



Blue economy scenarios for Viet Nam

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TEAM

The report was prepared by a team led by Jeremy Hills, Bui Tat Thang, Dao Xuan Lai, Ta Dinh Thi. The core team was composed of Cao Le Quyen, Nguyen Duc Cuong, Nguyen Hong Minh, Hoang Dao Cam, Nguyen Thi Phuong Hien, Nguyen The Chinh. Secretariat team includes Hoang Thanh Vinh, Jay Malette, Tran Hoang Yen, Le Minh Son, Phan Phuong Thanh. Contributors to the report were Chu Hoi, Nguyen Huy Hoang, Luu Anh Duc, Nguyen Ngoc Son, Nguyen Le Tuan, Du Van Toan, Lai Van Manh, Nguyen The Thong, Nguyen Thi My Hanh.

FOREWORD

The global Ocean Economy contributes an estimated USD 3 trillion per year, or about five percent of the world's GDP and comprises industries ranging from oil and gas, shipping and ports to renewable energy, fisheries, marine ecosystems and tourism. The value of the marine economy in the APEC region alone was estimated to be USD2.06 trillion in 2015, contributing approximately 4.7 percent of total APEC GDP (APEC, 2020). In Viet Nam, the Ocean Economy is expected to contribute up to 10 percent of GDP by 2030 (Resolution No.36).

The Ocean covers more than three quarters of the planet and absorbs up to 30 percent of carbon dioxide produced by humans. Viet Nam's long coastline of more than 3,260 km provides great natural capitals for economic growth for its 28 sea and coastal provinces. Viet Nam's coastline and seas offer significant potential for inshore and offshore wind power, which, if sustainably developed, will support energy security and help Viet Nam meet its commitment of net zero emissions by 2050.

However, the Ocean is faced with increasing threats and multiple risks posed by climate change, natural disasters, environmental pollution, over exploitation of natural resources, and unsustainable economic activities. Global warming and marine litter are threatening marine resources, including widespread bleaching of coral reefs. Globally, an estimated 8 to 20 million tonnes of plastic enter the Ocean every year. In Viet Nam, around 2,000 tonnes of plastic waste leaks from the country into the Ocean every day¹. It is estimated that there will be more plastic than fish in the Ocean by 2050.

Against this background, UNDP is honoured to produce the first ever report "Blue Economy Scenarios for Viet Nam" in partnership with the Viet Nam Administration of Seas and Islands (VASI) of Ministry of Natural Resources and Environment. The intention of the scenarios is to support Viet Nam to accelerate the development of its Blue Economy and realize the objectives of Resolution 36/NQ-TW on sustainable development of the marine economy and protection of the Ocean of Viet Nam to 2030, with a vision to 2045. The report has benefited from insights, research and contributions from a team of international and national experts from Viet Nam Institute for Development Strategies (MPI), Institute of Fisheries Economic and Planning (MARD), Institute of Energy (MOIT), Viet Nam Petroleum Institute (Petro Viet Nam), Institute for Tourism Development Research (Viet Nam Administration of Tourism), Transport Development & Strategy Institute (MOT), Institute of Strategy and Policy on Natural Resources and Environment (MONRE).

This report covers the six key ocean economic sectors of fishery, renewable energy, oil and gas, tourism, transportation, environment and ecosystem. Firstly, for each economic sector, a baseline scenario for up to 2030 was developed that reflects existing and planned policy and strategies set by the governmental administrations of Viet Nam within each sector to 2030. Secondly, a blue scenario was developed with the aim to optimize socio-economic and environmental benefits. This report shows that blue scenarios lead to benefits over and above the baseline scenarios in terms of GDP for all marine sectors and also an increase in GNI per capita beyond the baseline scenarios.

In the context of the COVID-19 pandemic, key Blue Economy sectors were heavily impacted with small-scale marine-based workers hit hardest. What is needed now is a sustainable and equitable blue rebound from the COVID-19 pandemic. This report provides recommendations on how Viet Nam could develop its Blue Economy to meets the needs of both planet and people such that noone is left behind.



Caitlin Wiesen

Resident Representative
United Nations Development Programme

¹<https://www.vn.undp.org/content/vietnam/en/home/presscenter/undp-in-the-news/marine-plastic-waste-an-urgent-issue-in-coastal-vit-nam.html>

FOREWORD

Viet Nam is a marine country, with a coastline of more than 3,260 km and over 3,000 islands, including two archipelagos Paracel Islands (Hoang Sa) and Spratly Islands (Truong Sa). The marine economy is an important driving force for socio-economic development, environmental protection and international cooperation. Population in coastal provinces and cities accounts for more than 50% those in the country, with majority of the labour here are working on marine economic sectors; 28 coastal provinces and cities contribute over 60% to the national GDP.

Ocean economy and marine economic sectors play an increasingly important role in the economic recovery from impacts of COVID-19 and promote economic growth in the country.

However, Viet Nam's marine economic development is not sustainable. Marine economic development has not been harmoniously linked with social development and environmental protection, but also ensuring defence and security, external relation and international cooperation. Pollution and environmental incidents in some places in the sea and coastal areas are still serious, plastic waste pollution has become an urgent problem; marine ecosystems, marine biodiversity is reduced; marine resources are unsustainably exploited.

Fully recognising the important role and contribution of the marine economy, Viet Nam has promulgated policies and actions for sustainable development of the marine economy. The 12th Party Central Committee issued Resolution No. 36-NQ/TW dated October 22, 2018, on the Strategy for sustainable development of Viet Nam's marine economy to 2030, with a vision to 2045. To institutionalize and concretize the Party's policy, the Government of Viet Nam has issued Resolution No. 26/NQ-CP dated March 5, 2020, on the Master Plan and 5-year plan for the implementation of Resolution No. 36-NQ/TW. Recently, the Prime Minister issued Directive No. 31/CT-TTg dated 24/11/2021 on renewing and strengthening the implementation of the Strategy for sustainable development of Viet Nam's marine economy to 2030, with a vision to 2045.

Blue economy is a development trend in the world, especially for marine countries. The report "Blue economy scenarios for Viet Nam" is one of the first studies on marine economic development using the concept of blue economy. The report clarifies the concept of blue economy and provides an assessment of several key Viet Nam's marine economic sectors, thereby identifying potentials and building scenarios for the future. The report brings forward several important recommendations to promote the blue economy in Viet Nam, contributing to the successful implementation of the Strategy for Sustainable Development of Viet Nam's marine economy until 2030, vision to 2045 and the United Nations' sustainable development goals, including SDG14 on marine resources and environment.

We hope this will be a valuable document for policy makers, scientists, and readers./.



Dr. Ta Dinh Thi

15th National Assembly's Delegate

Vice Chairman of the National Assembly's Committee on Science, Technology and Environment

Former Director General of the Viet Nam Administration of Seas and Islands

Key findings:

- ▶ The blue economy concept has been defined in a number of ways, but fundamentally it is about integrating marine-based economic development that leads to improved human well-being and social equity, while simultaneously reducing environmental risks and ecological scarcities.
- ▶ A review of the main marine economic sectors of Viet Nam was undertaken. Sectors covered were fisheries and aquaculture; oil and gas; marine renewable energy; coastal and marine tourism; the maritime sector; and environment and ecosystems.
- ▶ A number of blue scenarios to 2030 were developed for each of these marine economic sectors. The blue scenario for each sector was based on feasible sector-based interventions in policy, governance and management which were closely aligned to the blue economy concept. Blue scenarios were compared to baseline scenarios in which the existing approach to sector development was pursued until 2030.
- ▶ The blue scenarios lead to benefits in terms of GDP, GNI and GNI per capita for all marine sectors in comparison with the baseline scenario. The study shows that with the blue scenario applied, the GDP of the blue scenario will be VND 296 thousand billion (USD \$12.9 billion) more than the baseline scenario by 2025 and VND 538 thousand billion (USD \$23.5 billion USD), respectively to the year 2030.
- ▶ The interactions between the economic sectors were generally positive or quite neutral, suggesting that there is still room for expansion of marine economic development. However, many of the economic sectors were negatively linked to environment and ecosystems, suggesting that further expansion could lead to environmental degradation.
- ▶ The blue scenario indicates that ecosystem values linked to habitat quality, and the extent of key habitats (mangrove, seagrass, coral reefs and lagoon) could be increased. Thus, marine economic expansion could be accompanied maintenance or improvement of the quality of the environment.
- ▶ Facilitating the marine economy can have many benefits across the Sustainable Development Goals (SDGs) and climate change targets. The marine economy can be a means for realising all 17 SDG Goals, particularly industry, innovation and infrastructure (SDG-9), decent work and economic growth (SDG-8), responsible production and consumption (SDG-12) and poverty alleviation (SDG-1). The blue economy can also support progress in meeting long-term and higher climate ambition of the country, especially net-zero emissions by 2050.
- ▶ The study indicates that following the blue scenarios will significantly increase per capita income (GNI/capita). By 2025, under the baseline scenario GNI per capita is

147 million VND, while under the blue scenario per capita is 230 million VND. Similarly, in 2030, under the base scenario GNI/capita is VND 163 million, while under the blue scenario it is VND 290 million.

- ▶ More detail planning is required to operationalise the blue scenario outlined in this analysis through application of tools such as Marine Spatial Planning. Ensuring that marine economic growth is not traded-off for environment quality is fundamental to securing a powerful blue economy in Vietnam.
- ▶ Sector-based policy recommendation to achieve the blue scenario trajectory include:
 - **Fisheries and aquaculture:** reduce fisheries catch to Maximum Sustainable Yield (~2.7 million tons per year) through a 2% per year catch reduction, including reduction of near- and middle-shore vessels horsepower of 5% per year; maintain aquaculture area but implement technical; and management improvement leading to a secure productivity increases of 3.5% per year.
 - **Oil and gas:** promotion of energy saving within oil & gas production activities; enhanced protection of environment; and increased participating in the emerging marine renewable energy production.
 - **Marine renewables:** rapid expansion of marine renewables achieving towards 10,000 MW installed by 2030, including ~4,500 MW of near-shore wind (mainly Mekong delta) and 5,000 MW of offshore wind (mainly South-Central region).
 - **Tourism:** promote growth for international visitors of 8-10% per year and domestic tourists 5-6% per year to 2030; achieve 1.6 million tourist beds with 65% occupancy by 2030; embed climate change impacts, including sea level rise, in tourism planning.
 - **Maritime transport:** increase maritime transport share from 20.6% to 22.84%, equivalent to 289 million tons domestic transport and 787 million tons international transport by 2030.

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LIST OF ABBREVIATIONS

Abbreviations	Meaning
BCG	Boston Consulting Group
BCM	Billion Cubic Meters
BDPOC	(Bien Dong) East Sea Oil and Gas Operating Company
BE	Blue Economy
BOD	Biochemical oxygen demand
BSR	Binh Son Refining and Petrochemical Company
CPI	Consumer Price Index
CPUE	Catch per unit effort
D-FISH	Directorate of Fisheries (Viet Nam)
DO	Dissolved Oxygen
EEZ	Exclusive Economic Zones
ENI	National Oil and Gas Group of Italy
EVFTA	EU-Viet Nam Free Trade Agreement EVFTA
EVN	Electricity Viet Nam Corporation
FDI	Foreign Direct Investment
FIT	Feed-in-tariff
FPSO	Floating Production, Storage and Offloading
FSO	Floating Storage Offloading
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GNI	Gross National Product
GO	Gross Output
GSO	General Statistics Office
HPP	Hydro Power Plant
IC	Intermediation Cost
IHRDC	International Human Resource Development Corporation
IMO	International Maritime Organization
INDC	Intended Nationally Determined Contributions
IPCC	Intergovernmental Panel on Climate Change
JOA	Joint Cooperation Agreement
JOC	Joint Operating Contract
KNOC	Korea National Petroleum Corporation
KTOE	Kilotons of oil equivalent
kWh	Kilo Watts per hour
LCOE	Levelized Cost of Energy

LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MARD	Ministry of Agriculture and Rural Development
MoIT	Ministry of Industry and Trade
MoNRE	Ministry of Natural Resources and Environment
MPI	Ministry of Planning and Investment
MSY	Maximum Sustainable Yield
Mt	Megaton
MW	Megawatt
NDC	Nationally Determined Contributions
NI	Number of Individuals
NS	Number of Species
NSRP	Nghi Son Refinery and Petrochemical Union
OPRC	International Convention on Readiness, Response and Cooperation to Combat Petroleum Pollution
PAH	Total Polyaromatic Hydrocarbon
PDP	Power Development Plan
PPI	Producer Price Index
PQPOC	Phu Quoc Petroleum Operating Company
PSC	Product Sharing Contract
PTSC	Petroleum Technical Services Corporation
PTTEP	Petroleum Exploration Production Company (Thailand)
PV	Photovoltaic
PV DRILLING	Petro Viet Nam Drilling and Drilling Services Corporation
PV TRANS	Petro Viet Nam Transport Joint Stock Corporation
PVC	Viet Nam Oil and Gas Construction Joint Stock Corporation
PVCHEM	Petro Viet Nam Chemicals and Services Corporation
PVEP	Petro Viet Nam Exploration Production Corporation (Viet Nam)
PVFCCo	Petro Viet Nam Fertilizer and Chemicals Corporation
PVGAS	Petro Viet Nam Gas Corporation
PVN	Petro Viet Nam
R/P	Reserve/Product Ratio
RIMF	Research Institute for Marine Fisheries
RRR	Reserve Replacement Rate
SDG	Sustainable Development Goals
THC	Total Carbon Content
TOC	Total Organic Carbon
TPP	Thermal Power Plant

TSS	Total Suspended Solids
UNCLOS	International Convention on the Law of the Sea
UNDP	United Nations Development Program
UNFCCC	United Nations Framework Convention on Climate Change
USGS	United States Geological Survey
VIFEP	Viet Nam Institute of Fisheries Economics and Planning
VN	Viet Nam
VND	Viet Nam Dong (currency)
VPI	Viet Nam Petroleum Institute
VSP	Viet Nam-Russia Joint Venture Enterprise
WACC	Weighted average cost of capital

1. Introduction to the Blue Economy

1.1. Orientation to this Blue Economy study

This report focuses on the contribution of the Blue Economy (BE) to the socio-economic development in Viet Nam. This report will help support the realization of the objectives of the Strategy for Sustainable Development of the Marine Economy of Viet Nam Until 2030, Vision to 2045 (Resolution 36/NQ-TW), as well as assist Viet Nam in meeting its stated goals on socio-economic development and sustainable use and protection of marine resources.

This synthesis report amalgamates six in-depth thematic technical reports drawn from specific economic areas related to the BE: Marine Renewable Energy, Oil & Gas/Marine Resources, Aquaculture & Fisheries, Coastal & Marine Tourism, Maritime (marine transportation) and Environment, Biodiversity & Ecosystem Services. Each sector/sector thematic report uses the same general framework, which includes an assessment of several key national economic indicators for the sector, and its link to the Sustainable Development Goals (SDGs), interactions between the sectors and future scenarios to 2030 under different management approaches (baseline and blue scenarios). However, since each sector has its own characteristics and differences in terms of extent, detail and quality of information, there are some differences between each sector analysis.

This study attempts to synthesize the multiple sectors operating in the blue economy and search for development trajectories where BE “win-win” outcomes would appear to be possible. Rather than focussing on spurring growth in each marine economic sector, the approach tries to analyze the multiple sectors as a portfolio viewed through economic, social and environmental lenses. Overall, the study aims to define trajectories for growing the blue economy portfolio of Viet Nam which complement and build on Resolution 36 and 26.

This summary report begins by outlining the definition of the Blue Economy and provides an overview of the Blue Economy situation in Viet Nam. Chapter 2 provides an overview of the socio-economic status of the main economic sectors of the blue economy. Chapter 3 introduces the results of the comparative cost-benefit analysis of the industries. Chapter 4 analyses the possible future blue scenarios for the sectors up to 2030. Chapter 5 assesses the challenges and opportunities for the blue economy advancement in Viet Nam. The final chapter provides some key recommendations for promoting Blue Economy in Viet Nam.

1.2. Defining the blue economy

The essence of the Blue Economy (BE) can be traced back to the Brundtland Commission report (of 1987) which identified the importance of development and accounted for the needs of future generations. This was the precursor to what is now known as the 'Green Economy' which is recognized as a rapidly expanding sector over the last decades. BE can be seen to be allied to many of the Green Economy approaches but just related to marine economies. BE as a term emerged through the phase leading into the 2012 Rio+20 conference and its use and application has expanded over the intervening years.

However, BE has failed to attain a universal definition. One of the earlier definitions of the 'Blue Economy' came from Pauli (2010) in a report to the Club of Rome which highlighted the benefits of connecting and combining seemingly disparate environmental problems with open-source scientific solutions based upon physical processes common in the natural world, to create solutions that are both environmentally beneficial and which have financial and wider social benefits. More succinct definition from that period included Kaczynski (2011) who succinctly described 'Blue Economy' as being about the commercial development of oceans in a sustainable way. BE results in improved human wellbeing and social equity, while significantly reducing environmental risks and ecological scarcities, endorsing low carbon, resource efficiency and social inclusion UNEP have termed BE as an approach that is based on a vision of improved wellbeing and social equity, while significantly reducing environmental risks and ecological scarcities and also note that that BE offers an innovative approach to conserving the oceans, while reaping their benefits in a more equitable and sustainable way². The East Asian Summit (EAS) Region also produced the Changwon Declaration in 2012 which provided a similar but more detailed BE definition: *"We understand the Blue Economy to be a practical ocean-based economic model using green infrastructure and technologies, innovative financing mechanisms, and proactive institutional arrangements for meeting the twin goals of protecting our oceans and coasts and enhancing its potential contribution to sustainable development, including improving human well-being, and reducing environmental risks and ecological scarcities."*

² UNEP, 2015, Blue Economy: Sharing Success Stories to Inspire Change. www.unep.org/greeneconomy

A contemporary view on the definition of the BE by Steven et al. (2019³) stresses the economic, social and environmental pillars and the underlying sustainability aspect of BE, but also highlights the importance of enabling policy. Thus, a useful working definition of BE can be taken from the World Bank as “sustainable use of ocean resources for economic growth, improved livelihoods and jobs and ocean ecosystems health⁴”. Perhaps it is fair to say that a universally agreed aspect of the definition of BE is a fluid concept, employed differently in different contexts and by different actors. Although common to all approaches is the integration of marine-based economic development that leads to improved human well-being and social equity, while simultaneously reducing environmental risks and ecological scarcities.

In terms of the application of a BE approach, key decisions need to be made between two potentially conflicting discourses: growth and development, and the protection of ocean resources. This setting of balance within BE is also inherent in the Sustainable Development Goals (SDGs) of the United Nations. From a published survey of stakeholder, the association between BE and SDGs was assessed and shows a focus of BE on environmental aspects (SDGs 14, 15), partnerships and institutions (SDG 16 and 17) and good health and wellbeing (SDG 3) but less focus on economic aspects (work and industry, SDG 8 and 9 respectively) and other aspects such as equality and gender (SDG 10 and 5) (**Fig 1.1**).

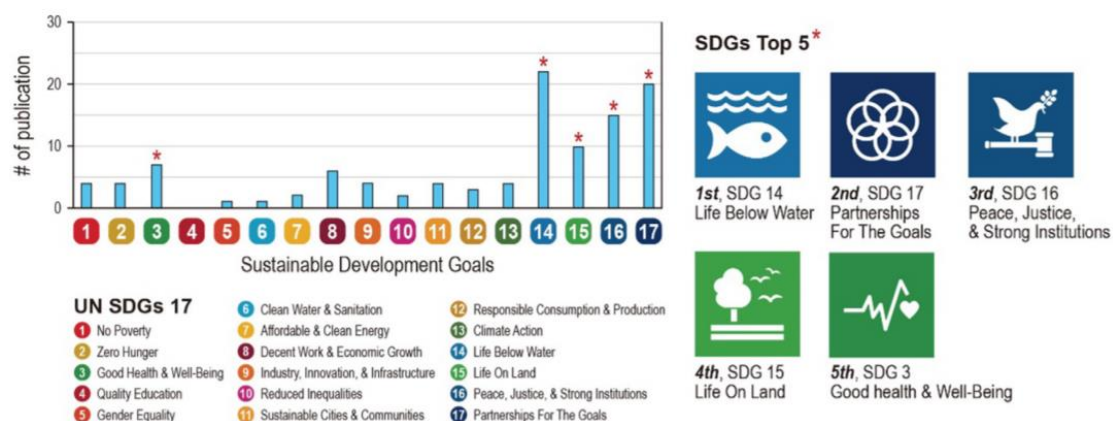


Figure 1.1. The stakeholder-focused SDGs linkage to the Blue Economy

Note: red asterisk at the above blue bars represents the top ranked 5 SDGs, which are displayed on right of graph⁵

³ Andrew D. L. Steven, Mathew A. Vanderkluft & Narnia Bohler-Muller (2019) A new narrative for the Blue Economy and Blue Carbon, Journal of the Indian Ocean Region, 15:2, 123-128, DOI: 10.1080/19480881.2019.1625215

⁴ World Bank. 2017. The Sunken Billions Revisited : Progress and Challenges in Global Marine Fisheries. Environment and Development. Washington, DC: World Bank. © World Bank. <https://openknowledge.worldbank.org/handle/10986/24056> License: CC BY 3.0 IGO.

⁵ Lee, K-H, Noh, J. & Khim, J.S. (2020) The Blue Economy and the United Nations' sustainable development goals: Challenges and opportunities. Environmental International: <https://doi.org/10.1016/j.envint.2020.105528>

Consequently, from the stakeholder community, BE seems to focus more on the environmental and governance aspects, with less connection to social and economic dimensions. However, national discourses and the application of BE can be expected to differ on the basis of country differences for example national development trajectories, living and non-living resources and level of technological development. Thus, global definitions would seem to be less important at a national level, compared to addressing some of the key challenges set up by the BE lens. These include ensuring the inclusion of the social, economic and environmental pillars and setting determining trajectories that have a correct balance of ocean growth and development with protection.

1.3. The national blue economy context

Viet Nam is located on the coast of the East Sea, has an area of 331,212 km², and a population of 98 million people (2020). The population of 28 coastal provinces/cities accounts for nearly 50% of the country's population. The area of territorial waters under sovereignty, with sovereign rights and jurisdiction, is over 1 million square kilometres, with two archipelagos of Hoang Sa and Truong Sa and over 3,000 other islands and archipelagos. The coastline is 3,260 km long (excluding islands), on average, there is 1 km of coastline for every 100 km² of land area (the world average is 600 km² of land/1 km of coastline). Viet Nam's coast has many estuaries (114 estuaries and an average of one large river mouth every 20 km) and more than 50 bays and lagoons (accounting for 60% of the coastline). The geographical topography of the land is narrow, stretching along the coast in the North-South direction, nowhere in the country is more than 500 km from the sea.

The East Sea is located on the arterial sea traffic route connecting the Pacific - Indian Ocean, Europe-Asia, and the Middle East-Asia. The maritime route through the East Sea is one of the busiest international maritime trade routes in the world. The development of many economies in East Asia is linked to this sea route. In the region, there are large ports such as Singapore port, Hong Kong port, etc. Viet Nam's coast has more than 100 locations where large seaports can be built, which are favourable conditions for the development of the marine transportation industry.

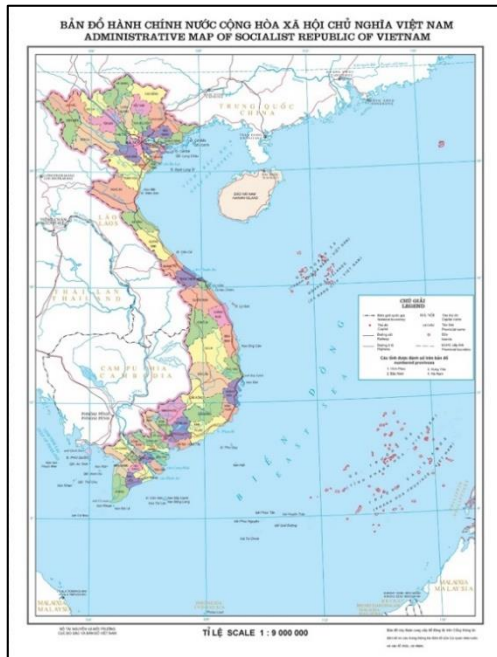


Figure 1.2. Administrative map of Viet Nam⁶



Figure 1.3. Natural map of Southeast Asia⁷

Viet Nam's seas and islands have rich and diverse biological and mineral resources, including about 12,000 species of living organisms in more than 20 typical ecosystem types, belonging to 6 other marine biodiversity regions. Viet Nam's sea is considered one of the 10 centres of marine biodiversity in the world. In the waters of Viet Nam, there are about 35 types of minerals with different sizes of exploited reserves from small to large, belonging to the following groups: fuels, metals, construction materials, precious and semi-precious stones, and liquid minerals. Petroleum potential is distributed in sedimentary basins. The seas and islands of Viet Nam have significant tourism resources. There are more than 120 beaches along the coast that can be developed for tourism, of which about 20 are of international scale and standards. The Ha Long Bay has been classified by UNESCO as a natural heritage of the world.

Viet Nam's sea and coastal areas are subject to many risks of natural disasters at sea and extreme weather phenomena and consequences from climate change, such as storms and storm surge and is assessed to be more likely to be affected by climate change and ocean change. According to the World Bank (WB), a sea-level rise of 5m will cause Viet Nam to lose 16% of its land area, threatening 35% of its population and 35% of its gross domestic product; coastal lowlands, atolls and a series of ecosystems and infrastructures destroyed by sea-water flooding.

⁶ Source: <https://abc.vn/ban-do-viet-nam/>

⁷ Source: <https://sites.google.com/site/khuvucdongnama1509/vi-tri-dia-li-va-lanh-tho>

With the geographical location, it can be said that the economic and cultural life of Viet Nameese people is closely related to the sea. The sea is considered a space for survival, development and security of the Viet Nameese nation. Sustainable development of the blue economy, therefore, becomes an indispensable need throughout the country's development process. Currently, the East Sea has disputes over sovereignty over sea and islands.

Marine economic activities in Viet Nam are diverse but can be simply divided into two main categories:

- 1. Primary marine activities – economic activities that take place within the coastal and marine zone. Includes 1. Maritime economy (Sea transport and seaport services); 2. Seafood (fishing and aquaculture); 3. Offshore oil and gas exploitation; 4. Sea tourism; 5. Making salt; 6. Search, rescue and rescue services; 7. Small island economic activities.
- 2. Secondary marine activities – economic activities that are associated to or support the primary marine activities but do not take place within the sea. Includes: 1. Building and repairing ships and boats; 2. Oil and gas processing industry; 3. Seafood processing industry; 4. Providing services, such as supporting coastal tourism and maritime insurance; 5. Communication; 6. Researching marine science and technology, training human resources for marine economic development, basic investigation of marine resources and environment.

Although there are many articles on the development of the marine economy in general and the key marine economic sectors in particular in Viet Nam, perspectives on the blue economy are still very limited. On the one hand, this is a new approach, so there are not many research reports. On the other hand, the current situation of data on the marine economy in Viet Nam is still very scattered and lacks uniformity. Furthermore, there is no statistical section for the marine economy in the official statistical system of Viet Nam.

Most of the statistics on the marine economy belong to the group of "sectoral statistics" as the industries themselves build according to each angle and scope of their management. For example, the fisheries sector is managed by the Ministry of Agriculture and Rural Development (MARD); the maritime economy under the management of the Ministry of Transport (MOT) and the Ministry of Industry and Trade (MOIT); oil and gas, marine energy by MOIT tourism is managed by the Ministry

of Culture, Sports and Tourism (MOCST). Moreover, the data from the different marine sectors tend to vary, some sectors lack indicators, such as labour or value-added; this makes consistency and comparison between marine sectors challenging.

According to the collected information, the GDP scale of net marine economic sectors of Viet Nam, including seafood, marine tourism, maritime, oil and gas exploitation, petrochemical refining, and offshore wind power. Offshore wind power has increased by 2.64 times from 2010 to 2019. Over the same period, the GNI of these industries increased by 3.4 times (Figure 1.5). At the same time, the structure of the marine economy has also undergone a significant change, in which the oil and gas exploitation and refining and petrochemical industries have decreased from 60% of marine GDP in 2010 to 37% in 2019; meanwhile, the marine tourism sector has increased from 13% to 40% marine GDP in the same period (Figure 1.4).

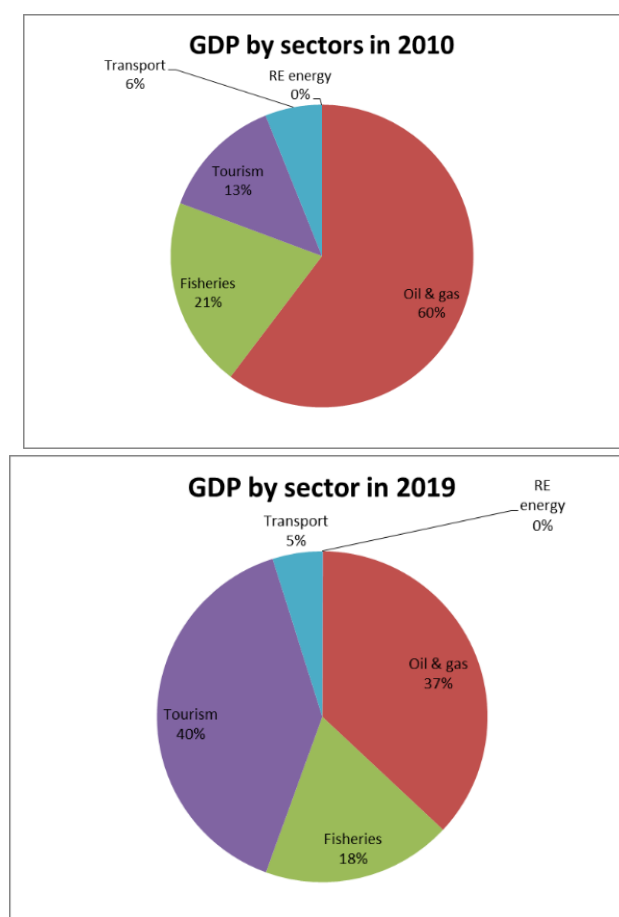


Figure 1.4. Structural change among marine economic sectors in the period 2010-2019

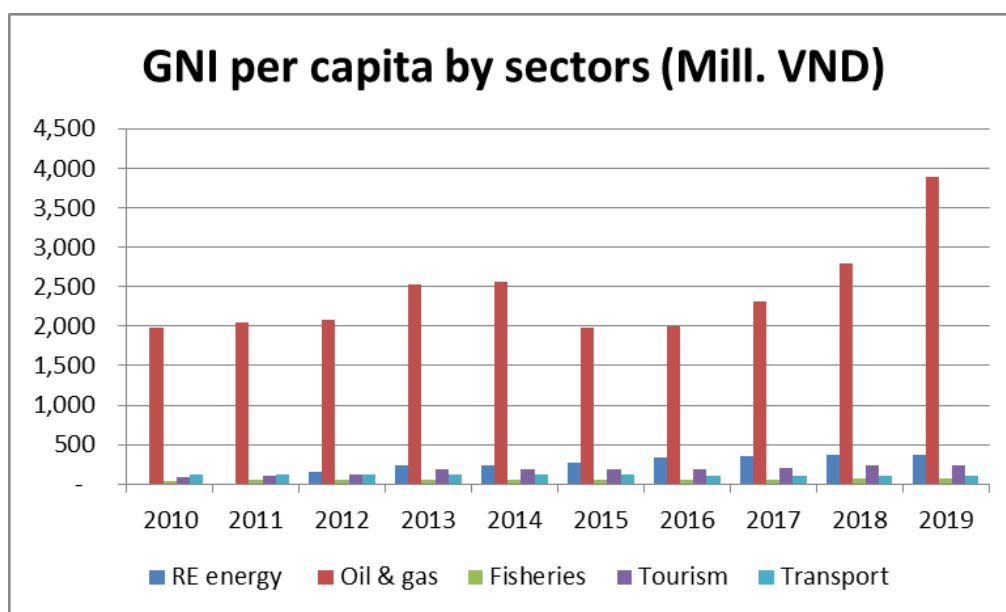


Figure 1.5. Gross National Income (GNI) per capita of marine economic sectors in the period 2010-2019

The labour structure shows that the majority of workers in the marine economy sectors belong to the seafood and marine tourism sectors. In contrast, the sector that generates the most value added per worker is the oil and gas exploitation and refining and petrochemical industries (Figure 1.6).

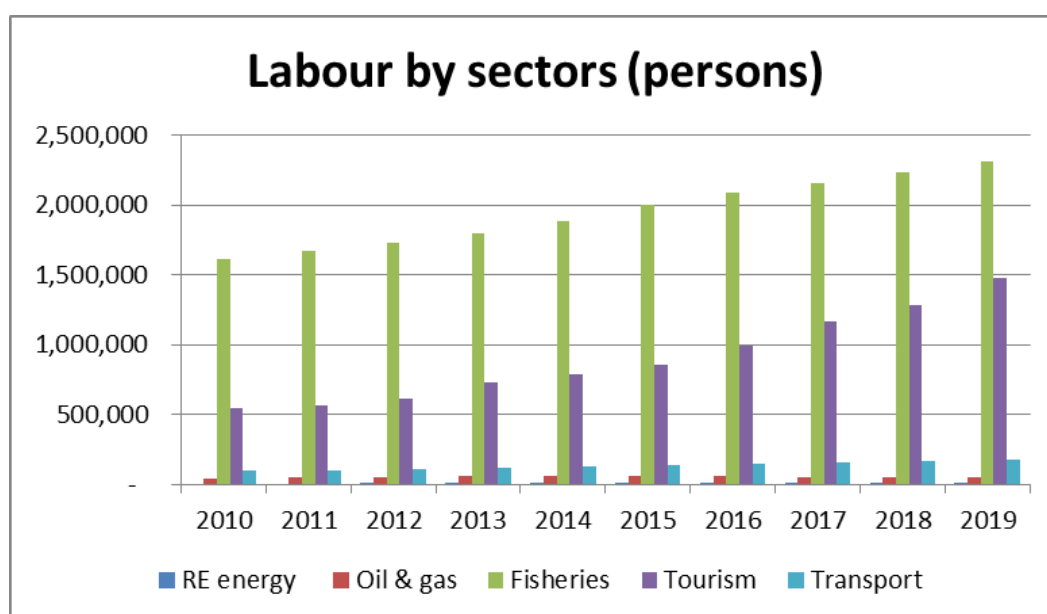


Figure 1.6. Labour structure in marine economic sectors in the period 2010-2019

1.4. Policy initiatives for ocean development

The importance of the ocean for national development has been long recognized, with specific policy instruments dating back to the 1990s⁸. In 2007, Resolution 09-NQ/TW on Viet Nam's Sea Strategy to 2020 was approved with a focus on becoming a "strong country based on the sea" through "promoting all potentials from the sea". The objective of the Resolution was that by 2020 the ocean economy would contribute about 53-55% of GDP and 55-60% of export turnover of the whole country as well as supporting sociological development. The importance of the sectors that form the marine economy was recognized and sector policies emerged, such as the Fisheries Development Strategy 2010; Tourism Development Strategy 2010 and Transport Development Strategy 2010; some of these were underpinned by the law⁹.

Renewed emphasis was placed on the ocean by The Party Central Committee's Resolution No. 36-NQ/TW dated October 22, 2018, on Viet Nam's Ocean Economy Sustainable Development Strategy. The Resolution was substantive in that it identified targets for 2030 and a vision for 2045, which included 5 major directions, and 7 key solutions. Three strategic advancements or "breakthroughs" were also identified in the Resolution:

1. ***Complete the institutional arrangements and supporting mechanisms for the sustainable development of the ocean economy.*** Give priority to the improvement of the legal framework, innovation, development of green growth models, environmental protection, and improvement of the productivity, quality and international competitiveness of marine industries. Establish the integrated ocean or marine management mechanism. Review, adjust, supplement and establish plans related to the sea, ensuring the linkage between sectors and localities (inter-sectoral and spatial integration).
2. ***Develop science, technology, and high-quality human resources, promote innovation and creativity.*** Make full use of advanced scientific and technological achievements, and new technology, and attract leading experts, scientists, and high-quality human resources.
3. ***Develop multi-purpose infrastructure and transportation networks.*** Connect major economic centres, industrial zones, urban areas and sea areas with

⁸ For example, Resolution No. 03-NQ/TW (of 1993), Directive 171/TTg (of 1995) and Directive No. 20-CT/TW (of 1997).

⁹ For example, Law of the Sea of Vietnam No. 18/2012/QH13, Law of the Sea and Island Resources and Environment No. 2/2015/QH13 and Law on Fisheries No. 18/2017/QH14.

seaports based on economic and natural ecosystems and strategically connecting North-South, East-West, between the domestic and international regions.

In 2020, the Government issued Resolution No. 26-NQ/CP promulgating a 5-year plan for implementation of Resolution No. 36-NQ/TW on the Ocean Economy Sustainable Development Strategy by 2030, Vision to 2045. The 5-year plan addresses important content related to the blue economy development. The plan has launched 24 projects and tasks for the period from now to 2025 and 9 projects for the period of 2026-2030. This included the promulgation of focusing on a National Marine Spatial Plan for the period of 2021-2030, vision to 2045 and the Master plan for the sustainable exploitation and use of coastal resources for the period of 2021 - 2030, vision to 2045.

Resolution 36 does not use the term blue economy in the text. However, the main thrust is towards invigorating the sustainable development of the marine economy. This is very much in line with the normative BE definitions, and directly inculcates the key sustainable development pillars of economy, society and environment. Accordingly, the Specific Objectives of Resolution 36 are broken down into economic, social and environmental objectives, as well as categories including science, technology, and marine human resources development. Economic Objectives raise the aspiration of the economy of coastal provinces and cities to represent 65-70% GDP (compared to the 53-55% GDP target of Resolution 09-NQ/TW of 2007) and the pure-marine economy to be about 10% of the national GDP.

The Resolution provides a view of the ocean with unexploited potential in which certain anthropogenic constraints need to be overcome (capacity, technology, etc) to further expand the array of benefits. The focus is on an implicit “win-win” for the generation of economic growth while moving towards increased sustainability (or “win-win-win” for economy, society and environment). The apparition is benign, with expansion possible across many sectors once constraints are lifted and negative interplay between expanding sectors is limited. The Resolution presents negligible narrative around the constraints to this expansion or the negative interactions between expanding sectors. Already some marine resources are reaching limits to further exploitation, for example in global capture fisheries the percentage of stocks fished at biologically unsustainable levels increased from 10 percent in 1974 to 34 percent in 2017¹⁰, with 90% of stocks fully fished or overfished, which is already

¹⁰ FAO. 2020. *The State of World Fisheries and Aquaculture 2020. Sustainability in action*. Rome. <https://doi.org/10.4060/ca9229en>

causing a lost economic benefit of USD \$83 billion per year¹¹. For fisheries stocks globally there is no “win-win” for the foreseeable future.

The concept of “win-win” is being more broadly questioned within green growth, with some evidence that it may pose more trade-offs than is readily acknowledged, especially when scaled up into national development strategies¹². This has also been questioned within the blue economy¹³ and it has been argued that green-growth “strategies have not led to environmentally sustainable and equitable outcomes on land, so there is little reason to expect them to perform better at sea”¹⁴.

However, Viet Nam has made strong climate commitments and other environmental obligations. The Prime Minister Pham Minh Chinh announced Viet Nam’s climate ambition, including net-zero emissions by 2050, at the 26th session of the Conference of Parties (COP26) to the United Nations Framework Convention on Climate Change in Glasgow, United Kingdom, in 2021¹⁵. This statement flags the national imperative of a green and blue path of promotion of socio-economic development without compromising environmental and ecosystem quality and the vital need for mapping out “win-win” scenarios. The future planning of sectors of the blue economy, such as marine renewable energy, especially offshore wind power and marine oil & gas, become crucial elements of promoting on blue growth through Resolution 36, but also for delivering on climate change commitments.

¹¹World Bank. 2017. The Sunken Billions Revisited : Progress and Challenges in Global Marine Fisheries. Environment and Development;. Washington, DC: World Bank. © World Bank. <https://openknowledge.worldbank.org/handle/10986/24056> License: CC BY 3.0 IGO

¹² United Nations University, 2012. Green Growth: A Win-Win Approach to Sustainable Development? <https://unu.edu/publications/articles/green-growth-a-win-win-approach.html>

¹³ E.g. Lancaster University, 2019. Africa’s Blue Economy – win-win or false promise? <https://www.lancaster.ac.uk/lec/about-us/news/africas-blue-economy-win-win-or-false-promise>

¹⁴ Cohen PJ, Allison EH, Andrew NL, Cinner J, Evans LS, Fabinyi M, et al. Securing a Just Space for Small-Scale Fisheries in the Blue Economy. *Frontiers in Marine Science*. 2019;6:171.

¹⁵ <https://en.baochinhphu.vn/full-remarks-by-pm-pham-minh-chinh-at-cop26-11142627.htm>

2. Blue economy sector overview

2.1. Introduction

This section provides an overview of the main marine sectors: fisheries & aquaculture, oil & gas, marine renewable energy, coastal and marine tourism, maritime and environment, biodiversity & ecosystems. Although the sectors are diverse and different information is available for each of them, the basic structure of the section on each sector is similar. Firstly, a review is made of the resources of the sector describing the types of resources, their location and the ways in which the resources are being used. Secondly, the present status is determined through an analysis of the stock of resources and the main trends in their use and extraction. Thirdly, the interaction of the sector with the 14 SDG Goals is assessed as well as the type of interaction (positive/neutral/negative) with the other marine sectors.

2.2. Fisheries & Aquaculture

2.2.1. Resources

Viet Nam has marine fishing grounds covering over 1 million square kilometres with over 2,000 species of fish, including 130 species of high economic value, and over 600 species of crustaceans, molluscs and seaweed. According to RIMF (2018), the average annual biomass of marine fish resources between 2011-2015 was estimated at 4.364 million tons (fluctuating between 4.1-4.6 million tons)¹⁶; with 12% of production from nearshore fisheries resources, middle shore areas producing 19%, and offshore areas producing 69%, excluding fish stocks of deep-sea areas, emerging mounds and continental shelf areas. Fish stocks have decreased by 13.9% from 2000-2005 (5.071 million tonnes), which is equal to an annual decrease of 1.36% per year. The fisheries grounds in Viet Nam are classified into five fishing zones: Tonkin Gulf (accounting for 17.3% of total fisheries resources), Central Coast Zone (20.0%), Southeast Zone (25.6%), South West Zone (13.4%) and Middle East Sea Zone (23.7%)¹⁷.

¹⁶ This 4.364 million ton do not cover the fisheries resources in the deep-sea areas and continent shelf areas of Vietnam as resource stock assessment there have not been conducted.

¹⁷ RIMF (2018), Report on marine fisheries stock assessment in Viet Nam sea in the period of 2011-2015 (submitted to MARD), Research for Marine Fisheries (RIMF), Hai Phong.



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Lobster aquaculture system in Hon Yen, Phu Yen Province – Image by: Trọng Đạt (VNA)

Viet Nam has a large potential for marine and coastal aquaculture development with a coastline over 3,260km long, over 3,000 islands, 12 coastal lagoons, and 112 coastal estuaries. In terms of potential locations and areas for aquaculture, about 500,000 hectares¹⁹ of closed bays, nearshore islands, middle shore sea areas and low tidal flats can be exploited for marine aquaculture development. So far, about 57,000 hectares out of that area have been used for marine aquaculture development and the remaining 443,000 hectares have potential for marine aquaculture, especially the nearshore and middle shore areas.

In addition, a large number of low and high tidal areas of about 750,000 hectares²⁰ in all 28 coastal provinces are also suitable for brackish-water²¹ aquaculture development with a majority appropriate for shrimp farming. So far, about 720,000 hectares of those areas have been used for brackish water coastal aquaculture farming along the coast.

2.2.2. Present status

Over the past 20 years, the growth of production from the total fishery production (including both capture and aquaculture) has quadrupled, from about 2.0 million tons a year in 1999 to 4.7 million tons in 2009 and 8.15 million tons in 2019 (See Figure 2.1).

¹⁸ <https://nhandan.vn/tin-tuc-kinh-te/phat-trien-nuoi-trong-thuy-san-vung-nam-trung-bo-379596>

¹⁹ MARD (2018), *National strategy for marine aquaculture development towards 2030 and visions to 2050*, Hanoi.

²⁰ VIFEP (2012), *Master Plan for Fisheries Sector Development towards 2020 and visions to 2030*, Hanoi.

²¹ Brackish-water aquaculture is to culture aquatic species in the coastal ponds with water salinity of 3-25ppt (sometimes the salinity may go lower or higher that range but should not last for a long time). This farming is mainly done in coastal areas.

Out of the 8.15 million tons in 2019, the marine catch was 3.77 million tons, of which 94.6% was caught at sea; and aquaculture production was 4.38 million tons, of which 28% is raised in coastal and marine farming areas.

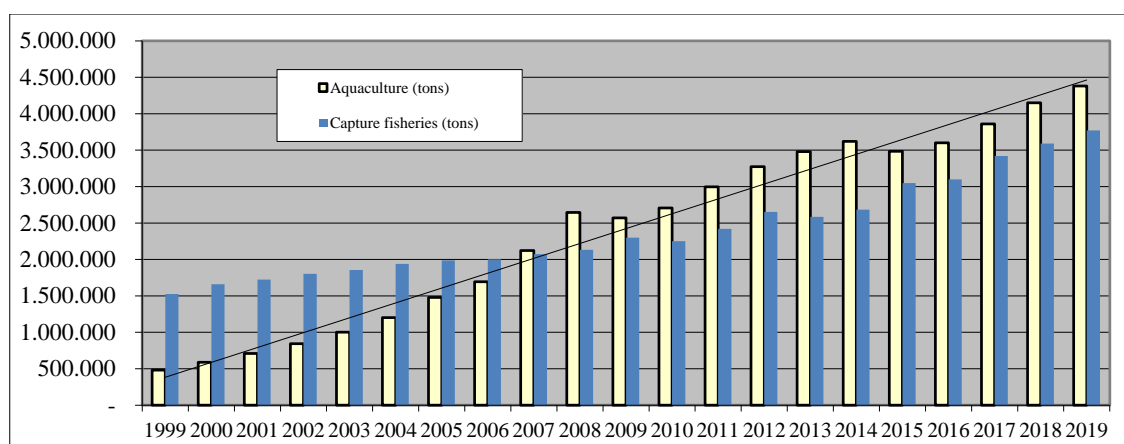


Figure 2.1. Aquaculture and capture fisheries production in the period 1999-2019²²

There has been a significant structural change in the means of fishing as the total number of small fishing boats operating in nearshore and middle shore areas have reduced from 92,391 boats in 2013 to 66,135 boats in 2019 (reduction of 5.42% per year). However, the number of offshore vessels has shown an upward trend from 26,398 vessels in 2013 to 30,474 vessels in 2019 (D-FISH, 2019) (increase by 2.42% per year). The reason for this structural change is partly due to the Government's policies to encourage offshore fishing and limit inshore fishing, and on the other hand due to the decline in nearshore fishery resources. There are 83 fishing ports (data in 2018) with a designed capacity of 1.8 million tons to provide logistic services for 9,298 fishing vessels arrivals/day.

Aquaculture production has been increased significantly in the last 10 years with an annual growth rate of 6.5% per year, from 692,904 tons in 2010 (VIFEP, 2013) to reach a total of 1,220,000 tons of seafood in 2019 (D-FISH, 2019) and its majority has come from coastal land-based brackish-water shrimp farming (accounting for 61.5% of total coastal and marine aquaculture production in 2019).

The value of seafood exports increased from USD 5 billion in 2010 to USD 8.6 billion in 2019²³ (accounting for 22.5% of the total export value of the agriculture-forestry-fishery sector), with an average growth rate of 6.1% per year. The nominal GDP of the

²² Gathered and compiled from annual reviewing reports of D-FISH and MARD.

²³ D-FISH (2019), Annual report of fisheries sector achievements in 2019 and action plans for 2020.

marine capture & aquaculture sector has increased from 68.91 VND thousand billion in 2010 to 166.76 VND thousand billion in 2019. It contributes approximately 72-89% of the whole nominal fisheries sector GDP, 15-20% to the nominal GDP of the Agriculture-Forest-Fisheries sector and 2-3% to nominal national GDP.

2.2.3. Interaction with SDGs

Marine capture and aquaculture have both positive and negative interactions with SDGs. Positive interactions include sustainable livelihood and income creation; contributing to reducing the poverty rate and ensuring food security, improving nutritional levels and social welfare access for poor communities in coastal and island areas; also creating more opportunities for women to participate in seafood processing and marketing. Negative interactions may be seen in excessive water resource uses in aquaculture and may create negative impacts on the environment such as organic pollution from feed residues, mud wastes, salinity intrusion; or unfriendly fishing activities like bottom trawling in nearshore areas. Such interactions create more pressures on coastal fisheries resources as well as marine environment and ecosystems.

Table 2.1. Linkage of aquaculture and capture fisheries to Viet Nameese SDGs

SDGs	Score	Comments
SDG 1	+3	Nearshore capture fisheries (accounting for 49.11% of total vessels in 2019 in Viet Nam) and small-scale aquaculture farming (60%) create sustainable livelihoods and incomes for poor communities in coastal and island areas.
SDG 2	+3	Contribute to reduce poverty rate and ensure food security for poor communities in coastal and island areas.
SDG 3	+3	Providing seafood that improves nutritional levels and contributes to social welfare access for poor communities in coastal and island areas.
SDG 4	+2	Sustainable capture fisheries and aquaculture development helps local communities in coastal and island areas have more opportunities to access to education and technical training.
SDG 5	+2	Many opportunities are created for women to participate in fish processing, marketing and aquaculture industry.
SDG 6	-1	Aquaculture development uses water resources and may create negative impacts on environment such as organic pollution from feed residues, mud wastes, and salinity intrusion.
SDG 7	0	No contribution
SDG 8	+ 2	Contribute to economic growth and creates more jobs for local communities in coastal and island areas.
SDG 9	+2	Contribute to improve infrastructures for coastal and island areas such as fishing port, storm shelter, roads, sluice, electricity, telecommunication, etc.

SDG 10	+1	Nearshore capture fisheries and small-scale aquaculture maintain daily livelihoods for vulnerable local people, leading to reduce inequality within local community.
SDG 11	+1	Contribute to sustainable urban and rural development with more access to good foods and infrastructure building in coastal areas.
SDG 12	+1	Organic shrimp and Marine Stewardship Council certification ²⁴ captured seafood products may contribute to responsible production and consumption.
SDG 13	+3	Brackish water aquaculture development in coastal salinity intrusion areas (ex. shrimp farming) is considered as one of feasible climate change adaptation solutions.
SDG 14	+3	Ending IUU (Illegal, Unreported and Unregulated) fishing and relevant subsidies for capture fisheries will protect aquatic resources and contribute to sustainable fisheries development.
SDG 15	+1	Shrimp-mangrove integration creates organic shrimp and contribute to protect and restore coastal mangroves.
SDG 16	0	No contribution
SDG 17	+2	Partnership with international and bilateral entities to end IUU fishing and sustainable aquaculture farming.

