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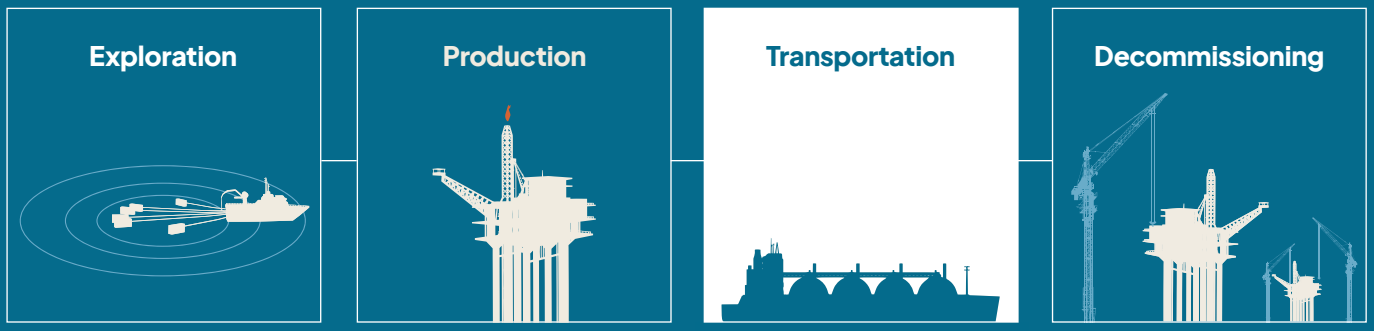
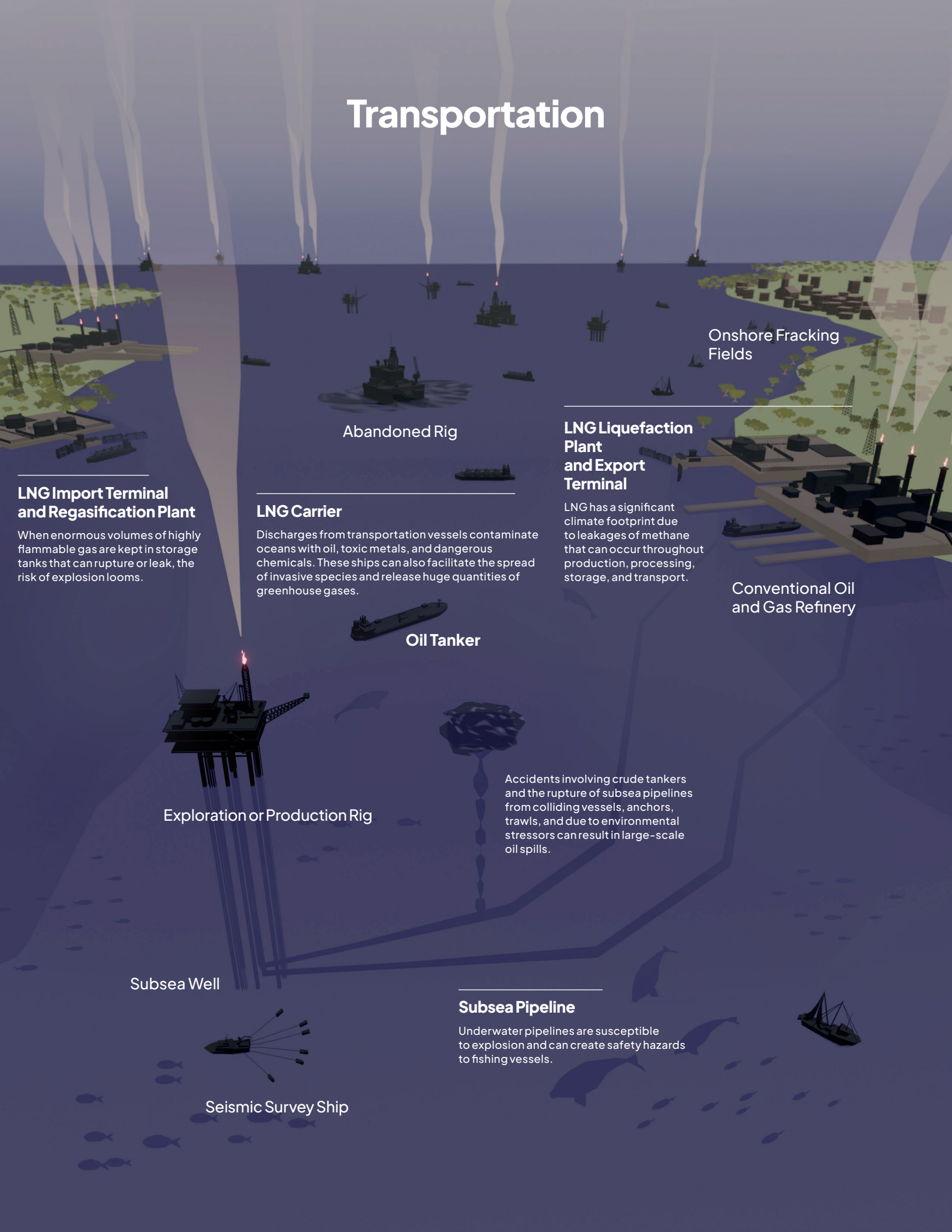
Offshore, Off-Limits

