



Ministry of Foreign Affairs

China offshore wind

Factsheet for Dutch companies

Commissioned by the Netherlands Enterprise Agency

China offshore wind FACTSHEET

for Dutch
companies



March 2022

NL



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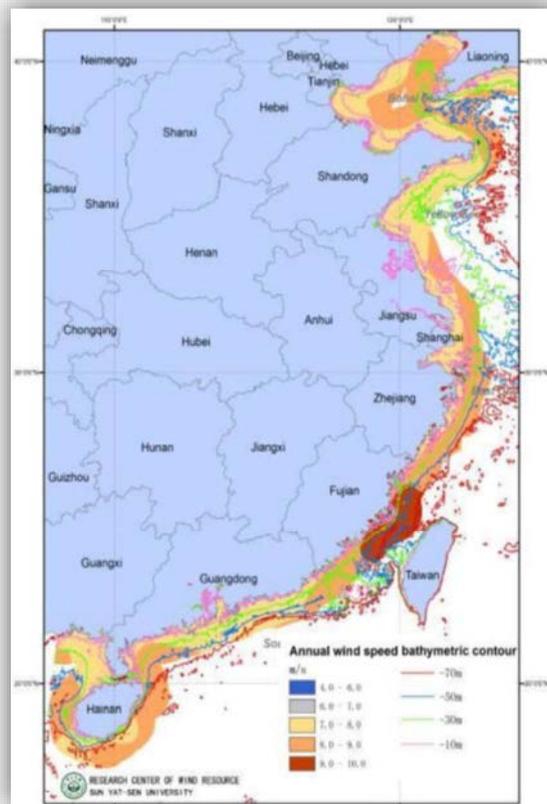
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GENERAL OVERVIEW

By the end of 2021, China became the No. 1 in the offshore wind sector, both in total installed capacity and in annual installed capacity, by installing more than 16GW in one year.

Although this is partially the result of the national subsidy reduction by 2021, and the quality of the “rushed projects” remains a question mark, China is without a doubt one of the important markets for offshore wind, with its ambitious planning and a fast-growing offshore wind sector. Due to its size and differences in development stage, one has to understand this market from a national planning point of view as well as by planning and status per region.



China's offshore wind map

Source: Sun Yat-Sen University

Every region has different seabed conditions, different geo-political strategies, or different infrastructural conditions to develop offshore wind.

All these diversified conditions create a differentiated landscape for the offshore wind industry, as well as diversified business opportunities for international players.

For example, by the end of 2021, Jiangsu province had the largest installed capacity and this region is considered to be the “early bird” with favorable sea conditions and mature regional infrastructure. The first and so far only foreign developer’s project (EDF) is located in Jiangsu.

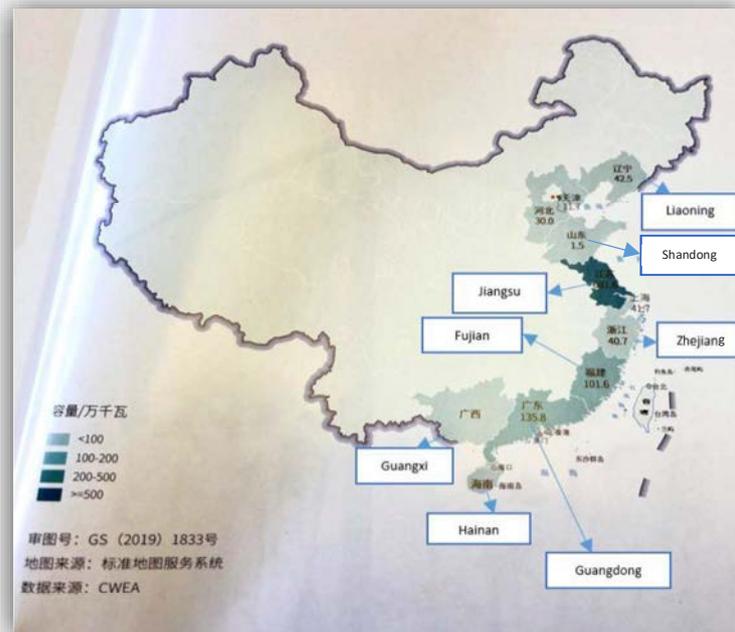
By comparison, offshore wind in Guangdong province took off a bit late, but grew very fast even with more difficult sea and weather conditions.

Guangdong province is expected to overpass Jiangsu in the next 5 years, not only by total installed capacity, but also as a frontrunner for floating offshore wind development.

Shandong, Guangxi, and Hainan provinces are also expected to speed up their offshore wind development in the next 5-year plan.

Regions who already developed or about to develop offshore wind:

- Liaoning
- Tianjin
- Hebei
- Shandong
- Jiangsu
- Shanghai
- Zhejiang
- Fujian
- Guangdong
- Guangxi
- Hainan
- Hong Kong