Source: Cao Le Quyen, 2021

2.3. Oil & gas

2.3.1. Resources

There are eight oil & gas bearing basins located in the exclusive economic zone and continental shelf in Viet Nam: Song Hong, Hoang Sa, Phu Khanh, Cuu Long, Nam Con Son, Tu Chinh-Vung May, Truong Sa and Malay-Tho Chu basins.

²⁴ Marine Stewardship Council



Image by: Petro Viet Nam

In the 4 basins, Song Hong, Cuu Long, Nam Con Son, and Malay-Tho Chu, up to the end of 2020, the reserves of more than 1,500 million m³ of oil equivalent have been discovered. From these reserves, at the end of 2020, nearly 700 million m³ have been produced and around 800 m³ of oil equivalent remain to be produced in the coming years, after recalculated data from TX Cuong (2019)²⁵.

The oil & gas recoverable resources that can be discovered in the future vary according to different authors. TX Cuong (2019) estimated this number to be about 1.7 billion m³. According to N. Hiep (2019), the total resources in place can reach 6.5 billion m³ of oil equivalent.

These data show the good potential for long-term and sustainable growth of the oil & gas industry in Viet Nam. In order to fully realize this potential, it requires both incentives for foreign investment and the favourable regulatory frameworks for mobilizing different domestic resources.

2.3.2. Present status

Up to the end of 2020, nearly 700 million m³ of oil equivalent have been produced in Viet Nam. Production from Cuu Long basin counts for 74%, Nam Con Son basin counts for 18%, Malay-Tho Chu basin counts for 7% and Song Hong basin less than 1%. This shows that most of the oil & gas activities are located in the Southeast and Southwest regions.

²⁵ <https://www.pvn.vn/chuyen-muc/tap-doan/tham-do-khai-thac-dau-khi-can-co-co-che-chinh-sach-phu-hop/bdd75abe-1b4b-468b-bcd8-26e004b8f596>

²⁶ Challenges and opportunities for conventional and unconventional oil and gas energy development in Viet Nam. Proceedings of the Symposium “National Energy Security: the Role of Petroleum Industry”, pp 131 - 145, 7/2019

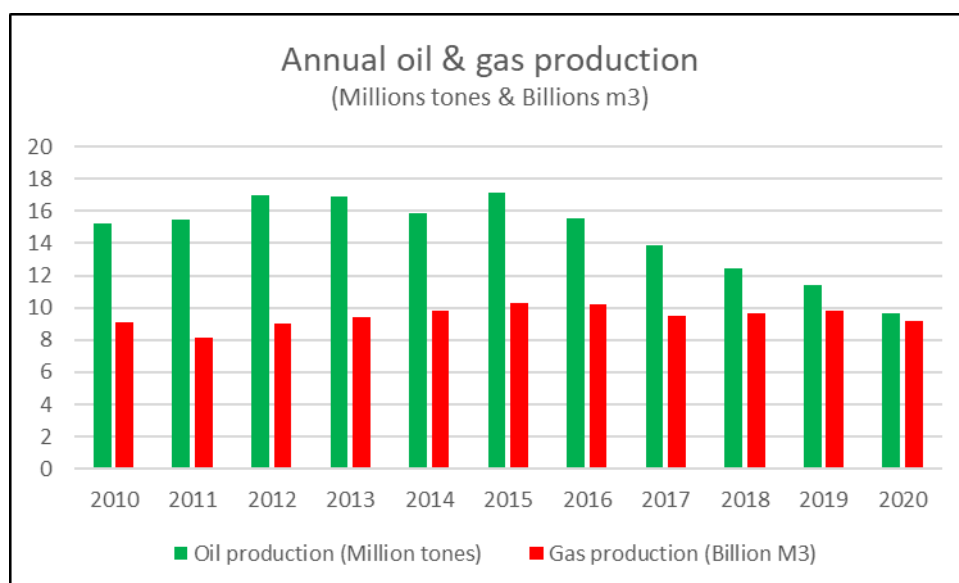


Figure 2.2. Oil & gas production during 2010-2020 (VPI)

The historical oil & gas production data during 2010-2020 show that oil production has reached its peak during 2012-2015 and is now declining. However, the gas production still remains almost steady.

The pace of production measured by reserves-to-production (R/P) ratio, calculated for oil is 51 years, for gas is 66 years at the end of 2019; these figures show potential longer time of production compared to Asia-Pacific and globally (BP, 2020)²⁷.

The investment level in the oil & gas exploration and production measured by the amount of invested money, the number of exploration, the number of appraisal wells and new signed petroleum contracts during 2016-2020 is declining. This will threaten the mid- and long-term growth of the sector.

The annual average amount of petroleum products produced by BSR²⁸ from domestic crude is around 6 million tons. The two fertilizer plants (Phu My, Ca Mau) are producing about 1.6 million tons of urea on average based on domestic gas feedstocks.

Around 15 billion Kwh of gas power are being produced every year by 4 gas turbine power plants of PetroViet Nam (Nhon Trach 1, Nhon Trach 2, Ca Mau 1 and Ca Mau 2). Besides, there are other gas turbine power plants operated by Viet Nam Electricity Corporation (EVN).

²⁷ BP Statistical Review of World Energy 2020. www.bp.com

²⁸ Binh Son Refining and Petrochemical Joint Stock Company

The extraction and processing activities related to other mineral resources in Viet Nam's sea and coastal areas (mainly titanium placers) are minor compared to the oil & gas sector.

2.3.3. Interaction with SDGs

The interactions between the sector and the Sustainable Development Goals (SDG) are shown in Table 2.2. The impacts on SDGs are measured by scoring from -3 to +3.

It is clear that, the progress of the oil & gas sector also delivers progress to most of the Sustainable Development Goals. Among the 17 SDGs, oil & gas sector only delivers minor negative effects on 2 SDGs, but gives positive impacts on 9 other SDGs. It especially delivers progress, or significant progress on 4 SDGs, namely SDG 1 No poverty, SDG 7 Affordable and clean energy, SDG 8 Decent work and economic growth and SDG 9 Industry, innovation and infrastructure.

This proves the important role of the industry to national economy and energy security.

Table 2.2. The impacts of the oil & gas sector on the SDGs

No	SDG	Score	Comments
1.	SDG 1. No poverty	+2	Oil & gas sector contributes remarkable portion of state budget, thus helps the government to have resources to end poverty in the remote and difficult areas.
2.	SDG 2. Zero hunger	+1	LPG produced from natural gas offshore Viet Nam may bring heat to remote communities and help with food preparation and cooking; Urea produced helps to get better agricultural outcrops. All help to end with hunger.
3.	SDG 3. Good Health and Well-being	0	
4.	SDG 4. Quality Education	0	
5.	SDG 5. Gender Equality	0	
6.	SDG 6. Clean Water and Sanitation	0	If not managed well, oil and gas can cause water pollution. (-) Oil & gas activities are mainly offshore and do not have impact on onshore water. In some cases oil & gas exploration even could help to find some water sources (f.e. Tien Hai). (+)
7.	SDG 7. Affordable and clean energy	+3	Development in the oil & gas industry and its energy transition lead directly to clean energy production affordable to all.
8.	SDG 8. Decent work and economic growth	+2	The Oil and Gas industry creates many direct jobs in large energy industrial regions like Southeast Viet Nam, Ca Mau, Quang Ngai, Thanh Hoa.... Besides, it creates many indirect jobs related with services, trading and products distribution.

9.	SDG 9. Industry, innovation and infrastructure	+2	Oil & gas sector develops infrastructure and leads the development for some industrial regions, like Ba Ria-Vung Tau, Southeast, Southwest, South- and North Central Viet Nam. By this, it promotes inclusive, sustainable development and fosters innovation in these areas.
10.	SDG 10. Reduced Inequality	+1	Providing clean and affordable electricity indirectly reduces inequality.
11.	SDG 11. Sustainable Cities and Communities	+1	Oil & gas industry contribute to sustainable urban development and communities (Vung Tau, Ho Chi Minh, Nhon Trach, Ca Mau, Quang Ngai, Thanh Hoa, Thai Binh...)
12.	SDG 12. Responsible Consumption and Production	+1	Oil & gas industry today and its transition to clean energy (renewable energy) show responsibility in energy production and consumption.
13.	SDG 13. Climate Action	-1	Oil & gas industry already has Action plan for mitigation of climate change (+), but as the main sources of GHG emissions this action plan may not be enough (-)
14.	SDG 14. Life below water	-1	Oil & gas sector uses the oceans, seas and marine resources and causes physical damage as well as further environmental hazards.
15.	SDG 15. Life on Land	0	
16.	SDG 16. Peace and Justice Strong Institutions	0	
17.	SDG 17. Partnership for the goals	+1	The traditional close partnership in oil and gas sector promotes global partnership for sustainable development.

2.4. Marine renewable energy

2.4.1. Resources

Viet Nam is assessed to have significant marine energy resources such as electricity generation from offshore winds, tides, waves and ocean flows. Offshore wind power has the greatest potential, if exploited, it will make a practical contribution to the targets of blue and sustainable marine economy development.

The potential of marine energy resources, especially offshore wind power of Viet Nam has so far not been fully quantified because of the lack of reliable data. However, there have been a few review studies which have provided encouraging figures in terms of installed power capacity potential but there is variation in capacity scale between these studies, from 160GW (source: C2WIND/COP; AEGIR; COWI) to 475GW (source: ESMAP/WB) event to 6,300GW (source: independent research team). Those differences may be due to the methodologies, approach as well as database source

used. Below is a summary of Viet Nam's offshore wind power potential from the selected studies.

Offshore wind power potential review report of international research agencies such as C2WIND/COP; AEGIR; COWI, which assesses the offshore wind power potential of Viet Nam within 100 km of shore at about 160 thousand MW ²⁹.

The report on the assessment of offshore wind power potential at sea of countries including Viet Nam published by the Energy Sector Management Program (ESMAP) of the World Bank Group in October 2019. Which, Viet Nam has about 261 thousand MW of fixed foundation and about 214 thousand MW of floating foundation³⁰.

The independent domestic research team also reviewed the wind power potential in the sea when considering the entire 200-nautical mile exclusive economic zone of Viet Nam, the results showed a total technical potential of about 6.3 million MW ³¹.

2.4.2. Present status

Viet Nam developed offshore wind power has two projects that have been put into operation by 2019 with a total installed capacity of 105 MW. These projects demonstrate the potential for offshore wind in Viet Nam but represent only about 0.02% of the 640 GW global offshore wind installed capacity in 2019³². The development situation of two offshore wind power projects is summarized as follows.

Cong Ly wind power plant is an investment project of a domestic private enterprise located in Bac Lieu province with a capacity of 99.2 MW. The project completed the installation of phase 1 in November 2012 with 10 turbines (type 1.6MW per turbine, provided by GE of the US). The project of selling electricity to the national grid started on May 29, 2013. Phase 2 of the project installs the remaining 52 turbines to sell electricity to the national grid with the schedule as follows: 10 turbines in April 2015. Continuing 10 turbines in 5/2015. Following 16 turbines in September 2015, and the final one of phase 2 with the remaining 6 turbines in June 2016. The capacity factor of both phases is expected to reach about 30%.

The wind power plant with a capacity of 6MW installed on Phu Quy island invested by PetroViet Nam Power Company was completed and put into operation in April 2012.

²⁹ <https://www.evwind.es/2020/05/19/vietnam-has-potential-for-160-gw-of-offshore-wind-energy/74789>

³⁰ ESMAP/WB, October 2019, Going Global, Expanding Offshore Wind to Emerging Markets

³¹ Du Van Toan ⁽¹⁾, Nguyen Hoang Anh ⁽²⁾, Pham Van Tien ⁽³⁾

³² <https://www.statista.com/statistics/268363/installed-wind-power-capacity-worldwide/>

This is a hybrid project between wind power and diesel power, producing electricity and supplying electricity to an independent 22kV power grid on Phu Quy island of Binh Thuan province.

The table below summarizes key information and revenue from electricity sales of the first two offshore wind power projects in Viet Nam in the period up to 2019.

Table 2.3. Information and revenue from electricity sales of the first two offshore wind power projects in Viet Nam in the period up to 2019

Categories	Unit	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Total power output	GWh	0	0	900	18.43	37.01	75.13	164.00	207.00	244.00	244.00
Total revenue	USD	0	0	702	14,374	35,763	72,629	159,120	200,860	236,720	237,170

Note: The electricity selling price of Cong Ly project is implemented according to Decision No. 37/2011/QĐ-TTg and Decision No. 39/2018/QĐ-TTg of the Prime Minister.

Source: Data collected from offshore wind power plants.

2.4.3. Interaction with SDGs

Linking offshore wind power development to Viet Nam's sustainable development goals through score-based assessments that reflect the interactions of offshore wind development across 17 sustainable development goals is outlined in the table below. In this assessment, many goals have a practical impact and achieve the maximum score such as goal number 7, 9, 13, slightly lower is goal number 8 and 12, then goal number 1, 3, 4, 6, 10, 11, 14, and 17.

This confirms that if managed well, offshore wind energy will make an important contribution to Viet Nam's sustainable development goals. Its impacts are not only providing green energy/electricity but also creating new jobs. Moreover, offshore wind power development is also a sector where it can significantly support and contribute positively to the implementation of the Paris Agreement on Climate Change (COP 21) and its commitment to achieving net-zero carbon emissions by 2050 (COP26).

Table 2.4. The Interaction between offshore wind power development with SDGs

SDG	Score	Comments
SDG 1	+1	Offshore wind power participates and contributes to poverty reduction
SDG 2	0	
SDG 3	+ 1	Offshore wind power indirectly supports health and good air quality

SDG 4	+ 1	Offshore wind power provides opportunities and platforms for access to quality education and learning
SDG 5	0	
SDG 6	+1	Offshore wind power contributes to clean water supply and access
SDG 7	+ 3	Offshore wind development focuses on access to affordable, reliable, clean and sustainable energy, diversifying power sources and contributions, and enhancing energy security.
SDG 8	+ 2	Offshore wind power contributes significantly to promoting economic development and creating jobs, especially for young people.
SDG 9	+ 3	Offshore wind development will promote development, infrastructure innovation (seaports, shipping and transport) and promote the development of supporting industries
SDG 10	0	
SDG 11	+ 1	It can also indirectly assist in achieving better health and air quality
SDG 12	+ 2	Developing offshore wind will contribute to the trend of using green products and sustainable consumption
SDG 13	+ 3	Developing offshore wind will make a positive contribution to replacing fossil fuels, reducing greenhouse gas emissions and contributing to climate change response.
SDG 14	+1	Offshore wind development will contribute to the sustainable use of marine resources
SDG 15	0	
SDG 16	0	
SDG 17	+ 1	Partnership with international and bilateral entities.

2.5. Coastal and marine tourism

2.5.1. Resources

Viet Nam has as many as 125 beaches that have a length of over 1 km or more, and some beaches stretch up to 15 -18 km long. The most beautiful beaches are located along the central coast, Quang Ninh province and on some large islands. Viet Nam has many lagoons and bays that are also valuable tourism resources.

Statistics by Le Duc An (1996) show that there are a total of 2,773 coastal islands, distributed mainly in Quang Ninh, Hai Phong, Kien Giang and Khanh Hoa provinces. Almost all islands possess a great potential to become attractive tourism destinations. Biodiversity in national parks, natural reserves, mangrove forests, biospheres, bird sanctuaries etc. is also an important tourism asset. Hot mineral water sources are important for the potential development of health tourism.

Besides natural resources, cultural and heritage resources (nature, culture) also have special significance for the development of marine and coastal tourism. Most of Viet Nam's World Heritage Sites are located along the coast: Ha Long Bay (Quang Ninh), Cat Ba Islands (Hai Phong), Trang An Landscape Complex (Ninh Binh), Ho dynasty citadel (Thanh Hoa), Hue Ancient Capital, Hoi An Ancient Town and My Son Sanctuary (Quang Nam). About 1/3 of Viet Nam's cultural relics are located along the coast with the highest density is in the North from Quang Ninh to Ha Tinh province (59% of the total coastal region). Festivals, villages and traditional culture would also be great attraction to tourists.

In general, tourism resources along Viet Nam's coast are abundant, diverse and valuable, which would greatly boost development of sightseeing, relaxation, ecotourism, sport and heritage tourism.

2.5.2. Present status

Tourism is becoming more and more important to Viet Nam's socio-economic development, in which marine tourism is the most important, taking about 2/3 of entire tourism sector. In 2019, Viet Nam welcomed 18 million international tourists and served 85 million domestic tourists. Total tourism revenue reached 32 billion USD, making an essential contribution to the economic growth of the country, representing 9.2% of the national GDP (Source: VNAT).

An assessment of marine tourism development in 28 coastal provinces Viet Nam was conducted. The assessment shows that the number of international visitors to coastal provinces has increased 13.6% per year, from 10.9 million in 2010 to 35.7 million in 2019. Similarly, the number of domestic tourists to 28 provinces has increased from 44.0 million in 2010 to nearly 145.6 million in 2019.

In 2019, the provinces attracting the most international visitors are Ho Chi Minh City, Quang Ninh, Quang Nam, Khanh Hoa, Da Nang, while most domestic tourists visited Ho Chi Minh City, Ba Ria - Vung Tau, Thanh Hoa, Quang Ninh, Hai Phong and Kien Giang.

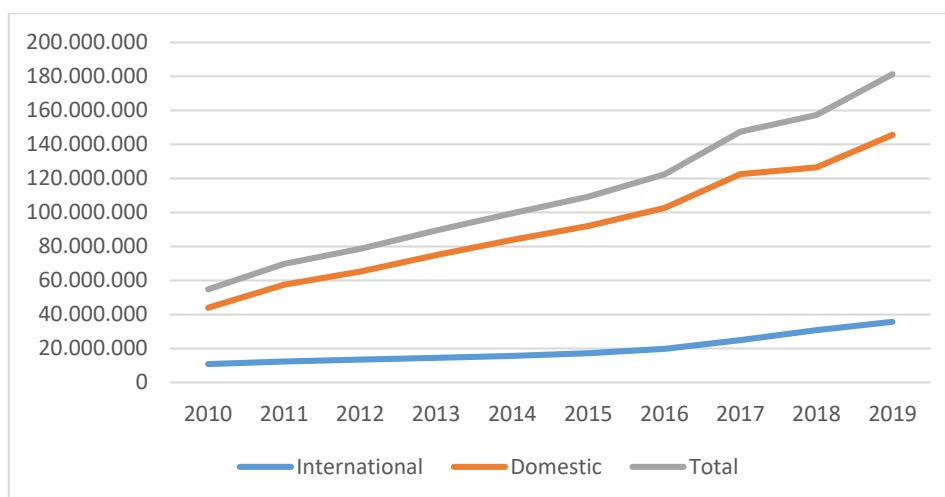


Figure 2.3. Tourism arrivals to provinces in Viet Nam coastal regions

Sources: statistics from provinces and cities

The total tourism revenue of 28 coastal provinces is over 508 trillion VND (67.3% of the whole sector). The total hotel rooms number of 28 coastal provinces is 398,234 in 2019 and accounts for 66% of whole country. Provinces with the largest accommodation offer are Khanh Hoa, Ho Chi Minh City, Da Nang, Thanh Hoa, Quang Ninh, Ba Ria - Vung Tau and Kien Giang. Cruise tourism, despite a huge potential, is still underdeveloped in Viet Nam due to shortage of appropriate infrastructure and suitable products. In 2019, Viet Nam served about 260,000 cruise visitors. The total number of direct tourism workers in coastal provinces has increased from 219,156 in 2010 to 738,979 in 2019. Besides traditional sun and beach tourism, other important tourism products include sightseeing, heritage and ecotourism and MICE (Meetings, Incentives, Conferences & Exhibitions).

2.5.3. Interaction with SDGs

World Tourism Organisation (UN-WTO) has clearly identified linkages between tourism and SDGs and that, tourism could be a significant tool in achieving these goals. However, as tourism is a business with a very complex nature as it involves a large numbers of stakeholders. This includes host communities, service providers, authorities, government agencies and tourists, under a proper and efficient management it would bring huge positive impact, and vice versa it would be a negative factor for environment and communities. Tourism can be either benefitting or damaging factor to environment and/or community. For instance, sustainable tourism with fair sharing of benefits to local community is a great approach for poverty alleviation, but sometimes large tourism complex, which requires extensive land

acquisition, would force local people to losing lands, properties as well as the opportunity to directly take part in tourism business.

Table 2.5. Tourism & SDGs

SDGs	Score	Comments
SDG 1	+2	Tourism is a labor-intensive industry, so it plays an important role in hunger eradication and poverty alleviation in many coastal areas of Viet Nam.
SDG 2	+2	Tourism is a labor-intensive industry, so it plays an important role in hunger eradication and poverty alleviation in many coastal areas of Viet Nam.
SDG 3	+2	Marine tourism improves the livelihoods of local communities, enabling them with conditions to take better care of their health and their family health.
SDG 4	+2	Sea tourism promotes local youth to participate in learning because they can understand the clear differences that education and knowledge could bring.
SDG 5	+2	As one of the sectors with the highest share of women employed and entrepreneurs, tourism can be an efficient tool for development of women, raising their roles and significance in families and communities.
SDG 6	+2	Tourist development also would probably improve water supply and drainage infrastructure, increase sanitation standards, and help improve the living conditions of local people.
SDG 7	+1	Local people can learn from innovative affordable and clean energy solutions in ecotourism establishment.
SDG 8	+3	Tourism has contributed 9.2% of national GDP and coastal and marine tourism is accounted 2/3 of entire tourism sector, is very direct tool for decent work and economic growth.
SDG 9	+3	Improve infrastructures for coastal regions and islands such as tourism ports, airports, roads and bridges, drainage, power supply, telecommunication, etc. where there are tourism development potentials.
SDG 10	+2	Marine tourism contributes to narrowing the gap and promoting development in remote, isolated and underdeveloped areas, reducing inequality, and thus is an important contributor to reduce inequity.
SDG 11	+3	Good contribution to sustainable urban development and coastal communities.
SDG 12	+1	Well-mannered tourists with ever growing awareness on sustainability would encourage local people and suppliers in responsible consumption and production.
SDG 13	-2	Tourism both contributes to and is affected by climate change.
SDG 14	+3	Coastal and maritime tourism, tourism's biggest segments, rely on healthy marine ecosystems. So preserving and developing life below water is completely in line with the future of coastal and marine tourism.
SDG 15	+2	Natural landscapes, natural reserves, rich biodiversity, and natural heritage sites are often main objectives of tourists. Sustainable tourism can play a major role, not only in conserving and preserving environment, nature and society.
SDG 16	+2	Contributing to enhancing cultural exchange and mutual understanding.
SDG 17	+1	Strengthen cooperation with stakeholders to contribute to sustainable development together.

2.6. Maritime sector

2.6.1. Resources

The marine and coastal navigation system are the lifeline of the country representing about 90% of the volume of import and export goods and 100% of cargo passing through the East Sea. Which is one of the seas with the busiest international maritime trade routes in the world, connecting the Indian Ocean and the Pacific Ocean with a trade value of about 5.3 trillion USD annually. The volume of goods exported through the East Sea by Southeast Asian countries, the newly industrialized countries, and Australia are 55%, 26% and 40%, respectively. In the region, there are major ports such as Singapore - the largest container seaport in Southeast Asia and the second largest in the world.

Viet Nam's maritime industry rapidly developed in the 1990s when the economy and trade began to open up. The leap forward development of shipping in the years after “doi moi” showed an increase in the volume of containers transported through Viet Nam's seaports by more than 1,500% in the period 2001-2019.

2.6.2. Present status

Maritime economy includes three main sub-sectors: shipping, port construction and services, ships building and repairing.

(1) Marine Transport

Marine transport is one of the five main modes of transport in Viet Nam including road, rail, inland waterway, sea and air transport. In 2019, there were nearly 493 million tons of goods transported by sea, accounting for about 23.2% of the total transport volume of all modes and 95.6% of the volume of imported and exported goods (corresponding to about approx. 65% of the value of imported and exported goods). The total volume of goods through the seaport in 2019 is 2.5 times higher than that of 2011, the average growth in the period 2011 - 2019 is 9.18% per year, of which container cargo increases by 3.1 times, the average growth 13.4%/year. Sea transport mainly handles large-volume cargos such as containers (accounting for about 35%-40%), crude oil, petrol, gas, coal, ores, cement, iron and steel, grains, etc.

Up to now, about 90% of the international transport market share (import and export freight) of Viet Nam is carried out by foreign shipping lines, especially in ocean container transport which undertakes almost all.

(2) Seaports operation

Over the past 20 years, Viet Nam's seaport system has made a remarkable development in both quality and quantity, meeting the development goals in accordance with the approved planning in each period and creating a driving force for the economic, industrial and urban coastal development. It has formed general, container and specialized wharf areas as well as international gateway ports in Cai Mep - Thi Vai, Ba Ria - Vung Tau province and Lach Huyen - Hai Phong port which are competitive with other countries in the region. Most of the general and regional ports have been newly invested and renovated to allow receiving ships up to 30,000 DWT and larger. At Hon Gai (Quang Ninh) and Phu Quoc (Kien Giang), investment has been made to build specialized passenger ports, when these ports are completed, they will be able to receive international passenger ships with a tonnage of up to 225,000 GT.

By the end of 2019, the national seaport system has 588 berths with a total length of 96,275m, 4 times higher than in 2000. The total volume of goods passed through reached 664.6 million tons, 8 times higher than in 2000; the average growth of goods through the port in the period 2000 - 2019 is about 10 - 12%/year, the average growth of container cargo is 13.4%/year. Viet Nam's container port operations are concentrated mainly in two main centres, namely Ho Chi Minh City - Vung Tau and Hai Phong - Quang Ninh, accounting for 70% and 25% of the total container volume of the country, respectively. The compound growth rate from 2000 - 2019 is more than 15%.

(3) Shipbuilding Industry

There are about 97 shipbuilding factories in Viet Nam (from 1,000 DWT or more) of which, 92 factories in the North, 13 factories in the Central, and 15 factories in the South. The total designed capacity of the newly built factories is 2.6 million DWT/year, but the actual capacity is only 0.8 million DWT/year (reaching 31%) equivalent to 150-200 ships/year. Viet Nam Shipbuilding Industry Corporation (Vinashin), established in 2006, which is now the Shipbuilding Industry Corporation (SBIC) plays a major role. Shipbuilding facilities are also owned by Viet Nam National Shipping Lines Corporation, the Viet Nam National Oil and Gas Corporation and a number of other State corporation and companies, shipbuilding facilities under the management of the Ministry of National Defence, local, private and foreign-invested enterprises.

After going through a very rapid development period, Viet Nam's shipbuilding industry fell into a spiral of crisis after the collapse of Vinashin. After a long period of crisis, Viet

Nam's shipbuilding industry is showing signs of recovery, but there are still many difficulties and challenges

2.6.3. Interaction with SDGs

The maritime industry has had both positive and negative interactions with 17 sustainable development goals. Impact and magnitude of impacts are summarised in the following table.

Table 2.6. Maritime Development and SDGs

Goal	Score	Comments
SDG 1	+1	Shipping activities, seaports and shipbuilding industry have certain contributions to job creation and income for coastal areas and islands. For example, many coastal localities have had jobs by participating in seaport operations, operating in the shipbuilding industry and working in shipyards, working as crew members on ships, since then. have income, improve the quality of life, eliminate hunger and reduce poverty.
SDG 2	+1	Maritime contributes a part to the state budget, thus helping the Government with resources to eliminate hunger and reduce poverty in remote and disadvantaged areas.
SDG 3	+1	Shipping activities will help increase local revenue, thereby indirectly contributing to the improvement of health and a good life in the regions. Emissions from shipping are significant, but only one of many sources released into the atmosphere and released into the sea. However, transportation has a limited impact on substance abuse and traffic accidents globally.
SDG 4	+1	Shipping activities will help increase local revenue, which will indirectly contribute to quality education.
SDG 5	-1	Shipping is one of the industries with a much higher proportion of male employees than female employees. The development of maritime transport without proper attention to gender equality will lead to deeper gender stereotypes.
SDG 6		
SDG 7	+2	Shipping also contributes to the development of clean energy in the world such as renewable energy solutions - biofuels, hydrogen, solar and wind power, improved energy efficiency and continued implementation. emission reduction solutions to achieve zero emissions.
SDG 8	+3	Maritime accounts for over 90% of Viet Nam's import and export goods (over 60% of value), so it plays a vital role in Viet Nam's economic growth thanks to the development of valuable and value-added service industries. high. It is necessary to apply modern, competitive technology, etc. Furthermore, jobs in ports, on ships and other maritime-related jobs offer many opportunities for young people of all skill levels.
SDG 9	+3	Building modern seaport infrastructure and fleets contributes to creating a synchronous transport system, thereby reducing national logistics costs, increasing

		trade capacity and competitiveness of foreign trade goods, promoting develop sea tourism.
SDG 10	+1	Maritime has a limited direct impact on inequality between countries. Coastal States are responsible for organizing search and rescue operations.
SDG 11	+2	Maritime has a limited direct impact on inequality between countries. Coastal States are responsible for organizing search and rescue operations
SDG 12	+3	Maritime contributes to improving market access and promoting the export of Viet Nam's key export products in a sustainable way (reducing logistics costs); Contributing to strengthening the distribution system and developing the national product supply chain.
SDG 13	-2	World shipping annually emits about 940 million tons of CO2 and accounts for about 2.5% of total global greenhouse gas (GHG) emissions. Switching ship-utilized energy from fossil fuels to low-carbon alternatives, including renewables in the future, will contribute to reducing greenhouse gas emissions.
SDG 14	-2	Maritime activities may pose some risks to the marine environment such as large number of vehicles or oil and chemical spills, maritime accidents. The shipping industry contributes 20% of marine pollution. Transport is the single largest contributor to the transfer of alien species. Emissions into the atmosphere contribute to the acidification and eutrophication of the oceans. Maritime operations have been minimized discharge of ballast water, chemicals, waste, oil and wastewater, reduced emissions into the atmosphere during operations as well as introduced anti-biological pollution regulations to prevent the transfer of alien species, minimizing disturbance to marine life, by minimizing acoustic noise and by identifying appropriate operational measures in the most environmentally sensitive areas.
SDG 15	-1	Maritime operations have released ballast water. Exotic species introduced by ships can affect terrestrial ecosystems.
SDG 16	+1	Maritime operations are the primary transport of goods, which may include illegal goods. It works around the world to reduce opportunities for corruption, bribery and illicit flows by enhancing transparency about goods, destinations, financial transactions and the use of agents. agent and mediator.
SDG 17	+3	Maritime is one of the important topics in bilateral and multilateral negotiations within the framework of international trade organizations. Maritime contributes to improving the value and competitiveness of Viet Nam's foreign trade goods. Maritime and seaports are very suitable to promote public-private partnerships, especially in the field of investment, construction and operation of seaports. Shipping can make an important contribution to the partnership, and there is a

		dedicated international organization (IMO) to develop international policies and regulations.
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2.7. Environment, Biodiversity & Ecosystem Services

2.7.1. Resources

Viet Nam's sea is a humid tropical sea with diverse and productive ecosystems. Viet Nam's marine area has about 20 ecosystems, including marine ecosystems around coastal islands, offshore islands especially water areas and deep seabed areas (the sea around Hoang Sa and Hoang Sa archipelagos and islands in the East Sea and South Viet Nam). Truong Sa). The coastal area, where hundreds of estuaries, lagoons, bays, islands and archipelagos are concentrated, creates a diverse landscape system with various ecosystems such as tidal flats and swamps, mangroves, estuaries, lagoons, coves, coral reefs, deltas, sandbanks, tidal mudflats, upwellings, brackish aquaculture lagoons, etc. Mangroves, coral reefs, seagrass and lagoons are considered typical ecosystems because they are the most biodiverse, contains highest conservation value and ecological-economic significance. Coastal landscapes and islands together with natural ecosystems with high biodiversity, are also the premise for the development of economic sectors such as tourism, fisheries and renewable energy. In addition, marine ecosystems also contain important functions such as carbon sequestration (seagrass and mangroves), climate regulation and disaster prevention. Viet Nam's sea is located on important traffic routes that are both opportunities for marine traffic and services development, but also pose many challenges for pollution and marine environmental incidents.

2.7.2 Assessment of the current state of the environment and biodiversity in the process of economic development in Viet Nam

Main marine ecosystems in Viet Nam are facing the risk of a decline in quantity and quality due to multiple and cumulative impacts. Changes in the area of mangroves in Viet Nam follow two trends, including a decrease in primary forest area and an increase in newly planted forest area. Up to now, the primary mangrove forests are almost gone. This leads to a decline in marine biodiversity, especially loss of spawning grounds and habitats for aquatic species, and destruction of nearby ecosystems such as chives and seagrasses. Coral reefs in the sea of Viet Nam are decreasing in area and coverage of live coral. Coverage of living corals on reefs in coastal areas is decreasing over time, in some places up to over 30% in the past 10 years. Seagrass ecosystems are being degraded and the area of seagrass beds has been reduced due to human

activities such as fishing, boat mooring, aquaculture causing environmental pollution, port construction activities and tourist facilities.

According to monitoring data, the quality of Viet Nam's marine environment data is still good, the pollution index is within the allowable limits. However, coastal areas and estuaries are at high risk of pollution, and there have been serious marine environmental pollution incidents. In 2016, the wastewater discharge of Hung Nghiep Formosa enterprise caused serious coastal pollution to the coastal areas of Ha Tinh, Quang Binh, Quang Tri and Thua Thien Hue provinces. Oil spills are still complicated and pose a high risk to Viet Nam's sea. Pollution caused by garbage, wastewater from the mainland and coastal socio-economic activities has not been completely prevented. The alarming problem of waste and plastic pollution causes damage and deterioration of coastal ecosystems.

2.7.3. Interaction with SDGs

Preliminary assessment of the correlation between Environment, Biodiversity & Ecosystem Services and SDGs in Viet Nam is as follows.

Table 2.7. Environment, Biodiversity & Ecosystem Services and SDGs

Goal	Score	Linked to Environment, Biodiversity & Ecosystem Services
SDG 1	+2	Biodiversity conservation, environmental protection and the expansion of ecosystem services enhance potential for economic activities (marine tourism, fisheries, renewable energy, etc.), increase the number of job opportunities that bring higher income for coastal residents.
SDG 2	+2	Biodiversity conservation helps increase the fisheries resources that yield high value of food supply.
SDG 3	+3	Marine ecosystems (mangroves, coral reefs and sea grasses) can be valuable raw materials for the production of medicine. Clean water helps to protect everyone's health when swimming.
SDG 4	+2	Biodiversity provides broad and rich knowledge through marine flora and fauna surveys that support biological students, researchers, and more.
SDG 5	+1	Women are a large force in all activities related to biodiversity conservation.
SDG 6	+3	Protecting the marine environment and biodiversity will contribute to protection and supply of clean water. Notably, desalination is an important process to ensure enough clean water in some countries.

SDG 7	+1	Maintaining a safe marine environment will indirectly support wind power development and offshore oil and gas production.
SDG 8	+2	Protection of the environment and marine biodiversity contributes to the sustainability of marine economic sectors such as tourism and fisheries.
SDG 9	0	There is a two-way relationship, positive and negative: Positive and negative, considered neutral.
SDG 10	+1	Increasing job opportunities for coastal residents through protecting environment can help reduce inequality in society.
SDG 11	+2	Cities in 28 coastal provinces of Viet Nam have many opportunities for urban development if they maintain the protection of marine environment and biodiversity and utilize sources of revenue from ecosystem services.
SDG 12	+3	High demands for responsible consumption and production.
SDG 13	+3	The mangrove ecosystem makes an important contribution to climate change response and disaster prevention. One of the most essential roles of marine ecosystem services is carbon storage - an indispensable solution to mitigate climate change.
SDG 14	+3	Enhancement of marine environmental protection and biodiversity conservation is the realization of SDG14.
SDG 15	+3	Mangroves play a role in preventing storms, natural disasters, protecting forest ecosystems and inland resources.
SDG 16	+3	Protection of the marine environment and biodiversity requires aid from all people at all levels.
SDG 17	+2	Strengthen cooperation between the parties to protect the marine ecological environment.

Source: Nguyen The Chinh, 2021

Table 2.40 shows that the link of environment, biodiversity and ecosystem with sustainable development goals is mainly positive, except for goal number 9 where a two-way impact is present. For industrial development, infrastructure has a negative impact (-) where as for creativity, environment, ecosystem and biodiversity it has a positive relationship (+). Therefore, the total relationship is assessed by 0.

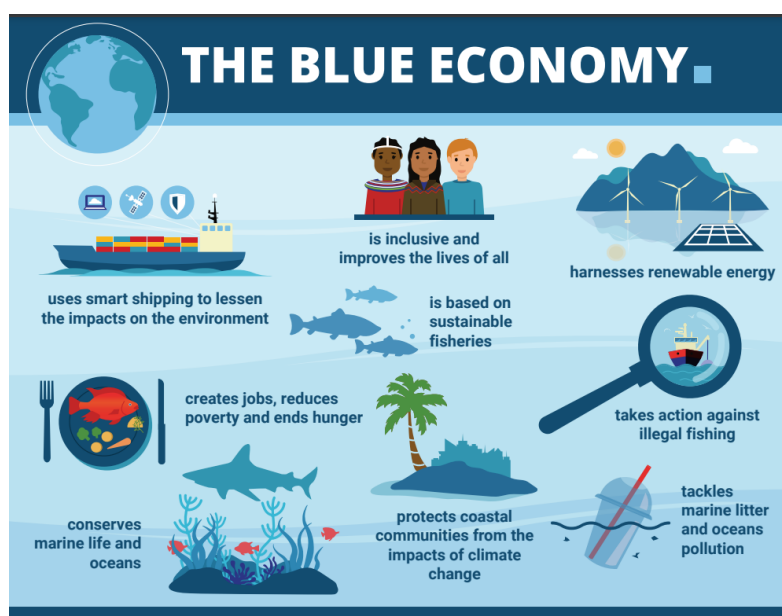
3. Blue economy scenarios

3.1. Introduction

On the basis of assessing the current status, analyzing the context, market trends, exploitation capacity as well as the national socio-economic development requirements and the requirements for the development of the blue sea economy, each ocean economic sector has particularly outlined the development scenarios for the period up to 2030. The analysis has assumed the specific conditions of each scenario in each sector and proposed the scenario to be developed with possible assessments from experts' point of view for reference. There are two scenarios to be considered for each sector:

Baseline Scenario: Developed from the assumption that resource conditions and policy mechanisms are based on current approaches and plans and strategies have been developed up to 2030. The baseline scenario represents the business-as-usual scenario for the country based on approved policies and plans. Economic sectors still develop in their available marine space, without causing major conflicts to other marine economic sectors. The environmental impact of marine economic sectors is still at an acceptable level, although there have not been any significant actions to improve the environment and enrich the marine ecosystem. Economic growth is basically similar to the average of the past 10 years.

³³**Blue Scenarios:** The Blue Scenarios are built on the idea that additional realistic and feasible interventions by 2030 could change economic and social outcomes in a more positive direction than the baseline scenario. Under this scenario, mechanisms and policies are adjusted to be more suitable with the requirements of increasing



³³ <http://www.blueeconomyconference.go.ke/wp-content/uploads/2018/11/SBEC-Infographic-Official-compressed.pdf>

quality and ensuring environmental sustainability and maintaining marine resources. The environmental impact of marine economic sectors is still at an acceptable level and real actions have been taken to improve the environment and enrich the marine ecosystem such as issuing marine conservation policies and regulations, planning to develop the system of marine protected areas. Marine economic sectors still basically develop in their available marine space, without causing major conflicts to other marine economic sectors.

3.2. Fisheries and aquaculture

Development prospects of Viet Nam's Aquaculture and Fisheries depend on many factors, of which economic, social and environmental sustainability is decisive. Limits on aquatic resources, land, fishing and farming techniques, human resources, investment capital, and markets will limit the development direction of the Aquaculture and Fisheries sector. On the other hand, the prospects of Blue Aquaculture & Fisheries also depend on the correlation with other marine economic sectors, especially areas with disputed marine resources.

To visualize the Development prospects of Viet Nam's Aquaculture and Fisheries, this report presents two scenarios: baseline and blue scenarios as follows.

3.2.1. Baseline Scenario

The baseline scenario reflects the current development trends, policies and priorities in the absence of any changes. The baseline provides a reasonable trajectory for growth and structural change of the sector for the ten-year period 2020-2030 that can be used as a basis for comparison.

Capture fisheries:

For fisheries stock, we assume that without any improvement in the fisheries management regimes and fisheries resource protection actions, the average annual biomass of marine fish resources in the period of 2021-2030 will still show a decreasing trend of 1% per year as the previous period of 2005-2016. Furthermore, this scenario also assumes that the marine fisheries resources in the deep-sea areas and continental shelf areas of Viet Nam have not been conducted.

For total capture catch, the annual capture catch has been increasing gradually by 5.36% per year between 2010-2019. This trend will be continued with the increase rate of 5% per year in the next period of 2021-2030.

³⁴For the fishing vessel fleet and horsepower, the number of near shore and middle shore fishing vessels will show a decreasing trend of 5% between 2013 to 2019 as mentioned in the D-FISH (2019). The number of offshore vessels will be frozen and not be allowed to be increased in the next few years. Therefore, offshore vessels will be assumed to be a stable trend (remained as the number of 2019 vessels) at about 30.47 thousand vessels. However, the total horsepower of vessel fleet has increased by 6.58% per year in the last ten years and will be assumed to continue to increase by 6% per year in the next period due to technical improvements in fishing vessels. This means overfished stocks are increasingly fished in the next period. Therefore, at some point, there will be an exponential decline of catch per unit of effort (CPUE) and the multiple species stocks move towards a crash, with a rapid decline of CPUE. In the last periods of 2010-2019 (10 years) and 1990-2019 (30 years), CPUE declined annually by 1.05% per year and 4.1% per year, respectively. However, lack of stock/capture information for both nearshore and offshore fisheries, this leads to high uncertainty in fish stock data in Viet Nam (mentioned in section of 2.3.1 and in the later section of challenges 7.1). Therefore, it is very difficult to predict for how long the marine catch and horsepower could continue to increase or will move toward an exponential decrease (a crash), leading to sharp decline of CPUE. Therefore, it is recommended to take the growth rate of CPUE in the last 30 year-time of 1990-2019 (instead of 10 year-time of 2010-2019) with the decreasing rate of 4% per annum as CPUE growth rate in the next period 2020-2030.



Hoai Nhon Commune's (Binh Dinh) fishing vessels –
Image by: QUIN QUIN

According to World Bank (WB, 2017), the cost of fishing is highly dependent on the fishing effort, or more formally the fishing cost is the function of fishing effort, $C = F$ (e). Overfishing has a significant cost associated with it. Therefore, in this baseline scenario, when the total horsepower of vessel fleet will continue to increase by 6% per year in the next period, the cost of fishing will rapidly increase as too many fishermen and vessels will chase fewer fish. If overfishing is of great enough magnitude, the

³⁴ <https://www.sggp.org.vn/khai-thac-thuy-san-ben-vung-chuyen-nghiep-lam-dung-de-di-xa-nhung-diem-sang-giua-khoi-xa-770926.html>

fishermen may fish at a loss with extremely high efforts and associated costs (C), yielding negative profit (a loss). However, with high uncertainty in fish stock data in Viet Nam, we cannot reliably estimate over a long period of time and assume that the increase rate of intermediary cost of capture production in the next decade will be at 3.79% per year as the last period 2010-2019.

Coastal and Marine aquaculture:

Shrimp farming is one of the key farming species in brackishwater in coastal areas of Viet Nam. The potential area for coastal shrimp farming is about 750,000 hectares with about 720,000 hectares already used³⁵. In this baseline scenario, we assume that the rate of shrimp farming expansion in the next period of 2020-2030 will be increased by 1% per year as the previous period (1.24% in 2010-2019). Due to continuous expansion of farming areas, the environmental impacts and disease outbreak will be more serious, leading to the costs for disease prevention and environmental treatment to increase and the crop failure frequency will be high at 20%³⁶. With the assumption of 20% crop failure accumulative over the whole period of 2020-2030, the annual average shrimp farming productivity and production will be reduced in the next decade are predicted at by about 2.5% and 2% per year, respectively.



Shrimp farming in Long An Province – Image by: Hồ Cầu/VNA³⁷

³⁵ VIFEP (2012), *Master Plan for Fisheries Sector Development towards 2020 and visions to 2030*, Hanoi.

³⁶ According to OXFAM (2018), the crop failure in shrimp farming is about 30% for white leg vannamei shrimp and 15% for *Penaeus* tiger shrimp in the period of 2010-2016. In this UNDP blue economy research, as the baseline scenario expands shrimp farming area further, it is assumed that the rate of crop failure of 20% is continued to happen in the next decade.

³⁷ <https://www.vietnamplus.vn/long-an-danh-1244-ty-dong-phat-trien-vung-nuoi-tom-nuoc-lo/638660.vnp>

The potential area for marine aquaculture development is about 500,000 hectares³⁸ located in closed bays, nearshore islands, middle-shore areas and low tidal flats. These areas can be exploited for marine aquaculture development (marine fish, mollusk and other species of lobster, seaweed, etc³⁹). Currently, about 57,000 hectares out of that area have been used for marine aquaculture development and the remaining 443,000 hectares are still potentials for exploitation, especially in the middle-shore areas. The main reasons for under-development of the marine aquaculture sector in the last period are difficulties and costs constraints in high initial investments on sea cage culture and low farming techniques, while the market price of cultured seafood is still low and export markets for local cultured seafood is still limited. In this baseline scenario, we assume that those constraints cannot be overcome in the next period, thus leading to the growth rate of marine aquaculture area, production and productivity as still the same as previous period 2010-2019 at 4.6% per year, 8.7% per year and 4% respectively.

For other parameters, we assume that the growth rate of aquaculture labour and intermediary cost of aquaculture production in the next period will be the same as previous ones.

The baseline scenario for marine capture and aquaculture sector will produce the sector's real GDP and real GNI in the year 2030 at VND 122.1 and 119.66 thousand billion, respectively; and per capita, GNI would reach VND 35.65 million per person.

3.2.2. Blue Scenario

The blue scenario for fisheries and aquaculture is a number of management actions taken which modify the baseline scenario and are outlined in the subsequent sections.

Blue capture fisheries:

In this blue scenario, we predict that, management agencies at both levels of local and central governments will take appropriate actions, as described in detail below, in fisheries management and fisheries resource protection to improve country's marine fisheries sustainability according to the regulations in the 2017 Fisheries Law. Furthermore, the marine fisheries resources in the deep-sea areas and continent shelf areas of Viet Nam will be assessed fully during 2021-2030 (personal discussion with D-FISH officers and RIMF researchers) so, the add-on to those standing potential fisheries

³⁸ MARD (2018), *National strategy for marine aquaculture development towards 2030 and visions to 2050*, Hanoi.

³⁹ The farming area and production of lobster, seaweed, crab, etc account for small number in the total marine and coastal aquaculture, so those species are grouped together in only one category.

resources in the next period can be predicted. Therefore, the average annual biomass of marine fish resources in the period of 2021-2030 will revert the decreasing trend of the baseline scenario and will be maintained at the level of 4.365 million tonnes per⁴⁰ year.

In terms of annual catch, in order to ensure sustainable development of capture fisheries and fisheries resources, the annual marine catch will have to be reduced to the defined level of maximum sustainable yield (MSY) of 2.65 – 2.75 million tons per year in the next period of 2020-2030. This



Fisherman in Khanh Hoa catching tuna fish. (Image by: Nguyễn Dũng/VNA)

MSY has been identified by Research Institute for Marine Fisheries (RIMF) with the models of Gulland (1971) and Schaefer (1954). To reach this MSY in 2030, the annual marine catch has to be reduced gradually by 2% per year in the next period of 2020-2030. This means that, the increase trend in annual catch in the previous period of 2010-2019 have stop since 2020 onwards. Therefore, from this target of reaching the MSY in 2030, other indicators for capture fisheries are developed accordingly (such as fishing effort, CPUE, labour) as follows: Fishing effort: With fishing vessel fleet and associated horsepower, the total of 96,609 fishing vessels in 2019 include four types of vessel length operated in three different fishing grounds: nearshore, middle-shore and offshore. As analysis in above sections, the fishing vessels with the length of 6-12m and 12-15m operated in the nearshore and middle-shore will be the targets for vessel cut off in the next period for fishing capacity reduction purpose, especially with the vessels 6-12m operated in nearshore areas. This is due to most of the 12-15m vessels were built with wood and installed with outdated engines from 15-20 years ago. Some of those vessels do not meet safety requirements for long sea trips, especially in bad sea weather. On the contrast, majority of the 30,400 offshore vessels are quite new and invested with higher investment costs, so their life times are still

⁴⁰ <https://www.vietnamplus.vn/ho-tro-lao-dong-danh-bat-va-che-bien-thuy-san-dong-nam-a-di-cu-an-toan/690536.vnp>

long and not easy to cut off. Therefore, we predict that the number of nearshore and middle shore fishing vessel fleets will be continuously reduced by 5% per year in the next period of 2021-2030 to 40,000 vessels/boats in 2030, while the number of offshore vessels will be frozen at the level of 30,400 vessels (as previous period 2010-2019) and not be allowed to be increased in the next few years. Accordingly, the total horsepower for nearshore and middle-shore vessels will also have to be reduced for sustainable development purpose with the reduction rate of 5% per year, higher than the one in the previous period of 2013-2019 (0.26% per year). In contrast, the total horsepower for offshore vessels will be the same for the previous period as the number of vessels will be stabilized (See annex 1 for detailed data of marine capture in the last period 2010-2019 and projection for the next period 2020-2030).

Although the total horsepower for nearshore and middle-shore vessels will be reduced and several effective management actions will be taken to solve the problem of overfishing and overcapacity in capture fisheries, we still see that the CPUE will still have to be reduced by 1% per year in the period of 2020-2030 for the purpose of resource protection and recovery and also because of the total annual maximum sustainable catch will be also reduced by 2% per year as mentioned above.

For capture labour, as the number of nearshore boats and middle shore vessels will be cut off in the next period, together with the technical improvement in advanced capture techniques, the number of labours required to work in each fishing boat/vessel will decline, leading to the total number of labours involved in this sector to reduce at a rate of 0.63% per year. It must be noted that at the same times, the technical and management skills of the fishermen will have improved with more professional skills.

For intermediary costs of capture production, we assume that it will be maintained at the previous level given the context that the CPI of the national economy will be fluctuated not so much.

Blue aquaculture:

In the last period of 2010-2019, about 720,000 hectares out of potential 750,000 hectares have already been used for existing shrimp farming. And we predict that the areas for shrimp farming for the next period of 2020-2030 will be maintained at the same level of area as in previous period with 720,000 hectares. At the same time, more efforts will be put into shrimp farming management and technical improvement in order to increase the level of sustainability of those existing 720,000 hectares of shrimp farming. Also, to ensure sustainable shrimp yield, the shrimp production and

productivity should be increased only slightly in the next period (due to the continual improvement in shrimp farming techniques), with the growth rate of less than previous ones, at 3.5% per year for both production and productivity (compared to 5.5% and 4.4% per year in the last period).

