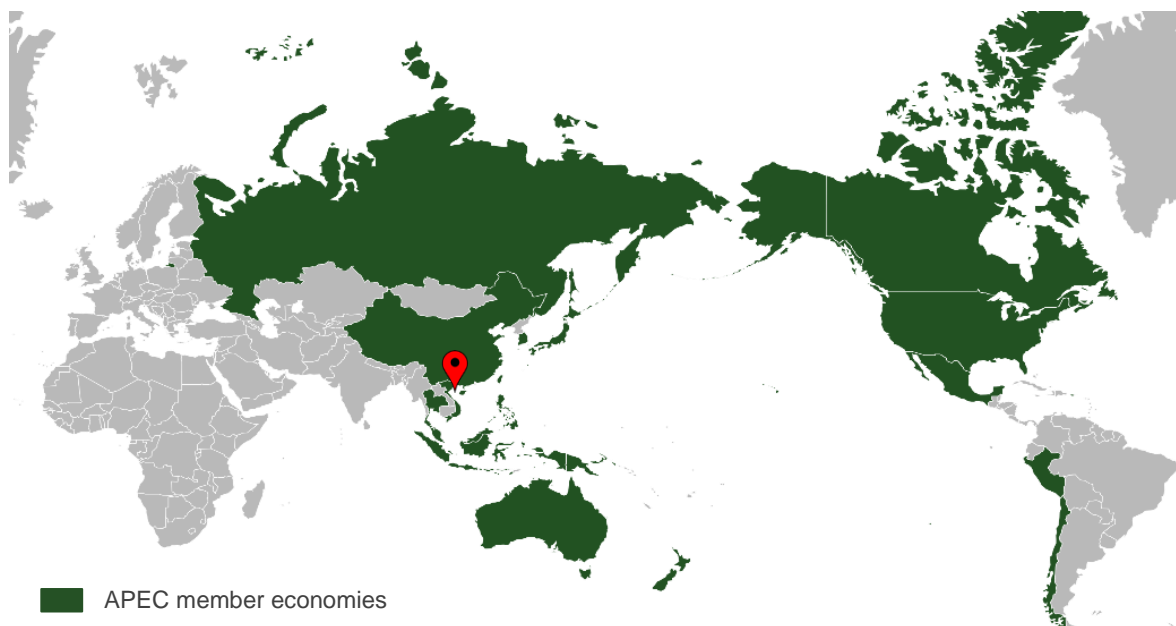


Energy and transport profile: Cat Ba Island, Viet Nam



This profile has been authored in October 2019 by Nikola Medimorec, SLoCaT, in cooperation with Dean Gioutsos and Alexander Ochs, SD Strategies, as part of the APEC project “Supporting the transition to energy-efficient electric transport systems.” It presents key information and observations on the energy and transport sectors in Cat Ba as important input for a Roadmap for the Integration of Sustainable Energy and Transport (RISET). Electricity and transport services on islands are often insufficient to meet the needs of their populations. Existing systems are economically, socially, and environmentally unsustainable. Quick and bold transitions to integrated, efficient energy and transport solutions based on domestic renewable sources can make services in both sectors affordable, reliable and sustainable.

KEY FINDINGS

Current challenges:

- Achieving energy security for the island while increasing the share of renewable energy.
- Establishing sustainable mobility for Cat Ba’s inhabitants by ensuring access to necessary services, provision of public transport and a transition to clean, efficient vehicles.
- Accommodating the growing energy and transport demand.

Renewable potential:

- Decentralized, local renewable energy supply can increase the island’s resilience.
- Solar and wind energy technologies can be deployed to help feed the growing energy demand.

Transport opportunities:

- A phase-out of fossil-fueled vehicles could be an entry point for sustainable mobility.
- Electrification of two-wheelers can quickly reduce transport-sector CO₂ emissions.

Opportunities for integration:

- Scaling up the use of solar and wind energy for electricity and the introduction of EVs could see integration best facilitated.

Key goals for RISET:

- Defining a long-term vision and strategy for achieving energy security and carbon neutrality for their energy and transport systems.

CAT BA ISLAND, VIET NAM - IN BRIEF

GENERAL INFORMATION

Land area:
285 km²

Population:
17,911 people (2017). Avg. household size: N/A – For Viet Nam: 3.8 (2018)

Administration:
Cat Hai district, part of Hai Phong city.