The Risks of Offshore Oil & Gas Transportation



Transportation



Onshore Fracking Fields

Abandoned Rig

LNG Liquefaction Plant and Export Terminal

LNG has a significant climate footprint due to leakages of methane that can occur throughout production, processing, storage, and transport.

Conventional Oil and Gas Refinery

LNG Import Terminal and Regasification Plant

When enormous volumes of highly flammable gas are kept in storage tanks that can rupture or leak, the risk of explosion looms.

LNG Carrier

Discharges from transportation vessels contaminate oceans with oil, toxic metals, and dangerous chemicals. These ships can also facilitate the spread of invasive species and release huge quantities of greenhouse gases.

Oil Tanker

Exploration or Production Rig

Accidents involving crude tankers and the rupture of subsea pipelines from colliding vessels, anchors, trawls, and due to environmental stressors can result in large-scale oil spills.

Subsea Well

Subsea Pipeline

Underwater pipelines are susceptible to explosion and can create safety hazards to fishing vessels.

Seismic Survey Ship

Offshore oil and gas activity poses myriad threats to the environment and human rights across its life cycle, from exploration and production to transportation and decommissioning. *Offshore, Off-Limits* examines many of the relevant risks and impacts at each of these phases. This brief in the series focuses on the risks and impacts associated with the overseas and undersea transportation of oil and gas via pipelines and vessels.

Key Takeaways

- The increasing use of the oceans as highways for the global trade in fossil fuels, especially liquefied natural gas (LNG), only magnifies the sector's climate impacts.
- Transportation-related oil spills can devastate large swathes of ocean and coastlines, and more oil and gas tankers moving between coastal or offshore sites and markets mean a greater risk of accidents.
- Routine harms associated with offshore oil and gas transportation include operational and illegal releases of toxic substances, the facilitation of the spread of invasive species, and the release of significant volumes of greenhouse gas emissions that, in turn, drive the climate crisis.
- Discharges from oil and gas vessels contaminate oceans with oil, toxic metals, and dangerous chemicals, endangering marine ecosystems and human health.
- As accelerating climate change impacts increase the physical risk to oil and gas infrastructure and transport vessels, more offshore transportation- and infrastructure-related disasters are in our future.