For marine aquaculture, about 57,000 hectares out of 500,000 hectares potential area (only 11.4%) have been used for marine aquaculture development in the last period of 2010-2019. With more investments on sea cage culture, and marine fish farming technique and hatchery improvements, especially in middle-shore areas, about 105,000 hectares of those potential areas could be further exploited for marine fish, mollusc and other species farming in the next period with the annual area growth rate of 5.7%.

To be specific for each farming species, the annual growth rate of farming areas for marine fish, mollusc and other species will be at 16.4%, 1.8% and 8.5% per year, respectively.

More efforts will be put on technological research and better management practices for marine aquaculture, the marine aquaculture production and productivity are predicted to increase by 11.8% per year and 5.8% per year, respectively. For each farming species, the annual growth rate of productivity for marine fish, mollusc and other species will be at 8%, 3% and 5% per year, respectively.

For aquaculture labour, in following with the general trend of higher technological application in shrimp aquaculture farming, automatization will be more common in farming work, such as auto-feeding, auto environmental monitoring and responding, e-traceability, e-commerce, e-advisory and e-extension, etc. Therefore, with shrimp farming area stable, the work load needed for one unit of shrimp farming hectare will be reduced and the total number of labourers required for the sector will also decline at the annual rate of 0.52% per year.

For marine aquaculture, as the farming areas are projected to increase significantly in the period of 2020-2030 for all key species of marine fish, mollusc and other species, the number of jobs that this sector may create in that period will increase at 18.3% per year, 3.9% and 7.9%, respectively. The technical and management skills of farmers will also be enhanced toward more professional and skilful.

For intermediary costs of aquaculture production, we assume that it will be maintained at the previous level given the context that the CPI of the national economy will be fluctuated not so much.

In this recommended development scenario, we calculate GDP and GNI of the sector at real price in 2020 for the period of 2020-2030.

The recommended blue scenario for marine capture and aquaculture sector will produce the sector's GDP and GNI at real price in 2020 in the year 2030 at VND 337.93 and VND 331,17 thousand billion, respectively; per capita, GNI would reach VND 114.20 million per person.

In the blue scenario, as annual marine catch in 2030 has been defined to be reduced to MSY of 2,750,000 MTs, reduced by 22.9% comparing to the year of 2019 (3,565,000 MTs), the fishing efforts has to be also cut off in 2030 by 26.8% from 96,609 vessels in 2019 to 70,400 vessels in 2030.

The mentioned baseline and sustainable development scenarios for marine capture fisheries and aquaculture are presented in the below table:

Table 3.1. Baseline vs blue scenarios for next period 2020-2030

Item	Unit	Status in 2010-2020 period	Baseline scenario 20-30	Blue scenario 20-30
Marine & Coastal Capture Fisheries				
Fisheries stock	%/year	- 1.36	- 1.36	Maintain at 4.36 tonnes, no decline
Total marine & coastal capture catch	%/year	+ 5.36	+ 5	- 2%, to 2.75 million tonnes per year
Offshore fishing vessel fleet	%/year	+ 2.57	0	0
Nearshore fishing boats	%/year	- 5.42	- 5	- 5
Total horsepower	%/year	+ 6.58	+ 6	- 1
CPUE	%/year	- 1.05	- 4	- 1
Intermediary cost	%/year	+ 3.79	+ 3.79	0
Labour	%/year	+ 4.61	+ 4.61	- 0.63
Coastal/ Marine Aquaculture				
Farming area - Shrimp	%/year	+ 1.24	+ 1.24	0
Production - Shrimp	%/year	+ 5.5	- 2.0	+ 3.5
Productivity - Shrimp	%/year	+ 4.4	- 2.5	+ 3.5
Area - Marine aqua	%/year	+ 4.56	+ 4.56	+ 5.7
Prod - Marine aqua	%/year	+ 8.68	+ 8.68	+ 11.8
Productivity - Marine aquaculture	%/year	+3.94	+ 3.94	+ 5.8

Labour – Shrimp	%/year	+ 3.68	+ 3.68	- 0.52
Labour – marine aqua	%/year	+ 4.09	+ 4.09	+ 13.56
Policy		2003-Fisheries Law	2003-Fisheries Law	2017-Fisheries Law, enforced since Jan 2019

Source: Cao Le Quyen, 2021

Table 3.2. Projection for GDP, GNI and GNI per capita (2030) at real price in 2020 of marine capture and aquaculture in the next period of 2020-2030

Year	Baseline scenario 2020-2030			Sustainable development scenario 2020-2030		
	GDP	GNI	GNI per capita	GDP	GNI	GNI per capita
	VND thousand billion	VND thousand billion	VND million	VND thousand billion	VND thousand billion	VND million
2020	216.73	212.40	88.95	218.80	214.42	91.94
2021	213.68	209.41	84.85	227.52	222.97	94.57
2022	209.66	205.47	80.53	236.86	232.12	97.21
2023	204.53	200.44	75.97	246.84	241.90	99.81
2024	198.13	194.17	71.15	257.50	252.35	102.36
2025	190.30	186.49	66.06	268.87	263.49	104.81
2026	180.83	177.22	60.66	281.00	275.38	107.12
2027	169.53	166.14	54.95	293.92	288.04	109.26
2028	156.15	153.03	48.89	307.69	301.53	111.18
2029	140.44	137.63	42.46	322.34	315.89	112.84
2030	122.10	119.66	35.65	337.93	331.17	114.20

Source: Cao Le Quyen, 2021

According to the National Social-economic development Strategy towards 2030⁴¹, the annual growth rate of national GDP is projected at 7% per year in the period of 2020-2030. Therefore, we can estimate the annual national GDP of the whole country and the contribution of ocean/coastal capture and aquaculture to the national GDP in the next decade.

In the recommended blue scenario, the GDP and GNI of ocean/coastal capture and aquaculture at real price in 2020, by 2030 will be VND 337,93 billion and VND 331,17 billion and contribute about 2.76% and 2.74% to the nominal national GDP and GNI, respectively. These contributions are clearly much better than the baseline scenario with its contributions of only 1% and 0.99%, respectively. See below tables:

⁴¹ <https://nhandan.com.vn/tin-tuc-su-kien/bao-cau-tong-ket-thuc-hien-chien-luoc-phat-trien-kinh-te-xa-hoi-10-nam-2011-2020-xay-dung-chien-luoc-phat-trien-kinh-te-xa-hoi-10-nam-2021-2030-621156/> (day of information accessing is 28 Oct 2020)

Table 3.3. Projection for the contribution of GDP, GNIs of marine fisheries (2030) at real price in 2020 to national GDP and GNIs in the next period 2020-2030 for the blue scenario

	Fisheries and Aquaculture		At national level		Contribution of fisheries and aquaculture	
	unit: VND thousand billion		unit: VND thousand billion		Unit: %	
Year	fish/aqua. GDP	fish/aqua. GNI	Nominal national GDP	Nominal national GNI	GDP	GNI
2020	218.80	214.42	6213.03	6150.90	3.52%	3.49%
2021	227.52	222.97	6647.95	6581.47	3.42%	3.39%
2022	236.86	232.12	7113.30	7042.17	3.33%	3.30%
2023	246.84	241.90	7611.23	7535.12	3.24%	3.21%
2024	257.50	252.35	8144.02	8062.58	3.16%	3.13%
2025	268.87	263.49	8714.10	8626.96	3.09%	3.05%
2026	281.00	275.38	9324.09	9230.85	3.01%	2.98%
2027	293.92	288.04	9976.78	9877.01	2.95%	2.92%
2028	307.69	301.53	10675.15	10568.40	2.88%	2.85%
2029	322.34	315.89	11422.41	11308.19	2.82%	2.79%
2030	337.93	331.17	12221.98	12099.76	2.76%	2.74%

Source: Cao Le Quyen, 2021

Table 3.4. Projection for the contribution of GDP, GNIs of marine fisheries (2030) at real price in 2020 to national GDP and GNIs in the next period 2020-2030 for the baseline scenario.

	Fisheries and Aquaculture		At national level		Contribution of fisheries and aquaculture	
	unit: VND thousand billion		unit: VND thousand billion		Unit: %	
Year	fish/aqua. GDP	fish/aqua. GNI	Nominal national GDP	Nominal national GNI	GDP	GNI
2020	216.73	212.40	6213.03	6150.90	3.49%	3.45%
2021	213.68	209.41	6647.95	6581.47	3.21%	3.18%
2022	209.66	205.47	7113.30	7042.17	2.95%	2.92%
2023	204.53	200.44	7611.23	7535.12	2.69%	2.66%
2024	198.13	194.17	8144.02	8062.58	2.43%	2.41%
2025	190.30	186.49	8714.10	8626.96	2.18%	2.16%
2026	180.83	177.22	9324.09	9230.85	1.94%	1.92%

2027	169.53	166.14	9976.78	9877.01	1.70%	1.68%
2028	156.15	153.03	10675.15	10568.40	1.46%	1.45%
2029	140.44	137.63	11422.41	11308.19	1.23%	1.22%
2030	122.10	119.66	12221.98	12099.76	1.00%	0.99%

Source: Cao Le Quyen, 2021

3.3. Oil & gas

3.3.1 Baseline scenario

The main feature of the exploration business in oil & gas industry is high uncertainty. The outcomes are depending on many factors: luck of exploration wells, oil price, level of investment, timing of projects, geopolitics, policy etc. This is why prediction and planning in the sector are always difficult. There are always ranges in the Master Plan of Oil & Gas Sector of Viet Nam, like yearly reserves added from 10-20 million tons, domestic oil production from 6-12 million tons and domestic gas production from 13-19 billion m³ etc.

Therefore, for oil & gas sector the scenarios will be developed as yearly average outcome of main products and calculated economic indicators through economic models for period 2021-2025 and 2026-2030. Analyzing the Master Plan of Oil & Gas Sector of Viet Nam and current situation, including COVID-19, energy transition, we predict that if no change in policy and situation, it is likely that oil & gas industry can achieve only the lowest range or even could not achieve some of targets in the Master Plan. We choose this as the baseline scenario.

⁴²In the current Energy Transition trend, the blue scenario is also developed. This scenario happens when PetroViet Nam transforms into a low carbon energy company which requires efforts and policy to bring the production to around the level of 2012-2015. But the key thing in this scenario is to change mindset and the direction towards blue development, investment in



Tam Dao 01 Rig of Vietsovpetro. (Image by: Petro Times)

⁴² <https://petrovietnam.petrotimes.vn/nganh-dau-khi-viet-nam-voi-nhung-buoc-ngoi-lich-su-539300.html>

renewable energy, development of low carbon products and services, more value-added, more efficient, more energy saving within oil & gas activities, and better protection of environment. This blue scenario to 2030 is also aligned with the Viet Nam's COP26 climate commitments as it produces oil & gas to meet needs during progressive reductions towards net zero in 2050, while promoting renewable energy growth and reduced environmental impacts.

The main production volume and the economic indicator of each scenario is summarized in the tables 3.6, 3.7, 3.8. The economic dimensions in terms of GDP and state budget contribution are calculated using economic model and the long-term oil prices predicted by Wood Mackenzie.

Table 3.5. Wood Mackenzie's oil price forecast at the end 2021 (Unit: USD/barrel)⁴³

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030
Brent price	71.3	72.4	69.5	76.9	80.6	82.2	83.8	86.7	89.6

The baseline scenario: The big fields in decline stage; development of other fields delayed; marginal fields not attractive to develop; reserves replacement ratio less than 1; lack of appropriate investment due to policy, COVID-19 and energy transition. If no facilitating policy and situation change, the production volume of the industry output will go down, the potential is underdeveloped;

Table 3.6. Summary of the Baseline Scenario

	Items/Indicators	2021-2025	2025-2030	Present constraints/Required facilitating mechanisms
Average yearly production volume	Oil (Million Tons)	7	5	Present constraints: <ul style="list-style-type: none"> The big fields in decline stage; Development of new fields delayed; Marginal fields not attractive for operators to develop; Reserves replacement ratio less than 1; Almost no new investment on exploration Facilitating mechanisms: <ul style="list-style-type: none"> Approval processes should be on time so that the Block B, Ca Voi Xanh projects could deliver first gas in the early 2026-2030; No substantial changes in policy and regulatory framework
	Gas (Billion m ³)	8.2	14	
	Petroleum products (Million Tons)	6	6	
	Fertilizers (Thousand Tones)	1,600	1,600	
	LPG (Thousand Tons)	271	462	
	Gas power (Billion KWh)	12.3	19.9	
Average yearly indicator	GDP (Thousand Billions VND)	299	384	
	GNI (Thousand Billions VND)	137	175	
	Contribution to budget (Thousand Billions VND)	146	187	
	R/P (years)	<50	<50	

⁴³ Note the effect of oil price variability. GDP, GNI, are highly sensitive to oil prices. So all scenarios are based on this assumption of oil prices predicted by Wood Mackenzie.

	RRR	<1	<1	
	Emissions (Million Tones CO2e)	35	44	

Source: Nguyen Hong Minh, 2021.

3.3.2. Blue Scenario

In this case, PetroViet Nam transforms into a low-carbon energy company. In this scenario, the efforts are made to bring oil and gas production volume back to level of 2012-2015; the value of offshore wind, other renewable energy, low-carbon products and services will be added. On the other hand, the operation to be more efficient, more value added, less energy consuming and less impacts on the environment. The targets of PetroViet Nam on 100 megawatts (MW) of renewable capacity by 2025 and 900 MW by 2035 are taken from Reuters' article in media⁴⁴.

The sustainability or impacts on the environment in terms of CO2e emissions is predicted using the methodology outlined in LT Nhat (2018).

Table 3.7. Summary of the blue scenario

	Items/Indicators	2021-2025	2025-2030	Present constraints/Required facilitating mechanisms
Average yearly production volume	Oil (Million Tons)	8	9	Present constraints: <ul style="list-style-type: none"> The key gas Block B and Ca Voi Xanh projects are delayed No new foreign investment in development of new fields, exploration of new blocks due to policy and/or global situation; State own enterprises are facing difficulties in investment in oil & gas as well as in other businesses due to required procedures Facilitating mechanisms: <ul style="list-style-type: none"> Approval processes accelerated so that key gas projects could deliver first gas in the early 2020s; Policy change to attract foreign investment in production enhancement, development new fields and exploration in open blocks Policy change to empower state own enterprises to make investment oil & gas and other related to energy transition businesses
	Gas (Billion m ³)	9	18	
	Petroleum products (Million Tons)	6	6	
	Fertilizers (Thousand Tones)	1,600	1,600	
	LPG (Thousand Tons)	297	594	
	Gas power (Billion KWh)	12.8	25.6	
	Renewable power (Billion KWh)	0.1	1.3	
Average yearly indicator	GDP(Thousand Billions VND)	312	462	
	GNI (Thousand Billions VND)	143	211	
	Contribution to budget (Thousand Billions VND)	152	220	
	R/P	50	50	
	RRR	1	1	
	Emissions (MT CO2 e)	36	50	

⁴⁴ [PetroVietnam to invest in renewables amid shrinking crude oil production | Reuters](#)

				<ul style="list-style-type: none"> PetroViet Nam to transform into the low carbon energy company, with more efficient operation, less impacts on the environment
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Source: Nguyen Hong Minh, 2021.

The authors recommend this blue scenario as it keeps reasonable contribution to the national economy, develops toward more efficient operation, reduces of CO₂ emissions and contribution to Viet Nam's commitments at COP26.

Table 3.8. GDP, GNI, GNI per capita of oil & gas industry in period of 2020 – 2030
(unit: thousand billion VND)

Year	Labour*	Baseline Scenario			Blue scenario		
		GDP**	GNI***	GNI per capita	GDP	GNI	GNI per capita
		VND thousand billion	VND thousand billion	VND million per person	VND thousand billion	VND thousand billion	VND million per person
2021	49,233	282	129	2,615	282	129	2,618
2022	49,725	290	133	2,668	297	136	2,730
2023	50,223	299	137	2,721	312	143	2,839
2024	50,725	316	144	2,847	342	156	3,081
2025	51,232	333	152	2,970	372	170	3,318
2026	51,744	350	160	3,091	402	184	3,550
2027	52,262	367	168	3,209	432	197	3,778
2028	52,785	384	175	3,325	462	211	4,000
2029	53,312	401	183	3,437	492	225	4,218
2030	53,846	418	191	3,548	522	239	4,430

Note:

*It is forecasted that the number of experts will increase by 1%/year due to the expansion of production along the value chain, which has offset the exploitation labour decrease. The number of employees in both scenarios remains the same because the Blue Scenario is expected to have higher labor productivity and higher efficiency.

** Estimated for 2021. Assume in 2 years reach the average of 2021-2025 and then a steady growth rate starting 2023 to reach the average of 2026-2030 in 2027 and Wood Mackenzie's oil prices at the end of 2021.

***GNI=GDPx 0,457 (on average)

3.4. Marine renewable energy

Based on the legal background (e.g. decisions, strategies, etc.) and current contexts⁴⁵, there can be 2 development scenarios of Viet Nam's marine wind energy as follows:



Marine wind energy in Bac Lieu Province (Image by: VN Express)

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3.4.1 Baseline Scenario

Baseline scenario is the scenario where a suitable capacity amount from offshore wind power plants which are able to be connected to the power grid to be developed, is being considered in the power generation structure of draft PDP VIII, and new policies on offshore wind power anticipated to be promulgated in the appropriate period.

Total proposed installed capacity will be 7,000MW by 2030. Summary contents of development in this scenario as follows:

i). Near-shore wind power projects

The focus is on exploitation of all electricity amount at economic prices of the all near-shore wind power projects. The particulars are as follows:

By 2030: Total installed capacity will be 4,000MW, in which:

- In the Mekong river delta region will have 4,000MW

⁴⁵ Available at the draft final thematic report: Marine Renewable Energy, dated Jan.2021.

⁴⁶ <https://vnexpress.net/canh-dong-dien-gio-tren-bien-duy-nhat-cua-viet-nam-3993544.html>

- In the remained locations and regions: 0 MW

ii). Off-shore wind power projects: Located in the areas beyond 3 miles from the water boundary line to 50 km:

By 2030: Total installed capacity will be 3,000MW, in which:

- In the Mekong river delta region will have 1,500MW
- In the South Central region will have 1,500MW
- In the remaining locations and regions: 0MW

iii). Off-shore wind power projects: Beyond 50km:

By 2030: 0MW

3.4.2 Blue Scenario

Blue scenario is the scenario where good offshore wind power projects which have been identified and proposed to be included in the PDP VIII will be considered with exploitation at maximal level of techno-economic potential. This scenario will also provide significant impetus to the early stages of progress towards new climate targets.

Total installed capacity will be 10,000MW by 2030. Summary contents of development in this scenario as follows:

i). Near-shore wind power projects

The focus is on exploitation of all electricity amount at economic prices of the all near-shore wind power projects. The particulars are as follows:

By 2030: Total installed capacity will be 4,500MW, in which:

- In the Mekong river delta region will have 4,000MW
- In the remained locations and regions: 500MW

ii). Off-shore wind power projects: Located in the areas beyond 3 miles from the water boundary line to 50 km:

By 2030: Total installed capacity will be 5,000MW, in which:

- In the Mekong river delta region will have 1,000MW
- In the South Central region will have 3,500MW
- In the remained locations and regions: 500MW

iii). Off-shore wind power projects: Beyond 50km:

By 2030: 500MW

The two scenarios (baseline and blue) were analysed for installed capacity, generated electricity, LCOE off-shore wind project groups, total revenue from selling electricity from off-shore wind project groups by locations by different conditions. In addition, the potential GHG emission reduction, total coal combustion demand reduction compared to baseline by the target year (2030) are summarized in the following table.

Table 3.9. Main indicators of two scenarios proposal for offshore wind development by locations in 2030

Offshore wind	By the year 2030							
	Baseline scenario				Blue scenario			
	Total	Near shore	Off Shore ≤50 km	Off shore> 50 km	Total	Near shore	Off Shore ≤50 km	Offshore >50 km
Installed capacity (MW) by location	7,000	4,000	3,000	0	10,000	4,500	5,000	500
<i>Mekong delta and South East region</i>	5,000	4000	1000	0	5,000	4000	1000	0
<i>South Central region</i>	2,000	0	2000	0	4,500	500	3500	500
<i>Remain regions</i>	0	0	0	0	500	0	500	0
Capacity Factor (%)								
<i>Mekong delta and South East region</i>		39.9	44.5	44.5		39.9	44.5	44.5
<i>South Central region</i>		42	48	49.5		42	48	49.5
<i>Remain regions</i>		32	40.1	40.1		32	40.1	40.1
Net annual energy production-P50 (GWh)	26,289	13,981	12,308	-	38,360	15,821	20,371	2,168
<i>Mekong delta and South East region</i>	17,879	13,981	3,898	-	17,879	13,981	3,898	-
<i>South Central region</i>	8,410	-	8,410	-	18,725	1,840	14,717	2,168
<i>Remain regions</i>	-	-	-		1,756	-	1,756	-
LCOE (USD/MWh)								

Mekong delta and South East region		85.70	92.70			85.70	92.70	92.70
South Central region		92.20	92.70			92.20	92.70	92.70
remain regions		102.5	115			102.5	115	115
Electricity tariff (temporary value as LCOE), (USD/MWh)								
Mekong delta and South East region		85.70	92.70			85.70	92.70	92.70
South Central region		92.20	92.70			92.20	92.70	92.70
remain regions		102.5	115			102.5	115	115
Total revenue from selling electricity (Mill. USD)	2,339				3,496			
Mekong delta and South East region	1,560	1,198	361	-	1,560	1,198	361	-
South Central region	780	-	780	-	1,735	170	1,364	200.98
remain regions	-	-	-	-	202	-	202	-
Total revenue form selling electricity (Bill. VND (*))	54,969				82,164			

Note: (*) The exchange average rate is assumed for period of 2021-2030: 23,500 VND = 1 USD

Source: Nguyen Duc Cuong, 2021

The differences between 2 scenarios according to view points of sustainable development (17 indicators in Agenda 2030) and commitments of Viet Nam in updated NDC are mainly four following factors:

- Share of offshore wind power (%);
- Accessibility to electricity;
- GHG emission reductions, and
- Contribution to economic development.

In the baseline scenario, the percentage target of electricity production from grid connected offshore wind power sources increase from 0.19% in 2019 up to 5.50% in 2030. GHG emission reduction potential is 27.58 million ton of CO₂eq in 2030.

In the blue scenario, the share of electricity production from grid connected offshore wind power sources is higher than that in the baseline scenario because relatively large amount of offshore wind power is developed, account for 8.03% in 2030. GHG emission reduction potential is 40.24 million ton of CO₂eq in 2030. Therefore, finance support is significantly increased in comparison with the base scenario due to cost of foundation construction, and cable increased.

Due to the size of the offshore wind power market in the two proposed scenarios, the difference is 1.43 times. With this feature, the blue scenario will be more attractive than the base scenario to call for and attract investment in the production and manufacture of equipment in domestic supply chains for offshore wind power projects. The supply chain and the degree of local contents of equipment could will be: i) fabrication and supply of wind towers; ii) Fabrication, construction and installation of foundations; Produces and supplies various electrical cables, etc.

The difference between the scenarios is also reflected in the level of job creation for Viet Nameese workers in stages from pre-construction, construction and operation & maintenance. In the blue scenario, because the scale of installed capacity of offshore wind turbines is greater than 1.43 times of the baseline scenario, the number of jobs and total revenues are about 1.43 times and 1.49 times respectively.

The localization step by step will help formulate and develop a supply chain of materials, equipment and manpower from the domestic offshore wind power supply chain, step by step forming a new local industry. It will help to reduce levelized cost of electricity (LCOE) which is mainly capital cost (CAPEX) and operation and maintain cost (OPEX) of the offshore wind power plants. Moreover, the expansion of the market size also helps to cut greenhouse gas emissions about more than 2.74 times compared with baseline scenario.

The choice of the development scenario also depends on the LCOE which is reflected in the weight average capital cost (loan and equity). If the cost of capital (e.g. Weight Average Capital Cost - WACC) is reduced to 7%, then the high scenario can be considered due to about half value of LCOE of offshore wind projects will be direct cost, e.g. cost of wind turbines, foundation, electrical cable system within wind farms, substations and transmission lines for grid-connection with national electricity transmission network. The remaining half is the financial cost of the projects which reflects high capital intensity of offshore wind projects. If financial conditions are improved, the LCOE of offshore wind power will be significantly reduced and then the

competition of offshore wind power compared to other fossil power sources is improved.

Therefore, basics for consideration include the techno-economically exploitable potential of offshore wind power sources, capability and financial support sources available in the conditions of Viet Nam, and power demand in the period from now to 2030 in the situation that supply capacity of commercial domestic primary energy such as coal, oil, gas, and big hydropower is limited and will be shorted. Meanwhile potential of offshore wind power sources is relatively high, if their exploitation is well organized, it will replace a portion of traditional energy resources being exhausted, creating a green, clean energy resource contributing in national ensuring energy security and sustainable development.

Table 3.10. Two offshore wind power development scenarios at nominal prices

	Unit	Baseline scenario		Blue scenario	
		2025	2030	2025	2030
Installed capacity	MW	1,000	7,000	1,800	10,000
Power production	MWh	3,000,000	26,289,000	6,000,000	38,360,000
Total revenue from selling electricity	VND thousand billion	6.63	54.97	12.85	82.16
GDP at nominal price (*)	VND thousand billion	5.97	51.43	11.56	73.94
GNI at nominal price (*)	VND thousand billion	5.37	46.29	10.41	66.55
Number of employees in the wind power sector (both direct and indirect) (***)	Thousand people	20,000	140,000	36,000	200,000
GNI per capita	VND million	268	331	289	332

Note: (*): Calculated according to output production approach. GDP= GO-IC = Gross outputs – intermediary costs. GO is equal to electricity outputs * selling price. Intermediary costs include sea surface rent cost, land rental cost, equipment maintenance cost and replacement costs.

(**) Equal to 90% of GDP

(***) Referenced from different sources around the world, taking into account the specific conditions of Viet Nam

From the above-mentioned bases, combined with scenario comparison, the blue scenario been selected for development in the period to 2030.

Table 3.11. GDP of offshore wind power sub-sector in Blue Scenario (selected scenario) in national GDP in period of 2020-2030

Year	Nominal GDP (VND thousand billion)		% GDP Offshore wind power/GDP Viet Nam
	GDP Viet Nam	GDP (Offshore wind power)	
2020	6,429,778	0.54	0.000008%
2021	6,847,713	2.29	0.000034%
2022	7,292,815	3.71	0.000051%
2023	7,766,848	5.46	0.000071%
2024	8,271,693	8.52	0.000103%
2025	8,809,353	11.56	0.000131%
2026	9,381,961	14.77	0.000157%
2027	9,991,788	18.23	0.000182%
2028	10,641,254	25.66	0.000241%
2029	11,332,936	41.53	0.000366%
2030	12,069,577	73.94	0.000613%

3.5. Coastal and marine tourism

The Viet Nam tourism development strategy to 2030 determines that tourism will continue to grow strongly at a high and stable rate as in the past decade. This development scenario presents three development options at a difference of about 10% for the major development indicators. However, because there is no major difference, in the framework of this report, all 3 options are only considered as one development scenario - called the base scenario.

This thematic report proposes another development scenario for coastal and marine tourism, having considered other factors:

- Climate change impact
- Impact of Covid-19 pandemic
- Focus on sustainable development with emphasis of business efficiency through quality improvement (which leads to increase of tourist expenditure), tourism product diversification and lengthening tourist stays.

Viet Nam's tourism development goals up to 2030 are set on the basis of researching the domestic and international tourism development context and trends; directions of national state; current status of Viet Nam's tourism development; the socio-economic development of the country; and other related factors. The main targets of Viet Nam's

tourism to 2030 are calculated and presented in two scenarios: baseline scenario and blue scenario. The growth scenarios are shown in indicators: tourism arrivals, total revenue from tourists, contribution to GDP, accommodation.

Table 3.12. Projection of tourism arrivals of the whole country to 2030

Unit: million visitors

Scenario	2025		2030	
	<i>International arrivals</i>	<i>Domestic tourists</i>	<i>International arrivals</i>	<i>Domestic tourists</i>
Baseline scenario	32	100	45	120
Blue scenario (selected scenario)	35	120	50	160

Source: Viet Nam Tourism Development Strategy to 2030

(1) Baseline scenario is based on the context that the world economy continues to face risks and challenges such as changes in trade policies of countries, global financial health, increasing tensions and political conflicts in many regions; high unemployment rate, idle investment activities, excessive supply; Natural disasters and epidemics are complicated and unpredictable in many parts of the world, especially the effects of climate change, extreme weather phenomena such as storms, cyclones, earthquakes, floods, drought .causes great difficulties for the socio-economic development of the world in general and tourism in particular. Meanwhile, Viet Nam still has not had effective and timely activities and measures to effectively respond to climate change and sea-level rise; tourism projects have not addressed climate change issues and protected the environment. The consequences of climate change on tourism have not been fully researched. These are the reasons for slowing economic growth and may affect travel motivation. In this context, Vietnamese tourism will be affected and have low growth in both the number of tourists, the length of stay and the tourism spending, leading to a decrease in total revenue from tourists.

(2) The Blue scenario is calculated in the context of a relatively stable world economy; tensions, political and ethnic conflicts in some areas are basically controlled; stable commercial and financial policies of the countries; Global issues (climate change, environmental pollution, natural disasters, epidemics, terrorism) are basically under control. The investment in tourism continues to increase; infrastructure system, tourist technical facilities, national tourist areas, provincial tourist areas, amusement - entertainment - sports areas, tourism training institutions, promotion tourism promotion are adequately developed; tourism products are diversified and quality improved. On the other hand, factors such as natural disasters, epidemics, impacts of

climate change and sea-level rise on tourism have been promptly responded to; Tourism projects are adapted to climate change issues. The above context will have a favourable impact on tourism development in Viet Nam, the growth rate of tourists, the number of days of stay, the level of spending and total revenue from tourists will continue to be maintained at a stable level.

However, the rapid development and increasing impacts of climate change will exacerbate the impacts on environmental resources, requiring much more commitment as well as efforts to adapt and mitigate.

3.5.1 Baseline Scenario

In the National Tourism Development Strategy (approved in January 2020 by Prime Minister) the Blue growth scenario was selected, at that moment, before the Covid-19 pandemic, it was a feasible scenario for 2030. According to this scenario, specific targets are calculated and forecasted as follows:

- About tourists: To attract 35 million international visitors, serve 120 million domestic tourists; the average growth of international visitors is 12-14%/year and domestic tourists is 6-7%/year by 2025. By 2030, to attract 50 million international visitors, serving 160 million domestic tourists; The average growth of international visitors is 8-10%/year and domestic tourists 5-6%/year.
- Total tourism revenue: By 2025, it will reach about 1,700 - 1,800 thousand billion VND (equivalent to about 77-80 billion USD). By 2030, it will reach about 3,100 - 3,200 trillion VND (equivalent to about 130 - 135 billion USD).
- Tourism contribution to GDP: By 2025, tourism will contribute about 13.9% of the total GDP of the country, the average growth is about 13.4%/year. By 2030, the corresponding figures are 18.2% and 11%/year.
- Accommodation: By 2025, there will be about 1,150,000 hotel rooms, the average occupancy rate will reach 62%/year. By 2030, the number of hotel rooms will reach 1,600,000, the average occupancy rate will reach 65%/year.
- Tourism employment: By 2025, total labour is forecasted to increase to 5.5-5.6 million, of which about 2 million are direct employees. By 2030, creating about 8.5 million employees, including about 3 million direct employees.



Hon Kho, Binh Dinh Province (Image by: VN Express)

According to the national development scenario as determined in the Viet Nam Tourism Development Strategy approved by the Prime Minister, the tourism development scenarios of 28 coastal provinces will be:

Table 3.13. Major tourism development indicators - Baseline scenario

	Unit	2025	2030
International arrivals	Thousand arrivals	69,000	99,000
Domestic tourists	Thousand visitors	206,000	274,000
Tourism revenue	Trillion VDN	1,144	2,086
Hotel rooms	Thousand rooms	725	1,008
Tourism employment	Thousand persons	1,441	2,161

Specifically for the development of marine tourism, Resolution 36 defines: intensify investment in tourism infrastructure; to encourage and create conditions for all economic sectors to participate in developing ecotourism, scientific exploration, community based tourism, and high-quality marine resorts in coastal areas; building, developing and diversifying world-class marine tourism products, product chains and brands on the basis of biodiversity conservation, promoting the value of natural, cultural and historical heritages characteristics of regions and regions, connecting with international tourist routes so that Viet Nam will become an attractive destination of the world. Pilot study on tourism development to offshore islands and areas; Strengthening the capacity of search and rescue; promote activities of scientific exploration; Focusing on education, marine health; Supporting and creating conditions for coastal people to change jobs from activities at risk of harm and negative impacts

⁴⁷ <https://vnexpress.net/8-vung-bien-xanh-cho-mua-nong-phia-nam-4245652.html>

on the sea to protection and conservation creating sustainable livelihoods, stable new jobs, and raising income for people.

The Viet Nam tourism development strategies over the time have always identified marine tourism as a special advantage of Viet Nam. This is a correct orientation, suitable for the natural conditions of Viet Nam on the basis of resources, geographical location, climate as well as market needs.

Based on that basic orientation, along with the identified development priorities of the country and provinces, marine tourism has made very strong development steps and has always been the leading tourism product of the country. This judgment is made on the basis of actual development as well as very convincing statistics of tourism activities in coastal provinces in comparison with the whole country.

3.5.2 Blue Scenario

In the view of adaptive development to climate change, sustainable development, especially in the context of the highly complicated situation of the Covid-19 pandemic, this blue scenario is built on the higher resolution, at the provincial level (bottom up approach). The development options are built from the provincial level on the basis of the tourism development potentials of the province, in the light of green growth, and focusing on quality development.

Since beginning of 2020, the COVID-19 pandemic has caused enormous impacts on tourism in Viet Nam and the world. Tourism has gone back to development level of 30 years ago, as by UN-WTO .

In 2020, Viet Nam received only 3.8 million international tourists (only in the first three months), the number of domestic tourists reduced by 50%, revenue loss is about 530 trillion VND.

In 2021, Viet Nam received about 3,500 international tourists, 40 million domestic trips (among which 19 million tourists have used accommodation service). Total tourism revenue reached 180 trillion VND (decreased 42.3% comparing to 2020).

In November 2021 Viet Nam started opening for international tourism and full open since 15 March 2022.

COVID-19 impacts are extremely serious to the entire system: accommodation, tour operations, food and beverage, shopping... and especially impact to tourism labour, both direct and indirect.

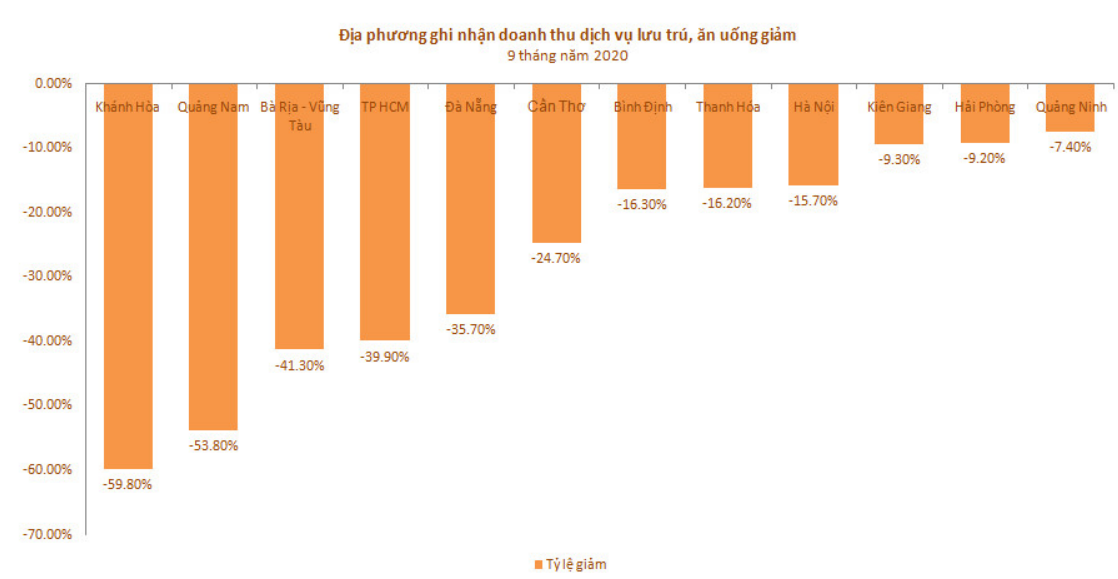


Figure 3.1. Decrease of hotel and food, beverage revenue in major tourism destinations

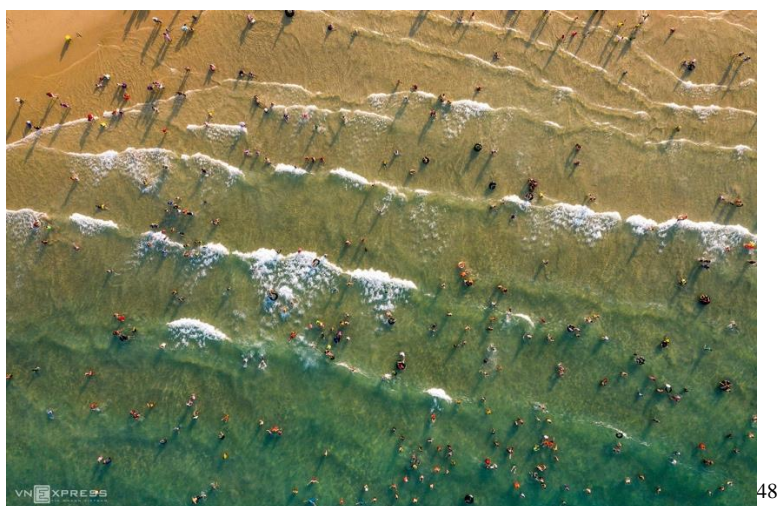
At the beginning of 2022, experts, surveyed by UN-WTO (United Nations World Tourism Organization) forecasted that the international tourist market will return to 2019 level by 2024. With Northeast Asia is the dominant market, it is estimated that Viet Nam international tourism in 2022 would be at 30% of 2019 level. The domestic market in 2022 would be at 80% of 2019 level.

According to the report on the Strategic Environment Assessment (SEA) attached to Viet Nam Tourism Development Strategy to 2030, in Viet Nam, under the RCP4.5 scenario (most likely), in the middle of the century the number of hot days will tend to rise in most parts of the country, from 25 to 35 days, with the biggest increase (up to 40 days) in the South Central region, including the coastal and marine tourist priority area of Quang Binh - Quang Tri - Thua Thien - Hue - Da Nang - Quang Nam and Binh Dinh - Phu Yen - Khanh Hoa - Ninh Thuan, at least (less than 20 days) in the Central Highlands, including the areas of Lam Dong - Dak Lak and the Southern region: Ho Chi Minh City - Ba Ria Vung Tau - Binh Thuan and Can Tho - Kien Giang - Ca Mau.

Droughts in some regions would be more severe due to the trend of decreasing rainfall in the dry season, typically occurring in the South Central Coast (Quang Binh - Quang Tri - Thua Thien-Hue - Da Nang - Quang Nam and Binh Dinh - Phu Yen - Khanh Hoa - Ninh Thuan) during spring and summer, South Viet Nam (Ho Chi Minh City - Ba Ria

Vung Tau - Binh Thuan, Can Tho - Ca Mau - Phu Quoc) and North (including Hanoi - Quang Ninh - Hai Phong - Ninh Binh) in winter.

According to the sea level rise scenario, under the RCP4.5, the average sea level rise for the entire coast of Viet Nam, including the tourism priority areas such as (i) Quang Ninh - Hai Phong - Ninh Binh; (ii) Quang Binh - Quang Tri - Thua Thien - Hue - Da Nang - Quang Nam); (iii) Binh Dinh - Phu Yen - Khanh Hoa - Ninh Thuan; (iv) Ho Chi Minh City - Ba Ria Vung Tau - Binh Thuan; (v) Can Tho - Kien Giang - Ca Mau, by 2050, 22cm (14 cm ÷ 32 cm); by the year 2100 is 53 cm (32 ÷ 76cm), of which, the coastal area from Mong Cai - Hon Du and Hon Dau - Pass Ngang has the lowest sea level rise of 55 cm (33 ÷ 78cm); Ca Mau Cape - Kien Giang is 53 cm (32 ÷ 75cm), the Paracel and Spratly archipelagos - 58 cm (36 ÷ 80 cm) and 57 cm (33 ÷ 83cm) (Source: SEA attached to Viet Nam Tourism Development Strategy to 2030).



Trung Luong Beach, Binh Dinh Province (Image by: VN Express)

The Viet Nam Tourism Development Strategy to 2030 (approved by the Prime Minister in Decision 147/QĐ-TTg dated January 22, 2020) defines "developing coastal and marine tourism" as one of the priority directions of the tourism industry in the period up to 2030. However, according to the Viet Nam climate change scenario 2016, if sea-level rises 100 cm and there is no adequate response, about 1.5% on the area in the central coast from Thanh Hoa to Binh Thuan, 38.9% of the Mekong Delta area is at risk of flooding. The islands of Van Don, Con Dao and Phu Quoc are at high risk of flooding (Climate change scenario 2016, MONRE).

The forecasts, according to the 2030 sea-level rise scenario in the South Central Coast region, especially in the tourism priority area of Quang Binh - Quang Tri - Thua Thien - Hue - Da Nang - Quang Nam show that the coastal districts of Da Nang, Quang Nam

⁴⁸ <https://vnexpress.net/8-vung-bien-xanh-cho-mua-nong-phia-nam-4245652.html>

and Binh Son and Son Tinh districts of Quang Ngai province have the highest rise from 18 to 18.24mm, which would greatly affect tourism of these provinces (Climate change scenario 2016, MONRE).

In Hue, under the 100cm SLR scenario, all the coastal and lagoon tourist areas will be affected. Under this scenario, effect on Tu Hien beach would be 87.12%, Vinh Thanh beach 82.12%, and Thuan An beach 29.1% (Doan Manh Hung, VNU Hanoi).

Thus, it can be seen that by the end of the century, sea-level rise will have a great direct impact on the coast of Viet Nam, but by 2030, the **direct** impacts are not that significant.

In general, the main impacts of climate change and sea-level rise between now and 2030 will be:

- Increase in extreme weather events: hot, cold, rains, but the average temperature and average rainfall will not change significantly.
- The sea level rise may not be that significant, but changes in currents, flows, temperature regime, and hydrology may lead to beach erosion. Erosions can be severe in some locations, however, with many unknown entry variables, it is not feasible to accurately define the location and extent of the erosion. In addition, the erosion would also be caused by the development of new infrastructures, the hydrological conditions of the rivers, so the precise description is even more difficult.

Sustainability in tourism would be shown in: higher income (efficiency), less motored travel (low emission), minimum impact on the natural environment and indigenous culture.

Considering current development, combined with the development focusing on quality improvement (targeting high spending markets), lengthening tourists stay, another development scenario would be shown in the following table. This scenario is proposed in early 2021 according to the developments of the Covid-19 pandemic as well as the trends and forecasts of the UN-WTO at that time.

Table 3.14. Major tourism development indicators - Blue Scenario

	Unit	2025	2030
International arrivals	Thousand arrivals	40,500	47,000
Domestic tourists	Thousand visitors	188,500	218,000
Tourism revenue	Trillion VDN	1,523	2,525

This scenario development is based on the main criteria as follow:

- International market: international arrivals in 2022 would be 30% the one of 2019, the growth in 2023 would be 5%, growth during 2024-2025 would be 4% per annum and during 2026-2030 would be 3% per annum (equal to world average).
- Domestic market: in 2022 domestic tourism would return to 80% of the level of 2019, during 2022-2023 growth would be 6% per annum, during 2024-2025 would be 5%, and during 2026-2030 growth rate would be 3% per annum.
- Average length of stay of international tourist in Viet Nam would be 8.5 days in 2025 and 9 days in 2030
- Average length of domestic tourist trip would be 3.4 days in 2025 and 3.5 days in 2030
- Average expenditure of international tourist in 2025 is 190USD per day and 250USD per day in 2030
- Average expenditure of domestic tourist in 2025 is 100USD per day and 130USD per day in 2030

Comparison of the two development scenarios is in the table below.

Table 3.15. Comparing two development scenarios at nominal and real price (2010)

Indicators	Unit	Baseline Scenario		Blue Scenario	
		2025	2030	2025	2030
<i>At nominal price:</i>					
Int. arrivals to coastal provinces	Thousands ppl	69,000	99,000	40,500	47,000
Domestic tourists of coastal provinces	Thousands ppl	206,000	274,000	188,500	218,000
Tourism revenue of coastal provinces	Trillion VND	1,144	2,086	1,523	2,525
Tourism GDP of coastal provinces	Trillion VND	801	1,460	1,066	1,768
Tourism GNI of coastal provinces	Trillion VND	757	1,373	1,007	1,661
Hotel rooms in coastal provinces	Thousands rooms	725	1,008	542	649
Tourism employment in coastal provinces	Thousands people	1,441	2,161	1,186	1,669

GNI per equivalent employee in coastal provinces	Million VND	282	368	502	692
<i>At real price 2020:</i>					
Tourism GDP of coastal provinces	Trillion VND	511	881	680	1,067
Tourism GNI of coastal provinces	Trillion VND	477	824	636	997
GNI per equivalent employee in coastal provinces	Million VND	178	221	317	416
Ratio of coastal tourism GDP to national GDP	%	9.1%	11.2%	12.1%	13.5%

It is clearly seen that in the Blue scenario where the total number of tourists is lower but with a higher spending and longer stay per visitor, efficiency of tourism business would be much higher compared to the base scenario. It can be said that the earning will be higher while emission is lower due to less travel. In order to achieve this, tourism products should be further diversified, service quality should be improved and likely slower type of tourism travel be encouraged (biking and hiking).

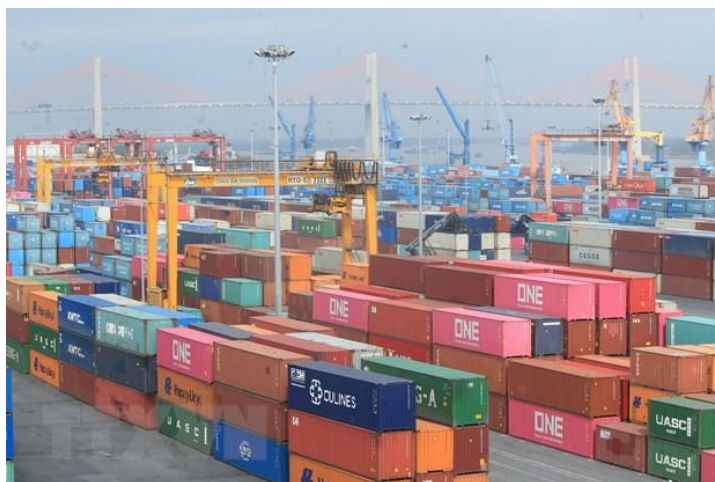
3.6. Maritime sector

For the current maritime sector, the industry development scenarios for the period up to 2030 have been identified in the Master Plan for the development of the seaport system to 2030, with a vision of 2050, organized by the Ministry of Transport and developed by the Ministry of Transport. approved by the Prime Minister in September 2021. In this Master Plan, two official development scenarios have been proposed for the development of Viet Nam's sea transport and seaports by 2030, with a vision of 2050. This can be considered the main foundation for us to research, consider and propose a sustainable development scenario according to the blue sea economic criteria.

Green growth and the blue ocean economy are becoming a global concern and is seen as the engine for economic recovery and promotion and as a tool for sustainable development at the global and national level. The focus of Viet Nam's maritime economy is the efficient exploitation of seaports and shipping services. To plan, build and organize the synchronous and effective exploitation of general seaports, international transshipment ports and specialized ports associated with supporting services; building and completing logistics infrastructure and traffic routes, connecting seaports with domestic and international regions, regions and localities. Promote the

development of a shipping fleet with a reasonable structure, apply modern technology, improve service quality, meet the needs of the domestic transport market, deeply participate in the transport supply chain, gradually increasing, occupying the international market share.

⁴⁹During the construction process, scenarios for the development of the maritime industry to 2030 were based on and integrated all national strategies and policies on green growth and sustainable development of the marine economy, specifically: Strategy National strategy on green growth to 2020, Strategy for exploitation and sustainable use of resources and marine environment protection to 2020, vision to 2030, as well as international commitments on environment and development. develop. A number of laws and plans to implement green growth-related tasks have been promulgated such as National Green Growth Action Plan for the period 2014 - 2020, Law on the Sea of Viet Nam 2012, Law on Natural Resources and Environment of Sea and Islands in 2015, and recently included "National Marine Spatial Planning" into the Law on Planning 2017, etc. and especially Resolution No. 36-NQ/TW dated 22 October 2018 of the 12th Party Central Committee on the Strategy for sustainable development of Viet Nam's marine economy to 2030, with a vision to 2045.



Import and export commodities at the Hai Phong International Container Terminal (Image by: VNA)

Therefore, it can be seen that in general, the development scenarios that are being proposed for the maritime industry to 2030, with an orientation to 2050, do not conflict with the goals or criteria for green marine economic development. Even, more orientations and solutions in the planning are given towards the criteria of sustainable and green marine economic development.

However, from an expert perspective, looking at the development situation of the maritime industry compared with the criteria for building a blue economy, we realize

⁴⁹ <https://www.vietnamplus.vn/cang-bien-hai-phong-huong-toi-muc-tieu-don-100-trieu-tan-hang/775780.vnp>

that there are many problems that need to be overcome or adjusted to guide the development of the marine economy.

1) Shipping and national fleet

- Maritime Transportation

In the transportation industry, ocean freight is proven to be one of the most efficient, low-cost, safe, energy-saving, and has less negative impacts on the environment than road transport and railway. This means that if the advantages of sea transport are not promoted at the optimal level, the level of safety, environmental protection and logistics efficiency will decrease because then it will have to use different modes of transport. other, especially by road. Promoting sea transport is towards the development of a safe, convenient, efficient and sustainable transportation system in Viet Nam.

According to statistics from the Institute of Transport Strategy and Development, Ministry of Transport, transportation activities in Viet Nam consume a large amount of energy, accounting for 30% of the total national energy demand and accounting for 30% of total energy demand, 60% of total fuel consumption. Energy consumption in transportation activities has increased by over 10% per year in recent years, of which road transport consumes the largest energy, accounting for about 68% of the total fuel of the industry. With the consumption of large quantities of fuel, transportation activities have emitted large amounts of greenhouse gases. Currently, an average year of transport emits about 50 million tons of CO₂. In which, emissions from road traffic are the largest, accounting for 86%, while both railways, waterways and airways have 14% (only for domestic transport).

