth.

How GHG Emissions and Air Quality Issues Relate to Credit Risks

GHG emissions and air quality issues can affect any of the air emissions-related credit issues and materialise as a single credit risk or a combination of credit risks.

The report focuses on the four above-mentioned core air emissions-related credit issues. It provides insights and case studies on how these core issues affect issuers from several sectors. This is followed by guidance on how air emissions-related credit issues transpire as credit risks and how they can affect the creditworthiness of issuers.

TRANSITIONAL VERSUS PHYSICAL RISK

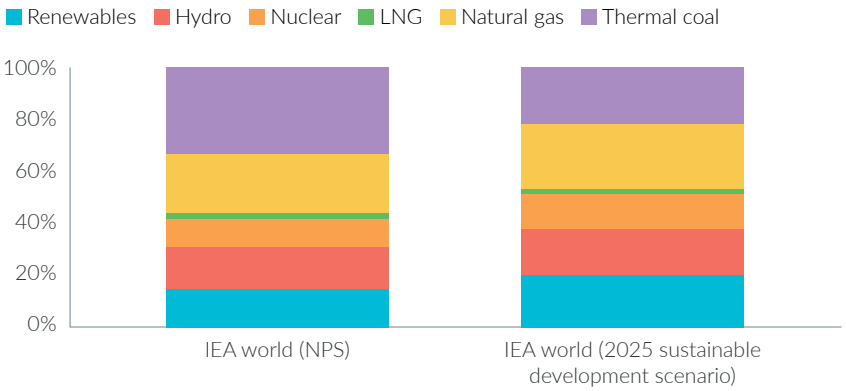
Most of the established disclosure frameworks for climate risk, such as the Taskforce on Climate Related Financial Disclosure (TCFD) recommendations, encompass both physical and transitional metrics of climate risk exposure for corporates and financial institutions. We mostly address the transitional aspects of climate risk, as physical risk is captured under 'Exposure to Environmental Impact' within our ESG.RS framework, but it is important to reflect on the relationship between the two when developing scenarios and risk assessments, stress tests and targets.

Since 2014, the Intergovernmental Panel on Climate Change (IPCC) has been augmenting its physical emissions-based representative concentration pathways (RCPs) with Shared Socioeconomic Pathways. These provide a range of economic, technological, trade and societal scenarios linked to different warming outcomes. Similarly, the International Energy Agency has produced its 'Stated Policies' and 'New Policies' scenarios detailing the technology and energy mixes associated with different levels of policy ambition and warming outcomes.

Each of these scenarios is subject to some degree of uncertainty and subjectivity, but a broad consensus appears to be forming around the use of the IPCC RCP 4.5 (which assumes strong policy action, albeit insufficient to limit warming to 1.5C) as a reasonable base-case scenario – the TCFD recommends the use of this scenario at a minimum. This is broadly consistent with the Paris Agreement and the various analytical tools, standards and data sources that are emerging to benchmark performance against it, such as the EU Taxonomy for Sustainable Activities.

A comparison of the IEA's New Policies Scenario versus a more ambitious Sustainable Development Scenario for 2025 shows the range of outcomes possible.

GLOBAL ENERGY MIX BY SOURCE



Source: Fitch Ratings, International Energy Agency

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TRANSITION MECHANISM FROM GHG EMISSIONS AND AIR QUALITY ISSUES TO CREDIT RISK

GHG Emissions and Air Quality Issues

- Rising carbon prices
- Tightening emissions standards
- Litigation and liabilities
- Investor demands for wider disclosure and target setting on emissions
- Changing demand for energy and commodities, resource consumption
- Supply chain – Increased scrutiny of GHG and air quality issues in supply chain
- Risk of stranded assets

Air Emissions-related Credit Issues

- GHG emissions and air pollutants from manufacturing processes
- GHG emissions and air pollutants from products
- GHG emissions and air pollutants from operations
- GHG emissions and air pollutants in economic development

Credit Risks

- Asset quality and concentration risk
- Business profile and competitive position risk
- Macroeconomic risks
- Operational and cash flow risk
- Profitability risk
- Refinancing risk
- Regulatory and litigation risk
- Reputational risk

Source: Fitch Ratings

GHG EMISSIONS AND AIR QUALITY ISSUES – RELEVANCE BY SECTOR

GHG emissions and air pollutants from manufacturing process	GHG emissions and air pollutants from product	GHG emissions and air pollutants from operations	GHG emissions and air pollutants in economic development
Aerospace & Defence	ABS - aircraft	ABS - aircraft	IPF-LRGs
Alcoholic Beverages	ABS - auto	ABS - auto	Sovereigns
Building Materials	ABS - equipment	ABS - equipment	USPF – state and local government
Building Products	ABS - SME	ABS - SME	
Chemicals	ABS - SME CDO	ABS - SME CDO	
Commodity Processing & Trading	ABS-Future Flow Receivables	ABS-Future Flow Receivables	
Non-Alcoholic Beverages	ABS-Oil Vessel-Backed	ABS-Oil Vessel-Backed	
Oil Refining & Marketing	ABS-Sprint Spectrum	ABS-Sprint Spectrum	
Packaged Food	ABS-Timeshare Loan	ABS-Timeshare Loan	
Protein	ABS-Utility Tariff Bonds	ABS-Utility Tariff Bonds	
Steel	Aerospace & Defence	Airlines	
Technology	Auto Suppliers	APAC Regulated Network Utilities	
	Automotive Manufacturers	Asia Pacific Utilities	

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GHG emissions and air pollutants from manufacturing process	GHG emissions and air pollutants from product	GHG emissions and air pollutants from operations	GHG emissions and air pollutants in economic development
	CMBS	Australia Regulated Networks	
	Consumer ABS - secured	EMEA Regulated Networks	
	CVB Commercial	EMEA Utilities	
	Diversified Industrials & Capital Goods	Engineering & Construction	
	MICH	Food Retailing	
		GIG - Hydro	
		GIG - Oil & Gas Production	
		GIG - Pipeline & Energy Midstream	
		GIG - Thermal Power	
		GIG - Transportation	
		GIG - Water/Wastewater	
		IPF - GREs	
		LATAM Utilities	
		Mining	
		Non-Bank Financial Institutions[1]	
		Non-Food Retailing	
		Oil & Gas Production	
		Oilfield Services	
		Packaged Food	
		Pipeline and Energy Midstream	
		Shipping Companies	
		US Healthcare Providers	
		US Utilities	
		USPF - Acute Hospital and Health Systems	
		USPF - Higher Education	
		USPF - Public Power	
		USPF - Water & Sewer	

Source: Fitch Ratings

1. Examples include business development companies, finance leasing companies, investment management, financial market infrastructure companies and securities trading companies.

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Relevance and Materiality of Sector-Specific GHG and Air Quality Issues

GHG EMISSIONS AND AIR POLLUTANTS FROM MANUFACTURING PROCESSES

Asset owners and managers, and, to a lesser extent, banks, are increasingly scrutinising financed emissions. Iron and steel producers are common areas of focus given the high carbon intensity of production processes, expensive low-carbon technology investments and increasing competitive pressures in world markets. Regulatory asymmetry is a growing concern, particularly in regions that have implemented a price on carbon or an emissions trading scheme (ETS).

Many manufacturers operate in highly competitive trading environments, so additional operating costs arising from tightening emissions regulations can be a concern if this affects competitiveness and if costs cannot be passed on. There appears to be a widening gap between the compliance costs for air pollutant control in most manufacturing activities and for more costly GHG emission control, with regulators in North America and EMEA tending towards more stringent measures for the latter.

Relevance to Sector

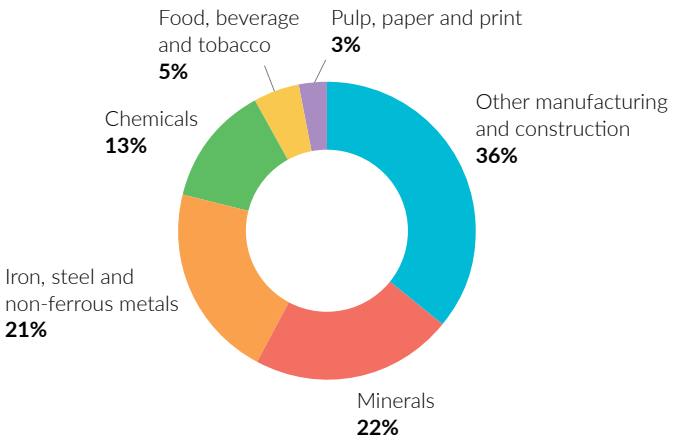
Long-term statistical analysis, where available, suggests that additional capex and opex for European industrials have been 2%–7% per EUR100 of value added, according to analysis by the European Commission. An analysis of industrial compliance costs for the Clean Air Act from 1990–2020 by the US Environmental Protection Agency pointed to annual costs of less than USD5 billion for US industrials, a small fraction of manufacturing value added within the US economy.

China's industrial emissions standards have tightened rapidly since 2014 under its previous Five-Year Plan, with rising compliance costs both for carbon emissions as well as other air pollutants. The national ETS launched in February 2021, initially covering around 2,200 thermal coal and gas power plants. Whilst free allocations will be used widely in the early stages of the scheme, future auctions could increase pass-through costs to energy-intensive manufacturers. This will be alongside the liberalisation of China's power sector, which is expected to drive prices higher. About 70% of respondents to the China Carbon Pricing Survey expect the national ETS to influence investment decisions by 2025.

GHG emissions tend to have the most material effects on competitive positioning for manufacturers because of the high carbon intensity of many manufacturing processes and the high costs of emissions control measures. Iron and steel producers have had particular investor engagement on climate issues in recent years and face the reinforcing pressures of intense global price competition, the very high carbon intensity of production, and prohibitively costly technology solutions for lowering carbon emissions.

EU MANUFACTURING EMISSIONS BY SOURCE

By milllion tonnes of carbon dioxide emitted



Source: Fitch Ratings, European Environment Agency

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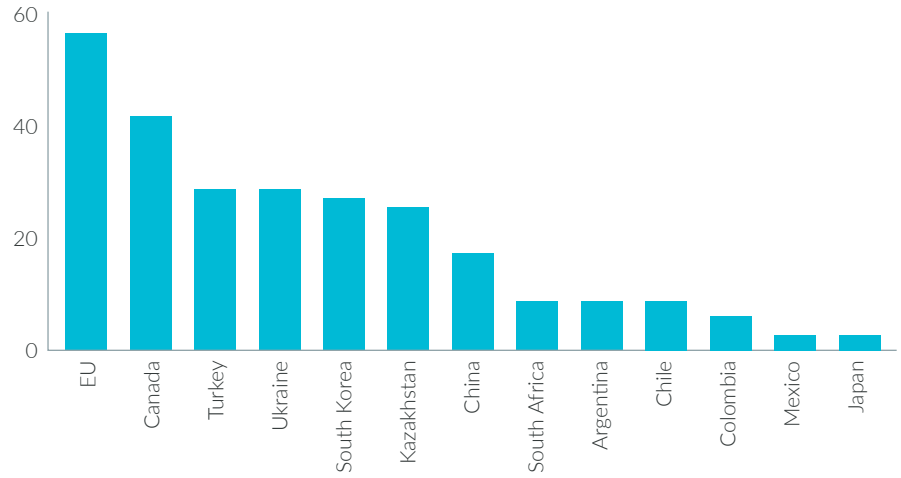
The EU's ETS has been in operation since 2005, and although persistently low prices and free allocation of emissions permits to large industrial manufacturers have limited its effectiveness in lowering carbon emissions, policy intervention since 2017 has caused the price of carbon allowances to hit new highs. Prices are expected to rise significantly in the coming two years – by as much as 40%, according to estimates by Reuters. Canada is projected to have a 500% increase in its federal carbon tax by 2030, whereas other regions have no or persistently low carbon price coverage. This could increase regulatory asymmetry and competitive pressures in the absence of compensating measures.

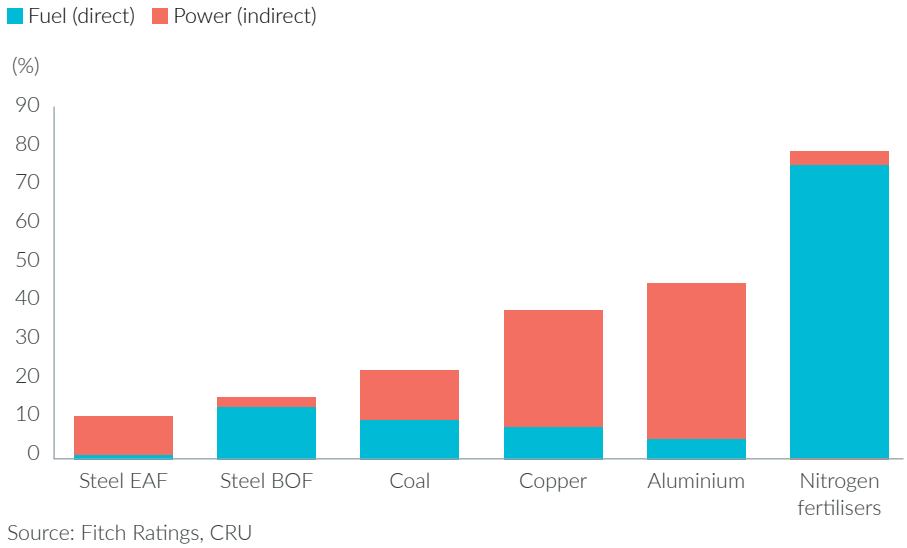
The degree to which manufacturers have direct control over production emissions will differ by activity – auto, industrial equipment and electrical engineering or electronics manufacturers have a particularly high emissions profile when manufacturing primary products. Steel, nitrogen fertilisers and thermal and metallurgical coal have particular direct exposure to rising fuel costs as a result of carbon pricing. As such, producers in regions subject to carbon taxes or ETSs have increasing sensitivity to competitive pressures from rising carbon costs.

WIDE VARIATION IN CARBON PRICES EXPECTED BY 2023



Source: Fitch Ratings, CRU, Reuters

FUEL AND POWER SHARE OF MAJOR COMMODITIES' PRODUCTION COSTS



Source: Fitch Ratings, CRU

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This also affects the Scope 1 emissions profile of manufacturing activities where these commodities are key inputs to primary production – notably auto and industrial equipment manufacturers, electrical engineering and electronics.

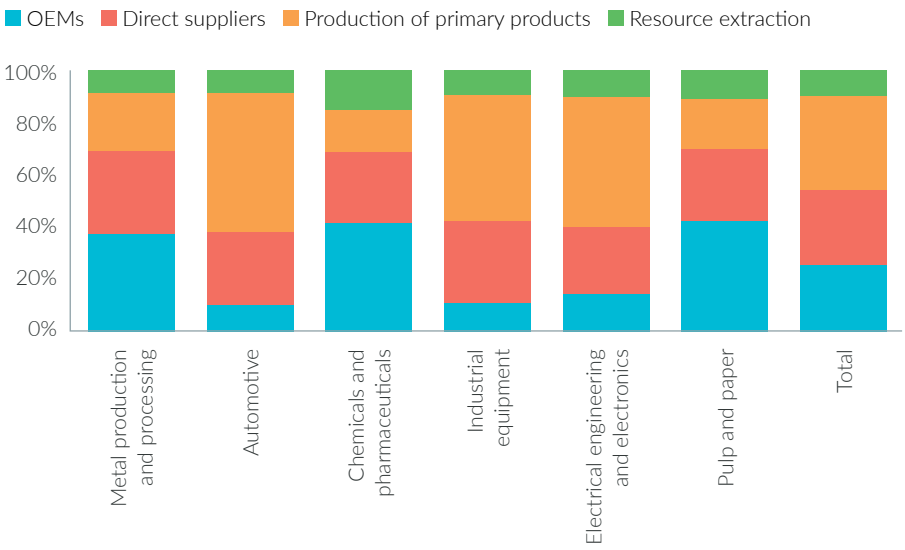
INCREASING PRESSURE TO REDUCE FREE CARBON ALLOWANCES

Regulators have typically relied on free carbon emissions allowances, such as direct cost compensation or financial support for energy-intensive industries affected by rising power costs.

However, most cap-and-trade systems have been consistently set at levels far in excess of those deemed necessary to achieve commitments under the Paris Agreement, so pressure on regulators to wind down free allocations is increasing, particularly in the EU. A Border Carbon Adjustment (BCA) tariff has been proposed by the European Commission, initially to be applied to steel and cement production, with the intention of equalising the costs of carbon for producers that don't have effective carbon pricing regimes in place.

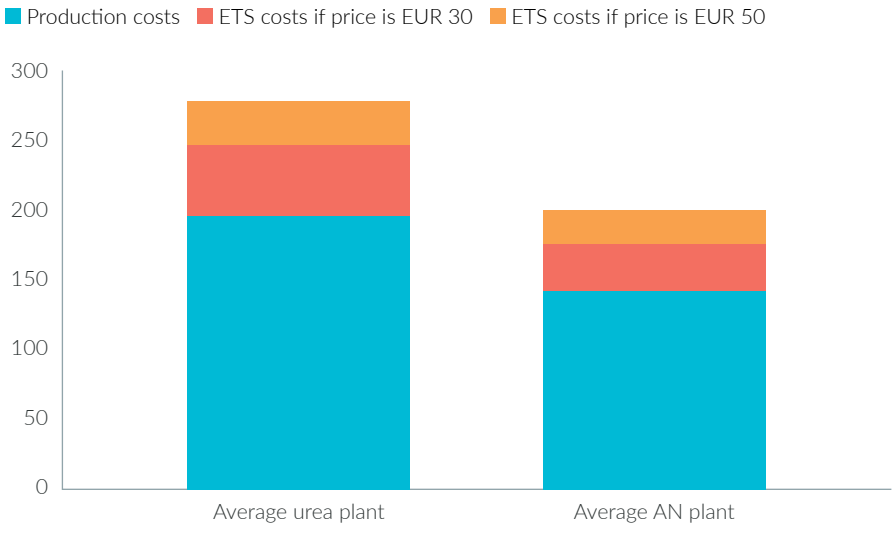
The European Commission has indicated that a BCA would supersede free allocations and other price support for manufacturers by addressing the issue of 'carbon leakage' to regions with weaker regulations in place. This offshoring trend has been well established for other areas of regulatory tightening; for example, much of Europe's phosphate fertiliser manufacturing relocated to northern Africa in the early 1990s in response

CO2 EMISSIONS FROM MANUFACTURING SUPPLY CHAIN



Source: Fitch Ratings, Atlas on Environmental Impacts

PASSENGER VEHICLES



Source: Fitch Ratings, CRU

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to tighter regulation around waste management, emissions, and water usage.

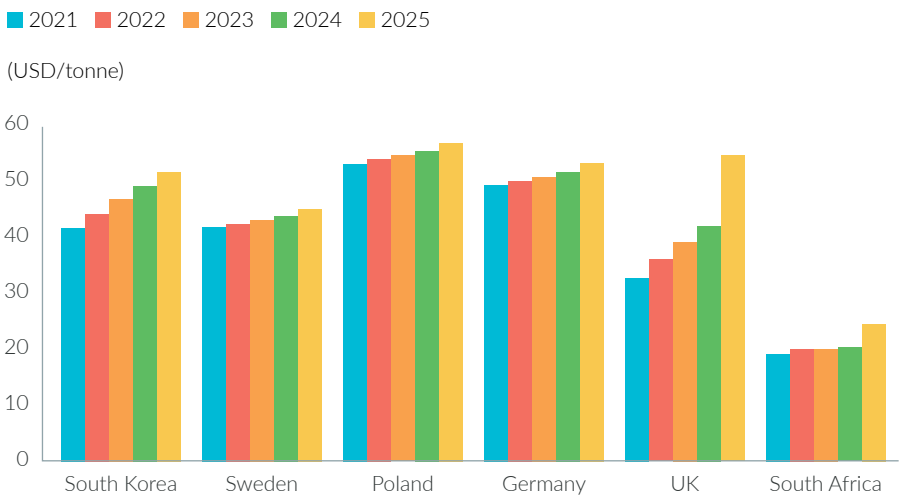
However, a BCA could have unintended consequences and reorient the competitive landscape based on regional trends in technology. For example, the US has had a large expansion in scrap-based electric arc steel furnaces in the past decade, whilst other key sellers into the European market (particularly Russian and Ukrainian producers such as PJSC Novolipetsk Steel (NLMK) (BBB/Stable), PAO Severstal (BBB/Stable), PJSC Koks (B/Stable), and Metinvest B.V. (BB-/Stable)) still make widespread use of more emissions-intensive blast furnaces. A BCA, which would penalise producers with a higher carbon emissions content, could benefit producers with lower emissions.

Steel and cement differ substantially in their global competitive positioning and the ability of producers to pass through higher compliance costs. Steel has very high levels of international price competition, whereas cement is normally produced close to construction demand and thus producers are able to pass on additional compliance costs. Moreover, concrete accounts for a much lower share of costs for the construction sector than steel does, so price increases can generally be passed on. Booming demand for both steel and cement with widespread construction in Asia-Pacific and Africa is projected after the pandemic over the coming decade, and this is likely to result in increasing competitive pressures on EMEA steelmakers.

Fitch research has highlighted steel producers' high exposure to carbon price increases. Producers with good access to affordable, low-carbon energy sources (such as those in Sweden) will have less exposure to carbon price increases, although they will still have strong incentives to lower direct emissions from the manufacturing process. The differences between current and future marginal costs of carbon per tonne of blast oxygen furnace (BOF) steel are demonstrated in the comparison graph below.

Our joint report with CRU (Emerging ESG Risks in the Metals and Mining Value Chain, June 2020) pointed to the influence of other elements of the value chain on emissions profiles of manufacturing activities. For example, iron ore grade can have significant implications for the carbon intensity of the production of finished steel (with higher ore grades leading to higher embodied emissions in finished steel), and distance to market can have a strong influence on freight and shipping energy requirements and overall Scope 3 emissions.

MARGINAL COST OF CARBON FOR BOF STEEL PRODUCTION



Source: Fitch Ratings, CRU

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THYSSENKRUPP, SSAB BET LONG-TERM ON HYDROGEN

Europe's second-largest steelmaker, Thyssenkrupp AG (BB-/Stable), has a target to cut emissions by 30% by 2030 and become carbon-neutral by 2050 by switching from coke-based to hydrogen-based production. This would have an estimated cost of at least EUR10 billion total investment for its estimated 13 million tonnes of annual steel production – around a quarter of 2019 revenue. The company has made these long-term commitments and early investments in anticipation of rising carbon prices in Europe, which will require technology investments to safeguard domestic production.

Despite punitively high costs for hydrogen-based production, we expect carbon prices on existing fuel inputs to increase, and for some form of carbon border adjustment or regulatory tightening in competitor markets. This could tilt the economics of hydrogen production positively over the next decade.

The EU has shifted from a net exporter to a net importer of steel in recent years, which has benefitted domestic steelmakers able to supply the regional market. Such long-term investments point to the confluence of low-carbon policies with trade interests. These large upfront capital investments would be uneconomical without large amounts of government aid in most cases, and suggest some degree of cost absorption and/or government support will be necessary across the steel sector as a whole – with costs passed on to industries such as construction and car manufacturing.

Sweden's SSAB, the most advanced company in the development of low-carbon steel production, estimates that its own hydrogen-based steel production will incur additional costs of EUR57 per tonne of steel, manageable once a carbon price of EUR30 per tonne (around today's price) is applied to oil and coking coal used in existing processes. This is approximately 10% of the cost of unfinished steel today, and given that the EU TS carbon price is projected to exceed EUR50 per tonne by 2023, the economics of low carbon steel could further improve, as compliance costs for fossil fuel-based production rise sharply. This price competitiveness will be crucial given limited evidence of consumer demand to pay a premium for low-carbon production, based on research by CRU.

GHG EMISSIONS AND AIR POLLUTANTS FROM PRODUCTS

GHG and air pollutant emissions from products can be influenced by product design and material choices. In some cases, emissions are determined by patterns of customer behaviour and product use, so their mitigation will require engagement with customer bases.

Large corporates are also increasingly incorporating GHG performance targets into their procurement practices for purchased goods, services and capital goods, as this is the major share of Scope 3 emissions for most companies. Heathrow Funding Limited, for example, has put in place energy-efficiency support to tier 1 (direct) suppliers, whilst VMED O2 UK Limited (BB-/Stable) has put in contractual arrangements regarding environmental impacts with its suppliers for all contracts over GBP1 million. These suppliers must commit to the delivery of emission-reduction programmes, and performance is regularly reviewed.

Whilst product-use emissions will, in most cases, be subject to regulation in the form of domestic performance standards, or, indirectly, product energy-efficiency standards, they will rarely be subject to targeted mechanisms such as carbon pricing. Nonetheless, because product emissions represent a large and growing share of many companies' carbon footprint, pressure for greater disclosure and mitigation efforts is increasing. Monitoring and reducing product-use emissions can entail far higher costs and complexity than for manufacturing or operational activities, largely because this can be heavily

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influenced by patterns of customer demand or consumer behaviour, which may lie outside a corporate's direct control. In addition, many of the companies in a supply or value chain are not able to measure product-use emissions and gather data.

Relevance to Sector

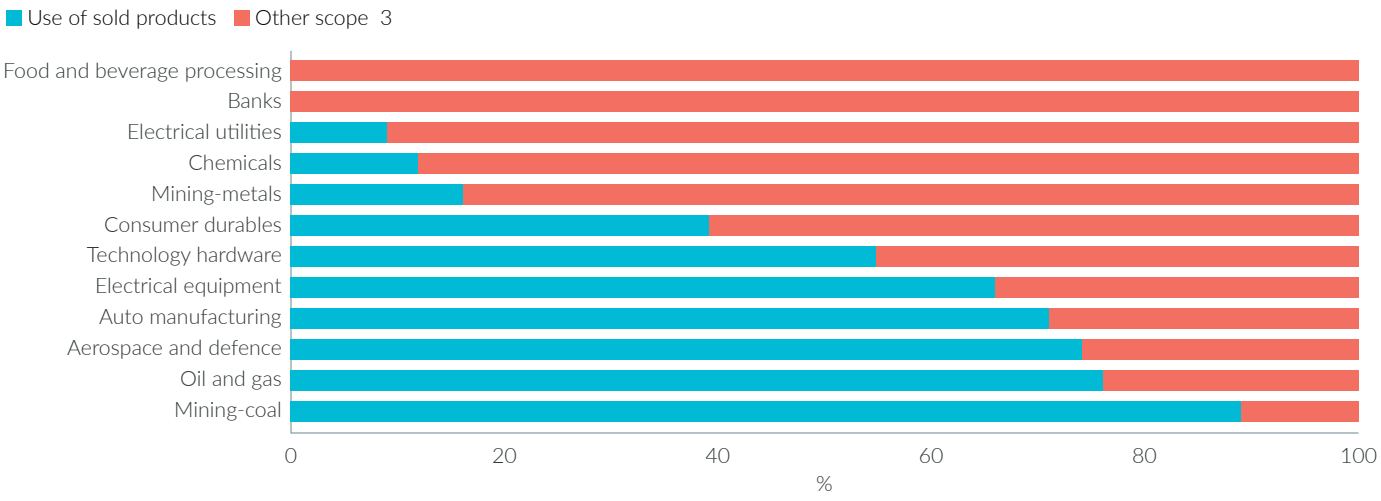
Scope 3 emissions are mostly from company supply chains, but also include emissions from activities that are within a company's direct control, such as product-use emissions. These represent the bulk of the overall emissions profile for just a handful of business activities. Despite being such a major share of emissions, regulators have typically been reluctant to address product-use emissions directly, though oil and gas emissions are typically subject to a complex patchwork of fuel taxes in many jurisdictions.

Coal mining, oil and gas, aerospace, auto, and technology and electrical equipment manufacturing activities all result in product-use emissions that are substantially greater than their direct operations or manufacturing activities. Companies operating in these areas are increasingly seen by stakeholders, such as shareholders or bondholders, to have a 'duty of care' to help minimise these emissions sources. Pressure is also growing on banks and other financial institutions to measure and monitor the degree to which their lending indirectly supports such emissions in the form of financed emissions – and the Partnership for Carbon Accounting Financials (PCAF) is leading efforts to standardise the measurement and disclosure of financed emissions.

For oil and gas companies, this has been heavily driven by activist investors targeting greater disclosure of Scope 3 emissions and inclusion of these within company emissions-reduction targets. A handful of oil majors have included Scope 3 within their corporate disclosures and target setting, but this is largely limited to carbon intensity targets for product use, rather than absolute reduction targets. Thus, companies may achieve absolute reductions in direct emissions but this will be offset by continuing growth in Scope 3 emissions as a result of product sales growth.

Achieving reductions in product emissions in the oil, gas and chemicals sector requires coordination between supply and demand, including engagement with customers as diverse as chemicals, shipping and consumer goods companies. For areas such as transport, policy fragmentation is a challenge – in contrast to utilities, the policy frameworks and incentives for a low-carbon transition in the transport sector vary. Ultimately, this will probably lead to investor requirements for greater public disclosure on low-carbon strategies, product portfolios and spending plans, as well as wider use of benchmarking. Some Scope 3 emissions are beyond a company's direct control – see the graphs below.

SHARP DIFFERENCES IN PRODUCT EMISSIONS AND DEGREE OF CONTROL



Source: Fitch Ratings, Gold Standard, Science Based Targets Initiative, Guidehouse

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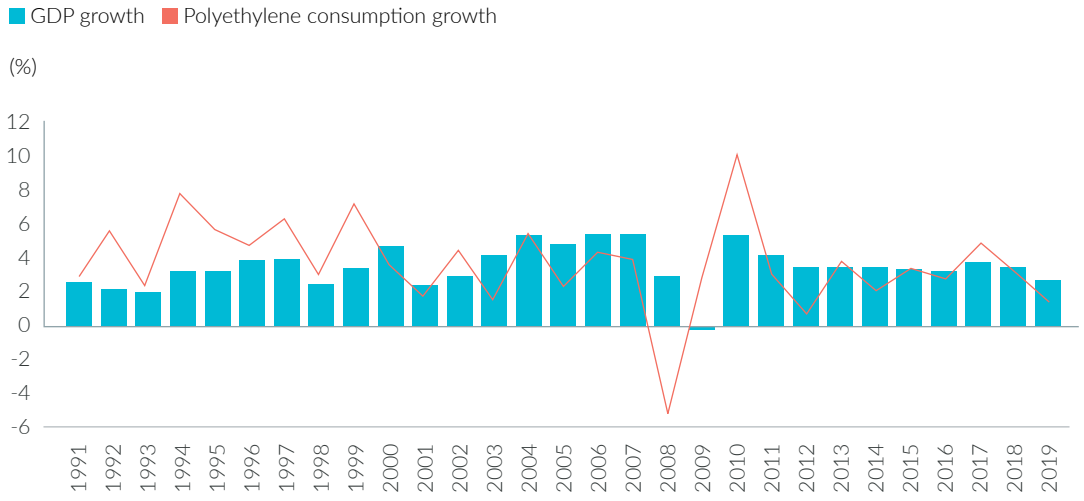
PLASTICS ARE KEY TO FUTURE OIL DEMAND PROJECTIONS

Most scenarios for a low-carbon transition in the oil and gas sector assume that demand for petrochemicals, particularly plastics, will grow by less than 5% annually. BP plc (A/Stable) and IEA Energy Services LLC's (B-/Stable) central scenarios assume that plastics demand will be the largest driver of oil demand growth, making up 95% and 45% of growth, respectively, to 2040, as existing oil demand is challenged in its core area of transport.

In recent decades, plastics resin demand has been fuelled by global growth, especially from China and emerging countries where per-capita consumption is lower than in developed countries, and by new applications, resulting in demand growth that outpaces GDP growth. Nonetheless, policy interventions such as the Chinese ban on waste imports and measures to increase waste collection and recycling rates pose a long-term risk to this source of growth. This risk is being led by emerging economies, often with weak recycling infrastructure, and will require considerable infrastructure and technological efforts. We therefore consider that it will add moderate pressure on oil demand from 2040.

POLYETHYLENE CONSUMPTION GROWTH VERSUS GDP GROWTH



Source: Fitch Ratings, Bloomberg Intelligence

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The degree to which gas will play a role as a key transition fuel could depend on regional regulations; whilst natural gas is effectively omitted from the EU's Taxonomy of Sustainable Activities in the absence of carbon capture and storage, Singapore's proposed taxonomy incorporates gas as a transitional energy source and many large Association of Southeast Asian Nations countries, as well as China, have reiterated their support for gas as an essential element of low-carbon transition.

Many large oil and gas companies are integrated producers, and therefore have higher ratings, more diverse cash flows and lower earnings volatility than pure upstream producers. As such, the energy transition is expected to be more manageable for integrated producers. Many companies, including oil majors and national oil companies, have deliberately increased their exposure to natural gas, refining, and chemicals over the past five to ten years to diversify earnings and better-position themselves in the energy transition. Royal Dutch Shell plc's (AA-/Stable) acquisition of the gas-heavy BG Group in 2016 is a good example of this.

Moreover, there is some evidence of shifting investor sentiment around exposure to new gas projects in North America, as highlighted in Fitch's ESG Vulnerability Scores for Utilities report (published October 2020). China and India are likely to be drivers of global gas consumption across the industrial, building and power-generation sectors, and gas demand is likely to be strengthened by tightening carbon and air emissions policies in the coming decade, although gradual increases in carbon prices could erode margins.

WALMART PUTS SCOPE 3 REDUCTION AT THE HEART OF 2025 TARGET

Some 90% of leading US retailer Walmart, Inc.'s (AA/Stable) emissions footprint is in the products it purchases and sells, presenting a degree of regulatory risk from future carbon taxes or prices. Accordingly, the company has a 2025 emissions reduction target of a gigaton of carbon, including Scope 3 emissions. A supplier engagement programme, Project Gigaton, was launched in 2017 to support reporting of emissions and reduction activities by suppliers. Suppliers can report emissions reductions in areas relating to energy, waste, packaging, product use and design, as well as agricultural and forestry practices. There are over 1000 suppliers reporting emissions reductions on the platform.

OIL MAJORS' SCOPE 3 TARGETS

Company	Scope 3 carbon-intensity targets	Annual low-carbon capex
BP plc	• Upstream: Net-zero emissions by 2050 • Net intensity of products sold: 50% by 2050	USD5bn by 2030
Eni SpA	• Europe: Net-zero emissions by 2050 • Net intensity of products sold: -55% by 2050 • Net absolute emissions: -80% by 2050	EUR1bn in 2020–2023
Equinor ASA	• Net intensity of products sold: -50% by 2050	USD2bn–USD3bn in 2022–2023
Exxon Mobil Corporation	• None (Scope 1 & 2 targets only)	Negligible
Repsol, S.A.	• Net-zero emissions by 2050	EUR0.8bn by 2025
Royal Dutch Shell plc	• Net intensity of products sold: -65% by 2050	USD2bn–3bn by 2030
Total SE	• Europe: Net-zero emissions by 2050 • Net intensity of products sold: -60% by 2050	5100MW

Source: Fitch Ratings

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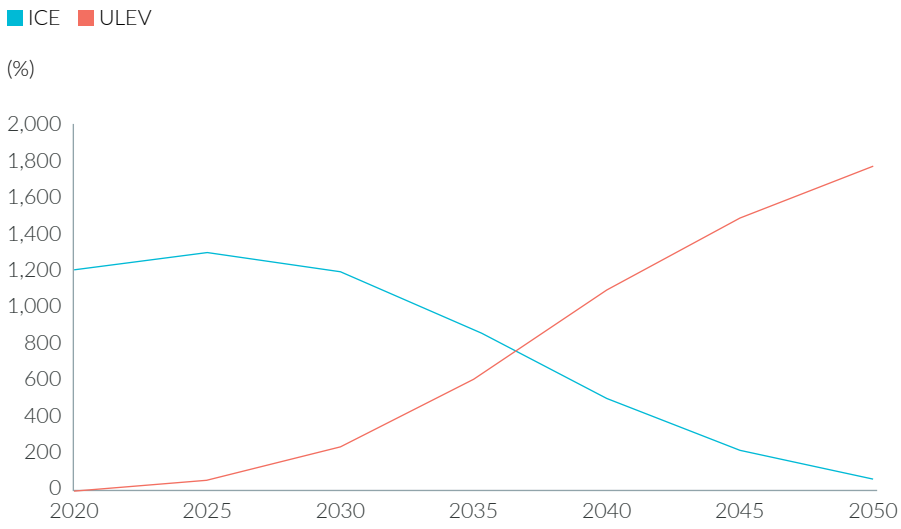
GROWING GAP BETWEEN REGULATIONS AND CONSUMER PREFERENCES IN AUTO SECTOR

In the automotive sector, a range of increasingly stringent product emissions regulations for fleet sales in Europe and China are affecting producers and look set to erode margins in the coming five years as a result of higher compliance costs. This is likely to have a disproportionate impact on smaller producers who are less able to absorb additional R&D expenditure on low-emissions technologies. Additional capex costs for electrification amongst EMEA auto producers has been estimated at as much as EUR40 billion, although it is difficult to separate this figure from the ordinary costs of product development in what is a highly capital-intensive sector.

Core assumptions in the UN-supported Principles for Responsible Investment's Inevitable Policy Response Scenario (IPR) include increasing ownership and sales of passenger electric vehicles (EVs) as well as recent government policies banning the sale of light-duty vehicles powered by internal combustion engines (ICEs). The IPR assumes that 70% of all passenger vehicles will be ultra-low emissions vehicles by 2040. Tighter fuel economy standards will also lead to reduced oil demand growth from combustion engines.

Reducing product-use emissions can also have second-order effects, particularly on utilities and oil and gas. In Europe, oil consumption has stagnated over the past decade due to the increasing efficiency of the

PASSENGER VEHICLES BY POWERTRAIN



Source: Fitch Ratings, UN's FPS

ICE cars. Norway, which has the highest penetration of EVs globally due to various incentives, has had its consumption of diesel and petrol decrease by 2% annually over the past five years. Nonetheless, this has been supported by heavy and sustained government subsidies and incentives, which may be difficult to replicate elsewhere in the absence of rapid technological breakthroughs that reduce battery costs, particularly for countries with weaker fiscal positions and financing flexibility.

Consumer preferences also present a challenge, as the trend in North America, China and, to a lesser extent, Europe has been for growing demand for larger, heavier vehicles with higher fuel consumption and associated GHG impacts. This tension has been challenging for producers in Europe, where regulatory drivers have been at odds with consumer preferences.

Electric and hybrid vehicles are inherently less profitable for most producers at present, so the bulk of manufacturers have opted to diversify and balance their product lines across drivetrain types to align with fleetwide emissions targets whilst meeting demand for larger, more profitable vehicles. This balance may be more difficult to attain for smaller, niche producers, which will also face greater challenges in meeting the costs of electrification.

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PRODUCT CARBON LABELLING TO DISRUPT DEMAND

Product-level carbon emissions labels have been gaining significant support in North America and Europe in the past year, with major food producers such as Unilever PLC (A/Stable), Upfield Group, Mondelez International, Inc. (BBB/Stable), Quorn Foods and Oatly in the process of introducing product-level emissions labelling. The UK government is also due to consult on a mandatory labelling system for food products later this year.

Mandatory labelling systems could be highly disruptive for food producers; in addition to the added costs of measurement and reporting of product level emissions, evidence suggests this could trigger shifts in demand for products on the basis of carbon impact.

Polling by YouGov and the Carbon Trust found two thirds of respondents across Europe supported the introduction of product-level labelling systems, whilst US polling by the National Retail Federation found that over half of consumers would be willing to change their eating habits to minimise environmental impact. Whilst some food companies voluntarily disclose product-level emissions, research suggests the lack of widespread, comparable disclosure means consumers struggle to compare impact between similar products. By contrast, mandatory systems are expected to ease comparability of products – in the USA, introduction of nutritional food labelling is estimated to have resulted in reductions in consumers' intake of calories by almost 7% and total fat by over 10%.

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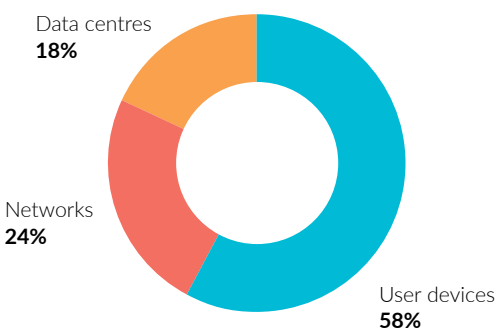
AT&T INC. DEMONSTRATES TELECOM'S SCOPE 3 CHALLENGES

The telecommunications industry is often perceived as having relatively low climate impact from its activities. However, this is starting to change with increased focus on product use emissions, and has gained increasing importance with widespread moves to remote working in 2020. Many existing telecoms carbon emissions targets focus on operational emissions, but some 40 telecommunications companies have committed to setting Science Based Targets (SBT) in line with the Paris Agreement 1.5C trajectory, which will entail deep reductions in product-use emissions. A recent survey by Deloitte LLP found that telecoms, technology and media companies were amongst the least likely to have Paris Agreement-aligned emissions targets.

