LNG, SHIPPING, AND THE AMAZON OF THE OCEANS:

Scoping Key Issues and Potential Impacts of the Massive Expansion of LNG in the Verde Island Passage

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Executive Summary

The domestic shipping industry plays a major role in the Philippine economy. In 2022, trade passing through the country's ports generated a total revenue of Php 20.531 billion. One of the major hotspots of trade and shipping activity is the Verde Island Passage (VIP). The VIP is also known for being a biodiversity hotspot. In 2005, it was identified as the "center of the center of the marine shore fish biodiversity" in the world. For this reason, the VIP has been touted as the "Amazon of the oceans".

The VIP has reached this level of significance to the shipping industry as it holds a strategic position, connecting the South China Sea with Tayabas Bay and Sibuyan Sea, which acts as the main shipping route between Manila, Visayas, and Mindanao and a popular shipping route to international ports in Batangas, Manila, and Subic Bay. It also is being passed by many ferries to and from different provinces like Batangas, Marinduque, Occidental Mindoro, Oriental Mindoro, and Romblon. A total of 476,156 vessel calls were recorded throughout the country's ports in 2022. In Batangas, Mindoro, and Marinduque alone there were 76,226 vessel calls in total.

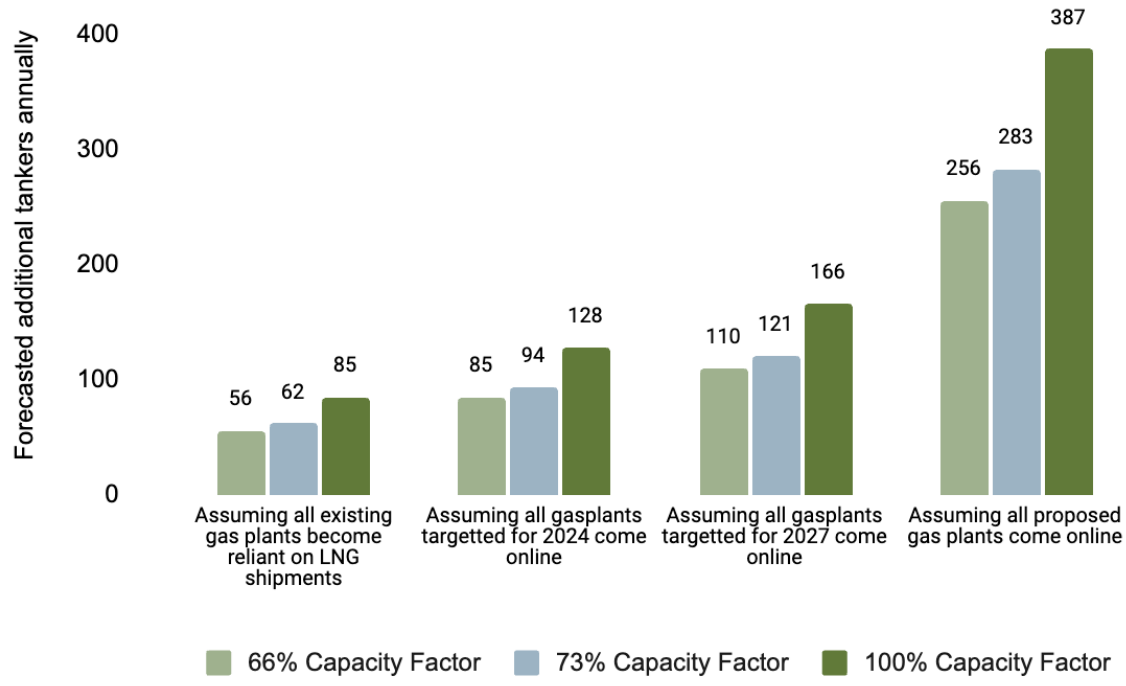
The VIP is also confronted with the threat of massive development from the fossil gas and LNG industries. In total, there are eight gas-fired power plants, one commissioned LNG terminal, and eight more LNG terminals being proposed in the Philippines. The VIP, or Batangas province to be precise, is the epicenter of this mad dash for gas. This will result in an expected growth of demand for LNG, and increase of LNG tankers and shipping traffic.

Key Findings

The table below forecasts the increase of shipping traffic in a given year based on the LNG requirements of all existing and proposed fossil gas power plants, and the range of LNG tanker capacities. In consideration of various plant capacity factors, three capacity factors based on the trend of fossil gas plant capacity factors in recent years were considered. From the year 2015-2019 the average capacity factor for fossil gas plants is 73%. This percentage dropped to 66% from 2020-2022. A 100% capacity factor was also considered for the forecast to show the gravity of increased shipping traffic at greater capacity factors.

* Figures shows calculations using the 125,000 m^3 ship carrying capacity

Figure ES-1. Forecasted Increase of LNG Tankers in the VIP



As of 2022, a total of 76,226 vessel calls were recorded between Batangas, Mindoro, and Marinduque annually. Findings show that the number of vessel calls will increase further due to the forecasted increase of LNG tanker traffic that will deliver the projected LNG demand. Considering only the existing gas plants, up to 85 LNG tankers could be potentially added to annual figures.

By 2024, if the Batangas EERI Combined Cycle Power Plant U1, 2, 3 and 4 comes online as scheduled, up to 128 LNG tankers could be potentially added to annual figures. This figure could grow to 166 by 2027 if VIRES LNG-Fired Power Plant Barge and the ACEN led BCE Natural Gas-Fired Power Plant comes online as scheduled.

Considering everything in the pipeline, if LNG demand for all existing fossil gas and all proposed fossil gas plants have come online, the forecast reveals up to 387 could potentially be added to annual vessel calls. This is a significant increase in such a rapid timeframe considering the country has accommodated one LNG tanker so far.

The forecast of increased shipping traffic provides only a glimpse of threats confronted by the VIP. However, to fully grasp the potential impacts of LNG terminals and ports development, and shipping activities, it is necessary to look into the activities attributed to these industries. The table below provides the main impacts and overall implications to VIP and resident coastal communities.

Table ES-1. Summary of main impacts LNG terminals development and increased shipping traffic in the VIP

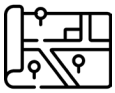
Activities	Potential Impacts	Implications for VIP
Pre-construction and construction phase of LNG terminals and ports		
Construction of off-shore infrastructure	**Marine and coastal ecology**	
	⦿ Loss of marine habitats ⦿ Loss of coral cover	⦿ Displacement of fish and other local biodiversity
	Water	
	⦿ Increased turbidity due to sedimentation ⦿ Potential oil and grease contamination ⦿ Decline in water quality	⦿ Species loss and reduced species abundance
	People	
	⦿ Hinders access to wildlife and fishing grounds ⦿ Lessens resource availability	⦿ Loss of livelihoods and food security ⦿ Higher expenses and longer travel for livelihood
Construction of ports and on-shore infrastructure, dredging, and reclamation	**Marine and coastal ecology**	
	⦿ High turbidity resulting to decreased light availability for coral reefs and seagrasses which are photosynthesizing organisms ⦿ Loss of coral cover	⦿ Species loss and reduced species abundance
	Water	
	⦿ Reduced dissolved oxygen due to sedimentation ⦿ Potential oil and grease contamination of marine waters and freshwater ⦿ Construction alters water flow	⦿ Construction affects coastal hydrology or the movement of water in the coastal area ⦿ Contamination affects freshwater supply ⦿ Contamination affects fish supply and the shoreline
	People	
	⦿ Disrupts shore fishing and livelihoods ⦿ Hinders access and transportation routes	⦿ Decline of available fishing grounds near shore ⦿ Contamination of waters and fish supply on top of the direct health risk to coastal communities

Noise pollution	**Marine and coastal ecology**	
	⦿ Noise and disturbances from construction activities affects sensitive marine organisms ⦿ Disturbance to small and large marine organisms that use echolocation	⦿ Displacement of biodiversity
Operational phase of LNG terminals and ports		
LNG spills and accidental fires	**Water**	
	⦿ Ignitable gas cloud which is a result of a rapid LNG spill ⦿ Infrastructures alter water flow	⦿ Risk of pollution ⦿ Infrastructures affect coastal hydrology or the movement of water in the coastal area
	People	
	⦿ Risk of of accidents and exposure	⦿ Inaccessible waters and fishing grounds due to obstruction
Noise pollution	**Marine and coastal ecology**	
	⦿ High levels of noise and disturbances during operation affects sensitive marine organisms ⦿ Disturbance to small and large marine organisms that use echolocation	⦿ Displacement of biodiversity
Air pollution and GHG emissions	**Air**	
	⦿ Increase local GHG emissions by releasing methane into the atmosphere through potential leaks throughout terminal processes ⦿ Emitting nitrogen oxides and sulfur oxides which are among the drivers of climate change ⦿ Pollutants introduced during pretreatment of feed gas include dust and particulate matter, carbon dioxide, carbon monoxide, methane, hydrogen sulfide, and ammonium	⦿ Emissions can contribute to nutrient enrichment problems in the oceans such as eutrophication which can result in harmful algal blooms ⦿ Water bodies can become unsuitable for marine life ⦿ Exacerbation of climate change
	People	
	⦿ Exposure of host coastal communities ⦿ Worsens preexisting cardiovascular and skin conditions	⦿ Rise of cardiovascular diseases due to the release of various pollutants ⦿ Short and long-term health implications to coastal communities
Increased shipping traffic through operation of the LNG industry		
Air pollution and GHG emissions	**Air**	
	⦿ Malodorous and toxic emissions ⦿ Increased traffic resulting to larger emissions	⦿ Increased GHG emissions ⦿ Decline in air quality ⦿ Exacerbation of climate change
	People	
	⦿ Exposure of coastal communities to air pollution ⦿ Worsens preexisting cardiovascular and skin conditions	⦿ Health implications to coastal communities

Accidental spill of oil, and other toxic, hazardous and dangerous substances	**Marine and coastal ecology**	
	⦿ Contamination and loss of coral reefs, seagrasses, and mangroves ⦿ Contamination and death of fish and other organisms ⦿ Stunted growth and cannot easily be eliminated by aquatic organisms ⦿ Destroyed reefs from sunken ships	⦿ Decline of biodiversity ⦿ Displacement of fish and other aquatic organisms
	Water	
	⦿ Oil and grease, toxic heavy metals, and other harmful chemicals contamination ⦿ Decline of light availability due to slicks or sheens	⦿ Long-term contamination of marine waters, freshwater, and coastlines ⦿ Decline of water quality
	Air	
	⦿ Malodorous and toxic emissions	⦿ Decline in air quality ⦿ Health implications to coastal communities
	People	
	⦿ Fishing bans and withheld access to marine and coastal resources	⦿ Long-term loss of livelihoods, tourism, and food securityDisplacement of fisherfolk and coastal communities ⦿ Health implications to coastal communities
LNG spills and accidental fires	**Water**	
	⦿ Ignitable gas cloud which is a result of a rapid LNG spill	⦿ Risk of pollution ⦿ Inaccessible waters and fishing grounds due to obstruction
	People	
	⦿ Risk of of accidents and exposure	⦿ Inaccessible waters and fishing grounds due to obstruction
Releasing of shipborne contaminants, in the form of wastewater discharge, ballast water, and bilge water	**Marine and coastal ecology**	
	⦿ Introduction of invasive species from ballast waters ⦿ Decline of marine ecology in heavily used ship routes ⦿ Stunted growth and cannot easily be eliminated by aquatic organisms	⦿ Decline of biodiversity ⦿ Presence of invasive species threaten endemic existing thriving species
	Water	
	⦿ Contamination of marine waters from untreated wastewater discharge and bilge water dumping ⦿ Heavy and other harmful chemicals contamination	⦿ Decline of water quality ⦿ Increase in concentration of contaminants over time ⦿ Dispersion of pollutants across VIP due to increased traffic
	People	
	⦿ Invasive species competing with commercially important fish	⦿ Lower fish catch

Contamination from routine ship processes such as ship maintenance and scrubber systems	**Marine and coastal ecology**	
	⦿ Stunted growth and cannot easily be eliminated by aquatic organisms ⦿ Impacts on lifespan and reproductive capacity ⦿ Loss of coral cover	⦿ Decline of biodiversity ⦿ Contamination of fish stock
	Water	
	⦿ Toxic heavy metals such as copper, zinc, lead, and chromium, and other harmful chemicals are released ⦿ Chemicals from antifouling paints ⦿ Release of sulfur emission from sulfur scrubber systems ⦿ Heavy metal accumulation in sediments	⦿ Adverse effects on aquatic organisms ⦿ Long-term impacts on aquatic ecosystems
	People	
	⦿ Threatened fish and aquatic resources	⦿ Lower fish catch ⦿ Contaminated fish catch
Noise pollution	**Marine and coastal ecology**	
	⦿ High levels of noise and disturbances from all ship traffic affects sensitive marine organisms ⦿ Disturbance to small and large marine organisms that use echolocation	⦿ Displacement of biodiversity
Ship strikes and collisions	**Marine and coastal ecology**	
	⦿ Ships striking and killing small to large marine organisms	⦿ Species loss and loss of abundance ⦿ Displacement of biodiversity ⦿ Disruption of migration and foraging patterns of small to large marine organisms
	Water	
	⦿ Collisions between ships resulting to accidental spill of oil, and other toxic, hazardous and dangerous substances such as coal and waste chemicals	⦿ Decline of water quality ⦿ Damage to marine and coastal resources
	People	
	⦿ Collisions between ships and small-scale fishing vessels ⦿ Damage to small-scale fishing vessels ⦿ Disruption of fishing activities ⦿ Loss of access to resources	⦿ Loss of livelihoods and food security

Recommendations



Map-out ecologically valuable areas that should be declared as no-go zones for the development of LNG terminals. Unfortunately, not all critical marine habitats or biodiversity hotspots are declared as protected seascapes under the ENIPAS and there are no maps of ecologically valuable areas in the country. Hence, these areas are open-access for development of harmful industries. Once identified, these ecologically valuable areas should be declared as no-go zones for LNG terminals, where LNG tankers are expected to moor and cause adverse impacts.

Review and revise shipping routes to ensure that ecologically valuable areas are avoided. The oil spill in Oriental Mindoro earlier this year shed light on how exposed coastal communities are to incidents occurring along shipping routes within municipal waters. Close proximity of shipping routes caused the rapid onset of oil spills along the coastline of Oriental Mindoro. Furthermore, deviation of ships from these routes have serious implications such as collisions and reef hits due to the close proximity to municipal waters. Worse, oil spills occurring outside designated routes could expose and threaten coastal communities close by. Given the significance and ecological value of the VIP not only to the country but to the world, the vast number of shipping routes must be reviewed and revised to avoid damage to the vital resources and prevent impacts from reaching resident coastal communities.

Ensure strict compliance of the maritime industry with regulations meant to ensure ships are seaworthy and environmental impacts are avoided or mitigated. The Oriental Mindoro oil spill also exposed prevailing ails in regulatory enforcement and compliance in the maritime industry, as government officials and RDC Reield are now charged with criminal charges filed by the National Bureau of Investigation's Environmental Crime Division and Mayor Jennifer Cruz of Palo, Oriental Mindoro before DOJ. The charges included multiple counts of falsification, multiple use of falsified documents; multiple counts of falsification of public or official documents; and perjury. Fisherfolk communities have also long complained about rampant illegal and waste discharging from ships. An immediate investigation must be conducted to surface the gaps in compliance monitoring and enforcement of laws governing these processes. The Philippine Coast Guard must ensure that monitoring systems are working and can prevent accidents. Government agencies should also be capacitated to immediately respond to accidents to avert major environmental catastrophes.

Designate bodies of water that have exceeded the DENR's Water Quality Guidelines as non-attainment areas for the relevant parameters. As a result of the Oriental Mindoro oil spill, the DENR reported that several coastal waters failed their testing. Under the Philippine Clean Water Act, the DENR has to formulate a plan for the clean-up and restoration of poor quality water bodies. To operationalize this, the DENR can issue guidelines for designation of non-attainment waters, although not specifically mandated by the Act. Designation of non-attainment areas should be done immediately, especially in areas with projected increase in shipping activities.