Therefore, the transformation of transport mode from road to sea transport is a sustainable development orientation. In theory, promote ocean shipping as an alternative to road transport as much as possible. However, in reality, this problem also depends on many factors such as transportation demand, transport routes, transport distances, types of goods transported, transport capacity, etc. The volume of sea transportation by 2030 according to the planning is calculated based on the binding conditions that are feasible under 02 options

In Viet Nam, the promotion of sea transport to replace other modes of transport can mainly only be done on the North-South inland transport corridor while international

shipping is a specific and fundamental growth. naturally according to the import and export needs of the economy, so it is difficult to intervene.

Currently, the maritime transport market share accounts for about 35% of the total transport volume on the North-South corridor, but for the overall domestic market share, sea transport only accounts for about 12.4% (about 128.2 million tons). According to the new master plan approved by the Prime Minister, the volume of inland shipping by 2030 will reach about 250-290 million tons, accounting for a market share of about 11.2-13.0% of the total domestic shipping volume and accounting for about 29% of inland transport volume on the North-South corridor. According to our calculations, the volume of domestic shipping in 2030 can reach 350 million tons if there are better development conditions than the plan's option (infrastructure capacity, fleet, personnel) resources, etc. and appropriate mechanisms and policies). However, in practice, this goal is difficult to achieve.

- National fleet of ships

⁵⁰Developing the national fleet is an indispensable element in the sustainable development of the maritime industry in order to bring maximum benefits to the maritime logistics service supply chain. Although no longer setting specific development goals for 2030 as in previous periods, orientation and encouragement for the development of the national shipping fleet still need to be promoted to increase the market



Image by: Vietnam Plus

share of import and export cargo transportation. Also, limiting dependence on foreign shipping lines to reduce logistics costs, increases foreign currency revenue, and at the same time undertake 100% of domestic shipping goods (as per current regulations).

Increasing the market share of international transport also significantly increases the contribution of shipping to the GDP and GNI of the maritime industry by 2030.

Viet Nam's shipping demand by 2030 is about 900 million-1,076 million tons of goods, of which international transport accounts for about 72%-73% and the rest is domestic transport. With annual revenue from international sea freight estimated at around 30

⁵⁰ <https://www.vietnamplus.vn/bat-chap-dich-covid19-doi-tau-bien-viet-cong-hang-hoa-tang-12/724523.vnp>

billion USD, the current situation of over 90% of international shipping market share is assumed by foreign shipping lines is a great loss to the domestic maritime industry. In order to change this situation, the most basic problem is to develop a national fleet of ships of the right type and structure to increase the market share of freight on international routes, especially specialized ships such as containers, oil tankers, LPG ships, etc. with large tonnage.

However, setting too high targets and too ambitious goals like before on the ability of the national fleet to participate in the international shipping market is unrealistic and lacks feasibility. Most recently, the maritime transport master plan for the period to 2020, with a vision to 2030, sets a goal that by 2030, the national fleet will account for 25% of Viet Nam's import and export freight transport market share (equivalent to about 20 percent) equivalent to more than 200 million tons according to the 2013 forecast). This means that domestic shipowners have to increase the shipping capacity of the national fleet by at least 2.5 times compared to the current one with the goal of modernizing and increasing tonnage, especially must be able to directly participate in competition and dominate the market on container shipping routes from Viet Nam to the US and Europe, crude oil and LPG transportation activities, etc. Up to this point, this goal can be confirmed to exceed the capacity of domestic shipping enterprises many times.

In addition to the development goal of the number, size, and tonnage of the necessary types of ships, the modernization and rejuvenation of the existing fleet must also be thoroughly implemented to meet the increasing standards of environmental protection, as well as international technical standards set for shipping, are increasing. The global shipping industry has been applying new solutions to reduce emissions. This will be the dominant trend in the shipping industry and the entire maritime supply chain in the near future. The new regulations of the World Maritime Organization (IMO) under the strategy to reduce the global greenhouse gas (GHG) by 50% from shipping activities by 2050 compared to the estimated emissions in 2008 are one of the major challenges for Viet Nam's fleet.

From 1 January 2020, according to IMO regulations, all ships must use marine fuel with a maximum sulfur content of 0.5%, up from the current limit of 3.5%. to prohibit shipping lines from transporting oil with a sulfur content of 3.5%. This regulation is pushing Vietnamese shipping enterprises to face a very difficult situation when the Vietnamese fleet is aging again, the average age is up to 14.7 years old, the exploitation capacity is no longer high, and the operating cost is not high. large depreciation charges. In case of using new fuel, shipowners, in addition to having to

spend an additional 100 USD/ton, may have to spend a relatively large amount of money to replace technical equipment such as cermet, piston, etc. to ensure safe operation of the machine. In the case of not using alternative fuels, installing a sulfur filter device, this equipment is very expensive, some companies offer prices ranging from 2 to 10 million euros, the financial arrangement of Vietnamese transport enterprises to buy this device is very low.

All the above analysis factors show that the setting of national fleet development goals should be carefully considered to ensure feasibility. In our opinion, with a growth rate of sea transport volume of about 7.4%/year in the period of 2020 - 2030, the goal by 2030 is to develop the national shipping fleet capable of taking on a maximum of about 10% of the market. The part of Viet Nam's import and export freight transport (equivalent to about 65 - 75 million tons) and undertake 100% of the inland sea transport volume (equivalent to 250 million - 280 million tons), which is considered suitable. Of course, along with this goal, the government needs to issue more effective encouragement and support policies so that businesses can afford to remove old and unqualified ships, and at the same time purchase more types of ships. Specialized ships, large tonnage.

2) The seaport system

The seaport economy is the mainstay of the maritime economy both now and in the future. Effective development and exploitation of the seaport system, as well as environmental protection for sustainable development, are the main goals that have been set for Viet Nam's seaport system by 2030, with orientation to 2050 according to the following principles: The script has been approved by the Government.

⁵¹Regarding the effective exploitation of the seaport system, the international gateway seaports at the two ends of the country, Hai Phong and Ba Ria-Vung Tau, are particularly focused on improving the international container transport operation capacity with the capacity to receive large container ships and also become the main logistics service centres of the country. In addition, the ability to connect the transport infrastructure between the seaport and the inland rear by more efficient modes of transport such as railways and inland waterways is also clearly defined in combination with the system of transport systems inland port (ICD) to improve the efficiency of logistics services.



Container terminal at Cai Mep, Ba Ria – Vung Tau Province (Image by: Vinamarine)

In terms of environmental protection, in the process of developing seaport development plans according to the planning scenarios, all of them have been evaluated for environmental protection, thereby showing that there is no conflict or impact. negative impacts on other areas of the marine economy as well as the criteria for blue sea economic development, especially affecting ecosystems, marine biological reserves, fishing and aquaculture. In addition, the orientation of seaport development in the trend of "green ports", has shown that Viet Nam is having policies to manage and develop sustainable seaports.

However, in the development of the seaport system in Viet Nam, there are problems that need attention to be overcome to ensure the sustainable development criteria that have been set in relation to the construction and operation of seaports including the following key issues:

- Regarding the effective exploitation of the seaport system: Firstly, the problem of connecting transport infrastructure and logistics services between the seaport and the rear inland needs to be thoroughly overcome the long-standing factors such as most

⁵¹ <https://www.vinamarine.gov.vn/vi/tin-tuc/cang-vu-hang-hai-vung-tau-trien-khai-phong-chong-covid-19-hieu-qua-gan-voi-lam-tot-cong-tac>

transports bring goods in and out of the port by road, causing congestion at the port, increasing costs, polluting the environment, etc. Railways, inland waterways and inland ports connect seaports, and it is necessary to focus investment and put into operation in accordance with the planning, to avoid an aggravating situation for seaports when goods are high, especially for international gateway ports. Secondly, it is necessary to consider an early decision on whether to continue or stop the investment in the international transshipment port at Van Phong (Khanh Hoa) because the project is still being planned but it is not known when it will be deployed, affecting the environment and development of a number of local marine economic sectors. According to the opinion of some international organizations and experts, this project is no longer topical, the exploitation efficiency as well as the low financial efficiency.

- Regarding environmental protection: Pollution sources in seaport exploitation activities include the construction of seaports, harbours, activities of ships, dredging, maintenance and dredging activities (dredging of navigational channels, moorings and transshipment areas, avoiding storms, oil spills or collisions). These activities affect air quality, water environment, cause erosion/accumulation and increase waste. It is necessary to have solutions to prevent and deal with these incidents in a timely and effective manner when in the future seaport activities in Viet Nam will continue to increase.

- Developing seaports according to the green port model: Determining the criteria for green ports and organizing the pilot implementation of the green port model suitable to Viet Nam's conditions; gradually deploy the green port model suitable to Viet Nam's conditions on a national scale; promote the use of clean, low-carbon, environment-friendly technologies in the seaport operation business to meet the requirements of sustainable development, protect the environment and ecosystems, respond to with climate change. Striving to apply mandatory green port criteria in Viet Nam from 2030.

3) Shipbuilding industry system

A new master plan for the shipbuilding industry is needed to reassess the capacity and development possibilities of the current system of shipbuilding and ship repair facilities, and to identify specific new development goals. and clearer. Currently, the old plan is only until 2020, but according to the new regulations, there is no independent plan for the shipbuilding industry for the period until 2030, but it needs to be integrated into the general industrial system planning.

The goal of sustainable development of the shipbuilding industry is inseparable from supporting industries such as mechanical engineering and metallurgy as well as the domestic demand for building and repairing ships and national fleet to create solid market. The issue of environmental protection also needs to be focused on shipbuilding and repairing facilities, especially repair.

3.6.1 Baseline scenario

From the above analysis, we propose baseline scenario for shipping by 2030 corresponding to the low plan according to the approved master plan. For developing the national fleet, the number of ships and the total tonnage in 2030 will both decrease compared to the present due to the number of ships that have to be marginalized (old ships, unsatisfactory technical standards, unsuitable types, etc). Limited number of ships will be added. However, the productivity and efficiency of ship operation have still improved, so although the market share of import and export freight transport of the domestic fleet in 2030 will decrease by about 2%, the volume of international transport realized is still high, 52.7 million tons, about 18 million tons higher than today. Capacity through the seaport system will reach 1104 million tons in 2030, in which capacity through container will reach 38,0 million TEU.

3.6.2 Blue scenario

Sustainable development scenarios for the maritime industry up to 2030 are synthesized from development scenarios of shipping, national fleet and seaport system. The component scenarios are all similar, unified and closely related to each other.

We propose blue scenario for shipping by 2030 corresponding to the high plan according to the approved master plan. For developing the national fleet, although the number and tonnage of the fleet in 2030 will decrease slightly compared to today due to the large number of ships being scrapped and the number of additional ships, the international transport market share will still remain at 10% due to the large number of ships being rejected. Ships develop in the direction of modernity and increase the efficiency of exploitation. Capacity through the seaport system will reach 1444 million tons in 2030, in which capacity through container will reach 47,0 million TEU.

The demand for sea transportation is associated with the volume through the seaport, which means that the system requires sufficient capacity to meet. Developing the national fleet is also associated with shipping demand with the task of taking on 100%

of domestic shipping demand and increasing the market share of international shipping.

The following table summarises the scenarios for the maritime industry up to 2030.

Table 3.16. Summary of scenarios for the maritime industry up to 2030

No.	Targets	Unit	2019	Baseline Scenario	Blue Scenario
I	Maritime Transportation	%	24.12	20.61	22.84
1	Maritime transport market share compared to total transport volume	%	24.12	20.61	22.84
2	Volume of goods transported by sea	Million tons	513	907	1076
-	International transport	Million tons	336	657	787
-	Inland transport	Million tons	177	250	289
3	National Sea Fleet	Unit	1.049	800	1.000
-	Quantity	Unit	1.049	800	1.000
-	Tonnage	Million DWT	6.9	6.0	6.5
-	The market share of imported and exported goods is handled by the domestic fleet	%	10.0	8.0	10.0
-	Cargo volume handled by domestic fleet	Million tons	210.6	302.7	367.7
	International transport	Million tons	33.6	52.7	78.7
	Inland transport	Million tons	177	250	289
5	Seaport				
-	Capacity through the seaport system	Million tons	664	1.104	1.444
	Only capacity through container	Million TEU	19.6	38.0	47.0

Source: Maritime transport team

The summary table of maritime industry development scenarios is the basis for the calculation and determination of added value (equivalent to the GDP and GNI) of the industry in the period of 2020 – 3030.

The method of calculating the GDP and GNI of the maritime industry in the period of 2020-2030 is similar to the period of 2010-2019 (presented in the content of the assessment of the economic situation of the industry).

As argued the calculation method in the status quo in 2019, due to the special nature of the maritime industry's products (sea freight costs and port services) are not final

goods but rather Intermediary costs have been deducted when calculating the added value (VA, GO) of other sectors. So the calculation of the GDP and GNI of the maritime industry in the period 2020 - 2030 is only an equivalent estimate for homogeneous and easy to compare with the rest of the blue sea economic sectors. In fact, the estimated result is the total value added of the maritime industry, not the contribution to GDP like other sectors.

Table 3.17. Comparative comparison of GDP, maritime GNI in GDP, national GNI for the period 2020-2030 according to the Baseline Scenario

Year	Maritime GDP	GNI Maritime	GDP Country	GNI Nationwide	The proportion of maritime industry in GDP	Percentage of maritime industry in GNI
	Billion dong	Billion dong	Billion dong	Billion dong	%	%
2020	47,441	20,514	6,429,778	6,183,225	0.74%	0.33%
2021	51,649	22,368	6,847,713	6,552,599	0.75%	0.34%
2022	56,229	24,390	7,292,815	7,000,257	0.77%	0.35%
2023	61,217	26,595	7,766,848	7,434,024	0.79%	0.36%
2024	66,646	28,999	8,271,693	7,878,811	0.81%	0.37%
2025	72,557	31,621	8,809,353	8,357,102	0.82%	0.38%
2026	78,992	34,479	9,381,961	8,989,389	0.84%	0.38%
2027	85,998	37,596	9,991,788	9,284,055	0.86%	0.40%
2028	93,626	40,994	10,641,254	9,981,231	0.88%	0.41%
2029	101,930	44,700	11,332,936	10,675,253	0.90%	0.42%
2030	110,970	48,741	12,069,577	11,606,763	0.92%	0.42%

Source: Maritime transport team

Table 3.18. Equivalence comparison of GDP, maritime GNI in GDP, national GNI in the period 2020-2030 under the Blue Scenario

Year	Maritime GDP	GNI Maritime	GDP Country	GNI Nationwide	The proportion of maritime industry in GDP (%)	Percentage of maritime industry in GNI (%)
	Billion dong	Billion dong	Billion dong	Billion dong	%	%
2020	47,814	20,515	6,429,778	6,183,225	0.74%	0.33%
2021	52,465	22,372	6,847,713	6,552,599	0.77%	0.34%
2022	57,568	24,397	7,292,815	7,000,257	0.79%	0.35%
2023	63,167	26,604	7,766,848	7,434,024	0.81%	0.36%
2024	69,311	29,012	8,271,693	7,878,811	0.84%	0.37%
2025	76,052	31,637	8,809,353	8,357,102	0.86%	0.38%
2026	83,449	34,501	9,381,961	8,989,389	0.89%	0.38%

2027	91,565	37,623	9,991,788	9,284,055	0.92%	0.41%
2028	100,471	41,027	10,641,254	9,981,231	0.94%	0.41%
2029	110,243	44,740	11,332,936	10,675,253	0.97%	0.42%
2030	120,966	48,789	12,069,577	11,606,763	1.00%	0.42%

Source: Maritime transport team

3.7. Environmental protection, biodiversity and marine ecosystem services

Practice shows that the environment, biodiversity and marine ecosystems (including marine ecosystem services) have the following main types of interactions:

(i) The environment, biodiversity and marine ecosystems create benefits for economic activities on land (oil refining, commerce, land transport connections, etc.). However, economic activities on land contain great *risks to the environment*, biodiversity and marine ecosystems due to waste from economic activities on land discharged into rivers and sea due to socio-economic activities of coastal localities.

(ii) Interactions from economic activities at sea to the environment, biodiversity and marine ecosystems in both forward and reverse directions. In the forward direction, the environment, biodiversity and marine ecosystems are the premises for maintaining marine economic activities. In the opposite direction, economic activities at sea will have different negative impacts on the environment.

(iii) Climate change and sea-level rise have created pressure on the environment, biodiversity and marine ecosystems.

Since the environment, biodiversity and marine ecosystems are one of the three pillars of sustainable development, the realization of the goal of environmental protection, biodiversity conservation and wise use of ecosystems for economic, social, security and defence development brings dual benefits and contributes to the successful implementation of 17 SDGs by 2030. On that basis, to be able to achieve sustainable development goals in the blue sea economy, environment, biodiversity and marine ecosystem services in Viet Nam needs to promote the following mechanisms and policies:

- Protecting the environment, biodiversity and marine ecosystems is the responsibility of all levels of government and sectors to successfully implement the 2030 SDGs, and implement the policy of rapid and sustainable development of the country;

- Environmental protection, biodiversity and marine ecosystem services are closely related to socio-economic and environmental activities on land. Therefore, it is impossible to separate the goal of protecting the marine environment from the objectives of protecting the environment on land;
- Protect the environment and biodiversity and wisely use marine ecosystems to make the values of the environment, biodiversity and services of marine ecosystems the driving force and input of the marine ecosystem and economic system, realizing the goal of sustainable economic growth;
- Apply market-based tools in line with international commitments that Viet Nam has signed to improve the system of institutions and policies on environmental protection, biodiversity, protection and development. Develop marine ecosystem services in order to adjust the behaviour of economic actors at sea to be friendly to the marine environment, towards sustainable development.
- Focus on biodiversity conservation, restoration of ecosystems, especially coral reefs, seagrass beds, mangroves and coastal protection forests ensuring the integrity and natural relationship between terrestrial and marine ecosystems.

In the coming years, in order to preserve the marine environment and biodiversity in line with the development of the blue sea economy, it is necessary to implement the following solutions:

(1) Increasing the application of economic tools and market-based mechanisms (MBA) in the management, exploitation and use of the environment, biodiversity and marine ecosystems

- To quickly issue decrees and circulars guiding the implementation of regulations on economic tools and resources for environmental protection in the Law on Environmental Protection in 2020 passed by the National Assembly (including the issue of environment, biodiversity and marine ecosystem services). Some of these notes are as follows:
- Develop 01 pilot program on application and completion of regulations on "payment for marine ecosystem services".
- Develop a separate set of criteria for business investment projects on the sea and coast to meet the requirements of effective and sustainable use of natural capital sources, environmental protection and marine biodiversity to do business. the basis

for the implementation of preferential and supportive policies in the law on environmental protection.

- Finalize regulations on compensation for environmental damage applied to marine economic activities; Liability insurance for the damage caused by marine environmental incidents, especially oil spills and discharges from the mainland, causing damage to the marine environment and ecosystems.
- Develop technical guidelines on integrating natural capital specific to the sea and islands into the development of master plans, plans, programs and projects at all levels and sectors. Especially for the marine spatial planning being implemented by the Ministry of Natural Resources and Environment.

(2) Developing sustainable marine economic models

- Ministries, branches and localities shall review, evaluate and select sustainable marine economic models suitable to the objectives of both economic development and improvement of the competitiveness of products and goods on the market. The school contributes to environmental protection, biodiversity conservation and marine ecosystems. In order to respond to climate change, the models that have been studied and demonstrated need to be learned and deployed such as green economic models and ecosystem-based models-EbA in islands and coastal areas.
- Promote the application of circular economy to improve resource use efficiency and reduce pollutants from economic activities on land, especially wastewater and plastic waste. Strengthening control and readiness to respond to marine environmental incidents and disasters, oil spills of unknown origin.
- Exploiting the values of conservation areas and natural landscapes, combining conservation with eco-tourism development; continuing to expand the mechanism of payment for environmental services for marine and coastal wetlands to generate income for investment in the protection, restoration and development of biodiversity and natural landscapes.
- Develop a roadmap to reduce the number of small fishing boats, reorganize fishing formations and increase fishing efficiency based on the separate issuance of policies with small fisheries and large fisheries, as well as integrated fisheries management based on synchronous problem solving - fisherman, fishery and fishing ground (three fish) and ecosystem. Control, prevent and eliminate destructive forms of fishing; implement community-based co-management of aquatic resources; apply ecological

certificates; develop aquaculture models that combine biodiversity conservation and develop marine ecosystem services.

- Increase the application of "natural solutions" to promote biodiversity conservation, live in harmony with nature and contribute to global efforts in nature conservation, biodiversity and sustainable development; investigate and assess the current situation and take resolute measures to eliminate destructive fishing and fishing practices; Researching and testing the mechanism of co-management of aquatic resources, applying ecological certificates, accessing other market mechanisms in the exploitation of aquatic resources; Develop and implement programs and projects to protect and restore biological productivity and the ability to provide nutrients, spawning places, and nurse aquatic resources of marine ecosystems in order to restore aquatic resources. aquatic products near the coast.

- Investigate, make statistics on the area, assess the status, make data banks, maps of natural coastal wetlands, seagrass beds, coral reefs and specific natural ecosystems is different

(3) Organization of management apparatus and resources for marine environment protection

- To perfect the organizational apparatus system, a close coordination mechanism between ministries, branches and localities to form an organizational apparatus strong enough to coordinate overall activities at sea.

- Assign the Ministry of Natural Resources and Environment to closely coordinate with relevant ministries and branches to invest in building facilities and equipment for automatic monitoring and warning on environmental quality, responding to environmental incidents, marine environment, and marine plastic waste management to prevent and minimize risk factors that may affect the development of marine organisms.

- Strengthening human resources and equipment for environmental protection for provincial, district and commune governments at all levels; strengthening coordination between local authorities and regional environmental management agencies to increase enforcement of law enforcement.

- Investment from the state budget, priority is given to development assistance (ODA) loans to implement programs, research and projects at home and abroad, especially

projects under the National Target Program on the treatment of natural disasters. pollution and improving the marine environment.

- The State implements investment programs, mobilizes ODA capital and resources from all economic sectors, domestic and foreign organizations to invest in the restoration of natural ecosystems, in combination with improving the resilient capacity of ecosystems to the impacts of climate change; advocate to establish payment for ecosystem services (PES) in the direction of promoting the restoration, regeneration and protection of marine natural ecosystems.

4. Comparative assessment

4.1. Supporting SDG delivery

The blue economy forms an important part of the socio-economic development of Viet Nam. This chapter explores the way in which each marine economic sector interacts with the 17 SDG Goals; this interaction can be positive in that the sector helps in the achievement of the SDG, or negative in that it constraints or limits delivery of a SDG. Part of the challenge of managing the ocean is about promoting the gains for multiple SDGs from the marine sectors, while at the same time limiting or mitigating the negative interactions with SDGs. Identifying gains across multiple SDGs and then setting policy and regulatory interventions to capture these gains, will help fill the remaining potential in the blue economy as per Resolution 36.

Various approaches have been developed to look at gains across multiple SDGs. In this study, in order to assess the impact of developing marine economic sectors with the Sustainable Development Goals (SDGs), the method of the Stockholm Environment Institute was applied (Stockholm Environment Institute⁵²) for understanding this interaction. The interaction between the economic sector and each SDG is estimate based on a 7 point scale, from +3 to -3 (Table 4.1).

Table 4.1. The scale shows the relationship between the development of marine economic sectors and the Sustainable Development Goals

Score	Description
+3	Progress in the sector delivers significant progress on the SDG
+2	Progress in the sector delivers progress in the SDG
+1	Progress in the sector delivers minor progress in the SDG
0	Progress in the sector is independent of the SDG
-1	Progress in the sector delivers minor negative effects on the SDG
-2	Progress in the sector delivers some negative effects on the SDG
-3	Progress in the sector delivers significant negative effects on the SDG

Using this approach, Table 4.2. shows that, at present, the marine economic sectors have had different impacts on the SDGs, but most of them are positive, either direct or indirect. Labour-intensive industries such as seafood and tourism have a positive impact on the goals of poverty reduction, improved nutrition and gender equality.

⁵² Nilsson, M., Chisholm, E., Griggs, D. et al. Mapping interactions between the sustainable development goals: lessons learned and ways forward. *Sustain Sci* 13, 1489–1503 (2018). <https://doi.org/10.1007/s11625-018-0604-z>

Table 4.2. Evaluate the correlation between the marine sectors and SDGs

Sector SDG	RE Energy	Oil & Gas	Fisheries	Marine Tourism	Marine Transport	Environment, Biodiversity & Ecosystem
1. No poverty	(+1) Attending to reduce poverty that bases on providing new jobs during constructions, installations and operations.	(+2) Oil & gas sector contributes remarkable portion of state budget, thus helps the government to have resources to end poverty in the remote and difficult areas.	(+3) Nearshore capture fisheries (accounting for 49.11% of total vessels in 2019 in Viet Nam) and small-scale aquaculture farming (60%) create sustainable livelihoods and incomes for poor communities in coastal and island areas.	(+2) Tourism is a labor-intensive industry, so it plays an important role in hunger eradication and poverty alleviation in many coastal areas of Viet Nam.	(+1) Shipping activities, seaports and shipbuilding industry have certain contributions to job creation and income for coastal areas and islands. For example, many coastal localities have had jobs by participating in seaport operations, operating in the shipbuilding industry and working in shipyards, working as crew members on ships, since then. have income, improve the quality of life, eliminate hunger and reduce poverty.	(+2) Biodiversity conservation, environmental protection and the expansion of ecosystem services enhance potential for economic activities (marine tourism, fisheries, renewable energy, etc.), increase the number of job opportunities that bring higher income for coastal residents.
2. Zero hunger	0	(+1) LPG produced from natural gas offshore Viet Nam may bring heat to remote communities and help with food preparation and cooking; ure produced helps to get better agricultural outcrops. All help to end with hunger.	(+3) Nearshore capture fisheries and small-scale aquaculture farming help to reduce poverty rate and ensure food security for poor communities in coastal and island areas.	(+2) Tourism is a labour-intensive industry, so it plays an important role in hunger eradication and poverty alleviation in many coastal areas of Viet Nam.	(+1) Maritime contributes a part to the state budget, thus helping the Government with resources to eliminate hunger and reduce poverty in remote and disadvantaged areas.	(+2) Biodiversity conservation helps increase the fisheries resources that yield high value of food supply.
3. Good Health and Well-being	(+1) It may also indirectly support the achievement and ensuring good health and air quality.	0	(+3) Providing seafood that improves nutritional levels and contributes to social welfare access for poor communities in coastal and island areas.	(+2) Marine tourism improves the livelihoods of local communities, enabling them to take better care of their health.	(+1) Shipping activities will help increase local revenue, thereby indirectly contributing to the improvement of health and a good life in the regions. Emissions from shipping are significant, but only one of many sources released into the atmosphere and released into the sea. However, transportation has a	(+3) Marine ecosystems (mangroves, coral reefs and sea grasses) can be valuable raw materials for the production of medicine. Clean water helps to protect

					limited impact on substance abuse and traffic accidents globally.	everyone's health when swimming.
4. Quality Education	(+1) Contributing opportunities to access to education and knowledge for local residents.	0	(+2) Sustainable capture fisheries and aquaculture development helps local communities in coastal and island areas have more opportunities to access to education and technical training.	(+2) Sea tourism promotes local youth to participate in learning and improve career knowledge.	(+1) Shipping activities will help increase local revenue, which will indirectly contribute to quality education.	(+2) Biodiversity provides broad and rich knowledge through marine flora and fauna surveys that support biological students, researchers, and more.
5. Gender Equality	0	0	(+2) Many opportunities are created for women to participate in fish processing, marketing and aquaculture industry.	(+2) As one of the sectors with the highest share of women employed and entrepreneurs, tourism can be an efficient tool for development of women, raising their roles and significance in families and communities.	(-1) Shipping is one of the industries with a much higher proportion of male employees than female employees. The development of maritime transport without proper attention to gender equality will lead to deeper gender stereotypes.	(+1) Women are a large force in all activities related to biodiversity conservation.
6. Clean Water and Sanitation	(+1) Contributing to access to clean water that bases on providing adequate and stable supply of energy.	(0) If not managed well, oil and gas can cause water pollution (-) Oil & gas activities are mainly offshore and do not have impact on onshore water. In some cases oil & gas exploration even could help to find some water sources (eg. Tien Hai). (+)	(-1) Aquaculture development uses water resources and may create negative impacts on environment such as organic pollution from feed residues, mud wastes, and salinity intrusion.	(+2) Tourist development also would probably improve water supply and drainage infrastructure, increase sanitation standards, and help improve the living conditions of local people.	0	(+3) Protecting the marine environment and biodiversity will contribute to protection and supply of clean water. Notably, desalination is an important process to ensure enough clean water in some countries.
7. Affordable and Clean Energy	(+3) Offshore wind power is an energy source that meets	(+3) Development in the oil & gas industry and its energy transition lead directly	0	(+1) Local people can learn from innovative affordable and clean energy solutions in	(+2) Shipping also contributes to the development of clean energy in the world such as renewable energy solutions - biofuels, hydrogen, solar and wind power, improved	(+1) Maintaining a safe marine environment will indirectly support wind power

	affordable and clean energy requirements.	to clean energy production affordable to all.		ecotourism establishments.	energy efficiency and continued implementation. emission reduction solutions to achieve zero emissions.	development and offshore oil and gas production.
8. Decent Work and Economic Growth	(+2) Promoting economic growth and create more jobs for youth.	(+2) The Oil and Gas industry creates many direct jobs in large energy industrial regions like Southeast Viet Nam, Ca Mau, Quang Ngai, Thanh Hoa.... Besides, it creates many indirect jobs related with services, trading and products distribution.	(+2) Contribute to economic growth and create more jobs for local communities in coastal and island areas.	(+3) Tourism has contributed 9.2% of national GDP and coastal and marine tourism is accounted 2/3 of entire tourism sector, is very direct tool for decent work and economic growth.	(+3) Maritime accounts for over 90% of Viet Nam's import and export goods (over 60% of value), so it plays a vital role in Viet Nam's economic growth thanks to the development of valuable and value-added service industries. high. It is necessary to apply modern, competitive technology, etc. Furthermore, jobs in ports, on ships and other maritime-related jobs offer many opportunities for young people of all skill levels.	(+2) Protection of the environment and marine biodiversity contributes to the sustainability of marine economic sectors such as tourism and fisheries.
9. Industry, Innovation and Infrastructure	(+2) Fostering innovation and infrastructure development in some coastal localities.	(+2) Oil & gas sector develops infrastructure and leads the development for some industrial regions, like Ba Ria-Vung Tau, Southeast, Southwest, South- and North Central Viet Nam. By this, it promotes inclusive, sustainable development and fosters innovation in these areas.	(+2) Contribute to improve infrastructures for coastal and island areas such as fishing port, storm shelter, roads, sluice, electricity, telecommunication, etc.	(+3) Improve infrastructures for coastal regions and islands such as passenger ports, airports, roads and bridges, drainage, power supply, telecommunication, etc. where there are tourism development potentials.	(+3) Building modern seaport infrastructure and fleets contributes to creating a synchronous transport system, thereby reducing national logistics costs, increasing trade capacity and competitiveness of foreign trade goods, promoting develop sea tourism.	0
10. Reduced Inequality	(+1) Providing clean electricity indirectly reduces inequality.	(+1) Providing clean and affordable electricity indirectly reduces inequality.	(+1) Nearshore capture fisheries and small-scale aquaculture maintain daily livelihoods for vulnerable local people, leading to reduce inequality within local community.	(+2) Marine tourism contributes to narrowing the gap and promoting development in remote, isolated and	(+1) Maritime has a limited direct impact on inequality between countries. Coastal States are responsible for organizing search and rescue operations.	(+1) Increasing job opportunities for coastal residents through protecting environment can help reduce inequality in society.

				underdeveloped areas, reducing inequality.		
11. Sustainable Cities and Communities	(+1) Contribute to sustainable urban development and communities in many coastal areas.	(+1) Oil & gas industry contribute to sustainable urban development and communities (Vung Tau, Ho Chi Minh, Nhon Trach, Ca Mau, Quang Ngai, Thanh Hoa, Thai Binh...)	(+1) Contribute to sustainable urban and rural development with more access to good foods and infrastructure building in coastal areas.	(+3) Good contribution to sustainable urban development and coastal communities.	(+2) Maritime has a limited direct impact on inequality between countries. Coastal States are responsible for organizing search and rescue operations.	(+2) Cities in 28 coastal provinces of Viet Nam have many opportunities for urban development if they maintain the protection of marine environment and biodiversity and utilize sources of revenue from ecosystem services.
12. Responsible Consumption and Production	(+2) High demands for responsible consumption and production.	(+1) Oil & gas industry today and its transition to clean energy (renewable energy) show responsibility in energy production and consumption.	(+1) Organic shrimp and Marine Stewardship Council (MSC) certifications applied in aquaculture and capture fisheries will contribute to responsible seafood production and consumption.	(+1) Well-mannered tourists with ever growing awareness on sustainability would encourage local people and suppliers in responsible consumption and production.	(+3) Maritime contributes to improving market access and promoting the export of Viet Nam's key export products in a sustainable way (reducing logistics costs); Contributing to strengthening the distribution system and developing the national product supply chain.	(+3) High demands for responsible consumption and production.
13. Climate Action	(+3) Offshore wind development is center on urgent action to combat climate change that bases on proving green power source, replacing fossil fuels and reducing green house gas emissions.	(-1) Oil & gas industry already has Action plan for mitigation of climate change (+), but as the main sources of GHG emissions this action plan may not be enough .(-)	(+3) Brackishwater aquaculture development in coastal salinity intrusion areas (ex. shrimp farming) is considered as one of feasible climate change adaptation solutions.	(-2) Tourism contributes to and is affected by climate change.	(-2) World shipping annually emits about 940 million tons of CO2 and accounts for about 2.5% of total global greenhouse gas (GHG) emissions. Switching ship-utilized energy from fossil fuels to low-carbon alternatives, including renewables in the future, will contribute to reducing greenhouse gas emissions.	(+3) The mangrove ecosystem makes an important contribution to climate change response and disaster prevention. One of the most essential roles of marine ecosystem services is carbon storage - an indispensable solution to mitigate climate change.

14. Life Below Water	(-1) May affect biological species in the project areas.	(-1) Oil & gas sector uses the oceans, seas and marine resources and the process is can not be reversed. .	(+3) Ending IUU fishing and relevant subsidies for capture fisheries will protect aquatic resources and contribute to sustainable fisheries development.	(+3) Coastal and maritime tourism, tourism's biggest segments, rely on healthy marine ecosystems. So preserving and developing life below water is 100% in line with the future of coastal and marine tourism.	(-2) Maritime activities may pose some risks to the marine environment such as large number of vehicles or oil and chemical spills, maritime accidents. The shipping industry contributes 20% of marine pollution. Transport is the single largest contributor to the transfer of alien species. Emissions into the atmosphere contribute to the acidification and eutrophication of the oceans. Maritime operations have been minimized discharge of ballast water, chemicals, waste, oil and wastewater, reduced emissions into the atmosphere during operations as well as introduced anti-biological pollution regulations to prevent the transfer of alien species, minimizing disturbance to marine life, by minimizing acoustic noise and by identifying appropriate operational measures in the most environmentally sensitive areas.	(+3) Enhancement of marine environmental protection and biodiversity conservation is the realization of SDG14.
15. Life on Land	0	0	(+1) Shrimp-mangrove integration creates organic shrimp and contribute to protect and restore coastal mangroves.	(+2) Majestic landscapes, natural reserves, rich biodiversity, and natural heritage sites are often main objectives of tourists. Sustainable tourism can play a major role, not only in conserving and preserving environment, nature and society.	(-1) Maritime operations have released ballast water. Exotic species introduced by ships can affect terrestrial ecosystems.	(+3) Mangroves play a role in preventing storms, natural disasters, protecting forest ecosystems and inland resources.
16. Peace and Justice Strong Institutions	0	0	0	(+2) Contributing to enhancing cultural exchange and mutual understanding.	(+1) Maritime operations are the primary transport of goods, which may include illegal goods. It works around the world to reduce opportunities for corruption, bribery and illicit flows by enhancing transparency about goods,	(+3) Protection of the marine environment and biodiversity requires aid from all people at all levels.

					destinations, financial transactions and the use of agents. agent and mediator.	
17. Partnerships to achieve the Goal	(+1) Partnership with international and bilateral entities.	(+1) The traditional close partnership in oil and gas sector promotes global partnership for sustainable development.	(+2) Partnership with international and bilateral entities to end IUU fishing and promote sustainable aquaculture farming.	(+1) Strengthen cooperation with stakeholders, contributing to sustainable development.	(+3) Maritime is one of the important topics in bilateral and multilateral negotiations within the framework of international trade organizations. Maritime contributes to improving the value and competitiveness of Viet Nam's foreign trade goods. Maritime and seaports are very suitable to promote public-private partnerships, especially in the field of investment, construction and operation of seaports. Shipping can make an important contribution to the partnership, and there is a dedicated international organization (IMO) to develop international policies and regulations.	(+2) Strengthen cooperation between the parties to protect the marine ecological environment.

A summary graph of the interaction of the 17 SDG Goals with the sectors demonstrates a strong positive contribution of the marine economies to the delivery of all of the SDGs. Notable contribution of marine sectors include industry, jobs, production and poverty reduction. Empowering the marine economy in the correct way can have multiple benefits across the spectrum of SDG Goals.

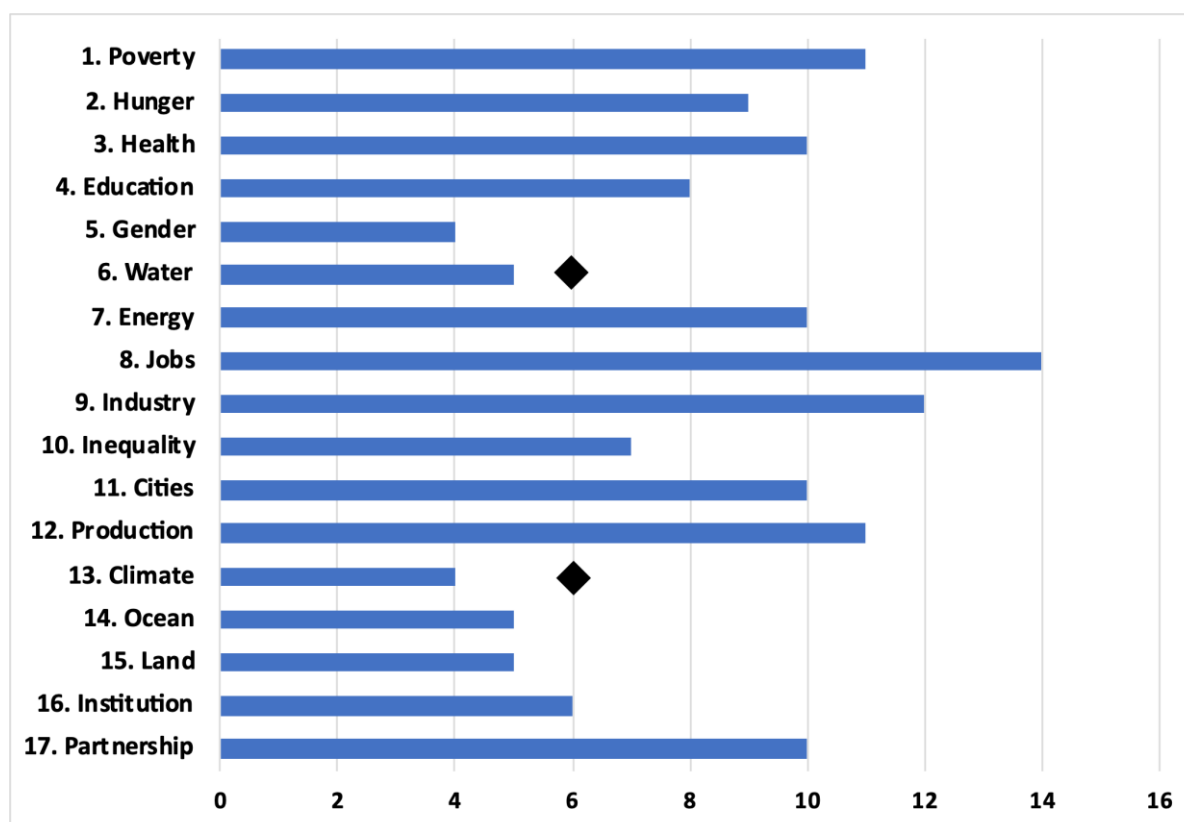


Figure 4.1. The additive interaction of marine sectors on delivery of the 17 SDGs

Note: All SDGs showed a net positive benefit of marine economies. Some negative interactions between the SDG Goal and the marine economic sectors have been identified for SDG6 (water) and SDG13 (climate); these are denoted by a ♦.

Although there was an overall positive effect on SDG delivery, some negative interactions between some economic sectors and SDG 6 (water, e.g. due to effect of aquaculture development) and SDG 13 (climate, e.g. due to effect of oil and gas production) were identified and this led to a low overall additive score. For enhancing the power of the marine economy, these negative interaction are areas which need further sector-based consideration and possible regulatory or technical support to overcome

4.2. Interaction between marine sectors

Theoretically, in areas of resource dispute, the development of one sector sometimes conflicts with the development of other sectors. For example, in a sea area, the extraction of oil can affect shipping or fishing; or the acquisition of an area for the construction of wind or solar power projects may limit fishing and aquaculture or coastal transportation. However, in the real case of Viet Nam, the development of marine economic sectors has not shown significant conflicts. The oil and gas industry operates mainly in the southern offshore waters of Viet Nam, the marine transportation industry is mainly concentrated in the port cluster related to two economic centres, the Northern Key Economic Zone, where two major cities in the North Hanoi and Hai Phong are located, and the Southern Key Economic Zone, where Ho Chi Minh City is the largest economic centre in the country. The seafood industry and marine tourism develop strongly and are scattered along the coast in association with available natural conditions. The newly developed renewable energy industry has only used a small amount of space and is also mainly located on the southern coast of Viet Nam, where other economic sectors are not too concentrated.

Thus, each area of Viet Nam's marine economy is not yet a factor hindering the development of other marine economic sectors. Moreover, in many cases, the development of a marine economic sector opens up more job opportunities for service industries in the value chain of that industry, and at the same time opens up opportunities for other marine economy industries. A fairly typical example is the wind power industry has helped the marine tourism industry by providing more opportunities to create new products: visiting a modern and novel "wind power field". Similarly the seafood industry is benefitted by the tourism industry through supplying fresh food to tourists.

The direction of the interaction between marine economic sectors in Viet Nam based on expert judgement is shown in Table 4.3 and Figure 4.2.

Table 4.3. Interaction between sectors

	RE Energy	Oil & Gas	Fisheries	Marine Tourism	Marine Transport	Environment & Biodiversity
RE Energy	NA	+2	0	+1	+1	+2
Oil & Gas	+1	NA	0	0	+1	+2
Fisheries	+1	-1	NA	-1	-1	+3
Marine Tourism	+1	+1	+2	NA	-1	+3
Marine Transport	+2	+1	+1	+1	NA	+2
Environment & Biodiversity	+1	-2	-1	-1	-2	NA

Note: The score for each cell is interpreted as the impact of the industry in the vertical column on the industry in the horizontal row, and is a composite score that calculates both positive and negative effects; (+3 positive; 0 neutral; -3 negative). Direction and values of interaction is determined based on sector experts consensus.

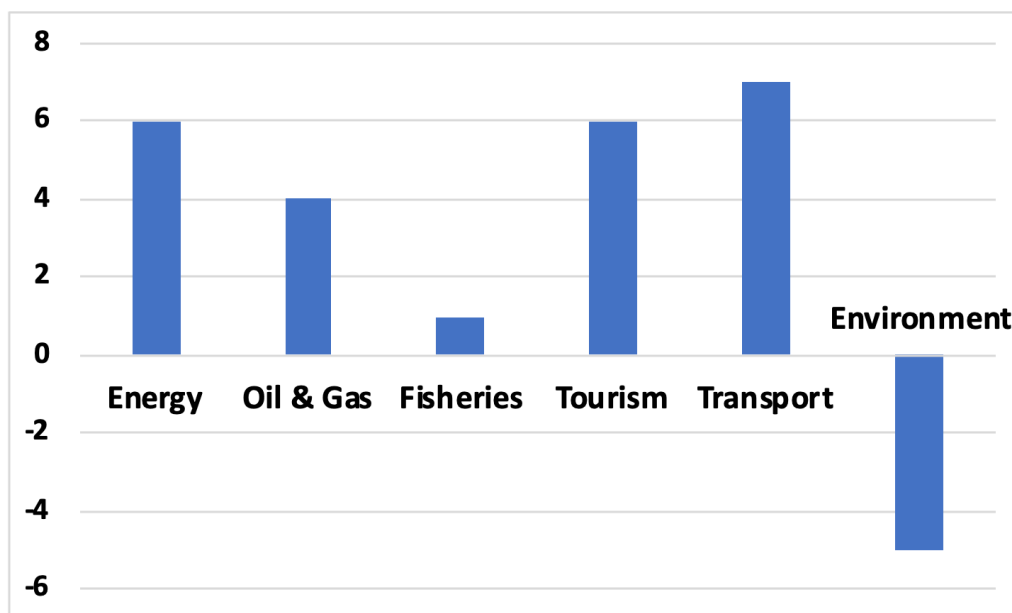


Figure 4.2. The additive interaction between targeted marine economic sectors on each sector

Note: Most interactions between sectors were positive and some were neutral. However, many interactions with the environment showed a negative outcome

Interpretation of this analysis suggests that there are positive interactions between some of the marine economic sectors and other sectors' interactions are neutral. However, the overall effect on the environment of the marine economies is generally negative, with only renewable energy providing a small positive interaction.

The conclusion from the analysis suggests that there are potential catalytic interactions which can be levered between some of the sectors, for example the maritime industry supports the offshore renewable energy growth. Further analysis should help identify these synergies in operational terms. In addition, the negative interaction of most economic sectors on the environment needs to be considered more closely. There may be the need for enhancing the regulation and protection of the marine environment to ensure that economic growth does not compromise ecosystem health; a fundamental principle of a blue economy.

This analysis of sector interlinkages has been undertaken at a national scale to indicate possible pathways forward. However, for inter-sector synergies to emerge and marine ecosystem protection to be strengthened a more detailed analysis is required. This

may well require the use of spatial mapping techniques and implementation of area or zone based management tools. Marine Spatial Planning (MSP) may be an effective way to consider these interactions in an explicit spatial and place-based way, and for growth trajectories which ensure ecosystem health to be identified.

4.3. Scenarios for blue sustainable economic development

Under the impact of the development of marine economic sectors with the SDGs and between marine economic sectors, using expert calculation method, experts have produced blue scenarios of each sector. Usually, experts build 3 scenarios, as follows:

1. Baseline scenario: Developed from the assumption, that resource conditions and policy mechanisms are based on present approaches and those plans and strategies already formulated for 2030. The baseline scenario represents is the business-as-usual scenario for the country based on already approved policies and plans. Economic sectors still have the opportunity to develop in their available marine space, without causing major conflicts with other marine economic sectors. The environmental impact of marine economic sectors is still at an acceptable level, although there have been no significant actions to improve the environment and enrich the marine ecosystem. Economic growth is basically similar to the average rate of the past 10 years, except that the offshore wind power sector has emerged in the last few years and has a strong explosive trend.

2. Blue scenario: The blue scenarios are based on the idea that additional practical and feasible interventions by 2030 can shift social and economic outcomes in a positive way compared to the baseline scenario. For example, the oil and gas industry increases investment to promote exploration, increasing potential oil and gas resources that can be ready for exploitation. The seafood industry has adjusted the structure of fishing boats (increasing the number of large ships, reducing the number of small boats fishing inshore) and increasing the area of intensive aquaculture. As a result, the total catch did not increase or even decrease, but the value obtained increased. The farmed output will increase in both volume and value. Particularly, the offshore wind power sector has a faster growth rate. Under this scenario, mechanisms and policies are adjusted to be more suitable for the requirements of increasing quality and ensuring environmental sustainability and maintaining marine resources. Real actions have been taken to improve the environment and enrich the marine ecosystem such as promulgating marine conservation policies and identifying clearly define marine protected areas. Marine economic sectors still basically develop in their available marine space, do not cause major conflicts with other marine economic sectors. In

addition, the blue scenarios also form a platform for the early progression towards the new climate targets, such as 2050 carbon net zero.

Baseline and blue scenarios were developed for each of the marine economic sectors and then combined together to provide an overall view. The comparison between the Baseline Scenario and the Blue Scenario (Table 4.4) shows that the economic indicators of the sustainable growth scenario are better than the base scenario including the GDP, GNI and GNI per capita. This suggests that there are gains to be made through enhanced sector-based enhancements, as outlined in the sustainable growth scenario. In addition, the general lack of negative interaction between most marine sectors means there is potential for further expansion. However, this will need more careful planning to ensure that marine economy expansion does not increase negative interactions between sectors, and that marine economy expansion does not undermine the quality of the environment and health of the coastal and marine ecosystems.

The use of area-based management tools, such as Marine Spatial Planning should be considered at a national scale, to complement this scenario-based analysis. In addition, if there are specific provinces or areas in which potential inter-sector negative interaction and threats to the environment may occur then more detailed planning should be done at this scale. In some cases, there may be no “win-win” options but careful planning should at least be able to manage the trade-offs and mitigate some of the consequences.