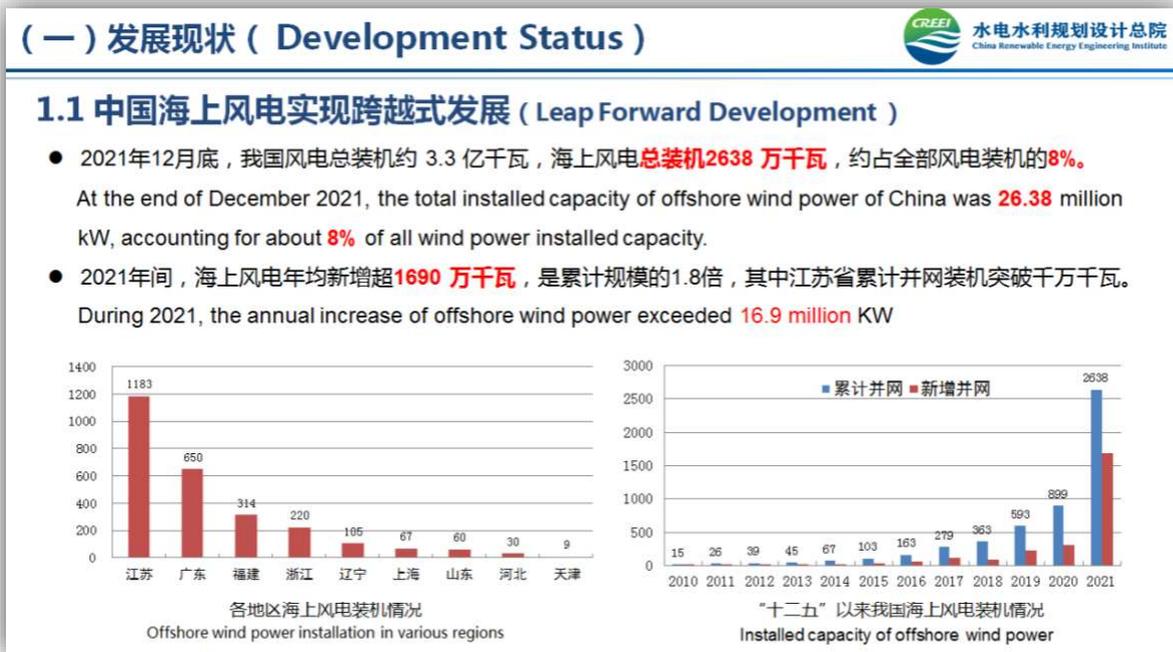
Numbers on the picture indicates the potential offshore wind capacity by per regions: capacity/10,000kilowatts

Source: GWEC

According to CREEI, the final approval by the National Energy Administration (NEA) of the provinces proposal for their next 5-year offshore wind planning will be granted after June 2022. This means that only by the end of 2022, we will know the exact planning of the whole country for the next 5 years.

Based on the current analysis and information, Guangdong and Jiangsu provinces will count for 60% of china’s future offshore wind development, which make these provinces priority areas for enhancing the relation with the government and for mapping opportunities for Dutch companies.

(Below picture is the info from China Renewable Energy Engineering Institute (CREEI) from December 2021, graph on the left is the overview of installed capacity of provinces)



(Graph on the left: from left to the right: Jiangsu, Guangdong, Fujian, Zhejiang, Liaoning, Shanghai, Shandong, Hebei, and Tianjin)

From previous projects, except differences in weather conditions, the following phenomenons are observed:

- In both provinces (actually in the whole country), State Owned Enterprises (SOEs) and regional players have the largest share as investors in the offshore wind projects;
- Jiangsu has significantly more private investors compared to Guangdong.

Zhejiang province has several projects under construction. One of the recent “zero subsidy” projects and “floating offshore wind projects” from 2021 is located in Zhejiang. This has to do with favorable water and weather conditions and the need to develop far sea solutions in the future.

Shandong province is picking up on offshore wind planning as well. The permitted project volume is unclear though. According to Bloomberg, the overall volume will not exceed 5GW by 2025.

Other provinces like Liaoning and Hebei also have offshore wind projects or plan to develop offshore wind. To know more about these projects, we will have to wait for the announcement from the regional government which ones are approved.

Guangxi province announced in November 2021 that their offshore wind planning of 7.5GW was approved by NEA. The expected installed offshore wind capacity by 2025 will be around 3GW.

Hainan recently announced to develop 15GW offshore wind as part of their renewable energy plan. This plan still needs to be approved by NEA this year.

Important facts to understand the market

- China still does not have a national power market, it is under development with reforms and demonstration projects in different regions. The current electricity price for offshore wind is still with fixed tariffs.

Offshore wind example

- Feed-in tariff level of 850 yuan per MWh for the projects connect to the grid by the end of 2021
 - Regional subsidy support between 2022-2023 (if there is one from regions)
 - Reach grid parity after 2024 (regional coal price: feed-in tariff level of 400-500 yuan per MWh)
-
- The national planning of offshore wind designated areas, provincial planning, approval from NEA and tendering of projects are quite different compared to the Netherlands. There is strong competition between provinces and among developers, which makes the “game more complicated”.
 - In the next 3 years the offshore wind industry in China is expected to develop “slow” due to the subsidy reduction and because the whole industry needs adjustment after the “rushing year-2021”. In addition, although the OEMs are reducing the prices with breakthrough innovation, not all regions have the same favorable conditions and infrastructure to reach grid parity by 2024.
 - Planned project numbers, approved projects, announcements of provinces are more a reference for companies than reliable information. For example, in the 13th 5 year planning of offshore wind for Guangdong, Guangdong planned double of the current installed capacity.
 - 1% drop in interest rate for renewable energy was announced in 2021 (as indirect subsidy to reduce LCOE). The central bank (PBOC) rolled out a low-interest loan mechanism to support renewable and low-carbon companies. This is the first time such a low-interest loan has been offered to the renewable industry. Experts estimated that the size of these loans could be over ¥1 trillion.
 - Further development of the national ETS and green certificate mechanisms are expected to create favorable conditions for renewable energy.
 - National grid parity is expected to happen after 2025 whereas specific provinces, like for instance Jiangsu province, might be able to reach grid parity by 2024.

Main players in the sector

- In China, 32GW of offshore wind projects are planned in the next five years. The exact number depends on final approval of NEA later this year.
- As part of EU China cooperation framework, renewable energy (especially offshore wind) is considered as an important industry, which is promising in short term and long term.

There are more than 20 local developers (mainly SOEs) and 10 Original Equipment Manufacturers (OEMs) active in China.