Rationalize plans and policies concerning fossil gas power plants and LNG terminals. The Climate Analytics report, getting fossil fuels out of the Philippine power sector, finds that fossil gas must almost entirely phase-out by 2040. By 2030 fossil gas will need to constitute only 6.5% of the power mix. This means plans for LNG and fossil gas must have an immediate phase-out plan for the country to be aligned to a 1.5C pathway. This puts into question if there is room for LNG and fossil gas in the power mix as its infrastructure will take years to be built and will have to be phased-out soon after.

Include shipping impacts in the impacts assessed and mitigated in the EIA Process for fossil gas power plants and LNG terminals. Considering that the scope of the EIS of LNG terminals only covers the impacts of the terminal and its infrastructures, the DENR should mandate that the EIS should cover impacts of increased shipping activity. It should include detailed contingency plans on oil or chemical spills and studies on the effects of ballast water on the surrounding marine environment as conditions under the ECC. Furthermore, other potential impacts of shipping must be taken into consideration given the major impacts that a shipping accident could bring about to marine ecosystems and coastal communities. The forecasted increase of shipping traffic due to the number of proposed LNG and fossil gas projects puts emphasis on the need to raise efforts on assessing impacts for the shipping industry, that's closely related to the expanding LNG and fossil gas industry.

Establish VIP as a protected area under the Expanded National Integrated Protected Area System (ENIPAS) law (Republic Act 11038). The Memorandum of Agreement of the five provincial governments seeking to protect VIP and several other local ordinances with the same objectives can be strengthened by translating these into national law. The inclusion of VIP in the ENIPAS will grant it all the protections under the law-such as the creation of a management board, whose composition can be revised to be representative of local stakeholders within and outside government, the establishment of a specific fund for the protection of the VIP, and the penalization of prohibited acts.

Declare VIP as a World Heritage Site (WHS). This declaration will attract international attention for the preservation and conservation of the globally significant VIP. For communities, it will promote tourism that can provide alternative or additional sources of income. Finally, this can open access to funds to support restoration and preservation efforts for VIP.

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I. The Verde Island Passage

The Amazon of the Oceans

The Philippines is an archipelagic country composed of over 7,000 islands. As such, the country is dependent on the domestic shipping industry for trade and inter-island transport. The domestic shipping industry plays a major role in the Philippine economy, backed by a large fleet that supports domestic trade. In 2022, the Philippines had 19,678 registered vessels that moved in and out of the country according to the Maritime Industry Authority (MARINA) Annual Statistical Report. In 2022, trade passing through the country's ports generated a total revenue of Php 20.531 billion according to the Philippine Ports Authority, the highest in 48 years signaling growth of the industry.

A major hotspot of trade and shipping activity is the Verde Island Passage (VIP), The VIP is constituted by waters and encompassed by land areas from five provinces across Region IV-A and IV-B: Batangas, Marinduque, Occidental and Oriental Mindoro, and Romblon. In 2005, Carpenter and Springer identified it as the "center of the center of the marine shore fish biodiversity" in the world. VIP houses roughly 1,736 marine fish species, nearly 60% of the world's known shore fish species, making it the most biodiverse marine habitat in the world. For this reason, the VIP has been touted as the "Amazon of the oceans". It is roughly 100 km long and about 20 km wide at its narrowest point, while depth ranges from 70 meters to 1,000 meters along its length (Sollestre et al., 2018). Apart from a vast assemblage of fish species, It is also home to more than 300 coral species, 32 mangrove species, and 20 seagrass species. Furthermore, its coastal habitats house endemic species like the Philippine teak, dungon, molave, and threatened species like flying foxes and giant fruit bats (De La Cruz, 2023). The country is home to many more of these rich marine ecosystems. It is no mystery that the country has been included by the United Nations Convention on Biological Diversity among the 18 mega-biodiverse countries in the world

The VIP has a diverse composition of ecosystems within its territory namely mangroves, seagrass, and coral reefs, which provide a myriad of ecosystem services. The mangrove ecosystem provides protection from storm surges and prevents soil erosion. It is estimated that the mangrove ecosystem in VIP is at least USD 59-78.7 million (Ateneo & Salmo III, 2019). A carbon stock assessment looked into the potential of mangroves in San Juan, Batangas and established that different species of mangroves present in different barangays have a good potential for storing carbon further emphasizing their role in carbon sequestration and climate change mitigation, and the need for proper forest management to sustain them (Gevaña et al., 2008).

The marine corridor also boasts a diverse seagrass and seaweed ecosystem within its vicinity. A survey of the diversity and distribution of macrophytes, which include seagrass and seaweed, along VIP revealed that the corridor supports a high species diversity of marine macrophytes (Rula et al., 2022). The species richness of macrophytic organisms in VIP highlights the importance of ecosystem services and functions that these organisms provide in coastal communities. These organisms serve as a habitat for a wide range of marine organisms while serving as carbon sinks and regulators of water quality such as water acidity. Furthermore, these organisms serve as a food source for marine organisms, but also a food source and livelihood-base for coastal communities.

In terms of corals and reef-associated fishes, the VIP also boasts of its rich biodiversity. Apart from serving as habitats for various marine life, corals also protect coasts by buffering waves and currents while the rich assemblages of fish provide sustenance and livelihoods. These species not only provide ecosystem services that are otherwise invaluable but also provide livelihood to 30 coastal municipalities and 2 coastal cities through fishing and ecotourism like diving, snorkeling, and swimming activities (Apaya, 2018). However, due to uncontrolled illegal fishing practices, overpopulation, and climate change, there's evidence of decreased fish catch by local fishermen harboring VIP (Lavides et al., 2016).The VIP is a sanctuary for reef fishes, where new species are still being encountered. In 2019, three new species of *Chromis* were discovered in the mesophotic reefs in Batangas (Arango et al., 2019).

A Major Shipping Route

The VIP holds a strategic position for the shipping industry as the VIP connects the South China Sea with Tayabas Bay and Sibuyan Sea, which acts as the main shipping route between Manila, Visayas, and Mindanao (Vanzi, 2020) and a popular shipping route to international ports in Batangas, Manila, and

Subic Bay (Conservation International, 2023). It also is being passed by many ferries to and from different provinces like Batangas, Marinduque, Occidental Mindoro, Oriental Mindoro, and Romblon (Vanzi, 2020). (See Figure 1 for the overall view of maritime routes in the country)

Figure 1: Maritime routes in the country.
(Source: Dimailig et al., 2011)

The Philippine Ports Authority distinguishes ports that operate for domestic or foreign use and further categorizes them into four types: 1) the Base Port which is the center or the hub operations in a cluster; 2) Other Terminal Ports that facilitate lesser activities compared to Base Ports; 3) Other Government Ports that are public ports owned and maintained by other government entities; and 4) Private Ports that are owned and maintained by private entities for commercial or non-commercial use. Between the five provinces constituting the VIP, there are a total of 96 ports registered in the Philippine Ports Authority in 2022, with Batangas Province having the most ports at 76, 60 of which are private ports. Over 63% of the ports in the VIP are private ports. (See Annex 1 for the full list of ports in the VIP)

VIP is a commonplace for ports intended for passenger traffic, shipping, and trade. A popular port located in VIP is the Batangas Pier, which covers a land area of 150 hectares and commonly serves as a starting point when traveling into and out of Region IVA or CALABARZON. Ports across the five provinces offer both RORO and Non-RORO services (Philippine Ports Authority, n.d.). The Roll-on/Roll-off or RORO services provides the option to load vehicles on vessels and unload them at their destination seamlessly.

Aside from Batangas, there are also a total of ten ports located in Oriental and Occidental Mindoro while there are five each Marinduque and Romblon that are within the boundary of VIP. Majority of these ports provide services to cargo vessels, specifically RORO services that carry cargo and passengers. But there are also shipping vessels that use ports in delivering their products to market sellers. There are also oil tankers that use the ports when docking in order to deliver their cargo to different fossil fuel facilities. (See Annex 1 for the full list of ports in the VIP)

Figure 2: Ports in VIP.
(Source: https://www.marinetraffic.com/en/ais/home/centerx:121.2/centery:13.3/zoom:9)

According to the Philippine Ports Authority, a total of 476,156 vessel calls – the number of vessels which call or arrive at a particular port at any given time – were recorded throughout the country's ports in 2022. In Batangas, Mindoro, and Marinduque alone there were 76,226 vessel calls in total. Figure 3 shows the maritime traffic of all vessels in 2022. Highlighted in dark red are the routes with the highest number of vessels that have passed through, the most frequently used routes through the VIP corridor. On the other hand, the light blue to yellow routes indicate moderate use while the dark violet hue indicate the routes that are least used. The red arrows are tankers passing through VIP.

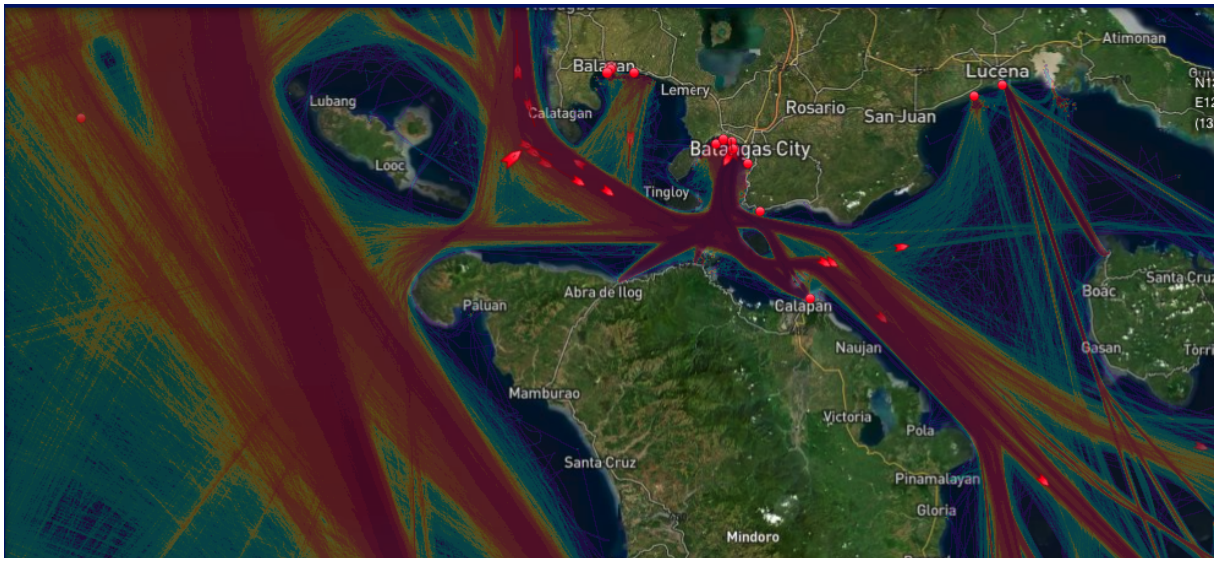


Figure 3: A one-year maritime traffic of tankers passing through VIP in 2022.
(Source: https://www.marinetraffic.com/en/ais/home/centerx:120.9/centery:13.4/zoom:9)

The Epicenter of LNG Expansion

On top of several existing threats such as uncontrolled illegal fishing practices, encroachment, oil spills, declining fish catch and water quality, reclamation, pollution from shipping activities and other industries, and climate change, VIP is also confronted with the threat of massive development from the fossil gas and liquified natural gas industries. Although peddled as clean, natural gas is far from it. Throughout the life cycle of natural gas, the industry runs the risk of leaking and emitting harmful pollutants. From the pretreatment phase of feed natural gas, various pollutants are already released to the environment. During the liquefaction phase there is further release of carbon dioxide and carbon monoxide, while the storage and transport also provides risks of methane leaks. Once regasified and used as fuel by power plants, combustion of this fuel further emits methane, a more formidable climate force compared to carbon dioxide. Given that the fuel is inherently fracked fossil fuel with major environmental implications throughout its lifecycle, natural gas is more appropriately called fossil gas.

In recent years, the Philippine government's recognition of fossil gas as a supposed "transition fuel" and its pronouncement of its vision of being an LNG Trading and Transshipment Hub of Asia-Pacific has opened the floodgates for massive plans for fossil gas and LNG projects build-out (see Figure 4).

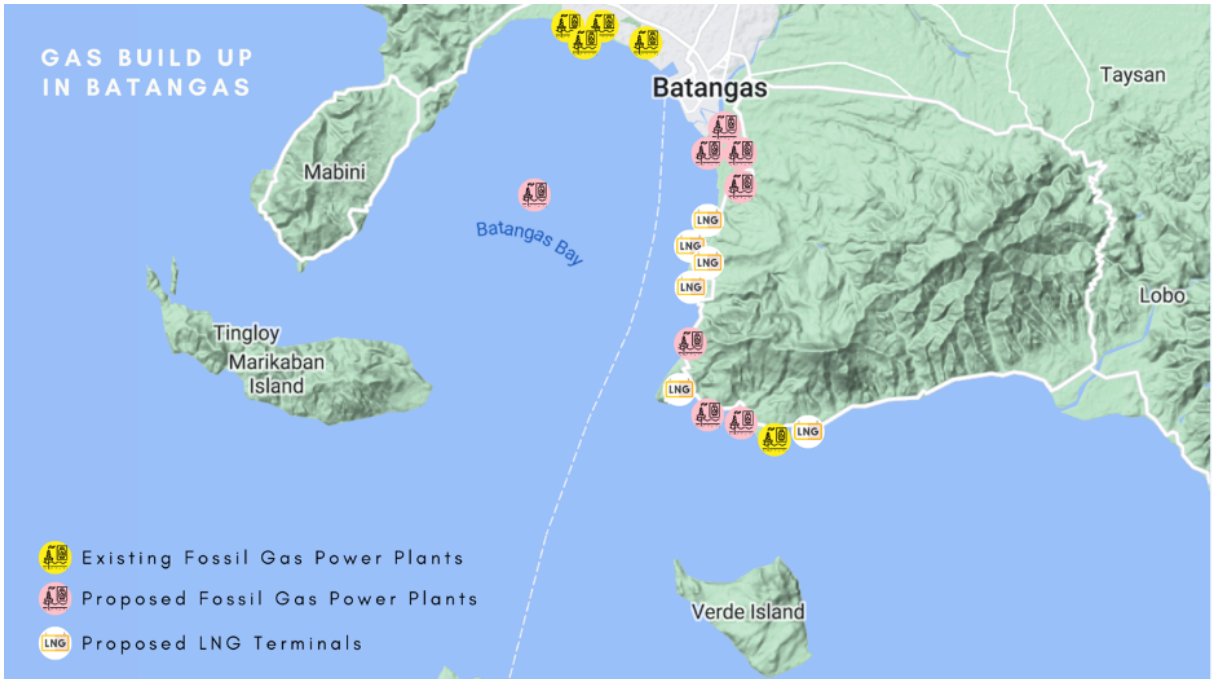


Figure 4: Existing and proposed fossil gas power plants and proposed LNG terminals
(Source: *Philippines: LNG Boom in the Verde Island Passage | Gogel*, 2023)

In total, there are eight gas-fired power plants, one commissioned LNG terminal, and eight more LNG terminals being proposed in the Philippines. The VIP, or Batangas province to be precise, is the epicenter of this mad dash for gas.

Currently, there are already five operating fossil gas power plants in Batangas province. The oldest fossil gas power plant, Santa Rita Combined Cycle Gas Turbine Plant owned and operated by First Gas Power Corporation, subsidiary of First Gen Corporation, in Sta. Rita, Batangas City has been commercially operating since June 2000. The newest power plant among the five existing is the Avion Open Cycle Gas Turbine Plant, also a subsidiary of First Gen Corporation, is located in Bolbok, Batangas City and started commercial operations in August 2016. In addition to these, there are eight more gas-fired power plants proposed in Batangas Province, majority of which are owned by San Miguel Corporation (see Table 1).