Table 4.4. Summary of development scenarios for major marine economic sectors

	2025		2030	
	Baseline Scenario	Blue Scenario	Baseline Scenario	Blue Scenario
Combined marine economic sectors				
GDP (billion VND)	1,112,822	1,408,486	1,583,504	2,121,840
GNI (billion VND Đ)	852,483	1,111,536	1,229,690	1,682,510
Labor (persons)	4,556,301	4,008,244	5,972,717	5,083,846
GNI per labour (million VND)	147	230	163	290
GDP difference between Blue and Baseline Scenarios (billion VND)	295,664		538,336	
GNI difference between Blue and Baseline Scenarios (billion VND)	259,053		452,820	

GNI per labor difference between Blue and Baseline Scenarios (million VND)	83		126	
GDP growth rate compared to the baseline scenario (%)	26.6%		34.0%	
Growth rate of GNI compared to the baseline scenario (%)	30.4%		36.8%	
Growth rate of GNI per labor compared to the baseline scenario (%)	56.5%		77.5%	
Sector-specific scenarios				
1. Fisheries & Aquaculture				
GDP (billion VND)	190,296	268,871	122,102	337,933
GNI (billion VND)	186,490	263,493	119,660	331,174
Labour (persons)	2,823,169	2,514,112	3,356,871	2,900,000
GNI per labour (million VND)	66	105	36	114
2. Oil & Gas				
GDP (billion VND)	333,000	372,000	418,000	522,000
GNI (billion VND)	152,000	170,000	191,000	239,000
Lao động (persons)	51,232	51,232	53,846	53,846
GNI per labour (million VND)	2,970	3,318	3,548	4,430
3. Marine renewable energy				
GDP (billion VND)	5,969	11,563	51,432	73,941
GNI (billion VND)	5,372	10,406	46,289	66,547
Labor (persons)	20,000	36,000	140,000	200,000
GNI per labor (million VND)	269	289	331	333
4. Coastal and marine tourism				
GDP (billion VND)	511,000	680,000	881,000	1,067,000
GNI (billion VND)	477,000	636,000	824,000	997,000
Labour (persons)	1,441,000	1,186,000	2,161,000	1,669,000
GNI per labour* (million VND)	178	317	221	416
5. Maritime				
GDP (billion VND)	72,557	76,052	110,970	120,966
GNI (billion VND)	31,621	31,637	48,741	48,789
Labour (persons)	220,900	220,900	261,000	261,000
GNI per labour (million VND)	143.1	143.2	186.7	186.9

* GNI per employee in coastal and marine tourism is calculated as GNI per equivalent employee (Hoang Dao Bao Cam. 2021)

Source: Calculations of the Blue Economy expert group

The blue scenario outlined above aligns with the Resolution of the Eighth Plenum of the 12th Central Executive Committee on the Strategy for Sustainable Development of Viet Nam's Marine Economy to 2030, with a Vision to 2045 (Resolution No. 36-NQ/TW; October 2018). According to this Resolution, the goal by 2030 is for “Viet Nam to

become a strong maritime nation; basically, meet the criteria on sustainable development of the marine economy; forming marine ecological culture; proactively adapt to climate change and sea-level rise; prevent the trend of pollution, degradation of the marine environment, coastal erosion and sea erosion; restore and conserve important marine ecosystems. New, advanced and modern scientific achievements have become direct factors promoting the sustainable development of the marine economy”.

By 2045, “Viet Nam will become a strong maritime nation with sustainable development, prosperity, security and safety; The marine economy makes an important contribution to the country's economy, actively and responsibly participating in solving international and regional issues related to seas and oceans. For each marine economic sector, the Resolution states: “By 2030, successfully and breakthrough develop marine economic sectors in order of priority: (1) Tourism and marine services; (2) Maritime economy; (3) Exploiting oil and gas and other marine mineral resources; (4) Aquaculture and fishing; (5) Coastal industry; (6) Renewable energy and new marine economic sectors”.

4.4. Ensuring a sustainable environment

Marine economy expansion is identified as a threat to environmental quality and health. Similar to the marine sectors above, scenarios for future ecosystem quality were made in order to demonstrate that proactive interventions have the possibility of reducing the environmental impact of marine economy expansion, or even increasing environmental quality. In ocean accounting terms, this means that raising GDP and GNI of the marine sectors does not undermine the natural capital of the ecosystems. Scenarios were developed for the environment as follows:

Table 4.5. Scenarios developed for the environment

	Baseline scenario	Conservation scenario	Blue scenario
Motivating factors			
The need to use resources	Unchanged	High	High
Energy demand	Unchanged	High	High
Energy supply	Current energy structure	<ul style="list-style-type: none"> - The energy structure changes - Recycled energy - Modern technology changes 	<ul style="list-style-type: none"> - The energy structure changes - Recycled energy - Renewable and environment--friendly technology changes
GDP growth	6,8-7%	About 7%	More than 7% or green growth

CPI	4%	3,2%	4,3%
Science and technology	Medium	Environmental-friendly technology. Modern and efficient environmental treatment technology	Environmental-friendly technology. Modern and efficient environmental treatment technology
Mechanisms and legal policies on biodiversity conservation	Unchanged	Improved	Innovative, more complete and more feasible
Conservation management	Unchanged	Tight control	Proactive and adaptive management of ecosystems; Effective management of protected areas
Resource Conservation	Unchanged	Conservation	Conservation
Approach to sustainable development	Unchanged	Sustainable development approach	Green technology; Ecological efficiency; Sustainable development approach
Pressure			
Environmental pollution	Environmental pollution	Remain of environmental pollution	Reduction in pollution levels
Climate Change	- Current greenhouse gas emissions - Increased saline intrusion - Scenario RCP8.5	- Average greenhouse gas emissions - Increased saline intrusion - RCP4.5-RCP8.5	- Low greenhouse gas emissions - Controlled saline intrusion - Scenario RCP4.5

Baseline scenario: According to this scenario, economic activities, management, exploitation and use of biodiversity, landscape and ecosystem services are still going on the normal trend as before. All impact measures are unchanged and the economy grows at a high rate (GDP of 6.8 - 7%, inflation rate of about 4%). Also under the scenario, it will normally lead to the general trend of decreasing size, quality and value of ecosystem services (about 3%/year).

Conservation scenario: This scenario assumes that Viet Nam will take many measures to strengthen biodiversity and ecosystem conservation through expanding the area of natural marine protected areas; all activities of exploiting and using ecosystems and biodiversity will be limited. This scenario supports strong protectionism and exclusion of human activities in high biodiversity areas. Economic development target may be lower than the first scenario (GDP of 7%, CPI of about 3.2%). In this scenario, the value of the ecosystem will increase but to a low level due to the limited provision functions (assuming a minimum of 3%/year).

Blue scenario: According to this scenario, the economy still has a high growth rate (GDP of 7%, CPI of 4.3%). Nonetheless, instead of strict conservation, the scenario is

cleverly used to find solutions to rational and sustainable use of the values/functions of the ecosystem and marine biodiversity for economic development through the greening of marine economic sectors. A handful of conservation measures, benefit-sharing mechanisms and economic tools will be formed towards regulating the behaviour of actors involved in marine operations; transforming technology, mode of exploitation and use into a sustainable direction; creating resources for promoting conservation (e.g. green credit, green bonds, payment for ecosystem services, etc). Therefore, the assumption is that the area and values of ecosystems and biodiversity are preserved and increased, but contribute to economic development better (assumed at 5%/year).

The choice of scenarios can have a significant effect on ecosystems within the 2030 year timeline. For example, mangroves could increase in area and nearly double in value, between the baseline scenario and the blue scenario (Fig. 4.3). Similar outcomes of the blue scenario can be seen for corals reefs, seagrass and lagoon in which the blue scenario leads to enhanced value, increased extent of habitat or both.

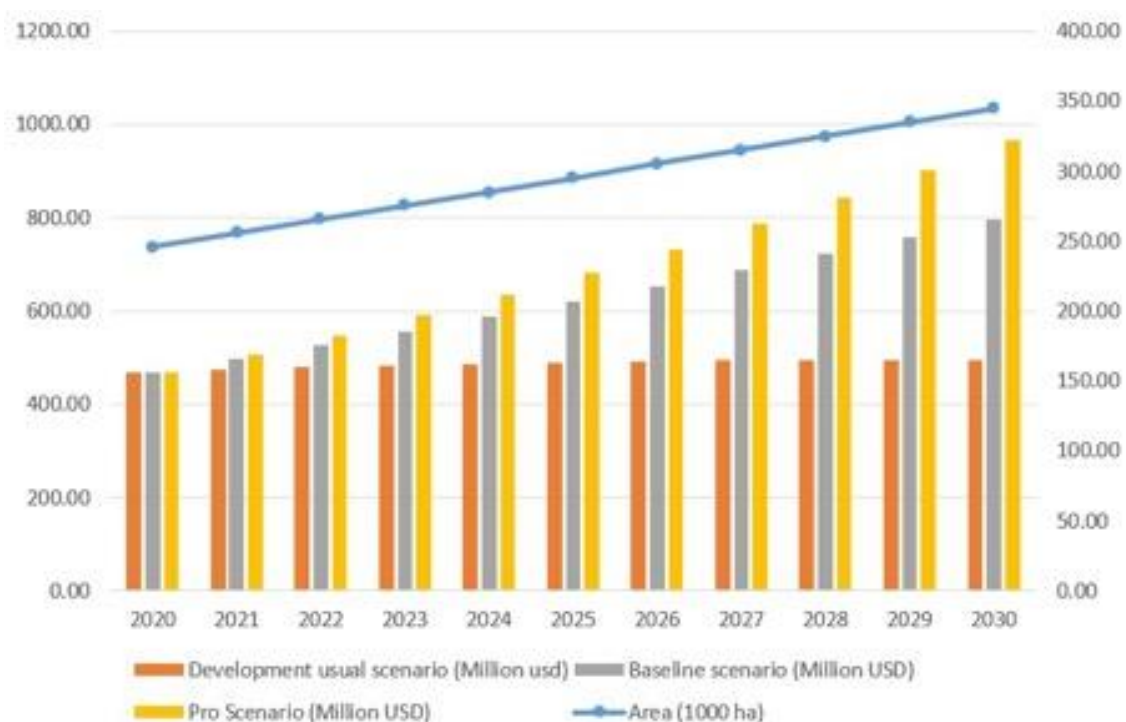


Figure 4.3. Impact trend of different development scenarios on mangrove value and area in Viet Nam over the period of 2020-2030

Overall, for four identified habitat types (mangrove, coral reef, seagrass and lagoon), the value and area of these habitats could increase by 2030. Ecosystem value can be

expected to more than double between the development as usual and the blue scenario.

Table 4.6. Area and ecosystem assets table of four types of marine ecosystem (mangrove, coral reef, seagrass and lagoon) under three scenario options

	ASSETS OF SOME KINDS OF SPECIAL ECOSYSTEM					
	Baseline scenario		Conservation scenario		Blue scenario	
	Area (ha)	Value (million dollars)	Area (ha)	Value (million dollars)	Area (ha)	Value (million dollars)
Beginning value (2020)	322,451.05	3,543.61	322,451.05	3,543.61	322,451.05	3,543.61
- Increased during the period	99,399.89	26.88	99,399.89	999.90	99,399.89	1,968.82
- Decreased during the period	-10,754.95	-1,576.66	0.00		0.00	0.00
Ending value (2030)	411,095.99	1,993.83	76,965.00	4,543.51	421,850.94	5,512.43

Traversing from the baseline scenario to the blue scenario will require a number of interventions to ensure that the ecosystems do not become degraded by marine economic expansion and as outline in the blue scenario prerequisites. Priority within the environmental sector may be given to a number of key areas which could include: (i) propagate, educate and raise awareness about environmental protection, biodiversity and marine ecosystems; (ii) collect data, information and implement ocean accounting; (iii) improve the efficiency and effectiveness of the legal system on natural resources and environment; biodiversity and ecosystem services; (iv) intensify the application of economic instruments and market-based mechanisms; (v) integrate internationally in environmental protection, biodiversity and marine ecosystems; and (vi) develop science and technology, apply scientific achievements.

5. Challenges and opportunities

5.1. Recognition of synergies and trade-offs in the ocean system

The ocean is like a living organism, a living space for living things, including humans. Looking to the future, the exploitation of marine resources for human life will increase and become more diversified due to the increasing production capacity and advancement in science and technology. Therefore, the demand and capacity to exploit marine resources are increasing in all fields/industries. However, increasing exploitation increases the risk of trade-offs: an increase in exploitation of one industry/sector will also limit the increase in exploitation of the other industries/fields. In addition, as pointed out in this study, the expansion of economic exploitation has the potential to negatively affect marine biodiversity if not managed effectively. Therefore, this frames the search for a reasonable "balance" in development between marine economic sectors as well as a "balance" between exploitation and conservation of marine resources. Identification and management of these complex trade-offs in the national socio-economic development of marine areas is of paramount importance.

5.2. Key challenges for the blue economy

Developing a blue economy is the foundation for sustainable marine economic development, but it is not without a number of challenges ahead. In the case of Viet Nam, the main challenges are:

(1) Geopolitical challenges: The East Sea area, including Viet Nam's sea, is currently one of the disputed waters among many related parties. This is one of the factors in the region between countries that are not favourable for the economic development of the whole region. Maintaining security and safety is one of the most important prerequisites for economic activities on the seas. Therefore, in the coming time, the promotion of activities to resolve disputes over sovereignty and sovereign rights in the sea and islands among stakeholders in the East Sea should be considered one of the priority activities.

(2) Limited financial capacity: Currently, Viet Nam is still a developing country with a low GDP per capita (about US\$2,785 per person in 2020⁵³). That shows a huge limitation in financial capacity, both in the public financial sector and in the private sector. In general, the transformation of industries and production facilities from

⁵³ <https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=VN>

"brown" to "green" is also the process of restructuring the production process and technology. If this cycle of change does not coincide with the economic cycle, it will be very expensive and will be very difficult for business establishments. Moreover, the "green" production technology is basically a new technology, which is capital intensive, so not within the reach of all businesses. In addition, the cost of infrastructure construction in most marine economic sectors requires large capital investment.

(3) Limited capacity in marine science and technology: As a late-developing country, undergoing industrialization, Viet Nam is among the countries with low scientific and technological capacity, including marine science and technology. The limitation of marine scientific and technological capacity is reflected in a series of manifestations such as the weak and lack of investigation and exploration of marine resources; production capacity of traditional equipment for marine economic development such as shipbuilding, port construction; marine scientific research institutions and the number of R&D people in the fields related to marine economy, etc.

(4) Limited manpower: As a maritime country, the labour force working in industries directly related to the sea is small in quantity and weak in quality. In addition to a number of workers in the marine industry such as oil and gas, maritime are technically trained due to the nature of the work; and a large part of workers in the fields of fisheries, tourism and salt making are unskilled workers. Most of their professional knowledge comes from self-experience and learning without formal training. This is also a significant limitation that needs to be resolved in the development of the blue sea economy in the near future.

(5) Managing blue economic development requires further institutional reform efforts. Some of the contents that need to be implemented in the near future include:

- Develop a marine economic development planning on the basis of the blue economic development way of thinking. Viet Nam has developed a number of master plans related to the marine economy, including National marine spatial planning; Master plan on exploitation and sustainable use of coastal resources; Master plan on development for seaport system; Planning the system of fishing ports and storm shelters for fishing vessels; Planning for the protection and exploitation of aquatic resources. These plans will determine the basic and long-term orientations for the exploitation of marine resources, the protection of the marine environment, and the development of marine economic sectors in a sustainable way.

- Unification in the management of marine economic development. Although there has been progress in building a management system for marine economic development with the establishment of the General Department of Seas and Islands under the Ministry of Natural Resources and Environment the marine economic fields, in fact, are still scattered under management by different ministries. For example, the maritime economy is under the management of the Ministry of Transport, the tourism economy is under the Ministry of Culture, Sports and Tourism, and the seafood economy is under the Ministry of Agriculture and Rural Development; the field of energy economy is under the Ministry of Industry and Trade. Among ministries, there is of course coordination in the management of marine economic development, but in fact, it is inevitable that the management is not effectively or closely connected, leading to limitations in management; consequently not enabling favourable conditions for production and business activities. The coordination between the management agencies at the central level as well as between the central and local governments is currently considered a weak link in the economic management system in Viet Nam in general, and the marine economy in particular, and is in urgent need of reform.

- Strengthening the building of information systems on natural resources, environment and the marine economic information. Due to the fragmented management system as above, in Viet Nam at present, information on natural resources, environment and marine economy is not available in a systematic and highly reliable manner. This situation has caused many difficulties for policymaking at the macro level as well as for survey and investment decisions at the micro-scale. Moreover, in the statistical information system of Viet Nam, there is still a shortage of many statistical indicators on the marine economy. Therefore, in the coming period, it is necessary to develop an information system of natural resources, environment and marine economic information to serve as a basis for planning guidelines and policies for the development of the blue sea economy.

5.3. Key opportunities for the blue economy

(1) Trends of blue economic development in the world: The world considers the 21st century to be the century of the ocean with a new approach, which emphasizes the aspects of sustainable economic development and environmental protection in order to promote socio-economic development as well as to better adapt to climate change on a global scale. Pioneering countries in the world have launched programs to develop the 'green' economy in general and the 'blue' economy in particular, with emphasis on the following contents: green production, green industry - using green

production techniques, using renewable energy, reducing environmental pollution; green consumption – building a green lifestyle, protecting and living in harmony with the natural environment. Every day, on the mass media, information about economic development associated with environmental protection, limiting greenhouse gas emissions, adapting to climate change, sea-level rise, has provided people with a certain and basic understanding of the trend of blue economic development going on in the world.

(2) Science and technology to develop the blue economy in the world is developing very strongly: This is necessary to create a foundation for the implementation of blue sea economic development and effective marine environmental protection. It can be said that countries around the world are having a race in creating technology to develop blue sea economy. For example, on October 17, 2021, after 21 months of construction, China put the world's first zero-carbon container port into operation at Tianjin Seaport, in the north of the country. Without using fossil energy, this smart container port operates on energy from wind and photovoltaic power. This seaport has an AI-based "smart brain", which can automatically come up with the best cargo handling plans and control each device, resulting in 20% higher efficiency than traditional container ports, designed capacity to reach 2.5 million TEU containers/year⁵⁴. The strong development of science and technology to develop the blue ocean economy in the world also brings good opportunities for all coastal countries through technology transfer and FDI channels.

(3) Orientation for the sustainable economic development of the State of Viet Nam. Grasping the trend and opportunities for the development of the blue economy in the world, on the basis of the need for sustainable development of the national marine economy, Viet Nam has set out a Strategy for the sustainable development of Viet Nam's marine economy to the end of the year 2030, with a vision to 2045 (Resolution No. 36-NQ/TW dated October 22, 2018), which affirms: “Sustainably develop the marine economy on the basis of green growth, conservation of biodiversity study, marine ecosystems; ensure harmony between economic and natural ecosystems, between conservation and development....creating a driving force for the country's economic development”.

The Resolution also states the following goals by 2030:

⁵⁴ (<https://www.Vietnamplus.vn/cang-container-khong-carbon-dau-tien-tren-the-gioi-di-vao-hoat-dong/747334.vnp>).

- *On the marine economy:* The marine economic sectors contribute about 10% of the country's GDP; The economy of 28 coastal provinces and cities is estimated at 65-70% of the country's GDP. The marine economic sectors develop sustainably according to international standards; control the exploitation of marine resources in the resilience of marine ecosystems.

- *On society:* The Human Development Index (HDI) of coastal provinces and cities is higher than the national average; the per capita income of coastal provinces and cities is 1.2 times or higher than the average income of the whole country. The islands inhabited by people have adequate basic socio-economic infrastructure, especially electricity, freshwater, communication, health care and education.

- *On science, technology, development of marine human resources:* Improve access and make the most of advanced scientific and technological achievements belonging to the group of leading countries in ASEAN which have a number of fields of marine science and technology reaching advanced and modern levels in the world. Training and developing marine human resources, forming a team of highly qualified and capable marine science and technology staff.

- *Regarding the environment, responding to climate change, sea level rise:* Assess the potential and value of important marine resources. At least 50% of Viet Nam's sea area is subject to a basic survey of marine resources and environment at a map scale of 1:500,000 and a large-scale survey in some key areas. Set up a digitized database of seas and islands, ensuring integration, sharing and updating.

Prevent, control and significantly reduce pollution of the marine environment; regional pioneer in reducing ocean plastic waste. In coastal provinces and cities, 100% of hazardous waste and daily-life solid waste are collected and treated up to environmental standards; 100% of economic zones, industrial parks and coastal urban areas are planned and built in the direction of sustainability, ecology, intelligence, adaptation to climate change, sea-level rise, and have concentrated water treatment systems that meet meeting environmental regulations and standards.

Good management and protection of marine, coastal and island ecosystems; to increase the area of marine and coastal conservation zones to at least 6% of the natural area of the national sea; restore the coastal mangrove area to at least 2000 levels.

Capacity to forecast and warn of natural disasters, earthquakes, tsunamis, marine environment monitoring and monitoring, climate change, sea-level rise, including through the application of space technology and artificial intelligence create and reach a level on par with advanced countries in the region. Take measures to prevent, avoid, prevent and limit the impact of high tide, saltwater intrusion and coastal erosion.

In summary, the development of the blue economy is a new issue and its success depends on many factors, both objective and subjective. Although there are many challenges ahead, there are also clear opportunities for the development of the blue economy in Viet Nam today. Indeed, it is apparent that development of the blue economy is a vital component of the array of actions which will lead to achievement of longer-term higher-levels goals, such as net-zero emissions by 2050. It is necessary to make good use of these opportunities to sustainably develop the marine economy and protect marine resources for the development of future generations. However, the policy frame through Resolution 36 and more broadly the SDGs provide a clear policy direction forward, and this study provides a synthesis of the blue economy to help shape implementation.

6. Recommendations

From the above analysis, some general comments and recommendations can be made as follows:

1. Viet Nam is a maritime country. Marine economic development is one of the very important contents of the national economic development strategy. The Strategy for Sustainable Development of Viet Nam's Marine Economy to 2030, with a Vision to 2045 (Resolution No. 36-NQ/ TW) clearly states the goals of developing marine economic sectors and conserving marine ecosystems for the period up to 2030, with a vision to 2045. The resolution also clearly states the goals by 2030, “the marine economic sector contributes about 10% of the country's GDP; The economy of 28 coastal provinces and cities is estimated at 65-70% of the country's GDP”. The Resolution is clear about the direction of travel, however, to support and promote the implementation of the Resolution this analysis presented here provides a more detailed look at the interplay between sectors, and the potential for a blue growth. The conclusion of this study, combined with the marine spatial planning initiative and other work, provides a route to integrated implementation of Resolution 36 and expansion of the blue economy.

2. This report is one of the first studies on blue economic development in Viet Nam. This new approach is both an immediate practical requirement and a long-term requirement, ensuring the goal of rapid and sustainable development of the national economy in general and the marine economy in particular. In the context of the lack of statistical data, especially investment data for each marine economic sector, the analysis of costs - benefits for each sector and the comparison between these sectors has not been performed. However, the estimated data of each industry in terms of value added (VA), the number of employees in use, etc. have allowed partial visualization of the scale and role of each sector in the development of marine economy in particular and the whole economy in general. The economic analysis in this study provides a baseline for more integrated planning across marine sectors to capture synergies.

3. The link between the growth of marine economic sectors with environmental protection and the SDGs targets that Viet Nam has committed to is a new perspective, bringing many issues to think about and consider in development policy. The 17 sustainable development goals cover areas that are very important to marine economic development in a developing country like Viet Nam, including No poverty (SDG 1): Eradicate poverty in all its forms everywhere; Zero hunger (SDG 2): Eliminate

hunger, ensure food security and improve nutrition, develop sustainable agriculture; Decent Work and Economic Growth (SDG 8): Promote long-term, inclusive and sustainable economic growth, full and productive employment and decent work for all; Climate Action (SDG 13): Take urgent action to combat climate change and its impacts; and Life Below Water (SDG 14): Conservation and sustainable use of oceans, seas and marine resources for sustainable development. Policies for marine economic development must ensure that the exploitation of marine resources by today's generation does not harm the exploitation of marine resources of future generations. Therefore, in the national marine spatial planning, a program that Viet Nam has begun to launch, besides identifying marine protected areas, it is necessary to calculate a reasonable marine socio-economic structure to bring about the highest values, while maintaining and increasing the area and value of marine ecosystems and biodiversity. Embedding the blue economy into broader socio-economic development provides a platform for enhancing the delivery of many of the SDGs.

4. In the immediate future, the development space for each sector of Viet Nam's marine economy is still quite open and has not led to major conflicts between sectors, and economic development has not reached the point of big conflict of interests to manage. Viet Nam's marine economic activities have led to environmental degradation, but not at a catastrophic scale. This result is partly thanks to the propaganda activities which helped raise awareness on protecting marine resources for all classes of people, and the workers in the marine economy. Recently, Viet Nam also joined the Global Plastic Action Partnership Program in Viet Nam (NPAP Viet Nam), which aims to reduce ocean plastic waste by 75% by 2030. The environmental tolerance threshold for marine economic sectors and the development of marine economic sectors, including both conflict and complementarity [between them] is still quite open. In addition, Prime Minister Pham Minh Chinh announced Viet Nam's strong climate commitments at the COP26, including net zero emission by 2050. Therefore, in the next 10-15 years, the economic growth scenarios are towards a faster direction, thanks to the factors of science - technology, productivity improvement combined with ecosystem conservation and maintenance of biological diversity is still very realistic. Building robust mechanisms, processes and regulations to ensure maintenance of environmental quality alongside the marine economy growth is a core recommendation for a blue economy.

5. In the medium and long term, in order to better manage the marine ecosystem and develop the marine economic sectors more sustainably and effectively, State

management agencies relevant to the marine economy need to develop a long-term program with continuous efforts on some of the following content:

- Develop mechanisms and policies to ensure good management of marine resources, and at the same time encourage marine economic activities based on environmentally friendly technologies, in line with Viet Nam's new international commitments. Expanding more business areas capable of bringing high value such as herbal medicine, marine energy, especially offshore wind power, etc. The main ideology of the policies is derived from a comprehensive and general view of the position and role of the ocean for the socio-economic development of a maritime country like Viet Nam. The ocean "is a living space, a gateway for international exchanges, closely associated with the progress of national development and defence. Sustainable development of the marine economy on the basis of green growth and biodiversity conservation, marine ecosystems; ensure harmony between economic and natural ecosystems, between conservation and development, between the interests of coastal localities and non-coastal localities; strengthen linkages and restructuring of industries and fields towards improving productivity, quality, efficiency and competitiveness; promote the potential and advantages of the sea, creating a driving force for national economic development". (*Resolution No. 36-NQ/TW dated October 22, 2018*);

- To organize the building of a systematic and unified marine economic information system to serve the study of blue sea economic policies in the coming period. Currently, at the central level, marine economic sectors are managed by various ministries; At the local level, the department that manages marine economic development issues is not the same [among local governments]. In the national statistical data system, which is published every year, there is no information on the marine economic sectors. Therefore, State agencies need to quickly build up a systematic and unified marine economic information system from the central to local levels to serve as a basis for research and development of blue economic policies.

- Strengthen human resource training for marine economic activities, especially forming a team of experts to conduct in-depth research on issues of blue sea economic development. In the face of the requirement to improve the quality of development of marine economic sectors in combination with the conservation of marine ecosystems and biodiversity in the new situation, the increase of human resources for marine economic development in both quantity and professional capacity is a must.

- Expand international cooperation on the sea. In the context of disputes over sovereignty over seas and islands in the East Sea, it is very important to expand and

strengthen international cooperation to maintain a peaceful and stable environmental and cooperate for development. Unlike land, marine ecosystems and resources are more “open”; therefore, international cooperation in sustainable management, use and conservation of seas and oceans, natural disaster prevention and control and adaptation to climate change, sea level rise, etc is a common requirement of all countries and based on international law, especially the 1982 United Nations Convention on the Law of the Sea.

- Organize well the elaboration of the National Marine Spatial Planning, the Master plan on Sustainable Exploitation and Use of Coastal Resources, etc. in accordance with the Law on Planning (*Law No. 21/2017/QH14*). In order to do well these master plans in the direction of developing the blue sea economy, it is necessary to have an overall, integrated view and "synchronized coordination among sectors and fields related to infrastructure, resource use and environmental protection in planning on a defined territory in order to achieve the goal of balanced, harmonious, efficient and sustainable development" (*Law on Planning, No. 21/2017/QH14*) .

- On the basis of the approved master plan, it is necessary to focus on prioritizing investment from public investment sources and encouraging the private sector to invest in projects using green technology and clean energy in the sea and coastal areas. The government should launch a Blue Economic Development Program, which clearly identifies a number of key projects to focus on implementation, and which periodically monitors and evaluates effectiveness and accountability in implementation.

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APPENDIX – SECTORAL REPORTS

Appendix A. Fisheries & Aquaculture

Aquaculture and Fisheries in Viet Nam include 2 types: (i) Freshwater Aquaculture and Fisheries inland (lakes, ponds, rivers, streams); and (ii) Aquaculture and Fisheries in salt/brackish water areas (coastal and offshore). This report considers only the Aquaculture and Fisheries in salt/brackish water areas (coastal and offshore).



Figure A1. Fishing boat⁵⁵

1. Resources

Viet Nam has a marine fishing ground of over 1 million square kilometres with over 2,000 species of fish that includes 130 species of high economic value and over 600 species of crustaceans, molluscs and seaweed. The total standing fisheries stocks in Viet Nam seas are about 4.36 million tons per year⁵⁶, excluding fish stocks of the deep sea areas, floating mounds and continental shelf areas with 12% nearshore fisheries resources, middle areas 19%, and offshore areas 69%. The fisheries grounds in Viet Nam are classified into five fishing zones, including Tonkin Gulf (accounts for 17.3% of total fisheries resource), Central Coast Zone (20.0%), Southeast Zone (25.6%), South West Zone (13.4%) and Middle East Sea Zone (23.7%)⁵⁷

According to the RIMF (2018), the average annual biomass of marine fish resources in the 2011-2015 period was estimated at 4.364 million tonnes (fluctuated between 4.1-

⁵⁵ Source: <http://baochinhphu.vn/Hoat-dong-dia-phuong/Dieu-chinh-quy-hoach-cang-ca-khu-vuc-dao-Cat-Ba/309129.vgp>

⁵⁶ RIMF's survey of 2011-2015

⁵⁷ RIMF (2018), Report on marine fisheries stock assessment in Viet Nam sea in the period of 2011-2015 (submitted to MARD), Research for Marine Fisheries (RIMF), Hai Phong.

4.6 million tonnes)⁵⁸, decreasing by 13.9% from 2000-2005 (5.071 million tonnes; equal to annual decrease of 1.36% per year). In recent years, marine capture had indicated a sign of overexploitation⁵⁹, leading to a decline in fisheries production efficiency that was measured by the catch per unit of effort (CPUE). The CPUE of the Viet Nameese fleet has been decreasing continuously from 0.9 tonnes per horsepower (hp) in 1990 to 0.29 tonnes per hp in 2010 (VIFEP, 2013) and to 0.26 tonnes per hp in 2019 (VIFEP, 2020) with annual decrease rate of 1.14% per year in the period of 2010-2019 and 4.13% in the period of 1990-2019.

Viet Nam has the potential for marine and coastal aquaculture development with the coastal lines of over 3,260km long, the numbers of islands over 3,000; 12 coastal lagoons along the coasts; 112 coastal estuaries. In terms of potential locations and areas, about 500,000 hectares⁶⁰ of closed bays, nearshore islands, middle shore sea areas and low tidal flats can be exploited for marine aquaculture development. So far, about 57,000 hectares out of that area have been used for marine aquaculture development and the rest of 443,000 hectares are still potentials for marine aquaculture, especially the nearshore and middle shore areas.

In addition, a large number of low and high tidal areas of about 750,000 hectares⁶¹ in all of the 28 coastal provinces are also suitable for brackish-water⁶² aquaculture development and its majority is for shrimp farming. So far, about 720,000 hectares of those areas have been used for brackish water coastal aquaculture farming along the coast.

2. Present status

The aquaculture and fisheries sector is one of the long-standing traditional marine economic sectors in Viet Nam. The main economic activities in this sector include: aquaculture; fisheries; seafood processing, including traditional fish sauce making developed in many coastal areas; ship/boat manufacturing/repairing; wire mesh

⁵⁸ This 4.364 million tonnes do not cover the fisheries resources in the deep sea areas and continent shelf areas of Vietnam as resource stock assessment there have not been conducted.

⁵⁹ In 2011-2015, this study identified 1207 captured marine species, including 945 species of fish, 135 species of crustaceans, 48 species of cephalopods and 50 other species. According to the study, fishing volume of demersal species reached the sustainable limit, fishing volume of pelagic species (big pelagic and small pelagic) was within sustainable limits and capture of some other marine species still had potential for greater fish catch volume.

⁶⁰ MARD (2018), *National strategy for marine aquaculture development towards 2030 and visions to 2050*, Hanoi.

⁶¹ VIFEP (2012), *Master Plan for Fisheries Sector Development towards 2020 and visions to 2030*, Hanoi.

⁶² Brackish-water aquaculture is to culture aquatic species in the coastal ponds with water salinity of 3-25ppt (sometimes the salinity may go lower or higher that range but should not last for a long time). This farming is mainly done in coastal areas

manufacturing, feed and seed manufacturing, and a host of other service jobs. Thus, in addition to the direct workforce in Aquaculture and Fisheries, there is a diverse workforce in many occupations that is an indirect workforce supporting the sector in before and after specific Aquaculture and Fisheries work. Therefore, Aquaculture & Fisheries is considered to create employment opportunities and livelihoods for a large number of residents in the coastal areas of Viet Nam.

Over the past 20 years, the growth of production from the total fishery production (including both capture and aquaculture) has quadrupled, from about 2 million tons a year in 1999 to 4.7 million tons in 2009 and 8.15 million tons in 2019 (See Figure 2.2). Out of the 8.15 million tons in 2019, the catch was 3.77 million tons, of which 94.6% was caught at sea and aquaculture production was 4.38 million tons, of which 28% is raised in coastal and marine farming areas.

There has been a strong structural change in the means of fishing as the total number of small fishing boats and vessels operating in nearshore and middle shore areas have reduced from 92,391 boats and vessels in 2013 to 66,135 boats vessels in 2019 (reduction of 5.42% per year). However the number of offshore vessels has shown an upward trend from 26,398 vessels in 2013 to 30,474 vessels in 2019 (D-FISH, 2019) (increased by 2.42% per year). The reason for this structural change is partly due to the Government's policies to encourage offshore fishing and limit inshore fishing, on the other hand, due to the decline in near-shore fishery resources.

The logistic services for capture fisheries include 83 fishing ports (data in 2018) with designed capacity of 1.8 million tons for 9,298 fishing vessels arrive/day; 25 first class fishing ports (of which, 9 ports for fishing vessels with maximum capacity of 1,000 hp and 2 ports for vessels with 2,000 hp); 58 second class ports; 66 storm shelters with maximum capacity for docking of 42,464 vessels; 354 facilities of ice production and 643 cold storages with total capacity of about 78,700 tons of seafoods (D-FISH, 2019).

The marine and coastal aquaculture has shown an upward trend in the period of 2010-2019 with the average growth rates of farming area for of marine aquaculture of 1.24% per year and coastal aquaculture is 4.56% per year. This leads to a growth rate of 1.88% per year for total marine and coastal aquaculture, from 710,400 hectares in 2010 (VIFEP, 2013) to 840,000 hectares in 2019 (D-FISH, 2019)⁶³. In terms of yield volume, aquaculture production has been increased significantly in the last 10 years with the annual growth rate of 6.5% per year, from 692,904 MTs in 2010 (VIFEP, 2013) to reach the total of 1,220,000 MTs of seafood in 2019 (D-FISH, 2019) and its majority

⁶³ D-FISH (2017), [Annual report of fisheries sector achievements in 2017 and action plans for 2018](#).

has come from coastal land-based brackish-water shrimp farming (accounting for 61.5% of total coastal and marine aquaculture production in 2019). In Viet Nam, aquaculture seed has been supplied by about 2,400 hatcheries nationwide, but majority of them are for shrimp seed with 2,362 shrimp hatcheries⁶⁴.

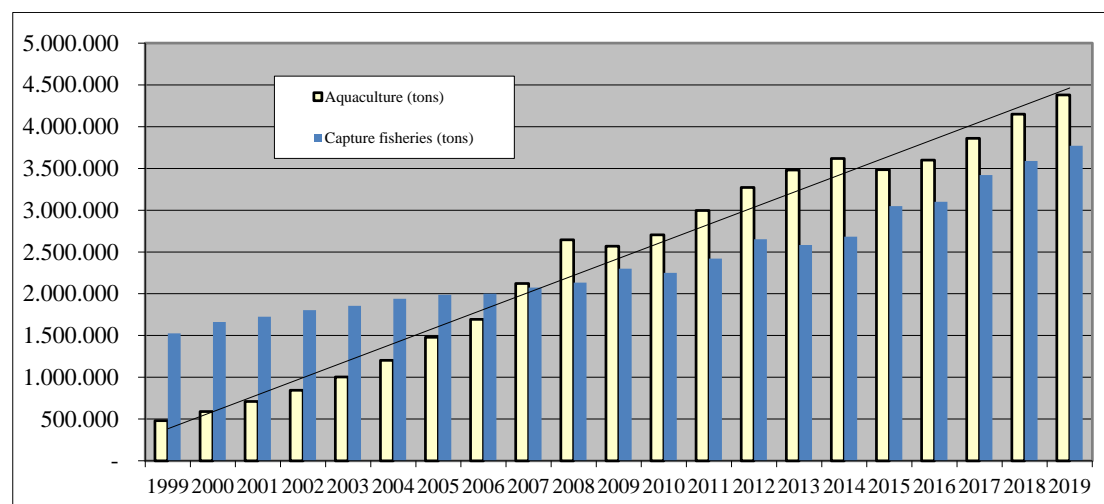


Figure A2. Aquaculture and capture fisheries production in the period of 1999-2019⁶⁵

For seafood processing and exporting, the total seafood processing enterprises was 784 in 2019⁶⁶, exporting seafood to EU, Korea, China and other countries. During 2010-2019, seafood processing in Viet Nam became a developed seafood industry, which has met almost all strict requirements for food safety, product quality and other sustainable development certifications from imported markets. The seafood processing industry has contributed significantly in making Viet Nam become the third largest exporter of seafood globally with its share of 6.9% of global seafood value total in 2018⁶⁷. The value of its exports increased from USD 5 billion in 2010 to USD 8.6 billion in 2019⁶⁸ (accounting for 22.5% of total export value of the agriculture-forestry-fishery sector), with average growth rate of 6.1% per year. The share of marine and coastal seafood (from both aquaculture and capture fisheries) in yearly export value of 2019 was 78%; the rest is from inland freshwater pangasius catfish (with pangasius catfish export value of USD 1.907 billion in 2019). The key processed seafood products are shrimp (about 39.3%, equal to USD 3.38 billion of total seafood

⁶⁴ D-FISH (2019), Annual report of fisheries sector achievement in 2019 and action plans for 2020.

⁶⁵ Gathered and compiled from annual reviewing reports of D-FISH and MARD.

⁶⁶ VIFEP (2020), Draft version of Sectoral Strategy for Fisheries Sector Development towards 2030 and vision to 2045

⁶⁷ According to *Statista.com*, in 2018, the total global seafood market value was about USD 130 billion, while the total Vietnamese seafood export value was about USD 9 billion in 2018.

⁶⁸ D-FISH (2019), Annual report of fisheries sector achievements in 2019 and action plans for 2020.

export value in 2019⁶⁹), tuna (export value was about USD 700 million per year), octopus and squid (export value is about USD 600 million per year).

The contribution of Aquaculture & Fisheries to economic growth: According to estimates, nominal GDP of marine capture & aquaculture sector has increased from 68.91 VND thousand billion in 2010 to 166.76 VND thousand billion in 2019. It contributes approximately 72-89% of the whole nominal fisheries sector GDP, 15-20% to nominal GDP of Agriculture, Forest and Fisheries sector and 2-3% to nominal GDP of Viet Nam as well (see Table A1).

Table A1. The share of nominal GDP of marine capture & aquaculture sector in national and Agriculture, Forest and Fisheries sector GDP

Year	Nominal GDP (unit: VND thousand billion)				The share of ocean/coastal fish & aqua GDP (%) in		
	Marine capture & aquaculture GDP	The whole fisheries sector GDP	Viet Nam national GDP ⁷⁰	Agriculture, Forest and Fisheries GDP	National GDP	Whole fisheries sector GDP	Agriculture, Forest and Fisheries sector GDP
2010	68.91	-	2157.83	396.58	3.19%	-	17.38%
2011	87.86	98.88	2779.88	543.96	3.16%	88.9%	16.15%
2012	95.13	-	3245.42	623.82	2.93%	-	15.25%
2013	100.17	128.69	3584.26	643.86	2.79%	77.8%	15.56%
2014	112.41	-	3937.86	696.97	2.85%	-	16.13%
2015	107.04	147.91	4192.86	712.46	2.55%	72.4%	15.02%
2016	114.00	-	4502.73	734.83	2.53%	-	15.51%
2017	134.59	171.47	5005.98	768.16	2.69%	78.5%	17.52%
2018	166.11	190.12	5542.33	813.72	3.00%	87.4%	20.41%
2019	166.76	205.25	6037.35	842.60	2.76%	81.2%	19.79%

Source: Cao Le Quyen, 2021.

The estimated result shows that the annual growth rate of real GDP of the marine capture & aquaculture sector was about 4.5% per year in the period of 2010-2019,

⁶⁹ D-FISH (2019), Annual report of fisheries sector achievement in 2019 and action plans for 2020.

⁷⁰ <https://www.gso.gov.vn/default.aspx?tabid=715>

which is slightly less than the annual growth rate of the whole fisheries sector (5.1% per year), larger than the Agriculture, Forest and Fisheries sector's real GDP (2.8% per year), and more than a half of the growth rate of national GDP's growth (6.3%).

Unlike industries and services with a very large share of foreign direct investment (FDI), the agricultural sector in general, and the marine capture & aquaculture sector in particular, the proportion of FDI is very small, and there is no outwards investment, so GDP generated by the marine capture & aquaculture sector is also roughly on par with GNI in this sector. Thus, almost all VA generated in the marine capture & aquaculture sector will belong to the income of Viet Nameese people/enterprises.

The Impact of marine Aquaculture & Fisheries on society and environment: Currently, the majority of the marine Aquaculture & Fisheries sector is undertaken by the private sector. The marine capture labor sector has approximately 750,000 direct labours (in 2019), together with about 500,000 indirect labours in service and logistic provision⁷¹. In the marine and coastal Aquaculture sector, specifically brackish water shrimp farming, with about 400,000 hectares of intensive and semi-intensive farming, and about 320,000 hectares of improved-extensive and extensive farming, there are about 0.6-0.7 million⁷² local households with more than 1.1 million people directly working.

Table A2. Labour shares in marine and coastal capture fisheries and aquaculture

Unit: labour	2010	2019	Annual growth rate in 2010-2019 (%)
Marine/coastal Aquaculture	807,383	1,125,850	3.76
Coastal aquaculture	650,000	900,000	3.68
Marine aquaculture	157,383	225,850	4.09
Marine/coastal capture	500,000	750,000	4.61
Total	1,307,383	1,875,850	4.09

Source: Cao Le Quyen, 2021.

In addition to the number of direct employees of marine aquaculture and capture above, a large number of employees work in the fields of processing, building and

⁷¹ According to estimation by VIFEP, the total number of direct and indirect labours in fisheries sector (capture, aquaculture, processing and logistics) is about 4.5 millions in 2018-2019.

⁷² Self estimated by the authors in the following way: Each shrimp farming hectare of intensive or sem-intensive may require 1.5 labours and improved-extensive or extensive may require 1.0 labour for farm work and management; each local shrimp household may own an average of 1.0 hectare of shrimp farming land.

repairing fishing vessels, manufacturing fishing gear, producing shrimp, fish feed, and other services. It is estimated that in 2019, the total labourers in seafood sector (aquaculture and capture fisheries) accounted for about 8% (approximately 4.5 million labourers) of the total labour force in Viet Nam⁷³.

3. Interaction with SDGs

The global SDG Agenda 2030 has been adopted locally in Viet Nam SDGs with the Prime Minister's Decision No. 622/QĐ-TTg dated on 10 May, 2017 on National Action Plan for Implementing Agenda 2030 for Viet Nameese sustainable development. In this National Action Plan, the Goal No. 14 on Conserve and sustainably use the oceans, seas and marine resources with the objectives and tasks No. 14.2; 14.4; 14.5; 14.6 are linked to fisheries and aquaculture sectors and the detailed action plans to implement those objectives are further defined in the agriculture Sector⁷⁴ Action Plan at the Decision No.1308/QĐ-BNN-KH of the Minister of Ministry of Agriculture and Rural Development (MARD) dated on 13 April 2018. In addition, most of the other Sustainable Development Goals are more or less directly related to the Marine Aquaculture & Fisheries sector.

In order to link the capture fisheries and aquaculture sectors to the SDGs that they influence in a positive or negative way, this research adapt established approaches and scales of Stockholm Environment Institute⁷⁵ for understanding this interaction as follows:

Table A3. Scoring table between aquaculture and capture fisheries sectors and SDGs

Score	Description
+3	Progress in the sector delivers significant progress on the SDG
+2	Progress in the sector delivers progress in the SDG
+1	Progress in the sector delivers minor progress in the SDG
0	Progress in the sector is independent of the SDG
-1	Progress in the sector delivers minor negative effects on the SDG
-2	Progress in the sector delivers some negative effects on the SDG

⁷³ GSO (2019), Press release on labour and employment in the first quarter of 2019, GSO.

⁷⁴ Since 2007, fisheries sector in Vietnam has been merged with agriculture and rural development sector and under the management of Ministry of Agriculture and Rural development (MARD)

⁷⁵ <https://doi.org/10.1007/s11625-018-0604-z>

-3	Progress in the sector delivers significant negative effects on the SDG
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From above table, we can then track the sector against the SDG Goals as follows:

Table A4. Linkage of aquaculture and capture fisheries to Viet Nameese SDGs

SDGs	Score	Comments
SDG 1	+3	Nearshore capture fisheries (accounting for 49.11% of total vessels in 2019 in Viet Nam) and small-scale aquaculture farming (60%) create sustainable livelihoods and incomes for poor communities in coastal and island areas.
SDG 2	+3	Nearshore capture fisheries and small-scale aquaculture farming help to reduce poverty rate and ensure food security for poor communities in coastal and island areas
SDG 3	+3	Providing seafood that improves nutritional levels and contributes to social welfare access for poor communities in coastal and island areas
SDG 4	+2	Sustainable capture fisheries and aquaculture development helps local communities in coastal and island areas have more opportunities to access to education and technical training
SDG 5	+2	Many opportunities are created for women to participate in fish processing, marketing and aquaculture industry.
SDG 6	-1	Aquaculture development uses water resources and may create negative impacts on environment such as organic pollution from feed residues, mud wastes, and salinity intrusion.
SDG 7	0	No contribution
SDG 8	+ 2	Contribute to economic growth and creates more jobs for local communities in coastal and island areas.
SDG 9	+2	Contribute to improve infrastructures for coastal and island areas such as fishing port, storm shelter, roads, sluice, electricity, telecommunication, etc
SDG 10	+1	Nearshore capture fisheries and small-scale aquaculture maintain daily livelihoods for vulnerable local people, leading to reduce inequality within local community.

SDG 11	+1	Contribute to sustainable urban and rural development with more access to good foods and infrastructure building in coastal areas.
SDG 12	+1	Organic shrimp and Marine Stewardship Council certification ⁷⁶ captured seafood products may contribute to responsible production and consumption
SDG 13	+3	Brackish water aquaculture development in coastal salinity intrusion areas (ex. shrimp farming) is considered as one of feasible climate change adaptation solutions.
SDG 14	+3	Ending IUU (Illegal, Unreported and Unregulated) fishing and relevant subsidies for capture fisheries will protect aquatic resources and contribute to sustainable fisheries development
SDG 15	+1	Shrimp-mangrove integration creates organic shrimp and contribute to protect and restore coastal mangroves.
SDG 16	0	No contribution
SDG 17	+2	Partnership with international and bilateral entities to end IUU fishing and sustainable aquaculture farming.

Cao Le Quyen, 2021

⁷⁶ Marine Stewardship Council

Appendix B. Oil & gas

1. Resources

Oil and gas are normally found in sedimentary basins. There are 8 sedimentary basins located in the exclusive economic zone and continental shelf offshore Viet Nam: Song Hong, Hoang Sa, Phu Khanh, Cuu Long, Nam Con Son, Tu Chinh-Vung May, Truong Sa and Malay-Tho Chu basins. But only 4 basins are being exploited and 3 of them namely Cuu Long, Nam Con Son and Malay-Tho Chu basins (are located in the southern sea of Viet Nam) has a large number of oil volume, playing important role in oil & gas industry in Viet Nam.



Figure B1. Bach Ho Mine⁷⁷

The overall assessment data on the potential oil and gas reserves of Viet Nam's waters today are not officially published. However, exploration and search work are still being continued by oil companies and basing on study of (T.X. Cường. 2019) by the end of 2019 Viet Nam had only exploited about 50% of the discovered reserves . In addition, according to N. Hiep, 2019, about 6.3 billion m³ of oil can be found in the future.

2. Present status

The chain value of oil and gas includes 5 subsectors: i) oil & gas exploration and production; ii) oil refining and petrochemistry; iii) gas transmission and processing; and power generation.

⁷⁷ Source: <http://www.pvn.vn/Pages/detail.aspx?NewsID=6c377577-811b-4d9a-89ca-f26794938278>

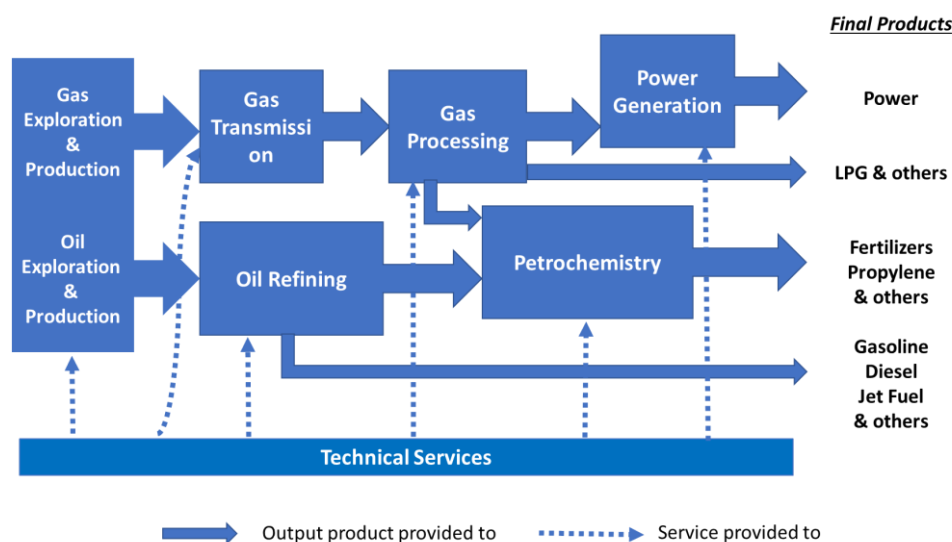


Figure B2. Value chain of the ocean component of the Viet Nam petroleum industry

Viet Nam's petroleum industry consists of 2 dominant companies, Viet Nam Oil and Gas Group (PetroViet Nam) and Viet Nam National Petroleum Group (Petrolimex), and some other small private companies. However, only PetroViet Nam operates in all 5 subsectors mentioned above. As for Petrolimex and other private companies, which mainly focus on trading and distributing petroleum products, not related to marine economic activities, the following status assessment only talks about PetroViet Nam.

(1) Petroleum Exploration & Production

Exploration & Production is the core business of the PetroViet Nam. Currently, PetroViet Nam's subsidiaries and partners are exploiting fields located in 4 basins Cuu Long, Nam Con Son, Malay-Tho Chu and Song Hong. The major subsidiaries of the group operating this business in Viet Nam are PetroViet Nam Exploration and Production Corporation (PVEP), Joint Venture Vietsovpetro (VSP), Bien Dong Petroleum Operating Company (BDPOC) and Phu Quoc Petroleum Operating Company (PQPOC). These subsidiaries in cooperation with many international partners are currently operating 56 petroleum contracts as of April 2020. Some of these international partners are Zarubezhneft, Rosneft, ENI, ExxonMobil, Gazprom, Petronas Carigali, KrisEnergy, KNOC, PTTEP, Murphy, Premier Oil, Jadestone, Pearl Oil, etc.