Climate: Humid subtropical (Köppen classification: Cfa).

Geographic characteristics:
Approx. 2 km from mainland Viet Nam. Very hilly (highest elevation 1,000 m), significant forest cover.

Primary economic activities:
Tourism, services, some industry and agriculture.

Income level:
N/A – For Vietnam: 2,914 USD¹ per capita and year (2019)², 9.8% of population living below national poverty line (2016)³.

ENERGY

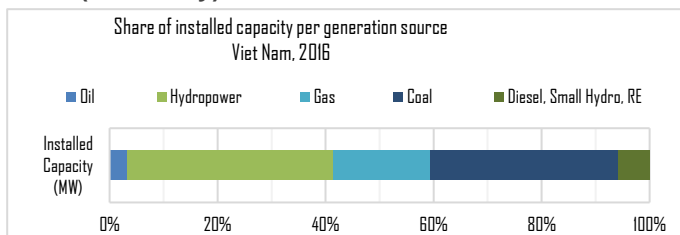
Share of electricity generation capacities:
Oil 3%; Hydro 38%; Gas 18%; Coal 34%; Diesel, Small Hydro, RE: 6%.

Annual energy demand:
N/A – For Viet Nam: Energy: 58,707 ktoe (2015)⁴. Electricity: 134 TWh (2018).

Demand growth rate: (electricity)

N/A – For Viet Nam: 7% (2018).

Share of GDP spent on electricity:
N/A



Connection to mainland elec. grid:

Yes, via a submarine power cable from Hai Phong city to Cat Ba island.

TRANSPORT

Access to the island: By ferries, ships and speedboats. A bridge connecting the mainland to the island is under construction.

Private vehicle fleet size:
170 cars; 4,290 motorcycles; 80 boats. EVs: 81 (1 bus and 80 cars).

Public vehicle fleet size:
0.

Demand growth rate:
N/A – For Viet Nam: 214% (growth of private motorization from 2005 to 2015).

Motorization rate:
N/A – For Viet Nam: 23.2 vehicles per 1,000 people (2015).

Transport modal split:
65% walking, 2% cycling, 21% motorcycles, 12% bus and car.

EMISSIONS

GHG of Energy generation:
N/A – For Viet Nam: 78.2 million t CO₂ per year⁵ (2017)

GHG of Transport:
N/A – For Viet Nam: 34.1 million t CO₂ per year (2017)

¹ 1 VND = 0.0000431883 USD <https://www.xe.com/currencyconverter/convert/From=USD&To=VND>

² Trade Economics, 2019, Vietnam Average Monthly Wages. <https://tradingeconomics.com/vietnam/wages>

³ World Bank, 2019, Poverty headcount ratio at national poverty lines (% of population) – Vietnam https://data.worldbank.org/indicator/SI.POV.NAHC?cid=GPD_8&locations=VN

⁴ IEA, 2019, Statistics, available at: <https://www.iea.org/statistics/>

⁵ Data is based on SLoCaT calculations of EDGAR, 2018, Fossil CO₂ emissions of all world countries, 2018 report. European Commission, Joint Research Centre /PBL Netherlands Environmental Assessment Agency

Introduction to Cat Ba Island

Cat Ba is situated in the northern part of Viet Nam and is the biggest Vietnamese Island. Located within the wider Halong Bay area, it is a popular tourist destination. It is the main island of the Cat Ba archipelago and part of Hai Phong City, which is one of the 5 largest cities in Viet Nam. There are only a few settlements on the island and two major towns. One settlement sits at the closest point to the mainland and a bigger town lies in the south-eastern part of the island - the major tourist destination. The island is overall very hilly and covered by forests. Cat Ba National park, a UNESCO biosphere reserve, has a core area of 8,500 ha, buffer zone of 7,741 ha and transition area of 10,000 ha. This area is home to 3,860 species of which 130 species are threatened by extinction. The near-extinct white-headed langur exists exclusively on Cat Ba island. There are hundreds of smaller islands surrounding the main island of Cat Ba and there are a few offshore fishing villages. These villages do neither have electricity nor any other infrastructure.