Table 1. Operating, proposed and under-development fossil gas-fired power plants in Batangas Province

Facility Name	Installed/ Rated Capacity (MW)	Status	Location	Operator and Owner/IPP	Date Commissioned/ Commercial Operation
Santa Rita Combined Cycle Gas Turbine	1,094.80	Operating/ Existing	Sta. Rita, Batangas City	First Gas Power Corporation	June 2000
Ilijan Combined Cycle Gas Turbine	1,277	Operating/ Existing	Ilijan, Batangas City	KEPCO Ilijan Corporation	June 2002
San Lorenzo Combined Cycle GasTurbine	549.1	Operating/ Existing	San Lorenzo, Batangas City	First Gas Power Corporation	September 2002
San Gabriel Combined Cycle Gas Turbine	430	Operating/ Existing	Sta. Rita, Batangas City	First NatGas Power Corp	July 2016
Avion Open Cycle Gas Turbine	100.6	Operating/ Existing	Bolbok, Batangas City	Prime Meridian Powergen Corporation	August 2016
SMC Ilijan LNG Power Plant	3,600	Announced	Ilijan, Batangas City	SMC Global Power Holdings Corp	Not available
VIRES LNG-Fired Power Plant Barge	450	Indicative	Simlong, Batangas City	Vires Energy	December 2026
Batangas EERI Combined Cycle Power Plant	1,750	Under construction	Dela Paz, Batangas City	Excellent Energy Resources Inc	U1&U2 - Sep 2024, U3&U4 - Dec 2024
ACEN led BCE Natural Gas-Fired Power Plant	1,100	Indicative	Libjo & Malitam, Batangas City	Batangas Clean Energy Inc	March 2027
Batangas (Millenium) power station	1,700	Announced	Dela Paz & Ilijan, Batangas City	Millenium Energy	Not available
Stellar Dual-Fired Power Plant Project	1,250	Announced	Libjo & Malitam, Batangas City	Ingrid3 Power Holdings Inc	Not available
Santa Maria Natural Gas-Fired Combined cycle	1,260	Indicative	Santa Rita, Batangas City	First Generation Holdings Corp	Not available
Lloyds Energy Philippines Inc. Floating Power Plant	1,200	Announced	San Pascual, Batangas bay	Lloyds Energy Ltd	Not available

(Source: DOE, https://www.doe.gov.ph/sites/default/files/pdf/electric_power/existing_power_plants/01_Luzon%20Grid-connected-July-2023.pdf;https://www.doe.gov.ph/sites/default/files/pdf/electric_power/private_sector_initiated_power_projects/01_Luzon-Committed-July-2023.pdf;https://www.doe.gov.ph/sites/default/files/pdf/electric_power/private_sector_initiated_power_projects/06_Luzon-Indicative-July-2023.pdf)

Despite being mired in lawsuits, Atlantic Gulf & Pacific-subsidiary Linseed Field Power Corporation's PH LNG, the first LNG terminal in the Philippines, started commissioning in April 2023. There are eight more LNG terminals being proposed, as shown in Table 2.

Table 2. Commissioned, proposed and under-development LNG Terminals

Facility Name	Capacity (Mtpa)	Status	Location	Owner	Date Commissioned/ Commercial Operation
Philippines LNG Terminal	5	Commissioning	Batangas	Linseed Field Power Corporation	April 2023
FGEN Batangas FSRU	5.26	Construction	Santa Rita, Batangas City	First Gen	2023
Pagbilao Grande Island LNG Terminal	3	Construction	Pagbilao Grande Island, Quezon	Energy World Gas Operations Philippines Inc.	2022
Filipinas LNG Gateway Project FSRU	5	Proposed	Batangas	Luzon LNG Terminal Inc.	Not available
Tabangao FSRU	3.8	Proposed	Tabangao, Batangas City	Shell Energy	Not available
Vires FSRU	3	Proposed	Simlong, Batangas City	Vires Energy	2023
Samat small scale LNG terminal	0.4	Proposed	Mariveles, Bataan	Samat LNG Corp.	2024
Batangas Clean Energy LNG Terminal	3	Proposed	Batangas	Batangas Clean Energy Inc	2025
Atimonan LNG Terminal	Not available	Proposed	Atimonan, Quezon	Manila Electric Co	2026

(Source: DOE)

It's striking how the country's energy development is skewed towards the development of the LNG and fossil gas industry despite the global push to decarbonize. It undermines the abundance of renewable energy potential in the country and the Renewable Energy law that puts preferential bias to the development of renewable energy. According to a report from Climate Analytics on getting fossil fuels out of the Philippine power sector, the Philippines must almost entirely phase out gas-fired generation by 2040 to stay aligned to a 1.5C pathway.

Confronting prevailing threats

The threat of fossil gas and LNG expansion comes on top of already prevailing threats. The five provinces encompassing the VIP are already home to various heavy industries. These industries include petrochemicals, coal, oil and gas, cement, steel, construction and manufacturing supply, ship building, and mining among others. Other existing threats include instances of toxic disasters such as capsizing of coal and diesel barges, and oil spills that have occurred in the VIP in the past. These industries and accidents are existing sources of pollution that threaten the marine resources, fisheries sector, and the health of coastal communities of VIP. Unfortunately, fisherfolk and coastal communities are exposed to even more prevailing threats that relate to their livelihood. These include encroachment of commercial fishing vessels in the municipal waters which displace small-scale fisherfolk, overfishing, illegal and destructive fishing, unsustainable tourism, habitat loss of mangroves, seagrasses, and coral reefs due to reclamation projects, and lack of enforcement of policies and laws that protect the rights of fisherfolk.

II. Relevant Maritime and Marine Conservation Policies, Laws, and Regulations and their Implementation

The Philippines has numerous policies, laws, and regulations that govern the maritime industry and the conservation and protection of marine habitats like the VIP. However, even as the provisions of these various laws ostensibly assure protection from the existing and growing threats across the country's marine habitats, implementation remains a challenge.

International Laws

The Philippines is a party to numerous multilateral conventions, treaties, and agreements pertaining to shipping and transportation, the protection of marine resources from pollution, and the safety of ships and their passengers from accidents, collisions, and fires, among others. While the International Maritime Organization (IMO), a specialized agency of the United Nations, is mandated to provide for a regulatory framework and standards regarding international shipping, it is the Philippine Coast Guard (PCG) that is tasked to implement the IMO's Conventions under Section 3(a) of Republic Act No. 9993 or the Philippine Coast Guard Law of 2009. Among the international treaties are the International Convention for the Prevention of Pollution from Ships along with its Annexes and Protocols, the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter and its Protocols, the International Convention for the Prevention of the Pollution of the Sea by Oil, the International Convention on Oil Pollution, Preparedness, Response, and Cooperation, and the International Convention for the Safety of Life at Sea (SOLAS).

Multiple Multilateral Environmental Agreements (MEAs) have also been ratified by the Philippines in order to safeguard our country's natural resources. Examples of these are the Rio Declaration and Agenda 21, the United Nations Convention on the Law of the Sea (UNCLOS), the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), the Convention on the Conservation of Migratory Species of Wild Animals (CMS or Bonn Convention), the Convention concerning the Protection of the World Cultural and National Heritage, and the Convention on Control of Transboundary Movements of Hazardous Wastes and their Disposal (the Basel Convention), and the Convention on Biological Diversity (CBD), among others.

An interesting observation regarding Philippine implementation of MEAs is that objectives of the MEAs are also frequently carried out through department administrative orders, administrative issuances, and policy frameworks by the DENR, along with projects and programs handled by its Biodiversity Management Bureau and Environmental Management Bureau, rather than through the promulgation of national laws. This presents advantages given administrative agencies like the DENR have more specialized knowledge of topics espoused in the MEAs, and can directly implement their expertise (Casis, 2021).

An example of the foregoing is the Verde Island Passage Marine Corridor Management Plan (The Verde Framework) issued in 2009. The Verde Framework is a management and policy framework for the conservation and development of the VIP and the provinces covered by it, and was drafted pursuant to President Gloria Macapagal Arroyo's Executive Order No. 578. It cites a number of international laws and policies that the DENR took into account upon its creation, which includes most of the abovementioned conventions, along with regional initiatives for the development and preservation of shared resources such as the Sulu-Sulawesi Marine Ecoregion Plan and the Sustainable Development Strategy for Seas of East Asia (SDS-SEA).

National Laws

The Philippines also has a plethora of national laws and policies for marine conservation and protection. As early as the 1970s, the country already put in place several policies in response to oil spills and other sources of marine pollution. As early as 1974, Presidential Decree No. 602 or the National Oil Pollution Operations Center Decree was issued, which established a National Operations for Oil Pollution, which shall act as the point of contact with similar national operations centers of ASEAN member countries and shall cause, when necessary, the immediate call for assistance from such countries to help contain oil pollution. It also mandates other agencies to provide assistance to the National Operations Center for Oil Pollution in the form of personnel, facilities and other resources to assure capacity to handle oil spill incidents. The decree

was issued amidst an alarming increase in environmental pollution and contamination and the dangers of major oil spills, and a perceived urgent need to prevent, mitigate or eliminate the increasing damages to marine resources as a result of pollution.

Another policy formed during this period is the Presidential Decree No.979 or the Marine Pollution Decree of 1976, which deals more generally with marine pollution, instead of oil pollution. It declared as national policy the prevention and control of pollution in the sea by the dumping of wastes and other matter which create hazards to human health, harm living resources and marine life, damage amenities, or interfere with the legitimate uses of the sea. The Decree mandated the National Pollution Control Commission to promulgate national rules and policies governing marine pollution, and the PCG to promulgate its own rules and regulations in accordance with the national rules and policies set by the National Pollution Control Commission. At present, Executive Order 192, series of 1987, has abolished the National Pollution Control Commission, and transferred its powers and- functions to the Environmental Management Bureau. The same Executive Order has also transferred the adjudication of pollution cases underRA No. 3931 and PD 984 to the Pollution Adjudication Board.

More than three decades later, the Republic Act No. 9483 or the Oil Pollution Compensation Act of 2007 was enacted. This law repeals and or modifies, as the case may be, all other laws, decrees, rules and regulations, and executive orders contrary to or inconsistent with its provisions. In its declaration of policy, it provides the state power to impose strict liability for oil pollution damage and ensure that prompt and adequate compensations for persons to suffer such damage. This act also implements provisions from the 1992 International Convention on Civil Liability for Oil Pollution Damage and the 1992 International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage.

Under the Oil Pollution Compensation Act, the owner of the ship at the time the incident occurred will be held liable for any pollution damage caused by their ships unless they or their insurer can prove that the damage resulted from an act of war, hostilities, civil war, or a natural phenomenon of an exceptional, inevitable, and irresistible character; was wholly caused by an act or omission done with intent to cause damage by a third party, or was wholly caused by the negligence or other wrongful act of the government or other enforcement agencies responsible for the maintenance of lights or other navigational aids in the exercise of that function. This Act also holds that the owner may be exonerated wholly or partially from his liability to a person who had suffered damage, if they can prove that person had deliberately committed an act or omission with intent to cause damage, or had been negligent.

In addition to the foregoing, if an incident involving two or more ships occurs and pollution damage results therefrom, the Oil Pollution Compensation Act holds the owners of all the ships concerned jointly and severally liable for all such damage that is not reasonably separable, without prejudice to the right of recourse of any of such owners to proceed against each other or third parties.

The actual expenses that the owner is liable for under the Oil Pollution Compensation Act include the following: a) expenses incurred during clean-up operations for the polluting incident and through the undertaking of preventive measures for the same; b) the loss of earnings due to properties contaminated or damaged by the polluting incident; c) pure economic or earning loss due to the incident even if the property contaminated or damaged by the same does not belong to them; d) damage to human lives or health as a direct result of the polluting incident; and e) environmental damages and other reasonable measures of environmental restoration.

This Oil Pollution Compensation Act also stipulates the establishment of an Oil Pollution Management Fund that will be managed by the Maritime Industry Authority (MARINA). The said fund will be used for the containment, removal, and cleanup operations conducted by PCG, along with the research, enforcement, and monitoring activities of relevant agencies like the PCG, MARINA, and the Philippine Ports Authority (PPA).

For the purposes of shipping and trade, R.A. No. 9295, otherwise known as the Domestic Shipping Development Act of 2004, was enacted. While it had no explicit provisions on pollution and conservation, it did give MARINA the authority to set safety standards for vessels in accordance with applicable conventions and regulations, along with requiring all domestic ship operators to comply with operational and safety standards for vessels set by applicable conventions and regulations, maintain its vessels in safe and serviceable condition, meet the standards of safety of life at sea and safe manning requirements, and furnish safe, adequate, efficient, reliable and proper service at all times. Its Amended IRR also requires tankers to obtain marine insurance coverage for oil spills.

To limit the impact of the growing number of vessels traversing the VIP, a PPA Administrative Order No. 01 was enacted in 2008, which inhibits all vessels traversing Batangas Bay, Balayan Bay, and VIP from anchoring along the corridor of VIP. There is also a speed limit of five knots being imposed on ships cruising Batangas and Balayan Bays and VIP (Philippine Ports Authority, 2008), and requires vessels navigating the VIP to observe the rules of International Regulations for Preventing Collisions at Sea, and other local and international regulations with respect to collision prevention. Just a year later, a complementing law was enacted called the "Coast Guard Law of 2009" which provides the PCG power to inspect vessels prior to departure, to detain vessels that are non-compliant with safety standards, to investigate possible causes of maritime accidents, and to develop oil spill response, containment and recovery capabilities against ship-based pollution (R.A. No. 9993, 2009).

Apart from the threats that oil spills and other marine pollution pose to the VIP and resident coastal communities and fisherfolk, there are also challenges in terms of access, use, and management of marine habitats resulting in challenges in sustaining livelihoods for the fisheries sector. In this regard, there are also laws that have existed as early as the 1970s to address these perennial issues. One of these is the Fisheries Act of 1975 (Presidential Order No. 704) which covers the fisheries development including the usage and management of marine resources. With the aim to protect and preserve said marine resources, PD No. 704 also penalized illegal fishing through the use of dynamite, fine-mesh nets, electricity, and poison, along with the dealing in and profiting off of fish obtained through such means. P.D. No. 704 also penalized the pollution of waters by the discharge, placing, or depositing of substances such as petroleum, acid, coal, or oil tar, lampback, aniline, asphalt, bitumen, or residuary products of petroleum or carbonaceous material or substance, mollasses, mining and mill tailings, or any refuse, liquid or solid, from any refinery, gas house, tannery, distillery, chemical works, sugar central, mill or factory of any kind, or any sawdust, shavings, slabs, edgings, or any factory refuse or any substance or material deleterious to fish or fishery/aquatic life.

Drastic reforms in the Fisheries Act were implemented in the enactment of the Local Government Code of 1992 (Republic Act No. 7160), which devolved the power in protecting and managing the environment to the local governments (Morooka et al., 2008). Later in 1998, the Fisheries Code (Republic Act No. 8550) was enacted, which repealed and modified provisions of the Fisheries Act and its amending laws. The main difference between the two laws is that the Fisheries Act aimed for an integrated development of the fisheries sector through extractive and exploitative activities while the Fisheries Code emphasized the sustainable use of resources through its welcomed provisions on management, conservation, and protection (Morooka et al., 2008). As such, provisions were added to the Fisheries Code in order to promote the conservation of marine habitats such as mangroves, coral reefs, and fish sanctuaries, and to penalize their destruction and exploitation.

In terms of protecting critical marine habitats, Republic Act No. 7586, or the National Integrated Protected Areas (NIPAS) Act, was also promulgated for this purpose in 1992. In essence, this Act sought to secure the perpetual existence of all native plants and animals, protecting wildlife and preserving environments both marine and terrestrial by establishing a comprehensive system of integrated protected areas within the classification of national parks as provided for under Art. XII, Section 3 and 4 of the 1987 Constitution. As such, the NIPAS Act instituted the classification and administration of "protected areas" - identified portions of land and water set aside by reason of their unique physical and biological significance, managed to enhance biological diversity and protected against destructive human exploitation.

The NIPAS Act was amended during 2018. R.A. No. 11038, the Expanded National Integrated Protected Areas (E-NIPAS) Act, established a list of protected areas deemed as such through acts of Congress, to be considered as national parks under the Constitution, This is in addition to those already declared as protected areas by Congress. This list is non-exclusive and additional protected areas may be added upon recommendation of Congress, with the remaining initial components - places already undergoing review to be considered as protected areas - to be established as the same through acts of Congress. The E-NIPAS Act also features a broader range of offenses than the NIPAS Act, with steeper penalties for the same.

It must be noted that the VIP should already be deemed as an initial component under the E-NIPAS Act according to Executive Order no. 578, which created the Task Force Verde Island Passage in order to formulate the Verde Framework. Yet to this date the VIP has not yet been deemed a protected area, despite the Verde Framework having already been completed and published.