Top investors by 2021

- CHN ENERGY
- Three gorges
- CGN
- SPIC
- Huaneng
- Yancheng guoneng
- HECIG
- Guangdong energy
- Fujian energy
- State grid

Top OEMs by 2021

- Ming yang
- Gold wind
- Envision
- Shanghai electrics
- Dongfang electrics
- CSIC
- SANY
- SINOVEL

Chinese wind turbine manufactures are dominating the Chinese market. International players are slowly losing ground. By 2021, 6 local OEMs launched 10MW+ models for offshore wind.

Innovative technologies for future demand

- Floating: due to their geographic location, floating technology has more traction in Guangdong, Fujian and Zhejiang provinces. Interviews with developers and certifying agencies show that Chinese players are still trying to develop floating technologies themselves; potential business opportunities for foreign players are limited. Real interest of local developers and OEMs needs to be further investigated.
- Offshore wind Hydrogen: we do not see obvious interest in the short term to start offshore wind hydrogen projects from any of these regions or developers in their action plans. Some developers are doing feasibility research. It is possible to initiate joint demo projects for Sino-Dutch cooperation.

- Ecological protection: this is an important topic, but the policy and regulation for ecological protection is not yet developed in China.
- Sustainability of the offshore wind sector: this topic is also not considered as important in China. Certain provinces and regions might consider developing demo projects as part of their innovation plans though.

In this report, you will find a short overview of some of the main provinces in the offshore wind sector in China and potential business opportunities in these regions (namely: Guangdong, Jiangsu, Fujian, Zhejiang, Shandong, Liaoning and Hong Kong).

It is difficult to include all the details of the dynamic and complicated market that China is in one report, so we encourage Dutch companies to reach out to us for specific questions and interests in business opportunities in China

We have the following supporting government network in China with good knowledge of the offshore wind sector:

Embassy Beijing	Paheerya yushan Senior commercial officer (Energy) Paheerya.yushan@minbuza.nl
Consulate general Shanghai	Fleur Edens Senior Economic policy officer Fleur.edens@minbuza.nl
Consulate general Guangdong	Karin Han Deputy Head Economic & Commercial Department Karin.han@minbuza.nl
Consulate general Hong Kong	Betty Liu Senior Commercial officer Betty.liu@minbuza.nl
NBSO Nanjing	Richard He Deputy representative richard@nbsonanjing.com
NBSO Qingdao	Ming Eikelenboom Chief representative ming@nbsqingdao.com
NBSO Dalian	Yin hang Deputy representative nbsodalian@nbsodalian.com



JIANGSU

Jiangsu is home to around 55% of China's total grid connected offshore wind capacity. Main hotspots in the province are Yancheng, Nantong and Lianyungang.

The current total installed capacity by the end of 2021 is around 11GW, after having installed around 6GW in one year.

Despite the high quality of wind resources, the city of Lianyungang has only one offshore wind farm. The main reason is that offshore wind farms will have a negative impact on the operations of Lianyungang Port, as well as its aquaculture breeding and fishing.

Next to accelerating cost reduction efforts and promoting technological expertise, Jiangsu is increasingly looking into electricity transmission mechanisms and (research) projects focusing on cutting-edge technologies related to ocean pasture restoration, wave energy coupling, the development of offshore-integrated energy island demonstration zones, and green hydrogen production.

Potential business opportunities

- Consulting and designing services to improve the strategic planning in Jiangsu's energy sector.
- Services and solutions to enhance the strategy and mode of offshore wind farm operations and maintenance, such as O&M base construction, staff trainings, parts management.
- In wind power manufacturing there is interest in joint research on key technologies related to large-scale high altitude wind turbines and low-speed wind turbines, and to realize the popularization and application of wind power generation above 200 meters.
- New key technologies related to the design and construction of offshore wind farms.
- Key components, such as bearing, control systems, converters, blades for offshore wind turbines of 10MW and above with independent intellectual property rights.

Offshore wind targets and goals

By the end of 2025, the total capacity connected to the grid will be expanded with 4GW to a total of 15GW of offshore wind power. By the end of 2030, Jiangsu will strive to have connected a total of 30GW offshore wind power to the grid.



Business climate

Despite the market being dominated by state-owned enterprises, foreign players very are active in Jiangsu. Also on government-to-government level, European countries are actively engaging with the local authorities.

In Jiangsu, there is a strong focus on developing the full supply chain (and a supporting ecosystem) and investing in R&D related to large-capacity offshore wind turbines and enabling technologies.

Jiangsu has the most complete offshore wind power industry chain in China, represented by two wind power industry bases in Dafeng District of Yancheng and Rudong County of Nantong respectively. In 2020, the output value of Jiangsu's offshore wind power industry was about 100 billion RMB, ranking the first in the country.

Despite having a very mature supply chain and offshore wind market, the province still has potential for more projects (and thus business opportunities) due to its richness in energy resources and space available to scale-up the offshore wind capacity.

Government policy

In line with a joint statement issued by the relevant government departments (the Ministry of Finance, the National Development Reform Commission and the National Energy Administration), national subsidies for new offshore wind projects in Jiangsu will no longer be available.

Important players

The information from Jiangsu Province Energy Bureau shows that, despite the fact that Jiangsu is one of the richest provinces in China, Jiangsu will not release relevant local government subsidy measures during the 14th-five-year plan period. Partly, this can be explained by the fact that Jiangsu has a lot of potential to reach grid parity in the next 3-5 years due to the favorable weather & water conditions and a well-developed supply chain.