Cat Hai district (of which Cat Ba represents around 85%) had a GDP of USD 228.9 million in the first 9 months of 2018 and the growth rate was at 14.8%. The larger Hai Phong city had a GDP of USD 8.4 billion with a growth rate of 16.3% from 2017. The observed growth in Hai Phong was 2.4 times higher than the national average growth rate. This demonstrates that Hai Phong is one of the growth engines of Viet Nam's economy. Continued growth of the local economy will lead to greater demand of transport and energy services.

Tourism and services are the backbone of the island's economy, constituting 76.5% of the island's economic production; industry (15%) and agriculture (8.5%) make up the remainder. Tourism is a major driver of infrastructural development in Cat Ba and Viet Nam more broadly. Cat Ba had 2.5 million visitors in 2018, which increased by 18% from 2017. The revenue from tourism in Cat Ba in 2018 was USD 67 million, increasing by 24%.

Power and transport on Cat Ba today

Current configuration of energy and transport system

Electricity sector

The growing tourism industry in Cat Ba is stimulating economic development, but also having impacts on the island's electricity sector. The increase in numbers of tourists is resulting in high seasonal energy demands and peaks at specific times of the day. Cat Ba island experiences power failures roughly once a week, some of which last up to about half a day, according to information from 2015. The frequency is higher during the summer where more demand comes from tourism. Thus, many hotels have installed diesel generators to be used during such power failures. In addition, factories on the island rely on coal-fired boilers to produce aquatic feed and other products.⁶

The electricity sector of Cat Ba is largely tied to Viet Nam's electricity network, since the island is connected to the national electricity grid. Electricity generation has historically been dominated by hydropower generation in Viet Nam, however the share of generation from coal has increased in recent years. In 2015, hydropower provided the largest share of the country's electricity with 35.0%, narrowly ahead of coal (34.6%) and natural gas (29.5%); oil provided 0.8% while wind (0.08%) and biofuels (0.04%) made marginal contributions. In terms of total installed capacity (2018), hydropower had a share of 40.2%, followed closely by coal (38.9%) and then gas (15.9%); non-hydro renewable power

⁶ City of Kitakayshu and City of Hai Phong, 2015, Green Growth Promotion Plan of the City of Hai Phong, available at: http://www.asiangreencamp.net/pdf/green_en.pdf

technologies accounted for a share of 2.1%, out of which, 1.3% was contributed by biopower, followed by wind (0.5%) and solar (0.3%)⁷.

Viet Nam has limited coal and gas resources, which could affect an increase in fossil fuel import dependency, or alternatively provide a stimulus to capitalise on renewable potentials in the country. Market development of renewable sources such as wind and solar is still at a very early stage, despite high potentials which are largely untapped; conversely, hydropower potential is almost fully exploited. Coal reserves are depleting, and the government has plans to diversify its energy mix. Due to government support and abundance of renewable potential, installed non-hydro renewable capacity is forecast to grow by 22.4% per year and reach 19.9 GW by 2030.

Viet Nam's power sector faces several challenges in its diversification: Low electricity prices; limited funding; slow pace of major power project development; lack of private sector interest; and lack of foreign investors are key barriers to capitalising on the country's renewable potentials.

Electricity generation costs increased in Viet Nam in 2019. Coal-fired power generation prices were set to range between USD 0.07-0.08 per kWh during 2019 (excluding some taxes, seaport fees and infrastructure) increasing by between USD 0.003 and 0.015 from 2018. The ceiling prices for power generation in hydropower plants increased to USD 0.05 per kWh (excluding taxes) up by USD 0.001 per kWh. The increased generation costs were also matched with tariff increases: electricity prices increased from USD 0.075 to USD 0.080, excluding VAT.

Transport sector

Transport in Cat Ba depends mainly on road transport and a minor demand satisfied by maritime transport. The island is currently only accessible by ferry, ship and speedboat; a bridge connecting the mainland to the island is under construction. The distance to the mainland is less than 2 km. Since a physical connection to the mainland is missing, there is no rail infrastructure. The closest international airport (Cat Bi International Airport) is just 20 kilometres away. Intercity buses connect Cat Ba to other regions in Viet Nam.

Two major roads connect all settlements on the island (see Figure 1). There are 25 times more motorcycles than cars on Cat Ba.