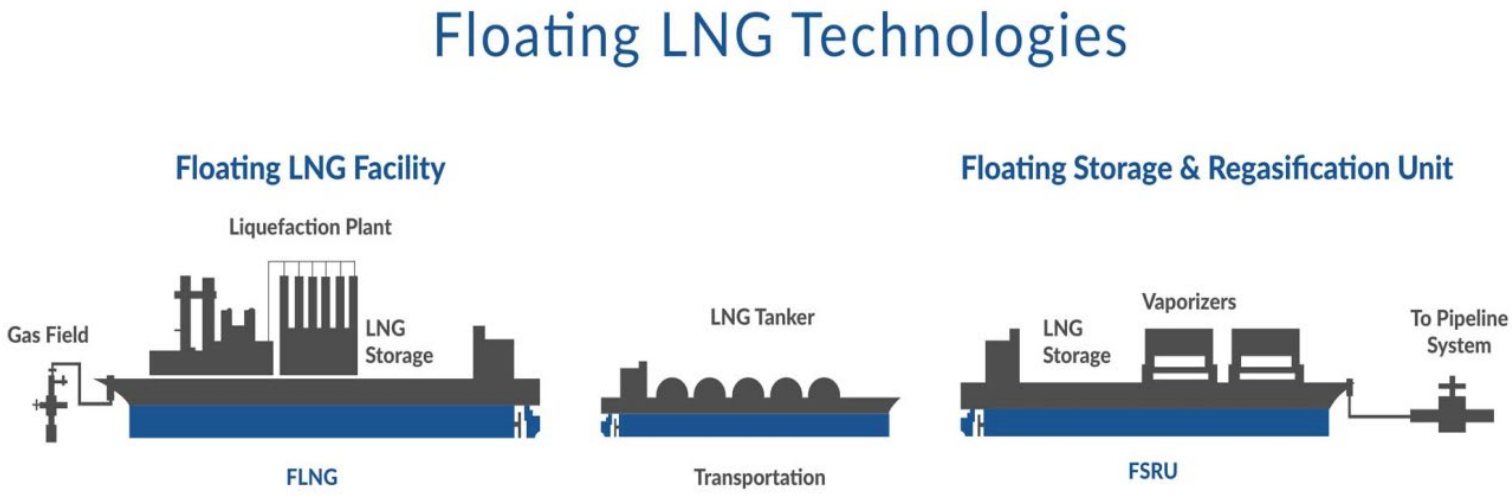
What Is Offshore Oil and Gas Transportation?

After fossil fuels are extracted from subsea fields, they are either processed at offshore facilities or moved via pipelines or tankers to onshore facilities for further processing, refining, and distribution. At present, fully 40 percent of maritime trade consists of shipping fossil fuels and fossil fuel products from one place to another.[1] Transporting massive volumes of crude oil or highly flammable gas over long distances and through fragile marine ecosystems is a massively energy-intensive and inherently hazardous activity. It has become even riskier in recent decades due to increased ship traffic and a rise in the frequency and severity of natural disasters and other climate change impacts that can damage transport infrastructure and result in ecological and human rights catastrophes. Moreover, on top of accidental spills and explosions and operational and illegal discharges, the spread of invasive species via ships and the release of huge quantities of planet-warming greenhouse emissions are among the many routine but harmful impacts of offshore oil and gas transportation on oceans and the wider planet.

How Are Oil and Gas Transported by Sea?

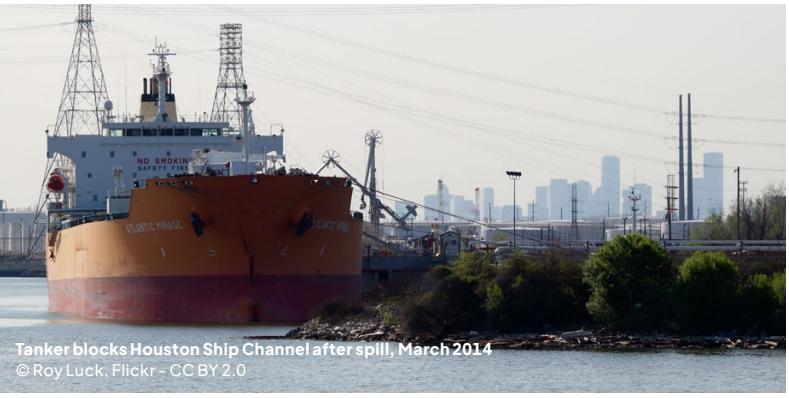
Pipelines

Both crude oil and natural gas can be transported by pipelines on or below the seafloor. Marine oil and gas pipelines are laid either by ships or barges, a process that entails welding together sections of steel pipe as the vessel progresses along the pipeline route.[2] Once in use, pipelines carry the mixture of oil, gas, and water that is extracted from the subsea wells either directly to nearby platforms or to distant facilities for processing and refining. Crude oil and natural gas can be separated out before transport or kept together in a mixture, depending on the type of export pipeline used.[3] These pipelines, particularly those laid out on the seafloor of deeper waters, are subject to immensely high pressures,[4] which can lead them to collapse.[5] As of 2017, there were reportedly over 150,000 km (over 9,300 miles) of undersea oil and gas pipelines around the world,[6] a figure that has likely spiked significantly since more tracts of the ocean have been targeted for new offshore oil and gas operations and infrastructure buildout.



