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Harmful Marine Extractives:

Understanding the risks & impacts of financing non-renewable extractive industries

Offshore Oil & Gas

Acknowledgements

Authors

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Project team

Julian Roberts
Lead Author
Blue Resources Ltd

Klaas de Vos
Project Coordinator
Ocean Fox Advisory

UNEP

Dennis Fritsch
Senior Project Coordinator
Sustainable Blue Economy Finance
UNEP FI

Jessica Smith
Nature Lead
UNEP FI

Ole Vestergaard
Programme Officer
Marine & Coastal Ecosystems
UNEP

Karla Martinez Toral
Junior Consultant
Sustainable Blue Economy Finance
UNEP FI

Cara Wilson
Communications Lead
Banking & Ecosystems
UNEP FI

Laura Essaidi
Communications
Nature
UNEP FI

Adam Garfunkel
Editor
Junxion Strategy

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Working Group

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Adam Hughes
Scottish Association for Marine Science

Aditya Siroya
rePurpose Global

Alice Merry
Finance Innovation Lab

Alice Millest
Finance Earth

Alpa Bhattacharjee
HSBC

Andre Almeida Santos
Indico Capital Partners

Andrew Friedman
Pew Charitable Trusts

Andrew Smith
Greenbackers

Andy Attali
8F Asset Management

Anne Golbery
ESAFON

Beate Hollweg and team
European Environment Agency

Ben Hart
World Resources Institute

Bernadette Blankers
Climate Fund Managers

Bettina Kretschmer
European Commission

Claire Cummins
Climate Fund Managers

Claire Jurgens
Green Digital Finance Alliance

Danélle Albertse
Climate Fund Managers

Daniel Fairweather
Gallagher

Dean Cooper
WWF Norway

Franck Jesus and team
European Investment Bank

François Mosnier
Planet Tracker

Gelan Jamil
Deloitte

Georg Baunach
Hatch Blue

Gloria Dei
Palladium Impact Capital

Grace Lucas
Palladium Impact Capital

Heidi Savelli-Soderberg
UNEP

Ioanna Skondra
American Hellenic Hull

Jean-Baptiste Jouffray
Stockholm Resilience Centre

John Virdin
Duke University

John Willis
Planet Tracker

Julia Manning
European Bank for Reconstruction and Development

Julie Foulon
European Commission

Julie Miller
BNP Paribas

Kai Wiegler
KfW

Kevin Flowers
European Commission

Komal Sinha
rePurpose Global

Laura Engeman
Scripps Institution of Oceanography

Lauren Compere
Boston Common Asset Management

Lin Zhiqian
Bank of China

Lionel Heurtin
OFI Asset Management

Louise Heaps
WWF UK

Lucy Holmes
WWF US

Luke Halsey
AiiM Partners

Mathew Hussey
Gallagher

Mark J Spalding
Ocean Foundation

Melissa Garvey
The Nature Conservancy

Melissa Walsh
Asian Development Bank

Michael Adams
Ocean Assets Institute

Nathanial Matthews
Global Resilience Partnership

Nick Zhang
Palladium Impact Capital

Nigel Bradly
EnviroStrat

Ozgur Altun
International Capital Market Association

Peggy Lefort
UNEP FI

Peter Chauvel
Common Seas

Peter Hjemdahl
RePurpose Global

Piera Tortora
Organisation for Economic Cooperation and Development

Rolando Morillo
Rockefeller Capital Management

Ruby White
Deloitte

Ruizhao Chen
China Industrial Bank

Shiblee Alam
8F Asset Management

Silvia Nanni
European Commission

Sylvia Michele Diez Campino
World Bank

Steven B. Adler
Ocean Data Alliance

Tan Sei Hoe
Bank of China

Ted Janulis
Investable Oceans

Valeria Ramundo Orlando
GreenSquare Ventures

Vemund Olsen
Storebrand Asset Management

Vita Moltedo
GreenSquare Ventures

Winnie Lau
Pew Charitable Trusts

Zacharias Malik
Deloitte

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List of abbreviations and acronyms

CCUS	Carbon capture, utilization and storage
CO_2	Carbon dioxide
CH_4	Methane
DPSIR	Driver, pressure, state, impact and response
E&P	Exploration and production
EEZ	Exclusive economic zone
EIA	U.S. Energy Information Administration
GHG	Greenhouse gas
H&M	Hull and machinery [insurance]
H2S	Hydrogen sulphide
IEA	International Energy Agency
IMO	International Maritime Organisation
IFI	International finance institution
IOC	International oil company
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
LNG	Liquid natural gas
MODU	Mobile offshore drilling unit
NGL	Natural gas liquid
NOC	National oil company
NOx	Nitrogen oxides
NZE	Net-zero emissions
O&G	Oil and gas
OECD	Organisation for Economic Co-operation and Development
P&I	Protection and indemnity [insurance]
RBL	Reserve-based lending
SO_2	Sulphur dioxide
TWh	Terawatt-hour
UNEP	United Nations Environment Programme
UNEP FI	United Nations Environment Programme Sustainable Finance Initiative
VPP	Volumetric production payments
WOR	World Ocean Review

Executive summary

The ocean covers the majority of earth's surface, holding 97 per cent of all our water and 80 per cent of all life forms. Major ocean sectors such as fisheries, ports & shipping, marine renewable energy and coastal infrastructure, collectively contribute to a "blue"economy.

According to estimates prepared by the Organisation for Economic Co-operation and Development (OECD), ocean-related sectors contributed approximately USD 1.5trn of global gross value-added in 2010, a figure that is projected to increase to USD 3trn by 2030, with some ocean industries set to grow faster than the global economy.

However, ocean health is under increasing stress, faced with the triple crises of climate change, nature loss, and pollution—leaving the industries, businesses and livelihoods that rely on the ocean exposed to serious risks. While many existing ocean-linked sectors have the potential to contribute positively to a sustainable blue economy, this is not true for all sectors. The extraction of non-renewable marine resources such as oil & gas and seabed mineral deposits in particular, poses a significant risk to the ocean and cannot be considered sustainable.

Recognizing that a significant amount of investment and financing continues to be directed towards the exploitation of non-renewable marine mineral resources, UNEP FI has prepared a series of sector-specific briefing papers[1] to explore their social and environmental impacts, with particular reference to the development, operation and closure of each of these sectors, the risks to financial institutions of continued association with these activities, and managing an equitable transition to more sustainable alternatives.

This briefing paper discusses the potential risks associated with the exploration and production of offshore petroleum resources (oil and gas), and how financial institutions should engage with and respond to this sector.

Key takeaways

- It is now widely recognized that, if atmospheric temperature is not to exceed 1.5°C above pre-industrial levels, emissions of human-caused carbon dioxide must fall by at least 45 per cent by 2030 (as compared to 2010 levels) reaching "net zero" by 2050.

1 The sectors addressed are: (i) offshore oil & gas exploration and production; (ii) dredging and marine aggregates extraction; and (iii) deep-sea mining.

- Reducing emissions to achieve the 1.5°C limit requires a fundamental shift away from fossil fuels and an unparalleled investment in the transition to low-carbon (renewable) energy sources, not just incremental emissions reductions. The inevitable consequence of this is that global fossil fuel use, and therefore production, must be phased out and eliminated as quickly as possible.
- **Simply stated, if the world is to achieve the Intergovernmental Panel on Climate Change (IPCC's) 1.5°C scenario, no new oil and gas production projects can be sanctioned and existing production must be significantly and urgently reduced towards full transition to sustainable renewable energy.** This is the primary and most significant message of this paper.
- The continued investment in the oil and gas sector by financial institutions is inconsistent with a cost-optimized Paris-aligned climate-change scenario. On this basis, many financial institutions have sought to divest their portfolios entirely of hydrocarbon companies and now support a thoughtful and rapid equitable transition towards a low-carbon economy. It is, however, acknowledged that many financial institutions remain invested in this sector.
- Those financial institutions that remain invested should refrain from providing financial services for the development of new oil and gas fields and other activities that are incompatible with the International Energy Authority (IEA's) Net-zero Emissions by 2050 Scenario (NZE), and require existing oil and gas clients to produce credible transition strategies toward NZE.
- In the interim, financial institutions should be aware of and take into consideration the broad range of additional, non-climate related impacts that create material risks to financial institutions, notably in the realm of reputational and regulatory risks as well as operational and physical risks. These additional impacts and risks are addressed in the subsequent sections of this briefing paper.
- At the same time, these financial institutions are encouraged to seek out and incentivize opportunities to drive the oil and gas industry to adopt new technology rapidly and operational approaches that will allow them to significantly reduce their environmental footprint, through:
    - Deploying industry capital and resources to support a smooth transition to renewable offshore energy;
    - Reducing the emissions associated with oil and gas production and its supply chain;
    - Supporting integrated sustainability of companies, including by encouraging the reduction of oil and gas dependency in other companies and holdings.