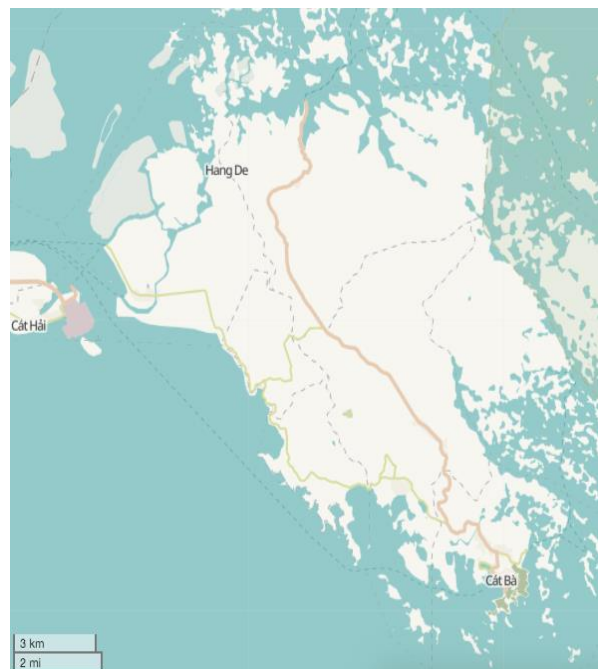


Figure 1: Map of Cat Ba showing main road network (OpenStreetMap, 2019)

The island lacks a public transport system. While the majority of households own motorcycles, some households do not have access to private transport. In the towns, there are electric vehicles (similar to golf carts) that transport groups of people through the major town of Cat Ba (south-eastern Cat Ba).

⁷ GlobalData, 2019, Non-hydro renewable to show strong growth of 22.4% in Vietnam, during 2019–2030, available at: <https://www.globaldata.com/non-hydro-renewable-to-show-strong-growth-of-22-4-in-vietnam-during-2019-2030-says-globaldata/>

The major share of collective transport is provided by private companies and it caters to tourists with fares that locals might not be able to afford. Motorcycles, three-wheel rickshaws and taxis are available as well. Similar to the general situation in Viet Nam, motorcycles are a major mode of transport. The introduction of public transport would increase the access to education, jobs and health care. It would create jobs by employing people to drive the vehicles and the whole operation system behind it. In addition, as a significant amount of travel is regional and many buses connect Cat Ba to other regions of Viet Nam, the employment of low-emission, long distance buses including the necessary infrastructure (a bus terminal, ticketing booths, gas stations) would be a favorable first step towards more sustainable transport.

Policy and investment environment

Existing measures and targets on emissions, climate & sustainable development

At national level, the Government of Viet Nam has committed unconditionally to reducing its GHG emissions by 8% compared to 2030 BAU projections, through the use of domestic resources⁸. As part of this commitment, emission intensity per unit of GDP will be reduced by 20% compared to 2010 levels and forest cover will be increased to the level of 45%. Conditional to the provision of international support and implementation of new mechanisms under the Global Climate Agreement, Viet Nam could increase its GHG reduction target from 8% to 25% and reduce emission intensity per unit of GDP by 30%.

At regional level, the 'Master Plan on Sustainable Tourism Development of Cat Ba Archipelago until 2025 and Vision to 2050' addresses sustainable development and emissions reductions for a time-horizon up to 2050⁹. The plan encourages energy-saving technologies and the use of environmentally friendly transport methods for tourists. It suggests reducing CO₂ emissions from transportation on the island and in the long-term, a phase-out of fossil fuel vehicles.

The Hai Phong People Committee's 'Cat Ba tourism development strategy', aims to triple the number of tourists by 2020 from the 1.7 million visitors in 2017.¹⁰ A nomination was submitted to UNESCO to expand the Ha Long Bay heritage area to include the Cat Ba archipelago and a buffer zone around the area. Even though biodiversity is the main criteria for this nomination, sustainable development of the region would also be a major benefit of this proposal being accepted.

Electricity sector

A national target has been adopted to increase access to clean energy in every region (with islands being explicitly mentioned), so that most households have electricity access by 2020 and then universal access to "modern, sustainable, and reliable energy services" in 2030.¹¹

⁸ Government of Viet Nam, 2015. Nationally Determined Contribution of Viet Nam.