As for the marine organisms residing in the VIP, R.A. no. 9147, the Wildlife Conservation Act, also states that it shall be the policy of the State to conserve the country's wildlife resources and their habitats for sustainability with the following objectives: a) to conserve and protect wildlife species and their habitats

to promote ecological balance and enhance biological diversity; b) to regulate the collection and trade of wildlife; c) to pursue, with due regard to the national interest, the Philippine commitment to international conventions, protection of wildlife and their habitats; and d) to initiate or support scientific studies on the conservation of biological diversity.

The same law states that its provisions shall be enforceable for all wildlife species found in all areas of the country, including protected areas under the E-NIPAS Act, and critical habitats. The VIP therefore falls squarely within its ambit given its status as a the major marine biodiversity corridor, despite not yet being included in the E-NIPAS' list of protected areas.

When it comes to development along the VIP, the Philippine Environmental Impact Assessment (EIA) process under P.D. No. 1586 and related issuances have been promulgated to safeguard areas deemed as environmentally critical. Proponents of development projects and activities that may have a significant adverse impact on the same are required to undergo an EIA under P.D. 1586 and related administrative issuances in order for the DENR-Environmental Management Bureau to issue then an Environmental Compliance Certificate (ECC).

While the Philippine EIA process is ostensibly strict, requiring stringent compliance from project proponents with regard to public participation and research on the possible impacts of their project, implementation of the same is frequently troubled. Numerous energy proponents have attempted to skirt the public participation requirements under the EIA Process, and despite numerous complaints from stakeholders, certain projects - many of them to be constructed along coastline of Batangas province, which is part of the VIP - have been allowed by the DENR to proceed to the succeeding stages.

A worrying observation with regard to the EIA Process under P.D. No. 1586 is LNG proponents' lack of detailed contingency plans with regard to pollution, especially oil. Proponents' Environmental Impact Statements (EIS) generally do not adequately cover the negative impacts of LNG, or the effects of pollution on the coastal waters. LNG proponents also do not generally include detailed plans for the possibility of tankers sinking and causing an oil spill. The DENR-EMB itself only includes the LNG proponents' submission of an Oil Spill Contingency Plan to the Philippine Coast Guard as a recommendation in its ECC, rather than a condition it should also monitor closely.

Lastly, R.A. No. 9275 (the Philippine Clean Water Act) has provisions safeguarding water sources from sources of pollution. Section 6 of the Philippine Clean Water Act requires DENR to designate water bodies, or portions thereof, where specific pollutants from either natural or man-made source have already exceeded water quality guidelines as non-attainment areas for the exceeded pollutants. The DENR is also required to prepare and implement a program that will not allow new sources of exceeded water pollutant in non-attainment areas without a corresponding reduction in discharges from existing sources. However, this program cannot be carried out due to DENR's lack of guidelines to implement the same. This is an inexcusable oversight given it has already been nineteen years after the promulgation of the Philippine Clean Water Act.

Local laws establishing Marine Protected Areas

Marine Protected Areas (MPAs) have been found to be an effective way for both national and local governments to conserve marine resources, prevent over-exploitation of resources, and guard against pollution. In particular, the establishment of no-take MPAs lead to fish stocks and sizes doubling, serve as safe breeding grounds for fish and shelter for other marine life, promote biodiversity, and generate revenue from tourism. Moreover, information obtained from conducting surveys and studies during the establishment of MPAs tends to be helpful in educating local fisherfolk and residents about the preservation and care of the same (Sollestre et. al, 2018).

Batangas province's MPA Network is currently held to be one of the best-managed in the country. The establishment of such was a multi-sectoral effort involving LGUs, government agencies, and NGOs. The result was a broad MPA network that spans 11 municipalities alongside three major bays, with an enforcement network active in protecting the same (Sollestre et. al, 2018).

However, MPAs still face problems, among them are limited finances, issues with management capacity, and scale issues such as small size and limited connectivity. Given the foregoing, the DENR-Biodiversity Management Bureau in tandem with Conservation International Philippines, HARIBON Foundation, the National Fisheries Research and Development Institute, RARE, and WWF Philippines launched the

Strengthening the Marine Protected Area to Conserve Marine Key Biodiversity Areas (Smart Seas Philippines), a project to expand Marine Protected Areas, assist the same with financing, and interconnect them into different Marine Protected Area Networks (MPANs) (Bujan and Arquiza, 2021).

The Smart Seas Philippines project was implemented at five major sites: VIP, South(east)ern Palawan, Tañon Strait, Lanuza Bay, and Davao Gulf. This included 21 marine key biodiversity areas. The project also resulted in 128 MPAs and 69 LGUs undergoing capacity development for management effectiveness (Bujan and Arquiza, 2021). The Project succeeded in building the VIP MPAN from the pre-existing Batangas and Oriental Mindoro MPANs. A MOA was subsequently signed by five provinces – Batangas, Marinduque, Romblon Oriental Mindoro, and Occidental Mindoro, in 2017 (Bujan and Arquiza, 2021).

Despite the foregoing, the VIP MPAN still remains vulnerable. In particular, the 28 February 2023 oil spill highlighted its vulnerability to the impacts of being a major shipping route. The oil spill has resulted in oil slicks coating the shorelines of various provinces, suffocating mangroves and thousands of hectares of corals. The VIP's MPAs have also been left devastated, with the water quality in various fish sanctuaries drastically reduced.

As a result of the above, DENR Secretary Maria Antonia Yulo-Loyzaga herself has already emphasized the need for the VIP to come under legislative protection, and met with shipping companies in order to prevent a similar catastrophe from occurring again. Time will tell if this statement will crystallize into a policy banning maritime shipping along the VIP. In the meantime, efforts from DENR-BMB, civil society, and the Philippine legislature are currently underway to include the VIP to come under the protection of the E-NIPAS Act.

Case Study: The MT Princess Empress Oil Spill Investigation

On February 28, 2023, MT Princess Empress, an oil tanker carrying 900,000 liters of industrial fuel owned by RDC Reield Marine Services (RDC), enroute from Bataan to Iloilo capsized in the coastal waters off Naujan in Oriental Mindoro, which is part of the VIP. The tanker capsized due to straining and overheating of its engines and the conditions of the rough seas during its voyage. On the same day at 8 a.m., the tanker completely sank at a depth of 400 meters in the coastal waters Northeast of Pola, Oriental Mindoro.

The municipality of Pola in Oriental Mindoro is considered as the 'ground zero' of the oil spill incident because it was the most affected town in the entire province from the environmental and socio-economic crisis, notwithstanding that the oil spill also reached Verde Island, Batangas, also part of the VIP, parts of Western Visayas, northern part of Palawan. Across the affected provinces of Batangas, Oriental Mindoro, Occidental Mindoro, Palawan, and Antique, a total of 200,244 individuals or 43,699 families were affected by the oil spill. Among these individuals are 27,850 affected farmers and fisherfolk. According to the National Disaster Risk Reduction and Management Council (NDRRMC), as of July 2023, estimated cost of damage to agriculture has amounted to Php 4.9 billion while the cost of damage to livestock, poultry, and fisheries is estimated to be Php 2.6 million.

Given the massive impact of the oil spill to the environment and the coastal communities across the affected provinces from its onset, a series of investigations were conducted to get to the bottom of the cause of the accident and other issues surrounding the incident. The Senate public hearing/inquiry, in aid of legislation on the Oriental Mindoro oil spill was conducted last 14 March 2023. It was during this inquiry that the Philippine Coast Guard (PCG), Maritime Industry Authority (MARINA), and RDC admitted that the Certificate of Public Convenience (CPC) did not cover MT Princess Empress. The tanker had no permit to operate in the form of an amendment to its CPC.

RDC not only lacked documents in its application to amend the CPC, it was also determined that the tanker sailed nine times already with no permit. Moreover, It was also determined that PCG did not board the tanker for inspection, surfacing the lack of coordination between authorities involved.

After the case buildup, on 6 June 2023, criminal charges were filed by the National Bureau of Investigation's Environmental Crime Division and Mayor Jennifer Cruz of Palo, Oriental Mindoro before DOJ against officials of MARINA, PCG, and crew and owner of the tanker. The complaint included multiple counts of falsification, multiple use of falsified documents; multiple counts of falsification of public or official documents; and perjury.

It is unfortunate that a major catastrophe needs to occur in order to surface the poor regulations of the maritime industry. Its negligence that resulted to the oil spill, subjecting the VIP and other water bodies to irreparable damage, and coastal communities to loss of livelihoods and health risks.

III. Forecasted Increase in LNG Shipping Traffic

Despite an abundance in laws protecting marine habitats and regulating shipping activities, the VIP, or Batangas province to be precise, is set to be the epicenter of the mad dash for fossil gas and LNG development in the country. If all proposed fossil gas power plants and LNG terminals are approved, the VIP will be a hotspot for the fossil fuel industry and will be confronted with a massive increase in LNG carrier traffic. Furthermore if the plans of gas companies go forward, the natural resources including biodiversity and coastal communities would face even greater risks to their lives and livelihoods (Gogel, 2023).

An LNG carrier is a tank ship designed for transporting LNG across waters. The dimensions of a modern LNG are 300 meters long and 43 meters wide and have a draft of about 12 meters. Cargo capacity varies between LNG tankers but it can be as large as 267,000 m^3 or 9,429,016 ft^3 (Bai & Jin, 2016). LNG carriers are usually designed as a single skeg hull shape with a redundant single-stage gearbox that feeds two medium motors. This scheme provides a high level of redundancy to override failures in the power chain (Baliga, 2015).

Figure 5 shows an example of a typical moss-type LNG tanker. A moss-type LNG Tanker has four or five tanks and the outside layer of the tanks is covered with a thick layer of insulation. A thin layer of "thin foil" is wrapped around the foam to keep the nitrogen atmosphere dry. Each tank creates a controlled atmosphere which has a -160°C in temperature where LNG is stored and transported to LNG hubs.

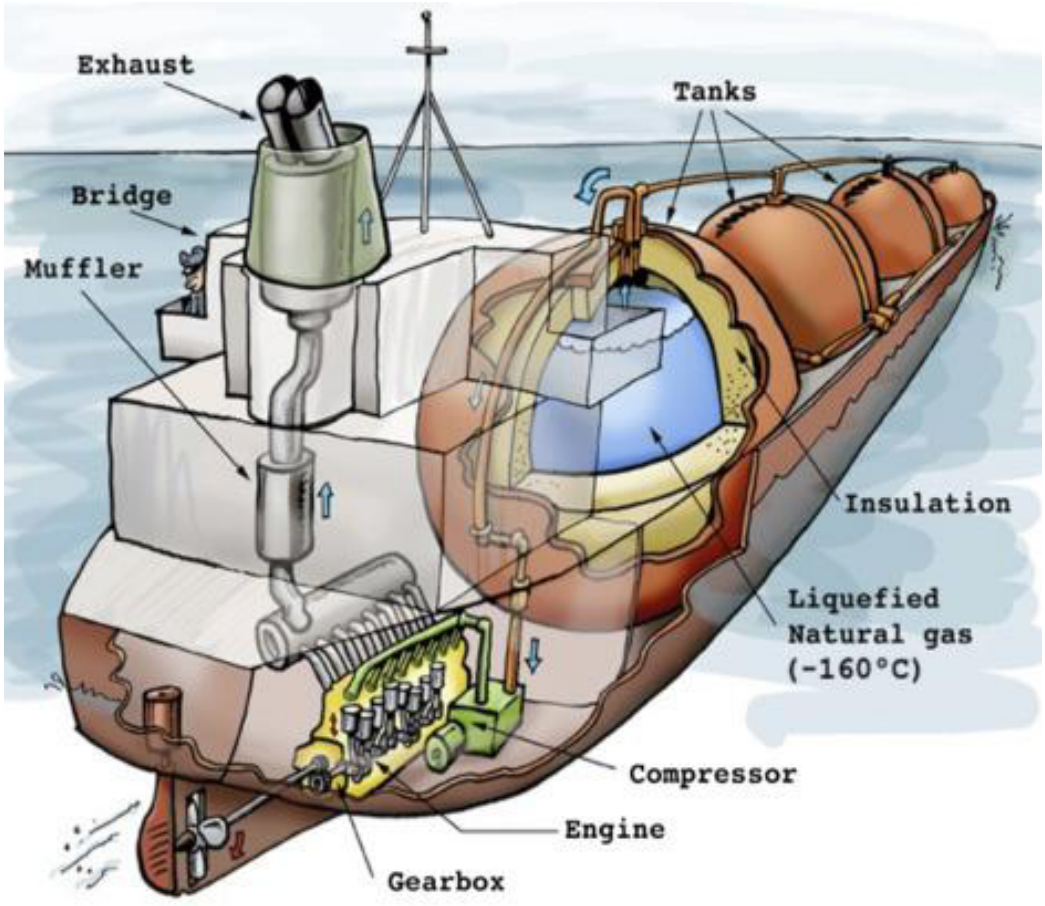


Figure 5: A typical moss-type LNG Tanker showing four tanks where the LNG is stored.
(Source: Bai, Y., & Jin, W.-L. (2016)

There are a total of five existing fossil gas plants in the VIP, with eight more on the way, one LNG terminal is already commissioned in the VIP while five more LNG terminals are proposed. Presently, AG&P, a Singapore-based infrastructure developer has developed the country's first commissioned LNG terminal through its wholly owned subsidiary Linseed Field Power Corporation. The first LNG terminal in the country is composed of both floating and onshore tank storage (Lagare, 2023). The first tanker that entered the country, Golar Glacier, was sent by Vitol Asia Pte Ltd from Das Island, UAE (Habibic, 2023).

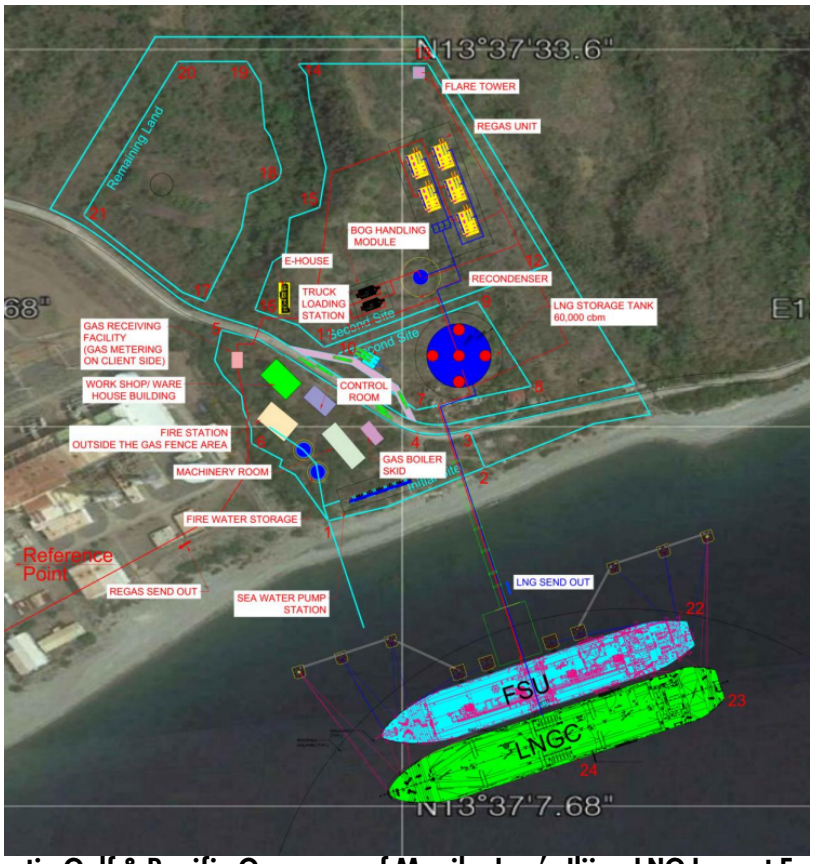


Figure 6. Atlantic Gulf & Pacific Company of Manila, Inc.'s Ilijan LNG Import Facility Project, the country's first commissioned LNG terminal.
(Source: Project Description for Scoping)

AG&P's LNG import terminal covers an area of nine hectares and is located in Brgy. Ilijan, Batangas City. The facility will supply regasified LNG to the 1,200 MW Ilijan Combined-cycle Power Plant which formerly sourced gas from the Malampaya gas field until its gas contract with Malampaya expired in June 2022.