Introduction

Context

The ocean is a vital driver of planetary systems and a source of economic activity, livelihoods and food security. The Intergovernmental Panel on Climate Change (IPCC)'s 2019 special report on the ocean and cryosphere in a changing climate states: "In addition to their role within the climate system, such as the uptake and redistribution of natural and anthropogenic carbon dioxide (CO_2) and heat, as well as ecosystem support, services provided to people by the ocean and/or cryosphere include food and water supply, renewable energy, and benefits for health and well-being, cultural values, tourism, trade, and transport)" (IPCC 2019 pp 15). This dependence on the ocean as a major source of resources and services is projected to continue growing as human populations increase, which by 2050 is projected to reach nine billion.

At the same time, the health of the global ocean is under threat from human activity, with increasing pollution, overfishing, invasive species, physical damage to ocean habitats, unsustainable coastal development and climate change all contributing to the loss of biodiversity and ecosystem services, and to the decline in the environmental health of the ocean. Finance for a sustainable ocean remains limited, with SDG 14 (Life Below Water) receiving the least official development assistance (ODA) out of all the SDGs in 2017 (Pincet, Okabe and Pawelczyk 2019). Nevertheless, awareness of the key services and provisions provided by the ocean is increasing, as well as the recognition that continued ocean health decline inhibits prosperity (Laffoley *et al*. 2019).

The sustainable blue economy is an approach put forward by the international community to take into account the health of the ocean as it strives to balance the three dimensions of sustainable development: economic, social and environmental. It is an economy based on circularity, collaboration, resilience, opportunity and interdependence. Its growth is driven by investments that reduce carbon emissions and pollution, enhance energy efficiency, harness the power of natural capital and the benefits that these ecosystems provide, alongside halting the loss of biodiversity.

A "sustainable blue economy" can be defined as one that: "provides social and economic benefits for current and future generations; restores, protects and maintains diverse, productive and resilient ecosystems; and is based on clean technologies, renewable energy and circular material flows".

With appropriate planning, governance and decision-making that involves the broad range of relevant stakeholders, many existing ocean sectors have the potential to contribute positively to a sustainable blue economy. However, this is not the case for all

sectors. The extraction of non-renewable marine resources—(particularly: (i) offshore oil & gas), (ii) dredging and marine sand & gravel extraction, and (iii) the potential future development of deep-seabed mining)—and the inherent impacts of these sectors on environment and society pose a significant risk to the ocean and therefore cannot be considered sustainable.

Given the critical importance of the ocean as a driver of socioeconomic development, it is becoming increasingly important that future investment in those ocean sectors that present the greatest social and environmental risks is replaced by investment in sectors of the blue economy that are rapidly transitioning towards sustainable pathways. In this regard, banks, insurers and investors have a key role to play in financing an equitable transition to a sustainable blue economy, helping to rebuild ocean prosperity and restore biodiversity. Through their lending, underwriting and investment activities, as well as their client relationships, financial institutions have a major impact on ocean health and hold the power to accelerate and mainstream the sustainable transition of ocean-linked industries.

With a significant amount of existing financing still largely directed towards the unsustainable extraction of non-renewable marine mineral resources, the United Nations Environment Programme Finance Initiative (UNEP FI) considers it important to provide financial institutions with science-based and decision-useful information, with a view to supporting those financial institutions wishing to transition away from, or avoid altogether, any involvement in non-renewable, marine extractive activities. Given the substantial differences within the three broad sector categories listed (oil & gas, dredging & aggregate extraction, and deep-sea mining), UNEP FI has prepared a series of sector-specific briefing papers to explore their social and environmental impacts, with particular reference to the development, operation and closure of each of these sectors, the risks to financial institutions of continued association with these activities, and managing the transition to more sustainable alternatives.

Climate change and the need for a low-carbon transition

According to the Intergovernmental Panel on Climate Change (IPCC), a finite amount of carbon can be emitted to the atmosphere if atmospheric temperature is to remain within the relative safety of 1.5°C above pre-industrial levels. Given that a significant amount of that "carbon budget" has already been emitted, the IPCC defines the amount of budget remaining as cumulative CO_2 emissions from the start of 2021 until the time of net-zero global emissions (IPCC 2021).

On this basis, in 2018 the IPCC stated that: "Global net human-caused emissions of carbon dioxide (CO_2) would need to fall by about 45 percent from 2010 levels by 2030, reaching 'net zero' around 2050, in order to keep global average temperature rise below 1.5°C" (IPCC 2018). This is reflected in the International Energy Authority (IEA's) recently published Net-zero Emissions by 2050 (NZE) Scenario, the first time IEA has published a scenario aligned with the IPCC's 1.5°C limit (Muttitt and Rouse 2022).

The need for such significant cuts has now been acknowledged by the global community which, at the 26th Meeting of the Conference of Parties to the Paris Agreement (COP26) recognized that: "limiting global warming to 1.5°C requires rapid, deep and sustained reductions in global greenhouse gas emissions, including reducing global carbon dioxide emissions by 45 per cent by 2030 relative to the 2010 level and to net zero around mid-century, as well as deep reductions in other greenhouse gases." (United Nations [UN] 2021).

Despite this, under the IEA's Announced Pledges Scenario (APS),[2] global temperatures are projected to rise by approximately 2.1°C in 2100 (with a 50 per cent probability). Moreover, the most recent country pledges to achieve net-zero emissions—that were announced at the COP26—suggest that the 1.5°C will not be met and that further commitments will be required. Reducing emissions to allow the global average temperature rise not to exceed the relative safety of 1.5°C therefore requires a fundamental shift away from fossil fuels and an unparalleled increase in clean energy investment (IEA 2021a).

According to IEA, actions in four key areas over the next decade are essential to keep the door to a 1.5°C stabilization open:

i. a massive push for clean electrification;
ii. a renewed focus on realizing the full potential of energy efficiency;
iii. concerted efforts to prevent leaks from fossil fuel operations; and
iv. a boost to clean energy innovation.

Of these, accelerating the decarbonization of the electricity mix is the single most important lever available to policymakers, and requires a significant increase in the deployment of low emissions power generation technologies.

In this regard it should be acknowledged that, while many of the most severe impacts of climate change will be felt most severely by developing nations, the bulk of emissions causing climate change result from the activities of developed nations. The costs associated with adaptation and mitigation measures needed to respond to the threat posed by climate change is largely beyond the capability of small and developing nations. Hence, there is a strong argument that such costs should be born largely by developed nations.

2 The APS assumes that all existing national net-zero emissions pledges are realized in full and on time. The aim of the APS is to see how far full implementation of the national net-zero emissions pledges would take the world towards reaching net-zero emissions, and to examine the scale of the transformation of the energy sector that such a path would require.

About this briefing paper

Purpose and scope

These briefing papers are a practical, working resource for financial institutions to assess their potential exposure to social and environmental risk factors associated with non-renewable marine extractive industries and recommend actions based on indicators of the social and environmental pressures in each sector. They summarize the key relationships between pressures and their associated impacts following a modified Driver-Pressure-State-Impact-Response (DPSIR) framework, building on this understanding to highlight how and why these pressures are material to financial institutions and the types of risk they represent.

The approach taken for these briefing papers is based on:

- How financial institutions should view these sectors, particularly in terms of managing and accelerating the equitable transition away from unsustainable economic activity;
- The avoidance of new financing for the sectors;
- Challenging the existing finance approaches (where these exist) for some of the above activities to minimize harm and mitigate their impact as far as possible; and
- The search for sustainable alternatives and divestment from these activities.

Notwithstanding the clear need for a rapid transition away from fossil fuels and the transition risks this implies for the oil and gas sector, the offshore exploration and production of oil and gas also presents a broad range of non-climate related impacts and risks that financial institutions should also consider. These additional impacts and risks are the main focus of this briefing paper, which discusses the potential risks associated with the exploration and production of offshore petroleum resources, and how financial institutions should engage with and respond to the offshore oil and gas sector.

Intended audience

The primary audience for this briefing paper is financial institutions (banks, insurers, and investors) with exposure to harmful and non-renewable marine extractive industries and those seeking to support the transition away from unsustainable activity towards a sustainable blue economy. The briefing paper aims to provide an initial framework for this broad variety of institutions to consider how sustainability impacts and risks specific to harmful and non-renewable marine extractives manifest within their own portfolios. Given

the breadth of this subject matter and the relevance of sustainability considerations to a broad array of stakeholders, this information may also be valuable to the public sector, intergovernmental organisations, academia, civil society, commerce, and industry.

The briefing paper also aims to provide an initial framework for institutions to consider the damaging environmental impact they could have, as well as the potential business risks arising from financing harmful and non-renewable marine extractives.

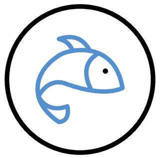
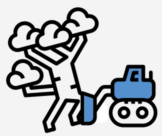
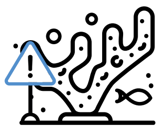
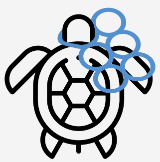
Approach

The information and recommendations in this paper were developed using a bottom-up approach grounded in extensive literature review and expert interviews. Based on this and the latest available science, the drivers of impact in the sector were determined, the pressures exerted by the oil and gas sector were identified, and these pressures were linked to categories of social and environmental impact. This approach is consistent with the DPSIR[3] framework developed by L'Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER) in 2004. On the basis of these pressures and impacts, risks and how these are material to financial institutions are articulated.