PetroViet Nam subsidiaries together with the international partners have produced so far nearly 700 millions m³ of oil equivalent in Viet Nam. In this total production, Cuu Long basin counts for over 75%, Nam Con Son basin counts for over 17% and Malay-Tho Chu counts for over 7%. This explains the fact that most of the oil & gas infrastructure are located in the Southeast and Southwest of Viet Nam (T.X. Cường, 2019).

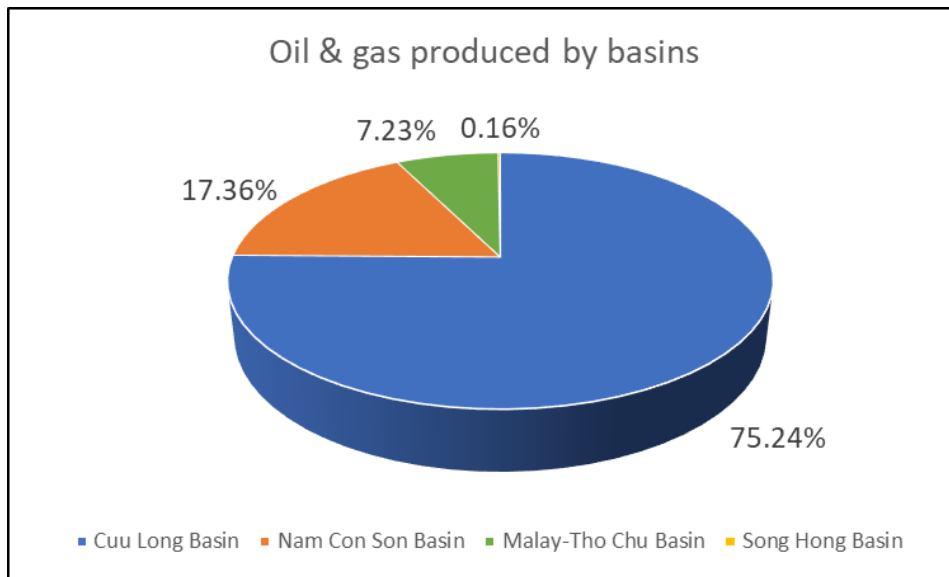


Figure B3. Oil & gas production distribution among basins in Viet Nam (T.X. Cường, 2019 [34])

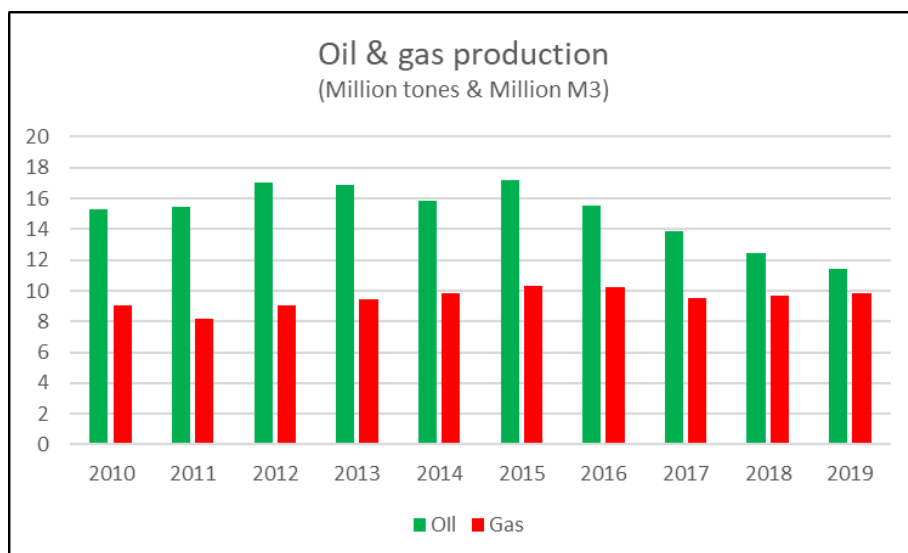


Figure B4. Oil & gas production during 2010-2019 (VPI, 2020, [37])

The historical oil & gas production data during 2010-2019 show that oil production reached the peak during 2012-2015 and is now declining. Gas production has kept steady from 2010 to 2019. Although the two mega gas production projects, Block B and Ca Voi Xanh (Blue Whale), are a bit delayed, it is expected that when these fields start production output will increase 20 - 30%.

In 2020, the domestic subsidiaries of PetroViet Nam along with their international partners produced 9.65 million tons of crude oil and 9.16 billion cubic meters of natural gas from offshore Viet Nam. The new reserves of 15 million tons of oil equivalent also has been added.

The produced crude oil is partly supplied to Dung Quat Refinery located in Central Viet Nam and partly is exported. The produced natural gas goes through 2 gas processing plants in Dinh Co and Ca Mau then are mainly supplied to gas power stations Phu My 1; 2; 3; 4 and Nhon Trach 1; 2 in Southeast and Ca Mau 1; 2 in Southwest Viet Nam. A small component of natural gas from these sources is supplied for industrial and transportation use. The natural gas produced from Song Hong basin is minor and fully supplied for industrial use in Thai Binh province.

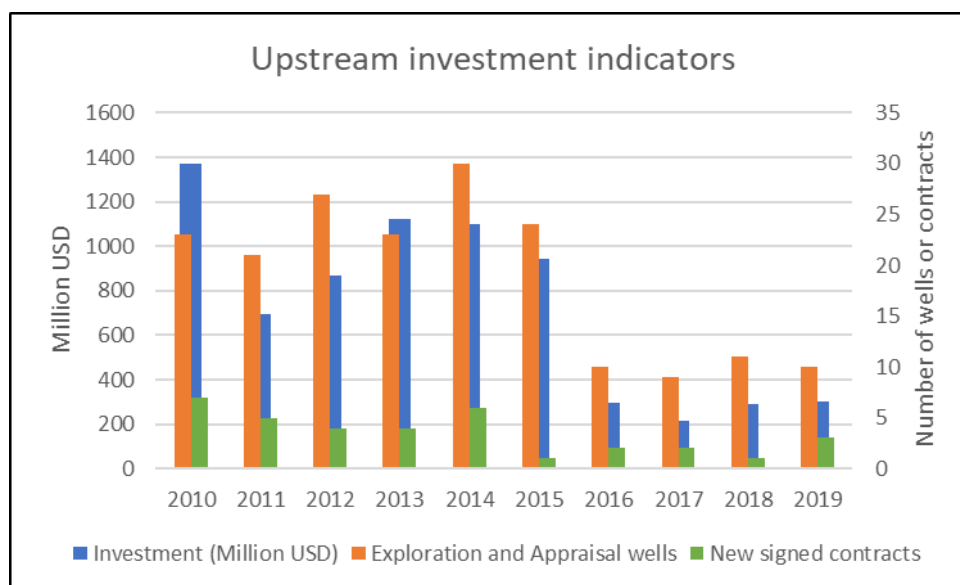


Figure B5. Upstream investment indicators (VPI, 2020, [37])

The investment in the oil & gas exploration and production is usually measured by the amount of invested money, number of exploration and appraisal wells and new signed petroleum contracts. These indicators show that the investment level during 2016-2019 and 2020 is declining.

PetroViet Nam also does upstream business outside Viet Nam through joint ventures and subsidiaries operating in Southeast Asia, Africa, Middle East, former Soviet Union and Central/South America. But these activities are not included in this blue economy study.

(2) Petroleum Refining and Petrochemistry

In Petroleum Refining and Petrochemistry, the sub-sector has following two subsidiaries and joint ventures, operating in refining business: 1) Nghi Son Refinery and Petrochemicals (NSRP, operated since 2018), and 2) Dung Quat Oil Refinery and Polypropylene (BSR, operated since 2010); two fertilizer plants, namely Phu My Fertilizer Plant (PVFCCo, operated since 2004), Ca Mau Fertilizer Plant (PVFC, operated since 2012) and two Gas Processing Plants (Dinh Co, operated since 2002 and Ca Mau,

since 2018). BSR refines the crude oil produced in Viet Nam, but to secure the input by importing certain share of crude oil. NSRP refines 100% imported crude oil. All the two fertilizer plants and the two Gas Processing Plants process gas produced in Viet Nam to produce fertilizer and liquified petroleum gas (LPG) and supply dry gas for gas power plants. Dung Quat Refinery processes approximately 6 million tons of crude oil every year and serves around 30% of the domestic petroleum products market.

In 2020, the two refineries produced 11.85 million tons of petroleum products. The two fertilizer plants produced 1.56 million tons of urea to serve around 70% of domestic market.

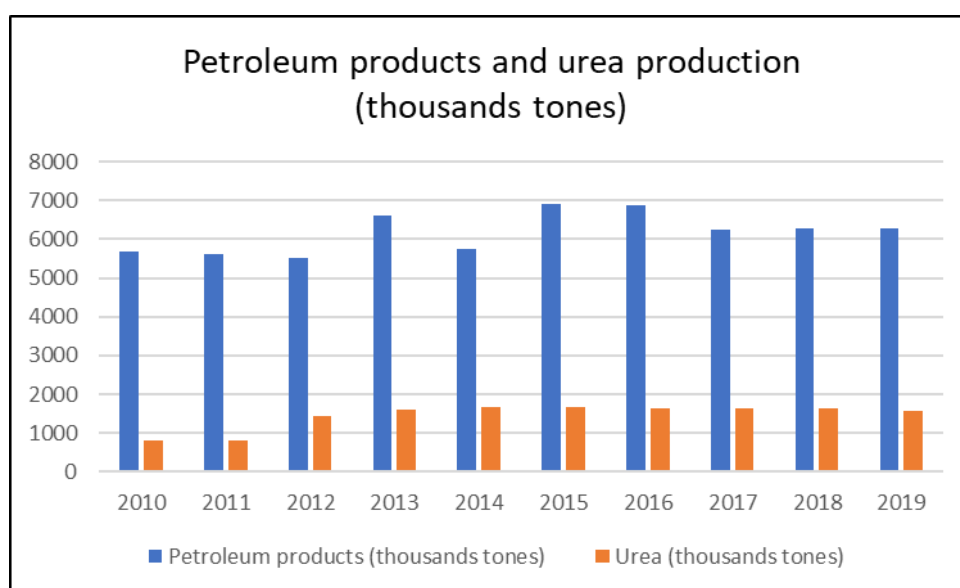


Figure B6. PetroViet Nam petroleum products and urea production (VPI, 2020, [3])

(3) Gas sector

PetroViet Nam Gas Corporation (PVGas), a member of Petrovietnam, is an unique unit operating in gas transmission, processing and distribution. PVGas has been engaged in many aspects of gas business from collection, import-export, transportation, storage, processing, marketing and trading to fuel power plants, serve industrial facilities, but the gas transmission and distribution are its core business. The corporation is operating and number of gas pipelines:

The Cuu Long gas pipeline system to deliver gas to Phu My terminal, Dinh Co Gas Processing Plant, Thi Vai terminal and other distribution stations.

The Nam Con Son gas pipeline connects the fields from Nam Con Son basin to gas processing and facility onshore.

The gas pipeline PM3-Ca Mau which delivers gas from Malay-Tho Chu basin to Ca Mau Gas Processing Plant to Ca Mau Fertilizer Plant and Ca Mau 1 & Ca Mau 2 Power Plants.

The Thai Binh Gas Pipeline connects gas fields in North Song Hong basin to industrial customers in Thai Binh province.

The entire volume of natural gas is annually produced offshore is equal to the volume of gas being transported, processed and distributed because until now Viet Nam does not import natural gas.

(4) Gas power generation

For power generation, PetroViet Nam has one subsidiary PetroViet Nam Power Corporation (PVPower). This corporation operates four gas turbine power plants (Nhon Trach 1, Nhon Trach 2, Ca Mau 1 and Ca Mau 2). There are other gas turbine power plants outside PetroViet Nam that are operated by Viet Nam Electricity Corporation (Phu My 1; 2; 3; 4).

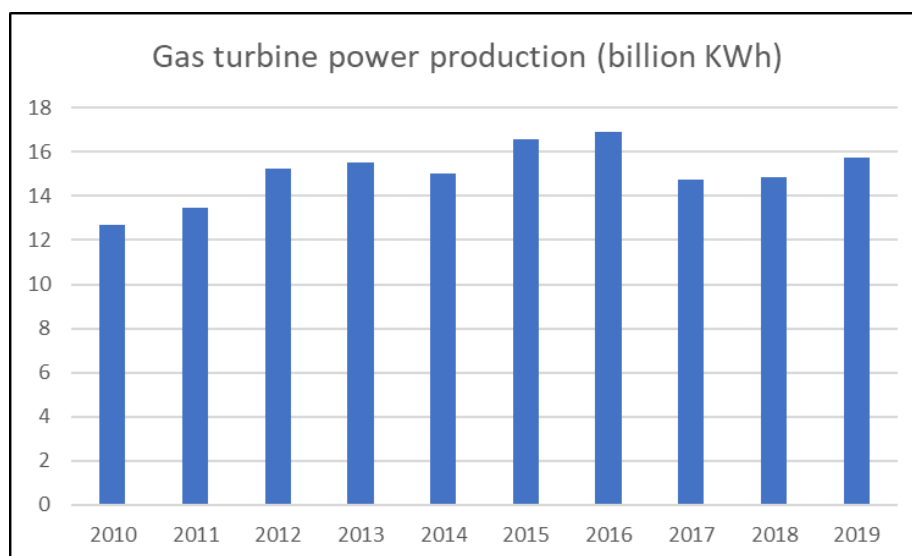


Figure B7. PetroViet Nam gas power production (VPI, [74])

In 2020, PVPower had produced 19.2 billions KWh.

(5) Technical services business

PetroViet Nam owns shares in partners working in a wide range of services covering technical, finance, insurance, transportation, operation consultancy, scientific research and training. However, at its core, is the technical services that provide a substantial portion of revenue in this business area. The major technical service companies, like PetroViet Nam Technical Service Corporation (PTSC), PetroViet Nam Drilling & Well Service Corporation (PVDrilling), PetroViet Nam Transportation

Corporation (PVTrans), PetroViet Nam Construction Corporation (PVC), PetroViet Nam Chemical & Service Corporation (PVChem) and PetroViet Nam Insurance Corporation (PVI Holdings), are now main providers of technical and insurance service to upstream operators in Viet Nam.

The exploitation volume of other mineral resources in Viet Nam's marine and coastal areas is minor when compared to oil & gas. According to public information, there are several mines of Coastal Heavy Mineral Sands (HMS) rich in titanium, and zircon. Current producing mines are Quang Xuong (Thanh Hoa prov.), Cam Hoa (Ha Tinh prov.), Ke Ninh, Ke Sung (Nghe An Prov.), De Gi (Binh Dinh prov.), Ham Tan (Binh Thuan prov.) with small production volume.

The Thach Khe Iron mine in the coastal area of Ha Tinh Province has rather big reserves of 532 MT. The ore body is located below the sea level, thus creating difficulties for development. Thus, It will take a long time before this mine can be approved for production.

There are indicators of the gas hydrates presence in the Viet Nam offshore, but resources have not been quantified. According to USGS, Viet Nam is ranked 5th in Asia regarding gas hydrate potential. It is predicted that in the next 15 to 20 years, this type of resource still cannot be commercialized in Viet Nam.

(6) The meaning of Oil & Gas/Marine Resources in economic growth:

Oil and gas exploitation, transportation and processing, gas power generation, oil and gas technical services are completely new industries in Viet Nam, operating on the basis of modern, high-tech technology. If counting from when the Viet Nam - Soviet Petroleum Joint Venture Enterprise (Vietsovpetro) exploited the first ton of oil from the Bach Ho field (June 1986) and in 1987 the Vietsovpetro joint venture exported the first ton of oil, it has only been 34-35 years. However, over the past 35 years, the oil and gas industry has contributed greatly to Viet Nam's economy. In particular, the oil and gas industry has contributed greatly to budget revenue, thereby contributing to macroeconomic stability and social security. Oil & Gas's contribution to GDP and the state budget in the past 10 years is as follows:

Table B1. The nominal GDP and contribution to the state budget of the oil & gas and marine resources sector⁽¹⁾

Years	Nominal National GDP (thousand billion VND)	Nominal Sector GDP (thousand billion VND)	Sector contribution to the GDP (%)	State budget (thousand billion VND)	Sector contribution to the budget (thousand billion VND)	Sector contribution to the budget (%)
2010	2,158	204.2	9.5%	588	110.4	18.8%
2011	2,780	281.4	10.1%	722	160.8	22.3%
2012	3,245	318.9	9.8%	735	186.3	25.4%
2013	3,584	343.6	9.6%	828	195.4	23.6%
2014	3,938	324.4	8.2%	878	189.4	21.6%
2015	4,193	245.5	5.9%	998	115.1	11.5%
2016	4,503	203.4	4.5%	1,102	80.2	7.3%
2017	5,006	229.7	4.6%	1,289	97.5	7.6%
2018	5,542	276.2	5.0%	1,422	115.0	8.1%
2019	6,037	331.4	5.5%	1,539	108.0	7.0%

Source: Nguyen Hong Minh, 2021.

(1) Audited Unified Financial Reports published by PetroViet Nam on its website (PetroViet Nam, 2020. Public information. www.pvn.vn) will be used as primary data for the sector GDP calculation. The unified revenue less financial income will be used for calculation. To adjust for non-marine economy of the oil & gas industry and addition of coastal mining activities, the coefficient 0.91 will be applied. This is based on expert's view that the non-blue economy of the oil & gas industry counts for about 10% and coastal mining activities are estimated to be 1% of oil & gas activities.

The Table 2.5 show that the sector GDP varies according to the oil prices, but generally remains steady in the absolute value. The contribution of the sector to the national GDP and state budget declines mainly due to growth of the scale of national economy.

The real GDP contribution of the sector also is calculated. The Producer Price Index of crude oil and natural gas are referred to GSO published data.

Table B2. The share of real GDP of the oil & gas and marine resources sector

Years	Real National GDP (thousand billion VND)	Nominal Sector GDP (thousand billion VND)	PPI (crude oil, natural gas)	Real Sector GDP (thousand billion VND)	Contribution to the GDP (%)
2010	2,158	204.2	100	204.2	9.5%
2011	2,292	281.4	157.1	179.1	7.8%
2012	2,413	318.9	158.79	200.8	8.3%
2013	2,544	343.6	152.88	224.8	8.8%
2014	2,696	324.4	148.97	217.7	8.1%
2015	2,876	245.5	82.64	297.1	10.3%
2016	3,054	203.4	62.48	325.5	10.7%
2017	3,263	229.7	80.38	285.8	8.8%
2018	3,493	276.2	99.66	277.1	7.9%
2019	3,739	331.4	95.06	348.6	9.3%

Source: Nguyen Hong Minh, 2021.

Table 2.6 show that if we take out the price factor, the relative contribution of the sector real GDP slightly increases compared to nominal ones. The overall growth picture of the sector remains steady like nominal GDP in Table 9 shows.

The income of the sector (GNI) is estimated as follows:

Table B3. The GNI of oil & gas and marine resources sector in 2010-2019⁽²⁾

Years	Total labor in sector	Nominal Sector GNI (thousand billion VND)	Real Sector GNI (thousand billion VND)	Nominal GNI/Labor (billion VND)	Real GNI/Labor (Billion VND)
2010	42,829	84.7	84.7	1.98	1.98
2011	50,445	103.4	65.8	2.05	1.31
2012	49,903	103.5	65.2	2.07	1.31

2013	55,084	139.0	90.9	2.52	1.65
2014	56,000	143.5	96.3	2.56	1.72
2015	58,423	116.0	140.4	1.99	2.40
2016	55,357	110.3	176.5	1.99	3.19
2017	52,127	120.8	150.3	2.32	2.88
2018	49,873	139.4	139.9	2.80	2.80
2019	48,263	188.0	197.7	3.89	4.10

Source: Nguyen Hong Minh, 2021.

(2) The fiscal terms for oil & gas exploration and production in Viet Nam allows 25% for cost recovery. This percentage means maximum investment cost that the operator can recover from produced barrels. In the unified revenue there are also investments of businesses other than exploration and production, so we estimated K_I to be 80%. K_F is estimated to be around 10% as discussed earlier. C refers to published data of GSO.

Unlike many other marine economic sectors, oil & gas is an industry with a very large proportion of FDI. On average, over the past 10 years, the GDP (real price) of oil & gas is more than 2.1 times larger than the actual GNI of the industry, which means that GNI is only less than half of the GDP, although in recent years, the rate GNI/GDP ratio tends to increase.

(7) The Impact of oil and gas on society and environment

- For society:

The biggest contribution of the oil and gas extraction industry, especially in the first stage of business, which is also when the Viet Nameese economy began to innovate, is to contribute to economic growth and especially for the state budget. During the peak period, the oil extraction industry accounted for 20% of the total GDP and 30% of the total state budget revenue. In the last 5 years, the contribution rate of Oil & Gas, the GDP and budget growth has decreased, to only 10% and 3-5% respectively due to a slow revenue growth of Oil and Gas and partly due to the increase of GDO and budget.

Thanks to the large contribution of the Oil & Gas industry to the State budget, the State has been able to maintain macroeconomic stability and maintain social

development expenditures (education, health care, hunger eradication and poverty alleviation).

For some coastal localities, the construction of petrochemical refineries (Quang Ngai, Thanh Hoa), gas power plants (Ca Mau), nitrogen fertilizer factories, gas pipeline, etc has significantly contributed to change the economic and social situation here compared to before.

The petroleum industry creates many direct jobs along a value chain. Around 42,000-58,000 employees work directly at PetroViet Nam and its subsidiaries. The number of indirect jobs, mainly in the service business, can be estimated to be as many as direct jobs. Petrolimex is estimated to have around 20,000 employees but the indirect jobs can be double of this as many gas stations are franchised.

- For environment:

The impacts of oil & gas production on the marine environment in Viet Nam are not fully known or fully researched. One significant paper on this theme was published in the PetroViet Nam Journal in 2017 (B.H Diễm, 2017 [68]). The paper studied the marine environmental changes in oil and gas fields in Cuu Long basin during the 1995 - 2015 period. The study focused on the monitoring of sea water quality, the sedimentary environment and benthic ecosystem around offshore production facilities of 16 oil fields in the basin. This study shows that the most important impacts caused by disposal of drilling muds into the sea, during drilling campaigns.

In many of the oil fields, the content of Barium and Mercury, Zinc and some other heavy metals and Total Carbon Content (THC) increase; but they generally are below acceptable values according to the national standard QCVN 10-MT:2015/BTNMT. The effect of production on indicators of benthic community, like Number of Species (NS), Number of Individuals (NI) also tend to be not significant. The quality of sea water through measured indicators, like Dissolved Oxygen (DO), Total Suspended Solid (TSS), Total Hydrocarbon Content (THC), Total Organic Carbon (TOC), and Biochemical Oxygen Demand (BOD) are all within the national standard QCVN 43:2017/BTNMT.

According to public data released in the Online Dialogue on Preventing and Responding to Oil Spills in Viet Nam Sea on December 17th 2019 (tienphong.vn, [38]), during 1992-2019 there were 190 oil spills in Viet Nam. Among them, 37 were offshore (19%) and 88 were in coastal areas (47%). Some cases which were mentioned in the dialogue include the VietSun Integrity shipwreck in Long Tau river, Ho Chi Minh City, with 150 tons of diesel inside which later was pumped out by response team; accident of Nordana Sophia ship with 180 tons of fuel inside in Ha Tinh province sea; Toan Phat

68 shipwreck in Quy Nhon sea with 25 tons of DO inside threatening oil spill into the sea. According to this, up to now no oil spills caused by oil production or by transportation of crude oil were recorded in the sea territory of Viet Nam.

3. Interaction with SDGs

Due to the specific nature of the industry, offshore oil and gas activities do not have an equal impact on all SDGs. In fact, Oil & Gas/Marine Resources is closely related is related to only a few objectives, the most affecting SDGs 1 and 7. The assessment of the impact of Oil & Gas/Marine Resources on SDGs is as follows:

Table B4. Oil & Gas/Marine Resources sectors and Viet Nameese SDGs

SDG	Score	Comments
SDG 1	+2	Oil & gas sector contributes remarkable portion of state budget, thus helps the government to have resources to end poverty in the remote and difficult areas
SDG 2	+1	LPG produced from natural gas offshore Viet Nam may bring heat to remote communities and help with food preparation and cooking; urea produced helps to get better agricultural outcrops. All help to end with hunger
SDG 3	0	
SDG 4	0	
SDG 5	0	
SDG 6	0	If not managed well, oil and gas can cause water pollution (-) Oil & gas activities are mainly offshore and do not have impact on onshore water. In some cases oil & gas exploration even could help to find some water sources (f.e. Tien Hai) (+)
SDG 7	+3	Developments in this area lead directly and significantly into affordable energy production for all.
SDG 8	+2	The Oil and Gas industry creates many direct jobs in large energy industrial regions like Southeast Viet Nam, Ca Mau, Quang Ngai, Thanh Hoa.... Besides, it creates many indirect jobs related with services, trading and products distribution
SCD 9	+2	Oil & gas sector develops infrastructure and leads the development for some industrial regions, like Ba Ria-Vung Tau, Southeast,

SDG	Score	Comments
		Southwest, South- and North Central Viet Nam. By this, it promotes inclusive, sustainable development and fosters innovation in these areas
SDG 10	+1	Providing clean and affordable electricity indirectly reduces inequality.
SDG 11	+1	Oil & gas industry contribute to sustainable urban development and communities (Vung Tau, Ho Chi Minh, Nhon Trach, Ca Mau, Quang Ngai, Thanh Hoa, Thai Binh...)
SDG 12	+1	Oil & gas industry today and its transition to clean energy (renewable energy) show responsibility in energy production and consumption.
SDG 13	-1	Oil & gas industry already has Action plan for mitigation of climate change (+), but as the main sources of GHG emissions this action plan may not be enough (-)
SDG 14	-1	Oil & gas sector uses the oceans, seas and marine resources and the process is irreversible.
SDG 15	0	
SDG 16	0	
SDG 17	+1	The traditional close partnership in oil and gas sector promotes global partnership for sustainable development

Source: Nguyen Hong Minh, 2021.

Appendix C. Marine renewable energy

1. Resources

The exploitation of marine renewable energy sources in general, and offshore wind power in particular, is still a very new field in Viet Nam. The number of investment projects and exploitations of wind power offshore and on islands in Viet Nam are still very low. Apart from offshore wind, other forms of marine energy, such as tidal power, ocean waves, and ocean currents are still in the research stage, but considered as potential energy sources in the future.

However, in recent years, the investment, construction and operation of renewable energy power projects in general and offshore wind power in particular have "exploded" strongly. The number of renewable energy projects, primarily solar and wind power, including offshore wind, registered by private investors, has increased rapidly. The explosion of registrations for these projects is driven by two basic reasons: first, the rapid advancement of solar and wind power generation technology, making construction and equipment installation cheaper which reduces electricity production cost per unit. Secondly, strengthening of the mechanisms and policies to encourage investment, especially the purchase price of electricity from solar and wind power of the Government of Viet Nam⁷⁸.



Figure C1. Offshore wind turbines of Bac Lieu Wind Power Plant⁷⁸

⁷⁸ Source: <https://Vietnamnet.vn/vn/khoa-hoc/viet-nam-buoc-dau-phat-trien-dien-gio-99651.html>

Therefore, even though the share of offshore wind power in total electricity output is currently modest, if this growth rate is maintained, the share of renewable energy which comes from offshore wind will certainly be much larger than today. Perhaps this is also one of the very important reasons that is responsible for the changing structure of the electricity industry in the future and one of the reasons why the Government of Viet Nam is implementing power development master plan in period of 2021-2030, vision to 2045

Sea wind resources

Viet Nam is evaluated as a country with relatively high potential for diverse renewable energy sources, including solar energy, wind energy (including offshore wind power), tidal energy, ocean waves and ocean currents, etc. A summary of renewable energy sources that Viet Nam can exploit both inland and offshore is referred as below:

Solar energy: Solar energy is available around the year, relatively stable and widely spreading throughout in various geographical and climate zones. Solar energy, especially in the Center and South regions, can be used 300 days/year on average, making Viet Nam have a high potential of solar energy (GIZ, 2016). In the Center and South regions, average solar radiation is 5 kWh/m²/day. Meanwhile, in the North solar radiation is about 4 kWh/m²/day⁷⁹.

Electricity power from ocean tides, ocean waves and sea currents: Eastern Sea provides high potential of marine energy through wave power, ocean current power and tide power of at least 500 MW/year. Though these technologies are not yet matured it may become one element of mix of power generations in Viet Nam in the upcoming decades.

Wind energy: As a coastal country in monsoon tropical zone, Viet Nam is considered to have a very good potential of offshore wind energy. However, like other developing countries, potential offshore wind power of Viet Nam was still not quantified at a reliable level because of lack of wind measurement data and current data sources of wind.

Regarding the concept of "offshore wind power", according to Decision No. 39/2018/QĐ-TTg dated September 10, 2018 of the Prime Minister (Viet Nam), that "Offshore wind power project" refers to any grid-connected wind turbine power project constructed and operated offshore and outside the mean low water mark

⁷⁹ Ministry of Industry and Trade, 2014, Maps of solar energy in Vietnam; and Institute of Energy, 2018, report "National solar power development plan".

baseline of several years (18.6 years). This is considered as legal background for the assessment of marine wind power potential including near-shore and offshore wind power projects of Viet Nam in this study.

Assessment of offshore wind power potential by installed capacity (MW) or electricity production (MWh) needs sufficient and suitable data to establish standards and regulations. This is since a small difference of wind speeds can lead to a significant difference in electricity production (annual electricity production and levelized costs of electricity (LCOE). Therefore, in order to assess the potential of offshore wind power, it needs to have wind measurement data. However, so far, no offshore wind measurement in Viet Nam has taken place sufficiently except one project with wind measurement tower installed on sea in Soc Trang province and one project using LIDAR fixed on a buoy in Binh Thuan province, but data of 12 months according to regulation are not available when this report was being prepared.

Until now, no activity of assessing offshore wind power potential “**officially**” was carried out by related ministries and sectors of Viet Nam but there are some initial overview studies (including domestic and overseas studies) which provide encouraging “**values**” of power capacity and electricity production which may be developed though there are big differences between these studies. The differences may be due to different methodologies, approaches and data sources used. The following is summary of offshore wind power potentials of Viet Nam taken from different assessment sources.

According to a research report by an independent group of experts, there are two types of offshore wind potential that are considered using wind data at 100 m altitude to assess the entire East Sea of Viet Nam. Average wind data were available for duration of 10 years, 2006-2015, with net 10 kmx10km. Tool used is software WASP. Calculation results are summarized in the following Tables.

Table C1. Total theoretical and technical potentials of wind energy

No.	Sea	Theoretical potential (GW)	Technical potential (GW)
1	Offshore	162.300	2.054
2	Coastal	297.924	4.321
Total		461.224	6.375

According to the assessment of Energy Sector Management Assistance Program (ESMAP)/World Bank (WB), the total technical potential of offshore wind power in Viet

Nam is about 475 GW, including 261 GW of fixed and 214 GW capacity. However, the report also states that converting this potential into actual must take into account the infrastructure connectivity, economic, social and environmental considerations of each region.

According to the Viet Nam - Denmark partnership program in the energy field, the review of the offshore wind power development roadmap mentioned the potential of this wind power source and considered that this power source can play an important role in Viet Nam's green energy transition. Preliminary and presented findings show that Viet Nam's offshore wind theoretical potential of around 160 GW.

According to the national power development plan period 2011-2020, with outlook to 2030 (revised PDP VII, according to Decision No. 428/QĐ-TTg, dated 18/3/2016), the annual target for development wind power as follows: 800MW (by 2020); 2,000MW (by 2025); and 6,000MW (by 2030)⁴. There are 11 provinces that have prepared provincial wind power development planning according to Power Plan VII and revised PDP VII, of which 7 are bordering the sea.

So far, the total capacity of wind power projects that has been added to the planning is 11,800 MW, mainly in the Southwest and Central South regions. In fact, as of March 2020, in addition to the projects added to the above-mentioned power development planning, the Ministry of Industry and Trade has received proposals from 250 wind power projects with a total capacity of about 45,000 MW from the provinces.

According to calculation results of the draft PDP VIII⁸⁰, by 2030 there will be 19,500MW of wind power, accounting for 14% of total generation capacity; wind electricity production of about 48.3 billion kWh, accounting for 9% of the total electricity production.

2. Present status

- *National overview of the Electricity of Viet Nam*: Annual growth rates of the installed capacity and the produced electricity of Viet Nam power system were approximately 11.19% and 10.10% respectively in the period of 10 past recent years. Evolution of growth rates of the installed power capacity by energy type and electricity load of Viet Nam power system in period 2010-2019 is shown in Table 2.10 and Table 2.11.

As of the end of 2019, total capacity of power plants in Viet Nam is 55,939MW⁸¹. Of which, capacity of coal fired power plants accounts for 36.23%; medium and big

4. Institute of Energy, Ministry of Industry and Trade, July 2020, First work shop on PDP VIII

⁸¹ EVN, 2020, operation report of Vietnam electricity system in 2019

hydropower plants (>30MW) accounts for 30.31%; gas turbines accounts for 13.31%; oil fired and diesel power plants accounts for 2.86%; imported power accounts for 1.02%, and renewable power plants⁸² from renewable energy (RE) resources accounts for about 16.22%.

Table C2. Evolution of installed capacity of power plants in period 2010-2019

No.	Power plants		Unit	2010	2015	2016	2017	2018	2019
Total capacity of National power plants, <i>in which</i> :			MW	21,542	38,642	41,422	45,410	49,410	55,939
1	Traditional power plants, including:		MW	21,042	36,524	39,036	42,274	44,818	46,250
	1.1.1	Coal TPPs	MW	2,745	13,251	14,595	17,089	18,945	20,267
	1.1.2	Gas TPPs	MW	3,179	7,446	7,446	7,446	7,446	7,446
	1.1.3	Oil TPPs	MW	537	1,242	1,242	1,242	1,579	1,579
	1.1.4	Big HPPs	MW	7,633	14,585	15,753	16,497	16,848	16,958
2	RE power plants		MW	500	2,119	2,386	3,137	3,976	9,072
3	Share of RE power		%	2.32	5.48	5.76	6.91	8.05	16.22

Source: National Load Dispatch Centre, Electricity of Viet Nam (EVN), from 2011 to 2020, Annual operation reports of Viet Nam electricity system and Nguyen Duc Cuong.

Table C3. Growth rates of electricity load in period 2010-2019

Content	Unit	2010	2015	2016	2017	2018	2019
Produced/gene rated electricity	mill. kWh	99,106	163,501	182,166	197,610	219,976	240,101
Growth rates of Produced/gene rated electricity	%	14.35	13.04	11.42	8.48	11.32	9.15

Source: National Load Dispatch Centre, Electricity of Viet Nam (EVN), from 2011 to 2020, Annual operation reports of Viet Nam electricity system and Author (Nguyen Duc Cuong).

- *Current status of RE and marine RE:* In the past recent years, construction of power plants with various types of RE technologies and putting them into operation in Viet Nam were relatively strong, which brought into effect in some locations/provinces in

⁸² Including solar power, wind power, biomass power, waste power and small hydropower (according to regulation, capacity of small hydropower plant is ≤30MW)

the South of Viet Nam. Two main drivers of this development are: i). Support policy mechanism for development of RE – based power projects, in which the most effective is electricity pricing mechanism (UScents/kWh) for wind power, solar power; and ii) Specific investment costs/or CAPEX. (USD/MW) of solar power and wind power have been being reduced over time.

With the features described above, growth rate of the installed capacity of RE power plants in period 2010– 2019 reached higher levels than that of traditional power plants, at about 37.99%/year on average. Of which, during only one year, from June 2018 to the June 2019, the total installed capacity of solar PV power plants in Viet Nam increased 53 times, from 86MW to 4,695MW (not including over 200MW of rooftop solar power systems installed in the same period).

Table C4. Capacity of RE (including marine RE) power plants in period 2010–2019

No.	Contents	2010	2015	2016	2017	2018	2019	Annual growth rate
1	Total installed capacity of the national power system (MW)	21,542	38,642	41,422	45,410	49,410	55,939	11.19%
2	Total installed capacity of RE power plants, <i>In which:</i>	500	2,119	2,386	3,137	3,976	9,072	37.99%
	<i>Small hydropower(MW)</i>	500	1,984	2,172	2,971	3,322	3,674	24.81%
	<i>Total wind power (MW)</i>	30	90	126	152	243	377	31.48%
	<i>In which: offshore wind power (MW)</i>	0	22	105.2	105.2	105.2	105.2	-
	<i>Solar power (MWp)</i>	3	5	8	10	86	4,696	126.44%
	<i>Biomass power and others (MW)</i>	24	24	80	319	319	325	33.58%

Source: National Load Dispatch Centre, Electricity of Viet Nam (EVN), from 2011 to 2020, Annual operation reports of Viet Nam electricity system; and Author (Nguyen Duc Cuong).

- *Economic present and infrastructure of Electricity of Viet Nam:* Table 2.13 below describes current status of infrastructure, economy of Viet Nam’s electricity sector in period 2010 - 2019.

Table C5. Main indicators of Viet Nam's electricity sector in period 2010-2019

No	Items	Unit	2010	2015	2016	2017	2018	2019
I	Infrastructure of Viet Nam's electricity							
1	Total power capacity mixed	MW	21,542	38,642	41,422	45,410	49,410	55,939
	<u>Of which:</u> Total capacity of RE power	MW	500	2,119	2,386	3,137	3,976	9,072
	<u>In which:</u> Total capacity of marine RE power	MW	0.00	51.02	105.2	105.5	105.2	105.2
	Share of marine RE in total RE	%	0	2.41%	4.41%	3.36%	2.65%	1.16%
	Share of marine RE in total national power capacity	%	0	0.13%	0.25%	0.23%	0.21%	0.19%
2	Substations							
	500kV	MVA	12,000	22,500	26,100	29,400	33,300	34,050
	220kV	MVA	20,020	39,103	45,028	48,553	57,441	62,236
	110kV	MVA	28,183	49,556	52,307	60,058	65,725	75,614
3	Transmission lines							
	500kV	km	3,890	6,957	7,346	7,414	7,799	8,496
	220kV	km	10,015	14,198	16,589	17,126	17,861	18,391
	110kV	km	13,141	19,414	18,511	20,584	21,708	24,783
II	Business data of Viet Nam's electricity							
1	Total electricity produced	GWh	100990	163433	181988	197433	221040	240101
2	Total electricity sold (consumed by customers)	GWh	85,674	143,680	159,790	174,650	192,360	209,420
3	Average electricity selling price	VND/kWh	1,061.4	1,630.96	1,661.57	1,660.19	1,731.04	1,864.44
4	Total revenue from electricity sales	Billion VND	90,934	234,339.5	265,510.7	289,954.7	332,983.3	390,451.0*

Note: (*) estimated based on average electricity selling price of the year 2019

Source: + National Load Dispatch Centre, Electricity of Viet Nam (EVN), from 2011 to 2020, Annual operation reports of Viet Nam electricity system; and Author (Nguyen Duc Cuong).

In 2010, total power capacity of power plants in Viet Nam was 21,542 MW. Total capacity of substations at voltage levels of 110/220/500 kV is 60,203 MVA and total transmission lines at voltage levels of 110/220/500 kV is 27,046 km. By the end of

2019, the total installed capacity of power plants has increased 2.57 times, reaching 55,939 MW. Similarly, the capacity of substations and transmission lines has increased by 2.85 times and 1.91 times and reached 171,900 MVA and 51,670 km respectively.

In accordance with the average electricity selling price (VND/kWh) and the amount of consumed electricity (kWh) (households) in the period of 2010 - 2019, the total revenue of Viet Nam's electricity industry increased from VND 90,934 billion in 2010 to about VND 390,451 billion in 2019. The average revenue growth rate reached about 17.58%/year in the period of 2010 - 2019.

- *Economic present of marine RE:* Until now, the investment and exploitation of renewable energy projects at sea such as offshore wind power projects, floating solar power or solar power projects on islands in Viet Nam is still very modest. The contribution of offshore wind power is almost non-existent but still in its infancy. However, in recent years, wind power projects have increased rapidly.

Table C6. The share of real GDP of offshore wind power in National and Electricity level GDPs

Year	Nominal GDP (unit: VND thousand billion)		% GDP offshore windpower/GDP Viet Nam
	GDP Viet Nam	GDP ⁸³ of offshore windpower sub-sector	
2010	2,157.83	0	0.00000%
2011	2,779.88	0	0.00000%
2012	3,245.42	0.0015	0.00005%
2013	3,584.26	0.0358	0.00100%
2014	3,937.86	0.0595	0.00151%
2015	4,192.86	0.1533	0.00366%
2016	4,502.73	0.3371	0.00749%
2017	5,005.98	0.4333	0.00866%
2018	5,542.33	0.5080	0.00917%
2019	6,037.35	0.5266	0.00872%

Nguyen Duc Cuong, 2021

The growth rate of real GDP of offshore wind sub-sector was about 131.8% per year in the period of 2012-2019, but the contribution rate is very small in the real GDP of Viet Nam and real GDP of the power sector in 2019, only 0.0141% and 0.2131% respectively.

3. Interaction with SDGs

⁸³ Estimate based on electricity revenue

Perhaps with the nascent state of the marine renewable sector, it is still too early to assess the link between offshore wind energy and SDGs. However, initially, it can be said that offshore wind power will be a key contributor to sustainable development. Its net impacts will go beyond the energy/electricity sector: from human wellbeing to employment growth. In addition, offshore wind power is important to support significant progress on the Paris Agreement on Climate Change as well as SDGs.

Impacts of offshore wind power including economic (GDP, stable prices, employment, secure supply, and investment); environmental (pollution, emissions, energy efficiency, biodiversity, greenhouse gases); and social (health, diversity, jobs, etc.).

-Small renewable energy projects are often located in remote and mountainous areas (mountains and islands). The development of renewable energy projects in these areas not only contributes to ensuring the goals of energy access and quality of electricity supply services (Goals 7 and 10 of the 17 sustainable development goals) but also promotes promote socio-economic development for these remote areas. Construction works in remote areas will create employment opportunities, develop local transport and improve infrastructure for communities (Goal 8).

Table C7. Link offshore wind power to the SDG

SDGs	Score	Comments
SDG 1	+1	Attending to reduce poverty that bases on providing new jobs during constructions, installations and operations.
SDG 2	0	
SDG 3	+ 1	It may also indirectly support the achievement and ensuring good health and air quality .
SDG 4	+ 1	Contributing opportunities to access to education and knowledge for local residents.
SDG 5	0	
SDG 6	+1	Contributing to access to clean water that bases on providing adequate and stable supply of energy.
SDG 7	+ 3	Offshore wind power is an energy source that meets affordable and clean energy requirements.
SDG 8	+ 2	Promoting economic growth and create more jobs for youth.

SDG 9	+ 2	Fostering innovation and infrastructure development in some coastal localities.
SDG 10	+1	Providing clean electricity indirectly reduces inequality.
SDG 11	+ 1	Contribute to sustainable urban development and communities in many coastal areas.
SDG 12	+2	High demands for responsible consumption and production.
SDG 13	+ 3	Offshore wind development is center on urgent action to combat climate change that bases on proving green power source, replacing fossil fuels and reducing greenhouse gas emissions.
SDG 14	-1	May affect biological species in the project areas.
SDG 15	0	
SDG 16	0	
SDG 17	+ 1	Partnership with international and bilateral entities.

Nguyen Duc Cuong, 2021

Links and interactions between offshore wind farms and other sectors are summarized in the table below:

Table C8. Interactions between offshore wind farms with other sectors

No.	Interactions with other sectors	Type of interaction	Constrain rate/scores	Description
1	Fisheries	Social and economical	-/0	Offshore wind development sites restrict access for fishing practices. Foundation constructions and electricity cables installations can temporarily increase suspended sediments in the water with negative impact to fisheries
2	Aquaculture	Social and economical	-/- +/+	Electricity cable and other cable installation can affects both intertidal (near-shore area) and offshore sites. Coastal aquaculture and maricultural of fish, shellfish, and seaweed.

				Offshore wind farms can be a "fulcrum" to develop offshore marine farming.
3	Offshore hydrocarbons (oil and gas)	Economical (technical) and social	-/0	Oil and gas supply pipe lines can affect some offshore sites.
4	Tourism	Social	0/+	There is small affect, e.g. sailing, coastal hotels, beach, cruise on boat, surfing, particularly for near shore areas
5	Transportation	Economical (technical)	-/0	There is small affect, e.g. marine routes. Particularly for near shore areas.
6	Biodiversity	Environment	-/0	During the period of the pre-construction and construction activities can affects both near-shore and off-shore areas, but more likely to impact in near-shore areas.

Nguyen Duc Cuong, 2021

Appendix D. Coastal and marine tourism

1. Resources

Viet Nam has many beaches with over 125 beaches that have a length of over 1 km or more, and some beaches stretching up to 15-18 km long. The most beautiful beaches are located along the central coast, Quang Ninh province and on some large islands. Along the coast of Viet Nam, there are many lagoons and bays that are also valuable tourism resources.

Preliminary statistics by Le Duc An (1996) show that there are a total of 2,773 coastal islands with a total area of more than 1,720 km² and distributed mainly on the coast of the Northeast region (2,321 islands), stretching border-to-border from Quang Ninh to Kien Giang province, from shore to far from the shore within 135 to 155 km (Bach Long Vi, Hon Hai) and with an area ranging from a few hundred square meters to over 500km². Some provinces with many islands are Quang Ninh has more than 2000 islands, Hai Phong has 243 islands, Khanh Hoa has 100 islands and Kien Giang has 159 islands.

Biodiversity in national parks and protected areas, as well as mangrove forests is an important tourist resource. Currently, there are 16 marine protected areas on the mainland, islands or underwater from the North to the South. Most of the global

biosphere reserves in Viet Nam are located in the coastal areas and islands. Coastal bird sanctuaries in the Mekong Delta are also very popular with tourists.



Figure D1. Binh Thuan Beach⁸⁴

Hot mineral water can be found in many places along the coast, from Quang Ninh to Ba Ria - Vung Tau. This is a foundation for the development of health and relax tourism.

In addition to natural resources, there are many cultural and heritage resources (nature, culture) that have special significance for the development of marine - coastal tourism. Most of Viet Nam's World Heritage Sites are located along the coast, of which the most significant ones are Ha Long Bay (Quang Ninh Province), Cat Ba Islands (Hai Phong City), Hue Ancient Capital, Hoi An Ancient Town and My Son Sanctuary (Quang Nam).

About one third of Viet Nam cultural relics are located along the coast, the highest density of relics are in the North from Quang Ninh to Ha Tinh province (59% of whole region), followed by the next segment from Quang Binh to Quang Nam (19%). Historical relics account for about 50% of total cultural relics, followed by architectural relics (23%).

The coastal fishing villages on the island are also very interesting to tourists, the place where many different sea festivals take place are the foundation of typical "sea culture" seen in Viet Nam. The handicraft village is also an attraction for sea-coastal tourists.

⁸⁴ Source: : <https://Vietnamtourism.gov.vn/index.php/prINTER/21826>

In general, tourism resources along the coastline of Viet Nam are copious, diverse and valuable which could be developed for sightseeing, ecotourism, relaxation, sports and culture tourism.

The distinction is relatively clear by geography: in the North there is a high concentration of cultural relics and landscape (e.g. Ha Long bay), in the Central area there are nice beaches and world heritage sites, in the South are mangroves and wetland ecosystems. This is very important to develop a variety of unique and regional tourism products.

Tourism products can be divided into five main groups to assess the attractiveness of tourism resources of the coastal areas/provinces as follows:

- Sun and beach, water sport and diving: this group refers to tourism activities directly related with the ocean.
- Sightseeing and relaxation: sightseeing can happen at the sea or in land, the same is with relax (resorts)
- Cruise ships: this is fast growing and typical marine tourism product. Although not all oceanic destinations could develop cruise tourism, it would bring big revenue to cruise destinations with land services, visa fee, land tours, food & beverages, souvenirs and personal spending of tourists.
- Heritage tourism: this includes visiting cultural relics, war nostalgia, festival, craft villages etc. this is related with tangible and intangible tourism resources.
- MICE (Meeting, Incentives, Conferences and Exhibitions) tourism: this is a distinctive type of tourism, and would be in a separate group.

The following table introduces the assessment of tourism business within each province in the coastal area. In this table, the maximum score for each item is five, making the maximum total up to 25. The weight is closer to 1.00, the bigger is tourism development potential of the province is.

Table D1. Assessment of importance of tourism products of coastal provinces

	Sun and beach, sport and diving	Sightseeing, relax	Cruise	Heritage tourism	MICE	Total	Significance of tourism sector
1. Quảng Ninh	3	5	4	2	3	17	0.68
2. Hải Phòng	3	4	1	1	4	13	0.52

	Sun and beach, sport and diving	Sightseeing, relax	Cruise	Heritage tourism	MICE	Total	Significance of tourism sector
3. Thái Bình	0	0	0	2	1	3	0.12
4. Nam Định	0	0	0	2	1	3	0.12
5. Ninh Bình	0	5	0	4	3	12	0.48
6. Thanh Hóa	5	4	0	3	2	14	0.56
7. Nghệ An	5	4	0	3	2	14	0.56
8. Hà Tĩnh	3	3	0	1	1	8	0.32
9. Quảng Bình	4	5	0	2	2	13	0.52
10. Quảng Trị	3	4	0	4	1	12	0.48
11. TT-Huế	4	4	3	5	4	20	0.80
12. Đà Nẵng	5	5	5	3	4	22	0.88
13. Quảng Nam	4	4	0	5	3	16	0.64
14. Quảng Ngãi	3	2	0	3	1	9	0.36
15. Bình Định	4	4	0	3	2	13	0.52
16. Phú Yên	5	4	0	2	1	12	0.48
17. Khánh Hòa	5	5	5	3	4	22	0.88
18. Ninh Thuận	4	3	0	2	2	11	0.44
19. Bình Thuận	4	5	0	2	2	13	0.52
20. BR-VT	5	5	3	4	4	21	0.84
21. TP HCM	1	0	4	5	5	15	0.60
22. Tiền Giang	0	0	0	3	3	6	0.24
23. Bến Tre	1	0	0	3	3	7	0.28
24. Trà Vinh	1	0	0	3	2	6	0.24
25. Sóc Trăng	0	0	0	4	1	5	0.20
26. Bạc Liêu	0	1	0	2	1	4	0.16

	Sun and beach, sport and diving	Sightseeing, relax	Cruise	Heritage tourism	MICE	Total	Significance of tourism sector
27. Cà Mau	1	3	0	1	0	5	0.20
28. Kiên Giang	5	5	5	3	5	23	0.92

Source: from specialist's analysis

The last column shows the percentage of the total weights of each group of tourism activities over the maximum value of 25 points, this value demonstrates the relative importance of the tourism industry to the tourism potential of each province.