Oil Tankers

Oil tankers are the key conduits for the risky transport of crude oil and related hazardous materials over long and heavily traveled sea routes. They include crude oil carriers — which carry oil from production sites at sea to refineries — and product carriers, which transport fossil fuel products such as gasoline, jet fuel, and diesel. As of 2023, there were approximately 7,500 oil tankers worldwide.[7] Additionally, chemical tankers carry large volumes of liquid chemicals used during the extraction and storage of crude oil — including corrosion inhibitors, thinners, and dispersants — to and from offshore rigs. Barges, which normally are not self-propelled and must be towed by tugboat, are primarily used to transport oil and other fossil fuel products on rivers, canals, coastal waters, and inland waterways.



Tanker blocks Houston Ship Channel after spill, March 2014
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LNG Carriers and Terminals

LNG is one of the fastest-growing forms of fossil fuel production. LNG projects that are already being built or have received financial backing could increase supply by 193 million metric tons per year from 2024 to 2028, a 40 percent rise over five years.[8] Liquefaction means gas can be moved over long distances, not just used within proximity of gas-producing regions. This processing technique has made it possible for gas extracted both onshore and offshore to be transported across the oceans.

© Yellow Boat - stock.adobe.com

Because liquefaction is primarily designed to enable transoceanic transport, the LNG boom has meant a glut of new coastal infrastructure, including liquefaction and regasification plants, import and export terminals, and seafaring vessels. Gas may be transported through pipelines from onshore or subsea wells to coastal processing plants, where it undergoes the liquefaction process at export terminals to be stored or carried by seafaring vessels. Alternatively, offshore gas may be liquefied on floating liquefied natural gas (FLNG) facilities before being transferred to carriers for export. Wherever liquefaction occurs, the process entails separating out liquid hydrocarbons from the fossil gas — which is comprised primarily of methane and may include ethane, propane, and other gases — and then compressing the gas and cooling it to extremely low temperatures (-260˚F or -161.5˚C) until it enters a liquid state.[9] The LNG is then transported to terminals in specially designed tankers equipped with heavily insulated, temperature-controlled storage tanks that keep the gas in a liquid state, when it is highly flammable and volatile.[10] At the terminal, the LNG is converted back to its gaseous state, a process called regasification, and moved through pipelines to storage and distribution facilities.[11]

Regardless of how natural gas is transported — by pipeline or by ship — the process of liquefying gas is incredibly energy-intensive, costly, and risky for surrounding communities and ecosystems.

What Are the Risks Posed by Offshore Transportation?

Climate Risks

The global transport of oil and gas generates significant greenhouse gas emissions. These stem primarily from the fuel burned for shipping, liquefaction, and compression; leaks of methane from pipelines and vessels, including from crude pipeline accidents;[12] and processing and storage activities upstream and downstream of transportation. Researchers at the Organisation for Economic Co-operation and Development (OECD) estimated that, in 2022, the transport of oil and LNG by tanker accounted for 171.6 million tons of CO_2 emissions globally, which was 20 percent of total shipping emissions that year.[13] As more offshore projects advance, this quantity will likely sharply rise. The overall life cycle greenhouse gas (GHG) emissions produced by offshore oil and gas activity are already likely underestimated due to difficulties in monitoring and gathering data on methane emissions at sea, as discussed in the Production brief.

Contrary to the fossil fuel industry's claims that gas is a "clean" bridge fuel, the production and transport of LNG results in 10 times the carbon emissions of pipeline gas.[14] LNG's massive climate footprint is attributable to the huge amounts of energy needed to liquefy, store, and regasify the fuel for transport, on top of the already energy-intensive process of extracting the gas.[15] The energy-intensive liquefaction process, which involves significantly lowering the temperature of the gas in order to reduce its volume by 600 times, often necessitates dedicated offshore power plants.[16]

LNG also has significant upstream GHG emissions due to releases of methane[17] — the principal component of fossil gas and a highly potent GHG — that occur throughout production, processing, and transportation. LNG storage tanks, by design, release vaporized methane into the atmosphere to maintain incredibly cold conditions, and even with some larger tanks engineered to capture boiled-off gas, leaks occur.[18] Methane is also flared and vented to control the pressure during the regasification of LNG.[19]