Table 1 outlines the meaning of the environmental and social impacts discussed in this briefing paper, and provides examples of where they may materialize.

3 DPSIR (Driver, Pressure, State, Impact, Response) is a framework to systematically approach impacts and describe the relationship between human activity and impact. It allows for a more precise assessment and understanding of how actions and activities affect the environment. It is based on a model originally developed by the Dutch National Institute of Public Health and Environment and later adopted by the European Environment Agency (EEA) (IFREMER 2004).

Table 1: Table of impact definitions

Environmental impacts		Description	Examples
	**Loss or reduction in marine biodiversity including loss of endangered, threatened and protected species**	Loss or reduction of populations of a given species, or of a species as a whole, due to human impact. This includes endangered, threatened and protected (ETP) species as defined by the IUCN Red List of Threatened Species and protections under applicable jurisdictions.	This may result from the impacts of noise or other disturbance that causes individuals to change their behaviour or may result from impacts to the habitats that support these organisms.
	**Loss of ecosystem resilience and provision of ecosystem services**	Loss or reduction in the ability of an ecosystem to provide specific benefits. These benefits, termed ecosystem services, include provisioning services such as oxygen production and carbon sequestration, as well as regulating services for the climate.	The introduction of pollutants (including suspended sediment) may exacerbate existing impacts and impact key services such as primary production.
	**Loss or degradation of coastal and marine habitats**	Changes to the physical environment on which life depends.	This may result from physical damage to the seabed as a result of dredging or mineral extraction.
	**Reduction in animal welfare**	The consequences of human activity on the health of individual animals, both wild and farmed. It complements the impact on biodiversity, which looks at impacts on groups of animals and species. These impacts are closely linked and often appear together.	Reduction in animal welfare includes sources of stress for many organisms—including noise pollution from vessels and construction activity.

Increased GHG concentrations	The role of greenhouse gas (GHG) emissions in contributing to climate change. While human activity affects the climate in many ways, as well as the capacity to offer resilience or adapt to climate change, this impact covers the output of GHG emissions into the atmosphere itself, raising concentrations that result in a changed climate.	This results from a broad range of human activity, including emissions from vessels and offshore mineral extraction activity (including flaring and venting of gas from offshore installations).
Changes to marine biological, chemical and geological cycles	The consequences of changes to biogeochemistry—the natural processes within the ocean that play a role in regulating the planet, such as the water, carbon and nitrogen cycles. While dependent on water chemistry, marine life also plays a role in these cycles. As such this is closely linked to loss of ecosystem services—though the consequences differ, focusing specifically on these global chemical regulation processes.	This may result, for example, from removal of specific mineral layers from the seabed or from the release of contaminants such as heavy metals to the water column.
Social impacts	**Description**	**Examples**
Violation of human rights including rights of indigenous communities	The violation of any human right, including the rights of indigenous communities, in the process of development or financing of a given sector. This includes both specific and clear examples of human rights violations as well as more systemic human rights violations such as the impact of inequality of opportunities between social groups and genders.	This may result, for example, from the exclusion of local communities from sites of specific cultural significance due to the occupation of the site for mineral processing purposes.
Reduction or loss of access to sustainable and inclusive livelihoods	The consequences of development on an individual or community's ability to attain and maintain livelihoods.	This impact may cover the consequences of pollution preventing a community's ability to harvest living marine resources upon which their livelihoods depend, or the construction of mineral processing infrastructure physically preventing coastal communities' access to the marine environment.

Increased likelihood of injury, disease or loss of life	The consequence of an activity on the short- and long-term physical health of an individual or community as a result of development.	This may include the risks of injury or fatalities associated with high-risk offshore extractive industries as well as the impacts of increased levels of atmospheric pollution on coastal communities and workers.
Economic damage and loss of productivity	While all these impacts ultimately lead to some form of economic damage and loss of productivity, this impact specifically examines the direct, proximate consequences of a given pressure on the economic output and productivity of an individual or an enterprise.	This may include economic damages and losses because of a loss of livelihoods or a reduction in attractiveness of a coastal community due pollution or the development of new infrastructure.
Inequality of opportunities on the basis of age, sex, disability, race, ethnicity, origin, religion or economic or other status	Closely linked to the impact of human rights violations, this impact looks more specifically at those instances where the development of a sector reinforces or establishes inequality of opportunities within and between communities and between individuals.	This may include gender imbalances in corporations across blue economy sectors, or racial discrimination in employment. This may also include unequal distribution of costs or benefits associated with a development.
Perceived degradation in cultural value of the environment	The degradation of cultural value perceived by communities because of development or operation of a sector of the blue economy. This is distinct from the economic implications of the impact, and covers changes to the non-monetary value of an environment for local stakeholders.	This may include, as an example, the destruction of coastal sites of cultural or historical significance to make way for coastal development of mineral processing facilities.

Pressures and impacts were mapped against current and potential risks to financial institutions, with the materiality of these risks assessed. These risks cover five broad categories, as highlighted in Table 2.

Table 2: Table of risk descriptions

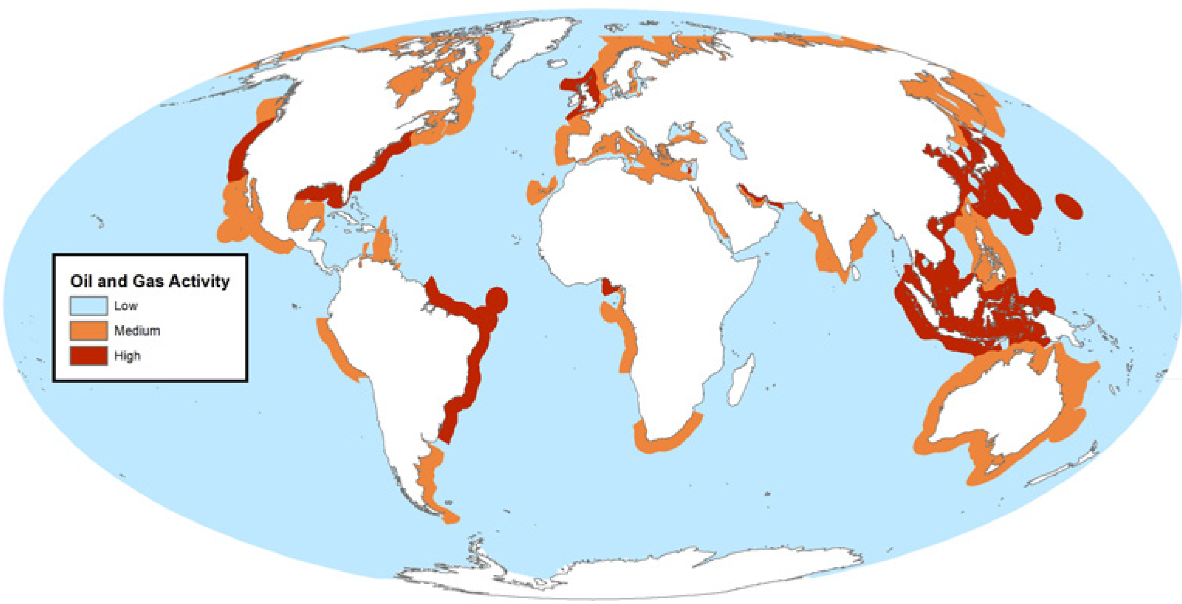
Risk	Description	Example
Physical	The risk to physical assets, often related to the impacts of climate change	Liabilities arising as a result of damage to sites of marine cultural heritage.
Operational	The risk of interruption of ongoing activities, including supply chain operations, logistics and other disruption of business operations	Loss of licence to operate or changes in project requirements due to environmental concerns.
Market	The risk of changes to the market served by a sector or development, including shifts in demand or supply	Major environmental incidents may result in significant financial liabilities for the operator/company to remedy the damage.
Regulatory	The risk of changes in the regulatory environment affecting the sector in question, including changes in how it may be taxed or subsidized	Policy/regulatory reforms as a result of increasing opposition to extractive industries. Risks of financial penalties for poor environmental performance.
Reputational	The risk of change in public perception, manifesting as public campaigns, boycotts or purchasing decisions	Negative press coverage associated with the loss of biodiversity or marine habitats associated with extractive activities. Economic losses experienced by other marine users resulting in local opposition.

The summary of key pressures, impacts and risks forms the basis of this briefing paper.

Sector overview

The generation of energy is a key factor for economic development. Since 1965 oil and gas has dominated the global energy mix, due to its broad distribution and relative ease of access (Stevens 2018). Production of oil and gas has routinely taken place in all offshore environments and, since 2000 more than half of major conventional oil and gas discoveries have been offshore (Zang *et al.* 2019) with discoveries of offshore production in: the Arctic, northern North Atlantic Ocean (UK and Norwegian waters), East and West Africa, Gulf of Mexico, Central and South America (including the Caribbean Sea), Southeast Asia, and Australasia (Cordes *et al.* 2016) (Figure I).

Figure I: Map indicating the present distribution of offshore oil and gas industry activity by exclusive economic zone.



