

OFFSHORE WIND ENERGY IN COLOMBIA

BACKGROUND

Colombia has been seeking to transition to greater use of renewable energies for some years now. According to the website of the Metropolitan Area of the Aburrá Valley (2022), primary energy production in Colombia mainly comes from hydroelectricity, followed by fossil fuels such as oil, gas, and coal, of which reserves are already running out. This reliance on hydroelectricity is due to the national topography, the abundance of water in the territory, and natural characteristics that allow for the development of dams.

Recently, the country has been implementing wind energy as an alternative. It started onshore, with the Jerípachi wind park. This park has been in operation since April 2004, with an installed capacity of 19.5 MW. After a period with low development, wind farms started to take off in Colombia. The Guajira I wind park has been in operation since January 2022, and is the first of 16 wind farms planned in La Guajira. It has an installed capacity of 20 MW.

Guajira I falls into a larger trend of wind energy development in la Guajira. The following are the top onshore wind farm projects which are being developed following Guajira I, by capacity:

- **Andrea Jusayu (formerly known as Cerrito)**

Owner: Desarrollos Eólicos Uribia

Proposed capacity: 378MW

Location: Uribia, La Guajira

Project phase: feasibility studies

Expected completion: December 2023

- **Guajira II**

Owner: Isagén

Proposed capacity: 325MW

Location: Maicao, La Guajira

Project phase: pre-feasibility, technical studies.

Expected completion: December 2022

- **Alpha**

Owner: Vientos del Norte

Proposed Capacity: 212MW

Location: Maicao, La Guajira

Project phase: feasibility studies

Expected completion: June 2022

- **EO200i**

Owner: Empresas Públicas de Medellín

Proposed capacity: 201MW

Location: Uribia, La Guajira

Project phase: feasibility studies

Expected completion: February 2023

- **Carrizal**

Owner: Jemeiwaa Kai

Proposed capacity: 195MW

Location: Uribia, La Guajira

Project phase: feasibility studies

Expected completion: February 2023

- **Electric House**

Owner: Jemeiwaa Kai

Proposed capacity: 180MW

Location: Uribia, La Guajira

Project phase: feasibility studies

Expected completion: February 2023

These developments caught the attention of Ecopetrol, the second largest oil company in Latin America. In 2021, it began pilot tests to measure the wind energy potential in areas near its operations in Cartagena. The objective is to evaluate the viability of building wind farms that will enable the company to supply part of the energy demand in this region of the country with renewable energy. The measurement is made by means of a 150-meter-high meteorological tower installed in the Casablanca lot, adjacent to the Cartagena refinery. (El Tiempo, 2021)

Despite these developments in onshore wind parks, plus the benefits of higher production with less visual and noise pollution, offshore wind energy has not yet been implemented.

That is why, following the Renewables Consulting Group's initiative in 2019, Colombia started the development of an offshore wind energy project in Barranquilla hand in hand with Copenhagen Infrastructure Partners. This wind park is estimated to produce 350 MW of energy and could attract investments of USD 1 billion.

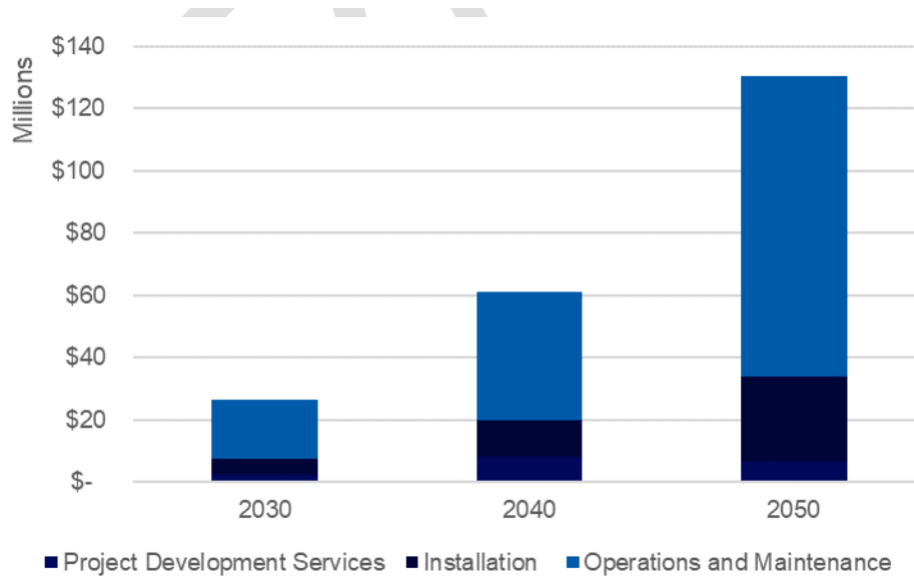
This is the beginning of an industry that could attract long-term investments of up to USD 27 billion by 2050. According to Reuters (2022), the potential that can be developed is approximately 50 GW, tripling Colombia's current installed capacity of 17.7 GW.