The increasing buildout of LNG means that even more methane emissions are likely to occur through offshore transportation activities. Governments worldwide are focusing on accelerating investments in LNG. In the United States alone, as of March 2023, the Department of Energy had authorized eighteen large-scale LNG export projects totaling 450 billion cubic meters per year of capacity.[20] This buildout will see US exports of LNG double by 2027, though in 2024, the Biden administration implemented a temporary pause on pending decisions on LNG exports, which the Trump administration has signaled it plans to reverse.[21] With a deluge of LNG projects slated to come online in 2025,[22] LNG is an extremely dangerous prospect for the climate, especially as some LNG facilities have been found to underreport and miscalculate their emissions.[23]

The climate impacts of offshore oil and gas production and transportation are compounded by the difficulties of underwater detection and monitoring. The oil and gas industry admits that the quantification of subsea emissions is "not technically feasible today," effectively acknowledging that they do not even know how much methane may be leaking from offshore wells and pipelines.[24]

The push for LNG-fueled tankers doesn't solve the problem. On the contrary, recent studies indicate that the most commonly used engine technology on marine vessels emits 70 percent more life-cycle GHGs when it combusts LNG than conventional oil-based fuels.[25] This means that if increasing numbers of ships — not just LNG carriers and conventional oil and gas tankers but other sectors' vessels — start using LNG for fuel, emissions from the shipping sector may increase rather than decrease. LNG is not a solution for decarbonizing the marine transport sector, much less transitioning the world away from fossil fuels.

Environmental and Biodiversity Risks

Air Quality Impacts

On top of releasing enormous quantities of planet-warming methane and other GHGs, the transportation of oil and gas across the oceans emits air pollutants that pose health hazards to those located near or working in ports and terminals — which serve as waypoints for tankers, barges, and other vessels delivering oil and gas from offshore production sites. Oil tankers have been linked to leaked toxic hydrocarbon gases and vapors (HGVs), which induce headaches and dizziness and smell foul enough to decrease the quality of life for upwind communities.[26] Hydrogen sulfide has also been detected in the air around ports[27] and can cause irritation to the eyes and respiratory system, weakness, irritability, sleep-related issues, and other health effects.[28] LNG export terminals can emit their own toxic mix of gases and other dangerous substances into the air, including fine particulate matter, sulfur dioxide, nitrogen oxides, carbon monoxide, and volatile organic compounds.[29]

Oil Spills

While blowouts during production have the potential to cause particularly massive oil spills, as detailed in the Production brief, accidents involving tankers, pipelines, and other oil and gas infrastructure during the transportation phase are even more common and can likewise be devastating to large swathes of ocean and coastlines. A widely cited study from 2003 reported that, at the time, 12 percent of the more than 343 million gallons of oil that enter the sea annually could be traced to transportation-related incidents.[30] Such incidents include collisions involving crude tankers carrying massive volumes of oil as well as the rupture of undersea pipelines from colliding vessels, anchors, and trawls. Equipment failure and/or human error can also result in spills near ports and marine terminals during routine operations — such as the offloading of oil from transport barges or tankers.[31] Additionally, as described above, the extreme pressure conditions at the subsea level, which increase the deeper the water, can cause pipelines to collapse and subsequently leak dangerous contaminants.[32]

MT *Princess Empress* oil spill offshore Philippines, March 2023

More oil and gas tankers moving between offshore sites and markets means a greater risk of accidents. In the US, out of nineteen large spills that occurred in the outer continental shelf from 1964 to 2015, thirteen were caused by accidents involving vessels.[33] From 2013 through March 2024, there were 360 reports of vessel spills of oil, liquefied petroleum gas (LPG), LNG, or methane made to the National Response Center — an emergency call center that fields and documents reports of spill incidents for the US.[34] Across the globe, the majority of oil spills that can be traced specifically to oil tankers over the last fifty years occurred in the Atlantic offshore Europe, accounting for 57 percent of all significant tanker accidents and resulting in the release of 1.4 million metric tons of oil.[35] Studies suggest that this is due largely to heavy ship traffic in these waters.[36] Offshore oil and gas buildout in emerging hotspots could, therefore, mean increased vessel-related spills in waters that have thus far remained ecologically sound.