AT&T Inc. (BB+/Stable) has set a SBT to reduce absolute Scope 1 and Scope 2 GHG emissions by 26% by 2030, using 2015 as a base year. AT&T also discloses that 50% of its suppliers by spend, covering purchased goods and services, capital goods, and downstream leased assets, will set Scope 1 and Scope 2 SBTs by 2024. AT&T's disclosed Scope 3 emissions in 2019 represented 37% of its emissions profile, but this did not include product use emissions.

Internet usage is projected to increase annually by 30%–40% over the coming decade, leading to 30 times the carbon emissions of 2021 traffic levels by 2030. If this trend holds, this would equate to the telecoms sector producing 60% of global emissions in 2030. As such, there is likely to be heightened scrutiny of product-use emissions for the telecoms sector, which will face the challenge of reducing energy consumption and emissions whilst applications and use of its products increases.

USER DEVICES DOMINATE TELECOMS EMISSIONS



Source: Fitch Ratings, Radonjič, Tompa (2021)

GHG EMISSIONS AND AIR POLLUTANTS FROM OPERATIONS

GHG emissions and air-quality issues from operations encompass a wide range of business activities, logistics and transportation. There are risks of higher operating costs, required capital or operational expenditure to improve emissions performance, and litigation or reputational risks. Changing consumer behaviour in relation to climate concerns also needs to be considered.

A key determinant of the extent to which these are disruptive to business models is the average age of assets as well as the overall capital intensity of operations. For example, companies with diversified manufacturing facilities in multiple locations can shift technologies and R&D investment to meet changing emissions performance standards more rapidly and inexpensively than shipping, where assets are long-lived and the risk of stranding is higher.

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ASSET LIFESPAN, CAPITAL INTENSITY KEY DETERMINANTS OF OPERATIONAL RISK

		Average asset lifespan (years)	Capex/ depreciation ratio (%)
Fossil assets	Coal and consumable fuels	40	76
	Integrated oil and gas	10.5	108
Fossil fuel-dependent infrastructure	Highways and railways	17.2	157
	Utilities	28	225
	Aviation	23	201
High-carbon assets without low-carbon competitors	Automobile manufacturing	10	188
	Construction materials	9.1	152

Source: Fitch Ratings, NIESR, UNEP-FI, NYU-Stern

PRICE OF EU ETS ALLOWANCES REACHES RECORD HIGHS

Source: Fitch Ratings, Intercontinental Exchange Inc.

Exposure to higher carbon prices is the most material financial concern for most company operations and business activities. The EU ETS is projected to hit EUR46 per tonne of carbon by 2023 (USD56 a tonne), largely due to policy interventions such as the tightening of the 2030 emissions target and removal of excess allowances from the market under the Market Stability Reserve mechanism. This will be an increase of around 43% from current trading prices and will place significant pressure on energy-intensive utilities, industrials and construction companies. Canada is targeting a carbon price of CND50 a tonne by 2023 (up from CND30 at present), and ETS prices have also increased rapidly in South Korea in the past year as a result of policy tightening. Japan recently committed to a net zero target and is in the process of formalising a domestic carbon pricing scheme.

These price increases will probably lead to further fuel switching; sustained highs in EU ETS prices of around EUR 25/tonne were sufficient to incentivise widespread switching from coal generation towards gas (and, to a lesser extent, renewables). The implications for company operations and logistics are likely to be higher fixed costs. Companies are likely to increasingly dispose of carbon-intensive assets and climate considerations are increasingly accounted for within M&A activities.

The pace at which these disposals will occur is uncertain; our central forecast for all sectors is of a gradual transition away from carbon-intensive assets

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towards low-carbon assets, but the wave of bankruptcies in the thermal coal power sector in recent years attests to how shifting sentiment can lead to rapid outflows in investment.

Relevance to Sector

Regulated utilities, pipelines and networks have borne the bulk of additional costs relating to operational emissions in recent years. This could erode their cash position if their ability to pass through costs is limited, although consumer demand elasticity in energy is fairly weak.

Sectors perceived to have high environmental impact in operations will need to access financing for the low-carbon transition. The mining sector, which is pivotal to the supply of materials for electric vehicles, batteries and renewable energy technologies, is becoming increasingly dependent on debt issuance and loans for new project development, which in turn is bringing deeper scrutiny of environmental-management practices and low-carbon strategies. Despite strong growth and media coverage of the green bond market, there is a growing recognition that this is largely limited to a handful of 'green activities' relating to energy efficiency and renewable deployment, with more established carbon-intensive industries having limited issuance of green bonds to support the low-carbon transition and green capital expenditure.

Brazilian mining company Vale S.A. (BBB/Stable) recently announced it was setting aside USD2 billion to achieve a 33% reduction in direct and indirect emissions by 2030, and it will pelletise iron ore rather than coal, electrify its mines and railroads and increase energy efficiency and renewable generation to reach its emissions targets. Glencore plc recently committed to a 30% reduction in Scope 3 emissions by 2030. These strategies have been largely driven by pressure from activist investors.

Pressure is also growing on companies to set 'science-based' operational carbon targets that align with a 'fair share' contribution to the Paris Agreement trajectory. The International Energy Agency's (IEA) publication of its country and sector-based roadmap for the Paris Agreement in May 2021 is likely to increase pressure for such science-based reduction strategies.

WIDE VARIATION IN MINERS' ENVIRONMENTAL EXPOSURE

	Environmental exposure	Country risk relative to mining operations	Governance structure	IDR
Vale S.A.	BB	BB	BBB	BBB
Anglo American plc	BBB	BB	A	BBB
BHP Group Limited	BBB	A	A	A
Freeport-McMoRan Inc.	BBB	BB	AA	BB+
PJSC MMC Norilsk Nickel	BBB	BBB	BB	BBB-
Samarco Mineracao S.A.	CCC	CCC	B	WD
Southern Copper Corporation (SCC)	BB	A	BB	BBB+
Teck Resources Ltd.	BBB	BBB	A	BBB-

Source: Fitch Ratings Corporate Navigator

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TRANSITION FINANCING COMES INTO FOCUS

The extent to which industries perceived as having a high climate impact should be able to issue debt labelled as 'green' or 'sustainable' to help finance the low-carbon transition is an ongoing debate. The growth in oil and gas, shipping, and mining companies issuing sustainability-linked bonds has led to calls for increased transparency on how the use of proceeds links to the issuer's low-carbon strategy and business plan, as well as wider capex and opex plans.

We believe that a major development of the growth of these instruments will be in borrowers publicly committing to a defined ESG or low-carbon transition strategy (Sustainability-Linked Debt Ties Borrowers to ESG Goals, November 2020). Elsewhere, the International Capital Markets Association (ICMA) recently published its Climate Transition Finance Handbook, which focuses heavily on issuance in carbon-intensive or hard-to-abate sectors and includes the following disclosure recommendations:

1. Issuer's climate transition strategy and governance;
2. Business model environmental materiality;
3. Climate transition strategy to be 'science-based' including targets and pathways; and
4. Implementation transparency.

A.P. MØLLER – MÆRSK A/S BUILDS ASSET LIFECYCLE INTO NET ZERO STRATEGY

International shipping and aviation both sit outside of the Paris Agreement but are subject to a complex series of international standards and voluntary commitments. Shipping is responsible for 2%–3% of global emissions, but is set to grow in the coming decade with wider trade.

The International Maritime Organization (IMO) and the EU aim to cut CO2 levels by 40% by 2030, although this may be revised in line with the recent 55% target for the EU as a whole. In late 2020, the European Parliament voted to include shipping within the EU ETS, whilst the IMO is working on requirements for energy-efficient ship design and management by bringing in proposals to assess and measure energy efficiency and to set thresholds, to be introduced alongside new climate targets by 2023. We expect more clarity on the measures and their probable impact on shipping companies in the IMO's Marine Environment Protection Committee session in 2021.

Risks of stranded assets in the shipping sector are perceived to be high because of the very long lifespan of assets (generally at least 20 years). Maersk recently introduced a 2050 net-zero emissions target together with a detailed research and development pipeline for low-carbon shipping technologies. Solutions such as green hydrogen, green ammonia, biofuels and electrification are being tested on a large scale in demonstration projects with the aim of selecting viable technology options by 2023 and introducing a carbon-neutral vessel design by 2030. Ships built after 2025 will also be required to be ready for retrofitting into carbon-neutral vessels, in recognition that these ships will be part of the fleet in 2050.

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OFFSETTING EMISSIONS COMING UNDER SCRUTINY

The use of carbon offsetting in hard-to-abate sectors is another area of contention (Tightening Climate Policy to Drive Carbon Offsetting and Emissions Trading, September 2020). Airlines make widespread use of emissions-offsetting credits as part of emission-reduction strategies. The low cost and often low quality of offsets purchased by airlines are drawing increasing scrutiny. The offsetting of 'three years' of emissions' by easyJet Airline Company Limited, for example, entailed a carbon cost of GBP3/tonne, compared with the GPB24/tonne it would have cost under the EU ETS. EasyJet's expenditure under the EU ETS was GBP80 million in 2019 as it made use of free emissions allocations, but full coverage of its emissions would have been GBP180 million, according to estimates by the Financial Times. Voluntary offsets are often so inexpensive that they don't incentivise investment in emissions reduction.

This highlights low prices and demand in the voluntary offsetting market for airlines and persistent use of free allocations in the regulatory market. In the EU, emissions reductions in other industries that are subject to the ETS have been deepened to offset increases in emissions for the airline sector. Accordingly, most airlines with net-zero pledges have made limited investments in fuel efficiency or technology improvements as a result of limited incentives, although there have been some exceptions, such as JetBlue. From a credit perspective, low-cost offsets could create long-term risk to companies if they delay investments in more carbon- and fuel-efficient technologies until regulations subsequently tighten.

CLIMATE CHANGE CONSIDERATIONS IN M&A TRANSACTIONS

Exposure to GHG emissions in operations is becoming key in M&A activities, a phenomenon that has been largely limited to power utilities and oil and gas, but is likely to accelerate in other sectors as GHG and air quality concerns grow. In the UK, Centrica (NR) has restructured its business and is building its capabilities in distributed energy through strategic acquisitions in this sector whilst reducing its exposure to centralised power-generation assets.

E.ON SE (BBB+/Stable) and RWE AG (BBB+/Stable), meanwhile, have opted to ringfence their power generation assets (which are less profitable than Centrica's) – mostly thermal coal assets affected by high carbon prices – into separate operating units whilst retaining their retail energy, renewables and distribution assets. Additional investment in asset purchases and capex is likely for all European energy utilities in order to meet decarbonisation targets, and any deterioration in credit quality from these additional costs is mostly offset by the low business risk of renewables and stability of power purchase contracts.

A recent survey of private equity, corporates and asset managers by Mergermarket found that more than half of expected ESG issues are expected to become significantly more important in M&A decisions, with climate considerations viewed as the most material issue. Investor pressure and perceived business risk, such as litigation or reputational damage, were seen as the major drivers.

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GHG EMISSIONS AND AIR POLLUTANTS IN ECONOMIC DEVELOPMENT

Carbon emissions are closely linked with economic activity and growth, and have been a by-product of virtually all industrialisation. However, there is some evidence of advanced economies beginning to decouple economic growth from carbon-emission growth in the power sector – notably Sweden and the UK.

Relevance to Sector

Energy-importing countries and regions tend to be most advanced in investing in the low-carbon transition. The World Economic Forum's Energy Transition Index underlines this trend. Since 2015, fuel-importing countries have improved their ranking at a faster rate than fuel-exporting countries. Key points of differentiation are on environmental sustainability, capital and investment in new energy infrastructure, and the inertia from legacy energy system structure.

This trend is particularly apparent in Asia, where coal forms a key part of economic activity in many fuel-importing countries. China and India's coal consumption has increased in particular over the past decade alongside economic growth. China has relied heavily on thermal and metallurgical coal to drive local economic development, and although approval of new thermal coal capacity has been slowed in recent years to address overcapacity issues, there is some evidence of this reversing in the past year. Several high-emitting sectors remain the major economic growth drivers – especially in the post-pandemic era, as secondary industry has increased its contribution to Chinese GDP growth since 2020. China's post-pandemic stimulus package has also pushed the demand and reliance for heavy industrials and construction sectors.

NEW YORK STATE PENSION FUND DIVESTS FROM FOSSIL FUELS

New York State has announced plans to divest from oil and gas holdings in its USD226 billion financial investment portfolio, becoming the first US state to do so. The divestment process will be done in phases, tackling companies in the most-polluting sectors first. By the end of 2021, the state comptroller's office will complete a review of companies that produce tar sands oil, a particularly polluting source of oil coming mainly from Canada. These companies include Imperial Oil Ltd, the Canadian branch of Exxon Mobil Corporation. Over the next four years, officials will go on to review fracking firms, oil majors such as Exxon Mobil and Royal Dutch Shell plc, oilfield service companies such as Schlumberger Limited and Baker Hughes, and storage and pipeline builders including Enbridge Inc. and Energy Transfer Equity LP. The aim is to entirely divest from oil and gas by 2040, in line with the state's net-zero target.

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JUST TRANSITION FUND CONCERNS WEIGH ON REGULATORS

Low-carbon policies and regulations can have a negative effect on social welfare, employment and economic growth in some cases. This, coupled with spiralling costs for compensation and diversification, is leading to recognition that emissions-reduction pathways may need to be better-tailored to local economic structures and needs if significant negative effects on welfare are to be avoided.

Poland, which, together with Germany, is the major beneficiary of the EU's EUR17.5 billion Just Transition Fund, has substantial employment linked to carbon-intensive industries, whilst the German government estimates that as many as 400,000 jobs in the auto manufacturing sector could be lost with the switch to electric vehicles, which require less labour resources in manufacturing and maintenance. As regulatory focus shifts from the power sector to decarbonising industry, pressure on regulators to factor in local employment and economic structure considerations to low-carbon policies will grow.

ANGLO BENEFITS FROM DIVERSIFICATION DESPITE COAL

Miner Anglo American plc (BBB/Stable) scores a '3' for GHG Emissions and Air Quality despite a relatively high share of EBITDA attributable to coal (18%) and mining operations in many countries with tightening climate regulations. The reasons for this lie in its diversification across other high-value commodity types as well as its diversification in terms of operating geographies, which will help offset loss of revenues from coal in some local markets. Demand for thermal and metallurgical coal remains strong in much of Asia-Pacific.

Effect on Credit

GHG and air pollutant emissions can translate into credit issues and potentially materialise in several forms of credit risk. Climate change issues encompass physical and transitional aspects of risk. We address eight main aspects of risk detailed in the ESG scoring templates: (1) asset quality and concentration risk, (2) business profile and competitive position risk, (3) macroeconomic risks, operational and cash flow risk, (4) profitability risk, (5) refinancing risk, (6) regulatory and litigation risk, and (7) reputational risk.

Asset Quality and Concentration Risk

Climate risks are often geographically diverse and regulatory asymmetry is a common challenge for corporates operating across multiple geographies. Corporates with diversification of assets by age, technology and operating geographies will be better-placed to absorb the costs of transition and regulatory compliance and to redirect capital, production, and other resources, if needed, than smaller, more local producers.

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JAGUAR LAND ROVER FACES TRANSITION CHALLENGES

Jaguar Land Rover Automotive plc (JLR; B/Negative) has a score of '4' for EAQ, along with the other Fitch-rated EMEA automakers (with the exception of Volkswagen, which has a score of '5' following ongoing liabilities from the 2018 emissions scandal). This reflects producers' exposure to stringent new EU vehicle emissions standards and associated fines, as well as the heightened need for investment in electric vehicles, which are generally less profitable than equivalent combustion engine vehicles.

The heightened business profile and competitive position risk for JLR stem from its high concentration of sales in the European market, relatively small product portfolio of large vehicles, and low cash flow from operations relative to total debt. This was consistently negative before the 2020 economic downturn and was a major factor in JLR's affirmation at 'B' with a Negative Outlook in November 2020, despite the positive effects of cost-control measures.

Tightening vehicle emissions standards are expected to remain a challenge for JLR as its product portfolio is weighted towards larger, less fuel-efficient SUVs. The company is optimistic that it will meet emissions targets for 2021 as it has offered electrified powertrain options on all new models from 2020. However, uncertainties regarding electric vehicle penetration and a decline in diesel sales in Europe pose a risk to meeting these emissions targets.

Business Profile and Competitive Position Risk

Companies operating in highly competitive markets, with relatively tight margins or more limited product portfolios, could be at particular risk from climate and air pollutant regulations as their free cash flow may be more limited and they may have less resources to respond to changing regulatory requirements or consumer demand.

Macroeconomic Risks

Many countries or regions have comparative advantage or economic concentration in industries that are particularly exposed to the low-carbon transition. Oil and gas majors are typically highly exposed to volatility in the regional or global economy and have long-term structural exposure to stranded-asset risk, including the various elements of their value chain. Companies operating in the battery metals supply chain tend to be highly exposed to variations in the global economy, but have a long-term structural advantage as they can support growing low-carbon policies.

Operational and Cash Flow Risk

Air emissions risks can disrupt the day-to-day running of a business and reduce production. They can also increase capital expenditure through the requirement for new infrastructure and alternative logistics arrangements as well as relocation costs due to stranded assets or rising compliance costs in some territories.

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Profitability Risk

Profitability risk refers to the impact air emissions can have on the costs of production and operations. Reductions in output to comply with tightening regulatory standards can reduce profitability, particularly for commodity producers that are highly sensitive to capacity utilisation and economies of scale. This can dampen demand for goods and services altogether.

Refinancing Risk

The intense focus on climate risk in investing across all regions will reduce some issuers' access to financial markets, and therefore their ability to raise funds. Investors that believe that risks may materially negatively affect an issuer's corporate performance, and pose an existential threat, may wish to avoid rolling their bonds or may only purchase short-dated bonds. For capital-intensive industries this poses a major challenge.

Regulatory and Litigation Risk

Regulatory compliance costs have increased in the past decade as a result of tightening air emissions standards in both emerging and developed markets, as well as the introduction of compliance ETSs in some regions. Companies may be subject to multiple regulators with overlapping remits, and governments can be highly reactive to short-term unrest and negative media coverage.

FORESITE HIGHLIGHTS REFINANCING RISK FOR US COAL

Foresite Energy LP (Rating Withdrawn) is a US coal mining company with operations located mostly in the Illinois basin. The company has a favourable operating profile, with fairly low-cost mines and stable and easy access to barge and rail transport. Nonetheless, the company has been under sustained domestic margin pressure from switches to natural gas as well as changes in thermal coal demand in China and the EU, its key export markets.

These changes are attributed to tightening carbon intensity standards for thermal coal in China and the effects of the EU ETS. Foresite has no new projects in development and CRU believes that any new global seaborne coal supply would probably only emerge from Russia, given difficulties in securing financing in other regions due to environmental considerations. As of 2019, available cash was around USD3 million, and very large loans due in 2022 and 2023 – USD752 million and USD435 million, respectively – would need to be refinanced.

Following Foresight's bankruptcy filing in March 2020, Fitch observed that access to debt capital markets transactions has been limited even for lower leveraged coal producers looking to extend maturities. Foresight's total debt/EBITDA was 6.3x for the year to 30 September 2019 compared with 5.0x at end-2018. This bankruptcy followed that of peers Murray Energy Holding Co. and Cloud Peak Energy in 2019.

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Similarly, penalties for non-compliance with regulatory standards have increased significantly, and this has been evidenced by the growth of class action lawsuits against individual corporates on the basis of air emissions (most famously Volkswagen's 2018 emissions scandal) or perceived climate impact. In the US, a 2007 Supreme Court ruling that the Environmental Protection Agency's remit to protect public health and wellbeing under the Clean Air Act extended to GHG emissions resulted in a short-lived attempt to introduce a non-legislative cap and trade system in the power sector.

Reputational Risk

Issuers are increasingly concerned by customer perceptions, especially as social media offers an open venue for consumers to express their views. Entities are spending more time on protecting their brand and ensuring their conduct is perceived positively –negative publicity can be detrimental to branding and sales, and could result in a boycott or legal action. Non-governmental organisations are increasingly engaging in 'shadow reporting' of company climate and emissions impacts using public data and growing access to satellite data – this in turn is increasing pressure on regulators to tighten policies and enforcement actions.

WEICHAI FACES UP TO TIGHTER AIR EMISSIONS STANDARDS

Weichai Power Co., Ltd. (BBB+/Stable) is China's largest heavy-duty truck engine manufacturer and fourth-largest heavy-duty truck manufacturer. It is also the largest company in the European forklift market through its control of German manufacturer KION GROUP AG (BBB-/Stable), and the second-largest in the global forklift market. KION's acquisition of warehouse automation solutions company Dematic makes Weichai North America's largest supply-chain solutions company and one of the three largest firms in the sector globally.

Weichai has an EAQ score of '4' due to exposure to air emissions regulations in its domestic market. Fitch believes heavy-duty truck demand in China may be reaching a structural peak in the coming five years. In the long term, ever-tightening emission restrictions and the improving economics of clean-tech alternatives may dampen demand for diesel engines.

In 2018, the China VI emission standard for new heavy-duty vehicles was introduced, in many ways more stringent than the equivalent European standards. Under the standard, it will be mandatory for all new diesel heavy-duty vehicles introduced to the market after July 2021 to be fitted with diesel particulate filters. If effectively implemented, it will transition all new heavy-duty vehicles in China to soot-free emission levels. In addition, many city or province-level regulations have affected diesel vehicles; Beijing has had a ban on the sale or registration of diesel-based light trucks since 2000.

Weichai's rating is supported by a leading position in several key markets as well as its management's conservative financial policies and demonstrated execution, and is counterbalanced by poorer positioning against global peers with more diverse business portfolios.

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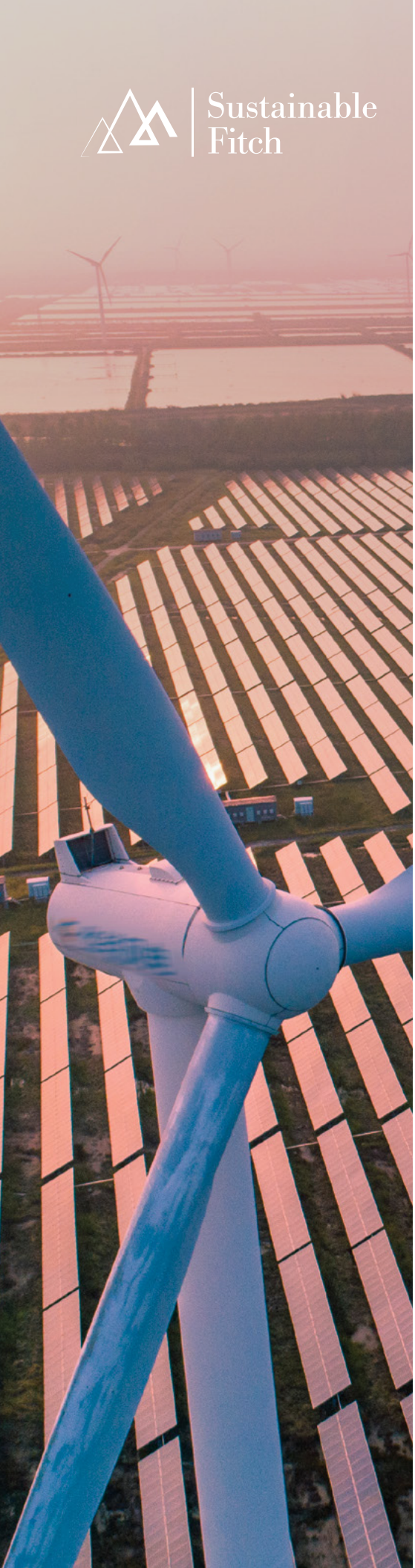

PART TWO: ENERGY AND FUEL MANAGEMENT ISSUES

RENEWABLE ENERGY ECONOMICS TO BRING DISRUPTION THROUGHOUT 2020s

Falling unit costs of solar and wind have gained intense focus in the past two years, but the implications of this for other energy sources has had relatively little attention. Renewables could lead to entirely different grid and financing models, and the full force of this disruption will start to be felt this decade as penetration rates increase.

This report focuses on energy and fuel management – specifically, the Energy and Fuel Management general issue within Fitch Ratings' ESG Relevance Score Framework and scoring templates. It explains how these issues can translate into relevant credit issues and potentially materialise as credit risks.

Gas and Nuclear Compete as Transition Fuel

Strong regional differences in the use and applications of natural gas and nuclear energy are driving varying perceptions of their roles in the energy transition. Most gas applications in OECD countries relate to building heat and industrial processes, which will be technically difficult to substitute.

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Distribution, Balancing Costs Higher

Falling spot prices for solar and wind have placed competitive pressures on other energy sources, but these lower prices need to be balanced against other costs that will ultimately be absorbed by end-consumers. These include higher grid balancing and distribution costs, and network utilities having to face sharp increases in capex costs.

It is likely that markets will evolve to link demand with resource availability, and green hydrogen is attracting interest as a means to balance intermittency issues from renewables whilst providing low-carbon fuel for 'hard-to-abate' activities.

Geographical Factors Are Important

Established economic structures, geography, climate and other regional characteristics influence patterns of energy consumption and energy efficiency. This is increasingly being reflected in regulatory actions, but issuers with sufficient sectoral and geographical diversification may be better-placed to absorb any increase in regulatory compliance costs or resource input costs.

Core Energy-Related Credit Issues

Fitch has identified the sectors and activities most heavily affected by emissions from a credit perspective. These can be categorised under four core energy and fuel-related credit issues: energy and fuel consumption in the manufacturing process; energy and fuel consumption from products; energy and fuel consumption in operations; and energy resource management in economic development.

Defining Energy Management

Energy- and fuel-management issues have physical, financial and economic impacts on borrowers. While the consequences of these issues can be clear (see table *Energy- and Fuel-Management Issues and Their Operational, Financial and Economic Impacts*), it can be difficult to attribute an ESG impact to a specific credit driver, as aspects of Energy Management are often linked to several different ESG credit issues.

Energy-management issues can materialise in and overlap with other ESG issues. Within Fitch's ESG.RS framework and sector-specific scoring templates, there are connections between these credit issues and the following general issues:

GHG Emissions and Air Quality: This addresses the issuer's ability to manage risks associated with emissions to air, including greenhouse gases (GHGs). Carbon-related considerations are increasingly important in investment decisions, and many corporates are under growing investor pressure to address sources of emissions in operations, supply chains, products and procurement.

FITCH'S ESG RELEVANCE SCORE FRAMEWORK AND SCORING TEMPLATES

Fitch's approach to sustainable finance and ESG integration is to provide transparency on ESG-related credit risks that influence credit ratings. In 2019 Fitch started producing ESG Relevance Scores (ESG.RS), which have been fully integrated into Fitch's existing research process across asset classes.

ESG credit considerations are systematically evaluated by Fitch's analysts using the ESG.RS framework that extracts the issues from the relevant sector criteria. When assessing issuers and transactions, analysts refer to the asset-class and sector ESG scoring templates to allocate individual and overall E, S and G scores (see table *Fitch's Oil and Gas Production Scoring Template* opposite for an example of an ESG scoring template).

ESG.RS articulate the level of influence an environmental, social or governance issue has had on a credit rating decision. Each entity or transaction receives 14 or 15 ESG.RS based on five environmental, five social and four or five governance general issues. Scores range from '1' to '5' where an ESG Relevance Score of '1' indicates no credit relevance at either a sector or entity level, whilst an ESG Relevance Score of '5' indicates a single identified environmental, social or governance risk that is unambiguously causing a change to the current rating level.

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Low-carbon energy procurement is a frequent area of focus and targets.

Management Strategy:
The management strategy for addressing market and technology risk for goods, services and operations stemming from energy efficiency and low-carbon generation standards, as well as litigation, reputational and regulatory compliance risks, is under increasing scrutiny. Corporates are being particularly scrutinised on management strategy relating to energy and fuel management by activist investor coalitions and civil society groups, with increasing requests for detail on how capex and opex spending plans, product portfolios and other aspects of management strategy contribute to emissions-reduction targets and contribute to the Paris Agreement trajectory.

Exposure to Environmental Impacts:
This relates to physical climate risk and other aspects of exposure to natural disasters. There is some degree of interplay between the physical and energy-transition aspects of climate risk. For instance, the frequency and severity of extreme weather events is expected to increase in the coming decades due to GHG emissions from power and fuel consumption, whilst pressure on policymakers to support renewable energy generation will increase in response to these extreme weather events.

While energy- and fuel-management issues are inter-related to other general issues in our scoring templates, we only consider issues to be credit-relevant, and therefore an energy- or fuel-related credit issue, when energy and fuel consumption are a key to an economy, management strategy, product, manufacturing process, operation or project.

FITCH'S OIL AND GAS PRODUCTION SCORING TEMPLATE

General issue	Sector-specific issue
GHG emissions and air quality	Emissions from OGP production
Energy management	Energy use in OGP operations
Water and wastewater management	Water management (e.g. usage levels, recycling capacity)
Waste and hazardous materials management; ecological impacts	Waste and material handling; operations proximity to environmentally sensitive areas
Exposure to environmental impact	Hydrocarbon reserves exposure to present or future regulation and environmental costs
Human rights, community relations, access and affordability	Operations proximity to areas of conflict or indigenous lands
Customer welfare – fair messaging, privacy and data security	n.a.
Labour relations & practices	Impact of labour negotiations and employee (dis)satisfaction
Employee wellbeing	Worker safety and accident prevention
Exposure to social impacts	Social resistance to major projects or operations that leads to delays and cost increases
Management strategy	Strategy development and implementation
Governance structure	Board independence and effectiveness; ownership concentration
Group structure	Complexity, transparency and related-party transactions
Financial transparency	Quality and timing of financial disclosure

Source: Fitch Ratings

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ENERGY- AND FUEL-MANAGEMENT ISSUES AND THEIR OPERATIONAL, FINANCIAL AND ECONOMIC IMPACTS

EFM Issue	Affected Sectors	Operational/Regulatory Impact	Financial and Economic Impact
Rising energy costs as a result of increasing carbon prices	• Energy-intensive industries • Metals and mining • Utilities • Transport • Commodities	• Lower output • Higher operating costs • Competitive pressures or tilt towards low-carbon producers	• Lower profit margins or revenue • Varying levels of cost pass-through • Large investments needed in new capital and operational expenditure • Decreased economic activity in exporting markets due to lower demand for fossil fuels
Changing demand for energy and commodities, resource consumption	• Energy-intensive industries • Mining • Utilities • Transport • Commodities • Auto producers • Financials	• Lower production output or capacity utilisation • Diversification of energy sources • Renewable energy procurement • Engagement with customers and suppliers	• Possible erosion of cash position, credit deterioration if costs cannot be passed on or goods and services adapted to fit market needs • Need for additional capex and opex in technology improvements
Supply chain – increased scrutiny of energy use	• Energy-intensive industries • Mining • Utilities • Transport • Commodities • Auto producers • Financials	• Costs of data collection and verification • Time and resources for engagement • Further investor scrutiny and engagement	• Additional purchasing criteria beyond price competitiveness may need to be introduced
Risk of stranded assets	• Energy-intensive industries • Mining • Utilities • Transport • Commodities • Auto producers • Financials • Sovereigns, sub-sovereigns • Public finance and infrastructure	• Early asset retirement • Under-utilisation of existing assets	• Revenue forgone from early closure/lost returns on investment in productive assets • Additional capex and opex costs on new assets

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EFM Issue	Affected Sectors	Operational/Regulatory Impact	Financial and Economic Impact
Tightening emissions standards	• Energy-intensive industries • Metals and mining • Utilities • Transport • Commodities • Auto producers • Shipping	• Lower output • Higher operating costs • Regulatory asymmetry • Competitive pressures or tilt towards low-carbon producers	• Lower profit margins or revenue • Varying levels of cost pass-through • Penalties and fines for non-compliance • Large investments needed in new capital and operational expenditure • Decreased economic activity in exporting markets due to lower demand for fossil fuels
Litigation and liabilities	• Energy-intensive industries • Mining • Utilities • Transport • Commodities • Auto producers	• Negative press coverage, political intervention and regulatory pressure • Business shutdown, interruption, slowdown and relocation • Loss or refusal of licence to operate due to community unrest and political response	• Lower revenue due to operating restrictions and rationing • Additional investments in capex and opex • Lower economic activity due to less favourable business environments
Investor demands for wider disclosure and target setting on clean energy sources	• Energy-intensive industries • Metals and mining • Utilities • Transport • Commodities • Financials • Telecoms and technology	• Costs of data collection and verification • Time and resources for engagement • Some operationally sensitive data may need to be disclosed	• Potential increases in financing or refinancing costs • Large investments needed in new capital and operational expenditure to transition to lower-carbon assets

Source: Fitch Ratings

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Sector-Specific Credit Issues

Fitch analysts evaluate whether an energy and fuel management issue is credit-relevant and material for all its rated issuers and transactions. Within their ESG scoring templates, Fitch analysts allocate a score of '1' to '5' for the general issue energy management.

The sector-specific ESG credit issues for energy management can be categorised into four core credit issues:

- **Energy and fuel management in manufacturing processes** – where energy or fuel is consumed in the processing, fabricating, washing or cooling of a final product;
- **Energy and fuel management from product** – where energy or fuel is consumed in the use of a product;
- **Energy and fuel management from operations** – where energy or fuel is consumed from resource production, power generation, logistics, transportation and other business activities;
- **Energy resource management in economic development** – where energy or fuel supports national, regional and local economic growth.

FITCH'S DEFINITION FOR ENERGY AND FUEL MANAGEMENT

This category addresses environmental impacts associated with energy consumption and with energy resource endowment management. It addresses an issuer's management of energy in the manufacturing of or for the provision of products and services derived from utility providers (grid energy) not owned or controlled by the issuer. It includes management of energy efficiency and intensity, energy mix, and grid reliance. Upstream (e.g., suppliers) and downstream (e.g., product use, assets and investments of financial companies) energy use is not included in this category. Scope 2 (indirect) and components of Scope 3 (supply chain) GHG emissions defined under the GHG Protocol are covered within the category.

TRANSITION MECHANISM FROM ENERGY AND FUEL MANAGEMENT ISSUES TO CREDIT RISKS

Energy and Fuel Management Issues

- Rising carbon prices
- Tightening emissions standards
- Litigation and liabilities
- Investor demands for wider disclosure and target-setting on clean energy sources
- Changing demand for energy and commodities, resource consumption
- Supply chain – Increased scrutiny of energy use within supply chain
- Risk of stranded assets

Energy and Fuel-Related Credit Issues

- Energy and fuel management in manufacturing processes
- Energy and fuel management from products
- Energy and fuel management from operations
- Energy resource management in economic development

Credit Risks

- Asset quality and concentration risk
- Business profile and competitive position risk
- Macroeconomic risks
- Operational and cash flow risk
- Profitability risk
- Refinancing risk
- Regulatory and litigation risk
- Reputational risk

Source: Fitch Ratings

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How Energy- and Fuel-Management Issues Relate to Credit Risks

Energy- and fuel-management issues can affect any of the energy and fuel-related credit issues and materialise as a single credit risk or a combination of credit risks.

The report focuses on the four above-mentioned core energy and fuel-related credit issues. It provides insights and case studies on how these core issues affect issuers from several of the sectors (see table *Energy- and Fuel-Related Credit Issues and Their Associated Sectors*). This is followed by guidance on how energy- and fuel-related credit issues transpire as credit risks and can affect the creditworthiness of issuers.

ENERGY- AND FUEL-RELATED CREDIT ISSUES AND ASSOCIATED ECONOMIC SECTORS

Energy and fuel management in the manufacturing process	Energy and fuel management from product	Energy and fuel management from operations	Energy and fuel management in economic development
Aerospace & Defence	ABS – aircraft	ABS – aircraft	IPF-LRGs
Alcoholic Beverages	ABS – auto	ABS – auto	Sovereigns
Building Materials	ABS – equipment	ABS – equipment	USPF – state and local government
Building Products	ABS – SME	ABS – SME	
Chemicals	ABS – SME CDO	ABS – SME CDO	
Commodity Processing & Trading	ABS-Future Flow Receivables	ABS-Future Flow Receivables	
Non-Alcoholic Beverages	ABS-Oil Vessel-Backed	ABS-Oil Vessel-Backed	
Oil Refining & Marketing	ABS-Sprint Spectrum	ABS-Sprint Spectrum	
Packaged Food	ABS-Timeshare Loan	ABS-Timeshare Loan	
Protein	ABS-Utility Tariff Bonds	ABS-Utility Tariff Bonds	
Steel	Aerospace & Defence	Airlines	
Telecommunications	Auto Suppliers	APAC Regulated Network Utilities	
	Automotive Manufacturers	Asia Pacific Utilities	
	CMBS	Australia Regulated Networks	
	Consumer ABS - secured	EMEA Regulated Networks	
	CVB Commercial	EMEA Utilities	
	Diversified Industrials & Capital Goods	Engineering & Construction	
	MICH	Food Retailing	

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Energy and fuel management in the manufacturing process	Energy and fuel management from product	Energy and fuel management from operations	Energy and fuel management in economic development
		GIG – Hydro	
		GIG – Oil & Gas Production	
		GIG – Pipeline & Energy Midstream	
		GIG – Thermal Power	
		GIG – Transportation	
		GIG – Water/Wastewater	
		IPF – GREs	
		LATAM Utilities	
		Mining	
		NBFIs	
		Non-Food Retailing	
		Oil & Gas Production	
		Oilfield Services	
		Packaged Food	
		Pipeline and Energy Midstream	
		Shipping Companies	
		US Healthcare Providers	
		US Utilities	
		USPF – Acute Hospital and Health Systems	
		USPF – Higher Education	
		USPF – Public Power	
		USPF – Water & Sewer	

Source: Fitch Ratings

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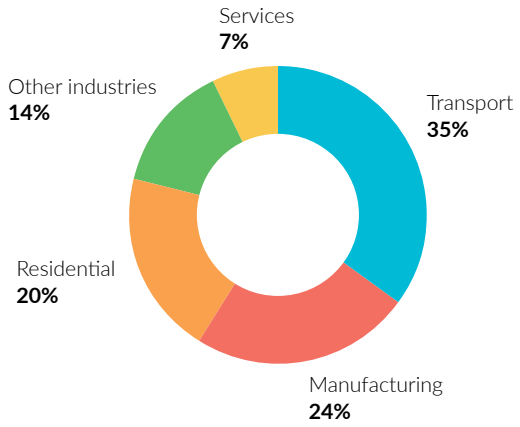
Relevance and Materiality of Sector-Specific Energy- and Fuel-Management Issues

ENERGY AND FUEL MANAGEMENT IN MANUFACTURING PROCESSES

Energy- and fuel-management issues are increasingly important for manufacturing activities as low-carbon policies add pressure to energy-intensive industries. Rising energy and fuel costs as a result of carbon pricing tends to be the most material factor for these industries, particularly where substitution with low-carbon energy sources or fuel is costly and complex. Carbon price increases are indirectly increasing costs for energy-intensive manufacturers. Higher energy prices arise as a result of cost pass-through from utilities and fuel combustion. However, energy efficiency standards in China have tightened substantially since 2014 and this has led to large energy savings in the industrial manufacturing sector.

Coal accounts for the majority of power generation in Asia, due to its availability, affordability and non-intermittency. The dominance of coal in power generation is expected to continue in the region over at least the next decade; it will be needed particularly in emerging markets to pragmatically address anticipated electricity demand growth. Nonetheless, the sector will face systemic risks challenging its sustainability in the long term. Asian countries have taken varying measures to contain growth of coal-fired power capacity, including limiting new approvals at the national or provincial level.

MANUFACTURING USES AROUND A QUARTER OF ALL ENERGY DEMAND



Source: Fitch Ratings, IEA

Relevance to Sector

Manufacturing represents around a quarter of global energy demand and is particularly important to the export-oriented manufacturing economies of Asia, where this represents a major share of economic activity. Energy access, affordability and security concerns are therefore high on the agenda for corporates and policymakers alike.

Energy efficiency in manufacturing can be heavily influenced by regulatory standards, but it also reflects differences in the economic structure of countries and their comparative advantages across sectors. In general, manufacturers in natural resource-exporting countries (such as Finland, Australia, Canada and New Zealand) tend to have lower energy efficiency in manufacturing than those more focused on the domestic consumption of natural resources and high value manufacturing. This may be due to their relatively small populations and abundant local resources, which disincentivise more-efficient consumption.

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PRIMARY RESOURCE-EXPORTING COUNTRIES TEND TO HAVE LOWER MANUFACTURING ENERGY EFFICIENCY

(MJ/2015 USD PPP)

PPP: Purchasing power parity
Source: Fitch Ratings, IEA

CHINA LEADS ON INDUSTRIAL ENERGY EFFICIENCY STANDARDS

Nearly 80% of Chinese industrial activities, two thirds of transport and half of buildings are covered by mandatory energy-efficiency policies; globally, less than 40% of these activities are covered. Rapid tightening of Chinese energy efficiency standards since 2014 has yielded energy savings of at least 13.1 exajoules, according to estimates by the IEA. Similarly, the energy intensity of the economy, which is the amount of energy required to generate a unit of GDP, has fallen by more than 70% in China since 1990 – the global decrease over the same period was 36%. Recent years have seen a slowing of China's pace of energy efficiency savings, driven largely by increased demand in the energy-intensive steel sector.