Source: Macreadie et al. (2018).[4]

With almost half of remaining technically recoverable oil reserves being offshore, in recent years there has been a significant shift to investing in offshore production in increasingly deeper waters (Figure II). Prior to the COVID-19 pandemic projections were

4 The map shows activity levels calculated using the number of static lights in the sea presumed to be associated with oil rigs (Halpern *et al.* 2008) in each EEZ. The number of 1km2 pixels with static lights (Halpern et al. 2015) was summed within each EEZ but not standardized by the EEZ area. The red EEZ have high densities of oil activity (> 25,000 pixels with static lights); orange have medium densities (5,000–25,000) and blue areas have low density (< 5000). There is little oil and gas activity outside EEZ areas. Some large oceanic territories of larger EEZ (e.g. the Marcus Islands off Japan) have been removed from the map as they have no known oil activities.

for offshore production to grow from 30 per cent to 50 per cent of total global production, (U.S. Energy Information Administration [EIA] 2016).

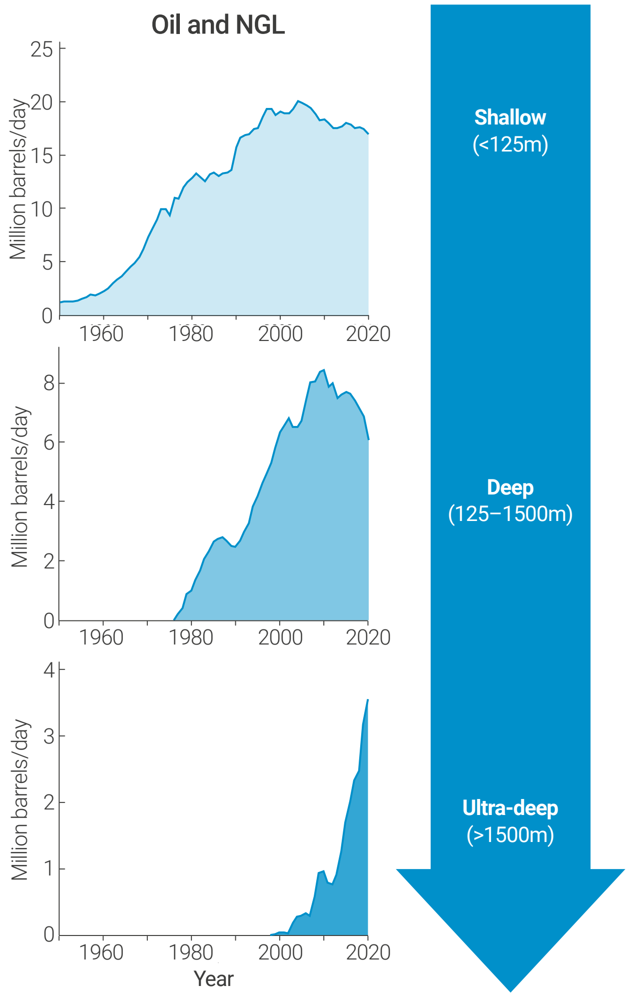


Figure II: Temporal trends in global offshore production volumes of crude oil and natural gas liquids (NGL) from 1950 to 2020, across water depth categories.

Adapted from: Jouffray *et al.* 2020. Data from Rystad Energy

Methane hydrates

In addition to conventional oil and gas reserves, the use of methane-rich gas hydrate deposits as an energy resource has also attracted attention (Lee and Holder 2001) with several countries (including Germany (SUGAR project), USA, Japan, South Korea, India, Taiwan, and China) currently supporting research into exploration and exploitation techniques. It should be stressed that no production activity has taken place and a number of potentially significant risks have been associated with the extraction of gas hydrates from the seabed.

The greatest impact would be accidental leakage of methane during the dissociation process. Other possible impacts of methane hydrate extraction include subsidence of the sea floor and submarine landslides, which could cause even greater instability in remaining hydrate deposits.

Structure of the oil and gas sector

The oil and gas industry is usually divided into three major life cycle stages, with some overlap between aspects of the stages:

Upstream	Otherwise known as "exploration and production" (E&P) the upstream stage includes identifying, evaluating and extracting new petroleum resources (both onshore and offshore). This stage may extend for many decades, with the productive lifetime of individual fields being constantly extended as new technologies make once marginal or uneconomic fields more commercially viable. The upstream sector accounts for approximately 75 per cent of financing investment in oil and gas projects. As such, upstream is arguably more risky and less predictable than downstream oil and gas ventures, as the amount of cash required to monetize an upstream resource and the timing of such investment contributions will not always be apparent at the outset.
Midstream	Generally, the midstream stage includes the transportation (by pipeline, rail, barge, or oil tanker), storage, and wholesale marketing of crude products. Midstream operations are often taken to include elements of the upstream and downstream sectors. For example, the midstream sector may include some initial processing to purify the raw natural gas as well as removing and producing elemental sulphur and natural gas liquids (NGL) as finished end-products.
Down-stream	Downstream operations include those processes involved in converting oil and gas into the finished product. This includes refining crude oil into gasoline, natural gas liquids, diesel, and a variety of other energy sources and the subsequent marketing and distribution of refined products.

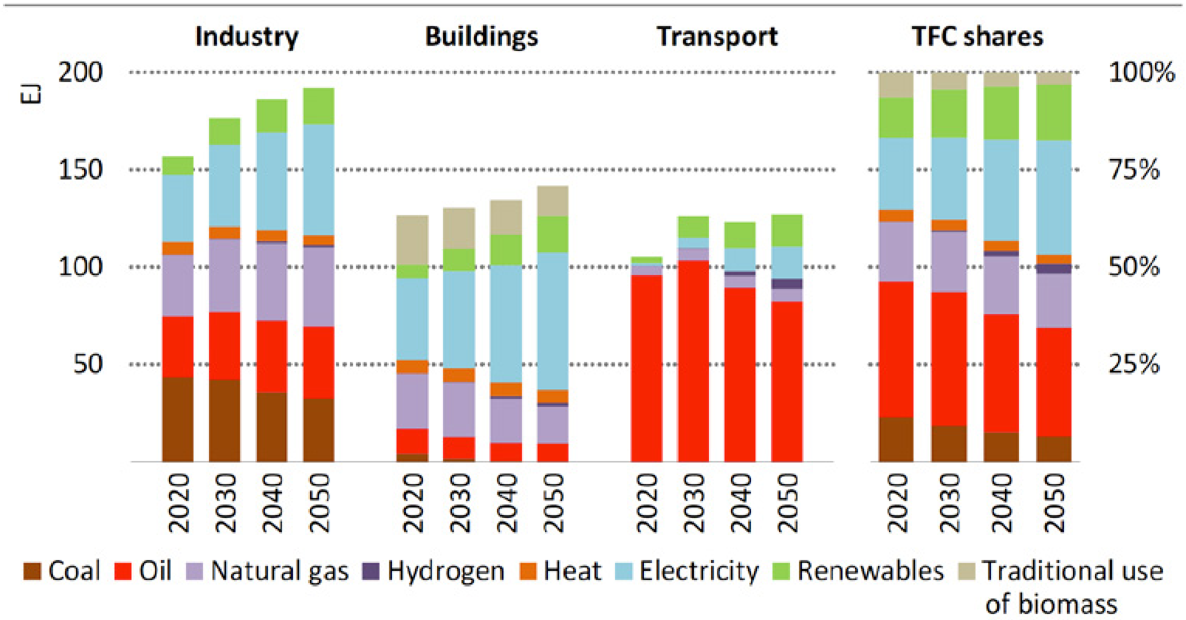
Each of these stages creates impacts on the environment and risks to worker health and safety. For the purpose of this document, the focus of this chapter includes exploration and production, transportation and the construction of new processing facilities, because it is during these stages that the most significant impacts to the ocean and ocean-dependent communities can be identified.

Oil and gas and the global energy transition

Despite the significant impact of the COVID-19 pandemic, if current policy and technology trends continue, recent forecasts project that global energy consumption will continue to increase until 2050, as a result of increasing prosperity and living standards in rapidly developing economies such as those of Asia and Africa. While the structure of energy demand is likely to evolve, with much of the projected increase in energy supply expected to come from renewable sources, some observers expect offshore oil and gas production to remain important until at least 2050 (International Energy Agency [IEA] 2021a).

According to the IEA, if all announced national "net zero" pledges are achieved in full and on time (the Announced Pledges Scenario (APS)), global electricity generation will nearly double to exceed 50,000 TWh in 2050. While the share of renewables in electricity generation is projected to rise to nearly 70 per cent in 2050, under the APS, oil demand is projected to fall only 10 per cent from 2020 levels, while natural gas use is projected to expand by 10 per cent in 2025 and remain at that level until at least 2050 (IEA 2021b) (Figure III).

Figure III: Total final energy consumption under the IEA Announced Pledges Scenario (APS).



Source: IEA 2021b

The latest UNEP *Production Gap* report (Stockholm Environment Institute [SEI], International Institute for Sustainable Development [IISD], Overseas Development Institute [ODI], E3G, and UN Environment [UNEP] 2021) also suggests that, despite the current climate emergency and pledges to cut emissions, governments are collectively projecting an increase in global oil and gas production over the next two decades. Since January 2020, G20 countries have directed USD297 billion of new public financial commitments towards fossil-fuel-consuming and -producing activities (SEI, IISD, ODI, E3G, and UNEP 2021).