⁹ Vanbanphapluat, 2014, Quyết định 2732/QĐ-UBND, available at: <https://vanbanphapluat.co/quyet-dinh-2732-qd-ubnd-2014-phat-trien-du-lich-ben-vung-quan-dao-cat-ba-hai-phong>

¹⁰ Info.net, 2018, Quy hoạch quần đảo Cát Bà: Cần khoanh vùng bảo tồn để phát triển bền vững <https://infonet.vn/quy-hoach-quan-dao-cat-ba-can-khoanh-vung-bao-ton-de-phat-trien-ben-vung-post256617.info>

¹¹ B.1 PDP-VII Decision No. 1208/QĐ-TTg (2011), <https://www.adb.org/sites/default/files/publication/389826/pathways-low-carbon-devt-viet-nam.pdf>; http://www.asialeds.org/sites/default/files/resource/file/2007_LEG1855_PM_National%20Energy%20Development%20Strategy.pdf

Cat Ba's Tourism Master Plan advocates the following measures related to energy and the electricity sector: Construction of wind power and solar power ensuring that electricity supply meets the minimum need of tourism; Expansion of clean energy capacity in tourism-related constructions and awareness raising on the need for clean energy in tourism.

The city of Hai Phong has investigated several actions for implementation in the energy sector. As part of a low-carbon city project, one idea is to introduce photovoltaic power generation to commercial buildings and private households and to introduce small-scale hydropower generation at water distribution stations¹². Specific actions for Cat Ba island are the promotion of efficient use of electricity. The installation of LEDs and modernisation of air conditioning equipment is being promoted, starting in tourist facilities, public buildings and commercial buildings.¹³

Viet Nam requires an estimated USD 10 billion annually until 2030 to keep up with growing electricity demand. Due to the high capital required, the government has allowed 100 percent foreign ownership of Vietnamese companies in the energy sector.

The government introduced a feed-in tariff in 2017 of USD 0.0935 per kWh in order to support renewable energy development. The feed-in tariff was modified in 2019 but will continue for another two years. With the feed-in-tariff level being relatively low and due to high production costs, public-private-partnerships (PPPs) appear to be the most effective form for foreign companies to enter the market and minimize risks. Renewable energy projects also benefit from import duty exemption in order to establish fixed assets, materials, and semi-finished products. Tax incentives include preferential corporate income tax (CIT) rate of 10 percent for 15 years; CIT exemption for four years and a reduction of 50 percent for the following nine years.

Transport sector

The Cat Ba Tourism Master Plan¹⁴ lists several measures that will be implemented in the next few upcoming years:

- Upgrade and/or construct Cat Ba tourist port, ferry ports and a yacht harbour.
- Construct a car parking garage in the centre of town and on a road linking major destinations.
- Construct an airstrip allowing tourists from Cat Bi airport or from Hanoi, Ha Long, Van Don to reach Cat Ba and vice versa.
- Build a tourist port at the Lach Huyen international port complex that can welcome international cruise ships.
- Replace transport vehicles using gasoline with vehicles using electricity/gas by 2025.
- Build a monorail linking Cat Ba town with the national park and the east coast of the island.
- Construct a cable car system linking Cat Ba and Hon Ong town.

These measures mainly focus on improving the efficiency of the current transport infrastructure system. Most of the measures would lead to an increase of transport (as well as energy demand) on the island. Thus, it is very valuable to see that the plan also aims to replace vehicles using diesel/gasoline with electricity and gas by 2025. This ambition can be an entry point for sustainable mobility and renewable energy.

¹² Nguyen, T. H., 2017, Low – carbon City Development in Hai Phong and Projects in collaboration with Kitakyushu City, available at: https://archive.iges.or.jp/files/research/sustainable-city/PDF/20170123/08_Hai_Phong.pdf

¹³ City of Kitakyushu and City of Hai Phong, 2015, Green Growth Promotion Plan of the City of Hai Phong, available at: http://www.asiangreencamp.net/pdf/green_en.pdf

¹⁴ Vanbanphapluat, 2014, Quyết định 2732/QĐ-UBND, available at: <https://vanbanphapluat.co/quyet-dinh-2732-qd-ubnd-2014-phat-trien-du-lich-ben-vung-quan-dao-cat-ba-hai-phong>