China has had a rapid tightening of industrial emissions standards since 2014 under its Five-Year Plan, with rising compliance costs both for carbon emissions as well as other air pollutants. The national emissions trading scheme (ETS), launched in February 2021, initially covers around 2,200 thermal coal and gas power plants. Some 70% of respondents to the China Carbon Pricing Survey expect the national ETS to influence investment decisions by 2025.

The World Economic Forum in its Energy Transition Index tracks the performance of countries annually in system-level readiness for the low-carbon transition. The WEF has also observed that net energy-exporting countries tend to be less advanced in the low-carbon energy transition than those that are net importers.

The degree of market concentration in a given industrial sector tends to be an important factor in companies' ability to pass on higher energy costs arising from low-carbon policies, such as carbon pricing or taxes. Companies operating in markets with a more diverse energy mix and competition between electricity sources are often better-placed to absorb these costs with, or cross-subsidise them with, low-carbon energy sources. In addition, elasticity of demand for certain manufacturing products may differ between regions, particularly emerging and developed markets, based on differences in consumption patterns.

For example, Poland is more sensitive to increases than the UK due to differences in the grid mix and patterns of consumption. Germany and Poland are particularly sensitive to incremental changes in the cost of carbon, with the bulk of any price increase being passed on to end-consumers.

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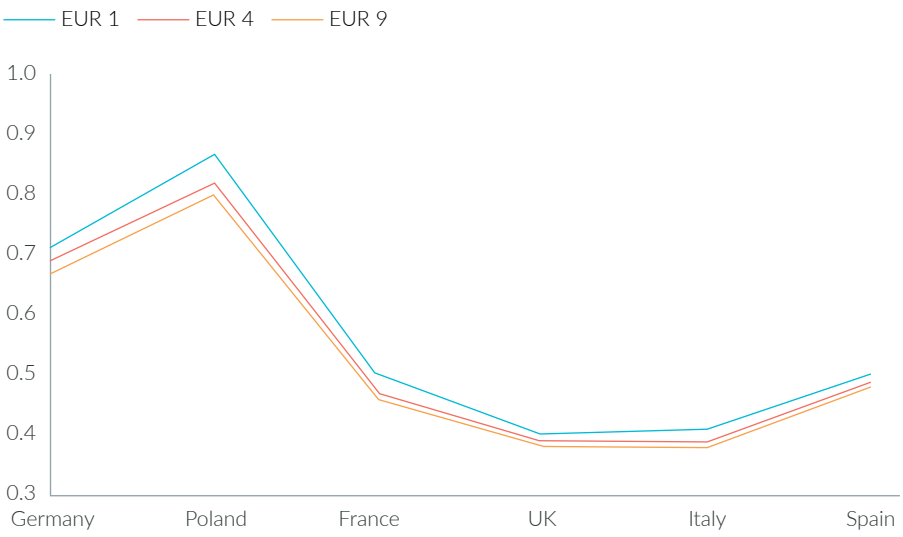
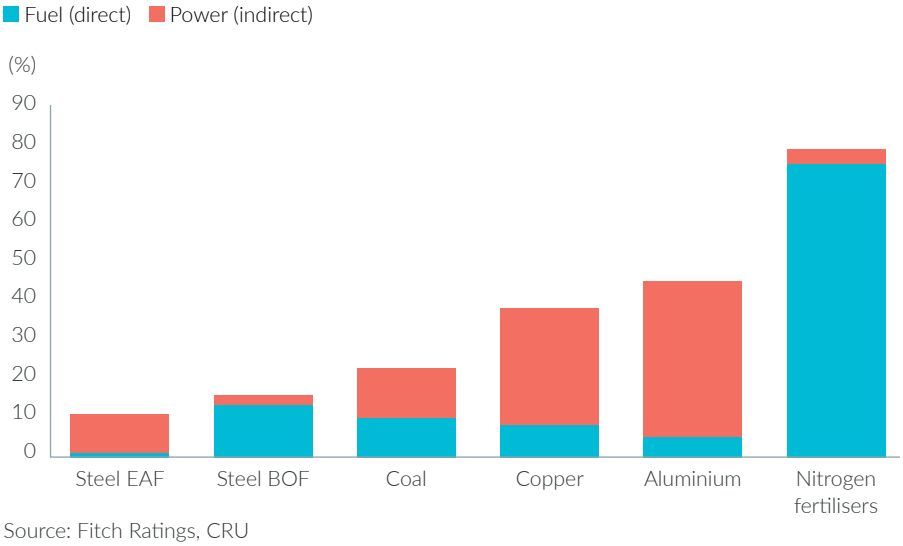
EU ETS MARGINAL INCREASE PASS-THROUGH



Source: Fitch Ratings, ICIS

FUEL AND POWER SHARE OF MAJOR COMMODITIES' PRODUCTION COSTS



Source: Fitch Ratings, CRU

The degree to which manufacturers have direct control over energy and fuel use in production differs by activity. Steel, nitrogen fertilisers and thermal and metallurgical coal are directly exposed to rising fuel costs as a result of carbon pricing. As such, producers in regions subject to carbon taxes or ETSs are increasingly sensitive to competitive pressures from energy cost increases as a result of rising carbon prices.

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Fuel switching from coal and natural gas will also often require new energy sources and modification of industrial processes. Research by the UK Department for Business Energy and Industrial Strategy has indicated that many alternative sources of fuel and energy, including biomass and hydrogen, will probably prove financially viable within a five-year return given the moderate carbon prices. Even without a carbon price signal, a moderate carbon price of GBP77 a tonne in 2030 would make it possible for these alternative fuel sources to deliver returns on investment within five years – even in the absence of savings over gas – due to the low carbon content of these fuels.

Carbon emissions are a growing concern for aluminium producers, given their higher share of Scope 2 (purchased electricity) emissions from the production process compared to steelmakers – approximately 80% of emissions relate to direct energy consumption in the smelting process. Recent Fitch commentary on the sector identified a competitive advantage for many low-margin Chinese producers with good access to affordable renewable energy and raw material self-sufficiency (Chinese Aluminium Profits Evaporate; Low-Cost Firms Resilient, March 2020).

China Hongqiao Group Limited (BB-/Stable), the world's largest aluminium producer, has started moving two million tonnes of capacity to Yunnan Province to take advantage of local hydro and solar resources. In 2018, the provincial government of Shandong, where the company is also located, introduced two power surcharge tariffs

FUEL SWITCHING OPTIONS BY ACTIVITY

Process driven by	Process type	Suitable fuel switching options	Key sectors relying on these processes
Indirect heating	Low temperature	Solid biomass boilers, hydrogen boilers, heat pumps, microwave heaters	Vehicle manufacturing, other industry
	High temperature	Electric heaters, hydrogen heaters	Refining, ethylene, ammonia
	Steam	Solid biomass boilers, hydrogen boilers, electric boilers, heat pumps	Food & drink, paper, chemicals, other industry
Direct heating	Low temperature	Electric heaters, hydrogen heaters	Vehicle manufacturing, other industry
	High temperature	Solid biomass and waste combustion, hydrogen heaters, electric kilns/ furnaces, plasma gas heaters	Glass, ceramic, cement, other non-metallic minerals
	Reduction processes	Direct substitution of solid biomass/ waste materials, hydrogen, plasma gas heaters	Iron production

Source: Fitch Ratings, UK BEIS

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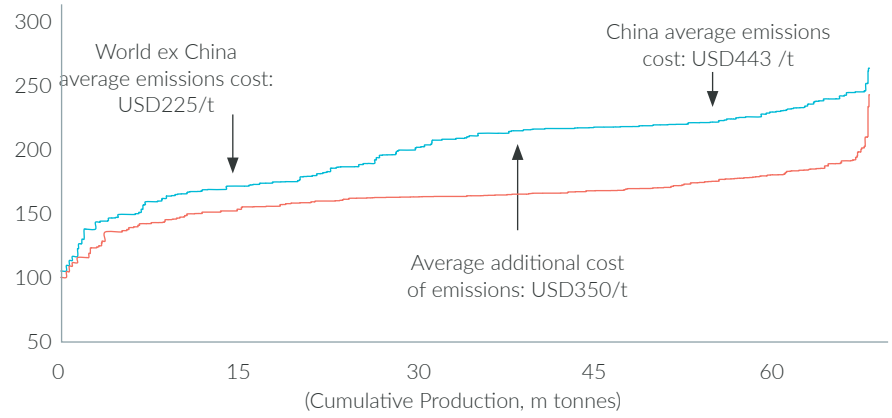
GLOBAL COST CURVES FOR PRIMARY ALUMINIUM PRODUCTION UNDER A USD30/TONNE CARBON PRICE

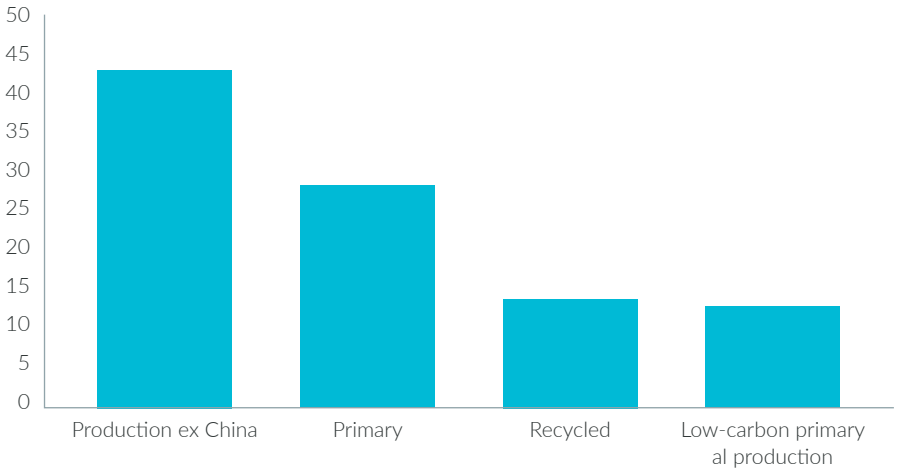
(Business Costs, index lowest cost =100)



The blue line shows additional business costs to smelters arising from a uniform USD 30/tonne carbon price, reflecting differences in production cost and volume across global smelters.
Source: Fitch Ratings, CRU

EX. CHINA LOW CARBON ALUMINIUM PRODUCTION VS. PRIMARY DEMAND IN 2019

(Mtonne)



Source: Fitch Ratings, CRU

on local power assets, which could substantially erode the company's low-cost position. These tariffs have not yet been enforced, and are unlikely to be in 2021 given the weakness in the manufacturing sector. However, unless the surcharges are officially abandoned, the policy uncertainty will continue to constrain Hongqiao's ratings.

Other producers in regions with a high share of coal in the grid (such as South Africa) are likely to be affected by rising carbon prices and electricity costs – on-site generation may be an alternative for larger entities but may not be a feasible solution for smaller companies.

For aluminium producers with access to hydro-based power, for example, a USD50/tonne CO2 global carbon charge implies a cost increase of USD100–USD150/tonne (t) (roughly equivalent to 5%–10% of the current London Metals Exchange sale price). By contrast, conventional smelters reliant on coal-based power could have cost increases averaging USD584/t, around a quarter of the current price. As such, carbon pricing will not only add to production costs, but it will also re-sort the competitive positioning of producers in the market. There is also a high risk of stranded assets within the sector.

There is likely to be a fairly slow shift away from coal power to hydroelectricity. CRU forecast the hydro-powered share of China's smelter power mix will increase to 21% from 13% by 2029, while coal-fired production will decrease to 78% from

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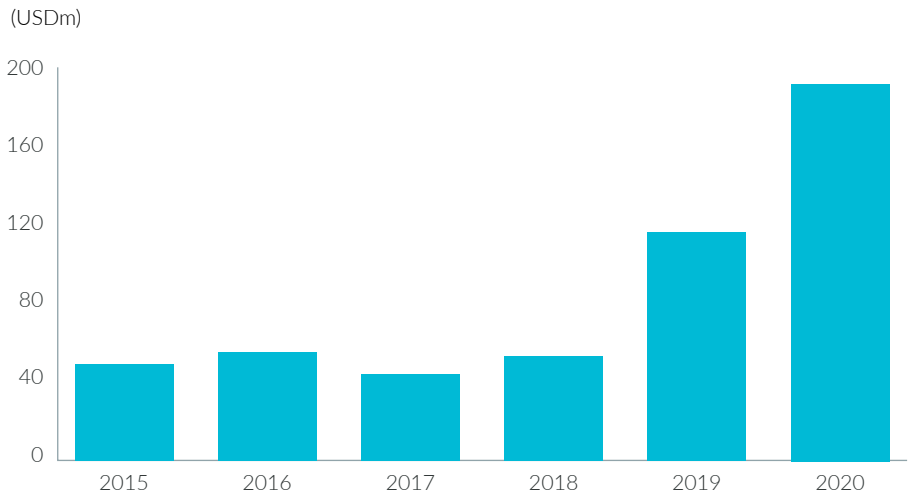
86% between 2019 and 2029.

Buyers of aluminium are increasingly pushing producers to lower emissions from production. Two high-profile aluminium consumers – Apple and Nespresso – have pushed producers to pursue certification by the Aluminium Stewardship Initiative, which requires a reduction of average carbon intensity to below eight tonnes of CO2 equivalent per tonne of content by 2020 for new smelters and by 2030 for existing facilities, from a global average of 12 tonnes. Procurement of low-carbon electricity sources will be essential to meet these targets, given the high share of aluminium's carbon emissions from this source.

The lack of any noticeable price premium for low-carbon aluminium indicates that investment in these product lines is being driven by financial market access and refinancing concerns – including issuing lower interest green-bonds, and companies being included in sustainability indices. Index inclusion is increasingly important for companies, as more fund managers shift from active to passive fund-management strategies.

Compensation by governments to EU aluminium producers for rising power costs also hit new highs in 2020 in response to rising carbon prices and associated pass-through costs, although not all producers benefitted. Our carbon pricing paper (Regulatory Risk Amid Global Emissions Gap: Carbon Pricing, December 2019) pointed out that this compensation is determined by a complex mix of country-level criteria, resulting in very different levels of compensation between EU member states, despite a common price burden in the EU ETS price.

EU COMPENSATION FOR INDIRECT CARBON COSTS TO SMELTERS



Source: Fitch Ratings, CRU

LOW CARBON CAPEX, RENEWABLE CAPACITY OF OIL MAJORS

Company	Annual low carbon capex	Total installed renewable capacity
BP plc	USD5bn by 2030	2500MW
Eni SpA	EUR1bn in 2020–2023	276MW
Equinor ASA	USD2bn–3bn in 2022–2023	500MW
Exxon Mobil Corp	Negligible	Zero
Repsol, S.A.	EUR0.8bn by 2025	1078MW
Royal Dutch Shell plc.	USD2bn–3bn in 2021–2025	923MW
Total SE	USD2bn-3bn by 2030	5100MW

Source: Fitch Ratings, Company disclosures

Sustainable Fitch

THE CASE FOR GREEN HYDROGEN

Green hydrogen – the production of hydrogen using renewable energy for electrolysis – has had increasing support from policymakers in the past year. Some 60 gigawatts of new green hydrogen projects were announced in 2020, with Australia leading in the deployment of large projects, followed by initiatives in Europe, China, Chile, South Korea, Japan and Saudi Arabia. Fitch's 2021 Outlook for Latin American Utilities references three pilot hydrogen projects for cargo transport at the mining sites of BHP Group Plc, Anglo American plc and CAP S.A., using trucks reconditioned to operate on dual fuel (hydrogen-diesel), battery fuel modules and fuel cells. Australia has pledged USD191 million in support of hydrogen projects. Portugal is planning to launch a new solar-powered hydrogen plant by 2023. The Netherlands unveiled a hydrogen strategy in early 2020, with plans for 500 megawatts of green electrolyser capacity by 2025.

Distribution costs and the intermittency of wind resources are the main challenges for green hydrogen. Modelling by Norway's Foundation for Industrial and Technical Research (SINTEF) in 2020 on the deployment of green hydrogen in Germany indicates that this will require a high level of technology interdependence, and that there are inherent trade-offs when locating electrolyser capacity either near to the renewable generation sources or near to demand.

When they are located close to source, intermittency of wind sources, electrolyser underutilisation, and large hydrogen storage requirements will amplify system costs and the corresponding levelised cost of energy, whilst locating electrolysers close to demand sites will entail far higher distribution costs. Another challenge is the dependence on cheap salt cavern hydrogen storage near to electrolyser capacity; these are limited across much of Europe and alternative tank storage will increase costs sharply.

Projects might be more viable in countries with plentiful and cheap solar energy, as evidenced by the volume of projects under development in Australia and Chile. Resource-scarce countries with limited opportunities for renewable deployment, such as Japan, have engaged in collaborative international projects for importing green hydrogen from these areas. Above all, the financial case for green hydrogen production rests on expectations of a long-term increase in the cost of natural gas, driven by carbon pricing. The International Renewable Energy Agency, meanwhile, has explored the effect of falling renewable energy and electrolyser costs as well as greater capacity utilisation, finding that these factors could deliver price competitiveness by around 2030. Much of this is driven by increasing economies of scale and falling technology capital costs, similar to the trend seen in solar and wind energy in recent years.

Sustainable Fitch

The impact of the EU's proposed border carbon adjustment mechanism is difficult to predict due to the complex effect of tariffs on trade flows. Europe imports 3.7megatonnes (Mt) a year of primary aluminium. Close to 1.7Mt of those imports have a carbon footprint higher than the EU average and would face a carbon border tax, but evidence from other tariffs and anti-dumping measures suggests that these taxes would more likely alter trade flows – with more high-carbon-intensity aluminium being bought outside of the EU, with no guarantee that costs would increase for imports or that European production would benefit.

ENERGY AND FUEL MANAGEMENT FROM PRODUCTS

Energy and fuel use from products relates to the consumption or combustion of energy or fuel in the use of a product, good or service. Product energy-efficiency standards are one example, where a tightening of standards in recent years has been offset by a growth in use of electrical products overall, which presents a degree of regulatory risk in the context of Paris Agreement targets.

Relevance to Sector

The credit relevance of fuel use in the transportation sector is growing due to tightening vehicle emissions standards as well as a complex patchwork of transport fuel taxes in many countries. Although ETSs rarely formally extend to transportation, carbon and air emissions are implicit considerations in these taxes and this has put pressure on auto manufacturers, in particular to increase vehicle fuel efficiency.

in recent years, often at substantial additional capex costs. The oil and gas sector, for which consumption of transportation fuels is a major driver of growth, faces disruption from tightening fuel economy standards and electrification of transport in the coming decade, and some European majors are seeking to diversify into renewable energy generation and supply in anticipation of this. However, there is a wide gap between European and North American majors in terms of annual low-carbon capex and renewable capacity, with North American majors lagging.

Rising fuel efficiency of combustion engines and wider adoption of electric vehicles (EVs) is expected to reduce demand in the oil and gas sector, with the most acute impacts expected to occur from 2030 as a result of tightening vehicle emissions regulations and projections of wider EV adoption around this time in many regions. This will be offset to some extent by rising demand for petrochemicals, as weak emerging market plastic waste recycling infrastructure is likely to persist until at least the 2040s.

EV EXPANSION TO DRIVE DEMAND FOR RENEWABLES

Manufacturers and policymakers promoting EVs have tended to focus on improving the efficiency and cost of battery technology, and have paid relatively little attention to the role of grid mix and electricity sources on EV lifecycle emissions and how this affects air quality. Anticipated growth in EVs in response to tightening emissions standards and long-term bans on combustion engines will throw into sharp focus the sources of electricity that power the EVs given the corresponding growth in electricity demand.

Renewable Energy 100 companies (a global network of companies with 100% renewable targets) purchase 220 terawatt hours (TWh) of renewable energy each year, making them the largest combined global buyer of renewable energy. IEA estimates of EV penetration by 2030 will entail nearly three times as much energy as this – at least 640 TWh. Because procurement of electricity from grids with heavy coal use negates most of the environmental and public health benefits of EV use, this will lead to a sharp rise in demand for solar and wind generation from this source, and expansion of power purchase agreements and dynamic spot markets is likely.

Research by the University of Toronto indicates that wider deployment of EVs could help address the issue of excess wind generation during times of low demand, as vehicle charging tends to take place overnight. Balancing supply and demand of solar and wind resources is a major cost for most power utilities, and has contributed to increased energy costs for businesses and households in recent years.

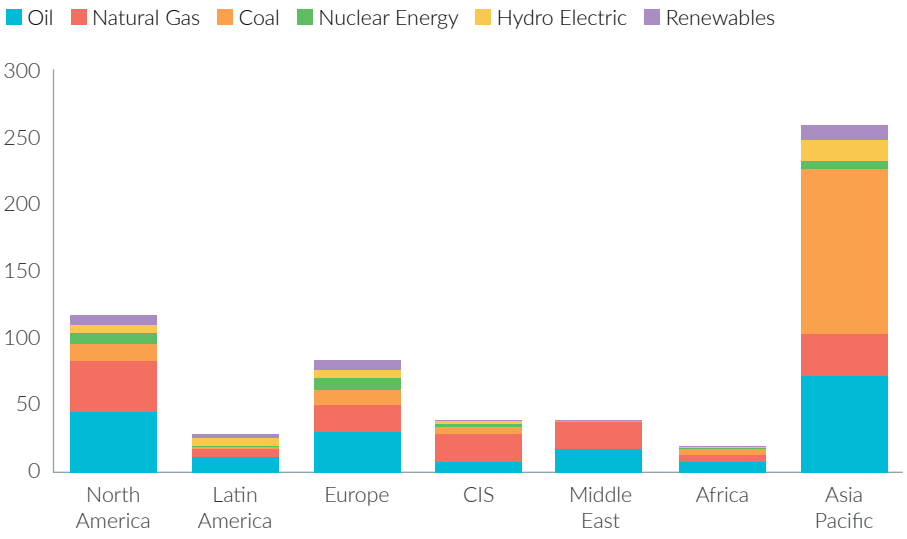
Sustainable Fitch

PRODUCT ENERGY CONSUMPTION POSES A CHALLENGE TO PARIS AGREEMENT TARGETS

Electricity consumption by household appliances continues to increase. It reached over 3,000 TWh in 2019, according to the IEA, and accounted for 15% of global final electricity demand, or one-quarter of electricity used in buildings. Demand is driven by rising ownership of connected plug-load devices, especially in emerging markets where people are becoming wealthier.

Mandatory Energy Performance Standards cover one-third of the energy used, mainly for large household appliances, but smaller plug loads, including consumer electronics, are less well regulated. Regulations will need to be expanded and tightened in order to align with the Paris Agreement targets.

ASIA-PACIFIC COAL DOMINATES GLOBAL FUEL USE



Source: Fitch Ratings, CRU

ENERGY AND FUEL MANAGEMENT IN OPERATIONS

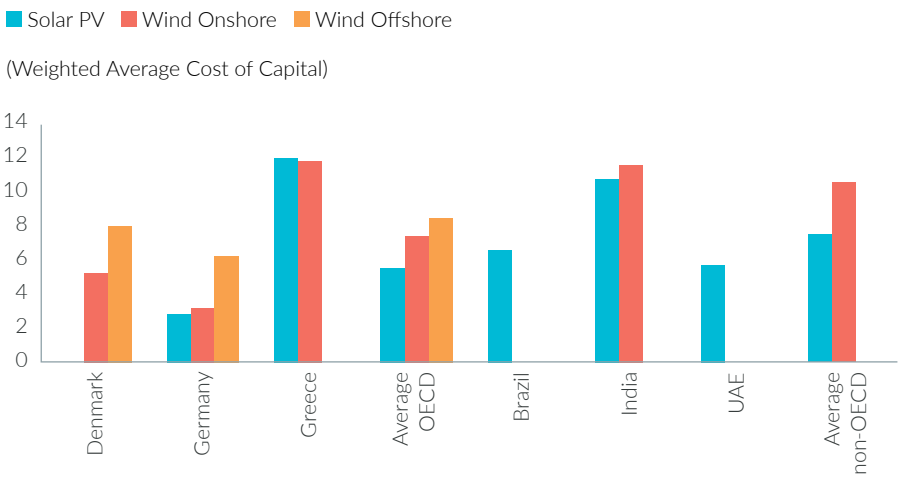
Energy management decisions can be critical to operations, heavily influencing operational disruption and overall costs across a number of sectors. Nonetheless, energy and fuel use patterns are often influenced by factors outside of corporates' direct control, particularly where they are dependent on local grids for their energy. Grids in many western countries have substantially decarbonised in recent years, but thermal and metallurgical coal still dominates consumption in Asia. With key markets such as China introducing carbon pricing systems, price rises are increasingly passed onto consumers.

Relevance to Sector

Regulated utilities, pipelines and networks have borne the bulk of additional costs from renewable energy integration in recent years, but have mostly passed these costs on to end-consumers. Meanwhile, falling solar and wind procurement costs in operations have benefitted corporates. This has been driven by the falling cost of capital for these technologies, which represents the bulk of project costs, and in turn has led to lower spot prices for solar and wind in many countries.

Sustainable Fitch

LARGE REGIONAL DIFFERENCES IN COST OF CAPITAL FOR RENEWABLES



Source: Fitch Ratings, Steffen, B. (2020) Estimating the Cost of Capital for Renewable Energy Projects. Energy Economics, Vol. 88.

Solar and wind generation have increased as a share of national and regional grids to levels (circa 50%) that were not projected to occur for several decades. This has been a result of falling energy demand in the early months of the Covid-19 pandemic and of the preferential status for renewables in grid dispatch. Wholesale price competition has increased, while capital costs have fallen due to increased auction volume.

Research by Goldman Sachs has predicted that global capex on renewables will exceed fossil fuel capex in 2021. This is driven by a shift in capital costs in favour of renewables – which have a weighted average cost of capital of 3%–5%. In contrast, fossil fuel capital costs have increased to an average of 10%–20%.

Countries with high shares of renewable generation in the grid (particularly the Nordics and Spain) have had more price volatility in recent years, which is largely attributed to changing solar and wind output and, to a lesser degree, policy uncertainty. Renewables have been linked to increasing retail electricity costs in competitive markets in North America and Europe, as generation costs in these regions are less than half of overall operating costs, and transmission, balancing and maintenance costs have increased. However, the influence of renewables on wholesale electricity generation costs has been largely deflationary. This explains the apparent paradox of falling renewable energy costs in recent years alongside rising electricity prices.

Sustainable Fitch

GAS AND NUCLEAR COMPETE AS TRANSITIONAL ENERGY SOURCES

Both natural gas and nuclear pose complex challenges for assessing the low-carbon transition risk. Debate around the role of gas has exposed regional divisions in the EU, for example, where some countries have pushed for gas to be excluded from the EU's Taxonomy of Sustainable Activities. Others, particularly some eastern European member states, view gas as an essential transition energy source.

In the absence of carbon capture and storage, gas-fired power projects are effectively excluded under the current Taxonomy criteria, although gas projects providing co-generated heating and cooling are permitted if these replace a high-emitting fossil fuel-based source.

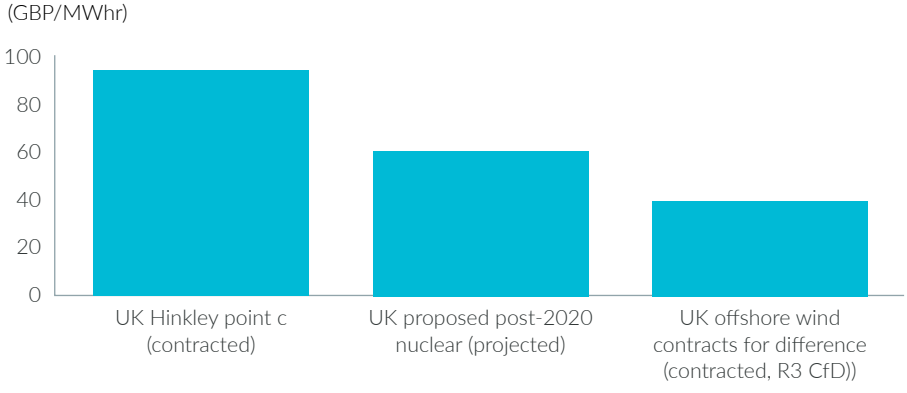
Separating gas from economic growth is a lot more complex than for oil, 60% of which is used for global transport, or coal, 60% of which is used for global power generation. Only 40% of natural gas consumption goes into electricity supply – the rest is used in buildings for space and water heating or cooking, or into industry as a feedstock or for process heat. Electrification or other replacements of gas applications in these areas entails costly or technically challenging investments.

Moreover, there are strong regional differentials – outside of the OECD, some 80% of gas is consumed in industrial applications, with only China, Russia and parts of Latin America making widespread use of gas heating in buildings. This in part explains the strong consensus that seems to have arisen in Asia around gas as a transition fuel, given the widespread use of more carbon-intensive coal in the region. In some places, gas is likely to capture market share against oil or coal or defend market share against competitors. In others, gas might be displaced by alternatives or fail to make inroads.

Similarly, there are strong regional differentials in the support and deployment of nuclear power in low-carbon transition; China and India have led the construction of new reactors in the past decade, whilst North America and Europe have had limited new capacity or life extension of existing reactors and have had wholesale shutdowns, as planned in Germany. Many countries that are advocating nuclear expansion (such as Japan) have faced strong opposition from the public and local government, whilst the UK and some US states have been forced to provide revenue support or project guarantees to ensure the viability of nuclear baseload with competition from falling renewable prices.

Nuclear operators in competitive markets have come under sustained competitive pressure from falling wholesale costs of renewables. The relatively static costs of energy from nuclear against the falling costs and increasing economies of scale of renewables is calling into question large-scale investments in nuclear in the UK and elsewhere amongst civil society and activist investors, although the Committee on Climate Change (CCC) last year highlighted nuclear as essential to meeting the domestic net-zero pledge, with the UK government stating that around 30GW–40GW of 'firm' (non-variable) nuclear capacity would be needed by 2050 to meet this target.

STRIKE PRICES FOR OFFSHORE WIND FALLING; NUCLEAR COSTS HIGH



Source: Fitch Ratings, UK Nuclear Energy Agency, UK Government

Sustainable Fitch

TRANSMISSION SYSTEMS OPERATORS FACE HEAVY INVESTMENT COSTS FROM ENERGY TRANSITION

The investment costs and challenges from Germany's energy transition from nuclear and coal-fired generation to volatile and decentralised green power could limit utilities' flexibility to grow renewable assets. They could even deteriorate some credit profiles if not mitigated. However, we believe that the coal phase-out plan will be credit-neutral for rated electricity generators in the medium term.

We view transmission system operators (TSO) as particularly exposed to potential deterioration in credit quality as Germany's energy transition unfolds. We expect TSO's already-high investment in grids to surge by 2030, whereas returns from new assets will be earned over the assets' lifetimes (including the investment period). This will increase leverage, which will remain high until at least 2030, despite Germany's fair regulatory framework. The ultimate impact on TSO's credit profiles will depend on their ability to partially delay capex, receive shareholder support or enact other mitigating actions.

Nuclear and coal exits will probably limit free cash flow generation for integrated utilities. Rating actions are less likely to be affected – this will ultimately depend on how efficiently companies manage the decommissioning and the substitution of fading earnings. We view eligibility to receive compensation to offset the closure of lignite- and hard coal-fired generation capacity as positive for credit profiles, although it will not fully cover lost income.

Nuclear provision funding schemes, as in the case of Energie Baden-Wuerttemberg AG (EnBW) (BBB+/Stable), are beneficial to the entities' credit profiles, providing visibility over associated cash outflows. Similarly, partially offsetting nuclear provisions with dedicated assets, as in the cases of E.ON SE (BBB+/Stable) and RWE AG (BBB+/Stable), is supportive of their credit profiles.

Corporate procurement of renewable capacity in North America and Europe boomed in 2020, and this seems set to continue in 2021. Corporates gained 3GW of additional renewable capacity in Europe in 2020. Demand for power purchase agreements and certificates has been driven by pharmaceutical, heavy industry and technology companies in these regions.

However, there are many structural barriers to renewable procurement in Asia-Pacific that have hindered corporates, and the reform of electricity market structures is likely to become increasingly important in the region as policymakers seek to deliver emissions reduction in the power sector. The Renewable Energy 100 group of 261 companies that are targeting 100% renewable energy procurement found substantial barriers to corporate sourcing of renewable capacity in key APAC markets, including in China, Japan and South Korea. Challenges included regulatory complexity, lack of available renewable resources and issues with tracking and certification. Addressing these barriers is likely to be a priority for policymakers seeking to increase the renewable share of generation as carbon prices begin to increase energy costs.

Sustainable Fitch

APAC COUNTRIES REPRESENT THE 10 TOUGHEST MARKETS FOR CORPORATE RENEWABLE ENERGY SOURCING

Australia	High renewable energy costs
China	Regulatory complexity
Indonesia	Limited availability of renewable capacity
Japan	Limited availability of renewable capacity
Singapore	Limited availability of renewable capacity
South Korea	Renewables not available for corporate sourcing
Taiwan	High renewable energy costs
Argentina	Renewables not available for corporate sourcing
Russia	Renewables not available for corporate sourcing
New Zealand	Insufficient sourcing options; no tracking system in place

Source: Fitch Ratings, Renewable Energy 100

MICROSOFT, VATTENFALL DEVELOP ENERGY TRADING SERVICE

An ongoing debate is the extent to which industries perceived as having a high climate impact should be able to issue debt labelled as 'green' or 'sustainable' to help finance the low-carbon transition.

Growing demand for corporate renewable energy procurement, coupled with increasing scrutiny of renewable energy generation certificates, is giving rise to innovation in the development of trading marketplaces. Microsoft Corporation and Vattenfall AB have jointly developed an online solution, called 24/7 Matching that links renewable energy generation from Vattenfall with data from end-consumers' smart meters on an hourly basis. This will give energy providers a detailed understanding of energy demands so that they can ensure that renewable production meets these demands, and will allow consumers to check whether their energy consumption is from renewable sources on an hourly basis.

Existing guarantee of origin (GO) and renewable energy certificates (RECs) documents largely match consumption and production over a year, so having hourly matching will enable consumers of renewable energy to track and report procurement more accurately.

The companies believe that this model could inspire regulatory change in how renewable energy procurement is governed, both in voluntary and compliance markets. Given the increasing price volatility of renewables in countries with a large share of solar and wind in the grid, such real-time or hourly spot price models are likely to grow in importance as companies seek the most cost-optimal routes to renewable energy procurement and carbon-reduction targets.

Sustainable Fitch

CHINA MOVES TOWARDS DECENTRALISED SUPPORT

In July 2017, China opened its pilot Green Electricity Certificate (GEC) system, which allows businesses and individuals to buy renewable energy voluntarily. This model is ultimately intended to replace central government subsidy. The system is also intended to support province-to-province trade in renewables as a complement to the national ETS. The GECs model has now been complemented by an online trading system.

The system is designed and maintained by the China Renewable Energy Engineering Institute (CREEI). GECs allow companies to claim the environmental benefits associated with renewable energy generation. Currently, large onshore grid-connected wind and solar photovoltaic (PV) projects receiving a feed-in-tariff are eligible to participate in the GEC system. Renewable electricity generators participating in China's GEC system are also able to issue multiple environmental market instruments, such as energy attribute certificates and GHG offsets.

OFFSETS, ALLOWANCES INCREASINGLY VALUABLE COMMODITIES

The trading divisions of some utilities are increasingly hedging their carbon offsets. Perceptions of offsets and ETS allowances are shifting from a conventional regulatory compliance cost to them being valuable commodities in their own right, and offset values that are expected to increase. RWE AG, for example, has hedged its position on carbon offsets for three years in order to supply customers with zero carbon energy whilst also profiting from speculative trading.

Many trading divisions of banks and large institutional investors, including pension funds, have increased their exposure to carbon offset credits in the past two years. They are increasingly exposed to new products such as the Global Emissions Offset contract by XCHG, which was launched in 2020.

Despite uncertainty around the exact role of international offsets and credits in regulatory systems such as ETS, expansion of such systems is likely to drive prices and demand for offsets higher – particularly as allowances are reduced. Experience from the EU ETS points to different sectoral usage of credits and offsets. Companies engaged in energy-intensive manufacturing of cement, iron and steel were significantly more likely to make use of Certified Emission Reduction (CER) credits in Phase II of the EU ETS than companies engaged in fuel combustion or oil refining, even though those sectors benefitted from large volumes of free allocations during this phase and compensation for rising energy costs that resulted from the EU ETS.

Emissions schemes have so far focused on power and industry sectors, and so many other major sources of emissions sit outside of ETSs. Recent research points to the emissions-reduction potential for buildings being at or above that of industrial emissions for most countries. Rising energy costs for building heating and lighting are spurring incremental improvements in the energy efficiency of buildings. Carbon emission schemes will probably expand to other sectors as governments attempt to meet more aggressive emissions-reduction targets, further driving demand for offsets from these sectors. Again, the degree of cost pass-through to end-consumers will differ substantially between entities and markets.

Sustainable Fitch

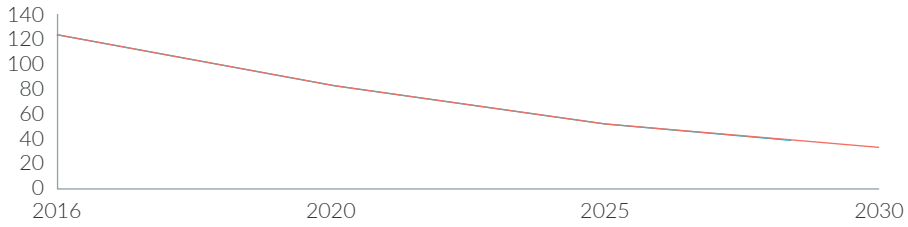
BATTERY STORAGE COSTS TO FALL

Costs are the major barrier to the widespread deployment of renewable energy storage, which would address the flexibility and demand management concerns around battery technology. Modelling by Massachusetts Institute of Technology, using existing battery storage technologies for large-scale solar and wind deployment, suggests that a cost of USD20 per kw per unit of storage would be needed to reach an equivalent availability factor (EAF) against nuclear baseload supply. This is equivalent to a 90% drop from today's average lithium ion storage costs, according to estimates from the International Renewable Energy Agency.

At 100% EAF, solar and wind generation and associated storage would precisely match supply to demand, providing baseload, intermediate, and peaking power, given real-world resource-availability conditions, in every hour of every day, over 20 years.

IRENA COST OF SERVICE, LITHIUM ION STORAGE

(USD/kw)



Source: Fitch Ratings, International Renewable Energy Agency

However, the authors indicate that relaxing the share of solar and wind in the US grid to 95% EAF would yield a far less stringent cost of around USD150/kw per unit of storage, which is far closer to the costs of existing technologies. IRENA projections for lithium ion battery storage points to a sharp fall in the average costs of lithium ion storage by 2025; around half of the residual cost are capital costs.

These estimates also fail to account for other flexibility measures such as demand-side management programmes that can use digital technologies to shift energy consumption over time, long-distance transmission, and microgrids. It is difficult to extrapolate from existing trends the impact of these flexibility measures on energy markets, but they can be expected to partially relax dependence on baseload generation sources or battery storage as technology improves.

Battery duration is also an important technological limitation. Most widespread commercial applications of battery storage can store energy for four hours. Solar power can be generated whilst the sun is shining but storage limitations still leave a gap of several hours if energy is required overnight. Conversely, wind power continues generating through the night so storage limitations are less of an issue. Nonetheless, battery storage duration will need to extend significantly, and costs to reduce, to deliver 24-hour power coverage.

Sustainable Fitch

REGULATORY RISK FOR BUILDINGS AND REAL ESTATE

Buildings and real-estate portfolios are increasingly recognised as a key area of stranded asset risk due to the very long lifespan of built assets and persistently poor energy efficiency of building stock in many countries.

Energy-related CO2 emissions from buildings have risen again after flattening between 2013 and 2016. Direct and indirect emissions from electricity and commercial heat used in buildings rose to 10 gigatonnes of CO2 in 2019, the highest level ever recorded. Several factors have contributed to this rise, including growing energy demand for heating and cooling with rising air-conditioner ownership and extreme weather events. Physical climate risks will also reinforce these trends, heightening requirements for heating in winter and cooling in summer conditions. Energy demand for air conditioning has more than tripled since 1990, and worldwide consumption for air conditioning is set to expand 33-fold by 2100, according to estimates by the International Panel on Climate Change.

Buildings sector energy intensity per square metre has been decreasing continuously by 0.5% to 1% per year since 2010. However, this rate is significantly below average annual floor area growth, which has remained around 2.5% since 2010. Around a third of global buildings stock is covered by energy-efficiency policies, according to the IEA, although China has had strong policy expansion. The widening gap between energy-efficiency improvements and the required trajectory to achieve Paris Agreement targets increases the risk of a rapid tightening of standards and less efficient stock either falling in value or potentially being unsellable in the commercial real-estate market.

The UK's use of ratcheting building Energy Performance Certificate Standards is one example of this, and the Bank of England has highlighted the key systemic risk of stranded assets in the UK real estate sector. Germany, meanwhile, has opted to include building energy and heat consumption in its domestic carbon tax – which will reach fixed costs of EUR55/tonne by 2025.