Despite the impact of increased investor pressure on climate issues, it is hard to argue that the ongoing sanctioning of new oil and gas development projects is aligned with a cost-optimized Paris-aligned climate-change scenario. There is an unavoidable need for a significant reduction in fossil fuel use, and therefore production. In fact, to realize the IPCC 1.5°C scenario, no new oil and gas projects can be sanctioned (Dalman and Coffin 2021). Thus, for oil and gas producers the energy transition represents an existential concern that goes right to the heart of corporate business strategy.

According to a recent briefing paper released by Greenpeace, the International Institute for Sustainable Development (IISD) and Oil Change International, the IEA's NZE scenario is a vital tool for financial institutions to assess alignment of their portfolios with the Paris goals, and the transition risks they face. Financial actors should consider incorporating the issue of new oil and gas licences and development into their public policy work on climate change; and support calls on governments to cease issuing new licences and approvals for extraction projects (Muttitt and Rouse 2022).

The rapid emergence of renewable energy technologies may in fact result in demand for oil and gas weakening much faster than current scenarios suggest. Indeed, recent research suggests that, if solar photovoltaics, wind, batteries and hydrogen electrolysers continue to follow their current exponentially increasing deployment trends for another decade, a near-net-zero emissions energy system could be achieved within twenty-five years (Way *et al*. 2021). Moreover, the costs associated with renewables energy technologies are falling rapidly and are already cheaper than fossil-fuel generated energy. This trend looks set to continue (Way *et al*. 2021).

Notwithstanding the clear need for climate change mitigation to transition as rapidly as possible away from fossil fuels and the transition risks this implies for the oil and gas sector, there are a broad range of non-climate-related impacts and risks that financial institutions should also be aware of and consider. These additional impacts and risks are addressed in the subsequent sections of this briefing paper.

Key environmental and social impacts and dependencies

As noted above, petroleum operations have the potential to cause significant negative impacts to the marine environment, air quality, worker health, coastal communities, and resilience in addition to their major contribution to climate change. These impacts can take place during each of the main phases of the upstream stage, as well as those aspects of transport that interact with the marine environment (i.e. transport via pipeline and shipping) and the construction of coastal infrastructure related to offshore development (e.g. new LNG plants).

Exploration and production impacts

Offshore petroleum production follows a defined life cycle of discrete but interrelated stages. This life cycle may last for several decades with the stages up to full production lasting several years alone. Figure IV lists the typical life cycle stages in offshore petroleum operations.

Figure IV: Stages in the E&P life cycle

Seismic survey	Exploration drilling	Appraisal	Development & production	Decommission
▪ Provides detailed information on geology	▪ Usually a single exploration well ▪ Verifies the presence or absence of a hydrocarbon reservoir and quantifies the reserve	▪ Usually multiple appraisal wells ▪ Determines if the reservoir is economically viable to develop.	▪ Produces oil and gas from the formation through formation pressure, artificial lift, and possibly advanced recovery techniques, until economically feasible reserves are depleted.	▪ Complete or partial removal of surface and sub-surface facilities and remediation to pre-disturbed state. Decommissioning and rehabilitation may occur for each of the above phases.

During the exploration phase, physical impacts can result from underwater noise and the interactions with vessels as well as physical disturbance of the seabed. Well drilling in particular is a source of pollution to the marine environment (e.g. drilling fluids) and has been the cause of several serious oil spills in the past two decades. Additional direct physical impacts occur in the production phase as structures and subsea infrastructure are installed and the volume of routinely discharged pollutants (in the form of produced water and platform drainage water) increases. Finally, decommissioning can result in a series of direct impacts on the sea floor and can reintroduce contaminants to the environment. A comprehensive overview of the environmental issues and impacts associated with the exploration and production sector is presented in a report jointly prepared by the International Association of Oil and Gas Producers (IOGP) and IPIECA (IOGP and IPIECA 2020).

Atmospheric emissions

Atmospheric emissions can be broadly classified into two types: (i) air pollutants (such as, particulate matter, oxides of sulphur and nitrogen and volatile organic components); and (ii) greenhouse gas (GHG) emissions. The principal emission gases include: carbon dioxide (CO_2); carbon monoxide (CO); methane (CH_4); volatile organic carbons; and nitrogen oxides (NO_x). Emissions of sulphur dioxide (SO_2) and hydrogen sulphide (H2S) can occur and depend upon the sulphur content of the crude oil. These emissions can contribute significantly to poor air quality which, in coastal areas with high levels of oil and gas production, can present a risk to the health and wellbeing of coastal communities.

By definition, the decarbonization of the oil and gas sector is extremely challenging, if not impossible. GHG emissions are generated directly (Scope 1 emissions) and indirectly through the consumption of energy for power generation (Scope 2 emissions). However, by far the largest emitter of GHG emissions is the downstream combustion and utilization of petroleum products (Scope 3 emissions), accounting for roughly 70 to 90 per cent of life cycle emissions from oil products and 60 to 85 per cent of those from natural gas (IEA 2018).

The materiality issues associated with Scope 3 emissions and the risks associated with stranded petroleum assets[5] are already well known to investors and financial institutions (see for example Caldecott *et al*. 2016). As a result, many investors have taken the decision to divest their portfolios entirely of hydrocarbon companies (Plantinga and Scholtens 2021). For this reason, and for the purposes of this analysis, a decision has been made that the materiality issues associated with Scope 3 GHG emissions will not be further addressed in this document. Rather this document focuses on other material risks to investors that are more closely aligned with the blue economy and other economic sectors. Materiality issues associated with Scope 1 and 2 emissions are, however, included in this document, since they are a direct result of on-site operations.

5 In the context of oil & gas the IEA defines stranded assets as: "those investments which have already been made but which, at some time prior to the end of their economic life (as assumed at the investment decision point), are no longer able to earn an economic return" (IEA/OECD 2013, p.98).

Scope 1 emissions in the oil & gas sector

According to the UK's Offshore Renewable Catapult, the UK's oil and gas sector contributes approximately 3 per cent of the UK's total GHG emissions, the majority of which come from gas and diesel power generation on offshore installations. The UK sector of the North Sea has ageing infrastructure, leading to a comparatively high emissions intensity. Powering the UK's offshore oil and gas assets is therefore a relatively high-carbon and high-cost undertaking.

Since floating offshore wind could be competitive with energy prices paid by offshore oil & gas operators, opportunities exist for electricity-consuming operators to provide early market development opportunities for floating offshore wind on its journey to full utility-scale deployment. The economic attractiveness depends largely on a combination of power requirements, wind resource and remaining asset life.

Source: ORE Catapult (2021)

Operational discharges

The most common sources of pollution from petroleum activities derive from normal E&P operations and include: drilling fluids, cuttings and well treatment chemicals; produced water containing dispersed and suspended hydrocarbons; process, cooling, wash and drainage water; ballast water from mobile offshore drilling units (MODUs) and ships and associated invasive species; sewerage, sanitary and domestic wastes; and, garbage.

Globally, chronic marine pollution has been identified as a major driver of ocean health decline reducing the resilience of key habitats to adapt to the impact of other critical impacts such as those related to climate change. The potential impact of such discharges include: pollution and contaminant accumulation in water and biota; physical disturbance, smothering and turbidity associated with disposal of drill cuttings; eco-toxicological impacts to marine life; localized thermal impacts; nutrient enrichment and eutrophication of surface waters; and the introduction of invasive species from fouling organisms on structures and vessels and ballast water from ships.

Accidental discharges (spills)

Accidental discharges of oil and chemicals (otherwise known as spills) can arise from a number of different sources, including: equipment failure and criminal damage; human error during offloading and filling tanks; cleaning operations; and poor storage/handling of wastes and chemicals. In some areas ageing infrastructure may increase the risk of accidents resulting in spills. In most cases human error is a significant compounding factor in the causal analysis.

A number of large-scale offshore petroleum accidents in recent years have highlighted the potentially significant impacts such incidents may have on both the environment and economy of coastal states (Cordes *et al*. 2021; McClain, Nunnally and Benfield 2019).

These can directly affect coastal wildlife and fishery resources and result in the long-term closure of economic activities that depend on the marine environment (such as fisheries and coastal tourism) as well as potentially impacting on the provision of vital protein, particularly to coastal communities, thereby impacting food security for the most vulnerable in society. In some countries, the potential economic opportunities that can be realized from stealing crude oil directly from oil and gas infrastructure has been the cause of significant ongoing pollution of coastal areas which has socioeconomic importance to local communities (Umar *et al*. 2021).

The costs of clean-up and the contingent liabilities along with the reputational damage of those associated with the spill means that oil spills present one of the greatest overall risks for this sector.

Direct impacts and physical damage

Direct impacts and physical damage include: significant impacts to organisms (particularly marine mammals) caused by high intensity noise emitted during seismic surveys; physical damage of the seabed from drilling; pipeline laying and subsea construction; smothering of seabed habitats from sediment disturbance and the accumulation of drill cuttings; engine and machinery noise causing short-term behavioural changes in marine fauna and possible long-term effects in fish and marine mammals; the potential impacts of light pollution from flaring and offshore installation operations; and potential ship strikes with marine mammals, large fish and turtles.