Investors interested in these projects are major players worldwide, including American and European companies. The first stage of investments is important for development of the electricity sector and for new port developments. Depending on the size of future developments, a whole new logistics chain might be required. (Figuerola, 2022)

The World Bank Group (2022) mapped out two possible scenarios for the future of the industry:

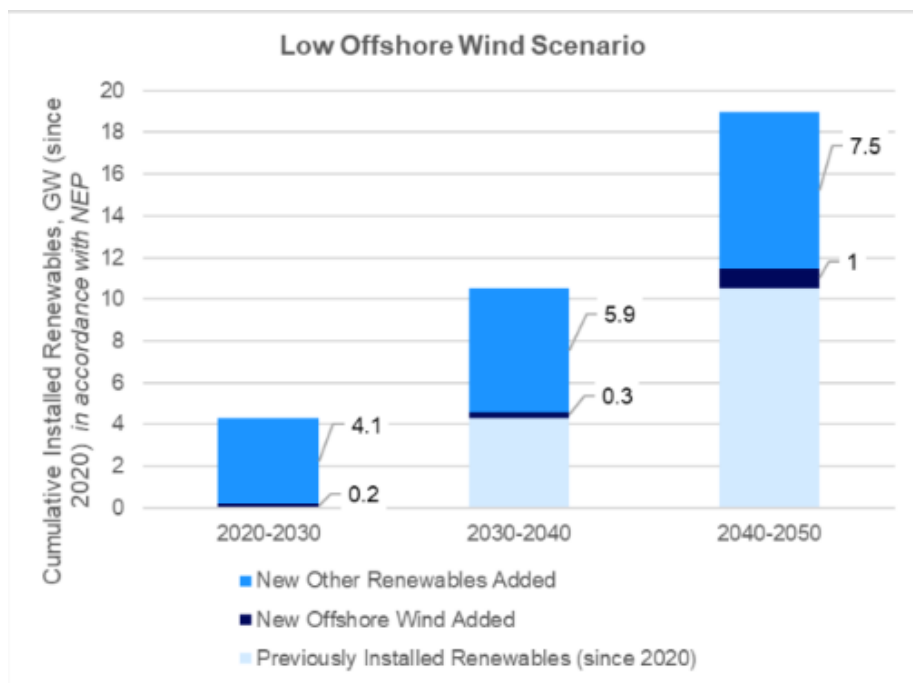
1. Low: It foresees production of 200 MW by 2030, 500 MW by 2040 and 1.5 GW by 2050 (cumulative basis). This would occur if the industry were to develop with smaller projects (< 500 MW), without a national strategy. Transmission expansion would not be necessary in this scenario.