The Exxon Valdez disaster of 1989, which was the largest oil spill in US waters until the Deepwater Horizon spill in 2010, demonstrated the destructive potential of transportation related accidents. The spill occurred when an oil tanker owned by Exxon Shipping Company ran aground in Alaska's Prince William Sound. The collision tore open the ship's hull and ruptured eight of its eleven cargo tanks, causing some 10.8 million gallons of crude oil to spill into the ecologically sensitive inlet and pollute 1,200 miles (1,900 km) of pristine coastline. The impact of the spill on wildlife was catastrophic, resulting in the death of an estimated 250,000 seabirds and countless other marine and coastal species.[37] The disaster has had resounding effects on the fragile ecosystem, local livelihoods, and economies for decades, and lingering oil contamination remains to this day.[38]

Tank Barge DBL 152 spill in Gulf of Mexico, November 2005
© NOAA Images

Repsol oil spill in Peru
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While the oil and gas industry points to recent studies suggesting that transportation related spills have declined in the last few decades — something that can't be said of production-phase spills, which have only increased due to the rise in offshore activity[39] — the threat of large-scale disaster nonetheless remains. Just the last few years have witnessed multiple major tanker and pipeline spills around the globe, including the following examples:

October 2021: Off the coast of Southern California, a damaged pipeline operated by Houston-based Amplify Energy dumped 25,000 gallons of crude oil into the Catalina Channel, creating a toxic oil slick that spanned 8,320 acres and smothered ecologically fragile wetlands and estuaries.[40]

January 2022: Thousands of liters of crude oil leaked into the sea off the eastern coast of Thailand from an underwater pipeline belonging to Chevron-owned Star Petroleum Refining Public Company Limited (SPRC).[41] The spill, which threatened coral reefs, seagrass beds, and local livelihoods[42] and led officials to declare a local beach a disaster zone,[43] pushed hundreds of Thai villagers and small businesses to file a $152.72 million lawsuit against SPRC.[44]

January 2022: A ruptured pipeline caused an offloading oil tanker to spill over 10,000 barrels of oil just south of the Peruvian capital of Lima, contaminating an area the size of Paris and leaving dead fish, seabirds, and marine mammals in its wake.[45] The spill resulted in one of the country's worst ecological disasters in recent memory and has triggered a $4.5 billion lawsuit against Spanish oil firm Repsol SA, the owner of the faulty pipeline.[46]

March 2023: The MT Princess Empress, an oil tanker that was carrying 210,000 gallons (800,000 liters) of oil, sank off the island of Mindoro in the Philippines. The resulting spill contaminated waters, mangroves, coral reefs, and beaches in Oriental Mindoro province and other islands,[47] threatened hundreds of fishing communities,[48] and upended the local tourism economy.[49] The oil eventually drifted into the Verde Island Passage[50] — known globally as the "center of the center of marine shore fish biodiversity" and threatened 21 marine protected areas.[51]

November 2023: A pipeline off the coast of Louisiana leaked an estimated 1.1 million gallons of crude oil into the Gulf of Mexico,[52] apparently due to a failed subsea cable that lost pressure. As of early 2024, the exact cause of the system failure is not known,[53] and the long-term impacts of the spill on the local marine environment are yet to be fully understood.

July 2024: A Philippine oil tanker measuring 213 feet, MT Terra Nova, capsized in Manila Bay after encountering monsoon rains and huge waves.[54] The tanker was carrying 1.5 million liters of industrial fuel when it sank in an area popular with fisherfolk, leaving one crewman dead and causing an oil slick over 2 miles long in its immediate wake.[55]

Offshore oil and gas buildout in new geographies, therefore, means that more such disasters are likely in the future in regions unequipped and lacking the experience and infrastructure to respond quickly and effectively.

Climate Change Means More Offshore Disasters in Our Future

Offshore oil and gas activity drives global temperature rise by releasing enormous quantities of greenhouse gases during production and transportation and through the emissions that inevitably follow when the produced oil and gas is used as intended. Climate change, in turn, contributes to the increased frequency and intensity of extreme weather events that can seriously damage offshore and coastal infrastructure and thereby lead to disastrous releases of hydrocarbons and chemicals into the ocean. Hurricanes and storm surges are among the leading causes of oil spills involving ships, barges, tankers, pipelines, platforms, and processing and storage facilities. For instance, Hurricane Katrina — a Category 5 hurricane that hit the Gulf Coast of the US in 2005 and caused over 1,800 fatalities and $100 billion in damage — triggered 81 oil spill events in southwest Louisiana.[56] More recently, the US National Oceanic and Atmospheric Administration (NOAA) reported a total of 55 oil spills in the two weeks after Hurricane Ida,[57] a Category 4 storm that in 2021 ravaged the Gulf Coast and parts of the Caribbean and South America.