The intensity of the impacts outlined above will depend upon the precise stage in the E&P life cycle, the size and complexity of the project and the nature and sensitivity of the surrounding environment. Moreover, while many of the impacts are common across all stages of the life cycle, their intensity and severity may vary. For example, underwater noise will be generated throughout the E&P life cycle but by far the greatest concern relates to the high-intensity sound generated during seismic acquisition. Similarly, the risks associated with different types of pollution will vary during the life cycle.

Table 3 illustrates, by way of a comparative analysis, where impacts of greatest magnitude may manifest.

Table 3: Relative risks associated with different impact categories throughout the E&P life cycle

Life Cycle Stage	Atmospheric Emissions	Operational Discharges	Accidental Discharges	Direct Impacts/ Physical Damage
Seismic Acquisition	Low	Low	Low	High
Exploration and Appraisal Drilling	Moderate	High	High	Moderate
Field Development	Moderate	High	High	High
Production Operations	High	High	High	Low
Decommissioning	Moderate	Low	Low	High

Transport impacts

In addition to the normal environmental impacts associated with maritime transport (as reported in Turning the Tide (UNEP FI 2021)) such as atmospheric emissions, introduction of invasive species, underwater noise and physical disturbance, the major issue associated with the transport of oil and gas from offshore fields is the risk of oil spills from tankers and subsea pipelines.

Impacts associated with the construction of shore-based processing facilities

Some offshore oil and gas projects (e.g. the development of new offshore gas fields) involve the development of dedicated shore-based processing facilities (e.g. LNG processing plants). Where such developments are the part of bigger projects, investors should consider the impacts associated with these shore-based developments.

In addition to environmental impacts such as habitat damage, pollution of rivers and coastal waters and air emissions, perhaps the greatest impacts will be socioeconomic impacts on local communities. Large-scale developments may result in a loss of access to certain coastal areas directly impacting livelihoods through, for example, loss of access to sites of cultural significance or the inability to carry out economic activities such as fishing. Construction may cause damage to culturally important heritage sites and the disturbance caused by construction lights, noise and dust may cause a nuisance.

Although construction sites may provide much needed jobs in the local area, this can also present challenges from the influx of large numbers of outside workers. These jobs will probably pay better than local traditional jobs, which may significantly impact the local economy.

Table 4: Pressures and impacts of the oil and gas sector

Pressures	Impacts	Explanation
Disruption to wildlife		Noise generated during every stage of the E&P process—particularly during seismic surveys, construction and decommissioning can result in changes in the behaviour of some animals, with some organisms entirely avoiding an area that may be critical to their life cycle (e.g. a feeding ground). Physical damage to hearing and disruption to communications may also result from high levels of noise.
		Vessel movements within and to/from offshore areas can result in collisions with marine life, notably marine mammals, large fish and turtles.
Seabed disturbance and disruption of habitat		Seabed disturbance caused by drilling, heavy equipment and construction may destroy or seriously harm seabed habitats.
		Drilling, construction, operation and decommissioning of offshore facilities seabed can reduce ecosystem resilience through smothering and suspended sediment, which can affect sensitive habitats and nearby organisms.
Pollution and water contamination		Pollutants such as heavy metals, biocides and hydrocarbons, that are discharged as part of the routine operational discharges, can adversely impact the health of organisms and make them more susceptible to diseases.
		Discharge of pollutants, particularly those containing nutrients, can encourage the proliferation of some species at the expense of others resulting in less species diversity and a less healthy ecosystem. This may directly impact productivity and impact marine food chains. These changes may also lead to changes in the fundamental structure of some habitats (e.g. through the proliferation of macro-algae).
		The introduction of non-native invasive species, through ballast water or hull fouling, may introduce species that can outcompete native species making it harder for them to survive or even outcompeting them completely.
		The discharge of contaminates to water (particularly relating to sewage) is generally culturally unacceptable and may impact coastal communities' ability to utilize coastal resources. This includes the transfer of pathogens to the marine environment, which may cause sickness or render shellfish unsafe to eat.

Accidental oil spills		Spills of crude oil can impact wildlife (such as sea birds and marine mammals) through direct oiling and ingestion. These impacts can lead to high levels of mortality to wildlife, which could impact species of high conservation value (i.e., those considered endangered or vulnerable).
		Oil spills can lead to smothering and toxicity of coastal ecosystems, particularly low-energy ecosystems such as mangroves and wetlands, causing damage to vegetation and long-term changes in habitat structure. Depending on the level of pollution, recovery from this type of damage may take many months or even years.
		Spills of crude oil may significantly impact marine living resources (e.g. fisheries) making them unavailable for exploitation and utilisation by dependent communities. Similarly, oil pollution may impact other economic sectors of the blue economy such as tourism beaches and infrastructure.
		Events such as well blowouts and ship collisions may not only lead to major oil spills but may also result in fires and loss of structures causing increasing mortality/risk of loss of life.
Air pollution		The discharge of air pollutants to the atmosphere emissions from ships and offshore installations may change the chemical composition of the sea and the health of all marine life. Pollutants that alter marine biochemistry include CO_2, SO_x, NO_x, untreated ballast water and fuel residue.
		Offshore installations and ships burn large amounts of fuel to generate power and routinely flare associated natural gas from the reservoir. GHG emissions from fuel combustion and flaring of gas contributes to global warming and climate change and their associated impacts.
Use conflicts		The physical placement of structures, and subsea infrastructure in particular, results in large offshore areas being unavailable for other productive uses (e.g. fishing or recreation).
		Loss of access to marine areas may directly impact other users' ability to carry out their own economic activities effectively resulting in lower economic returns than normal.

Social and economic conditions		Distortion of pay rates due to high pay in the extractives industries, including loss of workers from essential but low-paid jobs, increases in the value of property, land and everyday commodities. The loss of labour force may also directly impact other economic sectors.
		New economic opportunities in construction are likely to be more available to men leading to greater income disparities between men and women.
		Coastal construction may permanently damage or destroy sites of cultural significance (e.g. burial sites or middens).

Relationship to sectors of the blue economy

In addition to the impacts outlined above, dredging and aggregate extraction activities may have negative effects on blue economy sectors if they are not regulated or managed effectively, including:

Fishing: physical disturbance and damage to the benthic environment that destroys key fishing grounds and habitats—particularly those that support spawning activity or nursery areas for key species. Increased sedimentation may impact areas beyond the area of dredging activity resulting in smothering of seabed resources, trophic changes and avoidance of certain areas by mobile species. The disposal of contaminated dredge material may also adversely impact offshore fishing grounds.

Shipping: While much dredging is related to maintaining shipping routes, dredging activity may cause temporary displacement for shipping.

Tourism: May cause short-term loss of amenity due to increased turbidity of water. Longer term impacts may include loss of beach sediment, erosion and damage to coastal infrastructure and loss of critical habitats that support marine tourism (e.g. coral reefs).

Coastal infrastructure: Aggregate extraction (particularly sand) can either contribute to coastal infrastructure (as in the case of beach replenishment or use of sand motors (UNEP FI 2022) or present a risk to infrastructure where downstream impacts such as erosion and inundation result from offshore sand extraction.

Energy: May conflict with and bring benefit to energy development. It brings benefit by seabed intervention for offshore energy facilities and might impact through multi-use conflicts for the same maritime space.

Outlining materiality

In common with other aspects of the energy sector, offshore oil and gas is capital intensive, involves high-value assets and operates along very long project life cycle times. The management of risk, therefore, plays a crucial role in project planning, design and operation. In this regard, while there is a clear moral and societal imperative to mitigate the environmental and social damage caused by offshore oil and gas extraction, there are also strong business arguments for doing so. Most of the impacts identified above can lead to significant environmental and socioeconomic consequences, which can themselves represent significant organizational and financial risks to companies and their shareholders.

Moreover, the demonstrable occurrence of "black swan events"[6] has had severe implications for the sector as a whole, resulting in widespread environmental and economic losses with commensurate, largely uncapped, financial liabilities being reflected on the balance sheets and the overall value of companies involved, as well as a loss of public trust in those companies leading to boycotts of the companies' products. Perhaps the clearest example of this has been seen with recent catastrophic well blowout incidents in the Gulf of Mexico (*Macondo* or *Deepwater Horizon*) and in the Timor Sea between Australia and Indonesia (*Montara*). Both of these incidents resulted in significant and extended oil spills that caused serious environmental damage to coastal resources and livelihoods. In the case of the Deepwater Horizon blow out, eleven oil rig workers lost their lives. To date, it is estimated that BP has paid out more than USD60 billion in criminal and civil penalties, natural resource damages, economic claims and clean-up costs.

Notwithstanding the obvious contribution to climate change, of the consumption of fossil fuels including oil and gas (so called Scope 3 GHG emissions), the direct contribution of oil and gas activities to greenhouse gas emissions and broader climate change are readily apparent. The flaring and venting of natural gas associated with the production of crude oil is now viewed as both environmentally damaging and economically wasteful. Methane, in particular, poses a significant threat and has contributed around 30 per cent of the global rise in temperature today.