Estimated direct local spending in the case of a low growth scenario is shown in the following graph:



Source: Renewables Consulting Group (2022)

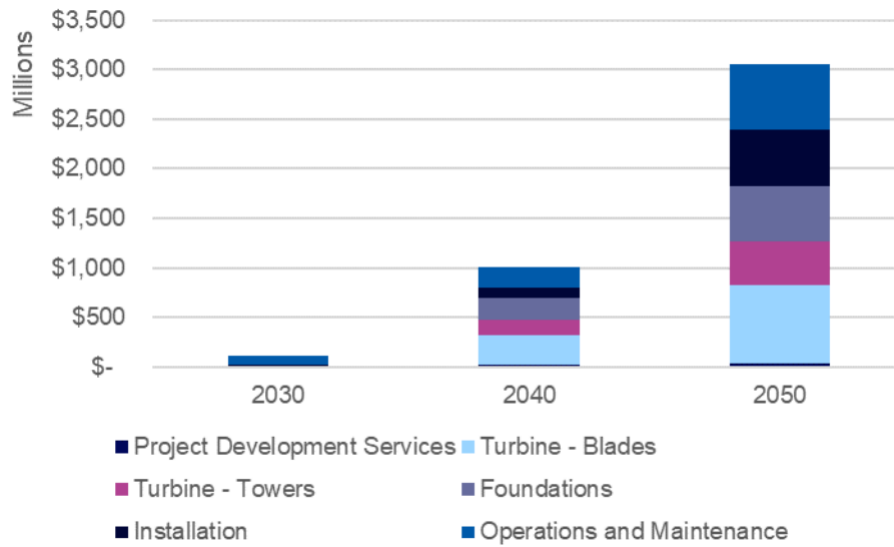
Estimated timeline in the low growth scenario:



Source: Renewables Consulting Group (2022)

- High: It foresees production of 1 GW by 2030, 3 GW by 2040 and 9 GW by 2050 (cumulative basis). This could happen in the case of commercial-scale development with a national plan. In this case, transmission upgrades would be necessary.

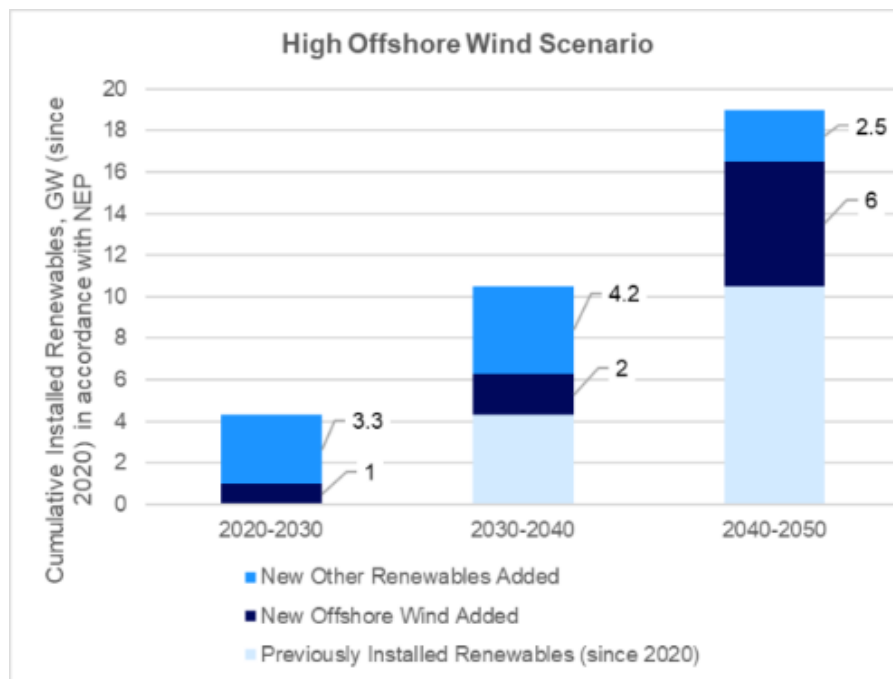
Estimated direct local spending in the case of a high growth scenario is shown in the following graph:



Source: Renewables Consulting Group (2022)

Unlike the low growth scenario, the high growth scenario would encourage a greater amount of investment in varying parts of the supply chain.