ENERGY AND FUEL USE IN ECONOMIC DEVELOPMENT

The energy intensity of a country's economy (energy or energy-equivalent fuel intensity per unit of GDP) is often used an indicator of energy efficiency, as data are comparable between countries and regions. However, a country with a low energy intensity, such as Switzerland, may not necessarily be efficient – other factors such as the structure of the economy and share of energy-intensive sectors, geographical characteristics and climate, balance of payment, and exchange rate conditions can also be influential.

Relevance to Sector

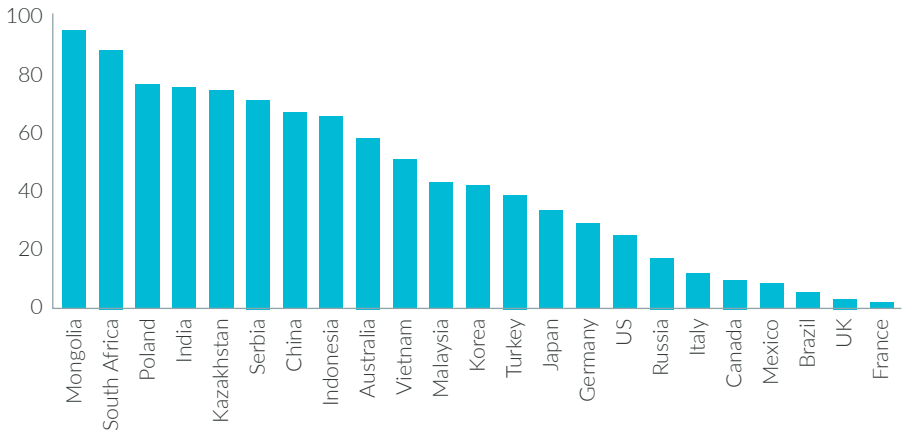
Credit risk to sovereign debt from energy transition and decarbonisation concerns is generally limited in the next two to three years, but longer-term exposure (over ten years) to stranded assets is high in petro-economies where fossil fuels form key export commodities. As demand for fossil fuels declines, major exporters will lose GDP, government revenues and export receipts unless they offset the loss, such as through economic diversification. This will lead to higher government debt, lower assets and higher net external debt. Exports of energy as they relate to sovereign and public finance credit are addressed under the ESG.RS category 'Biodiversity and Natural Resources Management'. Access to affordable, reliable energy sources is critical to economic growth and development and many countries have a critical dependence on energy imports to support power generation as well as industrial output.

Sustainable Fitch

RELIANCE ON COAL FOR ELECTRICITY GENERATION

Share of total generation, 2019, most dependent and large economies

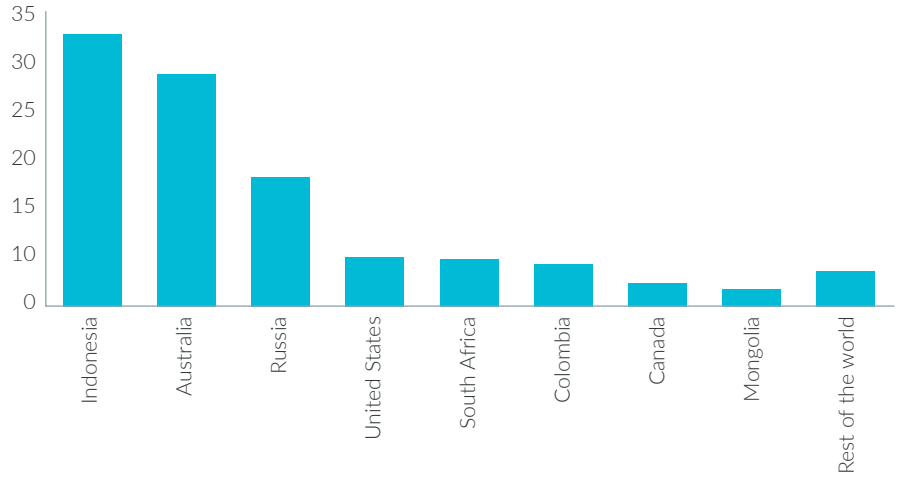
(% of total)



Source: Fitch Ratings, BP, Ember (2020), Our World in Data

INDONESIA AND AUSTRALIA DOMINATE COAL EXPORTS

(% World exports in 2019)



Source: Fitch Ratings, IEA

Many major emerging economies (including South Africa, Poland, India and Iran) have a key dependence on coal for power generation, and coal imports are highly sensitive to currency fluctuations in their purchase of energy. Demand for metallurgical coal and for industrial feedstocks is also rebounding heavily in China following the economic downturn in 2020.

Exports of coal, gas and other fuels are key in supporting local economic growth and public finance tax revenues in many resource-rich regions, so policies to limit emissions from energy consumption or fuel combustion can be highly disruptive. For instance, tightening emissions standards and falling demand has led to the bankruptcies of several North American coal miners servicing the European and Chinese markets.

Nonetheless, demand for coal for energy, heating and industrial uses appears resilient in many key emerging markets and is likely to support local economic growth in the coming decade. Similarly, imports of natural gas are critical in the energy mix of many major economies, and despite some moves by regulators in the EU and North America to limit the expansion of natural gas over emissions concerns, there is a widespread perception that gas is integral to economic growth and thus an important 'transitional' fuel source. This tension has been seen in debates within the EU over the treatment of gas projects within the EU Taxonomy of Sustainable Activities.

Sustainable Fitch

DEMAND FOR METALLURGICAL COAL SUPPORTS EXPORTS

Demand for metallurgical coal, used in making steel, is also growing, as world steel production increased by 4.9% in 2018. The global metallurgical coal trade is forecast to grow at an average rate of 1% a year over the next five years, according to the Australian government, with Australia's share of the export market remaining steady at 54%–55%. India is expected to be the biggest source of import demand growth as its domestic steel industry expands to meet construction needs. Australia's metallurgical and thermal coal exports benefit from higher energy content and lower emissions, on average, than exports from many other countries in the region.

PGE POLSKA GRUPA ENERGETYCZNA'S ENERGY TRANSITION WILL BE CREDIT POSITIVES

PGE Polska Grupa Energetyczna S.A. has an ESG.RS of '4' for Fuel Use to Generate Energy, primarily due to the dominance of lignite-and hard-coal-fired generation at PGE. This leads to lower debt capacity as more restrictive environment policies create long-term pressure on earnings, limit funding options for coal-related activities, and trigger additional capex due to the energy transition.

The company's newly published strategy, which affirms its intention to transition into a low-carbon-intensive utility by 2030 and to provide climate-neutral energy to its customers by 2050, is positive for PGE's business and credit profiles. This is despite the probable leverage increase. PGE will remain an integrated utility, but with roughly 50% contribution to EBITDA from distribution (up from 32% in 2019) and about 25% from renewable and gas-fired generation (up from 7% for renewables in 2019).

This restructure should occur by 2025, as soon as coal-fired assets are moved outside of PGE. By expansion of its distribution business and disposal of its coal assets, the company will avoid capacity payments on these assets, capex on coal-fired assets, and the burden of CO2 costs.

There are a handful of high scores for sovereigns under Energy and Fuel Management, typically in emerging markets. The Dominican Republic, for example, has an ESG.RS of '4' due to inefficiencies in the national electricity system, Gabon has a score of '4' due to the need for inward investment to balance declining oil production, whilst Ghana has large contingent liabilities in the state-owned energy sector. Oman's government revenues are heavily influenced by volatile dynamics of tax receipts from the oil and gas sector, whilst South Africa is having to provide increasing support to state-owned electricity provider Eskom Holdings SOC Ltd., which is a rating pressure leading to an ESG.RS of '4' for the sovereign.

Effect on Credit

Energy and fuel-management issues can translate into relevant credit issues and potentially materialise in several forms of credit risk. Whilst energy- and fuel-management issues encompass physical and transitional aspects of risk, here we address the eight main aspects of risk detailed in the ESG scoring templates: asset quality and concentration risk, business profile and competitive position risk, macroeconomic risks, operational and cash flow risk, profitability risk, refinancing risk, regulatory and litigation risk and reputational risk.

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PULP AND PAPER PRODUCER BENEFITS FROM SALE OF EXCESS BIOMASS ENERGY

Empresas CMPC S.A., the world's fourth-largest pulp producer, has an ESG. RS of '+4' (ie. a positive influence on the rating) for Energy Management as the company sells excess energy to the grid from cogeneration based on a renewable resource. This has a positive impact on the credit profile and is relevant to the ratings in conjunction with other factors.

ONESKY FACES UNIQUE RISKS OF PRIVATE AVIATION

OneSky Flight, LLC has an ESG Relevance Score of '4' for Energy Management due to concerns that stem from the potential for negative public perception of private aviation, which can drive down demand as climate awareness and activism becomes more pronounced. Unlike commercial aviation, which Fitch views as more of a public necessity, and which benefits from dense seating arrangements that reduce carbon emissions on a per-seat basis, private aviation is viewed as a luxury item that could face backlash if the public were to focus on the issue. This has a negative impact on the credit profile, and is relevant to the ratings in conjunction with other factors.

Asset Quality and Concentration Risk

As energy- and fuel-related risks tend to be highly regional, asymmetry is a common challenge for corporates operating across multiple geographies. Corporates with diversification of assets by age, technology and operating geographies will be better-placed to absorb changes in local fuel and energy input costs, additional regulatory compliance costs and redirect capital, production, and other resources, if needed.

Business Profile and Competitive Position Risk

Companies operating in highly competitive markets, with tight margins or limited product portfolios, may be at particular risk to rising energy and fuel input costs or regulatory compliance costs. Their free cash flow may be more limited than peers' and they may have fewer resources to respond to changing regulatory requirements or consumer demand.

Macroeconomic Risks

Many countries or regions have a comparative advantage or economic concentration in industries such as fossil fuels that are particularly exposed to the low-carbon transition. Many economies are heavily dependent on the export or import of key energy resources, so disruption to, and shifting of, supply or demand can create economic and balance of payment pressures.

Operational and Cash Flow Risk

Changes in energy-efficiency standards, grid energy costs or disruption to energy supplies can affect revenue, increase capital expenditure through the requirement for new infrastructure and alternative logistics arrangements and incur relocation costs due to stranded assets or rising compliance costs in some territories.

Profitability Risk

Profitability risk refers to the influence of changes in energy and fuel costs, or of supply disruption on the overall profitability of company operations. For some activities, such as ammonia fertiliser production or aluminium manufacturing, energy inputs represent the bulk of manufacturing input costs and there is key sensitivity to rising input costs linked to carbon pricing or increases in fuel costs.

Refinancing Risk

The growing investor focus on value chain carbon exposure creates a degree of refinancing risk for industrial companies dependent on fossil fuels and other polluting inputs. Thermal coal exposure is a major area of focus for many investors and financial institutions, and this extends to utilities and industrials with a key dependence on coal-fired generation. The long life of many assets in these sectors is a key consideration for investors.

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COAL EXPORT TERMINALS HIGHLIGHT REFINANCING RISK

Many European banks are applying exclusionary screens on thermal coal exposure, which can create refinancing risk for other aspects of the value chain, such as export terminals. These have come under scrutiny in refinancing due to wider market sentiment, despite their low direct emissions.

Fitch regards this as a governance issue as counterparty risk and shifting market demand are highly relevant to management strategy. This explains the score of '4' allocated to major Australian export terminals on this factor.

Regulatory and Litigation Risk

Regulatory compliance costs have increased in the past decade as a result of tightening air emissions standards in both emerging and developed markets, as well as the introduction of compliance ETSs in some regions. Companies may be subject to multiple regulators with overlapping remits in relation to air emissions, and governments can be highly reactive to short-term unrest and negative media coverage. The pass-through of carbon pricing costs to energy-intensive industries is a key and growing example of regulatory risks having a material credit impact.

Reputational Risk

Issuers are increasingly concerned by customer perceptions, especially as social media offers an open venue for consumers to express their views. Companies are spending more time monitoring perceptions of and sentiment surrounding their brand or products, as this can shift rapidly in response to changing social mores and media coverage. For instance, association with polluting sources of energy has been a persistent issue for consumers of thermal coal electricity or diesel-based transport in recent years. It has also had an effect on passengers choosing airlines with lower fuel-consuming aircraft fleets.

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PART THREE: WATER ISSUES

Investors consider strong water and wastewater management as a credit strength for issuers that operate in water-stressed sectors or regions. Deeper analysis of water strategy, controls and initiatives is supporting investors as they work to identify downside risks.

This report focuses on water issues – specifically, the two water-related general issues within Fitch Ratings' ESG Relevance Score Framework and scoring templates: water and wastewater management, and water resource and management. It explains how water issues can translate into relevant water-related credit issues and potentially materialise as credit risks.

Water Risks Are Important to Investors

Investors are assessing their portfolios and holdings for water risks. A survey by RBC Global Asset Management reported that two-thirds of roughly 800 institutional investors in the US, Canada, Europe and Asia were factoring water risk into their investment decisions, placing water risk third behind cybersecurity and anti-corruption in a list of the most important ESG considerations.

The focus on water risk is likely to continue. Allianz Global Corporate & Specialty SE, the corporate insurance provider of Allianz SE, identifies water management as one of five main ESG issues that will affect businesses' ESG footprints.

Investor Analysis Is Increasing

The credit analysis of issuers and transactions by investors is expanding to include water issues such as floods, droughts, competition, water quality and pollution, infrastructure, and supply chain disruption. Quantitative assessment – fundamental analysis, peer analysis and scenario analysis – of these issues is becoming more prevalent amongst investors.

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Core Water-Related Credit Issues

Due to the essential nature of water for certain businesses and processes, investors prioritise water risk issues in exposed industries. Fitch has identified the most relevant sectors, which can be categorised under four core water-related credit issues: water usage in the manufacturing process; water usage of product; water usage in operations; and water supply in economic development.

Defining Water-Related General Issues

Water issues – floods, droughts, competition, quality and pollution, infrastructure, and supply chain issues – have physical, financial and economic impacts on borrowers. While the consequences of water issues can be clear (see table *Water Issues and Their Physical, Financial and Economic Impacts*), it can be difficult to attribute an ESG impact to a specific water-related credit driver, as aspects of water risk are often linked to several different ESG credit issues.

Water issues can materialise in and overlap with other ESG issues. Within Fitch's ESG Relevance Score Framework and sector-specific, scoring templates, we find connections between water-related credit issues and the following general issues.

Exposure to Environmental Impact: This addresses the issuer's ability to manage risks associated with the physical effects of climate change, including rising sea levels, floods and droughts. These extreme weather events can cause infrastructure damage that can significantly affect the supply of water consumed in an economy.

Human Rights, Community Relations, Access and Affordability: When residential and agricultural consumers require affordable water supplies and rely on the same water source as extractive, industry and power consumers, shortages and quality issues can cause community unrest. Large water users in these circumstances are often at risk of imposed rationing, which can impair local economic development.

Management Strategy: The management strategy for water supply, consumption, development, efficiency, recycling and treatment can support a sustainable business model for issuers and generate a competitive advantage for water-intensive entities. The strategy should clearly link to both site-level and project-level management for issuers in sectors of high water-stress where water resource management planning is essential to avoid major operation disruptions.

While water issues are interrelated to other general issues in our scoring temples, we only consider water issues to be credit-relevant, and therefore a water-related credit issue, when water usage forms a key input to the economy, management strategy, product, manufacturing process, operation or project.

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WATER ISSUES AND THEIR PHYSICAL, FINANCIAL AND ECONOMIC IMPACTS

Water issue	Sector-specific ESG credit issues	Physical impact	Financial and economic impact
Floods – One-off large volume of water causing agricultural, property and infrastructure damage	• Water supply in economic development	• Loss and delays to agricultural produce (crops, arable, cotton, leather, rubber and so forth) • Disruption to business operations and supply chains. • Damage to commercial, industrial and residential property • Damage to extractive assets (including mines, tailing dams, equipment) • Prolonged water and power outage due to damage to infrastructure	• Lost income from ruined produce • Higher production costs • Rising insurance premiums • Large, one-off costs for repairs to infrastructure, including power lines, water pipes, dams, sea walls and property • Increased spending on flood protection including natural infrastructure (mangroves) and built infrastructure (sea walls) • Negative impact on local, regional or national economy and development
Droughts – Prolonged dry weather causing water shortages that reduce agricultural, commercial and industrial production and economic output	• Water usage in the manufacturing process • Water usage in operations • Water usage of product • Water supply in economic development	• Reduced yields and loss of agricultural land and produce, such as crops, arable, cotton, leather, rubber • Less vegetation increases frequency of flooding • Delays and permanent shutdown of extractive assets. • Reduced production activity of businesses • Lower energy production from fossil-fuel, nuclear and hydroelectricity generators	• Loss of revenue due to reduced productivity caused by less water availability • Increased operating costs due to higher water costs, including restricted allocations through water usage caps and water rationing • Increased costs to procure water from alternative sources or the relocation of operations • Higher energy prices due to reduced water availability for cooling and generation of hydroelectricity • Restricted residential and economic development in certain areas that have water availability guidelines • Negative impact on local, regional or national economy and development

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Water issue	Sector-specific ESG credit issues	Physical impact	Financial and economic impact
Competition – Agricultural, commercial, industrial, power and domestic consumers accessing the same water source causing unsustainable exploitation of groundwater and surface water that leads to water shortages, rationing, business disruption, loss of operating licences and conflicts	• Water usage in the manufacturing process • Water usage in operations • Water usage of product • Water supply in economic development	• Local community protests and associated bad press coverage, political intervention and regulatory pressure • Business shutdown, interruption, slowdown and relocation • Prioritisation of freshwater for domestic and agricultural over large companies • Risks to energy production	• Lower revenue due to operating restrictions and rationing • Loss or refusal of licence to operate due to community unrest and political response • Increased competition for water is leading to higher water rates or rationing, or both • Relocation costs for plants • Higher energy costs and bills due to higher cost of electricity production • Lower economic activity due to less favourable business environments
Quality and pollution – Inability to source or disruption to supply of high-quality water, and requirements and legislation to prevent water pollution	• Water usage in the manufacturing process • Water usage in operations • Water usage of product • Water supply in economic development	• Local community unrest due to limited access to clean water and sanitation • Water stress increases due to reduced levels of uncontaminated water • Bans on certain industries • Less attractive business environment due to high levels of low-quality water	• Fines for water pollution, legal settlements and possible loss of operating licence • Shutdown and relocation costs to areas of high-quality water • Increased production costs for extractive, industrial and power companies to remove contaminants from water and purchase purification equipment and chemicals • Increased costs on wastewater management to remove pollutants and achieve high grade of water • Restricted economic growth and business development due to limited freshwater resources

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Water issue	Sector-specific ESG credit issues	Physical impact	Financial and economic impact
Infrastructure – Insufficient and failing infrastructure that disrupts freshwater supply	• Water usage in the manufacturing process • Water usage in operations • Water usage of product • Water supply in economic development	• Interruption to water availability due to repairs to infrastructure • Transportation of freshwater over ground from distant water sources • Limited output due to insufficient infrastructure such as pipelines, water storage facilities and recycling processes • Inability to develop a substantial energy network for local or regional economic growth	• Reduced revenue due to lower production or temporary shutdown • High investment requirements on failing and updating infrastructure • Higher operating costs due to importing water by trucks that increases with quantity and gradient • Capex requirements for desalination technologies and plants •
Supply chain – Disruption to reliable sourcing of ingredients and products produced in high-stress areas.	• Water usage in product	• Interruption of flow of materials, including raw materials and components	• Loss of revenue due to unreliable supply of materials and goods caused by water shortage negatively affecting suppliers • Higher cost of goods due to water risks affecting the cost of manufacture and therefore increasing raw material prices

Source: Fitch Ratings

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Sector-Specific, Water-Related Credit Issues

Fitch analysts evaluate whether a water issue is credit-relevant and material for all its rated issuers and transactions. Within their ESG scoring templates, Fitch analysts allocate a score between '1' and '5' for the general issue:

- Water and wastewater management; or
- Water resource and management (ESG scoring templates for local and regional governments, state and local governments, and sovereigns refer to water resource and management).

WATER AND WASTEWATER MANAGEMENT

The sector-specific ESG credit issues for water and wastewater management can be categorised into three core water-related credit issues:

1. Water usage in the manufacturing process – where water is used for processing, fabricating, washing, cooling or transporting of a final product;
2. Water usage of product – where water supply is either a key ingredient to the final product, such as is the case with the beverage and protein sectors, or is required for and used in products of water and sewer utilities;
3. Water usage in operations – where water is: required to manufacture a raw material; used in the production of beauty, personal care and home care products; required to operate a service business; or required for or used in operations by water and sewer utilities, power utilities and regulated network utilities (water and sewer utilities features under both water usage of product and water usage in operations).

There is one core water-related credit issue for sector-specific ESG credit issues for water resource and management:

- Water supply in economic development – where water supply is required for national, regional and local economic growth.

TRANSMISSION MECHANISM FROM WATER ISSUE TO CREDIT RISK

Water Issues

- Floods
- Droughts
- Quality & pollution
- Infrastructure
- Supply Chain

Water-related credit issues
ESG Relevance Score = 2
(credit-relevant)

- Water usage in the manufacturing process
- Water usage of product
- Water usage in operations
- Water supply in economic development

Credit risks
ESG Relevance Score = 3, 4 or 5
(credit-material)

- Macroeconomic risk
- Operational & cash flow risk
- Profitability risk
- Refinancing risk
- Regulatory & litigation risk
- Reputational risk

Source: Fitch Ratings

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FITCH'S DEFINITION FOR WATER RESOURCE AND MANAGEMENT

The overarching definition of water resource and management for the ESG relevance scores is, "This category addresses the relevance of water availability on the surrounding economy and the operations of the issuer. Where credit-relevant, this category may reflect an issuer's planning, development, and management of its water resources, in terms of both water quantity and quality, across all water uses. For sub-sovereign governments, it considers the approach to sustainably developing and managing its water resources and the enforcement of governmental and regulatory standards.".

FITCH'S DEFINITION FOR WATER AND WASTEWATER MANAGEMENT

The overarching definition of water and wastewater management for the ESG relevance scores is, "The category addresses an issuer's direct water use, water consumption, wastewater generation and other impacts of operations on water resources, which may be influenced by regional differences in the availability and quality of and competition for water resources. More specifically, it addresses management strategies including, but not limited to, water efficiency, supply, intensity and recycling.".

How Water Issues Relate to Credit Risks

Water issues can affect any of the water-related credit issues and materialise as a single credit risk or a combination of credit risks (see flow chart of the transmission mechanism of water issues into credit risks).

The report focuses on the four abovementioned core water-related credit issues. It provides insights and case studies on how these core issues affect issuers from several of the sectors (see table *Water-Related Credit Issues and Their Associated Sectors*). This is followed by guidance on how water issues and these water-related credit issues transpire as credit risks and can affect the creditworthiness of issuers.

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WATER-RELATED CREDIT ISSUES AND THEIR ASSOCIATED SECTORS

Water and wastewater management			Water resource and management
Waste and hazardous materials management and ecological impacts of manufacturing process/ operations	**Ecological impact of manufacturing and operating incidents and spills**	**Waste and lifecycle management of product and services**	**Biodiversity and natural-resource management in economic development**
• Auto suppliers • Aerospace & defense • Automotive manufacturers • Building materials • Building products • Chemicals • Commodity processing & trading • Diversified industrials & capital goods • Medical devices, diagnostics and products • Oil refining & marketing • Packaged food • Pharmaceuticals • Technology • Tobacco	• ABS – oil vessel-backed • ABS – future flow receivables • ABS – sprint spectrum • ABS – timeshare loan • Alcoholic beverages • APAC regulated network utilities • Asia Pacific utilities • Diversified industrials & capital goods • EMEA regulated networks • EMEA utilities • GIG – hydro • GIG – water/wastewater • LATAM utilities • Non-alcoholic beverages • Protein • Regulated networks • US utilities • USPF – public power • USPF – water & sewer	• ABS – Future flow receivables • ABS – oil vessel-backed • ABS – sprint spectrum • ABS – timeshare loan • APAC regulated network utilities • Asia Pacific utilities • Australia regulated networks • Consumer products • EMEA regulated networks • EMEA utilities • GIG – hydro • GIG – oil & gas production • GIG – solar/wind • GIG – thermal power • GIG – transportation • GIG – water/wastewater • IPF – GREs • LATAM utilities • Mining • Oil & gas production • Oilfield services • Restaurants • Shipping companies • Steel • US healthcare providers • US utilities • USPF – acute hospital and health systems • USPF – higher education • USPF – not-for-profit CCRC • USPF – public power • USPF – water & sewer	• IPF-LRGs • Sovereigns • USPF – state and local government

Note: ABS = asset-backed securities; GIG = Global Infrastructure Group; USPF = US Public Finance
Source: Fitch Ratings

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Relevance and Materiality of Sector-Specific Water Issues

RELEVANCE OF CORE WATER-RELATED CREDIT ISSUES TO KEY SECTORS

The sectors most relevant to the water-related general issues are found in the table Water-Related Credit Issues and Their Associated Sectors in the section How Water Issues Relate to Credit Risks and have been grouped by the core water-related credit issues: water usage in the manufacturing process; water usage of product; water usage in operations; and water supply in economic development.

The following sections describe how these core water-related credit issues affect several sectors and drive the distribution of the ESG relevance scores across asset classes and sectors.

WATER USAGE IN THE MANUFACTURING PROCESS

Water usage in the manufacturing process refers to water required for the manufacture of final products. Water is fed into processes for fabricating, processing, washing, cooling or transporting a final product. Sectors include automotive manufacturers, building materials and products, chemicals, pharmaceuticals and technology.

Relevance to Sector

Automotive manufacturers and auto suppliers use water-intensive processes. It is estimated that over 39,000 gallons of water are consumed to produce the average domestic vehicle due to the following production processes: surface treatment and coating; paint spray booths; washing, rinsing or hosing; cooling, air conditioning systems; and boilers .[1] It is not clear whether this figure will go up or down with the increase in production of electric vehicles. Water consumption will, however, probably remain high due to a requirement for metal-finishing operations and painting – both of which consume large quantities of water.

Water has multiple applications in the manufacturing process. For construction material and products, water serves as a solvent, cleaning agent, lubricant, sealant, heat-transfer medium and for air pollution control. Cement consumes almost 10% of global industrial water – although it is better known for its contribution to global carbon emissions – and production facilities can often be located in water-stressed areas. It has been predicted that 75% of water for cement production is likely to come from water-stressed regions by 2050[2].

The chemicals industry is another large water consumer, although consumption varies within this diverse industry. The majority of the chemicals industry's water consumption is for cooling due to the intense heat generated by chemical reactions. Investors will look at both the water consumption of chemicals companies and their wastewater management. They will also analyse the business lines of chemical companies to identify positive credit drivers derived from water treatment equipment and chemicals.

For the pharmaceutical and semi-conductor sectors, pure water is vital for manufacturing. Pure water is used by pharmaceutical companies as a raw material, ingredient and solvent in the processing, formulation and manufacture of products. It is also used as a cleaning agent for rinsing vessels, equipment, and packaging materials. Pharmaceutical companies are concerned by the quality of wastewater and the ability to reuse it,

BUILDING MATERIALS COMPANY REDUCES PRODUCTION IN AREAS OF HIGH-WATER STRESS

LafargeHolcim Ltd is mitigating its water risk through various initiatives and targets, including by reducing the percentage of production sites in water-stressed areas. By 2019, 17% of LafargeHolcim's cement production sites were in areas at risk of water shortage, down from 25% in 2013.

1. Water, water, everywhere in vehicle manufacturing. Automotive World, published 6 October 2014, https://www.automotiveworld.com/articles/water-water-everywhere-vehicle-manufacturing/
2. Miller, S.A., Horvath, A. & Monteiro, P.J.M. Impacts of booming concrete production on water resources worldwide. Nat Sustain 1, 69–76 (2018). https://doi.org/10.1038/s41893-017-0009-5

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and they therefore monitor the quality of inputted water.

Semi-conductor companies with fabrication plants use pure water for cleaning and rinsing components throughout the manufacturing process, as well as for etching. Some fabrication plants are located in countries with highly variable rainfall, such as Taiwan. The reliance on an uninterrupted, high-quality water flow necessitates strong water and wastewater management to avoid disruption to operations. Significant operating costs and capital expenditure on water treatment and storage, and possibly on desalination plants, is essential to minimise regulatory and litigation risks.

The technology industry is well known for the high-water consumption of its data centres. Water and energy usage are large proportions of their operational costs. Data centres are often located in arid regions to take advantage of cheap solar energy but create pressure on water resources locally by consuming large quantities of water for cooling. The operators of data centres try to balance these trade-offs by developing and maintaining good relationships with local and state governments and by running initiatives to decrease water consumption and increase water reuse.

Other Relevant Sectors for Investors

Non-food retailing is not considered a relevant sector based on our analysis, and this is reflected in its ESG scoring template. However, Fitch and investors assess the water risks of the entities in the supply chain to non-food retailing, such as textiles industry, along with fair pay and safety standards. The textile industry is one of the most water-intensive industries due to the fabric-dyeing process. It is also exposed to profitability risks due to increasingly volatile cotton prices caused by water shortages.

Investors look at water risks in the real estate and construction sectors. The manufacture of construction material and products requires large quantities of water. Water supply disruptions can affect the price of construction materials and products and therefore increase profitability risks for real-estate developers and construction companies. In addition, construction and homebuilding rely on water as a direct input into their operations.

The water crisis in Chennai at the beginning of 2019 increased the cost of construction as companies had to slow down their activities, purchase water from original sources and private companies at an increased price, and use tanker trucks to transport water from outside the city.

The paper and pulp industry is one of the largest users of industrial water. Water is used across the whole process – including raw material processing, pulp washing, paper-making, equipment, cooling and cleaning. The industry also discharges a lot of water and therefore water and wastewater management is crucial to avoid fines and reduce reputational risks. Investors look at the water strategy, risk management and performance of paper and pulp entities. For example, when assessing the pulp business of UPM Kymmene Corporation in 2017, BNP Paribas Asset Management identified the location of their sites and reviewed their monitoring systems, initiatives and targets for reducing effluent loads and wastewater volumes.

WATER USAGE OF PRODUCT

Water usage of product affects issuers that require water as an ingredient, such as those from the beverages and protein sectors. It is also highly relevant to water and sewer utilities, where water supply is required for and used in their operations.

Relevance to Sector

As water is a major input or output of these sectors, or both, water risks can negatively affect profitability or cash flow. Water is predominantly used by the food and beverage industry as an ingredient, used in production processes and for heating, and is needed for cleaning and refrigeration. To reduce consumption, improve water-use ratios, and ensure product safety, the food and beverage industry is integrating wastewater technologies, such as advanced filtration systems, within their production lines.

Beverage and food issuers are also exposed to upstream water risks in the supply chain due to their purchasing of agricultural products. As agribusinesses consume huge quantities of freshwater and extreme weather events can wipe out harvests and reduce yields and outputs, raw material costs can be volatile and operations can be disrupted. Beverage and food companies are exposed to reputational risks where water stress, exacerbated by competition for freshwater, can cause local boycotts and loss of operating licences (see the Constellation Brands).

With the livestock sector expanding, water demand from animal protein production is likely to rise. Compared to other agricultural operations, animal agriculture is particularly

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water-intensive, with 98% of water going towards feed production (meat processing also consumes water). Due to drought at the beginning of 2019, feed and transport expenses increased the half-year production costs for Australian Agricultural Company Ltd to AUD36 million from AUD11 million.

Droughts and other water supply issues can increase operating costs and capital investment for water and sewer utilities. They also have wider social and economic implications on local and regional governments, especially when water use restrictions are in place. Such measures have significant operational impacts on water and sewer utilities, including the implementation of response planning and the sourcing of a supplementary water supply. Operating expenditures can rise if the utility needs to move to more expensive water resources – such as pumping from groundwater rather than reservoirs. Prolonged periods of dry weather can increase capital investments as well as operating costs.

Water and sewer utilities with strong management of water and wastewater develop detailed, long-term plans to minimise the impact of water supply issues. Their strategies on water supply, quality and efficiency include investments in repairs and expansions of their storage and network infrastructure to meet current and projected customer demand. State and federal regulations place legal requirements on these capital investments. Regulators put targets in place to improve water supply and quality – such as those designed to reduce leakage, pollution incidents, sewer flooding and customer's water usage.

Water quality standards and targets contribute to increased water availability for residential, commercial and industrial customers and therefore towards local and regional economic activities. They impose capital costs, as does regulation on leakage (see Water Usage in Operations for more information). Large capital investments are spent on water and wastewater treatment systems and processes to meet regulatory standards and to assist businesses subject to product quality standards, such as pharmaceutical entities. These processes also have high running costs.

Water quality standards are important to public health and carry regulatory, litigation and reputational risks. Fines and penalties are imposed on water and sewer utilities for delivery of unsafe drinking water and pollution incidents. Poor water quality can lead to poor public perception and customer complaints. The risk of litigation also rises.

In 2014, the city of Flint, Michigan, switched its water supply to the Flint River, which was highly corrosive, to reduce costs. Due to inadequate water treatment and testing by the local utility and Flint officials, residents and businesses received water with high levels of lead. This caused ill health amongst the residents and resulted in court orders that increased the city's financial burden through the replacement of lead pipes and compensation payments to affected residents.

Water supply issues can substantially increase operating costs and capital investments for water and sewer utilities, but they tend to have only small effects on revenue due to the stable demand driven by the essential nature of water and sewer services.

An exception is extreme weather events, which can contribute to demand variability, although this depends on the utility's ability to adjust current and future rates to cover costs. For example, East Bay Municipal Utility District was able to cover the additional costs of purchasing, pumping and treating extra water by applying a temporary surcharge of 25% on all customer bills. In other regulatory frameworks, such as those in the UK, water rates are capped and therefore unforeseen costs and reduced revenue caused by extreme weather events negatively affect utilities' financial performance.

CAPITAL INVESTMENT BY PUBLIC UTILITY LEADS TO SUSTAINABLE WATER SUPPLIES

LafargeHolcim Ltd is mitigating its water risk through various initiatives and targets, including by reducing the percentage of production sites in water-stressed areas. By 2019, 17% of LafargeHolcim's cement production sites were in areas at risk of water shortage, down from 25% in 2013.

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WATER USAGE IN OPERATIONS

Water usage in operations refers to where water is required: to manufacture a raw material; for the production of beauty, personal care and cleaning products; to operate a service business; or required for or used in operations by water utilities, power utilities and regulated network utilities. There is some overlap between water usage in manufacturing process and water usage in operations, especially when water is required to extract raw materials such as bauxite, gas or oil or when water is used in the production of beauty, personal care or home-care products.

Issuers that require water to operate their business, including service companies such as healthcare providers, restaurants and transportation entities, are categorised under water usage in operations. This categorisation also includes power utilities and regulated network utilities, where water supply is required for or used in their operations, or both. Water and sewer utilities features under both water usage of product and water usage in operations.

Relevance to Sector

Mine disruption rates due to water issues rose in 2019 and are projected to increase further. Copper mine disruptions neared 6% in 2019, above the long-term average of 4.8%. CRU forecasts highlight a sharp increase in disruption rates in the coming years, with disruption from the coronavirus pandemic contributing to a projection of over 9% in 2020. Much of this has been driven by social unrest and strikes before the pandemic, but persistent low rainfall has also been a factor in restrictions on abstraction permits (see Alcoa Corporation).

Oil and gas entities require water abstraction licences and consume, remove and treat large volumes of water, as do mining entities. Water scarcity is a big concern, with water generally being transported to wells by trucks due to limited infrastructure. Significantly more water is required for operations with more horizontal wells and hydraulic fracturing than for operations with vertical wells. Water quality and pollution is also a relevant water-related factor for the sector. Other investor concerns are the risk of water contamination and earthquakes affecting local communities due to hydraulic fracturing processes.

Water is increasingly important for the consumer products sector. Large quantities of water are required in the production and of household cleaning and laundry products. Water is a key ingredient in beauty and personal care products – for instance, up to 95% of shower gels and shampoos contain water.

While the sector is exposed to water stress within its operations, the consumer products entities focus their water-dependency considerations on product design to reduce end-user water consumption and pollution.

Unilever NV claims that their "Home Care and Beauty & Personal Care divisions account for more than 90% of the water used in homes, from washing dishes to washing hair, skin and clothes". In response, consumer product entities have been developing products that meet the demand of consumers concerned by their water consumption. These products include the use of greywater in suitable household products, laundry detergents that work on shorter wash cycles and products with fewer harmful, lab-synthesised chemicals and more natural ingredients.

The relevance of water issues in the day-to-day operations of service companies vary: restaurants require water for cooking, cleaning and dishwashing; healthcare providers consume lots of water for cleaning and sanitation, for the functioning and sterilisation of medical equipment, and for treating their wastewater for pharmaceutical residue; and transportation and shipping companies are concerned about water pollution.

Poor water quality and pollution incidents also affect profitability and the credit profiles of water and sewer utilities, as discussed in Water Usage of Product. Regulators will impose fines for missed regulatory targets on water quality and efficiency in operations; they sometimes provide financial incentives for meeting or exceeding targets. In the worst-case scenario, large fines can carry reputational risks due to low customer satisfaction, and could lead to the loss of operating licences.

Efficiency targets such as those on leakage can increase operating costs and capital investment. To reduce leaks, water and sewer utilities incur: replacement and repair costs for pipes and other network infrastructure, expenses related to disruption to surrounding businesses, and sometimes indirect costs for the development of more water resources facilities and equipment. To avoid fines and improve water efficiency, water utilities are

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FINES CONTRIBUTE TO LOWER CREDIT QUALITY FOR A WATER UTILITY

Due to inadequate service and poor water-leak management, Thames Water Utilities Limited received GBP230 million of regulatory performance fines between 2016 and 2020. At end-2019, the regulator ordered it to return GBP100 million to customers for achieving the lowest customer satisfaction scores. These fines will probably lead to reduced cash flow and increased total expenditure and incentive penalties under the 2020 price-control period put in place by the UK regulator.

PUBLIC UTILITY'S REVENUE BONDS IMPROVES AVAILABILITY AND TREATMENT SYSTEMS

Water system revenue bonds (5%; due 8 January 2046) issued by Aurora (CO) [Water] are designated to improve the water supply in times of drought. The proceeds were invested in riverbank filtration, a natural pre-treatment process, which achieved more efficient utilisation of water supplies and increased availability of water by 20%.

focused on projects that ensure a sustainable water supply over the long term. Artificial intelligence technologies are being trialled to forecast demand, weather, pump performance and pipe leaks.

As is the case with water utilities, customer demand for power utilities and regulated network utilities is fairly stable. However, weather conditions such as temperature and seasonality can cause demand fluctuation. Power utilities and regulated network utilities also have to manage extreme weather events, such as flooding and storms, which can damage infrastructure and cut off supply. With rising variable weather patterns and more frequent extreme weather events, revenue volatility and capital expenditure is likely to increase if not managed appropriately.

The operations of power utilities are dependent on a regular water supply: hydroelectricity generators use water directly and fossil-fuel plants and nuclear reactors use water indirectly through cooling processes. Water shortages from droughts can reduce production of hydroelectricity generators. Hydroelectricity generators will then have reduced revenue – and profitability – if energy prices cannot be increased. Water shortages for hydroelectricity generators often lead to higher dependence on coal generation, particularly in regions such as central Africa.

Nuclear reactors require more water than non-renewable energy sources do for cooling. According to the Nuclear Energy Institute, nuclear plants can consume up to 2725 litres of water per megawatt hour for cooling compared to the 2270 and 1200 litres required by coal and gas plants, respectively.

An inadequate supply of water for cooling can have large economic implications for local, regional and national economies. According to a World Resource Institute study, 40% of India's thermal power plants are located in areas facing high water stress and 14 of their 20 largest thermal utilities had at least one shutdown between 2013 and 2016 because of water shortages.

Other Relevant Sectors for Investors

Hotels and resorts are dependent on water for drinking water, cleaning, heating, swimming pools and irrigation. With many economies dependent on tourism, water shortages can have a large impact on employment and productivity.

WATER SUPPLY IN ECONOMIC DEVELOPMENT

Water supply in economic development refers to water supply being required for national, regional and local economic growth. This ESG credit issue is directly relevant to sovereigns, local and regional governments, and ultimately to all other issuers.

Relevance to Sector

Water supply issues can negatively affect national, regional and local economies, the public finances of governments, and businesses at all levels. In the case of prolonged or repeating drought situations, affected regions can experience economic decline – particularly if the area became unusable – and local and state, and sometimes federal,

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government expenditures can increase substantially. Long-term water supply issues for countries and regions could trigger businesses and residents to move to areas with a more abundant water supply, contributing to lower local economic development.

The pressures on water supply arise from demographic growth, economic development, rising income levels, and increased urbanisation rates and consumption patterns. Many emerging-market sovereigns are exposed to large increases in water demand due to demographic growth and larger potential gains in economic development. In particular, countries across the Mediterranean basin, central and southern Asia and parts of South America and sub-Saharan Africa are vulnerable to a growing demand for water.