Figure 7. Vitol Asia Pte Ltd.'s Golar Glacier, which is the first LNG tanker which arrived in the country earlier this year.
(Source: https://www.offshore-energy.biz/vitol-to-deliver-first-lng-cargo-to-philippines-in-mid-april/)

Modern LNG tankers have a capacity between 125,000 m^3 and 150,000 m^3, and the largest at 267,000 m^3 (Bai & Jin, 2016). Golar Glacier, the first LNG tanker that has entered the country, has a carrying capacity of 161,900 m^3. For the purposes of forecasting the increase in shipping traffic, three LNG tanker capacities will be considered; 125,000 m^3 and 267,000 m^3, typically the smallest and largest modern vessel sizes, respectively, and 161,900 m^3 being the only reference for LNG tankers that have entered the country.

The forecast of increased shipping traffic in a year is calculated using the LNG fuel requirements of existing and proposed power plants running on fossil gas. The fuel requirements are calculated based on the power plant's generation output and equivalent fuel amount to sustain that output. The forecast is then extrapolated based on the fuel needed by the power plants and the typical vessel capacities. The first step is to calculate the amount of LNG needed to produce 1 MWh of electricity.

According to the U.S. Energy Information Administration, 210.105 m^3 of fossil gas is needed to produce 1 MWh of electricity. The amount of LNG equivalent can then be determined as the volume of LNG is 1/600th of its volume in gas form (U.S. Department of Energy). Therefore, 0.3502 m^3 of LNG is needed to produce 1 MWh of electricity. The first calculation is as follows:

$$\text{Calculation 1: } 210.105\ m^3 \text{ of fossil gas } X\ \frac{1\ m3\ of\ LNG}{600\ m3\ of\ fossil\ gas} = 0.3502\ m^3 \text{ of LNG}$$

The next step is to determine the amount of LNG needed by a power plant in a year, given its capacity. Say a fossil gas plant has a capacity of 600 MW, it has an hourly generation capacity of 600 MWh. Therefore, the power plant will require 210.12 m^3 of LNG every hour, and approximately 5,043 m^3 of LNG in a day. In a year this will amount to 1,840,695 m^3 of LNG. Given the capacity of Golar Glacier as reference, it will take approximately 12 LNG tankers to deliver a 600 MW power plant's LNG requirements in a year. These sample calculations are made under the assumption that the power plant is operating at a 100% capacity factor, and the LNG tankers are transporting at a 100% carrying capacity. The calculations are as follows

$$\text{Calculation 2: } 600\ \text{MWh } X\ \frac{0.3502\ m3\ of\ LNG}{1\ MWh} = 210.12\ m^3 \text{ of LNG}$$

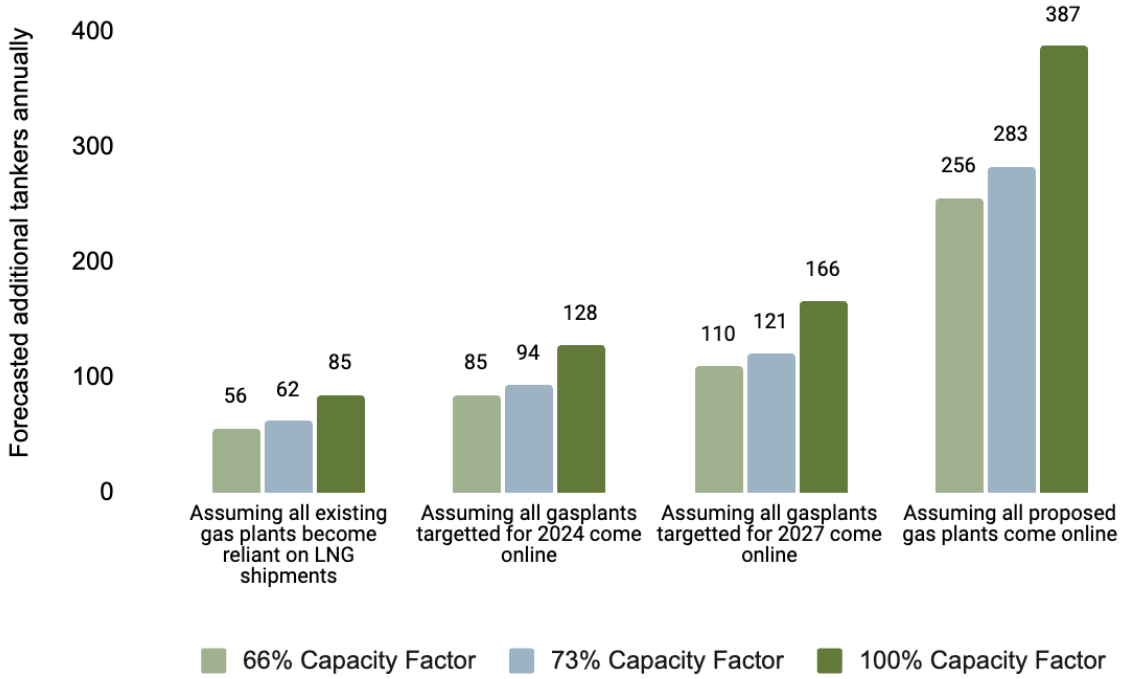
$$\text{Calculation 3: } 24h\ X\ \frac{210.12\ m3\ of\ LNG}{1\ h} = 5{,}043\ m^3 \text{ of LNG}$$

Table 3 forecasts the increase of shipping traffic in a given year based on the LNG requirements of all existing and proposed fossil gas power plants, and the range of LNG tanker capacities. In consideration of power plants that do not run at full capacity around the clock, the forecast takes into account various capacity factor levels, as later discussed. Three capacity factors based on the trend of fossil gas plant capacity factors in recent years were considered. According to the latest Independent Electricity Market Operator Philippines (IEMOP) Special Report on Philippine Electric Power Industry Assessment, from the year 2015-2019 the average capacity factor for fossil gas plants is 73%. This percentage dropped to 66% from 2020-2022. A 100% capacity factor was also considered for the forecast to show the gravity of increased shipping traffic at greater capacity factors.

Table 3. Forecasted Increase of LNG Tankers in the VIP

Name of Gas Plant	Status	Target Commercial Operation	Capacity (MW)	Forecasted Increase of LNG Tankers Based on Ship Capacity (m^3) and Plant Capacity Factor (%)								
				125,000 m^3			161,900 m^3			267,000 m^3		
				66%	73%	100%	66%	73%	100%	66%	73%	100%
SMC Ilijan LNG Power Plant	Announced		3,600	58.311	64.496	88.351	45.021	49.796	68.214	27.299	30.194	41.362
VIRES LNG-Fired Power Plant Barge	Indicative	Dec 2026	450	7.288	8.062	11.043	5.627	6.224	8.526	3.412	3.774	5.170
Batangas EERI Combined Cycle Power Plant U1	Construction	Sep 2024	437.5	28.346	31.352	10.737	21.885	24.206	8.289	13.270	14.678	5.026
Batangas EERI Combined Cycle Power Plant U2	Construction	Sep 2024	437.5									
Batangas EERI Combined Cycle Power Plant U3	Construction	Dec 2024	437.5									
Batangas EERI Combined Cycle Power Plant U4	Construction	Dec 2024	437.5									
ACEN led BCE Natural Gas-Fired Power Plant	Indicative	Mar 2027	1,100	17.817	19.707	26.996	13.756	15.215	20.843	8.341	9.226	12.638
Batangas (Millenium) power station	Announced		1,700	27.536	30.456	41.721	21.260	23.515	32.212	12.891	14.258	19.532
Stellar Dual-Fired Power Plant Project	Announced		1,250	20.247	22.394	30.677	15.632	17.290	23.685	9.479	10.484	14.362
Santa Maria Natural Gas-Fired Combined cycle	Indicative	TBD	1,260	20.409	22.573	30.922	15.757	17.428	23.875	9.554	10.568	14.477
Lloyds Energy Philippines Inc. Floating Power Plant	Announced		1,200	19.437	21.498	29.450	15.007	16.598	22.738	9.099	10.064	13.787
Avion Open Cycle Gas Turbine	Existing		101	1.635	1.809	2.478	1.263	1.397	1.913	0.765	0.847	1.160
Ilijan Combined Cycle Gas Turbine	Existing		1,277	20.684	22.878	31.340	15.970	17.663	24.197	9.683	10.710	14.672
San Gabriel Combined Cycle Gas Turbine	Existing		430	6.965	7.703	10.553	5.377	5.947	8.147	3.260	3.606	4.940
San Lorenzo Combined Cycle Gas Turbine	Existing		549	8.892	9.835	13.473	6.865	7.593	10.402	4.163	4.604	6.307
Santa Rita Combined Cycle Gas Turbine	Existing		1,095	17.736	19.617	26.873	13.694	15.146	20.748	8.303	9.184	12.581
Total (Rounded Up)			**15,762**	**256**	**283**	**387**	**198**	**219**	**299**	**120**	**133**	**182**

*Figures for the units of Batangas EERI Combined Cycle Power Plant have been combined as these will operate in a common facility



** Figures shows calculations using the 125,000 m³ ship carrying capacity*

Figure 8. Forecasted Increase of LNG Tankers in the VIP

If we take into consideration the target commercial operation of the proposed gas plants, tanker traffic in the VIP will increase gradually over the course of the next couple of years. Considering only the existing gas plants, forecasted LNG tanker traffic will increase by 27-56 LNG tankers assuming 66% capacity factor or 29-62 LNG tankers assuming 73% capacity factor. By 2024, if the Batangas EERI Combined Cycle Power Plant U1, 2, 3 and 4 comes online as scheduled, forecasted ship traffic will increase to 40-85 LNG tankers assuming 66% capacity factor or 44-94 LNG tankers assuming 73% capacity factor, on an annual basis. By 2027, if the two other remaining gas plants, the VIRES LNG-Fired Power Plant Barge and the ACEN led BCE Natural Gas-Fired Power Plant, with target commercial operation dates already, come online, forecasted ship traffic will increase to 52-110 LNG tankers assuming 66% capacity factor or 57-121 LNG tankers assuming 73% capacity factor, on an annual basis. The forecast does not take into account the annual growth of vessel calls which grew by 25.6% in 2022 according to the Philippine Ports Authority Annual report.

If the forecast assumes that all existing fossil gas plants will be dependent on LNG tanker shipments and all proposed fossil gas plants have come online, the forecast reveals that 120-256 LNG tankers assuming 66% capacity factor or 133-283 LNG tankers assuming 73% capacity factor, will be potentially added to the already staggering 76,226 vessel calls between Batangas, Mindoro, and Marinduque annually.

Figure 9 below shows three major shipping lanes vessels that LNG tankers may use to transport LNG to terminals in VIP. Each shipping lane uses VIP as a main shipping route. It is worth noting that each lane passes through different marine ecosystems and potentially coral reef areas which are highlighted in pink, seagrasses which are highlighted in teal, and mangroves which are highlighted in green, taking into consideration the possibility of route diversion, ship groundings, and capsizing.

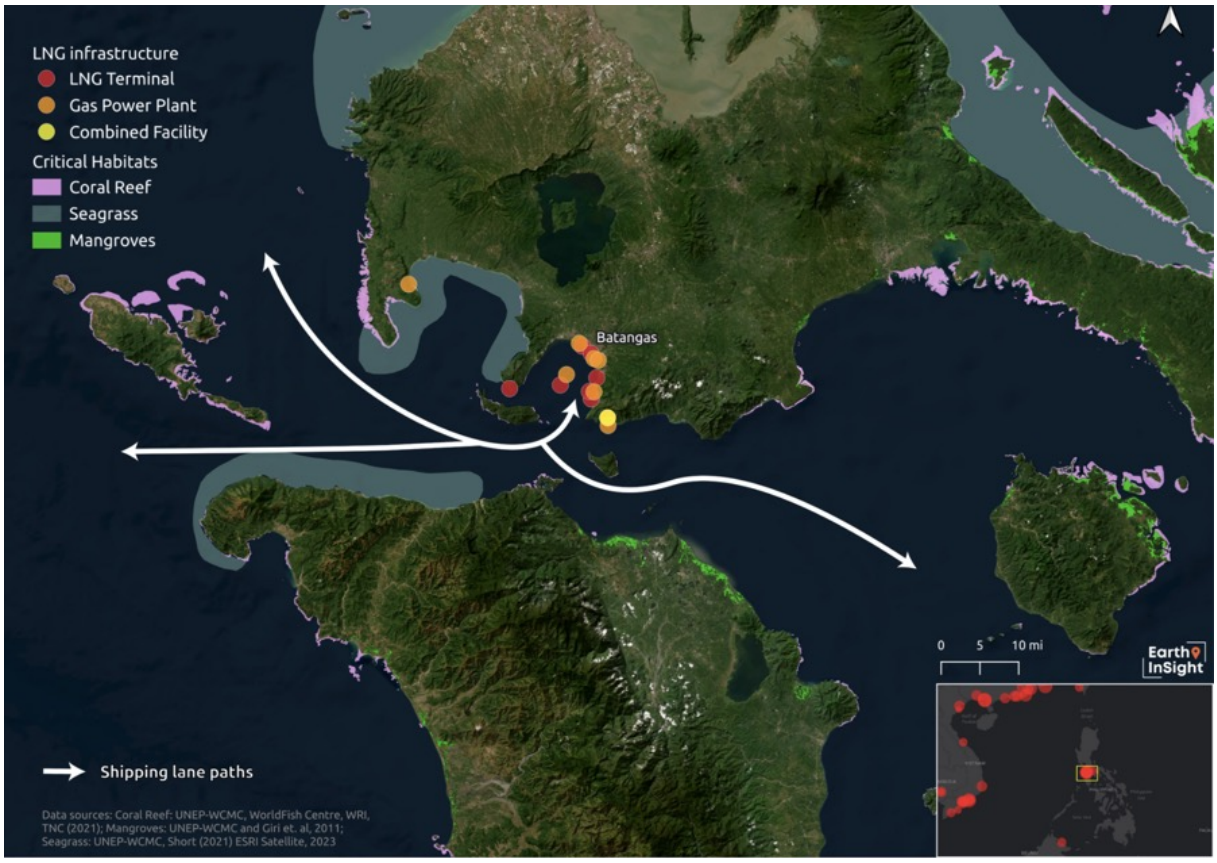


Figure 9: Three major routes of three shipping lanes that traverse VIP
(Source: https://www.banktrack.org/blog/philippines_communities_are_fighting_back_against_the_verde_island_passage_becoming_the_epicenter_of_fossil_fuel_expansion_in_southeast_asia)

IV. Potential Impacts of LNG Terminals Development and Increased Shipping Traffic in the VIP

The reef, fish, and other marine resources are the lifeblood of coastal communities and the fisheries sector. Given the numerous threats present and forecasted in the VIP, these conditions could affect food security since commercially-important fish, crustaceans, and other aquatic organisms would not be available, depleted, or displaced for the fisherfolk to catch. It could potentially bring about loss of livelihoods to a sector mostly dependent on fisheries, and decline of one of the most biodiverse hotspots in the world. The following analysis was made in consideration of the destructive activities and pressures already present in the VIP. The LNG terminals development and increased shipping traffic exacerbate this.

Degradation of corals and marine ecosystems due to LNG terminals and ports development

The plethora of planned LNG terminal projects aim to facilitate the importation of massive LNG supply for gas-fired power plants. However, once these LNG terminals are constructed along VIP, they would have major impacts on the environment, livelihood, and health of communities. Development of LNG terminals are potential threats to the natural resources. Construction of off-shore infrastructure can cause loss of habitat and coral cover, thus threatening local biodiversity, and hinder access to wildlife which the coastal communities are dependent upon. Disturbance from construction, dredging, and reclamation activities can also increase the turbidity and sedimentation and contribute to the decline of water quality (Batangas Clean Energy, 2022). This can ultimately result in species loss and reduced abundance of biota. Also, existing marine fish and fauna may also migrate to different areas away from the threats of LNG (Batangas Clean Energy, 2022). Ultimately it also affects socio-economics as fisherfolk have less to catch and would have to travel farther to fish.