While sudden-onset natural disasters may be among the more visible and newsworthy climate impacts, slow-onset environmental changes attributable to global temperature rise also endanger offshore oil and gas infrastructure and heighten the likelihood of disasters at sea and along coastlines. Sea-level rise, for instance, can cause damage to platforms, refineries, and pipelines through flooding and coastal erosion. Increased precipitation can significantly weaken structures and lead to unforeseen shutdowns of oil processing, storage, and transportation facilities,[58] whereas drought can increase the likelihood of flooding. Heavy rainfall, moreover, can increase the risk of mold growth, leading to further structural issues as well as electrical damage.[59]

Because existing offshore production sites generally are not built to withstand the effects of rising sea levels and other climate change-driven phenomena, the likelihood of future oil spills and other catastrophes is all but guaranteed. In the Niger Delta, for instance, a troubling 72 percent of hydrocarbon production sites are vulnerable to changing rainfall patterns, flooding, and drought.[60] According to the Intergovernmental Panel on Climate Change (IPCC), based on projections for sea-level rise, "almost all port and harbour facilities in the Caribbean will suffer inundation in the future,"[61] which could spell disaster for coastal processing and storage facilities. In the US, governmental audits have revealed that the more than 4,000 oil and gas platforms located in the country's outer continental shelf "were not designed to accommodate a permanent increase in sea level."[62] In Rhode Island, Shell's reported failure to prepare its oil terminal in Providence for near-term climate change impacts triggered a lawsuit brought forward by the Conservation Law Foundation alleging violations of the Clear Water Act. While the lawsuit, which was settled in 2023, concerned a riverfront terminal, it offers guidance for similar challenges that could be brought against offshore facilities as concerns over the escalating impacts of climate change mount.[63]

New offshore oil and gas projects, therefore, don't only drive climate change but, in doing so, also elevate the likelihood and frequency of catastrophic marine and coastal contamination. In light of this growing risk, plans by governments and companies to expand oil and gas infrastructure along coasts and oceans must be subject to increased scrutiny and accountability.

Water Contamination

Bilge dumping is a pervasive source of marine pollution across the shipping industry, including among oil and gas vessels. Bilge water is composed of the many hazardous substances that collect at the bottom of a vessel, including oil, toxic metals such as lead and arsenic, cleaning solvents, and dangerous chemicals like benzene. While bilge dumping is barred by international law under the 1973 International Convention for the Prevention of Pollution from Ships, as modified by the Protocol of 1978 — or "MARPOL 73/78" — that hasn't stopped ships from bypassing the costs of treating wastewater by illegally releasing enormous quantities of bilge into oceans every year. In fact, a recent investigation revealed that there may be up to 3,000 cases of bilge dumping by commercial vessels every year in European waters alone — a scale significantly higher than what companies have publicly owned up to.[64] The offshore oil and gas industry is a major contributor. One study indicated that accidental spills, as well as operational discharges of cargo oil occurring during transportation of petroleum products, accounted for the release of 160,000 metric tons of oil into oceans worldwide every year, the equivalent of four Exxon Valdez oil spills every year.[65]

When it enters oceans, bilge water can pose many of the same harms to marine life associated with oil spills, on top of the independent risks presented by its other toxic components. And while large-scale spills may garner the most attention, the impact of smaller-scale releases of oil in marine environments must not be underestimated. The ecological and socioeconomic impacts of both large-scale and small-scale oil spills are discussed in the Production brief.

Ecosystem Disturbances

Whether via pipelines or seafaring vessels, the transportation of oil and gas from coastal and offshore production facilities to global markets — and accompanying infrastructure — can cause a range of ecosystem disturbances. Early on, during the process of laying pipelines on the seafloor, cables and anchors are dragged along the seabed, disturbing local biota.[66] Operational and accidental discharges of oil and other contaminants from vessels also threaten lasting harm to marine and coastal ecosystems, as described above and in the Production brief.