Thus, according to the results of this assessment, some province show that there is potential for tourism development and tourism to play an important role in socio-economic development, includes Kien Giang, Da Nang, Khanh Hoa, Ms. Ria - Vung Tau, Thua Thien - Hue, Quang Ninh, Quang Nam, Hai Phong, Ninh Binh, Quang Binh, Ho Chi Minh City, Binh Thuan, Thanh Hoa, Nghe An, Binh Dinh, Phu Yen, Ninh Thuan, Quang Tri, and Quang Ngai.

2. Present status

Tourism is becoming more and more important to Viet Nam's socio-economic development, in which marine tourism is the most important among products range of Viet Nam tourism. In 2019, Viet Nam welcomed 18 million international tourists and served 85 million domestic tourists. Total revenue from tourism reached 32 billion USD, making an essential contribution to economic growth of the country, having made 9.2% of country' GDP. Although there are diverse resources, distributed throughout the coastal route, the development level of Viet Nam's sea and coastal tourism in many regions is very different, depending on market factors, natural conditions, tourism resources, technical infrastructure, tourist facilities and many other factors.

** Major tourist development indicators*

Assessing the tourism development of all 28 coastal provinces, cities of Viet Nam, one can observe some characteristics as follows:

- The number of international visitors to coastal provinces increased 13.6%/year, lower than the national average (14.8%/year) from 10.9 million in 2010 to 35.7 million in 2019;

- The number of domestic tourists to 28 provinces has increased from 44.0 million in 2010 to nearly 145.6 million in 2019, enjoying the annual growth rate of 12.3%, which is higher than annual national average growth of domestic tourist market of 11.8%;
- In 2019, the provinces attracting the most international visitors in the region are Ho Chi Minh City (8.5 million), Quang Ninh (5.7 million), Quang Nam (4.6 million), Khanh Hoa (3.6 million), Da Nang (3.5 million), while the provinces attracting the most domestic tourists are Ho Chi Minh City (32.8 million), Ba Ria Vung Tau (15 million), Thanh Hoa (9.4 million), Quang Ninh (8.3 million), Hai Phong (8.1 million), Kien Giang (8 million);
- Total revenue from tourism of 28 coastal provinces is over 508 trillion VND (67.3% of the whole country);
- The total hotel rooms of 28 coastal provinces has increased from 147,725 in 2010 to 398,234 in 2019 and accounts for 66% of the total number of hotel rooms in the country, mainly high-end hotels of the country are located in this area (except high-end hotels in Hanoi). Provinces with the largest accommodation system are Khanh Hoa (49,600 rooms), Ho Chi Minh City (44,200 rooms), Da Nang (40,000), Thanh Hoa (40,000), Quang Ninh (34,000), Ba Ria - Vung Tau (25,500), Kien Giang (23,000).
- The total number of direct tourism workers in coastal provinces has increased rapidly.

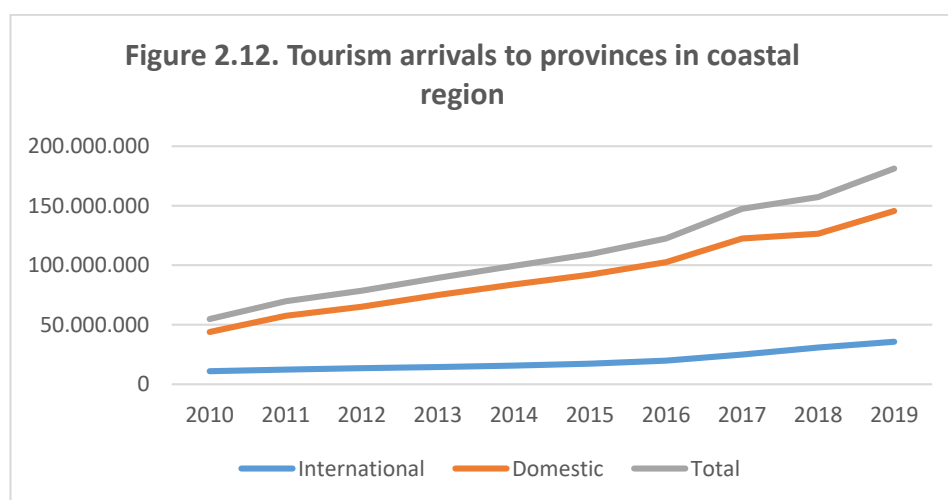


Figure D2. Tourism arrivals to provinces in coastal region

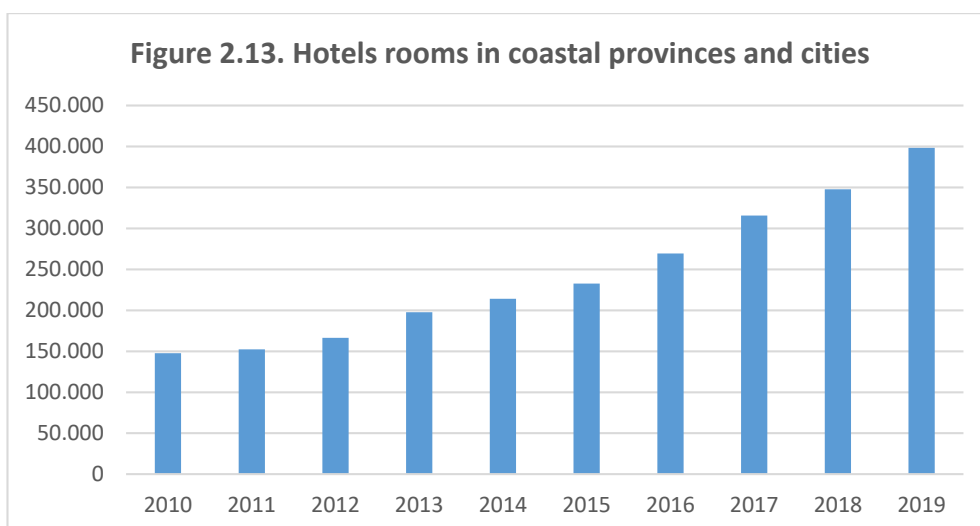


Figure D3. Hotels rooms in coastal provinces and cites

- Cruise ship tourism: cruise tourism has been developing fast in the world and the region. Despite a huge potential, cruise ship tourism development in Viet Nam is far behind expectation due to infrastructure shortage and diversification of tourism product offers. Cruise ship tourists account for about 1-1.5% of total international tourists of Viet Nam, or 2-2.5% of international tourists of coastal region. In 2019, Viet Nam served about 260,000 cruise visitors.

The figure 3 shows the total number of direct tourism labour in coastal provinces based on reports of coastal provinces and processed in relation with the total number of direct tourism labour as introduced in the Tourism Development Strategy to 2030 of Viet Nam (approved by Prime Minister in January 2020).

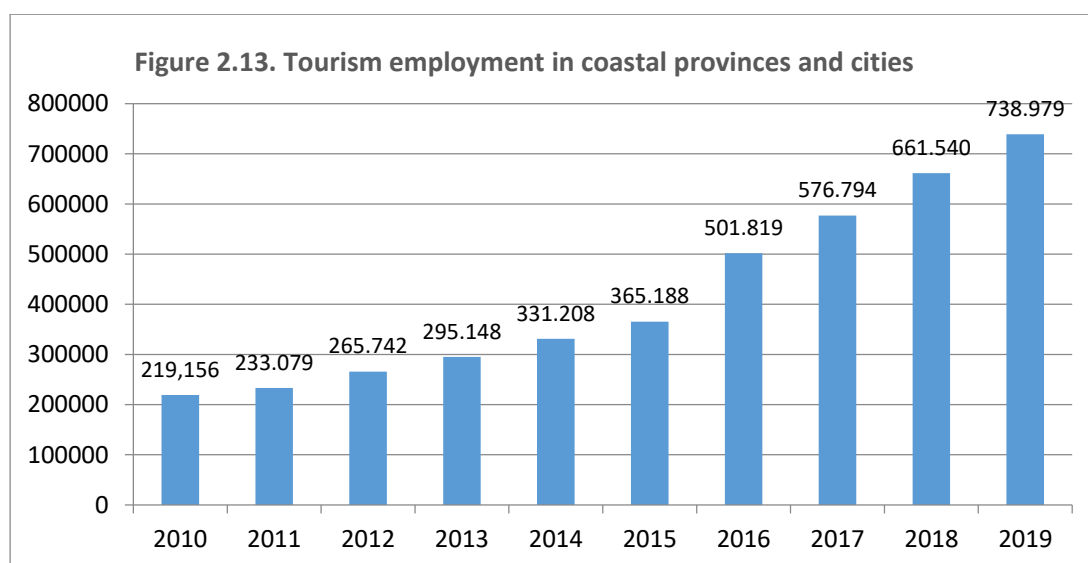


Figure D4. Tourism employment in coastal provinces and cites

Source: Viet Nam Tourism Development Strategy to 2030, provincial Tourism Development Strategies

** Coastal and marine tourism products*

Major tourism activities in coastal provinces include:

- Sun and beach tourism:

+ North and North Central: Thanh Hoa, Nghe An, Hai Phong, Ha Tinh, Quang Binh

+ South Central Coast: Da Nang, Khanh Hoa, Binh Thuan, Binh Dinh, Phu Yen

+ The South: Ba Ria - Vung Tau, Kien Giang

- Sightseeing, heritage: Ho Chi Minh City, Quang Ninh, Quang Binh, Thua Thien - Hue, Quang Nam, Khanh Hoa, Da Nang, Kien Giang, Ba Ria - Vung Tau, Ca Mau

- Entertainment: Ho Chi Minh City, Hai Phong, Da Nang, Ba Ria - Vung Tau, Kien Giang

- Ecotourism: Hai Phong, Quang Ninh, Quang Nam, Khanh Hoa, Kien Giang, Ba Ria - Vung Tau (Con Dao), Ca Mau

- MICE Tourism: Ho Chi Minh City, Da Nang, Quang Ninh, Hai Phong, Ba Ria - Vung Tau, Kien Giang, Khanh Hoa

** The tourist market in the coastal areas*

- 10 out of 28 provinces and cities welcomed a total of over seven million tourists in 2019, with the highest numbers being Ho Chi Minh City (41.3 million) and Ba Ria - Vung Tau (15.5 million arrivals).

- There are seven provinces with high proportion of international tourist market over 40%, of which Quang Nam and Khanh Hoa especially have high proportion of international tourist market over 50%.

- Provinces with the lowest proportion of international visitors are those in the north of Hai Van pass, whose main tourism product is sun and beach (main tourism activity of Quang Ninh is bay sightseeing). Some provinces in the South Central Coast have just started tourism development (Phu Yen, Binh Dinh, Quang Ngai, Ninh Thuan).

Ba Ria - Vung Tau is the traditional destination of domestic tourists, so the proportion of the international market is low, the same situation is with most of the Mekong Delta provinces including Kien Giang. In the Mekong Delta, the two provinces of Tien Giang and Ben Tre have many international visitors, but the tourism products of these two provinces are not directly related coastal and marine tourism, their main products are rural tourism and the Mekong delta exploration.

**Total revenue and GDP from coastal and marine tourism*

The total revenue from coastal and marine tourism has achieved a high growth rate in the last decade of 13.32% per year and reached 508,045 billion VND in 2019 (calculation based on nominal price). During the period 2010-2019, the total tourism revenue from 28 coastal provinces fluctuated between 66-70% of the total tourist revenue of the country, demonstrating the very important role of this area for Viet Nameese tourism. Only expenditure of cruise visitors on land (service fees, ground handling, visa, foods and drinks, entrance to attractions etc.) is accounted, expenses on cruises are excluded.

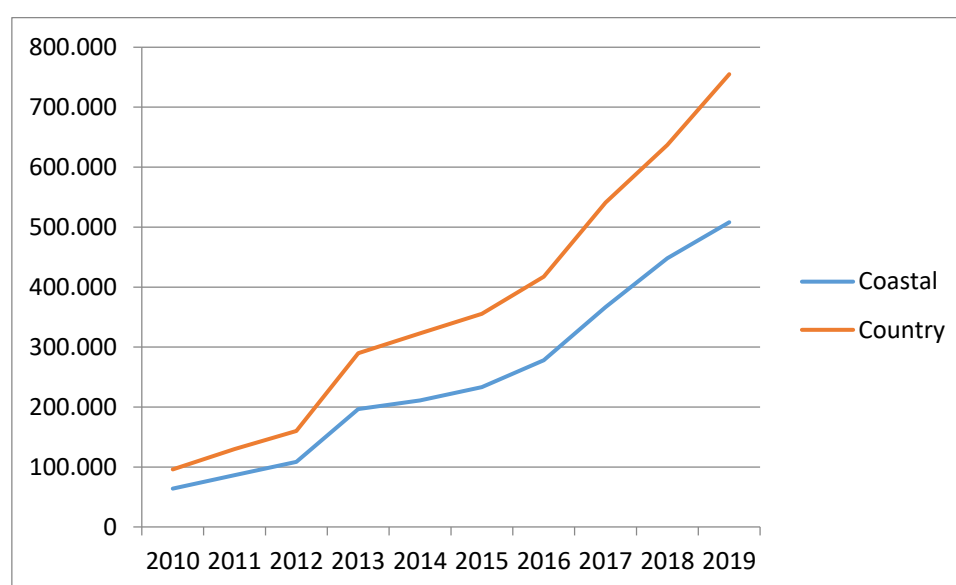


Figure D5. Tourism revenue

Table D2. Total revenue of the Viet Nam tourism sector and coastal & marine tourism segment

(Unit thousand billion VND, nominal price)

Total Tourism Revenue	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Coastal	59,720	86,522	108,631	196,602	211,105	233,212	277,970	366,645	448,121	508,045
Country	96,000	130,000	160,000	289,840	322,860	355,550	417,270	541,000	637,000	755,000

Source: VNAT and provincial reports

In the tourism sector, currently tourism GDP is calculated by 70% of the total tourism revenue, so the tourism GDP of the coastal provinces is shown in table below.

Table D3. GDP of Viet Nam tourism sector and coastal & marine tourism segment

(Unit thousand billion VND, nominal price)

Tourism GDP	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Coastal	44,822	60,565	76,042	137,621	147,774	163,248	194,579	256,651	313,684	355,632
Country'	67,200	91,000	112,000	202,888	226,002	248,885	292,089	378,700	445,900	528,500

Source: Calculated from VNAT reports, provincial reports and consultant estimation

Table D4. Economic performance of tourism sector

Tourism GDP	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Nominal Price										
Country'	67,200	91,000	112,000	202,888	226,002	248,885	292,089	378,700	445,900	528,500
% GDP	3.1%	3.27%	3.45%	5.64%	5.74%	5.91%	6.48%	7.55%	8.03%	9.2%
Coastal	44,822	60,565	76,042	137,621	147,774	163,248	194,579	256,651	313,684	355,632
% GDP	2.18%	2.29%	2.42%	3.94%	4.02%	4.14%	4.54%	5.29%	5.62%	6.1%
Pure marine	23,253	31,421	39,449	71,396	76,663	84,691	100,945	133,148	162,736	184,497
Real Price										
Country'	67,200	75,048	83,261	143,990	154,721	170,710	198,153	246,799	281,051	327,247
Coastal	44,822	49,948	56,035	96,905	104,127	111,972	133,357	166,096	189,147	220,207
Pure marine	23,253	25,192	29,070	50,272	54,019	58,089	69,183	86,167	98,126	114,239

Table D5. Average Annual GDP growth rate of tourism sector of the country, coastal provinces and pure marine tourism

Average GDP Annual Growth Rate (real price 2010) of:	Period		
	2010-2015	2015-2019	2010-2019
Whole Tourism sector	31.51%	24.22%	20.21%
Coastal Provinces	30.88%	25.29%	20.38%
Pure marine tourism of Coastal provinces	30.88%	3.48%	12.05%

The estimation result shows that while the growth rate of the Tourism GDP of coastal provinces has kept similar pace as the one of the whole country's tourism industry, the growth rate of pure marine tourism GDP has dropped in the second half of last decade. That proved that the tourism product range has been diversified by the fact that pure marine tourism activities are growing much more slowly compared to country as a whole, the growth of tourism sector GDP in coastal provinces is still higher than the country's average.

** Coastal tourism GNI and GNI per employee*

Prior to 2000, FDI played a significant role in tourism development investment, however the competition from domestic investors has risen strongly since then. Access to land in tourism potential areas has been among most crucial constraints of this situation, alongside with the very fast growing capacity of domestic investors. During the first decade of 21 century, some mega FDI projects in tourism sector were licensed but they could not be implemented. Since 2010, total capital of licensed FDI projects in tourism sector (hotel and restaurants only) vary from 300-500 million USD per year, accounting for about 20% of total investment in hotel and restaurants sector. However, it has become relatively common for Viet Nameese investors to buy shares in foreign tourist hotels in the past and there is not enough information about these transactions. It can be a real challenge to accurately calculate the foreign ownership share of tourism businesses. Considering that hotels and restaurants generate around 50-55% of tourism revenue, it can be said that the GNI in this sector is around 92% of the GDP. This matches with the statement of the Prime Minister before National Assembly in early 2020, when asked about GNI, he said: the difference between GNI and GDP in Viet Nam is not big, usually under 10%. In 2005, the contribution of foreign investment sector to national GDP is only 1.84%, it rose to 3.8% in 2010 and reached 7% in 2018.

Taking into account the above facts, GNI in coastal and marine tourism could be estimated at about 95% of its GDP (2019). In 2015 tourism GNI could be at 95.5% GDP and 96% GDP in 2010.

Table D6. GNI of country' tourism, coastal provinces and pure marine tourism sector

Tourism GNI	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Nominal Price										
Country'	65,856	89,180	109,760	196,801	219,222	241,418	280,405	363,552	423,605	502,075

Coastal	43,926	59,354	74,521	133,492	143,341	158,351	186,796	246,385	298,000	337,850
Pure marine	22,788	43,988	38,660	69,254	74,363	117,357	96,907	127,822	154,599	175,272
Real Price										
Country'	65,856	73,547	81,596	139,670	150,079	165,589	190,227	236,927	266,998	310,885
Coastal	43,926	48,949	54,914	93,998	101,003	108,613	128,023	159,452	179,690	209,197
Pure marine	22,788	36,277	28,489	48,764	52,398	80,495	66,416	82,720	93,220	108,527

** Tourism employment and training*

According to reports from 28 coastal provinces and cities, in 2019 the total number of tourism employment in this area is 739,000 persons (direct tourism labour) while the total number of direct tourism labour in the whole country is 1,026,500 persons, or 72% of national direct tourism labour are employed in the coastal provinces and cities. This figure is taken from the National Tourism development Strategy of Viet Nam to 2030, which was approved by Prime Minister in January 2020. However, in some occasions, VNAT has announced another number of tourism-related direct labour, which is about 1.3-1.4 million. In this case, the total number of tourism labour in coastal provinces would be about one million. Tourism in HCMC engages the largest number of employees with about 154,000, followed by Khanh Hoa and Quang Ninh – at 130,000, and Da Nang at 51,000.

In the accommodation industry, globally there is an average of one employee for each hotel room. One job in the core tourism industry creates about one and a half additional jobs in the tourism-related economy. Furthermore, there are three workers indirectly dependent on each person working in hotels, such as travel agency staff, guides, taxi and bus drivers, food and beverage suppliers, laundry workers, textile workers, gardeners, shop staff for souvenirs and others, as well as airport employees (UN-WTO and ILO: Measuring Employment in the Tourism Industries - 2014, page 17). In this study, assuming that there is one and a half additional jobs in the tourism-related economy created by one job in core tourism industry (one job in core industry equal to one hotel room), and 40% of working time of those who are "indirectly dependent on each person working in hotels" are paid by tourism, we can roughly calculate the total number of full time posts paid by tourism (hereinafter called Equivalent tourism labour). This result will be subsequently used to estimate the GNI per employee in tourism sector.

Division of GNI by number of Equivalent tourism labour will show the GNI per capita (per equivalent tourism employee). The table below shows the GNI per equivalent employee, calculated in nominal price and real price.

Table D7. GNI per equivalent employee in the last decade

Unit: Million VND

GNI per employee	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Nominal price	80	105	121	183	181	184	187	211	232	229
Real price	80	87	89	129	128	126	128	137	140	142

Source: consultant estimation (Hoang Dao Bao Cam)

** Marine tourism affects society and marine environment*

- Development of marine tourism contributes to promoting the development of many other economic sectors: Marine tourism is an interdisciplinary economic sector, so the development of marine tourism will lead to the development of many industries. First of all, the development of tourist resorts, attractions, and entertainment will create an increasingly large demand for the construction industry. The demand for tourist transportation will promote the development of the transportation sector, including the shipbuilding industry; building and improving airports and harbours. During operation, the need for travel and excursions; accommodation; entertainment; shopping of visitors will be the driving force to promote the development of the transport, aquaculture, production of handicrafts, and agriculture. Marine tourism development would also boost economic development of neighbouring regions.

- Developing marine tourism creates job opportunities: tourism, including marine tourism is labour intensive. The development of marine tourism has a very important role in create jobs and improving livelihood of local communities.

3. Interaction with SDGs

Table D8. Tourism & SDGs

SDGs	Score	Comments
SDG 1	+2	Tourism is a labor-intensive industry, so it plays an important role in hunger eradication and poverty alleviation in many coastal areas of Viet Nam.
SDG 2	+2	Tourism is a labor-intensive industry, so it plays an important role in hunger eradication and poverty alleviation in many coastal areas of Viet Nam.
SDG 3	+2	Marine tourism improves the livelihoods of local communities, enabling them with conditions to take better care of their health and their family health.

SDG 4	+2	Sea tourism promotes local youth to participate in learning because they can understand the clear differences that education and knowledge could bring.
SDG 5	+2	As one of the sectors with the highest share of women employed and entrepreneurs, tourism can be an efficient tool for development of women, raising their roles and significance in families and communities.
SDG 6	+2	Tourist development also would probably improve water supply and drainage infrastructure, increase sanitation standards, and help improve the living conditions of local people.
SDG 7	+1	Local people can learn from innovative affordable and clean energy solutions in ecotourism establishment.
SDG 8	+3	Tourism has contributed 9.2% of national GDP and coastal and marine tourism is accounted 2/3 of entire tourism sector, is very direct tool for decent work and economic growth.
SDG 9	+3	Improve infrastructures for coastal regions and islands such as tourism ports, airports, roads and bridges, drainage, power supply, telecommunication, etc. where there are tourism development potentials.
SDG 10	+2	Marine tourism contributes to narrowing the gap and promoting development in remote, isolated and underdeveloped areas, reducing inequality, and thus is an important contributor to reduce inequity
SDG 11	+3	Good contribution to sustainable urban development and coastal communities
SDG 12	+1	Well-mannered tourists with ever growing awareness on sustainability would encourage local people and suppliers in responsible consumption and production.
SDG 13	-2	Tourism both contributes to and is affected by climate change.
SDG 14	+3	Coastal and maritime tourism, tourism's biggest segments, rely on healthy marine ecosystems. So preserving and developing life below water is completely in line with the future of coastal and marine tourism.
SDG 15	+2	Natural landscapes, natural reserves, rich biodiversity, and natural heritage sites are often main objectives of tourists. Sustainable tourism can play a major role, not only in conserving and preserving environment, nature and society.
SDG 16	+2	Contributing to enhancing cultural exchange and mutual understanding.
SDG 17	+1	Strengthen cooperation with stakeholders to contribute to sustainable development together

** Coastal and Marine Tourism development and other marine economic sectors*

Tourism is a general economic sector, which has intensive interactions with many other sectors. Critical analysis of interactions between tourism and other blue economy sectors are described in the table below.

Table D9. Correlation between Coastal and Marine tourism and other marine economic sectors

Interactive sectors	Interaction type	Impacts	Remarks
Marine Renewable Energy	Social	0 / +	<p>No serious conflict detected except some possible disruption to sailing routes from areas with wind turbines, but it's avoidable</p> <p>Windfarm near coastline could be tourism attraction (i.e. Bac Lieu wind farm)</p>
Oil and gas: Oil rigs Refineries and port	Social and economical	0 / +	<p>Oil spills may affect beaches and sea water</p> <p>Conflict in landuse between oil industry development (refineries, oil ports etc.) and tourism, but it can be solved through appropriate planning</p> <p>Oil industry would be a high spending market for tourism services</p>
Fisheries and Aquaculture	Social and economical	+ / -	<p>Tourist consumption benefits greatly fisheries and aquaculture</p> <p>Fishing would be a attractive tourism products</p> <p>Landuse conflict between tourism development and aquaculture farms, traditional landing site of the fishing community. Aquaculture farming is also source for pollution if not properly managed</p>
Maritime	Social, Economic and Environment	0 / -	<p>Landuse conflict between tourism development and port development</p> <p>Maritime route may disturb sailing routes and cruise lines if not sufficiently planned</p>
Biodiversity	Social and environment	- / +	<p>Biodiversity is an important tourism resources</p> <p>Tourists may damage sealife if not well managed</p> <p>Wastes from tourism activities could create pollution and affect negatively the biodiversity</p>

Appendix E. Maritime sector

1. Resources

The East Sea is one of the busiest international maritime trade routes in the world, connecting the Indian Ocean and the Pacific Ocean. The development of many economies in East Asia is closely related to this sea route. The international shipping route through the East Sea is considered to be the second busiest in the world with a trade value of about 5.3 trillion USD annually. The volume of goods exported through the East Sea by Southeast Asian countries is 55%, the newly industrialized countries are 26%, and Australia is 40%. In this region, there are major ports such as Singapore - the largest seaport in Southeast Asia and the second largest in the world in terms of container ports. If a crisis occurs in this sea area, and ships have to follow new routes or circumnavigate South Australia, the freight charges will even increase fivefold and become no longer competitive in the world market.



Figure E1. Cat Lai Port⁸⁵

Viet Nam is a country with a long-standing marine economy. With a coastline of more than 3,000 km, the maritime and coastal transportation systems are the lifeblood of the country with about 90% of the volume of import and export goods going by border and 100% of the goods going across the East Sea.

Viet Nam's maritime industry rapidly developed in the 1990s when the economy and trade began to open up. In 1990, the National Assembly passed the Viet Nam Maritime

⁸⁵ Source: <https://vietship.net/van-chuyen-hang-hoa-tu-cang-cat-lai-hcm-di-cang-hai-phong.html/>

Code, the first specialized code at the time, which demonstrated the state management way of thoughts by legal tools for the shipping industry and created a legal foundation for business activities within the industry. The leap forward development of shipping in the years following the post reform years - a typical figure shown by the volume of containers moving through Viet Nameese seaports has increased at a rate of more than 1,500% in the period 2001 – 2019. This shows that new, urgent and drastic requirements for the organization of the seaport system along the length of the country are needed.

2. Present status

The maritime economy includes three main sectors: shipping, port construction and services, and ship building and repair.

(1) Marine Transport

Ocean transport is one of the five main modes of transport in Viet Nam including road, rail, inland waterway, sea and air transport. While sea passenger transport accounts for a negligible proportion, sea freight transport accounts for more than 90% of the country's import and export freight volume and accounts for about 20-24% of the total volume of goods transported by all modes. Developing and exploiting effective sea transport brings competitive advantages for import and export goods. This shows that maritime transportation plays a very important role in the economy.

Ocean transport has advantages over other modes of transport such as the ability to transport large volumes, long transport distances with low costs, safety but slow transport speed, and relatively complex exploitation organization. It is necessary to have a synchronism between ships and technology of loading and unloading at seaports combined with many other types of logistics services to be effective, especially container transport. Sea transportation mainly handles goods with large volumes such as containers (accounting for about 35%-40%), crude oil, petrol, gas, coal, ores, cement, iron and steel, grains,... Currently, Viet Nam has established 32 main shipping routes, of which 25 are international and 7 domestic.

In 2019, there were nearly 493 million tons of goods transported by sea, accounting for about 23.2% of the total transport volume of all modes and accounting for 95.6% of the volume of imported and exported goods (corresponding to about approx. 65% of the value of imported and exported goods). The total volume of goods through the seaport in 2019 is 2.5 times higher than that of 2011, the average growth in the period 2011 - 2019 is 9.18%/year, of which container cargo increases by 3.1 times, the average growth 13.4%/year.

Table E1. Transport volume and market share by modes in 2019

Transport Modes	Total volumes transported (Million tons)	Transport market share (%)	International Transport only	
			Volume (Million tons)	Market share (%)
Road	1,340.53	63.04	13.78	3.61
Rail	5.10	0.24	0.84	0.22
Inland Waterway	286.88	13.49	1.06	0.28
Maritime transport	492.75	23.17	364.58	95.62
Air transport	1.27	0.06	1.01	0.26
Total	2,126.53	100	381.27	

Looking at the economy as a whole, although the most important role of shipping is to ensure the safe and efficient transport of goods, maritime transport itself is also a very competitive business because it brings huge revenue from freight, which can be up to tens of billions of dollars per year. However, up to now, this revenue has mainly fallen into the hands of foreign enterprises with about 90% of Viet Nam's international shipping volume due to foreign shipping lines winning the right to transport while domestic enterprises are only responsible for transportation equivalent to about 10% due to low capacity and competitiveness.

The fleet of shipping vessels owned and operated by Viet Nameese enterprises (also known as the national flag fleet, referred to as the national fleet for short) has more than 1,000 units, but mainly small, old ships, ships carrying general cargo while the international transport market needs specialized, modern, large tonnage ships that require large investment and high level of exploitation such as container ships, oil tankers, and LPG ships. The main reason is that domestic enterprises do not have sufficient financial capacity and exploitation capacity is also very limited. Therefore, at the present, ships of Viet Nameese enterprises only transport goods on domestic routes and international transport on close routes; with a very low volume of container transport.

Currently, there are about 40 foreign shipping lines in operation, including some of the biggest names in the world such as Maek lines, NYK line, CMA CGM, MSC. The world shipping lines with large tonnage fleets currently with modern technology, strong financial potential along with a global logistics network and the establishment of alliance groups, all Viet Nameese shipping lines are in a state of unequal competition. Up to now, about 90% of the international transport market share (import and export freight) of Viet Nam is carried out by foreign shipping lines.



Figure E2. Container transport ships of domestic enterprises

Meanwhile, the number of shipowner enterprises in Viet Nam is quite large, but mainly consist of small-scale enterprises with weak financial capacity, so their competitiveness is still very limited. Among nearly 600 ship owners, only 33 ship owners own fleets with a total tonnage of over 10,000 DWT, the rest are owners of small ships belonging to small-scale private economic sectors, and many shipowners only manage 01- 02 ships. The organization and management of service provision of Viet Nameese enterprises are still weak, there is a lack of linkage between shipping lines and shippers. In addition, with the characteristics of the international shipping market, which is often heavily affected by regional and world economic crises, wars, epidemics, oil prices... Viet Nameese shipowner enterprises are very low, their business is not efficient, they suffer serious losses and many businesses go bankrupt

(2) Seaport operation

Due to the trend of opening up and global integration, the volume of goods through the seaport system has a deep correlation with trade growth and economic growth. Over the past 20 years, Viet Nam's seaport system has made a remarkable development in both quality and quantity, basically meeting the development goals according to the planning of each period, creating a driving force for the development of economic and industrial zones and coastal urban areas, ensuring the clearance of import and export goods and freight transport by sea between regions in the country, meeting the requirements of socio-economic development and economic integration. international security and national defence.

By the end of 2019, the nationwide seaport system had 588 wharves of all kinds with a total length of 96,275m, 4 times higher than in 2000; The total volume of goods throughput reached 664.6 million tons, 8 times higher than in 2000; the average growth of goods through the port in the period 2000 - 2019 is about 10 - 12%/year, the average growth of container cargo is 13.4%/year.

According to the geographical area, Viet Nam's seaport system is classified into groups of seaports in accordance with economic zoning. From 2000 to 2020, the seaport system is divided into 6 groups, including the Northern seaport group from Quang Ninh to Ninh Binh; Group of North Central Seaports from Thanh Hoa to Ha Tinh; Group of Central Central Coast seaports from Quang Binh to Quang Ngai; Group of seaports in the South Central Coast from Binh Dinh to Binh Thuan; The group of seaports in the Southeast region includes Ho Chi Minh City, Dong Nai, Binh Duong and Ba Ria-Vung Tau; Group of seaports in the Mekong Delta.

From 2021 according to the master plan on the seaport system to 2030 approved by the Prime Minister, Viet Nam's seaport system is divided into 5 groups, according to which there is no longer the Central Seaport group, but the ports in this group. included in the North Central Coast group and the South Central Coast group.

According to functions, Viet Nam's seaport system is divided into international gateway ports, national general ports, local general ports and specialized ports. Modern general, container, and specialized wharfs have been formed, especially international gateway ports in Cai Mep - Thi Vai area (Ba Ria - Vung Tau) and Lach Huyen port (Hai Phong).) be competitive enough in seaport operations with other countries in the region, able to attract and receive large container ships, reduce the rate of transshipment abroad, and reduce logistics costs for import and export goods. of Viet Nam. Most of the general and regional ports, including Quang Ninh, Hai Phong, Nghi Son, Ha Tinh, Thua Thien - Hue, Da Nang, Quang Ngai, Quy Nhon, Khanh Hoa, Ba Ria - Vung Tau, City. Ho Chi Minh City, Dong Nai, Long An have been newly invested and renovated, allowing to receive ships of up to 30,000 DWT and larger in line with the development trend of the world fleet. At Hon Gai (Quang Ninh) and Phu Quoc (Kien Giang) have been invested to build specialized passenger ports, when these ports are completed, they will allow to receive international passenger ships with a tonnage of up to 225,000 GT to meet the needs of international tourist passenger transportation by sea. This is an important basis, affirming the capacity of Viet Nam's seaports, creating a premise for shipping lines to use Viet Nameese seaports as a link in the global shipping chain.

Table E2. A summary of current capacity of Viet Nam's seaport system

No.	Parameter	Unit	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Total
1	Number of ports	Harbor	67	20	25	28	102	36	278
2	Number of berths	Wharves	128	55	52	61	211	68	575
a	General, container	Wharves	76	23	27	30	89	39	284
b	Specialized	Berths bridge	52	32	25	31	122	29	291
	Length	m	19,964	9,727	9,531	10,562	37,101	7,048	93,933
3	Port throughput in 2019	Million Tons/year	184.0	75.6	46.8	34.3	301.7	22.3	664.6
4	Proportion of cargo through ports in the system	%	27.7%	11.4%	7.0%	5.2%	45.4%	3.4%	100%

Viet Nam's container port operation is concentrated mainly in two main centers, Ho Chi Minh City - Vung Tau and Hai Phong - Quang Ninh, accounting for 70% and 25% of the total container volume of the country, respectively. The compound growth rate from 2000 to 2019 is more than 15%.

Along with the development of seaports, there are also many related maritime services and logistics such as inland transportation services, logistics services, forwarding services, etc. According to statistics of a number of related projects implemented there are about 1,300 enterprises in the whole country engaged in providing maritime and shipping services, 70% of which are based in Ho Chi Minh City. Many large shipping companies in the world have joined the Viet Nameese shipping market. Most of Viet Nam's shipping businesses operate at level 1 (self-service shipping) and level 2 (providing second-party shipping services).

In general, Viet Nam's transportation service providers operate on a small scale, with a low workforce, of which more than 90% of enterprises have registered capital of less than 10 billion VND, 70% of which have no registered capital assets, only 16% of enterprises invest in equipment and means of transport, 4% of enterprises invest in warehousing, and the rest must outsource (data from the Ministry of Industry and Trade announced at the Logistics Forum in 2018). Domestic enterprises only meet a quarter of the market demand and are stopping at providing services for some initial stages (packaging, warehouse leasing, customs services, etc.) for closed transport service chain. There are only about 30 major shipping service providers (in terms of revenue size and employers), such as: Saigon Newport Corporation, Gemadept, Transimex, Sotrans, U&I Logistics, MP logistics, and Bac Ky Logistics. Some foreign shipping companies are operating effectively and occupying a large market share in Viet Nam such as: DHL, Nippon Express, Yusen Logistics.

(3) Ship building and repair industry

Viet Nam's shipbuilding industry began to receive strong investments in 2002. From the initial capacity of building only 3,000DWT ships, up to now, Viet Nam's shipbuilding industry has built most of the synthetic ships, bulk carriers, oil tankers, car carriers. To build a number of supporting industrial establishments and to support the shipbuilding industry and technology design for several grams of bulk carriers it is necessary to form infrastructure and labor force nationwide. Initially, an important technical and material base of the shipbuilding industry has been formed with a number of active shipyards whose ship products are internationally accepted for quality.

Viet Nam currently has 97 shipyards (from 1,000 DWT or more) belonging to SBIC, Vinalines, PVN, and a number of military enterprises and private enterprises. There are 92 factories in the North, 13 factories in the Central region and 15 factories in the South. The total design capacity of newly built factories is 2.6 million DWT/year, but the actual capacity is only 0.8 million DWT/year (31%) equivalent to 150-200 ships/year. The export capacity has increased from 0.5 to 0.6 million DWT, but has slow delivery and low localization rate. Currently, about 42-46% of Viet Nam's fleet are repaired at foreign shipyards.



Figure E3. New product of Viet Nam's shipbuilding industry

In addition to Viet Nam Shipbuilding Industry Corporation (Vinashin), established in 2006, which is now the Shipbuilding Industry Corporation (SBIC), plays a pivotal role in Viet Nam's shipbuilding industry also has shipbuilding facilities. Owned by Viet Nam National Shipping Lines Corporation, Viet Nam National Oil and Gas Group and a number of other State-owned corporations and corporations has shipbuilding facilities under the management of the Ministry of National Defence, local enterprises public and private, and foreign-invested enterprises.

However, after going through a very hot development period, Viet Nam's shipping industry fell into a spiral of crisis after the breakup of Vinashin. After a long period of crisis, up to now, Viet Nam's shipbuilding industry is showing signs of recovery, but there are still many difficulties and challenges as follows:

- Fierce competition in the world shipbuilding market when shipbuilding demand is declining, prices in all ship segments are relatively low and shipbuilders in general are competing fiercely in all areas such as strategy on types of ships, prices, financial issues, services...
- Construction capacity of Viet Nam's shipbuilding industry currently only reaches 30-40% of design capacity. The development speed of supporting industries is still slow, investment is scattered, and the target of localization rate has not been achieved. In terms of design, the technical design stage currently only meets the requirements for small and popular ships. Viet Nam does not have an international standard model test tank to develop new designs, all technical designs of export ships are still purchased from abroad.

- The restructuring process of Vinashin- SBIC has not given the expected results: In 2013, the Prime Minister approved the project to continue restructuring Vinashin. Accordingly, SBIC was established with the model of a parent company - a corporation, with 8 member units being the core shipyards of the former Vinashin Group. However, because the consequences from the Vinashin era were too great, due to both unfavorable objective factors, in which a number of related mechanisms and policies have not been thoroughly implemented, the restructuring has not achieved the set out target.

(4) Identifying the contribution of maritime sector

Compared to the remaining marine economic sectors (renewable energy, fishing and aquaculture, tourism, oil and gas), the maritime industry has a special element of shipping services and port services. The sea has been considered as an input cost for the production of products of other industries, so the calculation of GDP and GNI values of the maritime industry here should only be understood as a way of estimating Economic Output and Revenue. The industry's income is comparable to that of other industries. In fact, determining the proportion of maritime industry's contribution to the GDP, and national GNI will have to be determined by different methods and formulas.

Based on the calculation principle of this method, the GDP of the shipping industry can be calculated as follows:

$$\text{GDP (Maritime)} = \text{GO (Shipping)} + \text{GO (Port)} + \text{GO (Shipbuilding)}$$

$$= \text{VA(shipping)} + \text{VA (Port)} + \text{VA (Shipbuilding)}$$

+ VA (shipping) is calculated by the total shipping revenue from the freight collected from the total volume of import and export sea freight and inland by year (according to the average international freight rates for different types of goods: container, dry cargo, liquid cargo from Viet Nam to the markets of Europe, America, Asia, Africa and domestic freight) minus total costs.

+ \sum VA (Port) is calculated as the total revenue from seaport operations in Viet Nam including revenue from loading and unloading activities and warehousing at the port for goods transported by sea through the port by year (to be determined by the average freight rate for each container, dry cargo, and liquid cargo to international and domestic markets) minus the total cost.

+ Σ VA (Shipbuilding) is calculated as total revenue from shipbuilding and repairing activities in Viet Nam minus production costs.

Because the collection of aggregated data on production costs of enterprises in the fields of shipping, seaports and shipbuilding over the period 2010 - 2109 is beyond the capacity in the current situation, Σ VA (shipping), Σ VA (Port) and Σ VA (Shipbuilding) are calculated by expert method and determined by the average profit value of enterprises in this field.

- Σ VA(shipping) = 8% of international shipping revenue + 6% of domestic shipping revenue.
- VA (Port) = 17% of port revenue
- Σ VA (Shipbuilding) = 0 because for many years this industry has suffered a loss, not bringing added value.

Calculation results of GDP, GNI of Viet Nam's maritime industry are shown in the table below with comparison with GDP and national GNI.

Table E3. The maritime sector's share of nominal GDP/GNI in national GDP/GNI

Year	Maritime transport GDP	GNI Maritime transport	National GDP	National GNI	Maritime transport percentage in national GDP (%)	Maritime transport percentage in national GNI (%)
2010	20,575	11,857	2,157,830	2,075,087	0.95%	0.57%
2011	22,364	12,481	2,779,880	2,660,076	0.80%	0.47%
2012	24,309	13,138	3,245,420	3,115,227	0.75%	0.42%
2013	26,423	13,829	3,584,260	3,430,668	0.74%	0.40%
2014	28,720	14,557	3,937,860	3,750,823	0.73%	0.39%
2015	31,218	15,323	4,192,860	3,977,609	0.74%	0.39%
2016	33,932	16,130	4,502,730	4,314,321	0.75%	0.37%
2017	36,883	16,979	5,005,980	4,651,399	0.74%	0.37%
2018	40,090	17,872	5,542,330	5,198,567	0.72%	0.34%
2019	43,576	18,813	6,037,350	5,686,985	0.72%	0.33%

Source: maritime team

The above results show:

- The nominal GDP of the maritime industry increased from VND 20,575 billion in 2010 to VND 43,576 billion in 2019. The average increase was about 8.7%/year during the whole period; equivalent to about 0.7-1.0% of Viet Nam's nominal GDP.
- GNI of the maritime industry increased from 11,857 billion VND in 2010 to 18,813 billion VND in 2019. The average growth rate was about 5.3%/year for the whole period; equivalent to about 0.3-0.5% of GNI of Viet Nam.

Table E4. Compare labor productivity of the maritime industry with the country

Unit: million USD

Year	Maritime transport labour (person)	GDP Per capita Maritime transport	GNI Per capita Maritime transport	GDP Per capita national	GNI Per capita national
2010	94,084	218.69	126.02	41.17	39.59
2011	101,166	221.06	123.37	51.93	49.69
2012	108,780	223.46	120.77	59.17	56.80
2013	116,968	225.89	118.23	64.56	61.79
2014	125,772	228.35	115.74	70.54	67.19
2015	135,239	230.83	113.30	74.89	71.05
2016	145,418	233.34	110.92	79.29	75.97
2017	156,364	235.88	108.58	90.29	83.89
2018	168,133	238.44	106.29	97.97	91.89
2019	180,789	241.03	104.06	105.53	99.41

Source: maritime team

Preliminary calculations on direct human resources in the shipping industry in 2019 is about 181,000 people with an average growth of about 7.5%/year in the period 2010 - 2019. Labor productivity of the industry in terms of GDP, GNI compares with the country as follows:

- Labor productivity of the maritime industry calculated by GDP is about 241 million VND/person, about 2.3 times higher than the national average labor productivity.
- Labor productivity of the maritime industry according to GNI is about 104 million VND/person, about 1.05 times higher than the national average labor productivity.

3. Interaction with SDGs

Preliminary assessment of the correlation between maritime economic development and SDGs in Viet Nam is as follows.

Table E5. Maritime Development and SDGs

Goal	Score	Comments
SDG 1	+1	Shipping activities, seaports and shipbuilding industry have certain contributions to job creation and income for coastal areas and islands. For example, many coastal localities have had jobs by participating in seaport operations, operating in the shipbuilding industry and working in shipyards, working as crew members on ships, since then. have income, improve the quality of life, eliminate hunger and reduce poverty.
SDG 2	+1	Maritime contributes a part to the state budget, thus helping the Government with resources to eliminate hunger and reduce poverty in remote and disadvantaged areas.
SDG 3	+1	Shipping activities will help increase local revenue, thereby indirectly contributing to the improvement of health and a good life in the regions. Emissions from shipping are significant, but only one of many sources released into the atmosphere and released into the sea. However, transportation has a limited impact on substance abuse and traffic accidents globally.
SDG 4	+1	Shipping activities will help increase local revenue, which will indirectly contribute to quality education.
SDG 5	-1	Shipping is one of the industries with a much higher proportion of male employees than female employees. The development of maritime transport without proper attention to gender equality will lead to deeper gender stereotypes.
SDG 6		
SDG 7	+2	Shipping also contributes to the development of clean energy in the world such as renewable energy solutions - biofuels, hydrogen, solar and wind power, improved energy efficiency and continued

Goal	Score	Comments
		implementation. emission reduction solutions to achieve zero emissions.
SDG 8	+3	Maritime accounts for over 90% of Viet Nam's import and export goods (over 60% of value), so it plays a vital role in Viet Nam's economic growth thanks to the development of valuable and value-added service industries. high. It is necessary to apply modern, competitive technology, etc. Furthermore, jobs in ports, on ships and other maritime-related jobs offer many opportunities for young people of all skill levels.
SDG 9	+3	Building modern seaport infrastructure and fleets contributes to creating a synchronous transport system, thereby reducing national logistics costs, increasing trade capacity and competitiveness of foreign trade goods, promoting develop sea tourism.
SDG 10	+1	Maritime has a limited direct impact on inequality between countries. Coastal States are responsible for organizing search and rescue operations.
SDG 11	+2	Maritime has a limited direct impact on inequality between countries. Coastal States are responsible for organizing search and rescue operations.
SDG 12	+3	Maritime contributes to improving market access and promoting the export of Viet Nam's key export products in a sustainable way (reducing logistics costs); Contributing to strengthening the distribution system and developing the national product supply chain.
SDG 13	-2	World shipping annually emits about 940 million tons of CO2 and accounts for about 2.5% of total global greenhouse gas (GHG) emissions. Switching ship-utilized energy from fossil fuels to low-carbon alternatives, including renewables in the future, will contribute to reducing greenhouse gas emissions.
SDG 14	-2	Maritime activities may pose some risks to the marine environment such as large number of vehicles or oil and chemical spills, maritime accidents. The shipping industry contributes 20% of marine pollution.

Goal	Score	Comments
		Transport is the single largest contributor to the transfer of alien species. Emissions into the atmosphere contribute to the acidification and eutrophication of the oceans. Maritime operations have been minimized discharge of ballast water, chemicals, waste, oil and wastewater, reduced emissions into the atmosphere during operations as well as introduced anti-biological pollution regulations to prevent the transfer of alien species, minimizing disturbance to marine life, by minimizing acoustic noise and by identifying appropriate operational measures in the most environmentally sensitive areas.
SDG 15	-1	Maritime operations have released ballast water. Exotic species introduced by ships can affect terrestrial ecosystems.
SDG 16	+1	Maritime operations are the primary transport of goods, which may include illegal goods. It works around the world to reduce opportunities for corruption, bribery and illicit flows by enhancing transparency about goods, destinations, financial transactions and the use of agents. agent and mediator.
SDG 17	+3	<p>Maritime is one of the important topics in bilateral and multilateral negotiations within the framework of international trade organizations.</p> <p>Maritime contributes to improving the value and competitiveness of Viet Nam's foreign trade goods.</p> <p>Maritime and seaports are very suitable to promote public-private partnerships, especially in the field of investment, construction and operation of seaports. Shipping can make an important contribution to the partnership, and there is a dedicated international organization (IMO) to develop international policies and regulations.</p>

Appendix F. Environment, Biodiversity & Ecosystem Services



Figure F1. Con Dao flooded area⁸⁶

This section examines mainly from the perspective of considering the marine environment and marine ecosystems as the foundation, the basic space on which the marine economic sectors operate. The development of marine economic sectors from time immemorial considered marine resources as the object of exploitation. Due to the small scale of exploitation and the undeveloped tools and techniques of exploitation, the degree of damage to the marine environment and marine ecosystems is almost negligible. Today, as the scale of exploitation of marine resources increases, leading to increased competition, while in addition to increasingly modern technology and mining tools, destructive fishing tools also increase, leading to the increased risk of encroachment on the marine environment and marine ecosystems. Thus, protecting the marine environment and marine ecosystems is very urgent, both on a global scale as well as on a national and local scale. The protection of the marine environment and marine ecosystems today itself has become an integrated, multi-sectoral and growing economic sector. However, this report only analyzes some activities related to the protection of the marine environment and marine ecosystems as a basis for the development of other economic sectors.

1. Resources

⁸⁶ Source: <https://kinhtemoitruong.vn/dat-ngap-nuoc-chong-bien-doi-khi-hau-tam-la-chan-bao-ve-bo-bien-19807.html>

Viet Nam's sea area is located in the East Sea area with geographical coordinates at latitude: from 30 to 260 north latitude; longitude: from 1000 to 1210 East longitude; is one of the largest seas in the world with 90% of its circumference surrounded by land. There are 9 countries bordering the East Sea: Viet Nam, China, the Philippines, Indonesia, Brunei, Malaysia, Singapore, Thailand, and Cambodia and one territory is Taiwan (belonging to China). The East Sea is not only an important strategic area for countries in the region but also for the entire Asia-Pacific region and the Americas. The East Sea is also home to important marine natural resources for the life and economic development of surrounding countries, especially biological, mineral and tourism resources. The region is under great pressure for environmental protection, conservation and development of marine ecosystems. In the East Sea, the territorial sea directly related to Viet Nam's territory has two large bays: the Gulf of Tonkin in the northwest of the country, about 130,000 square kilometers and the Gulf of Thailand in the southwest, with an area of about 293,000 square kilometers. The East Sea is the only sea in the world that connects two oceans - the Indian Ocean and the Pacific Ocean. The sea of Viet Nam is strongly influenced by the prevailing monsoon regime in the Northeast and Southeast directions. Therefore, the Viet Nameese sea bears many risks of natural disasters and marine environmental incidents of the East Sea, especially from oil spills and waste oils of unknown origin brought into the coast of Viet Nam.

The quality of Viet Nam's marine environment is relatively good. According to the report of the Ministry of Natural Resource and Environment (MONRE), as of August & September 2020, out of more than 70 coastal monitoring points in 16 coastal provinces, only 2% of points exceed QCVN 10-MT:2015/BTNMT for parameters N-NH₄⁺ and 11% exceeded QCVN 10-MT:2015/BTNMT for parameters of total mineral oil and grease⁸⁷. However, Viet Nam is still facing a deterioration in the quality of the marine environment due to various reasons such as pressure from population growth, inefficient use of marine resources, marine activities, etc. uncontrollable marine economy, and limited management capacity.