To accommodate the forecasted increase in shipping traffic when the planned terminals and power plants are developed, subsequent port development particularly in coastal areas will be pursued as well. These can further impact water quality, marine ecology, and coastal hydrology. During construction of these ports, dredging and disposal operations are done which can alter water quality – enhancing turbidity and sedimentation rates, and affects coastal hydrology or the movement of water in the coastal area (Orviku *et al.*, 2008). High turbidity decreases the light attenuation of seawater and reduces the dissolved oxygen levels leading to marine life having a hard time breathing underwater. Coral reefs and seagrasses which are photosynthesizing organisms would not be able to absorb sunlight if the waters are turbid brought by the construction of ports and this impacts existing coastal ecology in the area.

LNG, oil, and other toxic and hazardous substance spills

As LNG terminals are developed, shipments of LNG tankers will regularly make their way to and from these terminals, increasing the risk of accidents that can have major implications. One major impact is the occurrence of an ignitable gas cloud which is a result of a rapid LNG spill from a damaged tanker or terminal (Ahern, 1980). A sudden ignition of this gas cloud can result in a rapid combustion that's severity would depend on the amount of the LNG spill and vapor released. This rapid combustion can cause a spread of fire in adjacent infrastructures.

Another source of pollution are oil and grease contamination in marine waters, freshwater, or groundwater that can be associated with leakages of petroleum-based or oil-based products during the construction phase of terminals and transport of oil, and other toxic, hazardous and dangerous substances such as coal and waste chemicals. Earlier this year an oil spill in Oriental Mindoro occurred as oil tanker, MT Princess Empress, capsized in the waters of the VIP potentially affecting 36,000 hectares of coral reefs, seagrasses, and mangroves according to the University of the Philippines – Marine Science Institute. The oil spill resulted in months worth of lost livelihoods to the affected coastal communities brought by fishing bans and inaccessibility of fishing grounds. Accidental discharges such as oil spills sourced from the petroleum industry are among the highest damaging disasters globally (Höfer, 1998).

Unfortunately, this was not the only instance of a vessel sinking that occurred in the VIP in recent time. Last August 27, the ship, ANITA DJ II, came from Navotas Port in Manila but sank due to rough seas seven nautical miles off Cape Santiago in Calatagan, Batangas. The fishing vessel carrying 70,000 L of diesel fuel

sank during Super Typhoon Saola's onslaught. There were immediate reports of oil sheens sighted. Another vessel, MV Joegie 5, also sank off the coast of Paluan town in Occidental Mindoro last September 1. Smaller oil spills and oil slicks occur regularly due to discharges from ships traversing the ocean. According to Cerulean – SkyTruth's tool for detecting oil pollution in the ocean – there have been over 120 vessel-caused slicks in Philippine waters since it began analyzing satellite imagery in August 2020. These smaller incidents along with unreported oil spill in the VIP sheds light on the vulnerability of VIP and likelihood of more incidents as shipping traffic increases over time.

Increased sources of contamination

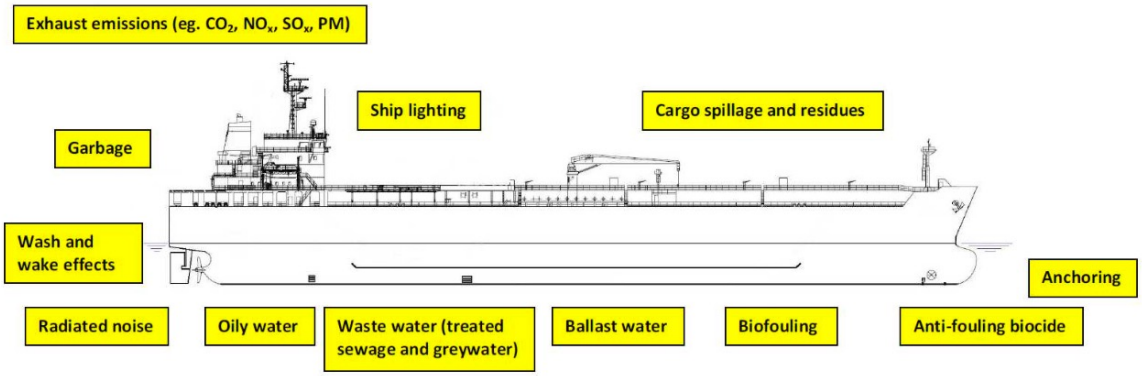


Figure 10: Summary of Routine and/or Unavoidable Discharges and Emissions from Ships
(Source: https://www.dcceew.gov.au/sites/default/files/env/pages/884f8778-caa4-4bd9-b370-318518827db6/files/23qrc-doc3.pdf)

Our country has experienced several sources of pollution coming from ships traversing our country through specific shipping routes. A major source of pollution are accidental spillage of oil and toxic, hazardous, and dangerous substances into the environment. The potential of an oil spill occurring can damage marine habitats and the livelihoods of fishermen due to loss of livelihoods and long-term environmental impacts. However, contaminants can also be emitted through its regular processes. In fact, several studies have shown the effects of shipborne contaminants on immediate marine ecosystems. Shipborne contaminants are essentially toxic substances that are collected and released to the environment in large quantities. These come in the form of wastewater discharge, ballast water, and bilge water. The ballast waters which are used to make large cargo ships stable if discharged untreated, can represent major threats to the marine biodiversity (Asariotis *et al.*, 2016). and among this is the introduction of invasive aquatic species in the marine environment which could compete with the endemic existing thriving species.

Maljutenko et al. (2021) examined the dispersion of pollutants in the Baltic Sea, which is considered to be the busiest body of water in maritime industry in the world. Their results have shown that the dispersion of pollutants is determined by surface kinetic energy (e.g. waves, currents) and weak stratification. The forecasted increase in shipping traffic in the VIP can potentially affect both concentration of pollutants, and its dispersion across the VIP and its seascapes.

Heavy metals contamination

Another type of pollutant that ships emit through shipborne contaminants are heavy metals. Some of the common heavy metals are copper, zinc, lead, and chromium that are released largely through routine maintenance of ships, use of antifouling paints, and oil spills from marine vessels. Heavy metals accumulated in sediments can potentially cause adverse effects on aquatic organisms such as corals, resulting in long-term impacts on aquatic ecosystems (Lim et al., 2022). Uptake of these heavy metals could result in stunted growth and cannot easily be eliminated by aquatic organisms. It will also have major impacts on lifespan and reproductive capacity, which adds tremendous pressure to an already sensitive and degrading ecosystem.

Similarly, a study conducted by Stokstad (2021) showed the effect of scrubber systems on cutting sulfur emissions. Scrubber systems are installed on ships to cut sulfur from air emissions. These systems capture

pollutants using seawater by sending the exhaust through a meters-tall cylinder. Within the cylinder, the exhaust is sprayed with seawater or freshwater to capture pollutants. The water used is eventually dumped as waste back into the sea. Open-loop scrubbers, a popular system, discharge the seawater used to capture sulfur to the ocean after little or no treatment. Some 4,300 ships with scrubber systems release at least 10 gigatons of wastewater each year either in ports or sometimes in sensitive coral reefs (Stokstad, 2021). An International Council on Clean Transportation (ICCT) study released in April 2021 examined routes taken by ships in 2019 and found that scrubber discharges are concentrated where shipping traffic is dense. This also extends to exclusive economic zones of many nations which extend 370 kilometers out to sea. The Great Barrier Reef is an example of a sensitive ecosystem that receives 32 million tons of scrubber effluent per year. Scrubber waters have drastically affected marine life. A study published in the Environmental Science and Technology Journal found that ships dumping scrubber water harms the development of the common copepod (*Calanus helgolandicus*), a tiny crustacean that is a key part of food webs. Copepods are food for larval fishes and filter-feeders. Given the declining fish stock observed in the country's seascapes, the forecasted increase of threats towards key organisms could result in further decline of marine ecosystem health.

Leaching of toxic chemicals in marine substrates

Another impact of vessels to shipping lanes is the accumulation of toxic shipborne chemicals especially in routes with high vessel concentration. This occurrence has been studied by Gómez-Ariza et al., (2006) where they have found that there is a significant accumulation of organotin in offshore sediments in the western Iberian Peninsula. Organotins are typically used as additives in paints for marine vessels, specifically, antifouling paints that ships use for their hulls. Organotins have been found to be toxic anthropogenic chemicals that impact marine systems. The sites proximal to shipping lanes generally exhibited higher values compared to other sampled sites. The forecasted increase in shipping traffic across the VIP threatens to exacerbate impacts to marine ecosystems.

Noise pollution and ship strikes

Dense shipping traffic, LNG terminals and port construction can also lead to noise pollution which affects both small and large marine organisms such as whales and dolphins that use echolocation to navigate themselves and locate their own food (Tan, 2020). High levels of noise pollution can make whales and dolphins disoriented making them unable to forage and can eventually lead to mortality. These operations can lead to displacement of large marine organisms and fish as they move away from the sources of disturbances.

Ship strikes are also a threat to large marine organisms especially since vessel routes overlap with migration and foraging patterns of these organisms amidst growing shipping traffic. With the forecasted growth of ship traffic in the VIP, collisions between ships are also a possibility along shipping routes. Small fishing vessels are also threatened by ship strikes and even by the waves produced by large ships that damage their fishing vessels and prevent fisherfolk from fishing.

Air pollution and greenhouse gas emissions

The presence of LNG terminals would also increase local greenhouse emissions by releasing methane into the atmosphere through potential leaks throughout its terminal processes. (Verma et al., 2022). Coupled with shipping traffic, there are also harmful air emissions emitted throughout the whole LNG and fossil gas life cycle. These emissions include greenhouse gasses such as nitrogen oxides and sulfur oxides which are among the drivers of climate change. Sulfur dioxide is sourced from sulfur-containing fuels that are being combusted while nitrogen dioxide is formed during high-pressure combustion (Hassellöv *et al.*, 2013). Nitrogen dioxide can contribute to nutrient enrichment problems in the oceans such as eutrophication which can result in harmful algal blooms. Algal blooms can make water bodies unsuitable for marine life to thrive as the phenomenon depletes the oxygen content of the water leading to hypoxia (EPA, 2011).

Harmful emissions are not only attributed to emissions from combustion of fossil fuels, since there are also risks of emitting harmful air pollution throughout the life cycle of LNG and fossil gas. The pretreatment of feed gas can potentially introduce various pollutants to the environment such as dust and particulate matter, carbon dioxide, carbon monoxide, methane, sulfur dioxide, hydrogen sulfide, and ammonium to name a few. During the liquefaction, an essential process for the transport of LNG, there is further potential to release carbon dioxide and carbon monoxide. The storage and transport of LNG on the other hand

provides risks of methane leaks (Yuan et al., 2020). Although there is less emission of carbon dioxide in these processes compared to other fossil fuels like coal, according to the Intergovernmental Panel on Climate Change (IPCC) Report, methane viewed over 10- to 20-year time scales, is at the least as influential as carbon dioxide as a climate force. Hence, the potential for methane leaks and methane emissions must not be taken lightly.

One immediate impact of exposure to these emissions is the rise of cardiovascular diseases due to the release of aforementioned pollutants (Verma et al., 2022). Furthermore, cryogenic burns can result if LNG comes into contact with exposed skin through damaged boots and gloves. Asphyxiation can also happen when LNG happens to be released in an enclosed space which can result in death (APEC Energy Working Group, 2010).

The impacts of increased shipping traffic from the development of gas-fired power plants and LNG terminals are summarized in Table 4 below.

Table 4. Summary of main impacts LNG terminals development and increased shipping traffic in the VIP

Activities	Potential Impacts	Implications for VIP
Pre-construction and construction phase of LNG terminals and ports		
Construction of off-shore infrastructure	**Marine and coastal ecology**	
	⦿ Loss of marine habitats ⦿ Loss of coral cover	⦿ Displacement of fish and other local biodiversity
	Water	
	⦿ Increased turbidity due to sedimentation ⦿ Potential oil and grease contamination ⦿ Decline in water quality	⦿ Species loss and reduced species abundance
	People	
	⦿ Hinders access to wildlife and fishing grounds ⦿ Lessens resource availability	⦿ Loss of livelihoods and food security ⦿ Higher expenses and longer travel for livelihood
Construction of ports and on-shore infrastructure, dredging, and reclamation	**Marine and coastal ecology**	
	⦿ High turbidity resulting to decreased light availability for coral reefs and seagrasses which are photosynthesizing organisms ⦿ Loss of coral cover	⦿ Species loss and reduced species abundance
	Water	
	⦿ Reduced dissolved oxygen due to sedimentation ⦿ Potential oil and grease contamination of marine waters and freshwater ⦿ Construction alters water flow	⦿ Construction affects coastal hydrology or the movement of water in the coastal area ⦿ Contamination affects freshwater supply ⦿ Contamination affects fish supply and the shoreline
	People	
	⦿ Disrupts shore fishing and livelihoods ⦿ Hinders access and transportation routes	⦿ Decline of available fishing grounds near shore ⦿ Contamination of waters and fish supply on top of the direct health risk to coastal communities
Noise pollution	**Marine and coastal ecology**	
	⦿ Noise and disturbances from construction activities affects sensitive marine organisms ⦿ Disturbance to small and large marine organisms that use echolocation	⦿ Displacement of biodiversity
Operational phase of LNG terminals and ports		
LNG spills and accidental fires	**Water**	
	⦿ Ignitable gas cloud which is a result of a rapid LNG spill ⦿ Infrastructures alter water flow	⦿ Risk of pollution ⦿ Infrastructures affect coastal hydrology or the movement of water in the coastal area
	People	
	⦿ Risk of of accidents and exposure	⦿ Inaccessible waters and fishing grounds due to obstruction
Noise pollution	**Marine and coastal ecology**	
	⦿ High levels of noise and disturbances during operation affects sensitive marine organisms ⦿ Disturbance to small and large marine organisms that use echolocation	⦿ Displacement of biodiversity

Air pollution and GHG emissions	**Air**	
	⦿ Increase local GHG emissions by releasing methane into the atmosphere through potential leaks throughout terminal processes ⦿ Emitting nitrogen oxides and sulfur oxides which are among the drivers of climate change ⦿ Pollutants introduced during pretreatment of feed gas include dust and particulate matter, carbon dioxide, carbon monoxide, methane, hydrogen sulfide, and ammonium	⦿ Emissions can contribute to nutrient enrichment problems in the oceans such as eutrophication which can result in harmful algal blooms ⦿ Water bodies can become unsuitable for marine life ⦿ Exacerbation of climate change
	People	
	⦿ Exposure of host coastal communities ⦿ Worsens preexisting cardiovascular and skin conditions	⦿ Rise of cardiovascular diseases due to the release of various pollutants ⦿ Short and long-term health implications to coastal communities
Increased shipping traffic through operation of the LNG industry		
Air pollution and GHG emissions	**Air**	
	⦿ Malodorous and toxic emissions ⦿ Increased traffic resulting to larger emissions	⦿ Increased GHG emissions ⦿ Decline in air quality ⦿ Exacerbation of climate change
	People	
	⦿ Exposure of coastal communities to air pollution ⦿ Worsens preexisting cardiovascular and skin conditions	⦿ Health implications to coastal communities
Accidental spill of oil, and other toxic, hazardous and dangerous substances	**Marine and coastal ecology**	
	⦿ Contamination and loss of coral reefs, seagrasses, and mangroves ⦿ Contamination and death of fish and other organisms ⦿ Stunted growth and cannot easily be eliminated by aquatic organisms ⦿ Destroyed reefs from sunken ships	⦿ Decline of biodiversity ⦿ Displacement of fish and other aquatic organisms
	Water	
	⦿ Oil and grease, toxic heavy metals, and other harmful chemicals contamination ⦿ Decline of light availability due to slicks or sheens	⦿ Long-term contamination of marine waters, freshwater, and coastlines ⦿ Decline of water quality
	Air	
	⦿ Malodorous and toxic emissions	⦿ Decline in air quality ⦿ Health implications to coastal communities
	People	
	⦿ Fishing bans and withheld access to marine and coastal resources	⦿ Long-term loss of livelihoods, tourism, and food securityDisplacement of fisherfolk and coastal communities ⦿ Health implications to coastal communities
LNG spills and accidental fires	**Water**	
	⦿ Ignitable gas cloud which is a result of a rapid LNG spill	⦿ Risk of pollution ⦿ Inaccessible waters and fishing grounds due to obstruction
	People	
	⦿ Risk of of accidents and exposure	⦿ Inaccessible waters and fishing grounds due to obstruction