Main stakeholders/actors

Electricity sector

The Vietnamese electricity market, until this year, was monopolistic in nature, led by the state-owned enterprise EVN and supervised by the Ministry of Industry and Trade (MoIT). In the generation market, EVN was a single buyer. The power transmission and distribution systems were exclusively operated by subsidiary companies of the utility, EVN. The government, however, has set the goal to develop a competitive generation sector by 2023, primarily to attract private and foreign energy sector investments. To this end, in January 2019 the Viet Nam wholesale electricity market (VWEM) officially came into operation and currently, five power corporations and a few large power plants are participating in the market¹⁵.

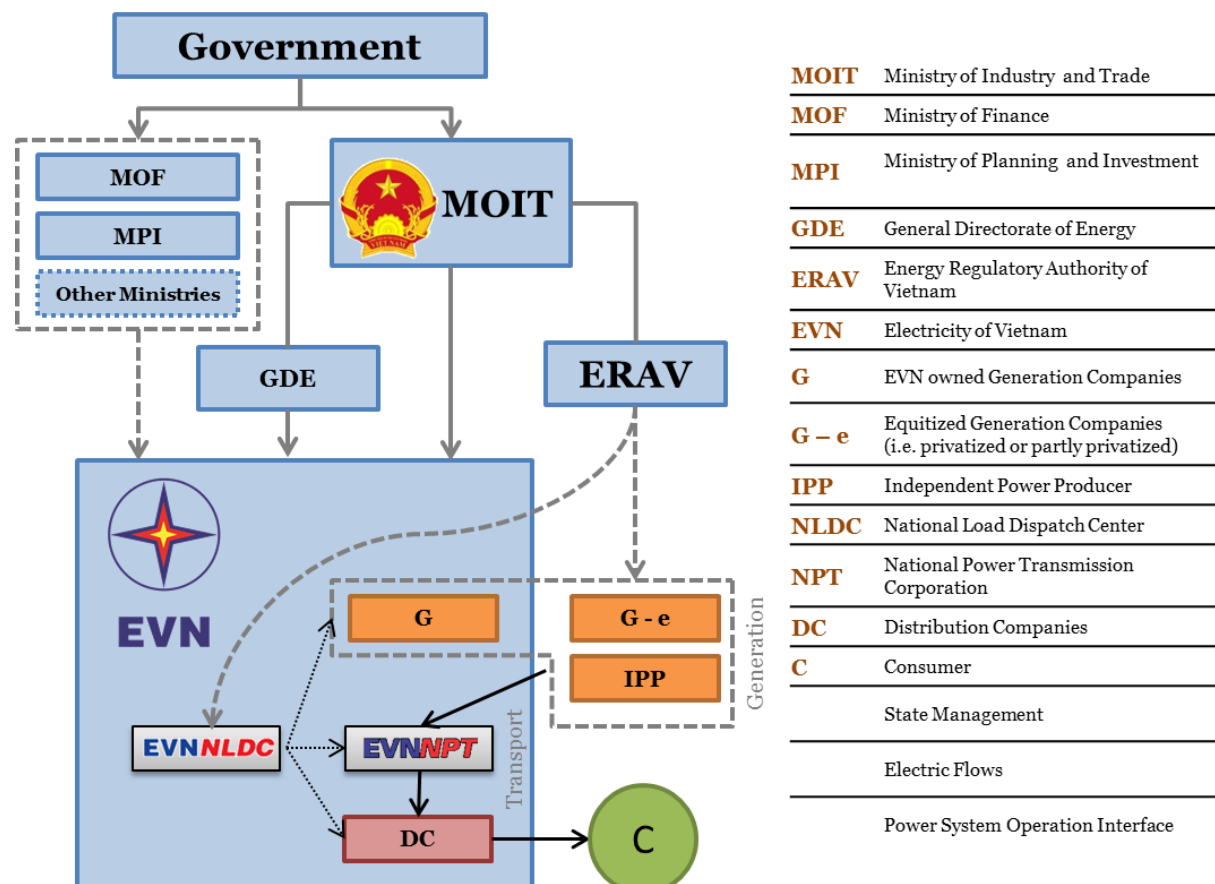


Figure 2: Institutional framework of the Viet Nam electricity sector prior to 2019 liberalisation. Source: GIZ Viet Nam Energy Support Programme, 2015).