6 May be defined as: An unpredictable event that is beyond what is normally expected of a situation and has potentially severe consequences. Black swan events are characterized by their extreme rarity, severe impact, and the widespread insistence that they were obvious in hindsight.

Flaring and venting of methane

Methane has contributed around 30 per cent of the global rise in temperature today and the IPCC 6th Assessment Report highlights that rapid reductions in methane emissions are a key tool to limit near-term global warming, with the most cost-effective abatement opportunities being in the energy sector (United Nations Environment Programme and Climate and Clean Air Coalition 2021).

The oil and gas sector is one of the largest sources of methane emissions today, through flaring and venting of associated natural gas (methane). According to the IEA, almost 45 per cent of current oil and gas methane emissions could be avoided at no net cost to the industry (IEA 2021c).

There are well-known technologies and measures that can be deployed to address methane emissions from oil and gas operations. If countries were to implement a set of well-established policy tools—namely leak detection and repair requirements, staple technology standards and a ban on non-emergency flaring and venting—emissions from oil and gas operations could be halved within a short timeframe (IEA 2021b).

At COP26, more than 100 countries signed up to the *Global Methane Pledge* committing to reducing methane emissions by 30 per cent by 2030 compared with 2020 levels. This includes six of the world's top 10 methane emitters: the United States, Brazil, EU, Indonesia, Pakistan, and Argentina. This equates to a potential of 46 per cent of global methane emissions and more than 70 per cent of global GDP, playing a critical role in keeping 1.5°C within reach.

However, the Net-Zero Emissions by 2050 Scenario requires all non-emergency flaring to be eliminated globally by 2030, resulting in a 90 per cent reduction in flared volumes by 2030.

Increasing focus is also being placed on the less apparent impacts associated with marine sectors, such as physical impacts to habitats and the impacts of underwater noise on marine organisms, particularly marine mammals, creating a high reputational risk for companies and financiers who are directly or indirectly exposed to these practices. For example, campaigners in South Africa filed a legal challenge against Royal Dutch Shell in late 2021, to prevent the company undertaking seismic surveys in vital whale breeding grounds off the east coast of the country (Ambrose 2021).

The oil and gas sector, in common with other non-renewable extractive industries, operates on the basis of a legal licence issued by a competent authority, normally a state. Increasingly stringent regulatory conditions and controls are being placed on such licences, as regulators react to these risks. Public opposition to the issuing of such licences has also increased in many parts of the world in recent years. Thus, the concept of a "social licence to operate" represents a very real and tangible asset to a company that may, if the company does not perform in accordance with the expectations of regulatory authorities and local communities, be suspended or even revoked.

This growing suite of impediments to new licences to operate emphasize the need to ensure maximum, safe, extraction from existing installations—and the opportunity for the renewable energy sector to contribute to the greener, low carbon extraction of these resources.

Financiers must require accountability from offshore operators and non-operating joint venture partners to ensure regulatory compliance and, especially, social and environmental best practices. Broadly speaking, the policy areas that need to be considered in the regulating of the offshore petroleum industry fall under three key areas:

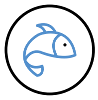
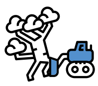
1. Licensing and permitting;
2. Fiscal policy and taxation regime; and
3. Operational policy (environmental protection, security, health and safety etc).

It should be noted that the third category—which includes the decommissioning phase and thus some repurposing of existing assets (e.g. for the storage of captured carbon subsea and the alternative use of platforms for renewable generation and artificial reefs)—may be set either at the national or global level. Because of the role of the International Maritime Organisation (IMO) and industry bodies, it cannot be assumed that compliance with local regulations also covers global regulations.

The impacts noted above create a number of material risks to financial institutions, notably in the realm of reputational and regulatory risks as well as operational and physical risks. Furthermore, the resulting demand for more stringent environmental stewardship and—at the extreme end of the spectrum—the complete removal of hydrocarbons from the energy system, represent a deterioration of the industry's social licence to operate.

Table 5 builds on the information set out in the previous section and summarizes these risks. This will reflect onto those funding and financing the sector (the "O&G funders").

Table 5: Overview of offshore oil and gas risks and materiality

Pressures	Impacts	Risks	Explanation
Disruption to wildlife	 	Reputational	Loss of biodiversity and habitat damage are some of the most likely issues for sustained campaigning from civil society around offshore oil and gas activities. Conservation of marine mammals is a particularly emotive issue for the public and public pressure regarding their welfare may increase in future. The impacts of seismic surveys on marine mammals, particularly in shallow inshore areas, has led to campaigns by NGOs to halt such activities.
		Regulatory	Negative impacts on endangered, threatened and protected species could result in policy reforms or regulations and forced shutdown of operations in the worst cases
		Operational	Concerns about the impacts and interactions between oil and gas activities and marine organisms may lead to regulators requiring modifications to the spatial and temporal management arrangements for offshore operations (for example scheduling survey and drilling activities outside key breeding seasons).
Seabed disturbance and disruption of habitat	 	Regulatory	Regulatory risk and liability from cost of damaged ecosystem services and use conflict with other industries (e.g. fishing, tourism).
		Reputational	Offshore installations situated/operating in areas of high biodiversity or critical habitat may become a significant source of civil society campaigning and public pressure. Reputational risk from citizen/NGO action concerning ecosystem damage may lead to loss of social licence to operate. Ultra-deepwater drilling and disposal of decommissioned offshore installations have previously led to NGO campaigns against individual companies. Increased community awareness of habitat damage, atmospheric pollution, oil spills, ballast water and underwater noise impacts to wildlife, incites public action and calls for regulatory action and fines.
		Operational	Concerns of potential damage to key habitats and resources may result in demands for project design to be changed, resulting in impacts to project schedules and budgets.

Pollution and water contamination		Regulatory Reputational	Increased community awareness of habitat damage, atmospheric pollution, oil spills, ballast water and underwater noise impacts to wildlife, incites public action and calls for regulatory action and fines.
		Operational	Unacceptable levels of pollution (e.g. from produced water) may result in temporary production shutdowns by the regulator until a solution is found.
		Physical	The introduction of organisms through ballast water or biofouling can result in excessive fouling of structures, resulting in costly removal/cleaning operations to minimize the risks of structural damage to marine structures.
		Regulatory	High levels of sustained pollution may result in strengthening of regulatory regimes to better control the pollution-causing activities.
		Reputational	Sewage and other types of pollution discharged from ships and offshore installations, particularly directly, impact the amenity value of marine areas and prevent local communities from using them for social and recreational purposes.
Accidental oil spills		Reputational	Major oil spills cause global headlines and can include graphic scenes of damage to and death of charismatic wildlife species. The reputational damage from this coverage can be significant and lead to protests and consumer boycotts of companies' products. Communities that are directly impacted by such events may be particularly vocal and lobby policymakers to support claims for damages.
		Operational	Major oil spills, particularly those arising from well blow outs, may interrupt operational activities for extended periods while efforts are made to control and clean up the spill.
		Markets	Major pollution events may result in significant financial liabilities for the operator to remedy environmental damage and economic losses of other marine users. High-profile accidents may lead to consumer boycotts of companies' product.
		Physical	The events that lead to major pollution events often result in the loss of structural integrity or even total loss of offshore assets.
		Regulatory	Major pollution events often catalyze major changes in regulatory regimes, both at the national and global levels. In this regard, such events may be significant for the industry as a whole.

Air pollution		Market	While Scope 3 GHG emissions will only be reduced with a commensurate reduction in the consumption of oil and gas, increasing demands for public disclosure from oil and gas companies means that emissions arising from operational issues and the extractive supply chain will become more material to investors.
		Regulatory	Risk of financial penalties for violations of local pollution regulations. Risk of new regulatory actions connecting offshore oil and gas with climate change and GHG emissions.
		Physical	Offshore infrastructure is often exposed to extreme weather events. The frequency and severity of such events is predicted to increase over time, resulting in the need for better design and engineering to cope with the additional stresses.
		Reputational	GHG emissions linked to climate change is one of the most likely issues for sustained campaigning from civil society around offshore oil and gas. Public opinion is already starting to impact the attractiveness of offshore oil and gas in the market.
		Operational	The flaring of associated gas is increasingly seen as inappropriate and wasteful in the context of reducing global GHG emissions. Efforts to reduce flaring may result in changes to the design of existing installations.
Use conflicts		Physical	Physical damage to offshore infrastructure caused by the interaction with other marine users (e.g. trawl nets snagging subsea pipelines)
		Reputational	Any economic impacts suffered by other marine users may be directly attributed to the oil and gas sector and may result in local protests.
		Regulatory	In the context of marine spatial planning, regulatory risk exists where development conflicts with designations of protected habitats and vulnerable species, though instances in which these designations shift after significant investment has already been made (as opposed to during the mapping or auctioning phases of development) do not appear to be likely.
Social and economic conditions		Market Regulatory	There is high visibility of actual or perceived corruption in the oil and gas sector as a result of several high-profile cases against oil companies. Major oil companies and service providers have been targeted and court cases with fines have occurred.
		Reputational	Potentially significant reputational risks associated with the direct and indirect negative social impacts associated with the construction of onshore facilities on local communities, in the context of displacement and loss of access as well as the potential socioeconomic impacts associated with increased workers and distortions to local pay rates.