Supply-side factors, such as extreme weather events and rainfall variability, contribute to the worsening balance between water demand and supply. Infrastructure damage and water pollution also have adverse implications for water availability and quality.

These demand-side and supply-side risk factors can vary in relevance. For example, Kuwait is exposed to high water stress and drought risk but low flood risk. Water risks also vary at the national and local level. According to WRI's Water Risk Atlas Aqueduct, the United States is classified as having low to medium baseline water stress levels; however, the State of New Mexico faces extremely high levels of water stress due to constrained water supply.

The composition of local and national economies can also influence the relevance of water issues. Water supply is particularly pertinent to exporting countries and regions with water-intensive industries. Those dependent on agricultural and natural resource exports are susceptible to water-related shocks to their public finances.

To mitigate water supply risks, sovereign and sub-sovereign governments plan, develop and manage their water resources and develop and enforce governmental and regulatory standards to ensure the prosperity of local, regional and national governments and economies.

DROUGHT CAUSES SHOCK TO SOVEREIGN CREDIT

Argentina had an unusually long drought in 2017 and 2018, which caused a large drop in agricultural production and export revenue, exacerbating its existing debt and negatively affecting balance of payments.

Despite some improvements to the political and governance environment of Argentina during the earlier years of former president Mauricio Macri's time in office, the economy could not absorb another shock and the drought contributed to the country's IMF bailout in 2018, causing a further decline in the peso's exchange rate.

Water quality standards that contribute to a safe water supply that meets the public and business needs and that protects humans and the environment is a crucial element of environmental regulation. Governments will impose fines, penalties and enforcement orders for pollution incidents as a deterrent and to protect the economy and business environment.

Effect on Credit

Water issues can translate in to relevant water-related credit issues and potentially materialise in several forms of risks. Water risk is most commonly classified into physical risk, regulatory risk and reputation risk. This report discusses the six main water-related, risk factors detailed in the ESG scoring templates: macroeconomic, operational and cash flow, profitability, refinancing, regulatory and litigation, and reputational. These six water risks can transpire to varying degrees across all four of the core water-related credit issues.

Macroeconomic Risks

Floods and droughts impede economic development as water resources are needed by all businesses and residents and because people will not build or live where there is risk of drought or repetitive flooding. When water supply is plentiful or scarce, local and regional economic activity can be hampered through infrastructure damage and water use restrictions to commercial and industrial consumers. In severe circumstances, insufficient water availability can force power utilities to impose electricity rationing or can cause power outages, which reduces the productivity of businesses.

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Local, regional and national economies reliant on agricultural and natural resource exports are exposed to variable weather patterns and water availability. Floods wipe out harvests and can affect mining activities. Prolonged droughts reduce crop yields and can cause the extractive industry to have lower production. The smaller output of the agricultural and mining sectors reduces companies' revenue and subsequently negatively affects local, regional and national economic growth.

Operational and Cash Flow Risk

Water risks can disrupt the day-to-day running of a business and reduce production. They can also increase capital expenditure through the requirement for new infrastructure and alternative logistics arrangements – such as transporting freshwater in trucks – and relocation costs due to stranded assets.

Due to water stress, it is increasingly likely that sectoral water recycling and desalination requirements – such as the 2020 EU Water Recycling Regulation – will appear in many regions. This will require very substantial amounts of capex to safeguard supply. There are huge differences in quality standards for wastewater recycling between countries. For example, Italy mostly requires a near-potable standard regardless of applications, which creates high compliance costs. The overall cost implication of recycling and desalination requirements will differ as technology used for water and wastewater management can vary between countries.

STORM ADDS TO CASH FLOW CONCERNS FOR WATER AND SEWER UTILITY

At the end of 2017, Hurricane Maria caused serious damage to Puerto Rico's already-deteriorating water infrastructure. The storm highlighted the need to invest in a more resilient water and wastewater system to minimise the disruption to water supplies from further extreme weather events.

Puerto Rico Aqueducts and Sewers Authority had insufficient net cash receipts and existing funds to meet long-term working capital, debt service and other funding requirements. The additional spending required in the aftermath of Hurricane Maria has exacerbated their weak cash flow position.

POOR MUNICIPALITY INFRASTRUCTURE INCREASES POULTRY PRODUCER'S OPERATING COSTS

Astral Foods Limited experienced water shortages at its Goldi operation in Standerton, South Africa, in 1H19 due to the local municipality failing to adequately maintain its water infrastructure.

Consequently, production was reduced by 50% of the scheduled capacity and the South African poultry producer was forced to seek assistance from the government and the courts to secure the quantity of water required to run its Standerton facility. Simultaneously, a drought in Zambia reduced crop yields and consequently increased feed costs for Astral's poultry operations across the continent outside of South Africa.

DESALINATION PLANT INVESTMENT IS CRUCIAL FOR EXTRACTIVE ENTITIES

Droughts in central Chile have led to local community unrest and threats of regulation on water sourcing. These actions and the impact on production – 2019 droughts led to a 28% fall in Chilean copper production and a worsening balance of payments – has encouraged extractive issuers to spend money on desalination plants.

A joint venture by BHP Billiton plc and Rio Tinto plc to build a desalination plant on the west coast of Chile has cost the firms USD3.4 billion over the past 10 years. Smaller sites may struggle to meet these capital requirements and other factors such as mine topography can also affect the viability of desalination.

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Profitability Risk

Profitability risk refers to the impact the water issues can have on the costs of materials and end products. Water scarcity and droughts can reduce crop yields and increase the price of agricultural ingredients. Mine outage, be it temporary or permanent, can have a significant impact on commodity prices, particularly where production of commodities is highly localised. Water shortages can also cause power rationing and higher water prices, especially in countries that rely heavily on hydroelectricity.

Refinancing Risk

The rising popularity of ESG investing across all regions will reduce some issuers' access to financial markets and therefore their ability to raise funds. Investors who believe that water risks may materially negatively affect an issuer's corporate performance, and pose an existential threat, may wish to avoid rolling their bonds or may only purchase short-dated bonds.

Regulatory and Litigation Risk

A weak regulatory environment can lead to an increase in water scarcity and stress, whereas a strong government policy and regulatory environment may prioritise groups such as residential and agriculture consumers and disadvantage industrial and power consumers. Issuers monitor potential changes to policy, especially those governed by stringent environmental regulations. Water and sewer utilities are overseen by regulators, standards and targets that have a significant impact on their capital programmes and operations and they will scrutinise and plan for new policies and regulation as they undertake compliance efforts.

Governments can be highly reactive to short-term unrest and negative media coverage. This can lead to operational disruption if issuers fail to anticipate future government action – such as reallocation of water rights or increased rates. In Australia, some gold miners have had high-security water rights rescinded by regulators in response to drought conditions and pressure to safeguard domestic supplies.

Beverage companies have made strong efforts to increase their product water use efficiency in recent years so as to pre-empt anticipated regulatory restrictions. For example, the Indian government may introduce targeted taxes on sugary drinks to address water supply concerns. Production by global beverage companies such as The Coca-Cola Company and PepsiCo, Inc. in India have been subject to heightened controversy in recent years due to growing pressure on aquifers, the high water intensity of sugar cane production, and boycotts by local traders over associated water risks.

DROUGHTS CAUSE PRODUCTION LOSS AND MISSED REVENUE FORECASTS FOR ALUMINIUM PRODUCER

The 2014 drought in Brazil caused hydropower reservoirs to dry up, energy prices to rise, blackouts, water rationing in 19 cities and animosity between states vying for water resources. Businesses have had to absorb the effects of higher energy prices.

For instance, Alcoa Corporation was forced to reduce its local aluminium production by 147,000 tonnes due to increased costs. The company then moved into energy trading to generate cash from its hydropower dams and take advantage of the higher energy prices.

However, water shortages in 2018 prevented Alcoa from achieving its revenue and earnings forecasts. Profits from its hydropower business were affected and restricted aluminium production meant the company couldn't profit from the higher aluminium prices.

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MINING ASSETS STRANDED BY TIGHTENING REGULATION

Community engagement and local resistance relating to water resources are likely to become increasingly material for corporates and investors as competition for resources increases. This increases the risk of stranded assets as a result of local opposition and related regulatory tightening.

For example, Canadian miner Barrick Gold Corporation invested USD5 billion into its Pascua-Lama open-pit mining project that straddled the border between Chile and Argentina. The project was under sustained pressure from local communities due to the risk it poses to local groundwater resources, prompting the Chilean regulator to withdraw its water abstraction licence – and forcing Barrick to suspend the project and effectively stranding these assets. Fitch expects these isolated examples to increase in frequency as water stress shifts from a localised issue to an increasingly widespread phenomenon in the coming decade.

ALCOHOLIC BEVERAGE ENTITY'S WATER PERMIT RESCINDED DUE TO LOCAL COMMUNITY RESISTANCE

Constellation Brands Inc. was subject to a surprise community vote in March 2020, where 76% of the voters chose to oppose the completion of a USD1.4 billion brewery that was already under construction in the Mexican city of Mexicali. Residents in the city were concerned that the alcoholic beverage company would deplete their water supplies, and that it would consume 25% of the water reserves and more water than all the industrial users in Melcali combined. Despite less than 5% of a population of 1 million voting, the result of the plebiscite organised by the government caused Constellation Brands to lose its water permits and absorb associated capex losses of up to USD1 billion.

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Reputational Risk

Issuers are increasingly concerned by customer perceptions, especially as social media offers an open venue for consumers to express their views. Entities are spending more time on protecting their brand and ensuring their conduct is perceived positively – negative publicity can be detrimental to branding and sales, and could result in a boycott or legal action. The Vale S.A. case study below shows how reputational risks can bring additional regulatory and litigation risks. The incident led to multiple legal actions, including a judge partially granting an injunction in May 2020, forcing Vale to set aside USD1.5 billion for potential fines.

TAILINGS DAM COLLAPSE SPARKS INVESTOR ENGAGEMENT AND DIVESTMENT OF MINING ENTITYE

The collapse of Vale's tailings dam in the Brazilian region of Brumadinho in January 2019 is an example of reputational risks intersecting with refinancing risk. Despite the site representing just 2% of all iron ore produced by the company, Vale (alongside 725 other extractive entities) is under pressure from investors to respond appropriately and to disclose more information on their environmental and social management.

A group of 100 investors with USD12.5 trillion in assets under management formed soon after the disaster to engage with Vale and to gather information on global tailings facilities. In June 2019, MP Pension (Pensionskassen for Magistre & Psykologer) announced that it will divest its equity and corporate bond holdings in Vale after discussions failed when trying to reach an agreement on issues related to Vale's mining activities in Brazil and to the Moatize mine in Mozambique.

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PART FOUR: BIODIVERSITY AND WASTE ISSUES

GLOBAL COLLABORATION AND STANDARDS ARE ESSENTIAL IN LIMITING BIODIVERSITY LOSS

Despite the biodiversity loss and rise in annual waste generation, issuers' resource, biodiversity and waste management has received little airtime compared to other ESG issues.

However, these considerations are implicitly built into business strategy and operational processes to control costs, protect supply chains, adhere to local biodiversity and waste-related regulations, and mitigate reputational risk caused by environmental damage and community health implications.

This report focuses on biodiversity and waste issues and how they translate into credit issues and potentially materialise as credit risks. It specifically covers the two biodiversity and waste issues within Fitch Ratings' ESG Relevance Score Framework and scoring templates: 'Waste & Hazardous Materials Management; Ecological Impacts'; and 'Biodiversity and Natural Resources Management'.

Biodiversity and Waste Issues Still Unclear

Investors and analysts have been evaluating biodiversity and waste-related credit issues for many years. Despite the numerous biodiversity and waste-related themes, the financial industry's approach to mitigating these issues is uncoordinated and financial materiality is considered to be low. A detailed framework is needed to tie together the conventional and emerging risks and ESG themes.

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Biodiversity Needs Extra Impetus

The momentum behind biodiversity analysis is likely to continue growing throughout 2021 due to the rise of ESG investing and the expectation of the adoption of a global framework for biodiversity.

However, the delayed 26th UN Climate Change Conference of the Parties (COP26) later this year may cast a shadow over the achievements so far due to the focus on climate mitigation by governments, investors, financial institutions, issuers, and civil society without due consideration for biodiversity issues.

Core Biodiversity and Waste-Related Credit Issues

Fitch has identified the sectors and activities most affected by biodiversity and waste-related issues from a credit perspective.

These can be categorised under five core biodiversity and waste-related credit issues: Waste and hazardous materials management and ecological impacts of manufacturing process/ operations; ecological impact of manufacturing and operating incidents and spills; waste and lifecycle management of products and services; ecological impacts in supply chain; and biodiversity and natural resource management in economic development.

Defining Biodiversity and Waste Issues

Climate risk has always been at the forefront of ESG investing and is the main environmental issue being factored into security selection and portfolio construction.

Waste- and biodiversity-related risk has also been a key ESG issue for investors for some time, in particular relating to oil spills and radioactive releases. The sustainability non-profit organisation Ceres was formed in 1989 by investors in response to the destruction to the local ecosystem caused when the Exxon Valdez oil tanker struck a reef in Prince William Sound off the Gulf of Alaska and spilt millions of gallons of oil.

Nuclear power generators and suppliers have long featured on exclusionary screening policies of ESG funds, although this could be changing as investors begin to view nuclear power as an important tool in decarbonising the global economy. Some investors are still not convinced that nuclear power will receive regulatory support due to social resistance, health and safety issues, and environmental concerns related to the disposal of radioactive waste.

Waste and hazardous waste management has always been important to investors and analysts when assessing industrials and natural resources issuers. Industrial automation and robotics have been a longstanding ESG theme for investors when making an investment case based on waste management and sustainable resource consumption. Morningstar, Inc. reported that the top two themes for thematic funds globally at the end of 2019 were robotics and automation (USD27 billion) and resource management (USD25.2 billion).

However, biodiversity and waste issues remain the least familiar environmental issue among investors and analysts, despite being seen as a proxy for quality management, strong business strategy and demonstrative cost-control implementation.

This could change. Biodiversity and waste issues have become a top ESG trend amongst investors since 2020. The UN and their member states are equally concerned by biodiversity and habitat loss. It is expected that the Conference of the Parties (COP15) of the Convention on Biological Diversity– twice delayed and taking place from 11 to 24 October 2021 – will lead to the adoption of the post-2020 global framework for biodiversity. The EU is also likely to motivate investors to include biodiversity in their financial analysis and portfolios through its Taxonomy Regulation, despite four of its environmental objectives – water, circular economy, pollution control, biodiversity – not being the focus of discussions thus far.

A Collection of Traditional and Emerging Risks and ESG Themes

Biodiversity and waste issues relate to activities that are associated with resource consumption and production, and waste generation and disposal. They become credit-relevant, and therefore a biodiversity and waste-related credit issue (see section Sector-Specific Credit Issues), when they are considered a key input or

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output to the economy, management strategy, product, manufacturing process, operation or project.

These issues encompass a range of conventional and emerging risks and ESG themes, including: automation and robotics; biodiversity and natural-resource management; circular economy; deforestation; plastic pollution; product lifecycle management; responsible resource consumption and production; supply chain risk; sustainable procurement; sustainable seafood; waste and hazardous materials management; and waste-to-energy.

The traditional and emerging risks and ESG themes can affect issuers across four stages of a product value chain:

1. Raw materials and components – manufacture and distribution;
2. Product manufacture and distribution;
3. Product use; and
4. Material and product reuse, recycling and disposal.

(Investors' approach to integrating biodiversity and waste-related themes is detailed in Portfolio-Level, Thematic Approaches to Biodiversity and Waste.)

Interconnectivity with other ESG issues

Biodiversity and waste issues can materialise in and overlap with other ESG issues. Within our ESG Relevance Score Framework and sector-specific, scoring templates, there are connections between biodiversity and waste issues and the following ESG issues:

GHG Emissions and Air Quality: This environmental issue encompasses direct emissions from manufacturing, operations, products and economic development. Issuers are scored on their management of regulatory risks, environmental compliance, and reputational risks – for example, strict emissions standards and targets for new cars, which automotive manufacturers and auto suppliers will build into their product design and lifecycle management.

Water and Wastewater Management; Water Resource and Management: These issues cover water and wastewater; the issue Waste and Hazard Materials Management relates to solid waste. While they cover separate substances, solid waste can contaminate water supplies and affect water availability, quality and infrastructure.

Water-related issue categories cover water pollution affecting the operations and creditworthiness of material sectors and issuers, whereas the biodiversity and waste issues include operating incidents and oil spills, and the management of water pollution and other environmental risks within the issuer's supply chain.

Exposure to Environmental Impact: This addresses the issuer's ability to manage risks associated with the physical effects of climate change, including but not limited to: ocean warming and acidification, floods and droughts, desertification, and wildfires. Consequences include high costs for adaptative measures or migration of businesses to areas with more favourable conditions and better biodiversity, which can affect local, regional and national economies.

Customer Welfare – Fair Messaging, Privacy & Data Security: This issue includes antibiotic use in animal production as well as health and nutrition of foods, beverages and pharmaceutical products. A major driver of biodiversity loss is intensive farming, which consumes 70% of antibiotics worldwide according to the FAIRR Initiative, a global investor network supported by institutional investors managing assets of USD29 trillion.

Members of the FAIRR Initiative engage with companies on ESG risks in the global food sector, including the impact of intensive livestock production and their excessive use and misuse of antibiotics and how this impacts public health and the global economy.

The use of harmful materials in products, such as asbestos, that can accrue significant disposal costs is another overlapping issue. A list of prohibited substances covering all applicable jurisdictions is fundamental to effective product design and lifecycle management and minimises the risk of any operating incidents or liabilities.

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BIODIVERSITY AND WASTE THEMES AND CREDIT ISSUES

Stages of the Product Value Chain			
Raw materials and components - manufacture and distribution	**Product manufacture and distribution**	**Product use**	**Material and product reuse, recycle and disposal**
			
Auto Suppliers, building materials & products, food & beverage, mining, O&G exploration & production, protein	**Auto manufacturers, consumer products, food retailing, homebuilders, non-food retailing, O&G refining & marketing, pipeline operators, pharmaceuticals, property & real estate, utilities**	**Airlines, healthcare, property & real estate, restaurants**	**All industries**
ESG Trends and Themes			
• Product design & life cycle management; circular economy; product environmental stewardship • Responsible consumption and production • Sustainable procurement; rare materials sourcing • Green commodities, sustainable agriculture, pollination, sustainable seafood; food security • Animal welfare, antibiotic resistance, fair trade, sustainable protein • Deforestation, palm oil sourcing, soil preservation	• Product design & life cycle management; circular economy; product environmental stewardship • Responsible consumption and production • Sustainable procurement; rare materials sourcing • Green commodities, sustainable agriculture, pollination, sustainable seafood; food security • Animal welfare, antibiotic resistance, fair trade, sustainable protein • Deforestation, palm oil sourcing, soil preservation • Plastic pollution • Automation and robotics	• Product design & life cycle management; circular economy; product environmental stewardship • Responsible consumption and production • Plastic pollution • Sustainable cities and communities	• Product design & life cycle management; circular economy; product environmental stewardship • Plastic pollution • Sustainable cities and communities • Waste-to-energy
Waste and Biodiversity-related Credit Issues			
• Biodiversity and natural resource management in economic development • Waste and lifecycle management of product and services • Waste and hazardous materials management and ecological impacts of manufacturing process/ operations • Ecological impact of manufacturing and operating incidents and spills • Ecological impacts	• Biodiversity and natural resource management in economic development • Waste and lifecycle management of product and services • Waste and hazardous materials management and ecological impacts of manufacturing process/ operations • Ecological impact of manufacturing and operating incidents and spills • Ecological impacts in supply chain	• Biodiversity and natural resource management in economic development • Waste and lifecycle management and services • Waste and hazardous materials management and ecological impacts of manufacturing process/ operations	• Biodiversity and natural resource management in economic development • Waste and lifecycle management and services

Source: Fitch Ratings

Human Rights, Community Relations, Access and Affordability: Poor management of waste and hazardous materials and environmental disasters can have a devastating impact on communities. The tailing dam failure in November 2015 at Samarco Mineracao S.A.'s iron ore mine, created and owned through a joint venture by Vale S.A. and BHP Billiton Brasil Ltda, destroyed villages, killed 19 people, and caused huge environmental damage to terrestrial and freshwater ecosystems. Vale was also the owner of the collapsed tailings dam in the Brazilian region of Brumadinho that killed 270 people in January 2019. The second incident resulted in the formation of the Investor Mining and Tailings Safety Initiative, demonstrating increasing investor scrutiny of waste and hazardous materials management in the metals and mining sector.

Management Strategy: Consideration of biodiversity and waste issues – resource consumption, commodities and rare materials sourcing, product lifecycle management, and waste and hazardous materials management – within business strategy and operations can improve market positioning and long-term prospects and profitability.

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FITCH'S COMMERCIAL MORTGAGE-BACKED SECURITIES (CMBS) SCORING TEMPLATE

General issue	Sector-specific issue
GHG emissions and air quality	Regulatory risks, fines, or compliance costs from building emissions standards (including energy consumption) and related reporting standards
Energy management	n.a. – included in sustainable building practices
Water and wastewater management	n.a. – included in sustainable building practices
Waste and hazardous materials management; ecological impacts	Environmental site risk and associated remediation/liability costs; sustainable building practices including Green building certificate credentials
Exposure to environmental impact	Asset, operations and/or cash flow exposure to extreme weather events and other catastrophe risk, including but not limited to flooding, hurricanes, tornadoes, and earthquakes
Human rights, community relations, access and affordability	Low-income housing; GSE/agency issued or provision for social good
Customer welfare – fair messaging, privacy and data security	n.a.
Labour relations & practices	Labour practices and employee (dis)satisfaction, especially for hotels and healthcare properties; tenant safety and wellbeing
Employee wellbeing	n.a.
Exposure to social impacts	Sustained structural shift in secular preferences affecting consumer trends, occupancy trends, etc.
Rule of law, institutional and regulatory quality	Jurisdictional legal risks; regulatory effectiveness; supervisory oversight; foreclosure laws; government support and intervention
Transaction & collateral structure	Asset isolation; resolution/insolvency remoteness; legal structure; structural risk mitigants; complex structures
Transaction parties & operational risk	Counterparty risk; origination, underwriting and/or aggregator standards; borrower/lessee/sponsor risk; originator/servicer/manager/operational risk
Data transparency & privacy	Transaction data and periodic reporting

Source: Fitch Ratings

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BIODIVERSITY AND WASTE ISSUES: PHYSICAL, REGULATORY, FINANCIAL AND ECONOMIC IMPACTS

Biodiversity and waste issue	Affected sectors	Physical and regulatory impact	Financial and economic impact
Population growth – rising demand for more resources and products reduces natural asset availability, increases competition for raw material and disrupts supply chains	• Chemicals • Construction materials and products • Diversified industrials & capital goods • Food & beverage • Local and regional governments (LRG) & sovereigns • Downstream businesses	• Reduced agricultural and mineral productivity • Higher competition for raw materials • Supply chain shortages and competition disrupts downstream business operations • Changing dietary patterns in emerging markets leading to increased land conversion for livestock	• Loss of revenue due to reduced productivity • Higher raw material costs from competition and new suppliers • Lower and more volatile tax revenue and local, regional or national economic growth • Compensation for use of genetic resources and biodiversity (eg. in pharmaceutical development)
Competition – rising demand depletes biodiversity and natural resources that leads to raw material shortages, business disruption, loss of operating licences and conflicts	• Chemicals • Construction materials and products • Diversified industrials & capital goods • Food & beverage • LRG & sovereigns • Mining • Downstream businesses	• Reduced agricultural and mineral productivity • Slowdown or relocation of natural asset producers • Supply chain shortages and competition disrupts downstream business operations • Quotas and stricter regulation on producer's activity, including rationing and priority for local firms	• Loss of revenue due to reduced productivity • Increased relocation costs to move operations or access new land • Higher raw material costs from competition and new suppliers • Lower and more volatile tax revenue and local, regional or national economic growth
Climate change – natural capital loss and damage caused by physical effects of climate change lowers agricultural and mineral productivity, and economic output	• Construction materials and products • Food & beverage • LRG & sovereigns • Mining • Paper & forest products • Downstream businesses • Utilities	• Physical climate events reduces or delays agricultural and mineral productivity • Damage to agricultural, industrial and extractive assets • Increased competition for commodities • Supply chain shortages disrupts downstream business operations	• Loss of revenue due to reduced productivity • Relocation costs for operations • Higher production costs • Higher raw material costs from competition and new suppliers • Rising insurance premiums • Large, one-off costs for repairs to assets • Limited residential and economic development in certain areas that have restrictive environmental regulations • Lower productivity leads to reduced exports and tax revenue

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Biodiversity and waste issue	Affected sectors	Physical and regulatory impact	Financial and economic impact
Water scarcity – reduced water availability and subsequent loss of ecosystem due to unpredictable weather patterns and water pollution causes lower agricultural and mineral activities and economic output	• Food & beverage • Energy • LRG & sovereigns • Paper & forest products • Technology • Downstream businesses • Utilities	• Reduced agricultural and mineral productivity • Local community unrest due to limited access to clean water and sanitation • Delays and permanent shutdown of extractive assets. • Lower energy production from fossil-fuel, nuclear and hydroelectricity generators • Less attractive business environment due to limited water availability • Supply chain shortages disrupts downstream business operations	• Lower revenue due to operating restrictions and rationing • Increased competition for water is leading to higher water rates or rationing, or both • High raw material costs due to reduced supply • Shutdown and relocation costs to areas with large volumes of high-quality water • Increased capital costs for extractive, industrial and power companies to source alternative water supply • Restricted economic growth and business development due to limited freshwater resources
Deforestation, soil degradation and land loss – natural capital loss and damage caused by deforestation, soil degradation and land loss lower agricultural and mineral productivity, and economic output	• Construction materials and products • Food & beverage • LRG & sovereigns • Mining • Paper & forest products • Downstream businesses	• Reduced agricultural and mineral productivity • Higher competition for raw materials • Quotas and stricter regulation on producer's activity, including rationing and priority for local firms • Supply chain shortages and competition disrupts downstream businesses	• Loss of revenue due to reduced productivity • Increased relocation costs to move operations or access new land • Higher raw material costs from competition and new suppliers • Fines, legal settlements and loss of operating licence from illegal activities • Lower productivity leads to reduced exports and tax revenue

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Biodiversity and waste issue	Affected sectors	Physical and regulatory impact	Financial and economic impact
Air, water and land pollution & incidents – operating incidents, leaks and spills damages local ecosystems, lowers local economic output, and risks large fines and litigation and loss of operating licence	• LRG & sovereigns • O&G production • O&G refining and marketing • Pipeline operators • Utilities	• Incidents suspend or shutdown operations • Loss or refusal of licence to operate due to community unrest and political response • Decreased capacity of ecosystems to remediate waste and pollution	• Fines for pollution, legal settlements and possible loss of operating licence • Large cash outflows and clean-up liabilities over multiple years • Local and regional business disruption leads to lower tax revenue and economic output
Hazard and non-hazardous waste levels and disposal – unmanaged waste damages ecosystems, increases regulatory and litigation risks, and raises future costs	• Agriculture • Business services • CMBS • Food retailing • Healthcare • Homebuilder, real estate, REIT • LRG & sovereigns • Mining • Technology • Utilities	• Large amounts of waste generation and disposal • Contamination of land and water bodies with hazardous materials • Potential human health impacts from waste	• Rising waste-handling costs • Fines for pollution, legal settlements and possible loss of operating licence • Higher government spending on waste management and disposal and lower tax revenue from businesses
Underdeveloped waste collection and processing infrastructure – high percentage of waste reaching landfills, dumped or untreated, driving up unsustainable resource consumption, ecosystem restoration costs and waste management costs	• Business services • Food retailing • LRG & sovereigns • Non-food retailing • Restaurants	• Large volumes of untreated waste generation in public spaces • Potential human health impacts from waste	• Additional costs to businesses to invest in waste management • Higher product sourcing costs • Fines for pollution, legal settlements and possible loss of operating licence • Higher government spending on waste management and disposal

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Biodiversity and waste issue	Affected sectors	Physical and regulatory impact	Financial and economic impact
Product design and lifecycle management – poor product design contributes to unsustainable resource consumption, damages ecosystems and creates unnecessary waste that causes reduced customer demand and rising costs	• Automotive manufacturers • Auto suppliers • Building materials and products • Consumer products • Pharmaceuticals	• High resource consumption • Large amounts of waste generation and disposal • Use of banned substances and conflict minerals	• High operating costs from unnecessary consumption of large quantities of raw materials • Rising waste-handling costs • Loss of revenue from consumers who prefer more eco-friendly products • Fines for sourcing banned substances
Asset retirement obligations and stranded assets –rising liabilities from cleaning-up and dismantling retiring assets; and revenue losses from stranded assets	• Energy • LRG & sovereigns • Mining • Utilities	• Badly designed and dismantled assets can cause accidents • Abandoned, highly-dangerous assets are left without proper protection	• Rising liabilities from cleaning-up and dismantling retiring assets • Revenue losses from stranded assets • Fines and litigation for pollution • Higher government spending on waste management and disposal and lower tax revenue from businesses
Supply chain disruption – lower agricultural and mineral productivity or major controversies cause delays and outages in the supply chain	• Automotive manufacturers • Consumer Products • Food & beverage • Real estate & property	• Interruption of flow of materials, including raw materials and components	• Loss of revenue due to unreliable supply of materials and goods • Higher cost of goods due to lower supply and more demand increasing raw material prices and volatility

Source: Fitch Ratings

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Sector-Specific Credit Issues

Fitch analysts evaluate whether biodiversity and waste issues are credit-relevant and material for all its rated issuers and transactions. Within their ESG scoring templates, Fitch analysts allocate a score between '1' and '5' for the issues:

- Waste & Hazardous Materials Management; Ecological impacts; and
- Biodiversity and Natural Resources Management (ESG scoring templates for local and regional governments, state and local governments, and sovereigns refer to Biodiversity and Natural Resources Management).

WASTE & HAZARDOUS MATERIALS MANAGEMENT; ECOLOGICAL IMPACTS

The sector-specific ESG credit issues for Waste & Hazardous Materials Management; Ecological impacts can be categorised into four core waste- and biodiversity-related credit issues:

1. Waste and hazardous materials management and ecological impacts of manufacturing process/operations – where resource extraction, production and consumption or waste and hazardous materials generation requires strong management within the manufacturing process or operations;
2. Ecological impact of manufacturing and operating incidents and spills – where major incidents caused by manufacturing and operating activities have damaged ecosystems and wildlife;
3. Waste and lifecycle management of product and services – where design and lifecycle impact is a key requirement or consideration in product development, manufacture and disposal;
4. Ecological impacts in supply chain – where the sourcing of raw materials can contribute to significant resource consumption, waste generation, environmental damage or biodiversity loss

TRANSMISSION MECHANISM FROM A BIODIVERSITY AND WASTE ISSUE TO CREDIT RISKS

Biodiversity and Waste Issues

- Population growth
- Competition
- Climate change
- Water scarcity
- Deforestation, soil degradation
- Pollution & incidents
- Asset retirement obligations, stranded assets
- Product design, life cycle management
- Supply chain disruption

Biodiversity and Waste-Related Credit Issues
ESG Relevance Score = 2 (credit-relevant)

- Waste and hazardous materials management and ecological impacts of manufacturing process / operations
- Ecological impact of manufacturing and operating incidents and spills
- Waste and life cycle management of product and services
- Ecological impacts in supply chain
- Biodiversity and natural resource management in economic development

Credit Risks
ESG Relevance Score = 3, 4 or 5 (credit-material)

- Asset quality and concentration risk
- Business profile and competitive composition
- Macroeconomic risk
- Operational & cash flow risk
- Profitability risk
- Refinancing risk
- Regulatory & litigation risk
- Reputational risk

Source: Fitch Ratings

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BIODIVERSITY AND NATURAL RESOURCES MANAGEMENT

The sector-specific ESG credit issues for Biodiversity and Natural Resources Management, which apply to local and regional governments, state and local governments, and sovereigns, can be categorised into one core biodiversity and waste-related credit issue:

1. Biodiversity and natural resource management in economic development – where exports, tax revenue and national, regional or local economic growth is dependent on the cultivation of natural resources and local ecosystems.

RELATING BIODIVERSITY AND WASTE ISSUES TO CREDIT RISKS

Biodiversity and waste issues can affect any of the related credit issues and materialise as a single credit risk or a combination of credit risks (see flowchart above).

The report focuses on the five abovementioned core waste- and biodiversity-related credit issues. It provides insights and case studies on how these core issues affect issuers from several of the sectors (see table **Biodiversity and Waste-Related Credit Issues and Their Associated Sectors**). This is followed by guidance on how biodiversity and waste issues and these biodiversity and waste-related credit issues transpire as credit risks and can affect the creditworthiness of issuers.

FITCH'S DEFINITION OF WASTE & HAZARDOUS MATERIALS MANAGEMENT; ECOLOGICAL IMPACTS

Fitch analysts refer to definitions for four environmental issues when allocating a ESG Relevance Score for general issue Waste & Hazardous Materials Management; Ecological Impacts:

Waste & Hazardous Materials Management: This category addresses environmental issues associated with hazardous waste (e.g. explosives, flammable and combustible substances, poisons and radioactive materials) and non-hazardous waste (any waste which causes harm to humans and the environment) generated by issuers. It addresses an issuer's management of solid waste in manufacturing, agriculture, and other industrial processes. It covers treatment, handling, storage, disposal, and regulatory compliance. Scope 3 GHG emissions defined under the Kyoto Protocol are included within the category.

Product Design & Lifecycle Management: This category addresses the incorporation of environmental considerations in characteristics of products and services provided or sold by a company. It includes, but is not limited to, managing the lifecycle impacts of products and services, such as those related to packaging, distribution, intensity of resources used during the life cycle, and other environmental externalities that may occur during their use-phase or at the end-of-life.

Ecological Impacts: This category addresses management of an issuer's impacts on ecosystems and biodiversity through activities including, but not limited to, land use for exploration, natural resource extraction, and cultivation, as well as project development and construction. The impacts include biodiversity loss, habitat destruction, and deforestation at all stages – planning, land acquisition, permitting, development, operations, and site remediation. The category does not cover impacts of climate change on entire ecosystems and biodiversity which is considered more applicable to sovereigns and sub-sovereigns and covered in the "Biodiversity and Natural Resources Management" issue category.

Supply Chain Management (product-related): This category addresses management of environmental risks (e.g. deforestation, water pollution) within a company's supply chain. It addresses issues associated with environmental damage created by suppliers through their operational activities (e.g. environmental responsibility). Management may involve screening, selection, monitoring, and engagement with suppliers to mitigate their environmental impacts.

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FITCH'S DEFINITION TO BIODIVERSITY AND NATURAL RESOURCES MANAGEMENT

The overarching definition of Biodiversity and Natural Resources Management for the ESG.RS is, "This category addresses the relevance of natural resource endowments, including the potential for stranded assets, on an issuer's financial and business operations, operating revenue, economy and/or exports. Where credit relevant, this may reflect the management of an issuer's diverse biological systems to ensure the capacity of underlying ecosystems to provide a stable and sustainable supply of essential goods and services without potentially decreasing the amount of natural resources available for future use. Substandard natural resources management will impair an issuer's future economic and revenue growth prospects."

BIODIVERSITY AND WASTE-RELATED CREDIT ISSUES AND THEIR ASSOCIATED SECTORS

Waste & hazardous materials management; ecological impacts				Biodiversity and natural-resource management
Waste and hazardous materials management and ecological impacts of manufacturing process/operations	**Ecological impact of manufacturing and operating incidents and spills**	**Waste and lifecycle management of product and services**	**Ecological impacts in supply chain**	**Biodiversity and natural-resource management in economic development**
ABS-Future flow receivables	ABS-Future flow receivables	Aerospace & defence	Aerospace & defence	IPF-LRGs
ABS-Oil vessel-backed	ABS-Oil vessel-backed	Alcoholic beverages	Alcoholic beverages	Sovereigns
ABS-Sprint spectrum	ABS-Sprint spectrum	Auto suppliers	Building products	USPF - State and local government
ABS-Timeshare loan	ABS-Timeshare loan	Automotive manufacturers	Commodity processing & trading	
Aerospace & defence	APAC Regulated network utilities	Building materials	Consumer products	
APAC Property & real estate	Australia regulated networks	Building products	Food retailing	
APAC Regulated network utilities	EMEA regulated networks	Consumer products	Medical products	
Asia pacific utilities	GIG - Oil & gas production	Medical products	Non-alcoholic beverages	
Australia regulated networks	GIG - Pipeline & energy midstream	Non-alcoholic beverages	Non-food retailing	
Auto suppliers	GIG - Thermal power	Non-food retailing	Packaged food	

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Waste & hazardous materials management; ecological impacts				Biodiversity and natural-resource management
Waste and hazardous materials management and ecological impacts of manufacturing process/operations	**Ecological impact of manufacturing and operating incidents and spills**	**Waste and lifecycle management of product and services**	**Ecological impacts in supply chain**	**Biodiversity and natural-resource management in economic development**
Automotive manufacturers	GIG - Transportation	Insurance- non-life	Pharmaceuticals	
Building materials	GIG - Water/wastewater	Packaged food	Protein	
Business services	Insurance- non-life	Pharmaceuticals	Restaurants	
Chemicals	IPF - GREs			
Chinese homebuilders	LatAm utilities			
CMBS	Oil & gas production			
Commodity processing & trading	Oil refining & marketing			
CVB Commercial	Oilfield services			
CVB Residential	Pipeline and energy midstream			
Diversified industrials & capital goods	Shipping companies			
EMEA Real estate & property	Steel			
EMEA Regulated networks	USPF - Water & sewer			
EMEA Utilities				
Engineering & construction				
Food Retailing				
GIG - Hydro				
GIG - Oil & gas production				
GIG - Pipeline & energy midstream				
GIG - Social infrastructure				
GIG - Solar/wind				
GIG - Sports				
GIG - Thermal power				

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Waste & hazardous materials management; ecological impacts				Biodiversity and natural-resource management
Waste and hazardous materials management and ecological impacts of manufacturing process/operations	**Ecological impact of manufacturing and operating incidents and spills**	**Waste and lifecycle management of product and services**	**Ecological impacts in supply chain**	**Biodiversity and natural-resource management in economic development**
GIG - Transportation				
GIG - Water/wastewater				
IPF - GREs				
LATAM utilities				
MICH				
Mining				
Non-food retailing				
Oil & gas production				
Oil Refining & marketing				
Oilfield services				
Protein				
Restaurants				
RMBS				
Shipping companies				
Steel				
Technology				
US Equity REITS & REOCs				
US Healthcare providers				
US Homebuilders				
US Utilities				
USPF - Acute hospital and health systems				
USPF - Higher education				
USPF - Not-for-profit CCRC				
USPF - Public power				
USPF - Water & sewer				

Note: ABS = Asset-Backed Securities; GIG = Global Infrastructure Group; USPF = US Public Finance
Source: Fitch Ratings

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Relevance and Materiality of Sector-Specific, Biodiversity and Waste Issues

RELEVANCE OF CORE BIODIVERSITY AND WASTE-RELATED CREDIT ISSUES TO KEY SECTORS

The sectors most relevant to the biodiversity and waste issues are found in the table Biodiversity and Waste-Related Credit Issues and Their Associated Sectors above and have been grouped by five core biodiversity and waste-related credit issues:

- Waste and hazardous materials management and ecological impacts of manufacturing process/operations;
- Ecological impact of manufacturing and operating incidents and spills;
- Waste and lifecycle management of product and services;
- Ecological impacts in supply chain; and
- Biodiversity and natural resource management in economic development.

These credit issues are relevant to businesses, enterprises and governments that rely heavily on natural resources or their development, are dependent on highly-regulated materials, or produce large quantities of waste or hazardous materials. Their manufacturing processes and operations are exposed to resource scarcity, supply chain disruption, rising raw material and waste disposal costs, and large asset-retirement obligations. They are also vulnerable to climate change, water scarcity, deforestation, and intensive farming, among other things.

The following sections describe how these core biodiversity and waste-related credit issues affect sectors in the table above and drive the distribution of the ESG.RS across asset classes and sectors.

WASTE AND HAZARDOUS MATERIALS MANAGEMENT AND ECOLOGICAL IMPACTS OF MANUFACTURING PROCESS/OPERATIONS

This biodiversity and waste-related credit issue relates to how issuers are managing their resource consumption, solid waste generation and disposal, and ecological impacts from manufacturing, agriculture, other industrial processes and their operations. Any controversial environmental incidents, such as oil spills, are covered under Ecological Impact of Manufacturing and Operating Incidents and Spills.

Issuers that are substantially dependent on natural resources in their production and operation, and therefore exposed to volatile commodity prices, or that exhibit poor biodiversity and waste practices, and therefore incur increasing associated disposal costs, are affected by this issue. It is likely that persistent poor resource, biodiversity and waste management can lead to material one-off or persistent operating incidents.

The sectors where this credit issue is relevant include agriculture, business services, commercial mortgage-backed securities (CMBS), food retailing, healthcare, homebuilders, mining, non-food retailing, protein, REITs, restaurants, technology and utilities.