Transport sector

On the national level, the main government body for transport is the Ministry of Transport. The planning approach at national level requires the Ministry of Transport to develop a national level master plan which has to be approved by the Prime Minister. The consultation of the relevant local governments is required in drafting and revision of the master plans. Relevant content of the plan will be integrated in local master plans which are developed by local governments. Cat Ba island falls under Hai Phong's people committee, which will have to be consulted in major activities.

¹⁵ Vietnam Electricity, 2019, Wholesale electricity market in 2019: The "race" begins, available at: <https://en.evn.com.vn/d6/news/Wholesale-electricity-market-in-2019-The-race-begins-66-163-1303.aspx>

Island snapshot: Electric shuttles

Without being part of a specific climate project, the major town of Cat Ba island already employs electric vehicles. These vehicles, as seen in Figure 3, are being mainly used to transport tourists from hotels to the city centre and vice versa. They serve short distances of just a few kilometres.



Figure 3: Cat Ba Town, main street with electric vehicle transporting tourists (Photos by Nikola Medimorec).

A handful of vehicles, assumed to be operated by private companies, are currently serving the transport demand. The vehicles transport between 2 and 10 people. Electric vehicles are well suited for this purpose as they can utilise idle time for recharging their batteries. To advance this service, more electric vehicles could be introduced, with more coverage and strategic positioning of charging stations. Solar panels on top of the vehicles (see example of solar rickshaws in India¹⁶) could even supply energy while driving.

The way forward...

Opportunities to advance the energy and transport systems

Viet Nam must continue to develop a framework that enables the uptake of renewable energy and gives incentives towards people for purchasing and installing private photovoltaic panels as well. In its long-term energy vision, Viet Nam acknowledges that the benefits of energy projects on islands contribute to economic development and poverty alleviation. The island is well positioned to make use of its solar energy resources, and to an even greater extent its wind resources. The extension of its feed-in tariff program also gives a strong signal to private investors that support for RE will continue.

To accommodate the extreme peaks, electricity generation capacity and supply need to be robust and flexible. This requires additional costs and a financial burden for periods when the demand is very low. A decentralised, renewable energy system with adequate energy storage services could improve the energy situation and more cost-efficiently accommodate such peaks and off-season lows.

¹⁶ Times of India, 2019, Solar rickshaws make debut on IIT-Delhi campus, available at: http://timesofindia.indiatimes.com/articleshow/70299940.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst

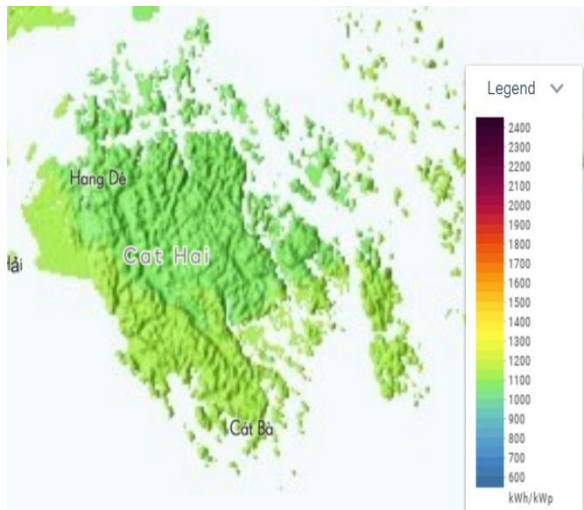


Figure 4: Potential for solar energy on Cat Ba (Source: Globalsolaratlas).

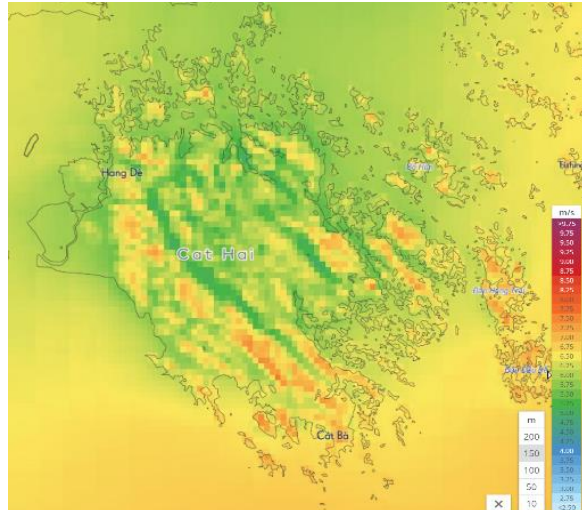


Figure 5: Potential for wind energy on Cat Ba (Source: Globalwindatlas).