OEMs

Jiangsu Goldwind Technology Co., Ltd.
Envision (Jiangsu) Co., Ltd.
Shanghai Electric
CSIC
Mingyang Smart Energy
United Power (Lianyungang) Co., Ltd.
NGC
NARI
Smona Blade
Jiangsu CRRC Electric Co., Ltd.
Baosheng Marine Cable

Developers

SPIC Jiangsu Branch
China Three Gorges Renewables (Group), East China Branch
CGN Jiangsu Branch
Guohua Energy Investment Jiangsu Co., Ltd.
China Datang Group Jiangsu Branch
Huaneng Power Jiangsu Clean Energy Co., Ltd.
China Huadian Corp. Jiangsu Branch
Jiangsu Longyuan Offshore Wind Co., Ltd.
Jiangsu Guoxin Investment Group
Jiangsu New Energy Development Group

Knowledge institutes

Jiangsu Province Energy Bureau
Jiangsu Province Renewable Energy Industry Association
National Wind Power Engineering Research Center
National Wind Power Energy Technology & Equipment R&D Center
Jiangsu Wind Power Research Center (Southeast University)
Jiangsu Wind Turbine Structure Research Center (Hohai University)



GUANGDONG

Guangdong Province had planned 40 offshore wind farm projects for year 2021, 19 of them regarded as key construction projects while the other 21 projects in the preparatory phase. According to this plan, it was expected to reach 4GW installed and operating capacity by the end of the year. In fact, 6.5GW generated from 21 offshore wind farms have been connected to the power grid, successfully meeting the yearly target set for 2021.

Goals

- **Installed capacity:** 18GW total installed capacity and realization of grid parity by 2025; approximately 30GW in operation by the end of 2030;
- **Industrial development:** complete offshore wind turbine manufacturing capacity reaching 900 per year by 2025; realization of a complete supply chain with international competitiveness covering equipment R&D, engineering design, construction and installation, and operation and maintenance.

Target projects

Facilitate the construction of ongoing projects

Shanwei Jiazi 1, Shanwei Jiazi 2, Huizhou Port 2 PA, Huizhou Port 2 PB, Jeyang Shenquan 2, Jinghai, Shantou Haimen (Site 1), Shantou Haimen (Site 2, Site 3), Le Men (2), Yangdong, etc.

Start the construction of new projects included in the offshore wind development plan and located in the sea area governed by Guangdong Province: Qingzhou site and Fanshichang site located in the deep-water area of Yangjiang, and other projects. Yangjiang and Shantou will be the focused areas for offshore wind development in Guangdong in 2022.



Challenges in terms of installation

- Deeper water and larger foundation are definitely the future development trends for the offshore wind projects in Guangdong, which bring the challenges for installation;
- The seabed is characterized by soil and rocks, which make pile driving extremely time-consuming. As a result, large-diameter pile driving equipment and suitable installation vessels are very necessary. In this case, cost control becomes difficult;
- In addition, specific equipment are needed, such as jack-up vessels for deep-sea turbine installation, and floating cranes for large-scale deep-sea construction;
- Typhoon season is long here in Guangdong, which cause longer installation period and raise the project cost even higher. Meanwhile, accurate typhoon data collection becomes challenging as well;
- Due to the cancellation of the tariff subsidies, only some one-time subsidies at the local level would be available in the near future. Therefore, the cost for developers and construction contractors will go up. In terms of wind turbine foundation installation, locally produced products and equipment will be used more often to further reduce cost. Materials processing and manufacturing companies must lower their cost to enter or to be able to enter the market here.

Government policy

According to the current price policy, only offshore wind farms that can be connected to the grid at the end of 2021, can receive a subsidy of RMB 0.85/kWh. Starting from 2022, the provincial government will provide fiscal subsidies to projects that are not qualified for national subsidies. The status of the current government subsidy funding area as follows.

- **Projects qualified for this round of government subsidy funding (meeting all three criteria):**
 1. located in the sea area governed by Guangdong Province
 2. verified and approved by the end of 2018
 3. planned to be fully connected to the grid between 2022 to 2024
- **Different levels of subsidies granted to projects based on the grid connection time:**
 1. Full-capacity grid connection in 2022: RMB 1,500 per kW
 2. Full-capacity grid connection in 2023: RMB 1,000 per kW
 3. Full-capacity grid connection in 2024: RMB 500 per kW

Business climate

In Guangdong, offshore wind sector is market-driven. Cooperation with foreign companies started quite early. However, there were setbacks and frustrations shared by some Dutch companies in the past, as copied equipment found, preference of using domestic products, no transparency of project information, and so on. In recent two years, the market situation has been improved. More and more Dutch companies have secured projects in Guangdong even during Covid-19 period.

Developers and construction companies are open for innovative solutions of foundation installation, installation equipment and vessels. More budget reserved by developers for foreign equipment in order to tackle the challenges from actual construction work. Leading market players in Guangdong have also showed interests in new research topics, such as floating foundation, green hydrogen production from offshore wind, efficient installation technology, etc.

Potential business opportunities

There are always opportunities for cooperation if such cooperation can contribute to the reduction of cost and improvement of efficiency of offshore wind power projects in China, despite of the types of businesses.

More specific areas that have been identified for further collaboration opportunities are:

- There are market demand for developing floating foundation for deeper water, and relevant research project and pilot projects have been carried out. If Dutch companies would like to cooperate in this aspect, an ideal business model should be further explored, which should be well-adapted to the local market here;
- Large-diameter pile driving equipment;
- In general, construction and installation equipment and vessels, which help to improve the project efficiency and reduce costs;
- Offshore wind farm maintenance: O&M training, maintenance vessels;
- As for vessels, LNG powered engine, fuel gas supply system, smart navigation, smart ship and related advanced technologies and solutions;
- Authorized by Guangdong government, Yangjiang city is building an eco-system that covers the entire offshore wind power value chain. The eco-system consists of an offshore wind designated port. Knowledge exchange can be the first step to explore further collaboration opportunity.