Relevance to Sector

The What a Waste 2.0 report by the World Bank estimates that global municipal solid waste – defined as residential, commercial, and institutional waste – will grow to 3.40 billion tonnes by 2050 under a business-as-usual scenario, compared to an estimated 2.01 billion tonnes in 2016. The amount generated varies by region – from 129 million of tonnes a year in the Middle East and North America to 468 million of tonnes a year in East Asia and the Pacific.

Other sectors have historically accumulated greater quantities of waste than municipal waste. When comparing the waste generation rates (kg/capita/day) in 2016, the industrial waste rate, agricultural waste rate and construction and demolition rate are all higher than the municipal waste rate. While hazardous waste is lower, it is also the most regulated and costly to treat and dispose of.

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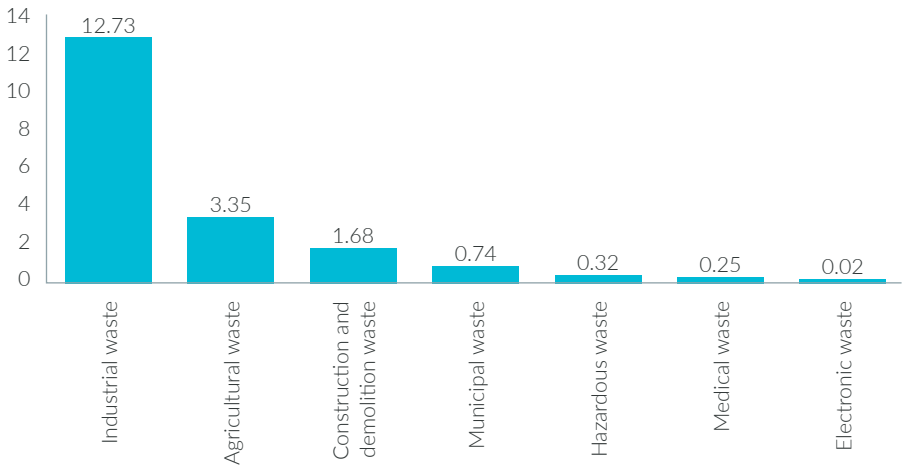
GLOBAL AVERAGE SPECIAL WASTE GENERATION IN 2016



Source: Fitch Ratings, World Bank

Rising recycling rates will help limit the amount of solid waste generated, with further improvements achievable. According to a 2017 study by Eunomia, the top 25 municipal solid-waste recyclers in the world have recycling rates ranging from 66.1% (Germany's recycling rate reported in 2015) to 34.6% (US's recycling rate reported in 2014). The greatest potential for higher recycling rates and, therefore largest waste reduction, is across low-income and middle-income countries where the use of sanitary landfills and automated waste systems is low.

Investors Target Mining Waste

Management of waste and hazardous materials is particularly pertinent for the metals and mining sector. Overburden (rock surrounding minerals), gangue (rock mixed with minerals) and mine tailings (typically a wet slurry of gangue, water, heavy metals and processing chemicals separated from the valuable mineral or metal from the ore) are all types of mine waste that mining issuers generate and store throughout their operations. While overburden removal and generation contribute to biodiversity loss, it is relatively easy to dispose of. Mine tailings and gangue require costly and meticulous waste and hazardous materials management due to the potential for catastrophic storage failure and contamination of soil and water supplies by toxic heavy metals and processing chemicals.

Mining waste is stored in waste piles or tailing dam embankments near the source. Originally, solid mining waste from coal mining was predominantly stored in waste piles; issuers now transport coal tailings offsite and these are used as valley and embankment fills to enable the reuse of land. The vast amount of liquid waste that is generated through coal processing – a highly water-intensive process that typically washes one ton of coal with roughly 45 m3 litres of water –is stored in coal slurry ponds constructed from solid mining refuse.

Dry-stacking tailings of mine ore waste is more expensive, but lowers water usage and the risk of toxic waste spillage from dam breaches. Risks from tailings dams failures have driven rating downgrades and are an increasing focus of investors' engagement and screening activities.

Some characteristics of strong waste management by mining companies include: boardroom accountability; full disclosure of all tailings storage facilities; alignment with international best practices on design, operation and closure, including the Global Industry Standard for Tailings Management; regular audits on the structural condition and stability of tailings dams and their susceptibility to extreme weather, and seismic events; deployment of clean technologies such as a decanter centrifuge to recycle water; reuse of waste rock such as in backfilling and road construction; and collaboration with stakeholders, including local communities.

The deployment of advanced monitoring and protection systems is also critical. According to analysis by Oboni Riskope Associates Inc.

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and Accenture plc, 80% of tailings dam failures are attributable to "controllable" causes, such as inadequate slope integrity, and overfilling and destabilising filling rates. The utilisation of geographic information systems and automated drones are being deployed for mineral exploration, facility and tailings management, safety and surveillance, among other reasons.

These practices have been put under the spotlight. The collapse of Vale's Brumadinho tailings dam in 2019 caused an international outcry. This led to NGO campaigns, international investors forming the Investor Mining and Tailings Safety Initiative to improve the disclosure and standards of tailings storage facilities, and a USD7 billion settlement with the authorities. This scrutiny is likely to continue as ESG investing remains popular and as the lower-grade ores being extracted to meet rising client orders generates more tailings per tonne of product, increasing the risks from tailings dam failures. Data from the Global Tailings Portal, maintained by the Investor Mining and Tailings Safety Initiative, highlight a substantial increase in the overall volume of mine tailings dams by 2025, increasing the scale of risks.

Similar Concerns with Coal Utilities

Coal power generators use coal ash ponds for their waste handling, which pose identical environmental and social problems to tailings dams, including mudslide hazards, and contamination of soils, streams and waterways with heavy metals. Coal miners and coal power generators also cause air pollution, which is linked to serious illnesses, including asthma, lung diseases, heart conditions and cancer. While methane is associated more with coal mining, toxic airborne pollutants such sulphur dioxide, mercury, cadmium, nitrogen oxide, carbon dioxide, particulates, and fly ash are also generated by coal burning.

Investors and various regulators also expect coal power generators to install flue gas desulphurisation equipment (also known as scrubbers) and electrostatic precipitators (that remove heavy metals and particulates). However, the biggest investment risk in developed markets is the phasing out of coal by nations and investors due to climate risk.

COAL ASH MANAGEMENT AFFECTS CREDIT PROFILE

AES Puerto Rico LP (PR) owns and operates a net 454-megawatt coal-fired circulating fluidised bed combustion power plant in Guayama, Puerto Rico. On 16 October 2020, it was assigned an ESG Relevance Score of '4' for Waste and Hazardous Materials Management due to its exposure to waste disposal related to coal ash management and pollution incidents, which, in combination with other factors, has a negative impact on the credit profile, and is relevant to the rating in conjunction with other factors.

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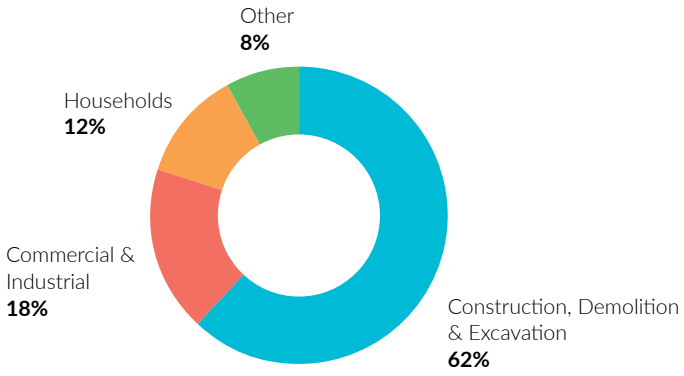
Green Building Certifications Require Good Biodiversity and Waste Management

Similar to the mining sector, construction also creates a huge amount of waste. More construction and demolition (C&D) waste is produced globally than municipal waste, but the contribution differs by region and country. Construction, demolition and excavation waste accounted for 62% of the UK's total waste in 2016 – 18% was commercial and industrial waste and 12% household waste. According to EU data, building sector waste of most developed markets is between 30% and 35% of the total amount of generated waste. Based on the 2018 data by the US Environmental Protection Agency, (EPA), C&D waste in the US – which was estimated to be 600 million tons in 2018 and double the amount of their municipal solid waste – consists of 67.5% concrete, 17.8% asphalt concrete and 6.8% wood products. The construction sector also generates lots of hazardous materials.

With waste generation generally positively correlated with income level and urbanisation rates, according to the World Bank, C&D waste will continue to grow. This is especially the case in emerging markets where economic development requires new buildings and infrastructure. C&D waste will also be generated in developed markets as ageing infrastructure will need to be replaced and renovated to meet mandatory sustainability standards – such as Leadership in Energy and Environmental Design (LEED) by the U.S. Green Building Council, Building Research Establishment Environmental Assessment Method (BREEAM) by the British Research Establishment and Green Star by Green Building Council of Australia.

UK WASTE GENERATION SPLIT IN 2016



Source: Fitch Ratings, Defra Statistics

All these standards assess buildings based on their energy efficiency, adaption to climate change, water usage, land use and biodiversity preservation. The achievement of high-band certification to these sustainability standards demonstrates strong waste, resource and biodiversity management by homebuilders. Certified buildings and property owners will also have lower operating costs, less capital costs caused by physical climate events due to structural durability and better planning, and less revenue volatility and tenant turnover.

A survey of more than 1,000 building owners across 69 countries, conducted by Dodge Data & Analytics and United Technologies Corporation, revealed that they expect a 14% savings in operating costs over five years for new green buildings and that new and renovated buildings achieve a 7% increase in asset value over traditional buildings.

The environmental lifecycle impacts of buildings are also examined during green building certification, including land use and material sourcing. It is an important component of green building standards and investors' ESG assessments of construction materials, construction products, homebuilders and real-estate issuers. Certification levels and ESG scores are positively affected by the responsible sourcing and consumption of green, recycled and reuse materials, and lower use of hazard materials (more information on life cycle impacts is found in section Waste and Lifecycle Management of Product and Services).

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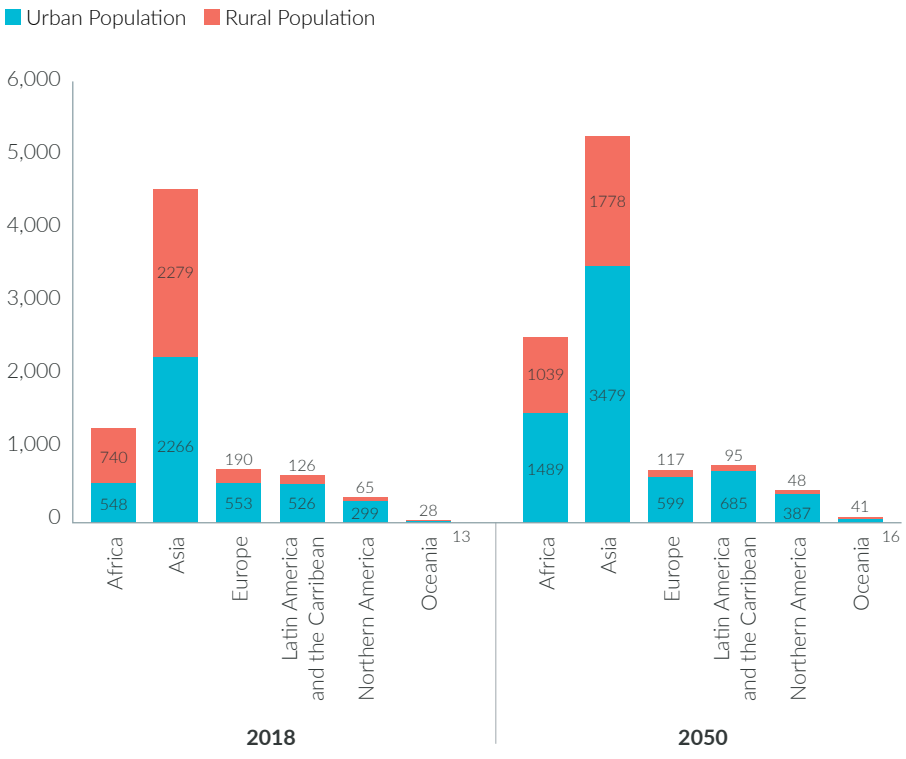
WASTE AND ECOLOGICAL MANAGEMENT IS A POSITIVE DRIVER FOR COMMERCIAL MORTGAGE PASS-THROUGH CERTIFICATES

MKT 2020-525M Mortgage Trust commercial mortgage pass-through certificates represent the beneficial interests in the trust loan portion of a USD682.0 million, 10-year, fixed-rate, interest-only mortgage loan. The mortgage loan is secured by the fee simple interest in a 1,034,170 square foot, 38-story office tower. The property is the third-largest office building in San Francisco by square footage and is certified LEED Platinum by the U.S. Green Building Council.

Fitch assigned it a property quality grade of 'A-'. On 26 February 2020, the commercial mortgage pass-through certificate was allocated an ESG.RS of '4+' for Waste and Hazardous Materials Management; Ecological Impacts. This was due to the LEED Certificate Platinum-certified collateral, which has a positive impact on the credit profile, and is relevant to the ratings in conjunction with other factors.

URBAN AND RURAL POPULATION IN 2018 AND 2050



Source: United Nations - Department of Economic and Social Affairs

Agriculture Exposed to Urbanisation and Food Insecurity

Lifecycle analysis and the responsible sourcing of construction material and products is also increasingly influencing urban construction, planning, and supply chains to avoid reputational damage and meet regulations. Property developers and homebuilders had been able to build residential, commercial and industrial property with limited restrictions and in the process destroyed wildlife and their habitat. They are now finding it increasingly difficult to obtain permits to build on greenfield land for development due to social resistance and governmental and local planning rules.

However, rising urbanisation and growing income levels inevitably increase the demand for construction materials, which contribute to rising levels of C&D waste and damaged ecosystems. According to the UN, 68% of the global population will be living in urban areas in 2050, compared to 55% in 2018. If this trend continues, despite the potential lower urbanisation rates caused by the Covid-19 pandemic, the future expansion of cities and towns will directly affect green spaces surrounding cities, farming land and all ecosystems.

Farming land is also being lost to soil degradation. Driven by agriculture and food industries' focus on yield since the 1950s, intensive farming continues to erode nutrient-rich soil. Practices such as excessive tillage, mineral or synthetic fertiliser use and monocropping are affecting the long-term productivity of existing arable land – currently

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covering 11% of global land, while 26% of global land is dedicated to grazing land – and causing further conversion of grasslands and forests to agricultural land. Livestock farming is also responsible for forest loss, with the UN's Food and Agricultural Organization (FAO) estimating that 91% of deforestation in Brazil between 1970 and 2003 was attributable to conversion to grazing land. Factory farming and animal welfare, zoonotic diseases, and antibiotic resistance are also concerns specific to livestock.

Ironically, the concerns around food supply not meeting demand that led to intensive farming practices are now resurfacing because of these same practices. The FAO reported that one third of the world's soil is now moderately to highly degraded. This is likely to worsen and have consequences for food security, agricultural revenue and economic development. It is also likely to change farming practices.

These concerns have already garnered support from governments, investors and issuers for stronger biodiversity and waste management within the agribusiness industry. Robeco are asking for entities that produce soy, cocoa or palm oil and companies that manufacture food to conduct biodiversity impact assessments of their operations and supply chains and achieve net zero deforestation by 2023.

Some producers have started to deploy "sustainable agriculture" practices to prolong their land use. This includes crop and livestock rotation and diversification; use of cover crops in off-seasons; livestock and crop integration; agroforestry practices; efficient, balanced use of organic and inorganic pesticides and fertilisers; advanced irrigation systems; and energy-efficient automated processes, machinery and technology.

Another important aspect of sustainable agriculture is waste. Agricultural waste is the second-largest contributor to total global waste, roughly 4.5 times larger than municipal solid waste. The main concerns are health and safety and biodiversity loss. The discharge of slurries and manure into water systems and bodies contaminate freshwater with bacteria, viruses and intestinal parasites. Discarded pesticides, fertiliser, herbicides, veterinary medicines, oil, batteries and horticultural plastics are all harmful for plants, beneficial microbes, pollinators, other terrestrial wildlife and aquatic ecosystems.

ECOLOGICAL IMPACT OF MANUFACTURING AND OPERATING INCIDENTS AND SPILLS

This waste- and biodiversity-related credit issue is relevant to issuers who may damage or destroy local ecosystems through their manufacturing and operating activities, which can result in regulatory action, lawsuits or loss of licences. These issuers are most often responsible for one-off incidents, such as cargo and plant spills, leakages and explosions, and recurring incidents, such as persistent contamination of local air, soil or water systems.

This credit issue does not cover poor management of resource consumption, waste or ecological footprint, which is detailed under Waste and Hazardous Materials Management and Ecological Impacts of Manufacturing Process/ Operations. It is possible that even if an issuer has strong biodiversity and waste-related management it may have been responsible for a major ecological incident that resulted in regulatory fines, permanent shutdown of operations by local, regional or national government, or large litigation payouts.

Sectors that are particularly exposed are mining, oil and gas (O&G) production, O&G refining and marketing, pipeline operators and utilities.

Relevance to Sector

Nuclear power generation is considered in some countries as the solution to meeting their emissions-reduction targets and supporting the transition to a net-zero economy. Often their support of nuclear power is for long-term energy security reasons and to maintain baseload electricity generation, which is the goal of some heavily coal-dependent EMEA emerging markets, such as Poland and Turkey.

While nuclear capacity is projected to rise in Asia, it is set to fall in North America and Western Europe. Societal views of nuclear power are normally posited as the cause of limited growth of capacity in these regions. Some of the concerns relate to health and safety concerns, as highlighted by incidents such as the Fukushima disaster, and this has led to tightened safety standards and consequently increased capital and operational investment requirements in recent years. The impact of nuclear fuel handling and decommissioning costs, which have risen sharply in some countries in recent decades, are also

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public concerns. While the majority of nuclear waste is low-level waste, 7% is intermediate waste – such as reactor components and graphite from reactor cores – and 0.2%–3% is high-level waste that requires dedicated storage facilities, according to the World Nuclear Association. The combination of these social and waste and biodiversity-related factors, competition from renewable energy, the high cost of new nuclear plants, and lengthy construction delays is limiting private-sector investment. Government support is generally required for most new nuclear development.

Water Pollution Is Synonymous with O&G Sector

The pressure on energy issuers from society, investors, and governments to decarbonise their operations is fairly new. Issuers have focused more on the carbon emissions and intensity of their products but are now setting emissions-reduction targets for their operations as well. The emphasis on emissions and energy-management often means that biodiversity and waste management is overlooked. The exception is when there is a major operational incident.

Examples of such incidents are the oil spill in the Gulf of Mexico involving BP plc and subcontractors Transocean, Inc. and Halliburton Company that received global coverage that lasted many months and the diesel spill caused by the collapse of a storage tank owned by a subsidiary of PJSC MMC Norilsk Nickel in May 2020, which resulted in large regulatory fines, affecting operating costs and cash flow.

IMPACT OF OPERATING INCIDENTS ON CREDITWORTHINESS

Due to weakened support posts, a rusty storage tank owned by PJSC MMC Norilsk Nickel collapsed and caused a huge diesel fuel spill that contaminated rivers, lakes and the Arctic ocean. The environmental damage was assessed at USD2.1 billion by the national regulator, and USD2 billion was ultimately claimed from the Russian miner Norilsk Nickel.

In response to the diesel spill, Fitch revised the company's ESG.RS for the Waste & Hazardous Materials Management; Ecological Impacts to '4' from '3' on the 14 August 2020. The operating incident highlighted the potential for future fines and increased capital expenditure requirements to prevent future accidents.

The diesel spill could have heightened the negative effect of the coronavirus pandemic on the Krasnoyarsk Region's revenue, particularly on corporate income tax (CIT). CIT is an important revenue source for the region, accounting for 47% of tax revenue in 2019, and it is the most volatile tax revenue item during a downturn. PJSC MMC Norilsk Nickel is among the region's largest taxpayers. The company's profit declined as a result of the spill, which could lead to a lower tax base, and ultimately lower tax proceeds for the region.

After the incident, Fitch changed the ESG.RS for the factor 'Biodiversity and Natural Resource Management' to '4' from '3' for the Krasnoyarsk Region to reflect the potential negative impact on the region's economy and ultimately on its budgeted revenue, which could harm the creditworthiness of the region.

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Waste and hazardous material management is also relevant to O&G exploration, development, and production. Drilling muds, cuttings and other materials, such as tank bottoms, are either buried in waste pits, landfills, or injected underground in slurry form. These methods can generate harmful leakage if liners are not used or if management practices are poor. The consequences can be contamination of aquatic ecosystems, soil degradation, irreversible wildlife loss, and reduced agricultural and industrial productivity.

Other eco-friendlier approaches to disposal and treatment of non-hazardous and hazardous wastes are landfarming and thermal treatment technologies, which demonstrate the O&G producer's commitment to mitigating their environmental impacts. The separation and reuse of waste material is also a strong signal of good biodiversity and waste management. It is possible to create other products, such as compost, and construction materials, such as binding materials for roads, concrete, and bricks, from this waste. With the construction industry being responsible for a huge amount of waste generation, reuse of waste from other industries can contribute towards more responsible resource consumption and production.

Environmental Concerns Affect Midstream, Downstream and Chemicals Issuers

The number of oil spills is decreasing, and in the past the largest oil spills were predominantly caused by tanker accidents. One exception was the Kolva River Oil Spill near the town of Usinsk in north-eastern Russia in 1994. A dike collapsed due to severe weather conditions, and released 88 million gallons of oil that had accumulated due to a corroded pipeline, causing huge damage to local wetlands.

According to analysis by the Center for Biological Diversity, there have been nearly 8,000 "significant" pipeline incidents in the US involving hazardous liquids between 1986 and 2013, which have resulted in more than 500 deaths and over 2,300 injuries, and nearly USD7 billion worth of damage. Roughly 70% of such incidents are attributed to excavation damage, corrosion or equipment failure. There were less gas distribution, transmission and gathering incidents than pipeline incidents between 2010 and 2019, according to FracTracker Alliance (3,978 and 2,320 incidents, respectively).

Pipeline operators deploy advanced machinery and technology to monitor seismic activity and subsistence; detect spills and leaks; identify corrosion and other damage; control pipeline pressure, temperature and flow rates; and remove debris from the walls. While these investments minimise the risk of oil spills and gas leaks, societal and regulatory resistance can delay, suspend or cancel new pipeline developments. Indigenous communities, local population and civil society groups campaign against pipeline projects on the grounds of damage to wildlife habitats and sacred sites, and contamination of municipal water sources, such as with the Dakota Access Pipeline. These protests and accompanying lawsuits can lead to rescinded permits and costly project shutdown and delays. This is also the

WHEN ENVIRONMENTAL AND SOCIAL ISSUES AFFECT PIPELINE OPERATORS

Enbridge Inc.'s 'BBB+' rating was affirmed on 12 April 2020. The company was experiencing opposition to its line 3 pipeline upgrade and expansion that moves tar sands oil from Canada to the midwestern US. First Nations communities and environmentalists protested based on the grounds of indigenous land rights and biodiversity concerns.

Enbridge Inc.'s approach to dealing with protesters has been more civil than other pipeline operators, such as confrontations over the Dakota Access pipeline in 2016. However, there was still litigation and social resistance to this project.

The company was allocated an ESG.RS of '4' for Exposure to Social Impacts due to the social resistance to their major projects or operations, including those in Minnesota and Michigan, causing delays and increased costs. These circumstances are generally viewed as having a negative impact on the credit profile and the score is relevant to the rating in conjunction with other factors.

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DECOMMISSIONING SERVICE INDUSTRY BENEFITTING FROM RISING SHUTDOWN COSTS

As of October 2020, 447 nuclear reactors were in operation globally. Of these, around 70% are over 30 years old, and a quarter are over 40 years old. According to estimates by the IEA, between 200 and 400 reactors are likely to be shut down by 2040, with 182 reactors already in permanent shutdown. More than half of these are in western Europe, but other countries, such as Japan, also have a substantial numbers of reactors in shutdown, where the long-term status of these plants remains uncertain. deforestation from the Brazilian government.

Only 21 reactors have been decommissioned worldwide, and therefore there is limited experience of the decommissioning process and costs. A recent OECD survey pointed to economies of scale with regard to the power capacity of reactors, with costs ranging from USD0.83 million–1.28 million per MW for reactors of 500–600 MW capacity, or USD0.21 million–0.59 million per MW for reactors of around 1100 MW capacity.

The costs of decommissioning are provided for via many different models across countries, with no single method predominating. In the US, a surcharge is applied to all generation from nuclear sources to cover future decommissioning costs, whilst in Germany, the owners of domestic reactors Energie Baden-Wuerttemberg AG (EnBW) (BBB+/Stable), E.ON SE (BBB+/Stable), RWE AG (BBB+/Stable) and Vattenfall AB pay into a state-owned fund to meet the costs of decommissioning and waste management in advance. In the UK, the state meets the costs of decommissioning existing plants and managing waste, but has set up a nuclear decommissioning fund for new nuclear projects.

In some cases operators are responsible for residual unfunded costs, whereas in others this falls to the state. Ultimately it is important that operators comply with jurisdictional requirements, and from the state's perspective that these ensure the waste is managed, and the operator remains solvent so that the full burden doesn't revert to the state.

Definitions of 'decommissioning' also vary significantly and can include 'interim storage' for decades (which significantly affects the discounted value of future cost provisions). Germany has set aside EUR38 billion (USD45 billion) to decommission 17 nuclear reactors, but the UK Nuclear Decommissioning Authority estimates that clean-up of the UK's 17 nuclear sites will cost EUR109 billion–250 billion (USD129 billion–296 billion) over the next 120 years. France has set aside EUR23 billion (USD27 billion) for decommissioning its 58 reactors, but the total cost is forecast to be nearer to EUR 54 billion, with EDF funding extra costs as they arise.

Given the age of the global nuclear generation fleet, the need for decommissioning services is set to rise significantly over the next few decades and, with the incidence of early decommissioning in countries such as Germany, this is likely to benefit entities operating in the decommissioning service industry.

case with any major incidents, such as gas leaks or fires, at refineries and chemical plants.

Strong environmental and social impact assessments by energy and chemical companies can reduce operational, regulatory and reputational risks. Stakeholder engagement is equally important. More recently, investors are demanding more transparency, better governance and business strategy aligned with a 2◦C warming scenario. Kinder Morgan, Inc., a US midstream energy company, had two investor-proposed resolutions passed in 2018. One resolution requested a sustainability report to be published before December of that year and the other resolution asked the company to undertake a 2◦C warming scenario analysis and disclose how it is preparing for a low-carbon economy, both of which the company has delivered on.

WASTE AND LIFECYCLE MANAGEMENT OF PRODUCTS AND SERVICES

ESG considerations are widely incorporated into product design and lifecycle management. As well as social issues – such as identification and elimination of hazardous substances in consumer products – the environmental performance is often also studied at each stage of the product's lifecycle. For instance, lifecycle assessments and lifecycle engineering performed by automakers have resulted in lightweight materials being incorporated in the construction of cars with the purpose of reducing carbon emissions and fuel consumption for vehicles.

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Carbon emissions and energy management have been the focus of investors' scrutiny. However, investors are also looking more closely into issuers' resource consumption and sourcing (resource sourcing is covered under Ecological Impacts in Supply Chain). Once an issuer demonstrates a clear commitment to reducing the lifecycle ecological impacts of their products and discloses a corresponding comprehensive, long-term roadmap, investors will then consider the financial implications for the issuer.

Fitch analysts also analyse the product design and lifecycle management of issuers. Waste and Lifecycle Management of Product and Services is concerned with the inclusion of environmental considerations during the lifecycle of a product or service. This credit issue focuses on packaging, distribution, intensity of resources used during the lifecycle and other environmental factors that may occur during usage or at end-of-life.

Environmental externalities in the production process are covered under Waste and Hazardous Materials Management and Ecological Impacts of Manufacturing Process/ Operations, and Ecological Impact of Manufacturing and Operating Incidents and Spills. Environmental externalities in the supply chain are covered under Ecological Impacts in Supply Chain.

Waste and Lifecycle Management of Product and Services is relevant to automotive manufacturers, auto suppliers, building materials, building products, consumer products and pharmaceuticals.

Relevance to Sector

Countries, regions and cities are responding to the increasing competition for resources, rising waste accumulation, and the scrutiny of developed markets exporting their waste treatment and disposal. They are developing legislation and recycling targets that require regional and local governments, businesses and society to reduce their material and product consumption and improve their recycling rates.

According to a report released by the Principles for Responsible Investment in 2019, over 60 countries have introduced bans and levies on plastic packaging and single-use waste. Additionally, several Asia-Pacific countries have or are soon-to-have partial or full bans on plastic waste imports. This is due to concerns regarding exported waste not being sufficiently recyclable or falsely labelled, which causes landfills to grow and rising levels of contamination, pollutions and fire incidents. China imposed an import ban on most domestic recyclables in 2017 after importing two thirds of the world's plastic waste in 2016. Such legislation and import bans are already having a significant effect on the product value chain and this is likely to intensify as plastic waste is projected to double between 2015 and 2050 based on current production and waste-management trends.

Electronic waste is also a major area of focus for APAC countries – as consumers become more affluent, demand for electronics increases exponentially. The regional average for electronic waste generation was 10 kg per capita in 2015. Hong Kong consumers produced the highest amount of electronic waste per capita at 21.7 kg, followed by Singapore (19.95 kg) and Taiwan (19.13 kg). Cambodia (1.10 kg), Vietnam (1.34 kg) and the Philippines (1.35 kg) were at the lower end of the scale. In recognition of high levels of electronic waste per capita, Hong Kong introduced a formal levy on such waste in 2016, with producers expected to cover the cost of recycling.

Other tools used by governments to reduce waste are increasing landfill taxes. To control the size and number of landfills in the UK, the government's landfill tax for businesses rose from GBP7 per tonne in 1996 to GBP94.15 per tonne in 2020. To encourage recycling of industrial waste, US authorities charged an average of USD30 per tonne to recycle waste in 2017 compared to USD50 to send to the landfill and USD65 to USD75 to incinerate it.

Auto Manufacturers Pioneered Life Cycle Assessments but More Still Needs to be Done

Lifecycle management in the auto industry has been driven by legislation on end-of-life vehicles (ELV) across jurisdictions including the China, EU, Japan and Korea. For example, the end-of-life Vehicles Directive introduced in 2000 in the EU imposed reuse, recycling and recovery targets for passenger cars and light goods vehicles on EU member states and EFTA countries. In response, 93% of parts and materials were reused and recovered and 87% of parts and materials were reused and recycled in 2018.

Before such legislation, lifecycle resource consumption and sourcing, energy use and emissions were already

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assessed by automakers. Automakers quantify the volume of raw materials required to build their individual models, the amount of virgin and recycled materials embedded in the design, power use in production, car fleet emissions, energy required for dismantling and recycling, and the quantity of waste generated, recycled and reused. Automakers will then run a process known as lifecycle engineering to identify the optimal design to minimise the environmental impacts across all stages of their vehicles' lives. The main benefits to automakers are a more secure and responsible supply chain, lower cost per unit, and a larger and wider customer base.

Toyota, for instance, has improved the ecological footprint of some of their models through comparing current models to their predecessors throughout their lifecycle, covering materials, production, use, maintenance, and end of life. At each stage, they determine the amount of resource and energy consumed and emissions generated. Toyota also looks at the sourcing of resources and portion of non-recycled and recycled materials, including recycled products, recyclable plastics and ecological plastics.

Despite this progress, automotive manufacturers are being pushed for more stringent assessments of vehicles' ecological footprints. These stakeholders are concerned by resource consumption, plastic use and disposal, and circularity, all of which have improved. The rising popularity of electric vehicles should also contribute to less costly and complex recycling due to having fewer moving parts in its drivetrain compared to an internal combustion engine. Tesla has said that its cars have 17 moving parts in their drivetrain compared to as many as 2,000 moving parts in a conventional drivetrain, according to Ernst & Young.

The rising consumption of cobalt, lithium, nickel and manganese attributed to electric vehicles comes with high biodiversity risks. Investors are also concerned by human rights issues related to these minerals. For example, the production of nickel, a toxic metal, is located in regions with high water stress. It is also an energy-intensive process and consumes chemicals such a sulphuric acid and ammonia, which increases the threat to local ecosystems. The environmental concerns linked to these metals – combined with the large projected increase in demand for rare earth metals in the coming decade, which could cause supply shortages – emphasises the need for lifecycle management and circularity factors to be assessed for automotive manufacturers, electronics issuers, and the information and communication technology sector.

Litigation and Regulation Hazards in Construction Sectors

The use of hazardous materials is also covered by legislation related to lifecycle management. End-of-life vehicles legislation, such as the EU End-of-life Vehicles Directive, asks automakers to limit the use of hazardous substances in vehicles and to reduce them as much as possible to mitigate the risk of contaminating the environment and avoid the need to dispose of hazardous waste. Similar regulation also affects the construction material and products industries.

The construction industry generates hazardous waste including asbestos-containing materials, lead-containing materials, solvents, chemicals, petroleum-derived products, dust, electronics, medical waste and other materials contaminated with hazardous waste. These materials require special treatment and disposal, and in some jurisdictions are highly regulated and even banned. Asbestos was prohibited as a construction material in many countries from the 1970s due to being harmful to humans and causing serious and fatal lung diseases. Companies have been subject to asbestos-related compensation claims and litigation, giving rise to significant outstanding liabilities and continual cash outflow lowering operating cash flow and financial flexibility.

Building material use is also affected by environmentally conscious customers. Customers are also driven by regulations on the energy-efficiency of buildings, which requires better thermal performance, lower electricity and heating consumption, and reduced lifecycle ecological impacts. These impacts are from construction material extraction; design and construction of materials; design and manufacture of construction products; maintenance and renovation; and demolition and recycling.

Construction materials and products issuers are now looking at diversifying their range of products and researching and selling more sustainable construction materials to maintain a competitive advantage. For example, HeidelbergCement AG produces alternatives to traditional cement with a smaller carbon dioxide footprint, PPG Industries, Inc., a US-based company, develops sustainable paints and coatings, and Owens Corning supplies insulation.

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Circular Economy in the Consumer Products Sector

The addition of more ethical and sustainable products to the range is also important to the consumer products sector. This requires lifecycle assessments and the inclusion of circular economy considerations in the design, development or retail of their products.

Adidas AG and Nike, Inc have been competing on ESG grounds for many years. Adidas worked with Parley for the Oceans in 2015 to create a shoe made of ocean waste and illegal deep-sea gill nets. Its success led to the production of more than five million pairs of shoes containing recycled plastic waste in 2018 and subsequent goal of a further 15–20 million pairs of shoes made of recycled plastics in 2020. Furthermore, it plans to make more than 50% of its products using polymer from recycled plastic waste and to reach a goal of 100% from 2024. Nike reached its target of sourcing 100% of its cotton sustainably in 2020, exceeded its 20% reduction in freshwater in textile dyeing and only just didn't meet its 100% target for meeting Nike's Restricted Substances List (RSL) of restricted chemicals.

Consumer preferences toward "green" or ecologically friendly products has been driving the sustainability strategies at Adidas and Nike, as have reputational risks relating to past labour practices. This is also the case for other consumer products companies who are driven by carbon-reduction targets and laws regulating environment pollution. Unilever NV, a home care and beauty and personal care business, identified ingredients as the biggest contributor to the lifecycle carbon emissions of their cleaning and laundry products. Their response is to finance research into low-carbon chemicals, thus reducing their consumption of fossil-fuel derived chemicals. Unilever are also investing in biodegradable and water-efficient product formulations and halving their virgin plastic consumption by 2025.

Hazardous Materials Handling and Pollution are Concerns for Pharmaceuticals

The pharmaceutical industry benefits from lifecycle management. While global medical waste is much lower than other waste categories, some pharmaceuticals are toxic, flammable, corrosive or radioactive, and so are defined as hazardous materials and are often regulated.

Hazardous waste can be a high percentage of an entities' total waste. For example, 35% of total waste generated by AstraZeneca PLC in 2020 was hazardous waste – 10,500 tonnes of hazardous waste compared to 19,762 tonnes or non-hazardous waste. Furthermore, the conversion rate of raw materials into products is low, although raw material consumption is small compared to other sectors.

As part of its efficiency-improvement efforts, AstraZeneca measure the ecological impacts of its products and processes during the following stages: active pharmaceutical ingredient (API) production and formulation; device production; packaging; distribution; patient use; and disposal. They conduct environmental analysis of medicine development projects together with process safety and occupational toxicology assessments. AstraZeneca also consider circularity opportunities across its product chains. It aims for 90% of API syntheses to meet its internal resource efficiency target by 2025.

ECOLOGICAL IMPACTS IN SUPPLY CHAIN

Investors had previously mostly ignored social and environmental concerns in supply chains, partly due to ESG analysis focusing on an issuer's direct operations and products, and partly due to the often-complex networks of suppliers and the limited ESG data collected from suppliers.

However, issuers are being pushed to scrutinise their suppliers and to disclose more on their ESG governance and practices within their supply chain. Investors are concerned by unknown ESG risks in an issuer's supply chain that can affect the valuations of their own securities and the investment performance of their portfolio. Controversies within the supply chain of investee companies can lead to reputational damage and to ESG-conscious clients moving assets out of investors' portfolios.

Ecological Impacts in Supply Chain is a biodiversity and waste-related credit issue arising from the sourcing of raw material and components contributing to significant resource consumption, waste generation, environmental damage or biodiversity loss. It addresses issues associated with environmental management of and ecological damage (e.g. deforestation, water pollution) by suppliers through their operational activities.

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Relevance to Sector

Water-related credit issues are widely viewed as relevant to the food and beverage industry, which we cover in the report ESG in Credit – Water Issues. The report focuses on two water-related issues within Fitch Ratings' ESG Relevance Score Framework and scoring templates: water and wastewater management, and water resource and management. It contains information and case studies on floods, droughts, competition, quality and pollution, infrastructure, and supply chain.

Solid waste management is also relevant to the food and beverage industry. According to the Boston Consulting Group in 2018, the world is wasting USD1.2 trillion tonnes of food each year, equivalent to one-third of the total food production. They estimate that food waste will rise to 2.1 billion tonnes in 2030. With 24% of global greenhouse gas emissions coming from agriculture, forestry, and other land uses, based on figures by the UN Intergovernmental Panel on Climate Change (IPCC), significant emissions reductions can be made through better solid-waste and land-use management. It can also help the 703 million–729 million people projected by the World Bank to be in extreme poverty by the end of 2020, a rise from 689 million people in 2017.

The majority of food waste comes from retail businesses and households through overstocking, cosmetic defects, stringent "sell-by" dates, damaged goods, oversized portions in restaurants and homes, and poor planning. Governments are taking a variety of actions to curb the amount of food waste. In 2016, France banned the disposal of food waste by supermarkets and incentivised food donations. Pakistan has had a one-dish rule for several years, limiting the variety of food that can be served during weddings. Similarly, China has followed suit launching the "Clean Plate Campaign", which encouraged the Wuhan Catering Industry Association to request restaurants to limit the number of dishes served to customers. More than 100 food businesses in the UK have signed a pledge to halve food waste by 2030.

Even before food reaches these food retail businesses, the FAO estimates that 30%–40% of food produced is lost. The main causes are: bad weather, overproduction, processing problems, dumping and unstable markets, cosmetics concerns, and poor supply chain infrastructure and efficiency. Due to their exposure to these causes of food waste, food retail businesses are under pressure to manage the ecological impacts in their supply chain. These hidden biodiversity and waste risks come with reputational and regulatory risks but strong ESG management can bring more secure and sustainable supply chains, lower costs and better-quality produce.

Food & Beverage Industry Exposed to Refinancing Risks from Deforestation

Deforestation, animal welfare and depleting seafood stocks are major issues that companies are addressing in their supply chains and investors are managing in their portfolios. Several producers of beef, palm oil and soy have been the target of large investor groups who have publicly expressed their concerns and engaged issuers across the forest-risk commodity value chain.

Investor engagement on palm oil sourcing and related deforestation in southeast Asia has taken place over many years. The most recent collaboration was instigated by the Brazilian president Jair Bolsonaro opening up the Amazon to miners, farmers and loggers. The subsequent rise in the deforestation rate led to the creation of a group of institutional investors with more than USD17

PALM OIL PRODUCER LOST RSPO CERTIFICATION AND INCOME

When accused of illegal deforestation of forest and peatland in Indonesia in April 2016, IOI Group Berhad was suspended from the Roundtable on Sustainable Palm Oil (RSPO). Twenty-seven buyers of their products swiftly ceased trading with the company, including Cargill Incorporated, Kellogg Company, Mars, Incorporated, Nestle SA, and Unilever NV. The financial consequence for IOI Group Berhad was withheld orders and negative net income in 2Q16.

The suspension was lifted six months later after IOI Group Berhad submitted plans to improve its ESG practices. However, some buyers did not resume their relationships with the company for several months.

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trillion in assets under management. They issued two open letters, one of which asked companies producing commodities in the Amazon to publicly adopt a no-deforestation policy. The other open letter followed in December 2019, signed by a mix of food retail companies and pension funds, calling for a commitment of no soybean-related deforestation from the Brazilian government.