Viet Nam's sea is evaluated as having rich biological systems and diverse ecological landscapes, ranked 16th in the world in terms of diversity of biological resources. Major marine species and groups such as fish, crustaceans, molluscs, seaweeds, etc. are superior to or equivalent to neighboring seas. To date, more than 11,000 marine species have been

⁸⁷ Official Dispatch No. 3987/TCMT-VPTC dated December 10, 2020 on the implementation of sustainable development goals under Decision 3756/QĐ-BTNMT

identified⁸⁸ in more than 20 typical ecosystem types, belonging to 5 different marine biodiversity regions, distributed over 1 million square kilometers in the East Sea⁸⁹. (MONRE, 2016).

Biodiversity of marine and island ecosystems is the foundation for the sustainable development of a number of marine economic sectors based on natural conditions and marine natural resources such as tourism, fisheries, and marine medicine. This is also the basis for UNESCO to recognize Viet Nam as having many world cultural and natural heritages such as Ha Long Bay, 06 world biosphere reserves⁹⁰, 04 wetland conservation areas⁹¹; established 07 national parks⁹² and 16 marine protected areas⁹³. Preliminary surveys over the past time have shown that in Viet Nam's seas, there are about 35 types of minerals with exploitation reserves ranging from small to large, belonging to the following groups: fuel (notably oil and gas with reserves of approx. 3-4 billion tons of oil equivalent), metals, building materials, precious and semi-precious stones, liquid minerals. Along the coast have discovered placer, heavy minerals of rare and precious elements such as titanium, immelite, and zircon.

Viet Nam's sea has about 20 ecosystems, including marine ecosystems, aquatic ecosystems around coastal islands, offshore islands, especially water areas, and deep seabed areas (the sea around Hoang Sa and Hoang Sa archipelagos and islands in the East Sea and South Viet Nam). Truong Sa). The coastal area, where hundreds of estuaries, lagoons, bays, islands and archipelagos are concentrated to create a system of complex and diverse habitats with many types of ecosystems: tidal flats and swamps, mangroves, estuaries, lagoons, coves, coral reefs, deltas, sandbanks, tidal mud flats, upwellings, brackish aquaculture lagoons. Mangrove forests, coral reefs, carpets Seagrasses and lagoons are considered the most important and typical

⁸⁸ According to the 2016 National Environmental Status Report, out of the 11,000 species of organisms that inhabit our waters, there are 6,000 benthic species; 2,000 fish species (with 130 fish species of economic value); 653 species of seaweed; 657 alluvial animal species; 537 species of phytoplankton; 225 species of marine shrimp...

⁸⁹ Tidal beaches, estuary mangroves, lagoons, lagoons, bays, conifers, ponds, coral reefs, seagrass beds...

⁹⁰ World biosphere reserves in coastal and island areas: Can Gio Mangrove Forest, Cat Ba Archipelago, Red River Delta, Kien Giang Coast and Sea Islands, Cu Lao Cham, Ca Mau Cape.

⁹¹ Wetland Reserves (Ramsar) coastal and island areas: Xuan Thuy, Ca Mau Cape, Con Dao, U Minh Thuong.

⁹² Coastal and island national parks: Cat Ba, Con Dao, Bai Tu Long, Phu Quoc, Xuan Thuy, Nui Chua, Ca Mau Cape.

⁹³ Marine protected areas: Tran Island, Co To, Bach Long Vi, Cat Ba, Hon Me, Con Co, Hai Van - Son Cha, Cu Lao Cham, Ly Son, Nam Yet, Nha Trang Bay, Nui Chua, Phu Quy, Hon Cau, Con Dao, Phu Quoc.

ecosystems because they have high biodiversity and highest conservation value (Figure 1). Coastal landscapes and coastal islands have a unique ecosystem. Natural ecosystems with high biodiversity are also the foundation for economic activities such as tourism, aquaculture, etc. In addition, marine ecosystems also contain important functions such as absorption and storage. carbon capture (seagrass, mangroves), climate regulation and disaster prevention.

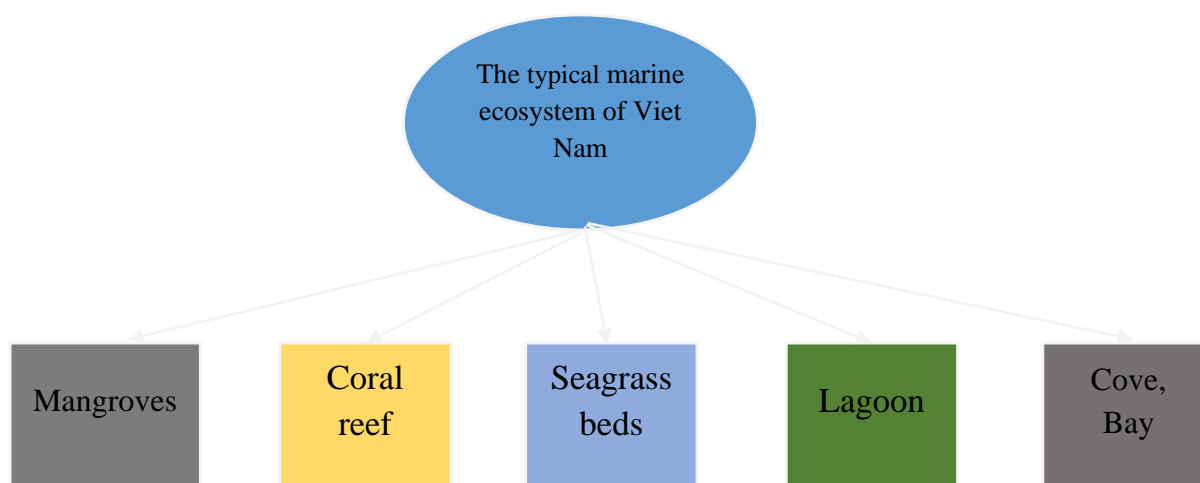


Figure F2. The typical marine ecosystem of Viet Nam

(1) Mangrove Ecosystems

Mangroves are mainly distributed and thrive in the South, accounting for 70% of the total area of the country (Ca Mau alone accounts for 50%); about 28% distributed in the Gulf of Tonkin. Changes in the area of mangroves in Viet Nam follow two trends, including: decrease in primary forest area and increase in new planted forest area.⁹⁴ (Figure 3). Up to now, the primary mangrove forests are almost gone⁹⁵. This leads to a

⁹⁴ According to a report of the Ministry of Agriculture and Rural Development (2016), as of November 30, 2015, new forests have been planted: 1,968 hectares (mangroves 1,103 hectares; wind- and sand-proof forests 301 hectares, production forests combined with protection forests). : 564 ha); zoning, promoting forest regeneration and restoration: 1,105 ha (763 ha of mangrove forest, 343 ha of wind and sand barrier forest); contracted forest protection: 12,681 ha (special-use protection forest: 12,326 ha; production forest: 355 ha). In Decision No. 120/QĐ-TTg dated January 22, 2015, the Prime Minister approved the Project on Protection and Development of Coastal Forests to Respond to Climate Change for the period 2015-2020. It is because of the conservation and afforestation projects in the coastal area that the forest area on the wetland is Melaleuca forest and mainly coastal mangroves increased markedly from 2016 to 2019.

⁹⁵ Between 1943 and 2005, at least 220,000 hectares of mangroves disappeared partly due to war and on the other hand due to deforestation and aquaculture development. Primary mangrove forests have almost disappeared in many coastal provinces (MONRE, 2019). According to the National State of the Environment Report for the period 2011-2015, statistics show that up to 56% of Vietnam's total mangrove area is considered "planted mangroves" with a very low number of species. Currently, mangrove forests are mainly planted forests, with poor quality in terms of size, tree height and species diversity.

decline in marine biodiversity, especially loss of spawning grounds and habitats for aquatic species, and destruction of nearby ecosystems such as chives and seagrasses.

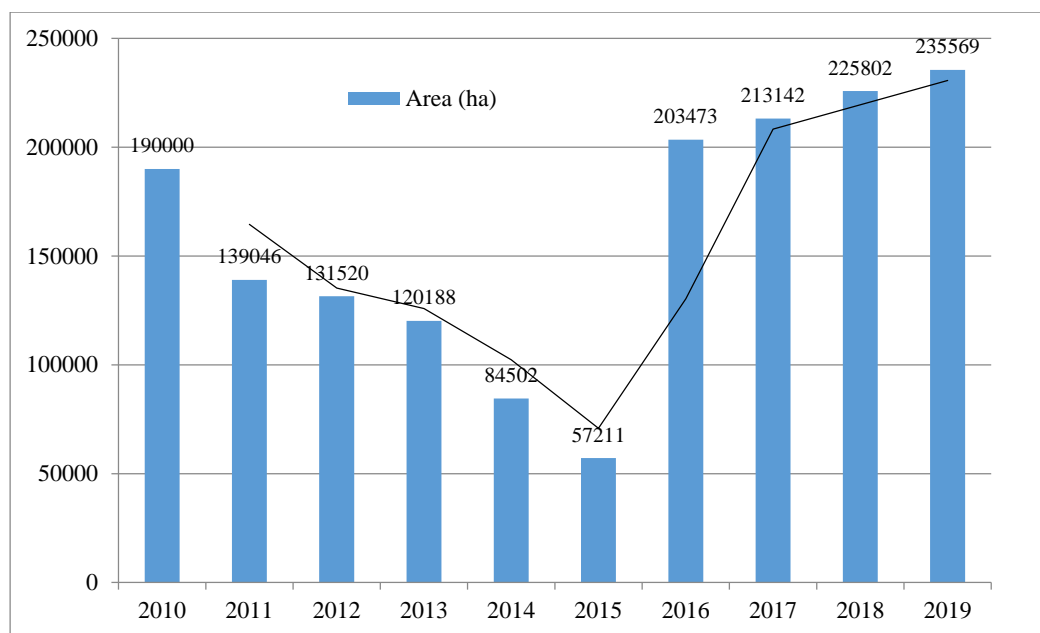


Figure F3. Area of mangrove forest in the period 2010-2019

Source: Ministry of Agricultural and Rural Development, 2019

(2) Coral reef ecosystem

In the waters of Viet Nam, four main coral reef distribution zones can be distinguished: the coral reefs of the Paracel Islands and the Spratly islands; coral reefs of the Gulf of Tonkin islands; coral areas in the central coast; and coral reefs of the East and South West Seas. In which, the majority of corals are concentrated in the waters of the Truong Sa and Hoang Sa archipelagos and the central coastal region (Vo Si Tuan and Nguyen Huy Yet, 2003), with more than 200 sites. These are areas with rich potential in biodiversity conservation, natural seafood seed sources, marine life resources and ecotourism development. In the coral reef ecosystems of Viet Nam, more than 1,780 species have been recorded and discovered, in which, fish is the group with the highest biodiversity; molluscs have more than 400 species.

Table F1. Distribution of reef-forming coral species in some seas of Viet Nam

No.	Waters	Number of species
1	West Gulf of Tonkin	176 species
2	Central region	252 species
3	Hoang Sa	201 species
4	Southern	406 species
5	Truong Sa	333 species
6	Southwest Bo	251 species

Source: Vo Si Tuan, 2014

Table F2. Distribution and area of corals in the coastal waters of Viet Nam

Area	Location	Estimated reef area(ha)	Area of coral reefs in marine protected areas(ha)	Number of hard coral species
Gulf of Tonkin	Đảo Trần*	unknown	unknown	48
	Cô Tô*	370	370	121
	Hạ Long-Cát Bà*	500	500	171
	Bái Tử Long	unknown	unknown	115
	Bạch Long Vĩ*	1.578	1.578	93
	Hòn Mê*	unknown	unknown	72
	Cồn Cỏ*	274	274	166
Central Coast	Hải Vân-Sơn Chà*	unknown	unknown	102
	Đà Nẵng	105	unknown	226
	Cù Lao Chàm*	311	311	227
	Lý Sơn*	1.704	1.704	79
	Phú Yên	303	unknown	139
	Vân Phong	1,618	unknown	292

	Nha Trang*	731	183	350
	Ninh Hải (Núi Chúa*)	2.330	1.070	310
	Hòn Cau*	506	506	184
	Phú Quý*	1.488	1.488	239
Coastal East, Southwest	Côn Đảo*	903	903	307
	Nam Du	80	unknown	126
	Phú Quốc*	474	292	251
	Thổ Chu	80	unknown	198
Tổng		13.355	9.179	403

(*: marine protected area under the planning - Decision 742/2010/QĐ-TTg)

Source: Vo Si Tuan (2014)

Studies on biodiversity in coral reefs in Viet Nam show that coral reefs have a very diverse and rich biome in species composition. It can be said that reef habitats have the largest number of species compared to other marine habitats, with representatives of almost all phyla and classes of animals mainly living in seas and oceans. Studies show that the fauna living in coral reefs in the sea of Viet Nam has about 2,100 species, of which coral reef fish are the most diverse with 763 species, followed by molluscs with nearly 700 species, crustaceans - more than 250 species, polychaetes - about 170 species and echinoderms - nearly 100 species [MONRE, 2020]

Coral reefs in the sea of Viet Nam are decreasing in area and coverage of live coral. Coverage of living corals on reefs in coastal areas is decreasing over time, in some places up to over 30% in the past 10 years. Only about 1% of the coral reefs have high coverage (coverage > 75%), while the number of coral reefs with low coverage accounts for over 31% (coverage < 25%), the number of coral reefs with medium and relatively low coverage are at 41% and 26% respectively (Institute of Oceanography, 2008).

Table F3. Quality of coral reefs in Viet Nam

Type	Live coral coverage	Percentage of area
Very good	>75% live coral	1
Good	50-75% live coral	26

Relatively good	25-50% live coral	41
Bad	<25% live coral	31

Source: World Resources Institute, 2008

(3) Seagrass

Seagrass ecosystems are concentrated mainly in coastal sea areas with a depth of 0-20m in some coastal water areas, tidal lagoons at small estuaries and along Viet Nameese islands, concentrated around Phu Quoc island. and some estuaries and lagoons in the central region such as Tam Giang - Cau Hai lagoon, tidal lagoon, etc. According to the National State of the Environment Report for the 2016-2020 period, the area of seagrass beds in our country that has been identified and discovered so far is estimated at 15,000 ha, of which 14 species of seagrasses and 14 species of seagrass have been identified. 1743 species of creatures living in seagrass beds (Ministry of Natural Resources and Environment, 2020). Seagrass ecosystems are in danger of being degraded⁹⁶. The area of seagrass beds has been reduced due to human activities such as fishing, boat mooring, aquaculture causing environmental pollution, port construction activities, and tourist facilities (MONRE, 2019).

(4) The lagoons

In Viet Nam, the lagoons are concentrated in the central region, where there is a rich source of coastal sand deposits, strong wave dynamics and low tides. From Thua Thien - Hue to Ninh Thuan, there are 12 typical lagoons with a total area of about 458 km², distributed over about 21% of the coastline of Viet Nam⁹⁷ [Trần Đức Thanh et al., 2009]. All 12 lagoon ecosystems have been degraded at different levels in terms of structure, function, and distribution area. In which, the ecosystem of Nai lagoon is severely degraded, and Thi Nai lagoon and TG-CH are moderately degraded. In particular, the intertidal ecosystems, seagrass beds, mangroves and economic and rare species that are important ecological components in the lagoons and lakes have been rapidly degraded in terms of both quality (coverage, biomass) and size of distribution area (MONRE, 2020).

⁹⁶ Cao Van Luong et al. (2012) have shown that the area of seagrass beds has decreased by 50% compared to 1999, the seagrass beds in Tam Giang - Cau Hai lagoons have decreased by 60% compared to the previous year. 1999; According to Nguyen Thi Thien Huong et al. (2017), in the past two decades, the area of seagrass has decreased by 45.4% and the average annual rate of decrease in the whole country is 4.4%.

⁹⁷ Vung Vinh along the coast of Vietnam and its use potential, 2009

Table F4. List of lagoons in Viet Nam

No	Lagoon's name	Area (km ²)	Depth (m)	Province	River-sea interaction
1	Tam Giang-Cầu Hai	216	Average: 1.6 Deepest: 6-7 (cửa lạch)	Thừa Thiên-Huế	It is a shallow water body with more than 10 rivers pouring fresh water into the lagoon. Outflows to the sea through the gates of Thuan An and Tu Hien.
2	Lăng Cô	16	Average: 1.2 Deepest: 2.0	Thừa Thiên-Huế	Due to the great influence of the sea, the salinity is often high.
3	Trường Giang	36.9	Average: 1.1 Deepest: 2.0	Quảng Nam	-
4	An Khê	2.9	Average: 1.3 Deepest: 2.0	Quảng Ngãi	-
5	Nước mặn (Sa Huỳnh)	2.8	Average: 1.0 Deepest: 1.6	Quảng Ngãi	-
6	Trà ố (Châu Trúc)	16	Average: 1.6 Deepest: 2.2	Bình Định	Receives fresh water from watershed streams. Water from the lagoon to the sea through the Chau Truc River is about 5 km long. The lagoon gate is not opened often, encroached by sand in the dry season. Freshening water.
7	Nước ngọt (Đề Gi)	26.5	Average: 0.9 Deepest: 1.4	Bình Định	-
8	Thị Nại	50	Average: 1.2 Deepest: 2.5	Bình Định	Receives fresh water from many rivers pouring in, the largest is the Con River. Water mass and salinity

					depend on river water flow and tidal current.
9	Cù Mông	30.2	Average: 1.6 Deepest: 3.5	Phú Yên	The lagoon is relatively deep, only connected to the sea by a narrow gate, influenced by the sea.
10	Ô Loan	18	Average: 1.2 Deepest: 2.5	Phú Yên	The lagoon has many properties of a saltwater lagoon.
11	Thuỷ Triều	25.5	-	Khánh Hoà	The lagoon has many properties of a saltwater lagoon.
12	Đầm Nại	8	Average: 2.8 Deepest: 9m (in creek of lagoon middle)	Ninh Thuận	A deep lagoon, more dominated by the sea, belongs to the salt water body type.

Source: Trần Đức Thanh et al., 2012

(5) Coves and bays

Viet Nam's sea has a total of 48 coves and bays with an area between 2 and 560 km² and a total area of about 3997.5km², 9 times the total area of the coastal lagoon system in Central Viet Nam. Of which, there are 13 large coastal coves (accounting for 27%), typically Bai Tu Long Bay (area, 3055.4 km² - accounting for 76.4% of the total area of the bay - bay), there are 6 pools - bays of medium type, 17 coves - small bays and 12 coves - very small bays (Tran Duc Thanh et al., 2009).

Table F5. Groups of bays - bays along the coast of Viet Nam divided by area

Area	Very small	Small	Average	Large	Total
Number	12	17	6	13	48
Proportion (%)	25	35.4	12.5	27.1	100
Area (km ²)	65.8	462.3	414	3055.4	3997.5
Proportion (%)	1.65	11.56	10.36	76.43	100

Source: Tran Duc Thanh et al., 2009

shore to far from shore is about 135 to 155 km (Bach Long Vi, Hon Hai) and has an area from a few hundred square meters to over 500 square kilometres. The number of islands distributed by sea areas is shown in Table 6.

Table F6. Distribution of coastal islands by sea areas

No	Waters	Number of islands	Ratio (%)	Area (km ²)	Ratio (%)
1	Northern coast	2321	83,7	841,1571	48.88
2	North Central Coast	57	2.06	14.29	0.83
3	South Central Coast	200	7,21	172	9.99
4	Central Coast	257	9,27	186.25	10.82
5	South Coast	195	7,01	693.47	40.3
6	Gulf of Thailand	165	5,96	613.13	35.64
7	Total	2773	99,98	1720.88	100

Source: Le Duc An, 1996

(ii) Offshore island

Two offshore archipelagos including Hoang Sa and Truong Sa are located in the northern centre and southern central part of the East Sea - it is the largest marginal sea of the Pacific Ocean, semi-enclosed by the Asian mainland and the coast of the Malacca peninsula to the west; the island of Taiwan, the Philippine archipelago and the island of Borneo to the east and southeast. These two places have high biodiversity values and many important ecosystems, especially coral reef ecosystems.

2. Assessment of the current state of the environment and biodiversity in the process of economic development in Viet Nam

(1) Current status of the environment and biodiversity

a) Sources of pollution

First, waste from the mainland:

Most of the pollutants are discharged from land into rivers and into the sea by rivers, including wastewater and garbage from factories, factories, industrial parks, economic zones, urban areas, and coastal residential areas. Noticeably, domestic wastewater

from urban areas, coastal tourist areas, aquaculture wastewater and industrial wastewater from coastal industrial zones are discharged directly into the sea or through underground sewers without being handled or handled not up to the specified standards. In the total amount of wastewater generated in the basins, domestic wastewater and industrial wastewater still account for the largest proportion. Currently, only 13% of urban domestic wastewater is collected and treated to meet prescribed standards, 89.28% of industrial parks, and 16.5% of industrial clusters have centralized wastewater treatment systems (in 2019) (ISPONRE, 2020)⁹⁸.

Besides the above wastewater sources, a large amount of solid waste is not controlled, and dumped indiscriminately, not only polluting canals and rivers but also obstructing the flow in some places. The rate of solid waste collection and treatment in urban areas is ~86.5%, and in rural areas this rate is only ~63.5% (in 2019). Thus, there is still a fairly large amount of solid waste that has not been collected and treated according to regulations and hence, a large part is discharged directly into ponds, lakes, canals, flows into the sea or discharges directly into the sea. An estimated 70% to 80% of marine litter originates inland (MONRE, 2016)⁹⁹. Currently of great concern, plastic waste, which usually accounts for about 50-80% of marine litter (ISPONRE, 2016)¹⁰⁰.

Plastic waste is a major threat to the environment and marine biodiversity. Many types of marine life mistake plastic for food (such as fish mistaking plastic beads for plankton, birds mistaking plastic fragments for squid or other prey, and sea turtles confusing plastic bags for jellyfish) and ingest plastic. This causes gastric emptying leads to possible starvation or possibly severe intestinal obstruction and organ damage. Various types of fishing nets and plastic ropes floating in the sea can catch and kill many sea creatures such as shrimp, fish, turtles, marine mammals, even dolphins, whales, and sea birds. Plastic fragments also absorb pollutants, especially persistent non-degradable organic pollutants (POPs), bio accumulative compounds and other toxic compounds (PBTs) and thus affect living organisms. According to the latest statistics of the Ministry of Natural Resources and Environment, each year, on average, Viet Nam discharges into the sea from 0.28 to 0.73 million tons of plastic waste (accounting for about 6% of the world's plastic waste), ranking fourth in the world. Marine litter pollution not only affects the quality of the environment, but also destroys habitats, degrades biodiversity, destroys the living environment of

⁹⁸ Institute of Strategy and Policy on Natural Resources and Environment, 2020. Report on Evaluation of implementation results of the National Environmental Protection Strategy to 2020

⁹⁹ Ministry of Natural Resources and Environment, 2016. Report on the status of the National Environment in 2016 - Urban Environment

¹⁰⁰ Institute of Strategy and Policy on Natural Resources and Environment, 2016. Research on theoretical basis, international experience on plastic waste control at sea.

ecosystems, and affects economic and community development of coastal populations.

Along with economic growth, more and more waste sources are generated: waste sources from industrial parks, domestic wastewater, and waste sources from marine activities such as fishing, oil and gas exploitation, and marine transportation. Currently, from 70% to 80% of marine waste originates inland when factories, factories, industrial parks, and residential areas discharge untreated wastewater and solid waste into rivers, coastal plains or discharged directly into the sea [VASI, 2018]¹⁰¹. Viet Nam has 112 estuaries, this is the source for garbage drifting into the ocean and many creatures mistake garbage for food or get stuck in fishing gear, so they die, resulting in habitat destruction.

The discharge of waste into the sea by economic zones, industrial parks, factories, and business establishments is taking place every day with increasing discharge volume and is complicated and difficult to control, especially in activities. discharge activities of coastal and marine aquaculture households. In many economic zones, concentrated industrial parks, and factories, monitoring and supervision are not regular and continuous, along with inadequate and outdated monitoring and supervision equipment, so violations have occurred. Hence environmental legislation is needed to monitor discharge untreated waste into the sea and pollution of the marine environment. According to reports of 28 provinces and centrally-run cities with the sea, there are currently 647 units and enterprises that have activities of discharging waste directly into the sea with a flow of 88,667,902 m³/day and night, of which 154/647 units and enterprises, accounting for 23.8%, have a discharge volume of 1,000m³/day into the sea; Some localities reported late, incomplete reports on the status of waste treatment systems, wastewater and environmental monitoring activities for 357 units and enterprises at the request of the General Department of Seas and Islands of Viet Nam.

Second, marine waste:

Besides waste sources from land, wastewater, solid waste, waste oil, chemicals of ships operating at sea (such as cargo ships, cruise ships, etc.) as well as oil and chemical spills. The toxic effects of mining rigs and oil tankers are all serious sources of marine environmental pollution, greatly negatively affecting the environment and marine ecosystems. The risk of oil spills tends to increase in recent years, on average, each year in Viet Nam's waters, there are 3-4 oil spills occurring at sea. According to

¹⁰¹ Marine Biodiversity Report, 2018

statistics, Viet Nam is one of the three countries (along with the US and China) with the highest number of oil spills in the 39 countries listed. Oil spills at sea have caused serious economic damage, polluted the marine environment, seriously affected the ecosystems of mangroves, lagoons and coral reefs due to toxins and causes ecosystem destruction. Oil pollution and oil spills even at an oil concentration of 0.1mg/l in water can be lethal to plankton species and greatly affect the juveniles and larvae of seafloor organisms (MONRE, 2015)¹⁰²

(2) Current status of marine environment

Due to the influence from the estuary area and the waste reception of coastal economic development activities, some sea areas have high TSS content. In addition, the increase in organic matter and grease content is also a concern for the quality of coastal seawater in Viet Nam in recent years.

The problem of pollution by organic matter in coastal seawater has been quite common in coastal provinces of Viet Nam. Concentrations of monitoring parameters such as COD, NH₄⁺ in the period 2011 - 2015 in most areas were at a high level exceeding the QCVN threshold (for aquaculture and beach purposes), especially in the coastal area to the east. Tho Quang boat dock (Da Nang) is one of the hot spots for seawater pollution. The level of organic pollution in the northern coastal area is higher than that in the central and southern regions but tends to decrease gradually in the period 2011-2015.

The content of mineral oil and grease in seawater tends to increase in port areas, which is a common problem. Some seaport areas have mineral oil and grease content exceeding the QCVN threshold. The main reason is due to the operation of ships that leak fuel and grease.

(3) Current status of marine biodiversity decline

Despite being considered a country with high biodiversity in the world, Viet Nam is facing increasing biodiversity loss. The inevitable consequence will be to reduce/lose the functions of the ecosystem such as regulating water, preventing erosion, destroying waste, cleaning the environment, ensuring the circulation of matter and energy in nature, and preventing disaster reduction/climate extremes, consequently the economic system will be degraded due to the loss of values of natural resources and environment (natural capital).

¹⁰² Ministry of Natural Resources and Environment (MONRE), 2016. National Environmental Status Report 2011-2015.

Currently, wetlands are being strongly impacted by human economic development activities and the effects of climate change. The area of wetlands tends to shrink due to increasing pressure on the exploitation and use of wetlands and natural resources on wetlands. The area of natural mangroves has decreased by over 85%, compared to the time before 1945 (Figure 3), while the artificial wetlands have increased (hydroelectricity, irrigation). Coastal wetlands are encroached by ponds for aquaculture, salt production, construction works, and development of urban areas; rivers are changed due to the system of dams and hydroelectricity. Natural resources, including living and non-living things in wetlands, are exploited beyond the allowable limit, even destructively,... Natural aquatic resources in the area such as water bodies in the northern and central provinces are almost exhausted; In the East and Southwest regions, reserves are reduced by 50% compared to the time before 1945. 12 Central coastal lagoons, unique wetlands not only for Viet Nam but also Southeast Asia have been exploited and are being exploited. The waterfall exceeds the allowable limit, including Tam Giang - Cau Hai Lagoon in Thua Thien Hue province. Many wetland areas are located in the lagoon system, even being "killed", levelled for urban development, roads, wharfs, etc...(VEA, 2016)¹⁰³. According to the 2012 Red Book of the World Union for Conservation of Nature (www.iucnredlist.org), Viet Nam has at least 135 globally threatened species residing in continental freshwater, intertidal and coastal habitats at the seaside. This figure is forecasted to increase if there is no effective management solution (Tong Minh, 2020).

First, for mangroves:

Old-growth mangrove forests in Viet Nam have declined greatly in recent years in area, data on mangrove area from 1943 to 2015 show that the area of mangroves in Viet Nam has decreased from 408,500 to 57,211 ha.

¹⁰³ Vietnam Environment Administration, 2016, Project Report on Conservation of Important Wetlands and Associated Habitats

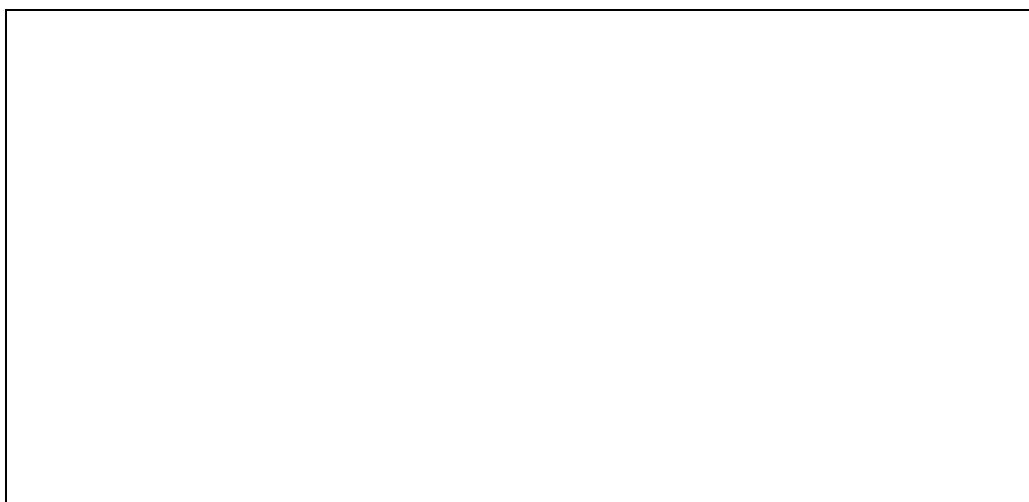


Figure F7. The decline of mangrove areas in Viet Nam over 50 years

Source: Forest census data of the General Department of Forestry, 2015

The current mangrove forest area is mainly planted forest, pure type, poor quality in terms of size, tree height and species diversity. The primary mangrove forests are almost gone. The severe reduction of mangrove area has led to a decrease in marine biodiversity, especially loss of spawning grounds and habitats of aquatic species. The destruction of mangroves has also caused the destruction of neighboring ecosystems such as chives and seagrasses¹⁰⁴.

Second, for coral reef ecosystems:

In recent years, coral reefs are being destroyed and have a strong tendency to degrade, mainly in populated areas such as Ha Long Bay, central coastal provinces and some islands. Some people live in the Truong Sa archipelago and area also affected. According to a report from the Program on Protection and Development of Aquatic Resources in Quang Ninh to 2020, with a vision to 2030, the coral reef ecosystem in Co To sea has lost 90% of its coverage and extent. Many reefs are 100% dead, becoming the area with the largest and fastest degradation rate and extent recorded in the coastal area of Viet Nam (Pham Hoach, 2020). Survey results in recent years in 7 key reef areas of Viet Nam show that only 2.9% of the coral reef area is assessed to be in very good development condition, 11.6% in good condition, 44.9% in bad and very bad condition. The coverage of coral reefs is decreasing, leading to a decrease in species diversity of some fish families closely associated with coral reefs such as Butterflyfish family Chaetodontidae, Angelfish Pomacanthidae, and Spinach Acanthuridae in Nha Trang Bay and Van Phong. On the other hand, some harmful

¹⁰⁴ Ministry of Natural Resources and Environment (MONRE), 2016. National Environmental Status Report 2011-2015

organisms are tending to develop, typically an explosion in the number of prickly starfish *Acanthaster planci* (>0.15 children/100m²) - a predator that eats corals, reducing the level of coral. hard coral cover, causing fish degradation on the reef¹⁰⁵. Area reduction and damage of many coral reefs reduce biodiversity, ecology and marine environmental quality; loss of livelihoods of coastal communities and damage to tourism and fisheries.

The cause of the decline in coral reef area is that the fishermen have been overfishing using destructive forms such as explosives for a long time. Meanwhile, coral reefs are the shelter, hiding, breeding and development of many marine species that develop along the natural food chain. Currently, despite the successful planting, restoration and reproduction of corals in the wild, the restored area is still very low.

Third, for the seagrass ecosystem

Seagrass ecosystems are in danger of being damaged and degraded. The degradation of seagrass beds is reflected in aspects such as species loss, narrowing of distribution area, pollution, habitat degradation, biodiversity loss and economic benefits of associated rare and precious species. According to the general statistics of the whole country, the area of seagrass beds in Viet Nam has been reduced by 40-60% (VASI, 2017)¹⁰⁶. Seagrass cover in some areas is only half what it was 5 years ago (VASI, 2017)¹⁰⁷. The degradation of species diversity is also taking place in the seagrass bed ecosystem.

The coastal islands of the North Central Coast are being severely degraded with an average rate of 6 - 7%/year (grades II - III) such as Ly Son, Nha Trang Bay. The grass beds along the South Central Coast decline more slowly with an average annual rate of about 3-5%/year (grades I - II) such as Hon Cau and Phu Quy. The rate of decline of grass beds in the South is lower than in the Central region with an average of about 3%/year such as Phu Quoc and Con Dao¹⁰⁸.

According to a report by the United Nations, as of July 2020, Viet Nam's population reached more than 97 million people, ranking 15th in the world, an increase of more

¹⁰⁵ Vietnam General Administration of Seas and Islands, 2017, Report on collection, information and documents for the development of project outline

¹⁰⁶ Vietnam General Administration of Seas and Islands, 2017, Report on collection, information and documents for the development of project outline

¹⁰⁷ Vietnam General Administration of Seas and Islands, 2017, Report on collection, information and documents for the development of project outline

¹⁰⁸ Vietnam General Administration of Seas and Islands, Draft Report on Status of Marine Biodiversity in 2018

than 10 million people compared to 2010 (86.9 million people). Rapid population growth increases pressure on the natural and social environment. The load capacity of the natural environment is limited, when the population increases rapidly and untreated waste is discharged into the environment, it will exceed the self-cleaning capacity of the natural environment, causing pollution every day.

Table F7. Degree of seagrass degradation in some studied islands

No	Distribution area	Area (ha)	Distribution status	Depression level	Recovery Capacity
1	Phu Quoc	10.000	Areas of Bai Bon, Rach Vem, Bai Vong, Bai Thom - Xa Luc	Level I-II	Can be restored if stop impact
2	Con Dao	500	Areas of Con Son Bay, Dam Tre, Ben Dam, Bai Dat Doc, Bai Ong Dung, Hon Cau, Hon Tre Lon, Hon Bay Canh	Level I-II	Can be restored if stop impact
3	wealth	31	Northwest of Hon Tranh, West, Southwest and Northeast of the island	Level I-II	Can be restored if stop impact
4	Hon Cau*	3	Southwest and North Island area	Level I-II	Can be restored if stop impact
5	Nha Trang bay	78	Areas of Dam Tre Bay, Dam Gia, Vung Me, Hon Chong and Lo River estuary	Level II-III	Can recover naturally but slowly
6	Nam Yet	8	North and South of the island	Level I-II	Can be restored if stop impact
7	Ly Son	45	The area to the southwest, southeast of the island, in the coves around the island	Level II-III	Can recover naturally but slowly
8	Cu Lao Cham	50	Areas of Bai Bac, Bai Ong, Bai Chong, Bai Bim, Bai Huong and a very small number at Bai Nam	Level I	Can be restored if stop impact

Ghi chú: () Additional census data in 2015, remaining islands in 2010 - 2011*

(source: Institute of Marine Environment and Resources, 2017)¹⁰⁹

(4) Current status of marine pollution and incidents

The deterioration of the sea water environment due to pollution and environmental incidents leads to the destruction of natural habitats of species, causing great loss of biodiversity in coastal areas.

There have been serious environmental incidents occurring, causing great consequences on ocean environmental pollution, damage to ecosystems and directly affecting people's daily life and livelihoods. In 2016, there was an incident of discharge of wastewater containing toxins that had not been treated up to standards into the environment by Hung Nghiep Formosa Ha Tinh Iron and Steel Co., Ltd, causing mass death of seafood and affecting some marine ecosystems. In the four central coastal provinces of Ha Tinh, Quang Binh, Quang Tri and Thua Thien Hue as a primary example. Coral reefs are the most affected objects in marine ecosystems, 100% of coral reefs in the survey area show signs of bleaching, most of the coral branches die off. Typical reef areas are: Hon Son Duong - Ha Tinh (first point), the highest coral mortality rate is about 90%, Hon Nom (Quang Binh) and Hai Van, Son Tra - Thua Thien Hue (end point), the rate of coral loss was 66.7%. Organisms on coral reefs are still very poor, fish density is very low, the lowest is Hon Son Duong, Hon Nom (MONRE, 2018)¹¹⁰. Formosa Company had to compensate Viet Nam with a total amount of 500,000,000 USD (equivalent to over 11,500 billion VND).

In addition, oil spills occur more and more complex in nature and extent. From 1992 up to now, 190 oil spill incidents have occurred in Viet Nam's waters, of which 37 occurred at sea (accounting for 19%), 88 cases inshore (accounting for 47%) [SOSmoitruong, 2020]. In particular, for example, the oil spill incident of Formosa One ship occurred in 2001 at Ganh Rai bay (BR-VT province), because the Formosa One ship crashed into the Petrolimex-01 ship, spilling about 900m³ (equivalent to 750 tons). DO oil to the sea; or the oil spill of Hong Anh ship, which occurred in 2003, due to high waves sinking the Hong Anh ship in the Ganh Rai bay area, spilling about 100 tons of FO oil, directly affecting the Can Gio protection forest and aquaculture areas. The total economic and environmental damage caused by the incident is up to tens of billions of dong...[Quang Vu, 2020].

¹⁰⁹ Vietnam General Administration of Seas and Islands, Draft Report on Status of Marine Biodiversity in 2018

¹¹⁰ MONRE, 2018, Report on the State of the National Environment 2018-Water environment in river basins

(5) Current status of climate change

Viet Nam is one of the countries most severely affected by climate change, especially in coastal wetlands, typically mangrove areas in Ca Mau, Ho Chi Minh City. Ho Chi Minh City, Vung Tau and Nam Dinh. The impact of climate change makes the problem of pollution, environmental degradation, and biodiversity loss in our country increasingly complex and unpredictable.

Climate change in particular is sea-level rise, making saltwater intrusion in coastal areas become more and more serious and become one of the most difficult problems in some localities. The Mekong Delta with 1.77 million hectares of saline soil accounting for 45% of the area, is the region with the largest saline soil area in the country. If sea level continues to rise by 30cm up to 2050 climate change scenario, land loss and saltwater intrusion will increase in the Mekong Delta and some areas of the Red River Delta, seriously affecting national food security. In addition, rising sea levels force aquaculture farms to relocate, and the reduced mangrove area will lose the habitat of aquatic organisms (VASI, 2020)¹¹¹

In addition, increasing temperature will change the distribution area and biome structure of many marine and coastal ecosystems: tropical species will decrease in coastal ecosystems and tend to move to high latitudes and regions than in terrestrial ecosystems; temperate species will decrease; The structure of food chains and webs also changes. Rising temperatures also make coral reefs home to many marine species, shielding against coastal erosion and protecting mangroves that will be degraded.

3. Viet Nam marine ecosystem services

Ecosystem services are “The benefits humans derive from ecosystems include provisioning services such as food and water, regulatory services such as floods and droughts, and supporting services such as soil formation and nutrient cycling. and cultural services such as entertainment, spiritual, religious and other non-material benefits” (MEA, 2005). Accordingly, ecosystem services include four types.

¹¹¹ Vietnam General Administration of Seas and Islands, 2020, Summary report on the current state of national coastal zones

Table F8. Types of marine ecosystem services

Service provided	Regulatory Service	Cultural services
<i>Human products obtained from ecosystems:</i> Food, fuel, yarns, soft drink genetic resources.	<i>The benefits that humans derive from the regulation of the ecosystem:</i> climate regulation, breakwater, erosion control, pure water, disease control, etc.	<i>The non-physical benefits obtained from the ecosystem:</i> spiritual enrichment, develop awareness, thinking, creativity aesthetic experience.
Support Services <i>Provide the necessary operations for all other types of services</i> oxygen production; accretion.		

Source: MEA (2005)

Biodiversity and marine ecosystems in Viet Nam are considered to be of great value for economic activities (tourism, fisheries, transportation, etc.), disaster prevention, climate regulation, absorption, and carbon storage. Research on the evaluation of marine ecosystem services has received more attention recently in terms of research quantity and quality. However, the general assessment shows that the number of valuable studies of the ecosystem is limited, only a few small studies have been conducted, focusing mainly on coral reef and seagrass ecosystems, mangroves in specific areas such as wetlands¹¹², islands¹¹³. Other ecosystems such as inland wetlands (rivers, lakes), marine ecosystems such as lagoons, lagoons, bays and offshore areas have not been studied and evaluated yet. In particular, to date, there have not been any announcements by state management agencies on the value of marine ecosystems through the results of investigation, assessment, inventory, statistics, evaluation and accounting; There are no legal guidelines on the economic evaluation of marine ecosystem services. Therefore, the awareness from various management levels to the community about the value of marine ecosystem services

¹¹² Tam Giang – Cầu Hai, Thái Thụy – Thái Bình..

¹¹³ Bạch Long Vĩ, Thổ Chu và gần đây là huyện đảo Trường Sa...

is still limited; the value of marine ecosystem services has not been adequately analyzed in the process of formulating, implementing and evaluating development strategies, master plans and plans at all levels and sectors; Policy tools implementing the principle of beneficiaries, using the value of marine ecosystem services to be paid for have not been applied, leading to unfairness. The Law on Environmental Protection 2020 has regulations on payment for marine and wetland ecosystem services, currently being concretized in a Decree for the Government to promulgate and will take effect in January 2022.

To the extent of some initial single research results on coastal mangrove ecosystems, we can see that wetland ecosystems are an extremely important natural resource in Viet Nam, bringing many benefits. and great value in terms of socio-economic, entertainment, tourism and especially cultural, social and historical values. Over the years, Viet Nam has risen to become the second largest rice exporter in the world; seafood export turnover in 2017 reached 8.3 billion USD, ranking in the top 10 industries with high export turnover [Van Hao, 2019]. Wetlands in the Mekong Delta have biodiversity values and are fertile land for farming. This is the largest rice granary of the country, contributing to 80% of the national export rice output.

In the Red River Delta, at the mouth of the Ba Lat - Nam Dinh River, the total economic value of the wetland ecosystem is estimated to bring about VND 88,619 billion/year including direct use value, indirect use value and non-use value [Thuy Ngoc, 2014]. Research by Nguyen Mau Dung et al. (2017) in Thai Thuy Wetland Area, Thai Binh Province has specifically evaluated economic values and divided them into direct use values and indirect use values, specifically is the total economic value of Thai Thuy Wetland Area, Thai Binh province is 23,034 million USD; direct use value accounted for (72.53%), indirect use value accounted for 26.32% (see Table 3) for details.

Table F9. Total economic value of mangrove areas in Thai Thuy district

No	Economic Values	Total value 1 year (millions of dollars)	Percentage (%) of total value
DIRECT USE VALUE			
1	Aquaculture	11.381	49.45
2	Fishing in the mangroves	1.289	5.60
3	Coastal fishing	2.479	10.77

4	Beekeepers	0.200	0.87
5	Travel services	1.343	5.84
Total direct use value		16.692	72.53
INDIRECT USE VALUE			
1	Disaster mitigation	1.787	7.68
2	CO ₂ storage value	2.190	9.52
3	Clean water	2.100	9.12
Total indirect use value		6.077	26.32
NON-USE VALUE			
1	Conservation of biodiversity	0.265	1.15
Total unused value		0.265	1.15
Total economic value (TEV)		23.034	100.00

Source: Nguyen Mau Dung, 2017

In the study by Merriman, JC, Murata, N. (2016), the total economic value of the wetlands of Thai Thuy district is estimated at 15 million USD/year and 60.3 million USD from carbon accumulation (calculated 1). times), smaller than the estimated results in this study (\$20.84 million/year and \$73.4 million from carbon accumulation for one time - equivalent to \$23.034 million/year). This is because the study by Merriman and Murata (2016) did not take into account the benefits from beekeeping, from tourism services, from water treatment or cleaning, and benefits from biodiversity conservation of the wetlands in the Thai Thuy district.

Nguyen Mau Dung et al (2017) also conducted a similar study in the Tam Giang - Cau Hai lagoon area, Thua Thien Hue province. The estimated annual value of the TG-CH lagoon is around **\$77,291 million**. The direct use value accounts for the largest proportion (over 99%), the indirect use value accounts for nearly 1% of the total economic value. It is quite surprising that direct values (fishery and non-fishery) have a high contribution to total economic value compared to other value groups (Barbier, Acreman, and Knowler, 1997; Janekarnkij and Mungkung , 2005; Schuyt and Brander, 2004; Kyophilavong, 2008). This shows that the TG-CH lagoon plays a very important role for the livelihoods of communities living in and around the wetland conservation area. The main reason for the high proportion of direct values of Tam Giang - Cau Hai

lagoon in total economic value is the richness of biodiversity and geographical conditions. According to fisheries experts, Tam Giang - Cau Hai lagoon is very rich in food sources and has ideal conditions for the development of different aquatic species.

Table F10. Ecosystem service value at Wetland Ecosystem in Tam Giang - Cau Hai, Thua Thien Hue province

No.	Economic Values	Total value 1 year (million dollar)	Ratio (%) in total value
DIRECT USE VALUE			
1	Aquaculture	71.777	92.87%
2	Seaweed	0.214	0.28%
3	Wild caught	3.204	4.15%
4	Agricultural activities	0.697	0.90%
5	Travel	0.383	0.50%
Total direct use value		76.275	98.69%
INDIRECT USE VALUE			
1	CO ₂ storage value	0.542	0.70%
2	Clean water	0.107	0.14%
Total indirect use value		0.649	0.84%
NON-USE VALUE			
1	Biodiversity conservation value	0.367	0.47%
Total non-use value		0.367	0.47%
Total economic value (TEV)		77.291	100%

Source: Nguyen Mau Dung et al., 2017

Research by Nguyen Huu Ninh, Mai Trong Nhuan et al. (2003) has evaluated the economic value of typical coastal wetland areas in Viet Nam including Tam Giang - Cau Hai lagoon, Thi Nai lagoon, and beach. the southwestern dynasty of Ca Mau and the estuaries of Bach Dang, Ba Lat, Van Uc and Tien Day rivers. The results of the total economic value are shown in the following table:

Table F11. Total economic value of some coastal wetland areas

No	Areas	Total economic value (TEV) (USD/ha)
1	Đầm Tam Giang - Cầu Hai	2,301
2	Bãi triều Cà Mau	4,593
3	Cửa sông Bạch Đằng	503.57
4	Đầm Thị Nại	503.57

Source: Nguyen Huu Ninh, Mai Trong Nhuan et al (2003)

From the calculations on the economic value of the wetland ecosystems of the authors in Viet Nam, it shows that, if compared with the economic values of the wetland ecosystems in the world, the economic value per 1 ha in Viet Nam belongs to the high group, this is an advantage for Viet Nam, so it needs to be preserved and developed to take advantage of this.

4. Interaction with SDGs

Preliminary assessment of the correlation between Environment, Biodiversity & Ecosystem Services and SDGs in Viet Nam is as follows.

Table F12. Environment, Biodiversity & Ecosystem Services and SDGs

Goal	Score	Linked to Environment, Biodiversity & Ecosystem Services
SDG 1	+2	Biodiversity conservation, environmental protection and the expansion of ecosystem services enhance potential for economic activities (marine tourism, fisheries, renewable energy, etc.), increase the number of job opportunities that bring higher income for coastal residents.
SDG 2	+2	Biodiversity conservation helps increase the fisheries resources that yield high value of food supply.
SDG 3	+3	Marine ecosystems (mangroves, coral reefs and sea grasses) can be valuable raw materials for the production of medicine. Clean water helps to protect everyone's health when swimming.

Goal	Score	Linked to Environment, Biodiversity & Ecosystem Services
SDG 4	+2	Biodiversity provides broad and rich knowledge through marine flora and fauna surveys that support biological students, researchers, and more.
SDG 5	+1	Women are a large force in all activities related to biodiversity conservation.
SDG 6	+3	Protecting the marine environment and biodiversity will contribute to protection and supply of clean water. Notably, desalination is an important process to ensure enough clean water in some countries.
SDG 7	+1	Maintaining a safe marine environment will indirectly support wind power development and offshore oil and gas production.
SDG 8	+2	Protection of the environment and marine biodiversity contributes to the sustainability of marine economic sectors such as tourism and fisheries.
SDG 9	0	There is a two-way relationship, positive and negative: Positive and negative, considered neutral.
SDG 10	+1	Increasing job opportunities for coastal residents through protecting environment can help reduce inequality in society.
SDG 11	+2	Cities in 28 coastal provinces of Viet Nam have many opportunities for urban development if they maintain the protection of marine environment and biodiversity and utilize sources of revenue from ecosystem services.
SDG 12	+3	High demands for responsible consumption and production.
SDG 13	+3	The mangrove ecosystem makes an important contribution to climate change response and disaster prevention. One of the most essential roles of marine ecosystem services is carbon storage - an indispensable solution to mitigate climate change.
SDG 14	+3	Enhancement of marine environmental protection and biodiversity conservation is the realization of SDG14.
SDG 15	+3	Mangroves play a role in preventing storms, natural disasters, protecting forest ecosystems and inland resources.

Goal	Score	Linked to Environment, Biodiversity & Ecosystem Services
SDG 16	+3	Protection of the marine environment and biodiversity requires aid from all people at all levels.
SDG 17	+2	Strengthen cooperation between the parties to protect the marine ecological environment.

Source: Nguyen The Chinh, 2021

Table F12 shows that the link of environment, biodiversity and ecosystem with sustainable development goals is mainly positive and positive, except for goal number 9 which is evaluated. two-way impact, for industrial development, infrastructure has a negative impact (-), for creativity, environment, ecosystem and biodiversity has a positive relationship (+), as Therefore, the total relationship is assessed by O. This suggests that industrial and infrastructure development needs to be studied carefully before deciding to compensate for the losses that industrial and infrastructure development. effects on the environment, ecosystems and biodiversity towards balance

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64 Ba Trieu - Ha Noi – Tel: (84.24) 39434044 - 62631720

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