Important players

Developers

China Three Gorges Corporation
China Guangdong Nuclear Power Company
China Energy Conservation and Environmental Protection Group
Guangdong Energy Group
Mingyang Smart Energy Group
State Power Investment Corporation
China Southern Power Grid
China Datang Corporation
China Huaneng Group

Turbine Manufacturers

Mingyang Smart Energy Group (Zhongshan, Yangjiang)
Shanghai Electric (Shantou)
Goldwind (Yangjiang)

Design

Guangdong Electric Power Design Institute Co., Ltd., China Energy Engineering Group

Construction

Guangzhou Salvage Bureau
CCCC First Harbor Engineering Company
CCCC Third Harbor Engineering Company
CCCC Fourth Harbor Engineering Company
Jinagsu Longyuan Zhenhua Marine Engineering Company
Huadian Heavy Industries
China Railway Major Bridge Engineering Company
Tianjin Port and Waterway Engineering Company
Nantong Offshore Construction and Engineering Company

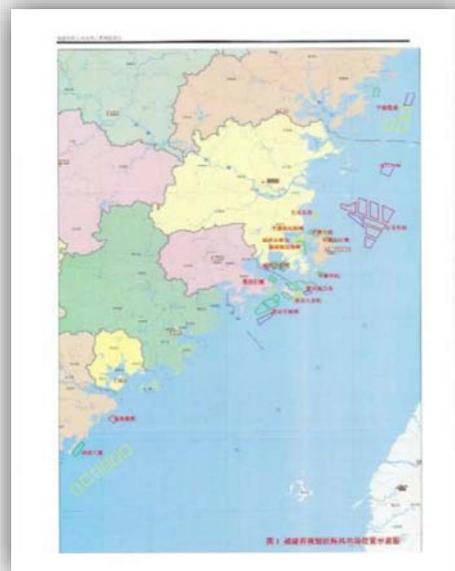


FUJIAN

According to the *Fujian Offshore Wind Development Plan* released in 2017, the total planned install capacity for the whole Province targets 13.3GW, including 17 offshore wind farms in Fuzhou, Zhangzhou, Putian, Ningde and Pingtan. By the end of 2021, the total installed capacity reached 3.14 GW, while the Provincial Government drafting the new plan to further boost the sector development.

Goals

In order to follow the successful European model and further drive project cost down, the local market will embrace the era of grid parity. Fujian government aims to develop a demonstration project of grid parity in China, which is located at the southwest side of the Taiwan Strait and the southeastern side to the coast of Zhangzhou city. The target total installed capacity is about 50GW.



Target projects

According to the recent news released by Zhangzhou government, after excluding the area protected by the marine eco-environment red-line, the area designated by the marine function zoning, anchoring area, shipping routes, and other sensitive factors, Zhangzhou government aims for developing 50GW installed capacity at the shallow-water site in south Fujian Province, which can be developed through the following phases:

- Phase I: 8 GW
- Phase II: 20 GW
- Phase III: 22 GW

Phase I will be the closest farm to the shore and can serve as the pilot area for the demonstration project. Three stages will be involved in the Phase I development: I-A (2,000MW), I-B (3,000MW), and I-C (3,000MW). It is expected that this plan will be approved by the end of 2022.

Challenges in terms of installation

- The seabed situation in Fujian is more complicated than Guangdong. It is characterized by rocks and silt, which requires longer and larger-diameter monopole. It makes pile driving time-consuming and cost control difficult;
- Typhoon season is long here in Fujian, which causes longer installation period and raise the project cost even higher. Therefore, improving the installation efficiency is a must;
- In addition, sea farming, maritime development and military restriction can affect wind turbine installation and construction as well.

Government policy

Before the official approval from the National Energy Administration (NEA) of the newest project development plan in Fujian, the provincial governmental supportive policies and related subsidies will not be available. At this moment, Fujian Development and Reform Commission encourages technical innovation, for example, encouraging the establishment of Fujian Provincial Engineering R&D center.

Business climate

In terms of technology innovation, the market players in Fujian are relatively open-minded, and willing to learn and adapt to the newest technology development. They are also open for joint research collaboration on certain topics, such as installation technology and floating turbine. However, Fujian market is not open to foreign investors due to its geographic location facing Taiwan and some military restrictions. For Chinese developers, it is also a big challenge for private companies to operate offshore wind farm projects. State-owned companies are preferred.

Potential business opportunities

There are always opportunities for cooperation if such cooperation can contribute to the reduction of cost and improvement of efficiency of offshore wind power projects in China, despite of the types of businesses.

More specific areas that have been identified for further collaboration opportunities are:

- Innovative foundation solutions;
- Efficient installation technology and equipment;
- Construction and installation vessels;
- Operation & maintenance is an area in offshore wind with huge potentials for cooperation. For example, the supporting facilities and equipment such as maintenance vessels, however, the good strategy of the Dutch side is key;
- Market demand for the equipment, such as geological survey equipment and positioning equipment and levelling instrument, also exists;
- Offshore long-distance electricity transmission cable;
- Energy storage technologies;
- Floating wind farms and floating PV farms can be another focus. The fact is that it is very challenging for the Dutch business models to be accepted by the Chinese market because Dutch companies want to provide services covering design, construction and maintenance, which would not be accepted by the Chinese counterparts. As a result, finding a suitable business model is essential;
- Ningde Municipal Government is planning to build the city as an international ocean demonstration city and further develop ocean energy, including offshore wind, floating solar, tidal energy, ocean current energy, offshore energy storage, offshore wind to hydrogen, etc. It is planned to set up a coastal engineering research center this year, where companies, universities and knowledge institutes can work together to jointly develop relevant projects. There is a chance that foreign parties can be possibly involved in project planning phase.

Important players

Developers

China Three Gorges Corporation

China Huadian Group

Fujian Funeng Strait Power Generation Company

Fujian Zhongmin Energy Investment Co., Ltd.

State Power Investment Corporation

Fujian Shipbuilding Industry Group

Fujian Sanchuan Offshore Wind Investment Co., Ltd.

China Guangdong Nuclear Power

China Power Engineering Consultancy Group

Fujian Ningde Mindong Energy Co., Ltd.