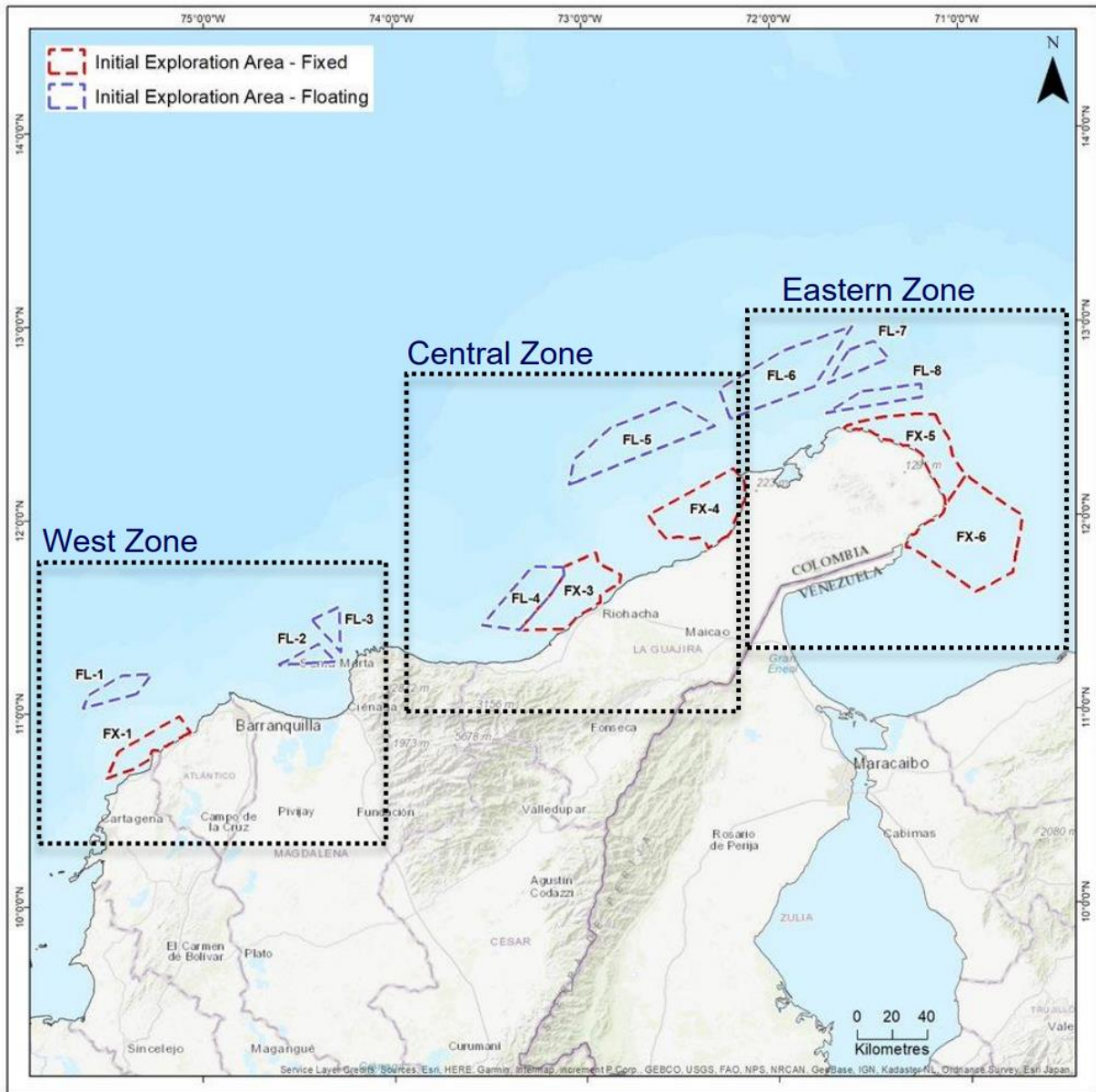
Estimated timeline in the high growth scenario:



Source: Renewables Consulting Group (2022)

LOCATION

In order to determine the appropriate locations for the projects in question, factors such as wind speed, bathymetry, geology, technical potential, technical factors, restrictions, etc. are taken into account.