The Hai Phong City approved a resolution¹⁷ to improve transport on Cat Ba island. The goal is to reduce congestion and the emissions caused by transport by 2025. Further, the local government wants to restore the operation of two public transport bus routes and provide a public bike-sharing system in 2019. However, easing congestion and reducing emissions isn't as ambitious as the Tourist Master Plan which asks for a transition from fuel combustion engines to electric or gas-powered vehicles on the island.

These are great opportunities for an improvement of transport on the island. The short distances within the towns enable a lot of walking and in general, the walking environment is relatively good (asphalted sidewalks). The current low number of private car ownership should be seen as an entry point to introduce electric two-wheelers. A recent study has shown that by replacing conventional motorcycles e-bikes have the second-largest CO₂ abatement potential in the transport sector of Viet Nam¹⁸. Additionally, the current use of electric shuttles for tourists shows that users are already open to the idea of electric vehicles and it can be scaled up further. Electric tourist taxis have been mentioned in previous plans, too¹⁹.

Major parts of the island are part of UNESCO and becoming completely carbon-neutral would help to attract even more visitors and enable new niches (e.g., eco-tourism). Current traffic volumes are low but the major streets with regular traffic have higher levels of local air pollution. The usage of zero emission vehicle would improve air quality and also reduce noise levels.

A major long-term step is to introduce alternative fuels in boats and shipping. Electric boats are being tested in Bangkok²⁰ and other places around the world. Cat Ba can also become a testbed for electric water transport. Solar-powered electric boats would be a great possibility and a way to integrate renewable energy and transport.

¹⁷ Resolution no 42/2018/NQ-HĐND on December 10th, 2018 of Hai Phong city People's Assembly

¹⁸ Bakker, S., 2018, Electric Two-Wheelers, Sustainable Mobility and the City, available at: <https://www.intechopen.com/books/sustainable-cities-authenticity-ambition-and-dream/electric-two-wheelers-sustainable-mobility-and-the-city>

¹⁹ Motion Digest, 2017. Viet Nam's five year plan towards sustainable mobility, available at: <https://motiondigest.com/2017/06/30/vietnams-five-year-plan-towards-sustainable-mobility/>

²⁰ The Thaiger, 2019, Electric boats will help alleviate some of Bangkok's air pollution <https://thethaiger.com/hot-news/air-pollution/electric-boats-will-help-alleviate-some-of-bangkoks-air-pollution>

Integration roadmap for e-bikes and other modes

The island profile for Cat Ba shows that the highest potential lies in the electrification of two-wheelers. It can be further accelerated if the supplied electricity comes from renewable energy. A roadmap would ideally start by setting up a clear vision with the target to become a carbon-neutral island by 2030. Then from this target, authorities can back cast what has to be achieved within the next decade: For example, by 2025 only zero emission vehicles (e.g., electric motorcycles and electric cars) should be allowed to be registered on the island. Thus, the vehicle fleet would slowly shift and become cleaner over the years.

The market for electric two-wheelers in Viet Nam needs to be scaled up quickly and an assessment about potential changes during the transition has to be performed. A potential outcome will be the increase in use of batteries on the island and the need to develop recycling solutions.

Sustainable alternatives for fishing and water transport have to be examined further. The few fishing islands around Cat Ba should receive solar panels in order to have electricity. Boats are still difficult to switch to electric power sources. Shortly after phasing out fossil fuel cars, alternative energy sources have to be introduced for boats and ships as well.

In the main town of Cat Ba, local authorities could potentially set up an electric bike sharing system which allows citizens and tourist to get familiar with the use of these new technologies and makes a purchase decision easier.



Figure 6: View of the port in front of Cat Ba town (Photo by Nikola Medimorec).

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