Releasing of shipborne contaminants, in the form of wastewater discharge, ballast water, and bilge water	**Marine and coastal ecology**	
	⦿ Introduction of invasive species from ballast waters ⦿ Decline of marine ecology in heavily used ship routes ⦿ Stunted growth and cannot easily be eliminated by aquatic organisms	⦿ Decline of biodiversity ⦿ Presence of invasive species threaten endemic existing thriving species
	Water	
	⦿ Contamination of marine waters from untreated wastewater discharge and bilge water dumping ⦿ Heavy and other harmful chemicals contamination	⦿ Decline of water quality ⦿ Increase in concentration of contaminants over time ⦿ Dispersion of pollutants across VIP due to increased traffic
	People	
	⦿ Invasive species competing with commercially important fish	⦿ Lower fish catch
Contamination from routine ship processes such as ship maintenance and scrubber systems	**Marine and coastal ecology**	
	⦿ Stunted growth and cannot easily be eliminated by aquatic organisms ⦿ Impacts on lifespan and reproductive capacity ⦿ Loss of coral cover	⦿ Decline of biodiversity ⦿ Contamination of fish stock
	Water	
	⦿ Toxic heavy metals such as copper, zinc, lead, and chromium, and other harmful chemicals are released ⦿ Chemicals from antifouling paints ⦿ Release of sulfur emission from sulfur scrubber systems ⦿ Heavy metal accumulation in sediments	⦿ Adverse effects on aquatic organisms ⦿ Long-term impacts on aquatic ecosystems
	People	
	⦿ Threatened fish and aquatic resources	⦿ Lower fish catch ⦿ Contaminated fish catch
Noise pollution	**Marine and coastal ecology**	
	⦿ High levels of noise and disturbances from all ship traffic affects sensitive marine organisms ⦿ Disturbance to small and large marine organisms that use echolocation	⦿ Displacement of biodiversity
Ship strikes and collisions	**Marine and coastal ecology**	
	⦿ Ships striking and killing small to large marine organisms	⦿ Species loss and loss of abundance ⦿ Displacement of biodiversity ⦿ Disruption of migration and foraging patterns of small to large marine organisms
	Water	
	⦿ Collisions between ships resulting to accidental spill of oil, and other toxic, hazardous and dangerous substances such as coal and waste chemicals	⦿ Decline of water quality ⦿ Damage to marine and coastal resources
	People	
	⦿ Collisions between ships and small-scale fishing vessels ⦿ Damage to small-scale fishing vessels ⦿ Disruption of fishing activities ⦿ Loss of access to resources	⦿ Loss of livelihoods and food security

Case Study: The First LNG Terminal in Batangas City

Batangas is situated at the Southernmost portion of Luzon. As it stands there are 76 ports based in the Batangas province area of the VIP. In Batangas City alone there are 18 ports that are used for a myriad of purposes ranging between passenger, shipping and trade use. Given the threats attributed to the growth of shipping traffic in the VIP, as well as the pressure brought about by other existing harmful industries, the VIP is showing the implications through the condition of its water quality and marine ecology.

CEED conducted two studies in Batangas in 2021 looking into: 1) health of the adjacent reefs, and particularly its benthic and fish communities, that will be directly impacted by the construction of two proposed fossil gas projects in Brgy. Ilijan and Dela Paz Proper of Batangas City, the Ilijan LNG Import Facility Terminal and the 1,750 MW Batangas Combined Power Plant; and 2) the water quality values within the Verde Island Passage, focusing on one of the heavy industrial areas of Batangas Bay to identify possible trends occurring in the water quality. Results show an average hard coral cover that ranges from 0.1% to 6.2%, classified as "poor" based on the quartile index for reef health, along the sampling sites in Brgy. Ilijan and Dela Paz. This is a result of disturbances and industrial development in the area. Furthermore, fish abundance remained poor as coral cover which is the sanctuary and breeding ground of fish is low. In terms of water quality, among all parameters tested, excessive concentrations of phosphate, chromium, total copper, lead, and zinc were detected based on the DENR 2021 Water Quality Standards.

The province is rich in marine biodiversity encompassing a major portion of VIP. Unfortunately, such a diverse ecosystem is under threat due to the expansion of LNG projects and other sources of pollution such as oil spills and other toxic, hazardous and dangerous substances such as coal and waste chemicals. Policy direction is geared towards the establishment of the Philippines as an LNG Hub in South East Asia, based on policy pronouncements and the development of the gas industry development bills. One LNG terminal, AG&P LNG Import Terminal, has started operating. There are five more proposed in Batangas

If such an event were to occur, we could expect an increase in marine traffic in the waters of Batangas that may be a source of pollutants especially if the frequency of tankers carrying toxic substances like LNG would pass through the corridor. When more vessels docks and traverses marine waters, it will inadvertently affect the mobility of many fishermen harvesting marine resources in the province of Batangas. The construction of structures for LNG may also affect the natural topography of marine habitats and may cause shifts in physical parameters like ocean currents which are key components for existing coral reefs to thrive (Salazar, 2023a).

Other than the impacts to marine ecosystems, river ecosystems and surrounding mangroves drastically changed from the presence of power plants and LNG terminals. Ilog Kabubulag, which is located in barangay Sta. Clara, were directly impacted by stressors from these power plants. It was noted that a decrease in fish catch has been observed since the construction of the said structures (Salazar, 2023a).

With these in mind, the expansion of LNG terminals, subsequent increase of LNG tankers, and other sources of pollution along VIP should be given due attention. These industries claim compliance with environmental standards set by the government and mitigation of impacts, but as recent developments and incidents show, impacts can have overwhelming damages to sensitive marine and coastal ecosystems, and resident fisherfolk and coastal communities.

Altering acidity levels due to carbon sequestration: The growing need to decarbonize ports

The VIP, including the lush mangrove forests and seagrasses within it, also sequesters excess carbon in the atmosphere–however at a cost. These marine habitats in fact store more atmospheric carbon compared to terrestrial and tropical tree ecosystems, a critical but overlooked adaptive capability of the ocean.

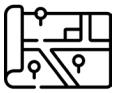
Increased carbon emissions from fossil industries, when absorbed by the seas and oceans, could potentially alter the acidity level of the waters. More sequestered carbon will make the waters more toxic for marine organisms, and endanger the source of livelihood and sustenance for coastal communities and Filipinos across the country.

However, part of the problem that gas and LNG build-out exacerbates is the carbon emissions of the country. The Philippine maritime industry is dependent on fossil fuels. According to a study, maritime petroleum dependency has resulted in a consumption of about five million barrels per day which is equivalent to 1 gigaton of carbon dioxide emissions annually. This is approximately 34% of carbon emissions of the transport sector (Palconit and Abundo, 2019).

The expected increase in shipping traffic, due to fossil gas and LNG development, should also result in an increase in the maritime industry's contribution to the country's carbon emissions. This signals the importance of discussing and formulating 1.5C-aligned pathways for hard-to-decarbonize sectors like the maritime industry.

V. Recommendations

As one of the few mega-biodiverse countries in the world, which also values shipping for its vital role in transportation and trade of goods and resources, the Philippines needs to ensure that the growing maritime industry will not threaten critical marine habitats and resources, especially the Verde Island Passage. The following are recommended.



Map-out ecologically valuable areas that should be declared as no-go zones for the development of LNG terminals. Unfortunately, not all critical marine habitats or biodiversity hotspots are declared as protected seascapes under the ENIPAS and there are no maps of ecologically valuable areas in the country. Hence, these areas are open-access for development of harmful industries. Once identified, these ecologically valuable areas should be declared as no-go zones for LNG terminals, where LNG tankers are expected to moor and cause adverse impacts.

Review and revise shipping routes to ensure that ecologically valuable areas are avoided. The oil spill in Oriental Mindoro earlier this year shed light on how exposed coastal communities are to incidents occurring along shipping routes within municipal waters. Close proximity of shipping routes caused the rapid onset of oil spills along the coastline of Oriental Mindoro. Furthermore, deviation of ships from these routes have serious implications such as collisions and reef hits due to the close proximity to municipal waters. Worse, oil spills occurring outside designated routes could expose and threaten coastal communities close by. Given the significance and ecological value of the VIP not only to the country but to the world, the vast number of shipping routes must be reviewed and revised to avoid damage to the vital resources and prevent impacts from reaching resident coastal communities.

Ensure strict compliance of the maritime industry with regulations meant to ensure ships are seaworthy and environmental impacts are avoided or mitigated. The Oriental Mindoro oil spill also exposed prevailing ails in regulatory enforcement and compliance in the maritime industry, as government officials and RDC Reield are now charged with criminal charges filed by the National Bureau of Investigation's Environmental Crime Division and Mayor Jennifer Cruz of Palo, Oriental Mindoro before DOJ. The charges included multiple counts of falsification, multiple use of falsified documents; multiple counts of falsification of public or official documents; and perjury. Fisherfolk communities have also long complained about rampant illegal and waste discharging from ships. An immediate investigation must be conducted to surface the gaps in compliance monitoring and enforcement of laws governing these processes. The Philippine Coast Guard must ensure that monitoring systems are working and can prevent accidents. Government agencies should also be capacitated to immediately respond to accidents to avert major environmental catastrophes.

Designate bodies of water that have exceeded the DENR's Water Quality Guidelines as non-attainment areas for the relevant parameters. As a result of the Oriental Mindoro oil spill, the DENR reported that several coastal waters failed their testing. Under the Philippine Clean Water Act, the DENR has to formulate a plan for the clean-up and restoration of poor quality water bodies. To operationalize this, the DENR can issue guidelines for designation of non-attainment waters, although not specifically mandated by the Act. Designation of non-attainment areas should be done immediately, especially in areas with projected increase in shipping activities.

Rationalize plans and policies concerning fossil gas power plants and LNG terminals. The Climate Analytics report, getting fossil fuels out of the Philippine power sector, finds that fossil gas must almost entirely phase-out by 2040. By 2030 fossil gas will need to constitute only 6.5% of the power mix. This means plans for LNG and fossil gas must have an immediate phase-out plan for the country to be aligned to a 1.5C pathway. This puts into question if there is room for LNG and fossil gas in the power mix as its infrastructure will take years to be built and will have to be phased-out soon after.

Include shipping impacts in the impacts assessed and mitigated in the EIA Process for fossil gas power plants and LNG terminals. Considering that the scope of the EIS of LNG terminals only covers the impacts of the terminal and its infrastructures, the DENR should mandate that the EIS should cover impacts of increased shipping activity. It should include detailed contingency plans on oil or chemical spills and studies on the effects of ballast water on the surrounding marine environment as conditions under the ECC. Furthermore, other potential impacts of shipping must be taken into consideration given the major impacts that a shipping accident could bring about to marine ecosystems and coastal communities. The forecasted increase of shipping traffic due to the number of proposed LNG and fossil gas projects puts emphasis on the need to raise efforts on assessing impacts for the shipping industry, that's closely related to the expanding LNG and fossil gas industry.

Establish VIP as a protected area under the Expanded National Integrated Protected Area System (ENIPAS) law (Republic Act 11038). The Memorandum of Agreement of the five provincial governments seeking to protect VIP and several other local ordinances with the same objectives can be strengthened by translating these into national law. The inclusion of VIP in the ENIPAS will grant it all the protections under the law–such as the creation of a management board, whose composition can be revised to be representative of local stakeholders within and outside government, the establishment of a specific fund for the protection of the VIP, and the penalization of prohibited acts.

Declare VIP as a World Heritage Site (WHS). This declaration will attract international attention for the preservation and conservation of the globally significant VIP. For communities, it will promote tourism that can provide alternative or additional sources of income. Finally, this can open access to funds to support restoration and preservation efforts for VIP.

Annex

Annex 1: 2022 List of Ports in the VIP

Province	Port Type	Complete Port Name	Type of Operation	Area of Operation	Type of Traffic
Batangas	BP	Batangas	Domestic	Anchorage	NR
Batangas	BP	Batangas	Domestic	Berth	NR
Batangas	BP	Batangas	Foreign	Anchorage	NR
Batangas	BP	Batangas	Foreign	Berth	NR
Batangas	BP	Batangas Phase 2	Foreign	Berth	NR
Batangas	BP	Batangas	Domestic	Berth	RR
Batangas	OGP	Calatagan	Domestic	Berth	NR
Batangas	OGP	Calatagan	Domestic	Berth	RR
Batangas	OGP	Mainaga	Domestic	Berth	NR
Batangas	OGP	Nasugbu	Domestic	Berth	NR
Batangas	OGP	Nasugbu	Domestic	Berth	RR
Batangas	OGP	San Juan	Domestic	Berth	NR
Batangas	OGP	Talaga	Domestic	Berth	NR
Batangas	OGP	Tingloy	Domestic	Berth	NR
Batangas	OTP	Bauan	Domestic	Berth	NR
Batangas	OTP	Bauan	Foreign	Berth	NR
Batangas	PP	Asturias	Domestic	Berth	NR
Batangas	PP	Atlantic Grains Inc.	Domestic	Berth	NR
Batangas	PP	Atlantic Grains Inc.	Foreign	Berth	NR
Batangas	PP	Batangas Bay Terminal Inc.	Domestic	Berth	NR
Batangas	PP	Batangas Bay Terminal Inc.	Foreign	Berth	NR
Batangas	PP	Balayan Distillery Inc.	Domestic	Berth	NR
Batangas	PP	Bauan International Port Inc.	Domestic	Berth	NR
Batangas	PP	Bauan International Port Inc.	Foreign	Berth	NR
Batangas	PP	Chevron Phils. Inc.	Domestic	Berth	NR
Batangas	PP	Chevron Phils. Inc.	Foreign	Berth	NR
Batangas	PP	Calaca Industrial Seaport Corporation - Phase 1	Domestic	Berth	NR
Batangas	PP	Calaca Industrial Seaport Corporation - Phase 1	Foreign	Berth	NR
Batangas	PP	Calaca Industrial Seaport Corporation - Phase 2	Domestic	Berth	NR
Batangas	PP	Calaca Industrial Seaport Corporation - Phase 2	Foreign	Berth	NR
Batangas	PP	United Coconut Chemicals, Inc.	Domestic	Berth	NR
Batangas	PP	United Coconut Chemicals, Inc.	Foreign	Berth	NR
Batangas	PP	Ecozone	Domestic	Berth	NR
Batangas	PP	Engineering Equipment Inc. Corporation	Domestic	Berth	NR
Batangas	PP	Engineering Equipment Inc. Corporation	Foreign	Berth	NR
Batangas	PP	First Gas Power Corporation	Domestic	Berth	NR
Batangas	PP	First Gas Power Corporation	Foreign	Berth	NR