Turbine manufacturers

Mingyang Smart Energy Group
Goldwind
Dongfang Electric Corporation
Shanghai Electric

Design

Fujian Yongfu Power Engineering Co., Ltd.
Fujian Provincial Investigation, Design & Research Institute of Water
Conservancy & Hydropower

Construction

CSSC Huangpu & Zhengli Offshore Engineering Co., Ltd.
CCCC First Harbor Engineering Company
CCCC Third Harbor Engineering Company
Huadian Heavy Industries
China Railway Major Bridge Engineering Company



ZHEJIANG

Zhejiang province is relatively late in developing the offshore wind sector.

However, the weather and water conditions are good: the average wind speed is 7.2-8.5 m/s and in the past 50 years, the highest wind speed recorded exceeded 50 m/s. Geologically the Zhejiang seabed can be characterized by a very thick silt layer. The area is also typhoon prone, especially the area near the city of Wenzhou.

In general the Zhejiang offshore wind players are interested in topics that are receiving attention globally and nationwide. Zhejiang authorities (and companies) are interested in further dialogue on:

- Green hydrogen production
- Floating wind
- Deep sea exploration
- Environmental protection.

Potential business opportunities

More specific opportunities for further collaboration:

- Anti-typhoon wind turbines
- Wind measurement equipment
- Design of wind generators
- Design of flexible HDVC transmission and converter stations.

Offshore wind targets and goals

Zhejiang has announced to build 4.5GW of extra offshore wind capacity during the 14th five-year plan (2021-2025). 2030 goal: total installed capacity of 10 GW.

Offshore wind is one of the renewable energy pillars in the national 14th five year plan and it is the first time Zhejiang province emphasizes offshore wind as one of the focus areas. Zhejiang is not one of the frontrunners in the sector but is accelerating its efforts fast.

The produced green energy will be partly used to support the gas and oil business – which is one of the biggest industries in Zhejiang province. The province harbors the port of Ningbo-Zhoushan, which ranks third in top 50 largest container ports worldwide.

Collaboration with foreign construction consultancies is going on with the authorities in Zhejiang since 2015.

Business climate

Collaboration with European companies has been mainly focused on information and knowledge sharing and R&D related to topics such as geological research, new models of wind turbines, and wind resources analysis. For the moment, the local supply chain is dominated by Chinese (state-supported) companies.

Government policy

With the phasing out of national subsidies, Zhejiang is looking into establishing a local financial subsidy system to stimulate offshore wind developments. However, details have not been revealed yet.

The local government is also aiming to have wind turbine assembly bases in the province to strengthen the supply chain. Big turbine manufacturers Envision and Shanghai Electric already have preliminary confirmed plans with the local authorities. If this materializes, it will increase the relevance of the city and province in the domain of offshore wind and can incentivize more activity (and lead to more players) in the province.

Important players

Investment

State Grid Investment Group
China Huaneng Group
China Datang Corporation Renewable Power Co., Ltd.
State Power Investment Corporation
Zhejiang Provincial Energy Group Company Ltd.
China Three Gorges Corporation
China General Nuclear Power Corporation
China Resources Power

Turbine manufacturers

Zhejiang Windey Co., Ltd.
Envision
Huayi Wind Energy Co., Ltd.

Design

PowerChina Huadong Engineering Corporation Ltd.

Construction

CCCC Sanhang (Shanghai) New Energy Engineering Co., Ltd
Huadian Heavy Industries



SHANDONG

Shandong province has a coastline of 3345km (ranking the second in China) and boosts a lot of potential for offshore wind. The wind speed is relatively low but the weather conditions are favorable (e.g. not typhoon prone). Broadly stated Shandong is focusing on the energy transition and the acceleration of the development of offshore wind bases receives a lot of attention recently.

- current installed capacity: 2 projects, 600MW in total by end of 2021.
- planned capacity: develop 10GW by 2025; finish the grid connection of 5GW.
- potential capacity that region believes they have is 35GW

As an emerging market in the field of offshore wind power, Shandong pays more attention to more comprehensive offshore energy projects in addition to offshore wind power installation, operation and maintenance. Concrete business opportunities are visible in the area of floating wind, and in the domain of developing new technologies focusing on combining offshore wind with e.g. green hydrogen production, floating solar, and/or fishery.

Offshore wind targets and goals

With three major offshore wind power bases in its region (Bozhong, the south of the peninsula, and the north of the peninsula), Shandong strives for a number of million-kw- level projects to achieve large-scale effects.

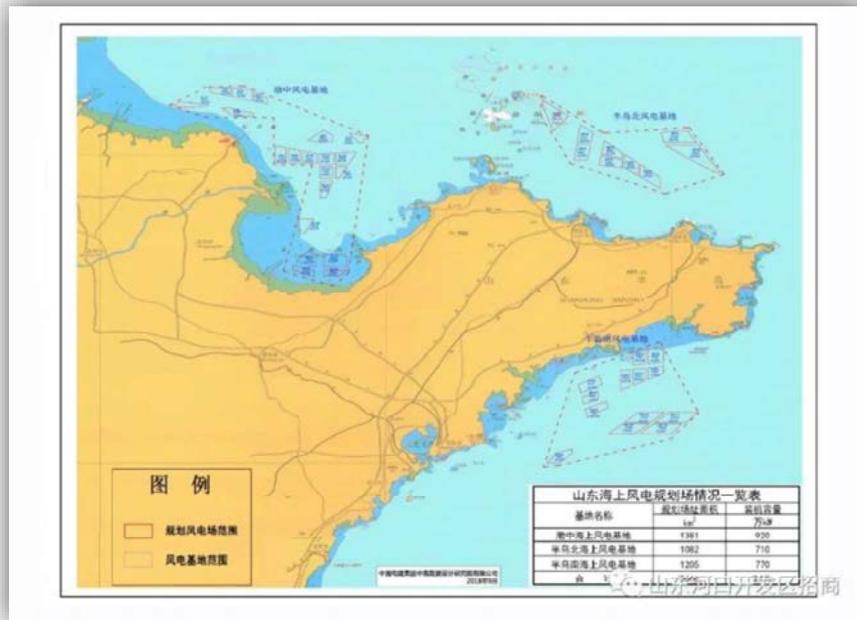
It is actively engaged in the wind power equipment industry cluster and supply chain, aiming to construct an offshore wind power homeport in northern China. In their ambitious plan, in the longer term they would like to be the base also for Korean and Japanese projects.