Oil and gas tankers and other carriers can also facilitate the spread of invasive species, which have been identified as one of the four greatest threats to the world's oceans.[67] Untreated ballast water released at a ship's destination can introduce thousands of harmful aquatic or marine microbes, plants, and animals from different ecosystems into new ecosystems, causing irreparable damage to biodiversity as introduced species multiply to outcompete native ones.[68] This can wreak havoc on food webs, which in turn is incredibly detrimental to the economies and health of local communities that rely on intact ecosystems for fishing and other activities.[69] Although shipowners are now required to install ballast water management systems under international law, chemicals used in this process can create high concentrations of byproducts that are more toxic than the chemical disinfection itself.[70] These chemicals can be harmful to the very native species they are trying to protect, thereby also putting the health of people who rely on the impacted marine ecosystem for protein at risk.

LNG terminals also threaten a range of adverse ecological impacts. The regasification of LNG requires huge inputs of seawater to serve as a heat medium to drastically increase the temperature of the gas. This cooled seawater — which will have undergone chlorination — is then released back into the ocean, where it can be toxic to invertebrates and fishes.[71] The discharge of processed seawater also results in the disruption and resuspension of coastal sediment, which often contains harmful contaminants like mercury, which then enters the marine food web.[72]

Health and Livelihood Risks

When enormous volumes of highly flammable gas are kept in storage tanks that can rupture or leak, the risk of explosion looms. LNG, in particular, presents a significant fire and explosion hazard, particularly during the liquefaction process, which occurs under extreme temperature and high-pressure conditions in which the severity of accidents is particularly high.[73] Spilled LNG in water can explode, while on land, it can create odorless clouds that can freeze skin and asphyxiate. Ignited LNG vapors can lead to intense, unquenchable fires, like vapor cloud explosions (VCEs) or jet fires.[74] LNG fires burn hot enough to cause second-degree burns on exposed skin up to a mile away.[75]

The gas industry and regulators have long downplayed the risk of LNG explosions and dismissed them as low-frequency events.[76] However, an independent expert study revealed that the magnitude of LNG explosions could be 15 to 20 times greater than what industry models project,[77] and when they do happen, LNG explosions are capable of mass destruction and high death counts.[78]

For instance, a 2004 explosion at the Skikda LNG terminal in Algeria — an early pioneer in the LNG industry — left thirty dead and another 70 injured, at the time fueling protests against the then-proposed buildout of LNG facilities in the US.[79] However, in spite of resistance from frontline communities and environmental organizations, the US has since become one of the world's biggest LNG exporters and, in 2022, it experienced an explosion at one of its own major facilities, the Freeport LNG terminal in Texas. While the explosion did not result in any deaths, its destructive potential and highly disruptive effects on domestic and international gas supply chains and prices underscore the risks intrinsic to increased reliance on the LNG industry.

Underwater pipelines are also susceptible to explosions. In 2021, a gas leak from an underwater pipeline that connected to a platform at the Ku-Maloob-Zaap oil field, operated by Pemex, Mexico's state-owned oil company, caused a fire on the ocean surface west of the Yucatan Peninsula.[80] Then, in 2023, two people died, and six people were injured in another fire on a Pemex oil platform in the Gulf of Mexico.[81] Reports stated that a tangle of pipelines were engulfed in flames and, according to Pemex, oil production was "impacted in a substantial way" due to the fire.[82] In 2022, explosions at the Nord Stream pipelines in the Baltic Sea caused extensive pollution, affecting sediment, seawater, and a vital fish spawning area, for over a month.[83] Shipping was restricted near the leak due to safety concerns,[84] and the incident was estimated to contribute to 32 percent of Denmark's annual GHG emissions, equivalent to around 14 million tons of CO_2.[85]

Undersea pipelines can also create safety hazards to fisherfolk and their vessels. Pipelines either laid on the seabed or buried underneath — and subsequently exposed by the weather and other environmental factors — can entangle fishing equipment and vessels, risking life and property.[86]

Conclusion

Transportation-related oil spills, air pollution from vessel traffic, methane leaks and releases from pipelines and LNG facilities, and chemical discharges all add to existing strains on the oceans and threaten the biodiversity, climate, and communities that depend on them. With the rapid expansion of LNG production, the oceans are increasingly treated as the highways for the global trade in planet-warming energy. The mounting impacts of climate change, from extreme weather events to sea-level rise, mean more offshore transport- and infrastructure-related disasters are in our future and underline the need for a rapid fossil fuel phaseout. The risks and impacts of other phases of offshore oil and gas activity are explored further in the other briefs in the *Offshore, Off-Limits* series, which can be found on CIEL's website.

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