Batangas	PP	Frabelle Fishing Corporation	Domestic	Berth	NR
Batangas	PP	Golden Bay Grain Terminal Corporation	Domestic	Berth	NR
Batangas	PP	Golden Bay Grain Terminal Corporation	Foreign	Berth	NR
Batangas	PP	Goodsoil Marine Realty, Inc.	Domestic	Berth	NR
Batangas	PP	Goodsoil Marine Realty, Inc.	Foreign	Berth	NR
Batangas	PP	Himmel Industries Inc.	Domestic	Berth	NR
Batangas	PP	Himmel Industries Inc.	Foreign	Berth	NR
Batangas	PP	J.G. Summit Olefins Corporation	Domestic	Berth	NR
Batangas	PP	J.G. Summit Olefins Corporation	Foreign	Berth	NR
Batangas	PP	Kepco Ilijan Corporation	Domestic	Berth	NR
Batangas	PP	Kepco Ilijan Corporation	Foreign	Berth	NR
Batangas	PP	Landoor Pier	Domestic	Berth	NR
Batangas	PP	Landoor Pier	Foreign	Berth	NR
Batangas	PP	LMG Land Development Corporation	Domestic	Berth	NR
Batangas	PP	LMG Land Development Corporation	Foreign	Berth	NR
Batangas	PP	Lucky One Realty Ventures Inc	Domestic	Berth	NR
Batangas	PP	Lucky One Realty Ventures Inc	Foreign	Berth	NR
Batangas	PP	Mabini Batangas Premier Terminal, Inc.	Domestic	Berth	NR
Batangas	PP	MG8 Terminal	Domestic	Berth	NR
Batangas	PP	Mabini Terminal Development Inc	Domestic	Berth	NR
Batangas	PP	Mabini Terminal Development Inc	Foreign	Berth	NR
Batangas	PP	Petron Corporation	Domestic	Berth	NR
Batangas	PP	Petron Corporation	Foreign	Berth	NR
Batangas	PP	Pilipinas Shell Petroleum Corporation	Domestic	Berth	NR
Batangas	PP	Pilipinas Shell Petroleum Corporation	Foreign	Berth	NR
Batangas	PP	Philippine National Oil Company - Energy Supply Base	Domestic	Berth	NR
Batangas	PP	Philippine National Oil Company - Energy Supply Base	Foreign	Berth	NR
Batangas	PP	Southbay Bulk Terminal, Inc.	Domestic	Berth	NR
Batangas	PP	Southbay Bulk Terminal, Inc.	Foreign	Berth	NR
Batangas	PP	SEM-Calaca Power Corporation	Domestic	Berth	NR
Batangas	PP	SEM-Calaca Power Corporation	Foreign	Berth	NR
Batangas	PP	SL Mariveles Drydocking & Shipyard Corporation	Domestic	Berth	NR
Batangas	PP	San Miguel Mills, Inc.	Domestic	Berth	NR
Batangas	PP	San Miguel Mills, Inc.	Domestic	Berth	NR

Batangas	PP	Empire East Land Holdings, Inc. / Southpoint Science Park Inc.	Domestic	Berth	NR
Batangas	PP	Empire East Land Holdings, Inc. / Southpoint Science Park Inc.	Foreign	Berth	NR
Batangas	PP	Suntrak Corporation	Domestic	Berth	NR
Batangas	PP	Tiger Land Realty Corpo-ration	Domestic	Berth	NR
Batangas	PP	Tiger Land Realty Corpo-ration	Foreign	Berth	NR
Marinduque	OGP	Cawit	Domestic	Berth	NR
Marinduque	OGP	Cawit	Foreign	Anchorage	NR
Marinduque	OGP	Cawit	Domestic	Berth	RR
Marinduque	OTP	Balanacan	Domestic	Berth	NR
Marinduque	OTP	Balanacan	Domestic	Berth	RR
Occidental Mindoro	OTP	Abra de Ilog	Domestic	Berth	NR
Occidental Mindoro	OTP	Abra de Ilog	Domestic	Berth	RR
Occidental Mindoro	OTP	Lubang	Domestic	Berth	NR
Occidental Mindoro	OTP	Lubang	Domestic	Berth	RR
Oriental Min-doro	BP	Calapan	Domestic	Berth	NR
Oriental Min-doro	BP	Calapan	Domestic	Berth	RR
Oriental Min-doro	OTP	Puerto Galera	Domestic	Anchorage	NR
Oriental Min-doro	OTP	Puerto Galera	Domestic	Berth	NR
Oriental Min-doro	OTP	Puerto Galera	Domestic	Berth	RR
Oriental Min-doro	PP	Premium Megastructures, Inc.	Domestic	Berth	NR
Romblon	OGP	Alcantara	Domestic	Berth	NR
Romblon	OGP	Banton	Domestic	Berth	NR
Romblon	OGP	Banton	Domestic	Berth	RR
Romblon	OGP	Concepcion	Domestic	Berth	NR
Romblon	OGP	Corcuera	Domestic	Berth	NR

* BP- Base Port, OGP- Other Government Port, OTP- Other Terminal Port, PP- Private Port, RR- Roll on/Roll off, NR- No Roll on/Roll off

References

Ahern, W. R. (1980). California meets the LNG terminal. Coastal Zone Management Journal, 7(2-4), 185-221. doi:10.1080/08920758009361860

Algo, J. L. (2022). Algo: Protecting our VIP, Verde Island Passage - SUNSTAR. https://www.sunstar.com.ph/article/1939878/manila/opinion/algo-protecting-our-vip-verde-island-passage

Apaya, K. (2018). Environmental Systems Analysis Group Developing Ecosystem Account for Verde Island Passage Marine Corridor, Philippines.

APEC Energy Working Group. (2010). Case Studies of LNG Public Education and Information Campaigns in APEC Economies and Development of Best Practice Guidelines. www.apec.org

Arango, B. G., Pinheiro, H. T., Rocha, C., Greene, B. D., Pyle, R. L., Copus, J. M., Shepherd, B., & Rocha, L. A. (2019). Three new species of Chromis (Teleostei, Pomacentridae) from mesophotic coral ecosystems of the Philippines. ZooKeys, 835, 1-15. https://doi.org/10.3897/zookeys.835.27528

Ateneo, A., & Salmo III, S. G. (2019). Mangrove blue carbon in the Verde Island Passage. https://archium.ateneo.edu/es-faculty-pubs

Bai, Y., & Jin, W.-L. (2016). LNG Carrier. Marine Structural Design, 49-71. https://doi.org/10.1016/B978-0-08-099997-5.00004-6

Baliga, B. J. (2015). IGBT Applications. The IGBT Device, 223-275. https://doi.org/10.1016/B978-1-4557-3143-5.00009-2

Banktrack Blog. (2023, May 25). BankTrack - Philippines communities are fighting back against gas & LNG build-out in the Verde Island Passage. https://www.banktrack.org/blog/philippines_communities_are_fighting_back_against_the_verde_island_passage_becoming_the_epicenter_of_fossil_fuel_expansion_in_southeast_asia

Batangas Clean Energy, Inc. (2022). ENVIRONMENTAL IMPACT STATEMENT (EIS) Proposed Batangas Combined Cycle Gas Turbine Power Project.

Clear Seas. (2021). Ballast water management: stopping the spread of invasive species by ships | Clear Seas. https://clearseas.org/en/blog/ballast-water-management-stopping-the-spread-of-invasive-species-by-ships/

Conservation International. (2023). Verde Island Passage. https://www.conservation.org/philippines/projects/verde-island-passage

Cudiamat, M. A., & Rodriguez, R. A. (2017). Abundance, Structure, and Diversity of Mangroves in a Community-Managed Forest in Calatagan, Batangas, Verde Island Passage, Philippines. Asia Pacific Journal of Multidisciplinary Research, 5(3), 27-33. www.apjmr.com

De La Cruz, C. (2023, March 20). Mindoro Oil Spill Reaches Verde Island Passage, Batangas. https://www.spot.ph/newsfeatures/policy/104111/mindoro-oil-spill-reaches-verde-island-passage-batangas-a833-20230320

del Rosario, V. R., Gonzales, M. T. C., Grasparil, D. R. B., & Cerrada, J. E. (2022). The Shipping Law Review: Philippines. https://thelawreviews.co.uk/title/the-shipping-law-review/philippines

Department of Energy Philippines. (2021, August 20). Secretary Cusi Continues Push for LNG . https://www.doe.gov.ph/press-releases/secretary-cusi-continues-push-lng?withshield=1

Department of Environment and Local Government. (2004). SUMMARY OF THE ENVIRONMENTAL IMPACT STATEMENT (EIA REPORT) for the Irving Oil Limited Liquefied Natural Gas (LNG) Marine Terminal and Multi-Purpose Pier Project.

Dimailig, O. S., Jeong, J.-Y., & Kim, C.-S. (2011). Marine Transportation in the Philippines: The Maritime Accidents and their Causes. Journal of Navigation and Port Research, 35(4), 289-297. https://doi.org/10.5394/kinpr.2011.35.4.289

DiSilvestro, A. (2018, September 7). What Does it Mean to be a UNESCO World Heritage Site? https://discovercorps.com/blog/mean-unesco-world-heritage-site/

Gevaña, D. T., Pulhin, F. B., & Pampolina, N. M. (2008). Carbon Stock Assessment of a Mangrove Ecosystem in San Juan, Batangas.

Gómez-Ariza, J. L., Santos, M. M., Morales, E., Giráldez, I., Sánchez-Rodas, D., Vieira, N., Kemp, J. F., Boon, J. P., & Ten-Hallers-Tjabbes, C. C. (2006). Organotin contamination in the Atlantic Ocean off the Iberian Peninsula in relation to shipping. Chemosphere, 64(7), 1100-1108. https://doi.org/10.1016/J.CHEMOSPHERE.2005.11.068

Habibic, A. (2023, April 12). WATCH: First LNG cargo arrives in the Philippines - Offshore Energy. https://www.offshore-energy.biz/watch-first-lng-cargo-arrives-in-the-philippines/

Horigue, V., & Licuanan, W. Y. (2013). Sensitivities of coral reefs in the Verde Island passage to climate change. Journal of Coral Reef Studies (Special Issue), 359-365.

Lagare, J. B. (2023). First LNG cargo arrives in PH via Singapore-based firm | Inquirer Business. Inquirer.Net. https://business.inquirer.net/398032/first-lng-cargo-arrives-in-ph-via-singapore-based-firm

Lavides, M. N., Molina, E. P. v., de La Rosa, G. E., Mill, A. C., Rushton, S. P., Stead, S. M., & Polunin, N. V. C. (2016). Patterns of coral-reef finfish species disappearances inferred from fishers' knowledge in global epicentre of marine shorefish diversity. PLoS ONE, 11(5). https://doi.org/10.1371/journal.pone.0155752

Lim, Y.-C. ;, Chen, C.-F. ;, Tsai, M.-L. ;, Wu, C.-H. ;, Lin, Y.-L. ;, Wang, M.-H. ;, Albarico, F. P. J. B. ;, Chen, C.-W. ;, Dong, C.-D., Southern, T., Lim, Y.-C., Chen, C.-F., Tsai, M.-L., Wu, C.-H., Lin, Y.-L., Wang, M.-H., Paolo, F., Albarico, J. B., Chen, C.-W., & Dong, C.-D. (2022). Impacts of Fishing Vessels on the Heavy Metal Contamination in Sediments: A Case Study of Qianzhen Fishing Port in Southern Taiwan. Water 2022, Vol. 14, Page 1174, 14(7), 1174. https://doi.org/10.3390/W14071174

Maljutenko, I., Hassellöv, I. M., Eriksson, M., Ytreberg, E., Yngsell, D., Johansson, L., Jalkanen, J. P., Kõuts, M., Kasemets, M. L., Moldanova, J., Magnusson, K., & Raudsepp, U. (2021). Modelling spatial dispersion of contaminants from shipping lanes in the Baltic Sea. Marine Pollution Bulletin, 173, 112985. https://doi.org/10.1016/J.MARPOLBUL.2021.112985

MarineTraffic. (n.d.). MarineTraffic: Global Ship Tracking Intelligence | AIS Marine Traffic. Retrieved July 5, 2023, from https://www.marinetraffic.com/en/ais/home/centerx:120.9/centery:13.4/zoom:9

Morooka, Y., Bradecina, R. G., Shinbo, T., Iiguni, Y., & Launio, C. C. (2008). Kuroshio Science 2-1.

Namaganda, E., Otsuki, K., & Steel, G. (2022). Learning from Africana critical theory: A historicized contextualization of the impacts of Mozambique's natural gas project. The Extractive Industries and Society, 10, 101075. https://doi.org/10.1016/J.EXIS.2022.101075

Philippine Coast Guard. (2019). Approved NOSCOP.

Philippines: LNG Boom in the Verde Island Passage | gogel. (2023). Global Oil and Gas Exit List. https://gogel.org/philippines-lng-boom-verde-island-passage

Philippines LNG Terminal - Global Energy Monitor. (2023). Retrieved August 11, 2023, from https://www.gem.wiki/Philippines_LNG_Terminal

Philippine Ports Authority. (2008). PPA Administrative Order No. 01 of 2008. https://www.ppa.com.ph/sites/default/files/issuances_docs/AO%20001-2008_0.pdf

Philippine Ports Authority. (2012). PPA Administrative Order No.04-2012. https://www.ppa.com.ph/sites/default/files/issuances_docs/AO%20004-2012.pdf

Official Gazette of the Republic of the Philippines. (1974). Presidential Decree No. 602, s. 1974. https://www.officialgazette.gov.ph/1974/12/09/presidential-decree-no-602-s-1974/

Official Gazette of the Republic of the Philippines. (1976, August 18). Presidential Decree No. 979, . https://www.officialgazette.gov.ph/1976/08/18/presidential-decree-no-979-s-1976/

Official Gazette of the Republic of the Philippines. (2007, June 2). Republic Act No. 9483 . https://www.officialgazette.gov.ph/2007/06/02/republic-act-no-9483/

Official Gazette of the Republic of the Philippines. (2017, July 24). Republic Act No. 11038. https://www.officialgazette.gov.ph/downloads/2018/06jun/20180622-RA-11038-RRD.pdf

Offshore Energy. (2023, April 12). WATCH: First LNG cargo arrives in the Philippines - Offshore Energy. https://www.offshore-energy.biz/watch-first-lng-cargo-arrives-in-the-philippines/

R.A. No. 9993. (2009). https://lawphil.net/statutes/repacts/ra2010/ra_9993_2010.html

Rula, N. A. M., Ramos-Danila, K. A. J., Valera, J. A. P., Arcega, J. M. H., & Saco, J. A. (2022). Macrophyte Diversity and Conservation Values of the Verde Island Passage, Philippines. Philippine Journal of Science, 151(S1), 135-156. https://doi.org/10.56899/151.S1.09

Saco, J. A., Rula, N. A. M., Arcega, J. M., Tabuga, A., Persia, A., & Alub, M. A. (2020). Marine macrophyte composition during summer, southwest and northeast monsoons in Verde Island, Batangas City, Batangas, Philippines. Philippine Journal of Systematic Biology, 14(3), 1-15. https://doi.org/10.26757/pjsb2020c14008

Salazar, C. (2023a, March 7). Verde Island Passage in danger as LNG projects flock to Batangas. https://www.rappler.com/environment/verde-island-passage-danger-liquefied-natural-gas-projects-flock-batangas-pcij-report/

Salazar, C. (2023b, March 9). The last fishermen of Ilijan. https://pcij.org/article/10320/the-last-fishermen-of-ilijan

Sollestre, L. A., Awitan, L. A., & Amboya, R. P. (2018). Marine Protected Area Networking in the Center of the World's Marine Shorefish Biodiversity Abundance: Verde Island Passage Marine Corridor.

Stokstad, E. (2021). Shipping rule cleans the air but dirties the water. Science, 372(6543), 672-673. https://doi.org/10.1126/SCIENCE.372.6543.672

UNESCO World Heritage Centre. (n.d.). World Heritage Institute of Training and Research for the Asia and the Pacific Region - Our Partners. Retrieved July 11, 2023, from https://whc.unesco.org/en/partners/398

Vanzi, S. (2020). The center of the center - Manila Bulletin. Manilla Bulletin. https://mb.com.ph/2020/09/20/the-center-of-the-center/

Veloria, R. (2020, August 3). Ship-to-ship LNG transfer operations resume in Subic | Philippine News Agency. Philippine News Agency. https://www.pna.gov.ph/articles/1110969

Verma, S., Soni, R., McWilliams, G., Potter, M., & Schmollinger, C. (2022). U.S. regulator releases report blaming Freeport LNG blast on inadequate processes | Reuters. https://www.reuters.com/business/energy/freeport-lng-provides-no-timeline-texas-export-plant-restart-2022-11-15/

Williams, G. C., & Chen, J.-Y. (2014). Illustrated Key to the Shallow-Water Gorgonians and Pennatulaceans of the Verde Island Passage, Northern Philippines, Including Synopses of the Taxa and a Glossary of Terms (Cnidaria: Anthozoa: Octocorallia). The Coral Triangle: Hearst Biodiversity Expedition.

Wong, W. (n.d.). Guide to Diving in Verde Island Passage: The Center of the Center of Marine Biodiversity of the World | Guide to the Philippines. Retrieved March 1, 2023, from https://guidetothephilippines.ph/articles/adventure-and-outdoors/verde-island-passage-diving-guide

What are the Advantages of WHS Status? | Arunachala World Heritage Site Initiative. (n.d.). Retrieved July 5, 2023, from https://arunachalawhs.com/advantages-of-whs/

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