Shandong plans to gradually promote the development of offshore wind power to the deep sea, select some sites to carry out the demonstration of offshore wind parity in the deep sea, and promote innovative applications such as floating wind and flexible DC transmission technology.

Business climate

Shandong's GDP output ranks third in China after Guangdong and Jiangsu. As an economic powerhouse in China, Shandong's main energy source has been coal power in the past. Although compared to Guangdong and Jiangsu, Shandong is relatively late in offshore wind developments; it will be a very important part of their energy transformation strategy and a necessary direction.

As the birthplace of Confucius, people from Shandong are well known for their hospitality. Both local government and companies are open to cooperation with international companies. Dutch companies' leading position in the offshore wind sector has been well recognized in Shandong. However, due to the lack of experience of local governments and key players in this field, the approval of new projects and the progress of international cooperation are relatively slow currently.



Government policy

At the moment, there is no local subsidy in Shandong. However, the government has recently released several official documents proposing to accelerate the development of offshore wind power in Shandong. The 14th Five-Year Plan for Shandong Offshore Wind Power has been completed and is now awaiting approval from the central government.

Important players

Developers

Huaneng Shandong Power Generation Co., Ltd.
 State Power Investment Shandong New Energy Co., Ltd.
 Three Gorges New Energy Shandong Changyi Power Generation Co., Ltd.

OEPC contractors

Shandong Electric Power Engineering Consulting Institute Co., Ltd.
Power China Huadong Engineering Co., Ltd Shandong Branch (*very important organization for designing and EPC process of the projects)

Equipment manufacturers

Dajin Heavy Industry (Yantai)
Mingyang Smart Energy (Weihai)
Envision Energy (Yantai, Weihai)
Shanghai Electric New Energy Shandong
CIMC (*one of the biggest vessel design and production company who signed the contract with Van Oord in 2021 for new generation installation vessel)

Alliance

China Northern Wind Power Alliance (*important alliance for the development of local supply chain)



LIAONING

Liaoning province is relatively new in developing offshore wind. There is only 1GW project developed (Zhuanghe city).

In the 13th 5-year plan, Liaoning got approved projects for 1.9 GW. By the end of 2021, 1.05 GW have been completed and put into operation. Completed projects:

- Datang Zhuanghe I (100MW) Wind farms
- CSIC Zhuanghe II (300MW) Wind farms
- China Three Gorges New Energy Zhuanghe III (300MW) Wind farms
- China Huaneng Zhuanghe IV (350MW) Wind farms.

The second phase of the plan for the wind farms in Zhuanghe was about 1.35 GW, but has not been approved by NEA yet. The province does have potential: the coastline is 2100 km and the weather conditions are favorable. The locations of windfarms for future planning will be in Changhai Island, Jinpu area and Wafangdian city. However, challenges are also faced: complex seabed conditions and floating ice in the cold winters.

Liaoning has, like other provinces, the energy transition and clean energy solutions high on the agenda. Within those priorities **business opportunities** can be identified, for example related to energy storage and new solutions and materials.

Offshore wind targets and goals

According to the local government, the first phase of the offshore wind plan was approved with 1.9GW, 8 wind farms and an estimated investment of 3.5 billion CNY.

The second phase of the plan is about 1.35GW.

In September of last year, the China Merchants Group Taipingwan Development company in Dalian signed a cooperation agreement with several leading energy companies to further develop offshore wind projects in the Dalian Taipingwan area.

In December 2021, Dalian Changhai Island government signed a cooperation agreement with the China State Shipbuilding Corporation (CSSC) to develop offshore wind equipment on Dalian Changhai Island.

Government policy

At the moment, there is no information on regional subsidies in Liaoning.

Important players

Developers

China Three Gorges New Energy Group

CGN Group

SPIC Group

China Huaneng (Zhuanghe) Power Generation Co., Ltd.

China Datang (Zhuanghe) Power Generation Co., Ltd.

Turbine manufacturers

Luoyang Sunrui Wind Turbine Dalian Branch

Construction

CSSC Dalian

Power China Huadong Engineering Co., Ltd.

Design institute and companies for EPC contracts

Shanghai Investigation, Design & Research Institute Co., Ltd

Power China Huadong Engineering Co., Ltd



HONG KONG

With the announcement of the Hong Kong Government to reach carbon neutrality before 2050 the goal is to increase the share of renewable energy for electricity generation from the existing (less than 1%) to 15% before 2035.

Because of the limited renewable sources on land, the government actively explores the potential of offshore wind farms. With the Feed-in-tariff (FIT) policy launched by the two largest local electricity generators in 2018, companies rushed the installation of renewable energy power systems at their premises, including solar and wind power systems, and sell the generated energy to power companies at a rate approx. five times higher than the normal electricity tariff rate.

In 2020, about 200MW of electricity was generated by 14,000 approved small-scale renewable energy installations per year. Around 1.5% of those installations are onshore wind farms.

Government policy

The lack of government support remains a limiting factor for the development of offshore wind in Hong Kong. Both the government and the two largest power companies (Hong Kong Electric and CLP Power) are negative about the long-time payback, high risk, and low return on projects. Mainly because of this, the growth of renewable energy has been stagnating during the last two decades.

However the government announced ambitious carbon neutrality goals and it is the responsibility of the two big electricity generation companies to facilitate the energy transition. To succeed more favorable policies for wind farm projects are needed.