Source: Renewables Consulting Group (2022)

After these analyses, the following area of interest was obtained, both for fixed (FX-1-6 on the map) and floating (FL-1-8 on the map) offshore wind power:

The western zone includes the departments of Bolivar, Atlántico and Magdalena; the eastern zone includes the Eastern Peninsula of La Guajira - and the central zone includes La Guajira.

All these zones have different sizes and energy deployment potentials. These indicators can be found in the following table:

Site ID	Area (km2)	Nominal reference capacity (MW)
FX-1	550	2,200
FX-3	1,150	4,600
FX-4	1,400	5,600
FX-5	1,200	4,800
FX-6	2,500	10,000
Fixed Bottom Potential	6,800	27,200
FL-1	350	1,400
FL-2	200	800
FL-3	200	800
FL-4	800	3,200
FL-5	1,550	6,200
FL-6	1,550	6,200
FL-7	350	1,400
FL-8	400	1,600
Floating Wind Potential	5,400	21,600

Source: Renewables Consulting Group (2022)

These projects will be awarded to interested companies in the form of concessions by the Colombian state. The financing of these projects is usually provided by experienced international financiers such as international banks, international financial institutions, development finance institutions, etc.

CURRENT STATUS

In the past couple of years, wind and solar energy has been increasing rapidly in Colombia. In 2018, the share of these energy types in the electricity portfolio of the country was 50 MW, 1% of the total electricity supply. In 2019, it had increased to 180MW, representing 1.5%. Growth accelerated and in 2020 it had reached 1500MW. It is expected that by 2022 it will reach 2500MW, corresponding to 10% of Colombian energy supply.

Colombia is one of the most vulnerable countries to climate change and the weather phenomenon “El Niño”, which lowers the level of the sea drastically affecting the generation of energy from hydroelectric power systems. (Arce & Bayne, 2020). Right now, Colombia is working with a strategic plan for low carbon development (ECDBC). The objective of this plan is to facilitate and promote the conditions to put the country on the path to economic development with low greenhouse gas emissions. The ECDBC is one of the short and medium-term programs integrated into the 2050 Strategy to achieve carbon neutrality and mitigate the effects of Climate Change. (Ministerio de Ambiente de Colombia).

According to rumors in the Colombian energy market, the Colombian government could implement a tax reduction or exemption for investors to support the inclusion of offshore energy farms into their portfolios. One of the main reasons for implementation of offshore energy technology is the reduction of carbon dioxide emissions in the country. Through policies like this, Colombia could accomplish the goal of reaching carbon neutrality by 2050. (Arce & Bayne, 2020).