In response to evidence of increased fire clearing in the Amazon in 2020, a group of 10 investors, eight of whom signed one or both of the 2019 letters, met with the Brazilian government in July 2020 and secured an agreement from the vice president to halt fires for 120 days. One of these investors, Nordea Asset Management, has further announced that it is divesting from JBS S.A. (BB+/Stable), the world's leading meat processor, having already suspended investing in Brazilian sovereign bonds last year.

As well as the associated biodiversity and water risks, livestock farming brings concerns around animal welfare and antibiotic resistance. Under the auspice of the FAIRR Initiative, another group of investors that represent USD30 trillion in assets under management are collaborating on ESG risks in intensive livestock production. The FAIRR Initiative has evaluated 60 of the largest listed global meat, dairy and aquaculture companies against ten ESG factors, including deforestation and biodiversity loss, waste and water pollution, antibiotics, animal welfare, and sustainable proteins. The results of the assessment find 82% and 68% of companies were in the highest risk category for biodiversity and deforestation, and animal welfare issues, respectively.

Such investor collaboration and government influence demonstrate the increasing importance of strong water, biodiversity and waste management in the operations and supply chain of end-product producers and downstream businesses (restaurants). Along with consumer preference for certified agricultural investments (such as Fairtrade, Forest Stewardship Council, Rainforest Alliance, UTZ, Marine Stewardship Council), these factors are likely to resonate up the supply chain and increase demand for agricultural producers who implement "sustainable agriculture" practices. Carrefour SA, for instance, is targeting EUR4.8 billion of organic products by 2022, doubling the revenue spent in 2019. They are also developing financing solutions to help farmers transition to practices that support health and nature.

As mentioned in section Waste and Lifecycle Management of Product and Services, building materials, building products and consumer products are also affected by consumer preference for more eco-friendly products. As this trend continues and technology develops, more downstream issuers will look to source increasingly sustainable materials and products.

BIODIVERSITY AND NATURAL RESOURCE MANAGEMENT IN ECONOMIC DEVELOPMENT

Biodiversity and Natural Resource Management in Economic Development is related to the management of natural resources and potential damage to entire ecosystems and biodiversity overseen by local, regional and national governments.

This differs from the other four biodiversity and waste-related credit issues as those credit issues relate to issuers who are not responsible for protecting ecosystems but are required to maintain operating licences to work within ecosystems or are subject to environmental regulation and penalty systems that protect biodiversity and wildlife.

Where credit-relevant, Biodiversity and Natural Resource Management in Economic Development may reflect the management of an issuer's diverse biological systems to ensure the capacity of underlying ecosystems to provide a stable and sustainable supply of essential goods and services without potentially decreasing the amount of natural resources available for future use. Substandard natural-resource management will impair an issuer's future economic and revenue growth prospects, and the operations and financial performance of all issuers operating in the ecosystem will be affected.

Strong biodiversity and natural-resource management minimises natural capital depletion, which can affect short-term and medium-term fiscal strength. Local, regional and national economies implement laws to protect air, soil and water and to protect ecosystems against destructive development and natural-resource extraction. Protected areas and species, restoration projects, invasive species control, environmental planning and frameworks, and education programme are being implemented to protect and regenerate ecosystems and wildlife. Some countries are incentivising biodiversity practices through subsidy schemes or tax relief (see box

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'Uruguay Determined to Reverse Land Degradation with Incentives').

Relevance to Sector

Countries, businesses and people have relied on ecosystem services – the processes and outputs (such as fresh water, food, fuelwood and medicines) that nature freely offers to support economies – for development and growth. The reliance on natural capital remains high, with more than half of the world's GDP moderately or highly dependent on nature and its services, according to the World Economic Forum.

The rising demands for natural capital as a means for economic development, rising income levels, and demographic growth has caused significant natural capital losses. The Global Footprint Network has calculated the consumption rate of natural capital – the amount of land and sea required to produce the quantities consumed. Global natural-asset consumption has exceeded natural asset regeneration since the 1970s, with consumption currently at 1.6 times more than the Earth can create.

This unsustainable consumption of natural resources is likely to continue. Public finance and private investment have been insufficient thus far to protect wildlife and habitats. The OECD reported that global biodiversity finance was roughly USD78 billion–91 billion per year on average between 2015 and 2017 – compared to USD500 billion per year of governmental expenditure being spent on support for activities that are potentially harmful to biodiversity. A continuation of the current, uncoordinated, global approach to protecting ecosystems will support net positive funding for activities responsible for biodiversity destruction. The pending post-2020 global biodiversity framework by the Convention on Biological Diversity may help redirect more capital towards the funding of biodiversity preservation. The framework is expected to be adopted by signatories to the convention.

How the continual loss of natural capital, and hence biodiversity-related risks, affects credit assessments can vary. Soil degradation and desertification lowers the agricultural production and subsequently reduces the tax revenue for local, regional and national governments. This can negatively affect the trade balance of exporting countries and local currency. The lower global production of agriculture can increase global food prices and volatility, which can be particularly burdensome for countries with high household spending on food or high food commodity imports. The economic impact negatively affects GDP, worsens current account balances and increases inflation.

When the UNEP Finance Initiative and the Global Footprint Network collaborated on their E-RISC (Environment Risk in Sovereign Credit Analysis) project, they reviewed the ecological footprint and biocapacity of five countries between 1961 and 2008 to see how they may affect sovereign credit risk. The conclusion was market participants should consider ecosystem degradation and climate change impacts in the short (zero to five years) to medium-term (five to ten years). Across Brazil, France, India, Japan and Turkey, the trade balance can change by 0.2%–0.5% of a nation's GDP should there be a 10% variation in commodity prices. Furthermore, a 10% reduction in the productive capacity of renewable, biological resources could lead to a reduction of at least 1%–4% of a nation's GDP, assuming consumption levels remain the same.

A closer look at the performance of individual countries demonstrates the uneven impacts of biodiversity loss on trade balance. France and Turkey, for instance, both had a larger ecological footprint than their biocapacity in 2008. However, when there is a 10% reduction in the productive capacity of their ecological assets, the percentage change in trade balance compared to their GDP is roughly -1% and -4% for France and Turkey, respectively.

Climate Policies Are Causing Disruption to Fossil Fuel Exporters

Coal power is seen as a critical underpinning of economic growth in many Asia-Pacific countries because of its association with energy-intensive industries such as steelmaking. It is also a key export commodity for fuel in major economies such as China; Australia is the second-largest exporter of coal after Indonesia and specialises in production of low-sulphur and ultra-critical coal, which is increasingly demanded in Asia as emissions standards tighten. We expect demand for the metallurgical coal used in steelmaking to grow alongside the pandemic recovery of the Asia-Pacific steelmaking sector.

Exports of coal, gas and other fuels are key in supporting local economic growth and public finance tax revenues in many resource-rich regions, so policies to limit emissions from energy consumption or fuel combustion can be highly disruptive.

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For instance, tightening emissions standards and falling demand has led to the bankruptcies of several North American coal miners servicing the European and Chinese markets.

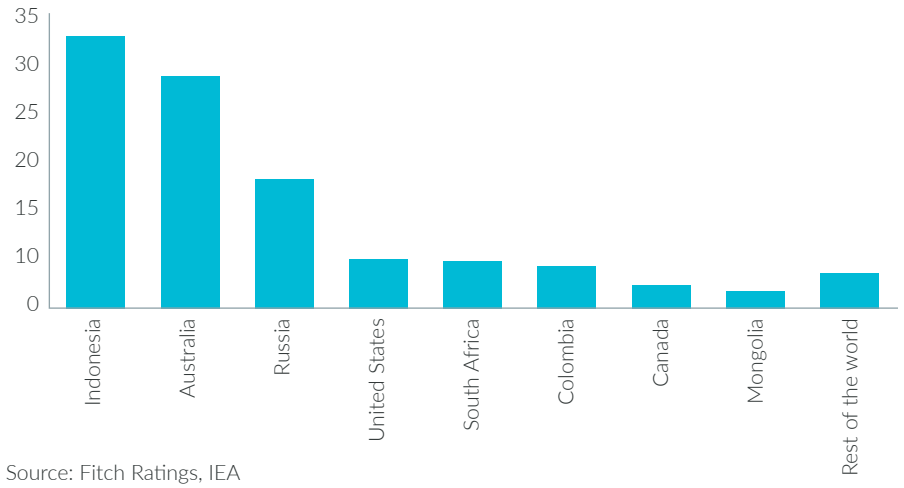
The 20 sovereigns with the highest ratio of net fossil-fuel exports-to-GDP had a median net downgrade of 1.6 notches between 2015 and 2020. Two defaulted and a further three were downgraded by at least four notches in this time. A simulation on Fitch's Sovereign Rating Model (SRM) suggests the direct effects of these stranded assets could lead to the SRM output falling by around one rating notch by 2040 and two to three notches by 2050 for a large oil exporter.

Natural Capital Losses Affect Local Industries and Economies

The US's EPA notes that nutrient pollution, such as from excess fertiliser use, negatively affects the US economy through lower contribution from several sectors and local economies that are dependent on clean water. Tourism losses are nearly USD1 billion each year, mostly from fishing and boating activities. The fishing and shellfish industries are affected by algal blooms killing fish and contaminating shellfish, reducing the industries' revenue by tens of millions of dollars. The EPA also highlights the rising treatment costs caused by nitrates and algal blooms. They point to Minnesota, where nitrate-removal systems caused supply costs to rise from 5–10 cents per 1000 gallons to over USD4 per 1000 gallons.

INDONESIA AND AUSTRALIA DOMINATE COAL EXPORTS

(% World exports in 2019)



Source: Fitch Ratings, IEA

FOOD AND TIMBER DEMAND DRIVES EXCESSIVE LAND CLEARING

The leading cause of forest loss is commodity production – primarily beef, palm oil, soy, and timber or pulp. Forest land conversion for commercial agricultural use normally results in deforestation (i.e. permanent loss), while logging for timber and wood products can cause temporary loss with the possibility of future regrowth. However, illegal logging, which is common in tropical regions and Siberia, tends to have a more permanent impact on forests, as does agriculture.

Palm oil is the most commonly used vegetable oil in the world and grows exclusively in tropical regions. The World Wide Fund for Nature estimates that nearly 50% of all packaged products – food, toiletries, and cosmetics – contain palm oil. It is also the main forest-risk commodity in southeast Asia and the primary cause of area loss for the Borneo rainforest, which spans Indonesia, Malaysia, and Brunei.

Deforestation in Borneo has been rapid; 30% of the forest's land area was lost between 1975 and 2015, and the World Wildlife Foundation estimates that another 22 million hectares, or around half of what still remains, could be lost by 2030. Fire is also the main clearing method in this region, causing seasonal haze and air pollution that regularly stretches into the urban centres of Singapore and Kuala Lumpur in August to October.

For further details, see *Fitch's* report Financial Sector Confronts Deforestation as a Key ESG Risk.

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URUGUAY DETERMINED TO REVERSE LAND DEGRADATION WITH INCENTIVES

Uruguay is dependent on its agriculture sector. The sector is responsible for 12% of total GDP and over 70% of total exports. It also supports the industrial sector: half of all industrial production is based on food processing or the refining of agricultural products, such as leather. Due to the country's reliance on the agriculture sector, the economy is exposed to environmental shocks to its export revenue and therefore its balance of payments.

The reliance on agricultural revenue has led to more intensified agricultural production and higher concentration of land ownership in Uruguay, which has increased urbanisation rates. At the same time, ecosystems have suffered from soil degradation, deforestation, invasive alien species, and water pollution from agrochemicals.

Uruguay has been credited for its strong energy, biodiversity and natural-resource management. It ratified the multilateral environmental agreement Convention on Biological Diversity in 1994 and two of its supplementary agreements: the Cartagena Protocol and Nagoya Protocol on Access and Benefit-sharing. Furthermore, Uruguay has adopted the Law on the National Protected Areas System (2000), Law on Responsible Fisheries and Promotion of Aquaculture and the Law on Land Management and Sustainable Development. They have created a list of ecosystems to protect, educational programmes in schools, and a framework for land-use planning with built-in biodiversity guidance. Uruguay is deciding national targets and corresponding action plan.

With large amounts of land held privately, financial tools have been created to provide incentives to protect the country's biodiversity and, by extension, its agricultural sector and economy. There are tax-exemption mechanisms for sustainable management of natural resources in protected areas. The government is working with UNDP in 2020–2022 to continue with their efforts to restore degraded land and create biological corridors to improve connectivity between protected areas.

According to the secretariat of the Convention on Biological Diversity, Uruguay's long-term energy policy and investment in renewable energy sources have placed the country second overall in South America in terms of environmental sustainability. However, data from Global Forest Watch reveal that there is more work to do. Between 2000 and 2019, the amount of tree cover in Uruguay decreased by 21%, and 6.4% of the total tree cover loss resulted in deforestation.

Effect on Credit

We identified that the impact of the biodiversity and waste-related credit issues can affect one of eight credit risks: asset quality and concentration; business profile and competitive position; macroeconomic performance; operational and cash flow; profitability; refinancing; regulatory and litigation; and reputation. These risks can influence credit analysis and rating decisions.

Asset Quality and Concentration Risk

Large exposures to high biodiversity and waste risks have financial implications for economies and entities. National, regional and local governments can be dependent on particular resources, industries or businesses. For instance Russia's Natural Resources and Environment Ministry estimated in 2019 that its oil, gas and other resources amounts to 60% of GDP.

Businesses can also be reliant on certain regions, resources (such as copper, soybeans, timber, rubber, gas, uranium), assets (such as land, mines, farms, rigs, buildings, plants, manufacturing facilities), regulated products or customer base. Antofagasta PLC, a Chilean mining company, is highly reliant on copper demand. Copper sales generated 82% of its 2019 group revenue. Furthermore, it has a concentration of mines in Chile with more than 40% of group revenue generated from its Los Pelambres mine. This leaves Antofagasta significantly exposed to biodiversity and waste issues in Chile, where a more diversified competitor may have an advantage through lower ESG credit risks.

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Biodiversity and waste issues can also be managed through high asset quality. Issuers that own assets – such as land, mines, facilities, buildings, vehicles– that demonstrate strong ESG practices and performances have the ability to create sustainable revenue and cash flow, and lower operating costs. Fitch considers buildings that achieve high-band green building certification as having a positive impact on credit profiles.

Business Profile and Competitive Position Risk

With more investors conducting ESG analysis, issuers avidly look to include more sustainable products in their range or to perform better on ESG due diligence. The purpose is to mitigate reputational risks and maintain "leader" status. Those that assess waste, biodiversity and other ESG issues in their operations and supply chain are likely to foresee future opportunities and risks, allowing for advanced planning and strategy adjustments to minimise cash-flow instability and operating costs.

Certain industries receive more in-depth scrutiny from investors due to their exposure to high ESG risks or breaching their screening policies, such as tobacco, gaming, defence and coal. The oil and gas industry is also receiving a lot more attention, due to the affordability of technological advancement in power generation and transportation. Issuers along the O&G value chain are better placed when installing strong ESG management and governance, developing a transition strategy to a low-carbon economy, and when engaging effectively with all stakeholders.

GREEN BUILDING CERTIFICATION PROVES CREDIT POSITIVE FOR STRUCTURED FINANCE

Fitch recognises the green credentials of the assets underlying commercial mortgage pass-through certificates. BBCMS Trust 2015-SRCH Mortgage Trust's commercial mortgage pass-through certificates were allocated an ESG.RS of '4' for Waste & Hazardous Materials Management; Ecological Impacts.

This commercial mortgage pass-through certificate has superior collateral quality. The loan is secured by the fee simple interest in three newly constructed, single-tenant office buildings in Sunnyvale, California. The three buildings hold a LEED-Gold designation. In combination with other factors, the green credentials of the underlying assets had a positive impact on the rating decisions.

Macroeconomic Risks

When natural resources are depleted or at risk of being stranded, this can have implications on resource-reliant governments, business and communities. While unsustainable extraction and production of natural resources can generate significant wealth in the short term, they are likely to lower exports, tax revenue and employments in the long term.

Governments that manage their natural resources and biodiversity effectively and companies that manage their land assets responsibly improve the long-term prosperity of economies and businesses. Plentiful water supply can avoid water restrictions on agricultural, industrial and power consumers. Sustainable farming practices can prevent the permanent loss of land-based and marine ecosystems. Environmental regulation can minimise the negative contributions of air pollution to physical climate risks, deterioration of land, extinction of species, decay of building materials and human health problems.

The constant supply of natural resources that come from the strong management of rich and stable ecosystems, and the subsequent, uninterrupted and higher productivity from businesses maintains economic activity and supports local, regional and national economic growth. It can also reduce cyclicality in commodity price and production that causes economic and financial volatility.

Operational and Cash Flow Risk

Similarly to business profile and competitive position risks, cash flow from operations can be affected by consumer preference for eco-friendly business strategy and products. Manufacturers and retail businesses can also experience less revenue due to disruption in the supply chain. Unusable land, lower crop yields and depleted mineral sources affects the productivity of suppliers, which may lead to issuers seeking additional suppliers to meet customer demand. The combination of lower productivity and loss customers will affect cash flow for suppliers too.

Another factor that can affect cash flow is regulation and litigation.

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LEGACY ASBESTOS LIABILITIES FOR MANUFACTURER CONTINUES

The net asbestos liability of ITT Inc., an industrials company, has decreased to USD384 million at 31 March 2020 from USD747 million at end-2014 due to fewer projected cases, lower average settlement values and an insurance settlement of USD52.5 million in March 2020. The liability is expected to continue to decrease as the number of potential claimants declines. The after-tax cash outflow for asbestos claims was USD21.6 million in 2019, USD40.8 million in 2018 and USD45.3 million in 2017.

ITT Inc. had an ESG.RS of '4' for Waste and Hazardous Materials Management, Ecological Impacts on 23 July 2020 due to its significant remaining outstanding asbestos liabilities of USD805 million as of 31 March 2020. While the net liability has reduced yoy, asbestos-related payments have been a continual cash outflow, lowering operating cash flow and financial flexibility.

Profitability Risk

Poor management of waste and hazardous materials and the resulting ecological impacts can lead to rising costs and lower profit margins if landfill taxes increase, new regulation is introduced, or existing regulation becomes more burdensome. On the other hand, strong management can reduce raw-material consumption and increase material reuse, which improves profit margins. Robotics and automation technology can further save on input costs – raw materials, water and energy – which can bring advantages through competitive pricing.

While lower resource consumption and less demand for ecosystem services is accomplished through better waste management, the benefits can be lost through indirect biodiversity loss that reduces supply through lower agriculture productivity. The reduced yield can increase the price of agricultural ingredients and operating costs.

Another factor that can affect profitability is regulation and litigation (see section on Regulatory and Litigation Risk).

Refinancing Risk

Growing ESG considerations in lending and investment decisions are starting to affect issuers' abilities to raise finance. This has driven a credit rating action in at least one case. Fitch downgraded the ratings of CoreCivic, Inc. from 'BB+' to 'BB' and revised the Rating Outlook to Negative from Stable in July 2019 as a result of US and international banks announcing plans to stop providing financial services to private prison operators, thereby reducing access to capital. Global concerns about coal usage have extended to the supply chain, affecting financing for Australian coal export terminals. We also identified ESG considerations as one of several issues contributing to negative investor sentiment for the US exploration and production sector.

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RISING LITIGATION COSTS FOR BUILDING MATERIALS AND CONSTRUCTION FIRM

In July 2019, Sherwin Williams Company, ConAgra Grocery Products Co., NL Industries, and 10 California cities and counties, mutually agreed to resolve litigation related to lead-based paint. The defendants collectively paid USD305 million. Sherwin Williams Company made its initial payment of USD25 million in September 2019.

While the payments are manageable relative to the company's free cash flow, this agreement could have broader ramifications by encouraging similar legal actions. In October 2018, two proceedings in the Pennsylvania counties of Montgomery and Lehigh were initiated against Sherwin Williams Company and several other former lead-based paint and lead-pigment manufacturers asserting claims for public nuisance.

The Sherwin Williams Company has an ESG.RS of '4' for Waste & Hazardous Materials Management due to ongoing environmental investigation and remediation activities, which has a negative impact on the credit profile, and is relevant to the rating in conjunction with other factors.

Regulatory and Litigation Risk

Lost revenue can be substantial when environmental compliance proves too costly to viably operate in a region or country. Breaches of environmental regulation can lead to fines, penalties or loss of permits, while operating incidents can lead to substantial liabilities, with regulatory and litigation pay-outs lasting over several years.

Reputational Risk

With society, customers and employees able to freely share news, views and complaints on the internet, issuers are exposed to reputational risks that can damage their business and brand. These risks can materialise in their supply chain. To minimise the risks of controversies and bad publicity, some issuers request suppliers to abide by a Supplier's Code of Conducts, run periodic ESG diligence programmes, and develop initiatives on promoting more environmentally friendly practices.

Investors monitor the number and severity of controversies surrounding the operations and supply chains of issuers to identify and minimise unrealised reputational risks in their holdings and portfolios. This can lead to revaluation, engagement or divestment.

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PART FIVE: EXPOSURE TO ENVIRONMENTAL IMPACT ISSUES

INCREASE IN MAGNITUDE AND FREQUENCY OF IMPACTS WILL TEST LIMITS OF RISK DIVERSIFICATION

Diversification is the mainstay of most investment strategies to mitigate physical climate risk, but with projected increases in both the frequency and severity of extreme weather conditions and other environmental hazards, this will be tested to the limit in the coming decade.

This report focuses on the Exposure to Environmental Impacts and the Natural Disasters and Climate Change general issues (together referred to as Exposure to Environmental Impacts) within Fitch Ratings' ESG.RS framework and scoring templates.

Supply Chain Fragilities in Focus

The Covid-19 pandemic has highlighted the fragility of many global supply chains, alongside increasing supply chain disruption from natural disasters and environmental hazards. Companies with well-developed internal coordination and contingency planning will be best-placed to respond to these shocks, which can have impacts ranging from manageable to severe.

Climate Protection Gap Widening

Around two thirds of damages from extreme weather incidents in 2020 were uninsured, with gaps in insurance coverage mostly in countries with high exposure to natural catastrophes. This reflects an 'adverse selection' phenomenon, where property owners opt out of coverage because of rising premiums despite heightened exposure, which drives up premiums further.

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Risk Mitigation Rising in Importance

Both public and private sectors are historically more inclined towards payout of rebuild costs after events than risk mitigation. However, the systemic risks posed by climate change will increasingly require property owners, banks, non-bank financial institutions, insurers and governments to collaborate in risk-mitigation.

This will open the door to blended finance mechanisms and targeted premium reductions for projects that can show evidence of risk mitigation.

Core Environmental Impact-Related Credit Issues

Fitch has identified the sectors and activities most affected by exposure to environmental impacts from a credit perspective.

These can be categorised under four core environmental impact-related credit issues: environmental impacts on product and material sourcing; environmental impacts on assets and inventory; environmental impacts on operations; and environmental impacts in economic development.

Defining Exposure to Environmental Impacts and Natural Disasters

Exposure to environmental impacts has physical, financial and economic effects on borrowers and asset owners. While the consequences of these issues can be clear (see table *Exposure to Environmental Impact Issues and Their Operational, Financial and Economic Impacts*), it can be difficult to attribute an ESG impact to a specific credit driver, as aspects of environmental impacts are often linked to several different ESG credit issues.

Environmental impact issues can materialise in and overlap with other ESG issues. Within our ESG.RS framework and sector-specific scoring templates, we find connections between these credit issues and the following general issues:

GHG Emissions and Air Quality: This addresses the issuer's ability to manage risks associated with emissions to air, including greenhouse gases. Carbon-related considerations are increasingly taken into account in investment decisions, and many corporates are under growing investor pressure to address sources of both physical and transitional climate risk in operations, supply chains, products and procurement. GHG emissions are expected to contribute to more severe weather conditions in the future, with some debate as to whether current patterns of more severe weather are driven by climate change.

Management Strategy: This addresses the management strategy for addressing risks to operations and the provision of goods and services stemming from physical climate risks, as well as litigation, reputational, regulatory and compliance risks. Corporates are being particularly scrutinised on management strategy as it relates to environmental risks by activist investor coalitions and civil society groups, with increasing requests for detail on how capex and opex spending plans, product portfolios and other aspects of management strategy will ensure resilience of business operations or built assets in the face of rising environmental impacts.

While exposure to environmental impact issues are interrelated to other general issues in our scoring temples, we only consider issues to be credit-relevant, and therefore an environmental impact issue, when physical climate risks are a key risk factor or driver for an economy, management strategy, product, manufacturing process, operation or project.

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FITCH'S MINING SCORING TEMPLATE

General issue	Sector-specific issue
GHG emissions and air quality	Regulatory risk - emission standards
Energy management	Energy use in operations
Water and wastewater management	Water usage in operations (including exposure to regions with water scarcity)
Waste and hazardous materials management; ecological impacts	Total amount of tailings and mineral processing waste produced; management of tailings dams
Exposure to environmental impact	Exposure to extreme weather events
Human rights, community relations, access and affordability	Relationships with local communities or land right holders
Customer welfare – fair messaging, privacy and data security	n.a.
Labour relations & practices	Impact of labour negotiations and employee (dis)satisfaction
Employee wellbeing	Worker safety and accident prevention
Exposure to social impacts	Social resistance to major projects or operations that leads to delays and cost increases
Management strategy	Strategy development and implementation
Governance structure	Board independence and effectiveness; ownership concentration
Group structure	Complexity, transparency and related-party transactions
Financial transparency	Quality and timing of financial disclosure

Source: Fitch Ratings

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EXPOSURE TO ENVIRONMENTAL IMPACTS ISSUES AND THEIR OPERATIONAL, FINANCIAL AND ECONOMIC IMPACTS

Environmental impacts issue	Affected sectors	Operational/regulatory impact	Financial and economic impact
Physical impacts of climate change	• Real estate • Manufacturing • Agriculture • Raw materials sourcing • Infrastructure • Energy • Insurance • Commodities • Telecoms and technology • Governments • Utilities • Hospitals, universities	• Operational disruption, delays • Business shutdown, interruption, slowdown or relocation • Loss/impairment of productive assets • Supply chain/sourcing disruption	• Loss of revenue due to operating restrictions • Costs of rebuild for uninsured or unsupported losses • Loss of tax base • Large investments needed in new capital and operational expenditure • Lower economic output due in part to population loss • Higher raw material costs • Liquidity erosion due to immediate damage response
Increase in costs following natural disasters	• Real estate • Manufacturing • Agriculture • Raw materials sourcing • Infrastructure • Energy • Insurance • Commodities • Governments • Utilities • Hospitals, universities	• Disruption to sourcing and operations • Raw material supplies tightening • Increased use of price hedging	• Spike in prices of labour, energy and logistics following natural disasters • Spike in raw material costs, which may not be able to be passed on to end consumers • Impact on competitive position in cases of ineffective price hedge bets
Litigation and liabilities	• Real estate • Manufacturing • Raw materials sourcing • Infrastructure • Energy • Insurance • Commodities	• Breach of contracts • Invocation of 'Force Majeure' clauses • Local community protests and associated bad press coverage, political intervention and regulatory pressure • Business shutdown, interruption, slowdown and relocation • Loss or refusal of licence to operate due to community unrest and political response	• Legal fees • Damages for non-compliance with contracts • Closure or reduction in output from productive assets

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Environmental impacts issue	Affected sectors	Operational/regulatory impact	Financial and economic impact
Underinsurance	• Real estate • Manufacturing • Agriculture • Raw materials sourcing • Infrastructure • Energy • Insurance • Commodities	• Partial or no coverage of key risks from environmental impacts • Rising premiums for insured as a result of reduced diversification	• Delayed recovery from natural disaster events • Increased probability of default
Risk diversification	• Real estate • Manufacturing • Raw materials sourcing • Infrastructure • Energy • Insurance • Commodities	• Supply chain screening on physical risk exposure, disaster preparedness and business continuity planning • Limiting exposure to high risk suppliers or locations	• Loss of revenue for some suppliers • Increased costs of compliance with disaster preparedness requirements • Higher opex and capex costs
Changing demand for energy and commodities, resource consumption	• Energy intensive industries • Mining • Utilities • Transport • Commodities • Auto producers • Financials	• Lower production output or capacity utilisation	• Possible erosion of cash position, credit deterioration if costs cannot be passed on or goods and services adapted to fit market needs • Need for additional capex and opex in technology improvements
Stress testing on physical climate risk exposure	• Energy intensive industries • Metals and mining • Utilities • Transport • Commodities • Financials • Telecoms and technology • Insurance	• Costs of data collection and verification • Time and resources for engagement • Some operationally sensitive data may need to be disclosed • Increased citation of EIM issues in proxy voting, resolutions • Further investor scrutiny and engagement	• Potential increases in financing/refinancing costs • Large investments needed in new capital and operational expenditure to transition to lower carbon assets • Opportunities for development of insurance products/coverage

Source: Fitch Ratings

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Sector-Specific Credit Issues

Fitch analysts evaluate whether an environmental impact issue is credit-relevant and material for all its rated issuers and transactions. Within their ESG scoring templates, Fitch analysts allocate a score between '1' and '5' for the general issue Exposure to Environmental Impacts.

The sector-specific ESG credit issues for exposure to environmental impacts, natural disasters and climate change can be categorised into four core related credit issues:

1. **Environmental impacts on product or material sourcing** - where environmental impacts affect the availability or pricing of resources and material supply chains.
2. **Environmental impacts on assets or inventory** – where environmental impacts directly affect the resilience or value of built assets or inventory.
3. **Environmental impacts on operations** – where environmental impacts disrupt company, enterprise or governmental operations.
4. **Environmental impacts on economic development** - where environmental impacts materially affect local, regional or national economic growth and development.

FITCH'S DEFINITION FOR EXPOSURE TO ENVIRONMENTAL IMPACTS

Physical Impacts of Climate Change: This category addresses an issuer's ability to manage risks and opportunities associated with direct exposure of its owned, controlled or governed assets and operations to actual or potential physical impacts of climate change. The category relates to an issuer's ability to adapt to increased frequency and severity of extreme weather, a shifting climate, sea level risk, and the other expected physical impacts of climate change.

Management may involve mitigation strategies, such as enhancing resiliency of physical assets or surrounding infrastructure as well as incorporation of climate change-related consideration into key business or governance decisions – such as mortgage and insurance underwriting or the planning and development of real assets projects.

Materials Sourcing and Efficiency: This category addresses issues related to the resilience of material supply chains to the physical impacts of climate change and other external environmental factors. It captures the impacts of such external factors on the operational activity of suppliers, which can further affect the availability and pricing of key resources. It addresses a company's ability to manage these risks on a product through design, manufacturing, and end-of-life management, such as by using recycled and renewable materials, reducing the use of key environmentally unfriendly materials (known as dematerialisation), maximising resource efficiency in manufacturing, and making R&D investments in substitute materials.

Additionally, companies can manage these issues by screening, selection, monitoring, and engagement with suppliers to ensure their resilience to external risks. The category does not address issues associated with environmental and social externalities created by operational activity of individual suppliers, which is covered in Biodiversity and Waste Issues category.

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How Environmental Impacts Relate to Credit Risks

Environmental impacts can materialise as a single credit risk or as a combination of credit risks.

The report focuses on the four abovementioned core environmental-impact credit issues. It provides insights and case studies on how these core issues affect issuers from several sectors. This is followed by guidance on how environmental impact-related credit issues transpire as credit risks and can affect the creditworthiness of issuers.

TRANSITION MECHANISM FROM ENVIRONMENTAL IMPACTS ISSUES TO CREDIT RISK

Environmental Impacts issue

- Physical impacts of climate change
- Increase in costs following natural disasters
- Litigation and liabilities
- Underinsurance
- Risk diversification
- Changing demand for energy and commodities, resource consumption
- Stress testing on physical climate risk exposure

Environmental Impacts credit issues

- Environmental impacts on product or material sourcing
- Environmental impacts on assets or inventory
- Environmental impacts on operations
- Environmental impacts on economic development

Credit Risks

- Asset quality and concentration risk
- Business profile and competitive position risk
- Macroeconomic risk
- Operational & cash flow risk
- Profitability risk
- Refinancing risk
- Regulatory & litigation risk
- Reputational risk

Source: Fitch Ratings

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EXPOSURE TO ENVIRONMENTAL IMPACTS-RELATED CREDIT ISSUES AND ASSOCIATED ECONOMIC SECTORS

Environmental impacts on product and material sourcing	Environmental impacts on assets and inventory	Environmental impacts on operations	Environmental impacts on economic development
Alcoholic beverages	ABS - Aircraft	ABS - Aircraft	IPF - LRGs
Asia Pacific utilities	ABS - Auto	ABS - Auto	Sovereigns
Commodity processing & trading	ABS - Equipment	ABS - Equipment	USPF - State and local governments
Diversified industrials & capital goods	ABS - SME	ABS - SME	
Non-alcoholic beverages	ABS - SME CDO	ABS - SME CDO	
Packaged food	ABS - Credit card	ABS-Credit card	
Protein	ABS - Future flow receivables	ABS - Future flow receivables	
	ABS - Oil vessel-backed	ABS - Oil vessel-backed	
	ABS - Sprint spectrum	ABS - Sprint spectrum	
	ABS - Timeshare loan	ABS - Timeshare loan	
	ABS - UK student loan	ABS - UK student loan	
	ABS - US student loan	ABS - US student loan	
	ABS - Utility tariff bonds	ABS - Utility tariff bonds	
	APAC Property & real estate	Airlines	
	APAC Regulated network utilities	Asia Pacific utilities	
	Asia Pacific utilities	Banks	
	Australia regulated networks	Building Materials	
	Banks	CMBS	
	Building products	Commodity processing & trading	
	Chinese homebuilders	Consumer ABS - secured	
	CMBS	Consumer ABS - unsecured	
	Consumer ABS - secured	CVB Commercial	
	Consumer ABS - unsecured	CVB Residential	
	Consumer products	Engineering & construction	
	CVB Commercial	Food retailing	
	CVB Residential	Insurance- Life	
	EMEA Real estate & property	IPF - GREs	
	EMEA Regulated networks	IPF-LRGs	

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Environmental impacts on product and material sourcing	Environmental impacts on assets and inventory	Environmental impacts on operations	Environmental impacts on economic development
	EMEA Utilities	Latin America real estate	
	Gaming	MICH	
	GIG - Hydro	Mining	
	GIG - Oil & gas production	NBFIs	
	GIG - Pipeline & energy midstream	Non-Food retailing	
	GIG - Power transmission	Oil Refining & marketing	
	GIG - Social infrastructure	Oilfield services	
	GIG - Solar/wind	Protein	
	GIG - Sports	Protein	
	GIG - Thermal power	RMBS	
	GIG - Transportation	Shipping companies	
	GIG - Water/wastewater	US Healthcare providers	
	Insurance - Life	USPF - Acute hospital and health systems	
	Insurance - Non life	USPF - Not-for-profit CCRC	
	LATAM Utilities	USPF - Public power	
	Lodging	USPF - State and local governments	
	Medical products	USPF - Water & sewer	
	MICH	USPF - Higher education	
	NBFIs		
	Oil & gas production		
	Pharmaceuticals		
	Pipeline and energy midstream		
	Restaurants		
	RMBS		
	Telecommunications		
	US Equity REITS & REOCs		
	US Homebuilders		
	US Utilities		
	USPF - Higher education		
	USPF - Public power		
	USPF - Water and sewer		

Source: Fitch Ratings

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Relevance and Materiality of Sector-Specific Exposure to Environmental Impacts

ENVIRONMENTAL IMPACTS IN PRODUCT AND MATERIAL SOURCING

Exposure to environmental impacts is a growing area of concern for companies sourcing key materials for their manufacturing processes. Broadly, companies have three options to address these risks, the first being engagement activities with suppliers, focusing on identifying areas of key risk and collaborating on risk mitigation. The second is diversification, where producers seek to diversify their supplier base where possible, increase inventory capacity and build greater flexibility into their sourcing and logistics processes.

Diversification can be at odds with lean management practices that prioritise 'just in time' manufacturing processes on the basis of efficiency, but can yield greater resilience in instances of supply chain disruption. To some degree, there may be trade-offs between engagement and diversification, as the latter gives buyers less long-term influence over suppliers' environmental practices.

The third is hedging, where companies lock in raw material input prices as a means to respond to price volatility. Nonetheless, companies that make the wrong hedging bets can pay heavily, becoming locked in to contracts when prices fall, putting them at a competitive disadvantage.

These three strategies all entail some degree of risk transfer to suppliers. However, climate risks are increasingly pervasive and systemic, and so internal risk mitigation can be key. Companies with internal cross-departmental coordination can respond to volatility in raw material input costs. For example, changes in manufacturing processes can allow some producers to substitute feedstocks in response to price volatility, allowing individual sources and suppliers to be diversified. Nonetheless, many companies have limited coordination of sales, procurement, product development and manufacturing divisions, so their ability to respond to external shocks such as extreme weather is also limited. Building internal flexibilities and capacity to respond to short-term shocks and long-term environmental risks will allow companies to develop more resilient long-term business models in the face of climate change.

Relevance to Sector

Highly specialised sectors with limited geographical diversity in materials sourcing tend to be the most exposed to environmental impacts on product and material sourcing. Electronics and semi-conductor manufacturing is a key example, with much of the world's production and supply chain concentrated in areas of heightened environmental risk.

Food and beverage companies also have key vulnerabilities, due to the sensitivity of agricultural production to physical climate risks and the tendency of natural disasters to deliver short-term shocks to supply chains. Food production is one area where such acute climate risks are likely to compound longer-term chronic risks, with increases in temperatures driving increased losses to pests and insects as well as more incidences of droughts and floods.

The price volatility of commodities and raw material inputs has been a hallmark of the past two decades, and the consensus is that such volatility is set to increase in response to increasingly extreme weather patterns over the coming decade.

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EARTH METALS SUPPLY CHAIN LIMITS DIVERSIFICATION

Battery metals will be key to the deployment of many critical low-carbon technologies, raising expectations of a new commodities 'super cycle' in the coming decade. Nonetheless, many key commodities for battery metals are associated with severe environmental impacts that could pose constraints to future supply in some areas.

Heavy rare earth metals production, for example, is heavily concentrated in south-eastern China, which is increasingly subjected to extreme rainfall events. Such events are expected to occur at least twice as often by 2030, leading to increased incidences of landslides. This poses key risks to the global value chain for rare earth metals, with repercussions for global output and prices.

McKinsey analysis suggests that a severe precipitation event in the region could yield to a drop in global output of at least a fifth, leading to price spikes similar to those seen in 2010 and 2011 when the Chinese government-imposed restrictions on exports, leading to a tenfold increase in the price of certain rare earth metals. Responses from downstream consumers of these commodities could include diversification of sourcing and increase in inventory storage capacities, although these will not address the wider systemic challenges posed by physical climate change, and the limits of diversification may be increasingly tested in rare earth metals.

CISCO SHOWS THE VALUE OF PROACTIVE RISK MITIGATION

Cisco Systems Inc. has invested heavily in proactive supplier engagement and risk mitigation. When Hurricane Katrina hit the US in 2005, the company had substantial supply chain disruption. Conversely, similar levels of disruption arising from Japan's 2011 tsunami resulted in virtually no financial losses, as the company had developed detailed processes and protocols for supplier engagement and business continuity in the event of such disruption.

The company has also developed detailed risk assessments of several thousand items in its procurement spend and has since engaged heavily with customers to better manage expectations in the event of such natural disasters.

Commodity-processing companies also face environmental impacts in product and material sourcing beyond the direct effects of climate change. Rising temperatures in many regions are expected to lead to the increased use of pesticides and insecticides in food production, but many widely used types such as glyphosate and chlorothalonil have come under increased regulatory scrutiny or restrictions in use due to animal or human health concerns, leading to higher costs for raw material producers and commodity processors in some cases.

Similarly, the EU's de-facto ban on palm oil imports has arisen from concerns over deforestation from production in Southeast Asia, but has tilted the competitive landscape in favour of European producers. Both the UK and the EU are in the process of introducing new regulations governing screening of deforestation risk in imports, and just a handful of commodities – beef, palm oil, soy, timber and pulp – tend to be the major drivers of deforestation globally.

Accordingly, large asset owners are increasingly scrutinising the performance of investments in relation to these issues.

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GROWING IMPORTANCE OF FORCE MAJEURE CLAUSES

Physical risks of climate change will require greater detail on the conditions under which 'force majeure' applies to contracts between purchasers and suppliers, or who bears risk when circumstances occur that are beyond the control of either party. Climate change is expected to lead to an increase in events that could be considered force majeure, including extreme weather, other environmental hazards and disease outbreaks.

Accordingly, purchasing companies may want to clearly define these circumstances within purchasing contracts for goods and services in order to protect themselves or to make their exposures more transparent. A 2020 article in the Journal of the American College of Construction Lawyers suggests that both buyers and sellers have a vested interest in establishing the conditions under which force majeure applies to extreme weather events, based on the assumption that as climate change impacts increase, courts may struggle to create consistent legal interpretations of liability, contributing to legal and operational uncertainty.