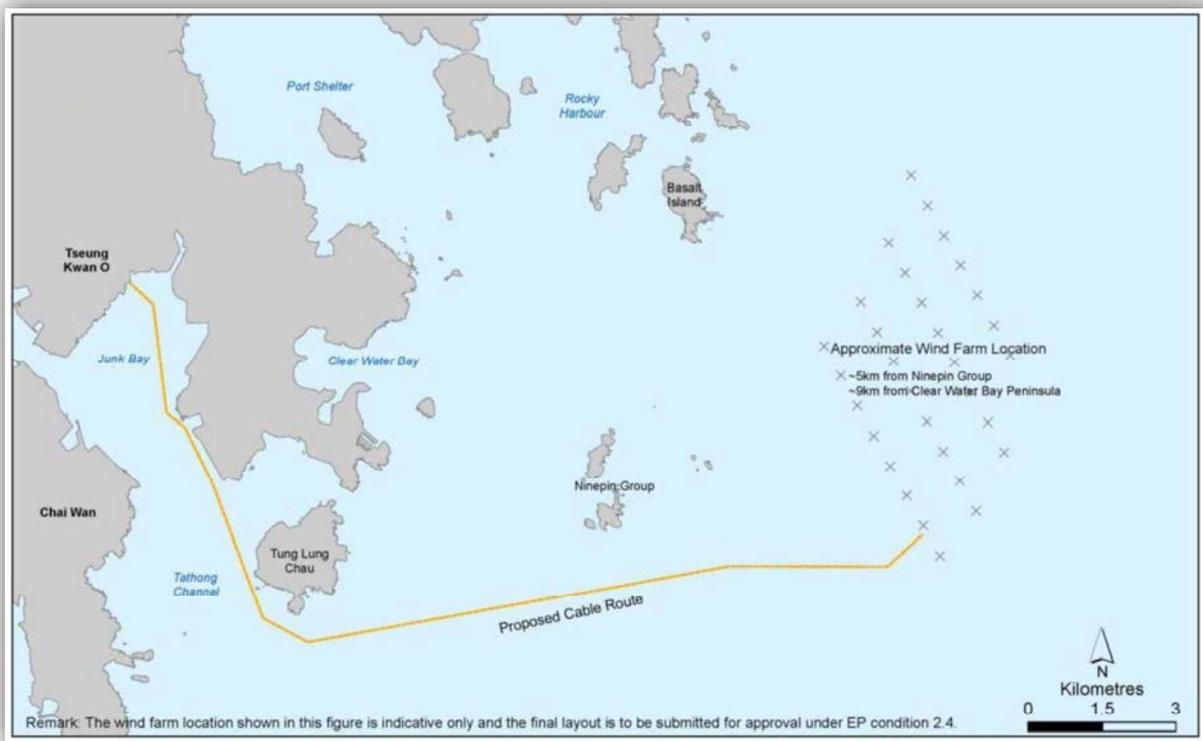
Potential business opportunities

Currently, Hong Kong does not have operating offshore wind farms and therefore differs from the developments on Mainland China. There are not many local market players.

However, offshore wind is receiving increased attention. In 2012, a monitoring station and an offshore met mast had been set-up by Hong Kong Electric and CLP Power respectively to gather relevant data in order to identify the potential.

As of now, two projects have been announced by the two main electricity generation companies:

- Hong Kong Electric proposed to build an offshore wind farm which would be located at a 600-hectare site about 3.5 km southwest of Lamma Island featuring up to 33 wind turbines. Each turbine would be 3.6MW with the wind monitoring station at the windfarm. The total generating capacity of around 100MW is expected to produce 175 million units of electricity per year. This is equivalent to 1.5% of the yearly electricity output of the company. The construction of the proposed wind farm is contingent upon government approval.
- The other project is proposed by CLP Power and entails a windfarm located at the southeastern waters with a total capacity of 250MW. CLP Power will appoint a consultancy firm for the project development strategy, as well as for the preliminary engineering services including preliminary wind farm layout, concept foundation design, electrical concept and the transport & installation concept. Expected work is commenced in 2024-2028 and will provide approximately 1% of total annual generating capacity of CLP Power.



Information on the CLP Power project

Location

Southeastern waters, approx. 9 km and 5km east of the Clearwater Bay peninsula and East Ninepin Island

Components

- Up to 31 units of 5MW wind turbines
- 1 offshore transformer platform
- 1 Research mast
- Subsea collection and transmission cables
- Distribution on site = 33kV cables
- Transmission to shore = 2 x 132kV cables

Foundation Type

Tripods /suction caissons method

Design Life

Typical turbine design is 20-25 years

Specific areas with business opportunities are:

- Marine ecology protection
- Subsea cabling, offshore foundations
- Cost effective installation process
- Grid capacity and transmission
- Operation & maintenance issues and,
- Green hydrogen production.

Typhoons, seismic waves, and rocky seabed conditions can pose challenges for Dutch companies. Furthermore, the two above-mentioned big players are not in favor of floating wind due to concerns about the technical feasibility and the impact on the environment. This requires foreign market players to come up with models and ideas that have the impact on the environment identified as a priority.

On the G2G, level there is potential to engage in further dialogue with the Hong Kong authorities when looking at how the offshore wind market matured in the Netherlands. This has been incentivized by a framework of policies that can serve as an example for Hong Kong.

NI Netherlands

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This publication was commissioned by the ministry of Foreign Affairs.
© Netherlands Enterprise Agency | March 2022

Publication number: RVO-085-2022/RP-INT

NL Enterprise Agency is a department of the Dutch ministry of Economic Affairs and Climate Policy that implements government policy for Agricultural, sustainability, innovation, and international business and cooperation. NL Enterprise Agency is the contact point for businesses, educational institutions and government bodies for information and advice, financing, networking and regulatory matters.

Netherlands Enterprise Agency is part of the ministry of Economic Affairs and Climate Policy.