The urgent need to transition to a ‘net-zero’ future

Despite the clear need to rapidly accelerate the decarbonization of the electricity mix, it is clear that oil and gas will continue as a component of the overall energy mix and the drivers for the future production of offshore oil and gas will remain in place for many years to come. In light of this, while an increasing number of investors are acting in line with the Paris Agreement to divest their portfolios of oil and gas producers, those that remain invested are urged to transition to net zero and should also be aware of the additional impacts that arise from these operations. Financial institutions can use their considerable leverage to advocate for a swift and equitable transition away from fossil fuels alongside supporting rapid improvements in overall environmental performance, while identifying and securing new opportunities arising from the transition to a low carbon economy.

In addition, those financial institutions that remain invested should refrain from providing financial services for the development of new oil and gas fields and other activities that are incompatible with the IEA’s Net-zero Emissions (NZE) Scenario, and require existing oil and gas clients to produce credible transition strategies toward NZE.

By focusing on innovation, those financial stakeholders that remain invested may therefore still assist in the transition to a low carbon economy:

- **Deploying industry capital and resources to support a smooth transition to renewable offshore energy:** There is a strong drive to capture and build upon the skill sets, assets and infrastructure that exist in the oil and gas sector for use in the growing renewable energy sector that will ultimately displace fossil fuels. Many of the barriers to the development and deployment of new offshore renewable energy technologies present oil companies with a competitive advantage (Johnson, Blakemore and Bell 2020). While oil companies could invest directly into marine renewable energy technology, the industry’s expertise with supply chains, scalability, and technological deployment may, in fact, be a greater currency than its capital. Investments designed to develop and exploit existing capabilities and infrastructure may therefore provide a more compelling narrative for the industry’s contributions as a strategic partner in the low carbon transition. In this regard, key opportunities are emerging in mature provinces (e.g. the North Sea) that could leverage offshore operating experience, project management, and downstream/offtake partnership capabilities of such offshore

operators in the area (Johnson, Blakemore and Bell 2020). The decommissioning of existing offshore platforms, in particular, may offer interesting possibilities because they could conceivably be used to convert and store offshore wind energy in ways that eliminate costly hook-ups with onshore grids (Jepma and van Schot 2017).

- **Removing the emissions associated with oil and gas production and its supply chain:** During the transition, financial institutions are encouraged to incentivize (for example through the use of differential pricing instruments that recognize performance) opportunities to drive the oil and gas industry to adopt new technology and operational approaches that will allow them to significantly reduce their considerable impacts on the marine environment, while at the same time leveraging their significant resources and assets for the renewable transition.

  A significant focus here would be Scope I emissions (i.e. direct emissions from upstream oil and gas production and its supply chain), for example through:

  - zero-emissions electrification of ocean basins and enabling the use of resident systems powered by batteries charged with electricity that is renewably generated;
  - carbon capture, utilization, and storage (CCUS); and
  - focused attention on methane efficiency; and hydrogen).

  However, opportunities should also be sought to extend decarbonization further in Scope II and Scope III, customer and indirect emissions.

- **Support integrated sustainability of companies:** Growing momentum for an equitable and rapid transition to low carbon and increasing concerns over the environmental damage to the ocean is creating new requirements for sustainability strategies.[77] Evolving government policies, direct public and shareholder activism, and changing investment strategies by major institutions are creating urgency for oil and gas companies to demonstrate better management of their day-to-day operations. Considerable scope therefore exists for investors to catalyze improvements across the board, and to support those companies that are pioneering integrated approaches to improving their overall operational and environmental performance. This includes the deployment of a widening range of technologies and solutions that contribute to companies becoming more sustainable, minimizing production costs and ultimately cutting their overall environmental footprint, contributing to the regeneration of the ocean while reducing existing harm.

  Moreover, financiers and insurers should engage with policymakers and regulators to support the implementation of all relevant legislation and industry standards pertaining to the asset and their operations while supporting innovation in financing, including advanced market commitments to accelerate energy transition. One approach that may be appropriate is the application of differential pricing attached to financial instruments such as bonds and debt instruments linked to specific environmental performance standards and outcome targets. As well as driving behavioural change this also helps the funders demonstrate that they are acting as an agent for change while still supporting the sector.

7 pwc.de/en/sustainability/sustainability-in-the-oil-and-gas-industry.html

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Annex 1: Financing the sector

Given the high risks involved, these highly capital-intensive projects often involve a partnership between multiple companies or equity partners (Duff & Phelps 2018). Operators are typically granted the rights to specifically defined petroleum reserves through some form of legal agreement with the host country, such as a concession agreement, production sharing contract, service contract, lease or licence (or a combination of these). In some cases, countries may wish to retain an equity or production stake in any development project, as a matter of security of supply, to maximixe local economic benefits and to preserve their rights in national natural resources (Szczetnikowicz and Dewar 2018).

Equity participants in the oil and gas industry may therefore include:

- International oil companies (IOCs) and other listed companies, that have historically dominated this sector, tend to have a large global footprint and are responsible for approximately half of the world's oil and gas production;
- National oil companies (NOCS);
- Private equity and hedge funds;
- State-owned investment funds (sovereign wealth funds);
- Pension funds and insurance companies; and
- Oil field service companies.

Oil and gas projects are typically highly capital-intensive with varying degrees of risk. As a result, investors typically require different sources of financing to meet development and production needs (Szczetnikowicz and Dewar 2018). These instruments are summarised in table 6 below, with a selection of instruments explained in more detail, including:

- **Equity funding and corporate finance:** Many large IOCs will look to their own balance sheets to source funds or alternatively seek corporate loans or high-yield debt. During the recent downturn, for companies with a strong balance sheet, corporate financing and high-yield bond issuances have provided much-needed liquidity (Vinson and Elkins 2021). Factors such as the credit rating (if any), size of the corporate, asset base and nature of reserves, diversification and stage of production are all dictate companies' ability to access capital and maintain lines of credit.

- **Shareholder funding:** The vast majority (if not all) of the large- and mid-sized oil companies are publicly listed entities. As such, shareholders of these companies (many of which are large-scale institutional investors and pension funds) are critical players in shaping the oil and gas sector. The use of shareholder capital as a source of funding is therefore common across the various components of the oil and gas

sector. Through increasing sustainability disclosure requirements, stock exchanges could be powerful actors ensuring that sustainability criteria are incorporated into the practices of publicly listed firms (Jouffray *et al.* 2019).

- **Reserve-based lending (RBL):** Traditional reserve-based lending, where loans are made against, and secured by, a portfolio of undeveloped—or developed and producing—oil and gas assets, is one of the main instruments used to finance exploration and production activities (Vinson and Elkins 2021). By their nature RBLs require an adequate borrowing base of proved reserves.

- **Volumetric production payments (VPPs):** The lender (the VPP buyer) makes an upfront cash payment to a producing entity (the VPP seller) in exchange for a non-operating interest, for which in the future the VPP buyer will receive payments from the VPP seller in the form of cash or units of hydrocarbons.

- **Mezzanine debt:** Mezzanine debt may be used as part of project financing to optimize the financing plan or fill a funding gap. This can be a secured loan, but repayment will always be subordinated to the senior lenders' rights of repayment (and ahead of the equity distributions) (Szczetnikowicz and Dewar 2018).

- **Other sources:** Other sources of capital such as bonds, hedging and trade finance may be sourced as and when available or appropriate. Products such as prepays and forward sales—the sale of a commodity to be delivered at an agreed future time and price—have also proved useful, including for entities without access to an unrestricted pool of capital. The commodity trader counterparties have therefore continued to play an important role in funding the junior end of the E&P market. The potential for a mix between traditional debt finance, alternative debt structures and equity financing also provides oil and gas market players with greater flexibility.

Table 6: Financial instruments deployed during the E&P life cycle

Exploration and appraisal	Field Development	Production	Decommissioning
Duration: 5–10 years	**Duration: 20–30 years**		
Main Financial Instruments			
▪ Equity financing ▪ Sponsor loans ▪ Farm-ins	▪ Equity financing ▪ Bond issuances ▪ Reserve-based lending ▪ Mezzanine financing with equity participation ▪ Farm-ins	▪ Traditional loans ▪ Reserve-based lending ▪ Volumetric Production Payments ▪ Mezzanine financing with equity participation ▪ Cash flow from production	
Negative Cumulative Cash Flow		**Positive Cumulative Cash Flow**	

Modified from: Duff & Phelps, 2018

Energy companies operate in a high-risk world, often in the most hostile environments, where the end products are subject to a high degree of price volatility. As such, another key element of the financing for this industry is the insurance sector, which is actively involved in the upstream and midstream stages. The types of insurance that are most relevant to the oil and gas sector include: property damage; third party liability; control of well; and business interruption. Another type of insurance instrument (Construction All Risks) is typically used to provide cover for offshore construction projects.

In some cases, multinational companies will self-insure, meaning that any liabilities will not pass through to the insurance sector. However, many countries require some form of liability insurance to be lodged as a condition of operation—to provide assurances that the costs associated with any large-scale accidents and subsequent environmental damage will be adequately covered by the company.

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