EXTREME WINTER WEATHER IN TEXAS LEADS TO UTILITY BANKRUPTCY

Fitch recently downgraded the Issuer Default Rating on Brazos Electric Power Cooperative Inc. (TX) to 'D' from 'A+', reflecting the electric cooperative filing for bankruptcy following catastrophic failures as a result of extreme winter weather and multiple snow and ice storms. These failures resulted in a USD1.8 billion invoice from the Electric Reliability Council of Texas (ERCOT), nearly twice the cooperative's annual revenues. The regional electricity market requires all utilities to purchase all energy from the market and sell all energy produced back to the market. As many of the state's generation plants were not prepared for the multiple days of freezing temperatures that occurred in February, generation and natural-gas wells and pipelines shut down production across the state. The shortage of energy supply from both owned and contracted generation plants drove Brazos Electric to purchase energy from ERCOT without a corresponding sale of energy from its own generation resources during certain periods to offset market prices, resulting in significantly higher-than-budgeted net energy costs.

Before the storms, we considered Brazos to have adequate liquidity and a relatively strong credit profile – but the unprecedented costs of the supply collapse far exceeded the company's available cash reserves, and the cooperative indicated it was unable to pass these costs on to its 1.5 million customers. Accordingly, Brazos Electric has an ESG Relevance Score of '5', revised from '4', for Exposure to Environmental Impacts due to the effects of recent severe winter weather, which has had an acute, negative impact on Brazos Electric's credit profile, and is highly relevant to the filing for bankruptcy protection.

ENVIRONMENTAL IMPACTS ON ASSETS AND INVENTORY

Exposure to environmental impacts is a key concern for many issuers' assets and portfolios. These issues can materialise in substantial rebuilding costs after natural disasters or extreme weather conditions, rising insurance premiums, or lost revenue from periods where assets are unusable due to environmental impacts. A growing issue for many sectors is uninsured or underinsured assets and inventory against many natural hazards, especially as physical climate risks are expected to become more severe in the coming decade, with more temperature and weather extremes in many regions.

Damages from extreme weather and physical climate risks can be acute or chronic. Physical risks include event-driven risks such as droughts, floods and fires. They can also relate to longer-term changes in weather patterns and variability, triggering changes in rainfall, sea levels and temperatures. Much of the existing data, tools and methodologies is designed to assess the acute natural disaster impacts and often struggle to reliably assess the chronic environmental risks – as uncovered during the pilot implementation of the Task Force for Climate Related Financial Disclosures recommendations by UNEP FI working group participants in recent years.

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EXAMPLES OF CLIMATE RELATED RISKS AND FINANCIAL IMPACTS

Acute	Reduced revenue from decreased production capacity (e.g. transport difficulties, supply chain interruptions)
	Reduced revenue and higher costs from impacts on workforce (e.g. health, safety, absenteeism)
	Write-offs and early retirement of assets (e.g. damage to property and assets in 'high risk' areas)
Chronic	Increased operating costs (e.g. inadequate water supplies for power generation)
	Increased capital costs (e.g. damage to facilities)
	Reduced revenue from lower sales/output
	Increased insurance premiums and potential for reduced availability of insurance on assets in high risk locations

Source: Fitch Ratings, Task Force on Climate Related Financial Disclosure

UNDERINSURANCE AND 'ADVERSE SELECTION'

A common problem with insurance coverage is the so-called 'adverse selection' issue, whereby rising insurance premiums (for example, as a result of increased claims from extreme weather events) lead to a decline in coverage by asset or property owners alongside an increase in coverage by higher-risk policyholders. This in turn leads to greater uninsured losses and protracted recoveries from future extreme weather events. It also drives up premiums further by reducing the risk diversification that is key to ensuring insurance affordability.

Environmental risks differ from other types of insurance coverage, such as healthcare, in that public awareness or understanding of their potential exposure tends to be weak. Moreover, there are strong cultural and regional differences in perceptions of liability for damage costs from natural hazards; many regions with strong consensus around private responsibility for rebuild costs from natural disasters such as floods (such as in central Europe) tend to have low levels of insurance uptake for these risks. Germany, for example, has only a 41% household flood coverage rate despite multiple severe floods in recent years and sustained public information campaigns.

Relevance to Sector

Large or costly built assets tend to have the greatest exposure to physical climate risks due to their long lifespan. Many new assets built today can be expected to be in use in the 2040s and 2050s – or even longer in the case of infrastructure assets – coinciding with when many key physical climate risks are projected to reach extremes. Commercial and residential real estate, where mortgages or leases typically extend to several decades, are a key example. There is a growing body of evidence around the influence of extreme weather events on the underlying creditworthiness of securitised real-estate debt and direct lending.

Fitch's ESG.RS for the insurance and reinsurance sector point to the particular credit-relevance of natural disasters and environmental hazards for issuers in APAC, with a number of Chinese and Japanese non-life insurers having a score of '4' for the category 'Exposure to Environmental Impacts', similar to most reinsurers, suggesting that this issue is having a material influence on credit ratings. The heavy concentration of global industrial and agricultural activities in a handful of Chinese regions, coupled with widespread underinsurance, increases the risk to assets in the region from extreme weather events.

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FROM RISK TRANSFER TO RISK MITIGATION

Most commentaries on climate risk for insurers or reinsurers suggest that the annual policy cycle and repricing will give sufficient flexibility to adapt to evolving areas of climate risk. Nonetheless, this fails to account for the wider systemic risks of climate change, which could lead to rapid repricing of asset values or business failures, with implications for insurers both on the asset side of their business and in underwriting activities. The Bank of England's Insurance Stress Test, for example, highlighted that under a severe physical climate risk scenario a 1-in-100-year loss in the future may exceed today's 1-in-1,000-year loss.

Providing expertise and pricing to support risk mitigation, beyond conventional risk transfer is likely to be a growing focus for insurers in the coming decade. The performance of Governments and the private sector have particularly poor investment in natural disaster risk mitigation; post-event claims and relief funding typically massively outnumbers spending on mitigation. Moreover, the link between mitigation actions and premium repricing to reflect reduced risk is generally weak and subject to political influence. The US National Flood Insurance Programme, for example, typically offers reductions in premiums of up to half on the basis of mitigation measures, often with little basis in actual risk reduction.

This could start to change with a focus on forward-looking mitigation efforts in post-disaster rebuilding. The UK's industry-led Flood Re scheme, for example, is promoting a 'build back better' agenda with payouts for resilience measures prioritised in addition to normal rebuild costs after floods. Moreover, industry participants such as Munich Reinsurance Company and Aon Public Limited Company are leveraging their catastrophe risk models to support clients and investees in proactively identifying areas of heightened long-term risk exposure.

FANNIE AND FREDDIE AND RISK TRANSFER

The role of US government-owned lenders Fannie Mae and Freddie Mac in providing mortgage-backed securities with insurance against climate risk is gaining increasing attention as extreme weather events proliferate. The lending policies of these two agencies prohibit them from refusing loans on the basis of climate risk exposure. As a result, banks and other private sector lenders are increasingly offloading assets perceived as high risk due to extreme weather – meaning that mortgage investors are effectively insured against climate risk by the US government.

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BRAVO RESIDENTIAL FUNDING 2019-2 HIGHLIGHTS CONCENTRATION AND DISASTER RISK DOUBLE PENALTY

Due to the large concentration of mortgages in the Gulf Coast region, there is far greater natural disaster and catastrophe risk in this pool compared to most transactions. Approximately 43% of the pool is concentrated in Louisiana and an additional 33% in Texas. This resulted in a 1.16x probability of default adjustment for the geographic concentration, and increased Fitch's expected loss by 104 basis points (bp). This is one of the largest adjustments Fitch has made for geographic concentration.

Nearly a quarter of the pool is in an area recently listed by federal agencies as a natural disaster area as a result of Hurricane Barry in 2019. Fitch lowered property values for homes located in these areas by 10% to reflect the potential risk of property damage. Multiple studies of US Federal Emergency Management Agency natural disaster areas find a significant detrimental effect on local property values, driven by higher insurance premiums and anticipation of future damage. To account for potential future risk of natural disaster, the catastrophe risk adjustment added 28bp to expected loss levels; however, given the highly concentrated profile of the pool, Fitch doubled the catastrophe risk adjustment to 56bp.

This rated transaction consists of 7,026 prime seasoned residential mortgage loans of USD425.9 million as of the cutoff date. The pool has an unusually low average loan-to-value ratio of 49.6%, with 94% of fixed-rate mortgages under 30 years in duration, and 90% of payments made on time in the past two years. Despite this, it has an ESG.RS of '5', indicating a direct impact on the ratings driven by Exposure to Environmental Impacts.

BANKS' HEIGHTENED EXPOSURE TO ENVIRONMENTAL IMPACTS CREDIT-NEUTRAL FOR SOME, MATERIAL FOR OTHERS

Analysts have adopted a 'blanket' approach and assigned high Exposure to Environmental Impacts (EIM) scores across some portfolios – such as Puerto Rican banks, which scored '4' for EIM, where credit profiles have been negatively affected by frequent hurricanes. Kenyan banks have EIM scores of '3' because farming loans, which are material for Kenyan banks, are affected by extreme environmental conditions such as locust plagues.

KCB Group PLC's (a Kenyan bank) ESG.RS for Exposure to Environmental Impact was changed to '3' from '2'. This reflects Kenyan banks' exposure to extreme weather events – including the locust invasion that has been ongoing since early 2020 –that can affect the environment in which banks operate given their high share of lending to the agricultural sector. KCB Group's exposure to this environmental impact is relevant to its rating but the materiality to the credit profile is considered minimal.

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INSURERS, AGRICULTURAL LESSORS HAVE INCREASING CREDIT IMPACTS FROM PHYSICAL CLIMATE RISK

Insurers with higher exposure to physical assets located in areas exposed to frequent adverse weather conditions that have negatively affected credit have also been scored '4' for EIM. Examples include Lloyd's of London, which insures assets in Florida and other weather-affected areas of the US, and ABCI Insurance Company Limited in Hong Kong, which insures assets in mainland China affected by frequent typhoons and earthquakes.

Among non-bank financial institutions (NBFIs) there is only one EIM score above '3'. TechnoLeasing LLC (a Kazakh agricultural equipment lessor) has an ESG.RS of '4' for Exposure to Environmental Impacts due to its sizeable exposure to the agricultural sector (80% of total lease book at end-1H20) through leasing of specialised equipment. The vulnerability of the agricultural sector to weather conditions exposes TechnoLeasing to high credit risks during weak harvests. This has a negative impact on the company's credit profile, and is relevant to the ratings in combination with other factors.

IPCC REPRESENTATIVE CONCENTRATION PATHWAYS CLIMATE CHANGE SCENARIOS (2081-2100)A

Scenario[d]	CO2 emissions (Gt)[a]	Global temperature rise (C, mean)[b]	Global sea level rise (cm, mean)[c]
RCP 2.6	990	1	40
RCP 4.5	2,860	1.8	47
RCP 6.0	3,885	2.2	48
RCP 8.5	6,180	3.7	63

a Relative to 1986-2005 reference period. The observed warming from 'pre-industrial' 1850–1900 to the 1986–2005 reference period is 0.61°C (range 0.55 to 0.67)
b Cumulative, mean, gigatonnes
c Global mean surface temperature change,C
d Global mean sea level rise, cm
e 5% to 95% confidence interval RCP = Representative Concentration Pathway Source: Fitch Ratings, IPCC, Climate Change 2013: The Physical Science Basis

ENVIRONMENTAL IMPACTS IN OPERATIONS

Environmental impacts in operations can be diverse – from operational disruption due to acute risks such as storms, flash floods, or ice storms, to longer-term chronic environmental risks such as drought, sea level rises or increases in extreme precipitation. Chronic impacts of climate change are expected to be highly disruptive to operations from the 2040s under most scenarios, but there is some evidence that acute effects are increasing in frequency and severity already as a result of climate change.

Impact on issuer operations is usually framed by the various Intergovernmental Panel on Climate Change (IPCC) scenarios.

Relevance to Sector

Network utilities and infrastructure tend to have direct exposure to disruption from physical climate risks, as these can impair their ability to deliver services. Exposure of power utilities to wildfire risk liabilities was highlighted by the bankruptcy of Pacific Gas and Electric in 2019. More recently, the high number of Texas power utilities placed on Ratings Watch Negative as a result of record cold temperatures and ice storms highlights the key risk of such extreme weather patterns on operational delivery and cashflow.

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Fitch research (Constraints to Growth in Water-Stressed Regions, October 2020) has highlighted the effects of increased drought conditions on large industrial water users in Asia and Africa (particularly mining, food and beverage and power utilities companies), which often depend on water resources for cooling or power generation. This has been particularly problematic in the African 'copper belt' – Zambia and the Democratic Republic of Congo – with Zambia shifting from a net energy exporter to an importer as a result of rapid growth of population and copper mine output. Sub-Saharan Africa is one of the most resource-rich and electricity-poor regions in the world, and has a critical dependence on hydropower in many regions. Zambia has regular power shortages as a result of drought and maintains a schedule of rolling blackouts.

THE CREDIT SALIENCE OF FOREST FIRES

There were record-breaking wildfire events in California, Australia and parts of the Arctic circle in 2020. Losses attributable to wildfires have clearly risen in recent years, although the scale of these losses is typically harder to predict due to the joint influence of man-made and climatic risk factors – such as increasing urbanisation. Increasing urban sprawl in arid regions of the southern US, for example, has dramatically increased loss potential in that region. The majority of fires near populated areas are caused by human activity. The frequency and severity of these events is expected to worsen as rising temperatures lead to increasingly dry vegetation in high risk regions.

The exposure of power utilities in high-risk regions was highlighted by the bankruptcy of PG&E in early 2019, arising from class actions and potential liabilities of about USD30 billion after two severe wildfire seasons. Following these events, insurers are reducing their capacity for wildfire liability and increasing premiums for utilities. Californian utilities' premiums to coverage ratio was reported to have quadrupled between 2017 and 2019, according to Oliver Wyman. If this continues, power utilities operating in high-risk areas may need to examine alternative risk-transfer solutions such as catastrophe bonds or risk pools, or work with governments and regulators to find equitable solutions to financing their liability risks.

Wildfires have also increased in incidence in historically low-risk regions (such as southern Europe), whilst China, Latin America, Eastern Europe and Central Asia look likely to have increased forest fire risk in the future as temperatures increase and precipitation patterns change. Fitch has an ESG.RS of '4' for most Latin American pulp and paper companies due to their heightened exposure to wildfires. This highlights the growing credit relevance of forest fires in operations and material sourcing.

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SUPPLY CHAIN DISRUPTION AND OPERATIONS

The Covid-19 pandemic and its impact on global supply chains, coupled with recent examples of severe weather events, has heightened awareness of the risks posed by environmental impacts to business continuity and procurement. Responses to these shocks include 'China+1' (China with additional diversification) supply-chain diversification strategies or moves by the EU to promote relocation of critical raw material supply chains to the Mediterranean Basin and North Africa regions.

Similarly, the normal delays between insurance claims and payouts are likely to gain increased prominence as claims increase in scale and volume, which could slow economic recovery after natural disasters. For example, Lloyd's of London faced claims of USD2.2 billion as an indirect result of the 2011 Thailand floods – with losses arising from business-interruption claims and supply-chain disruption.

Modelling by McKinsey points to the sharply different impacts of a 1-in-100-year hurricane events on electronics manufacturers, depending on relative preparedness. A well-prepared manufacturer with diversified materials sourcing could expect a 5% loss in revenue from such an event on semiconductor production, whereas the same event on an ill-prepared, single-source manufacturer could yield a 35% revenue loss. The former manufacturer would be expected to have invested in supplier diversification, and to have engaged with suppliers on underlying asset resilience and disaster preparedness. A consequence of increased incidences of extreme weather events is likely to be an increased focus on disaster preparedness in procurement decisions.

UK WATER UTILITIES FACE BRUNT OF FLOOD, STORM RISKS

The price review system imposed on the UK water utilities sector prioritises capital investment by companies and in recent years has been focused on 'resilience' metrics that reward companies that make investments to secure long-term reliability of supplies in the face of climate change.

The UK water industry has also issued a roadmap towards a 2030 net-zero target against a 2018–2019 baseline, which will be technically challenging and would equate to total reductions of around 10 million tonnes of carbon dioxide. These factors impose particular ratings stresses on some companies. United Utilities PLC and Thames Water (Kemble) Finance Plc both have ESG. RS of '4' for 'Exposure to Environmental Impacts', on the basis of exposure to storm, drought and flood risks in their operations that could be negative for cash flow, operating costs and profitability. Conversely, these could be positive in terms of greater returns on capex for weather-resilience investments.

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ENVIRONMENTAL IMPACTS IN ECONOMIC DEVELOPMENT

Physical climate risks, and vulnerability, differ substantially across geographies, and level of economic development tends to be an important factor in capacity to adapt and respond to these risks. As the effects of climate change take hold over the coming decade, impacts on low-income countries and regions are projected to be more severe, and capacity and resources to manage these impacts will be inherently weaker. For small or island economies these impacts can pose an existential threat longer term.

Links between environmental hazards and socio-economic vulnerabilities are often extremely difficult to predict, but a handful of broad trends can be identified. Countries best-placed to mitigate the effects of climate change are likely to be those with high levels of human capital, income and private-sector wealth, diverse economies, strong public finances and policy space, social resilience, and strong governance and institutional capacity. These are factors that are already highly correlated with sovereign and public finance ratings. At the other end of the spectrum, small, poor countries with limited resources and weak governance will have less capacity to mitigate the effects of climate change.

Some effects, such as coastal inundation and hurricane damage, are expected to intensify from the 2040s but have caused substantial GDP loss already, according to research by Rhodium Group focusing on the continental US. Houston, for example, has already had more than a foot of sea level rise since the 1980s, whilst Miami incurs an annual economic loss from hurricanes equivalent to nearly 3% of GDP. The Gulf Coast region, the South Atlantic seaboard and much of Arizona are particularly exposed.

ESTIMATED 'BUSINESS AS USUAL' CLIMATE EFFECTS

	Today	2020–2040	2040–2060
Sea level rise (feet)			
Houston	1.2	1.6	2.5
New York	0.9	1.2	1.9
Hurricane damage (annualised % GDP loss)			
New York	0.2	0.2	0.2
Miami	2.5	2.5	2.8

Note: Using a 1980 baseline
Source: Fitch Ratings, Rhodium Group

Relevance to Sector

Emerging economies of sub-Saharan Africa and Asia-Pacific are more likely to be centred on agricultural and natural capital use and other outdoor economic activities that could be affected by rising temperatures and limits in workability. Economic growth, urbanisation in particular, has also sharply increased the destructive capacity of events such as wildfires, floods and storms.

In many advanced economies, tax- and growth-generating assets such as properties and infrastructure may not have insurance protection. Substantial volumes of Asia-Pacific agricultural production at heightened risk of flood or drought exposure is uninsured, with negative implications for long-term growth as well as food prices.

A patchwork of insurance and reinsurance coverage across developed and emerging markets, often with little relation to actual exposure to hazards, sharply increases the economic consequences of extreme weather events and chronic environmental risks by delaying rebuild and recovery or shifting the rising costs of rebuild onto governments. For lower-income governments, this means less funding available for activities to support long-term growth and a potential deterioration in balance of payments depending on the scale and severity of natural disasters.

There is evidence of the scale and frequency of extreme weather events acting as a deterrent to economic growth. Major tornados hitting Ohio and Texas in 2019 caused insured losses of up to USD480 million and USD2 billion, respectively. Hurricane Dorian cost the Bahamas USD3.4 billion, adding to losses equivalent to more than a third of the region's GDP since 2014. Japan experienced significant damage from Typhoon Hagibis, 30% of which is estimated

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to be uninsured. Costs will therefore fall on property owners, particularly agricultural and industrial businesses.

Historically, support from central governments to sub-sovereign entities, such as state and municipal governments, has been a critical element of responses to natural disasters. In the US, for example, there is an exceptional reliance on the Federal Emergency Management Agency for disaster recovery and rebuilding costs, as well as support for chronic risks such as flooding through subsidised insurance products. These costs are often manageable at the national level but beyond the resources of most local authorities. With expected increases in both the frequency and magnitude of natural disasters in the coming decades, however, a growing number of sub-national sovereign entities may find that these risks are increasingly also beyond the capacities of their national government.

FLORIDA HIGHLIGHTS CONFLUENCE OF REAL ESTATE DEPENDENCY AND PHYSICAL CLIMATE RISK

Florida's economy is heavily dependent on real estate for local economic growth, employment and tax revenues – it provides around a quarter of state GDP, and 30% of tax revenues and homeowner wealth tied to the sector. In the US as a whole, homes represent around 40% of the overall wealth of owner-occupiers, according to UPFINA research.

Losses from floods and storm surge have led to large areas of Florida being effectively uninsurable in the private sector, leading to a significant role for state-backed schemes, such as the Florida Hurricane Catastrophe Fund Finance Corporation (FL) [General Government], Citizens Property Insurance Corporation (FL), and the National Flood Insurance Programme. Increases in the severity and frequency of floods reducing property values – with corresponding impacts on household wealth and tax revenues – is a long-term concern.

Effect on Credit

Exposure to environmental impact issues can translate into relevant credit issues and potentially materialise in several forms of credit risk. Whilst climate change issues encompass physical and transitional aspects of risk, here we address eight main aspects of risk detailed in the ESG scoring templates: asset quality and concentration risk, business profile and competitive position risk, macroeconomic risks, operational and cash flow risk, profitability risk, refinancing risk, regulatory and litigation risk and reputational risk.

Asset Quality and Concentration Risk

Environmental risks tend to be highly regional, and environmental asymmetry is a common challenge for corporates operating across multiple geographies. Corporates with suitable diversification of assets by age, technology and operating geographies will be better-placed to absorb shocks from environmental impacts, for example by redirecting production or business activities. Corporates with a high degree of asset and geographical concentration will, by contrast, be far more exposed to extreme weather events and other environmental hazards.

Business Profile and Competitive Position Risk

Companies operating in highly competitive markets, with fairly tight margins or more limited product portfolios, may be more vulnerable to environmental impacts on revenue and profitability, with environmental hazards representing an additional stress on their competitive position.

Macroeconomic Risks

Many countries or regions have advantages or economic concentration in industries and economies that are particularly exposed to extreme weather and other environmental hazards. Increases in the incidence or severity of these hazards could lead to

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redirection of capital away from assets and regions perceived as high risk, posing macroeconomic challenges for disaster-prone regions. For example, Kenya depends on agriculture for around a third of GDP but experiences regular locust plagues, leading to an ESG.RS of '3' for Kenyan banks given their exposure. Major disaster events can also lead to loss of tax bases and population, as highlighted by the experience of Louisiana in the years following Hurricane Katrina.

Operational and Cash Flow Risk

Exposure to extreme weather and other environmental hazards has the most immediate impact on operations and cash flow, where it disrupts normal sources of revenue. The 2011 Thai floods, for example, created severe operational disruption for a range of businesses operating in the country, and substantial rebuild costs fell on the government. Again, companies with existing challenges in free cash flow are likely to be particularly exposed to event-driven risks.

Profitability Risk

Profitability risk refers to the influence of resource input cost changes or changes in margins as a result of environmental impacts. These can be long-term and cumulative or acute in nature, with event-driven risks to profitability typically being in the form of extreme weather or fines imposed by regulators, which reduce overall margins.

CAPARRA HILLS HIGHLIGHTS FLOOD RISK TO REITS

Caparra Hills, LLC is a Puerto Rico-based operator of non-residential real-estate portfolios. The company has an ESG.RS score of '4' for 'Exposure to Environmental Impacts' on the basis of high portfolio exposure to physical climate risks, particularly flood risk. This poses a risk to its financial flexibility and profitability.

HURRICANES POSE PROFITABILITY RISK FOR CABLE AND WIRELESS COMMUNICATIONS

Cable & Wireless Communications Limited has operations heavily focused on the Caribbean and central America, which are areas of heightened hurricane risk. Fitch assigned an ESG.RS of '4' for 'Exposure to Environmental Impacts' given its operational footprint and its potential risk to profitability.

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Refinancing Risk

The growing investor focus on value chain environmental exposure creates a degree of refinancing risk for industrials dependent on fossil fuels and other polluting inputs. The long asset lifespan of many infrastructure and real-estate investments creates heightened risk around refinancing where exposure to extreme weather events and other refinancing activities is a concern.

Regulatory and Litigation Risk

Regulatory compliance costs have increased in the past decade as a result of tightening environmental standards in both emerging and developed markets. The introduction of compliant emissions trading schemes in some regions has also pushed up costs. Companies may be subject to multiple regulators with overlapping remits, and governments can be highly reactive to short-term unrest and negative media coverage. High-profile environmental litigation cases in North America and Asia in recent years have demonstrated the ability of these cases to significantly affect companies.

FOOD PROCESSOR TEREOS FACES TIGHTENING INSECTICIDE REGULATION

Tereos SCA has an ESG.RS of '4' for Exposure to Environmental Impacts as the volumes of its sugar production in France are affected by regulation that restrains the use of nicotinoid-based insecticides in beetroot farming. This has a negative impact on the credit profile and is relevant to the rating in conjunction with
other factors.

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APPENDIX

EXAMPLES OF ENERGY-MANAGEMENT DATA SOURCES AND TOOLS

Data/tool	Description	Source examples
Energy consumption by type, energy efficiency performance	Publicly available qualitative and quantitative information, metrics and targets on an entity's policies, initiatives, strategies, risk management, energy consumption by source, and energy efficiency	Public disclosure in reports and financial filings, e.g. annual reports; sustainability reports; TCFD reports; CDP Climate Change C8; GRI 302 1-5-Energy Consumption/Efficiency; Specialist providers (eg. Urgentem, Quantis, South Pole, ISS) For metals and mining assets - CRU
Aggregate and individual climate/ emissions/ESG/SDG scores	Company profile scores that provide an assessment on the current climate/ESG/SDG credentials of entities relative to their sector peers	Bloomberg; Vigeo Eiris (Moody's Corporation); MSCI; Refinitiv; Sustainalytics; Trucost (S&P Global)
Sentiment-based data and ESG controversies	Scores that are based on either positive, news flow, negative news flow, or number of reported emissions-related controversial incidents such as pollution incidents or fines	Bloomberg; Factset; RepRisk; Truvalue Labs
ESG credit scores	Scores that articulate the level of influence a energy-related issue has on a credit rating decision.	Fitch's ESG.RS
Materiality frameworks	Sector-specific or regional frameworks that identify relevant climate-related risk factor	Fitch's ESG Dashboards; Fitch's Relevance Maps; SASB Materiality Map; Datamaran; ERM
GHG-related indices	Thematic indices based on a climate or GHG emissions theme, usually on the basis of carbon efficiency, low-carbon power generation or exposure to carbon pricing	Benchmark providers; ETF providers; index providers
Emissions factors	Standard emissions factors for calculating emissions from company operations, energy purchase and supply chains	UK DEFRA, IEA, US EPA
Climate scenario analysis		
and portfolio stress testing	Tools that measure the exposure of entities and portfolios to climate transition risk	UN PRI/Vivid Economics Inevitable Policy Response, Planetrics, IEA, The Climate Service, 2DII PACTA, Asset Resolution
Green/sustainability bond and loans	Data on issuance and use of proceeds	Climate Bonds Initiative, Bloomberg
Product lifecycle analysis data	Data on product lifecycle emissions	EcoInvent. GaBi
Carbon offset data	Data on price, performance and availability of carbon offsets and emissions credits	Sylvera, Forest Trends, Ecosystem Marketplace

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Data/tool	Description	Source examples
Pricing and investment data	Data on energy pricing rates, low-carbon investment trends	World Bank Carbon Pricing Survey, CDP; Refinitiv, Ember Climate , OECD, China Carbon Pricing Survey, Arabella Investors, Global Data, World Resources Institute
Valuation tools	Shadow pricing, probabilistic value adjustment, value at risk, financial impact disclosure, scenario analysis	Oliver Wyman, Trucost (S&P Global), Resources for the Future , WRI

Source: Fitch Ratings

EXAMPLES OF ENERGY AND FUEL MANAGEMENT DATA SOURCES AND TOOLS

Data/tool	Description	Source examples
Entity GHG emissions, emissions to air	Publicly available qualitative and quantitative information, metrics and targets on an entity's policies, initiatives, strategies, risk management, Scope 1, 2 and 3 emissions in line with the GHG Protocol	Public disclosure in reports and financial filings, e.g. annual reports; sustainability reports; TCFD reports; CDP Water; GRI 305 1-7, GHG emissions; Significant Air Emissions; Specialist providers (eg. Urgentem, Quantis, South Pole, ISS)
Aggregate and individual climate/ emissions/ESG/SDG scores	Company profile scores that provide an assessment on the current climate/ESG/SDG credentials of entities relative to their sector peers	Bloomberg; Vigeo Eiris (Moody's Corporation); MSCI; Refinitiv; Sustainalytics; Trucost (S&P Global)
Sentiment-based data and ESG controversies	Scores that are based on either positive, news flow, negative news flow, or number of reported emissions-related controversial incidents such as pollution incidents or fines	Bloomberg; Factset; RepRisk; Truvalue Labs
ESG credit scores	Scores that articulate the level of influence an emissions-related issue has on a credit rating decision.	Fitch's ESG.RS
Materiality frameworks	Sector-specific or regional frameworks that identify relevant climate-related risk factor	Fitch's ESG Dashboards; Fitch's Relevance Maps; SASB Materiality Map; Datamaran; ERM
GHG-related indices	Thematic indices based on a climate or GHG emissions theme, usually on the basis of carbon efficiency, low carbon power generation or exposure to carbon pricing	Benchmark providers; ETF providers; index providers
Emissions factors	Standard emissions factors for calculating emissions from company operations and supply chains	UK DEFRA, IEA, US EPA
Climate scenario analysis and portfolio stress testing	Tools that measure the exposure of entities and portfolios to climate transition risk	UN PRI/Vivid Economics Inevitable Policy Response, Planetrics, IEA, The Climate Service, 2DII PACTA, Asset Resolution

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Data/tool	Description	Source examples
Green/sustainability bond and loans	Data on issuance and use of proceeds	Climate Bonds Initiative, Bloomberg
Product lifecycle analysis data	Data on product lifecycle emissions	EcoInvent. GaBi
Carbon offset data	Data on price, performance and availability of carbon offsets and emissions credits	Sylvera, Forest Trends, Ecosystem Marketplace
Pricing and investment data	Data on carbon pricing rates, low carbon investment trends	World Bank Carbon Pricing Survey, CDP; Refinitiv, Ember Climate , OECD, China Carbon Pricing Survey, Arabella Investors, Global Data
Valuation tools	Shadow pricing, probabilistic value adjustment, value at risk, financial impact disclosure, scenario analysis	Oliver Wyman, Trucost (S&P Global), Resources for the Future , WRI

Source: Fitch Ratings

EXAMPLES OF EXPOSURE TO ENVIRONMENTAL IMPACTS DATA SOURCES AND TOOLS

Data/tool	Description	Source examples
Energy consumption by type, energy efficiency performance	Publicly available qualitative and quantitative information, metrics and targets on an entity's policies, initiatives, strategies, risk management, energy consumption by source and energy efficiency	Public disclosure in reports and financial filings, e.g. annual reports; sustainability reports; TCFD reports; CDP Climate Change C8; GRI 302 1-5-Energy Consumption/Efficiency; Specialist providers (eg. Urgentem, Quantis, South Pole, ISS) For metals and mining assets - CRU
Aggregate and individual climate/ ESG/SDG scores	Company profile scores that provide an assessment on the current climate/ESG/ SDG credentials of entities relative to their sector peers	Bloomberg; Vigeo Eiris (Moody's Corporation); MSCI; Refinitiv; Sustainalytics; Trucost (S&P Global)
Sentiment-based data and ESG controversies	Scores that are based on either positive news flow, negative news flow, or number of reported controversial incidents such as pollution incidents or fines	Bloomberg; Factset; RepRisk; Truvalue Labs
ESG credit scores	Scores that articulate the level of influence a energy-related issue has on a credit rating decision.	Fitch's ESG.RS
Materiality frameworks	Sector-specific or regional frameworks that identify relevant climate-related risk factor	Fitch's ESG dashboards; Fitch's relevance maps; SASB materiality map; Datamaran; ERM
GHG-related indices	Thematic indices based on a climate theme, usually on the basis of carbon efficiency, low carbon power generation or exposure to carbon pricing	Benchmark providers; ETF providers; index providers

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Data/tool	Description	Source examples
Natural hazard data	Database on historical and future modelled natural hazard data	GRESB, Munich Re, Verisk, Aon
Climate scenario analysis		
and portfolio stress testing	Tools that measure the exposure of entities and portfolios to climate physical risk	UN PRI/Vivid Economics Inevitable Policy Response, Planetrics, IEA, The Climate Service, 2DII PACTA, Asset Resolution. Baringa, MSCI, ERM, ClimateWise, 427, Carbon4Finance, Ortec, RMS, South Pole
Green/sustainability bond and loans	Data on issuance and use of proceeds	Climate Bonds Initiative, Bloomberg
Carbon offset data	Data on price, performance and availability of carbon offsets and emissions credits	Sylvera, Forest Trends, Ecosystem Marketplace
Valuation tools	Shadow pricing, probabilistic value adjustment, value at risk, financial impact disclosure, scenario analysis	Oliver Wyman, Trucost (S&P Global), Resources for the Future WRI

Source: Fitch Ratings

EXAMPLES OF GHG EMISSIONS AND AIR QUALITY DATA SOURCES AND TOOLS

Data/tool	Description	Source examples
Entity GHG emissions, emissions to air	Publicly available qualitative and quantitative information, metrics and targets on an entity's policies, initiatives, strategies, risk management, Scope 1, 2 and 3 emissions in line with the GHG Protocol	Public disclosure in reports and financial filings, e.g. annual reports; sustainability reports; TCFD reports; CDP Water; GRI 305 1-7, GHG emissions; Significant Air Emissions; Specialist providers (eg. Urgentem, Quantis, South Pole, ISS); CRU for metals and mining assets; The EEquator Principles and IFC Performance Standards for project finance
Aggregate and individual climate/ emissions/ESG/SDG scores	Company profile scores that provide an assessment on the current climate/ESG/SDG credentials of entities relative to their sector peers	Bloomberg; Vigeo Eiris (Moody's Corporation); MSCI; Refinitiv; Sustainalytics; Trucost (S&P Global)
Sentiment-based data and ESG controversies	Scores that are based on either positive news flow, negative news flow, or number of reported emissions-related controversial incidents such as pollution incidents or fines	Bloomberg; Factset; RepRisk; Truvalue Labs
ESG credit scores	Scores that articulate the level of influence an emissions-related issue has on a credit rating decision.	Fitch's ESG.RS

Sustainable Fitch

Data/tool	Description	Source examples
Materiality frameworks	Sector-specific or regional frameworks that identify relevant climate-related risk factor	Fitch's ESG Dashboards; Fitch's Relevance Maps; SASB Materiality Map; Datamaran; ERM
GHG-related indices	Thematic indices based on a climate or GHG emissions theme, usually on the basis of carbon efficiency, low carbon power generation or exposure to carbon pricing	Benchmark providers; ETF providers; index providers
Emissions factors	Standard emissions factors for calculating emissions from company operations and supply chains	UK DEFRA, IEA, US EPA
Climate scenario analysis	Tools that measure the exposure of entities and portfolios to climate transition risk	UN PRI/Vivid Economics Inevitable Policy Response, Planetrics, IEA, The Climate Service, 2DII PACTA, Asset Resolution
Green/sustainability bond and loans	Data on issuance and use of proceeds	Climate Bonds Initiative, Bloomberg
Product lifecycle analysis data	Data on product lifecycle emissions	EcoInvent. GaBi
Carbon offset data	Data on price, performance and availability of carbon offsets and emissions credits	Sylvera, Forest Trends, Ecosystem Marketplace
Pricing and investment data	Data on carbon pricing rates, low carbon investment trends	World Bank Carbon Pricing Survey, CDP; Refinitiv, Ember Climate , OECD, China Carbon Pricing Survey, Arabella Investors, Global Data
Valuation tools	Shadow pricing, probabilistic value adjustment, value at risk, financial impact disclosure, scenario analysis	Oliver Wyman, Trucost (S&P Global), Resources for the Future , WRI

Source: Fitch Ratings

EXAMPLES OF BIODIVERSITY AND WASTE DATA SOURCES AND TOOLS

Data/tool	Description	Source examples
Entity biodiversity and waste disclosure	Publicly available qualitative and quantitative information, metrics and targets on an entity's governance; policies; initiatives; strategies; risk management; land use for forestry, agriculture and mining activities; natural-capital consumption and production; waste reuse and disposal; among others.	Public disclosure in reports and financial filings, e.g. annual reports; sustainability reports; TCFD reports; CDP Forests; various data aggregators and research providers
Aggregate and individual biodiversity and waste /ESG/SDG scores	Company profile scores that provide an assessment on the current biodiversity and waste /ESG/SDG credentials of entities relative to their sector peers or comparable across sectors and regions.	Bloomberg; Vigeo Eiris (Moody's Corporation); MSCI; Refinitiv; Sustainalytics; Trucost (S&P Global).

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Data/tool	Description	Source examples
Sentiment-based data and ESG controversies	Scores that are based on either positive or negative news flow; or number of reported biodiversity and waste -related controversial incidents such as waste, pollution and other ecological incidents or fines.	Bloomberg; Factset; RepRisk; Truvalue Labs.
Supply-side biodiversity and waste data	Supply-side biodiversity and waste data covering land use; protected area; deforestation; threatened species; commodities; commodity producers, processors and traders.	IBAT, ENCORE; Global Forest Watch;
ESG credit scores	Scores that articulate the level of influence a biodiversity and waste issue has on a credit rating decision.	Fitch Rating's ESG.RS
Materiality frameworks	Sector-specific or regional frameworks that identify relevant biodiversity and waste -related risk factor.	ENCORE, Fitch's ESG Dashboards; Fitch's Relevance Maps; SASB Materiality Map;
biodiversity and waste indices	Thematic indices based on a biodiversity and waste theme (see theme list in section Portfolio-level, Thematic Approaches to Biodiversity and Waste).	UK DEFRA, IEA, US EPA
Benchmark providers; ETF providers; index providers	Tools that measure the exposure of entities and portfolios to climate transition risk	UN PRI/Vivid Economics Inevitable Policy Response, Planetrics, IEA, The Climate Service, 2DII PACTA, Asset Resolution
Biodiversity and waste footprinting and risk integration in entity and portfolio analysis	Tools that measure the biodiversity impacts of entities and portfolios.	Biodiversdity Footprint for Financials (BFFI); Global Biodiversity Score (GBS); Species Threat Abatement and Recovery Metric (STAR); Exiobase
Valuation tools	Shadow pricing, probabilistic value adjustment, value at risk, financial impact disclosure, scenario analysis	

Source: Fitch Ratings

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EXAMPLES OF WATER DATA SOURCES AND TOOLS

Data/tool	Description	Source examples
Entity water disclosure	Publicly available qualitative and quantitative information, metrics and targets on an entity's policies, initiatives, strategies, risk management, withdrawal, consumption, reuse and treatment	Public disclosure in reports and financial filings, e.g. annual reports; sustainability reports; TCFD reports; CDP Water; GRI 303-Water and effluents; for project finance – The Equator Principles and IFC Performance Standards
Aggregate and individual water/ESG/ SDG scores	Company profile scores that provide an assessment on the current water/ESG/SDG credentials of entities relative to their sector peers	Bloomberg; Vigeo Eiris (Moody's Corporation); MSCI; Refinitiv; Sustainalytics; Trucost (S&P Global)
Sentiment-based data and ESG controversies	Scores that are based on either positive, news flow, negative news flow, or number of reported water-related controversial incidents such as pollution incidents or fines	Bloomberg; Factset; RepRisk; Truvalue Labs
Supply-side water data	Supply-side water data covering drainage basin water figures on availability, consumption, competition, quality, pollution, variability, floods, droughts, penalties, incidents, tariffs, etc	Natural Capital Finance Alliance's ENCORE; WRI's Aqueduct; WWF Water Risk Filter;
ESG credit scores	Scores that articulate the level of influence a water-related issue has on a credit rating decision.	Fitch's ESG Relevance Scores
Materiality frameworks	Sector-specific or regional frameworks that identify relevant water-related risk factor	Fitch's ESG Dashboards; Fitch's Relevance Maps; SASB Materiality Map
Water-related indices	Thematic indices based on a water theme. The constituents can contain water utilities and manufacturers of water and wastewater solutions	Benchmark providers; ETF providers; index providers
Water footprinting and water risk integration in entity and portfolio analysis	Tools that measure the water consumption of entities and portfolios	CDP Water (Supply Chain); Ceres' Investor Water Toolkit; Natural Capital Finance Alliance's ENCORE; WRI's Aqueduct; WWF Water Risk Filter
Pricing and investment data	Municipal tariff surveys, water related capital and operational spending data	Global Water Intelligence, DesalData, International Water Association
Valuation tools	Shadow pricing, probabilistic value adjustment, value at risk, financial impact disclosure, scenario analysis	Bloomberg; Columbia Water Center; South Pole; Veolia's True Cost of Water tools; WRI's Aqueduct; WWF Water Risk Filter

Source: Fitch Ratings

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