MAIN ACTORS

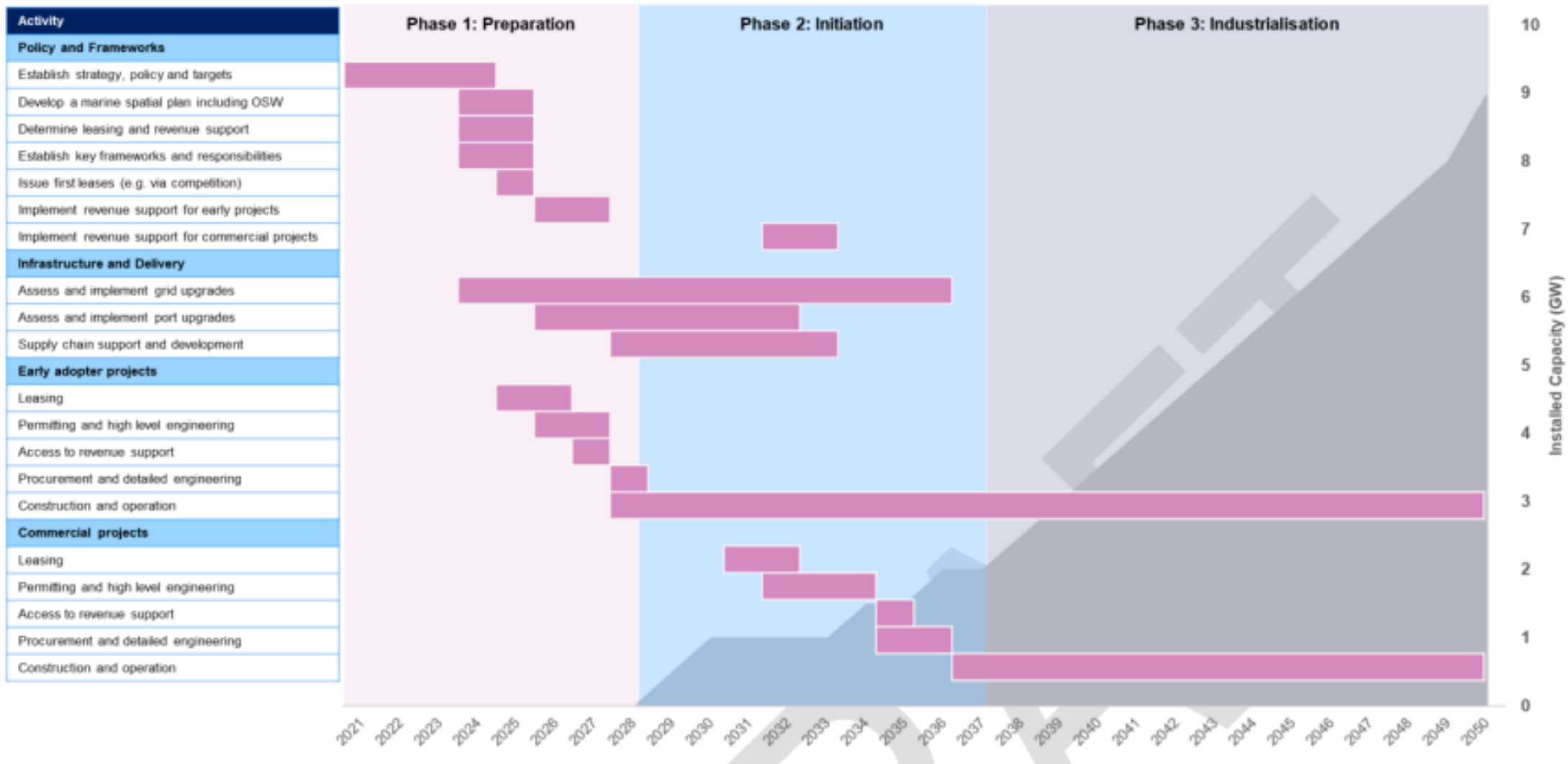
According to the World Bank Group (2022), the following organizations and public institutions are involved in the implementation of the various projects that will enable the development of the industry:

- Ministerio de Minas y Energía (MME)
- Autoridad Nacional de Licencias Ambientales (ANLA)
- Unidad de Planeación Minero Energética (UPME)
- Agencia Nacional de Hidrocarburos (ANH)
- Dirección General Marítima (DIMAR)
- Autoridad Nacional de Acuicultura y Pesca (AUNAP)
- Ministerio de Hacienda y Crédito Público (Minhacienda)
- Ministerio de Ambiente y Desarrollo Sostenible (Minambiente)
- Comisión de Regulación de Energía y Gas (CREG)
- Instituto de Investigaciones Marinas y Costeras (INVEMAR)
- Corporación Autónoma Regional de La Guajira (Corpoguajira)
- Corporación Autónoma Regional de Magdalena (CORPAMAG)
- Corporación Autónoma del Atlántico (CRA)
- Dirección de la Autoridad Nacional de Consulta Previa (DANCP)
- Asociación de Energías Renovables de Colombia (SER)
- Ministerio de Defensa Nacional
- Colombia Aeronáutica Civil
- Ministerio de Comercio, Industria y Turismo
- Organización Nacional Indígena de Colombia

Relevant private companies and institutions are:

- Vientos Alisios
- Mainstream Renewables
- AES
- ENEL Green Power
- Isagen
- Grupo EPM
- EDP Renovables

Exhibit 5 Policy implementation and development timeline for the High scenario



Source: Renewables Consulting Group (2022)

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