

# Road map of the offshore wind development in Costa Rica: Challenges and Opportunities

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**Keywords**—Road map, metocean data, infrastructure, social acceptance, Costa Rica.

## I. INTRODUCTION

OFFSHORE wind will be a core pillar of the global energy transition, supported by increasing public commitment to decarbonization and widescale electrification measures. As a cost-competitive, and reliable source of renewable energy, with higher capacity factors and lower variability than other renewable energy technologies, offshore wind offers a great resource for clean power and energy security (IRENA, 2019).

Offshore wind is also a lever for generating economic growth by starting green jobs which can be sustained over the 25-year lifetime of a project and regenerate coastal communities. A supply chain of industrial, business and service activities supporting an offshore wind sector is often concentrated in coastal areas, extending opportunities to regenerate the economy of coastal communities (GWEC, 2022).

Global technical potential for fixed and floating offshore wind is 71,000 GW – enough to meet the world’s current electricity demand 18 times over – and most of this potential remains untapped, according to the World Bank. In markets with rising power demand and climate commitments, offshore wind offers a solution to generate carbon-free electricity at increasingly affordable prices (IRENA; 2019). According to GWEC Market Intelligence, the offshore wind market is growing quickly, forecast to increase by 19% the annual growth rate over the next five years, with activity largely concentrated in Europe, China, elsewhere in Asia (Taiwan, Japan, Korea, Vietnam) and the USA (East Coast) (GWEC, 2023).

### Case of Costa Rica

Located in the middle of the Central America tropical belt, Costa Rica represents a core zone with thousands of megawatts of non-conventional offshore energy available in the Pacific and the Caribbean coasts. This small emergent economy has shown commitment to renewable energy and environmental stewardship, and in recent years has achieved nearly 100% electricity generation from renewable energy sources. The Costa Rican government is

committed to maintaining and improving these levels (Cornick, 2020).

The existing electricity matrix is based on onshore sources; in 2022, the generation mix comprised 68.6% hydropower, 17% wind, 13.5% geothermal and 0.84% biomass plus solar. The commitment is to keep producing almost 100% of electricity from renewable energy. Hydropower, geothermal and onshore wind energy currently stand out as the three largest renewable energy sources with lowest greenhouse gas emissions factor (33.5 tCO<sub>2</sub> / GWh) in Central America region. Based on this electricity mix, Costa Rica is at the forefront of environmental sustainability, climate action and driving the energy transition (ICE, 2022).

However, Costa Rica’s parallel aim to ensure energy security through the country’s climate change resilience paths requires further diversification and growth of electricity generation. Offshore renewables should play a bigger role, not only to mitigate global warming and provide a clean and reliable source of energy, but also to exploit marine energy solutions, boost coastal economic revitalization and enhance innovation and job creation opportunities.

Based on the Costa Rican Institute for Electricity (ICE) studies, Costa Rica has near of 17 GW of technical resource potential for offshore wind with 1 GW of fixed foundation potential at water depths up to 50 m and 16 GW of floating foundation potential at water depths from 50-1,000 m. This area with favorable offshore wind resource is in the sector of Punta Descartes, in the country’s northwest (Figure 1). Notably, any new power generation sources will need to avoid any adverse impacts on the environment and biodiversity, as well as harmful impacts on human communities like population displacement, touristic activities, and social acceptance.

Regarding current condition, during the end 2021 and the mid-2022, the Ministry of Environment and Energy (MINAE), Costa Rican Institute for Electricity (ICE), and the Global Wind Energy Council (GWEC) planned an offshore wind road map for Costa Rica focused on knowledge-sharing and market readiness assessment. The purpose of this road path was to develop understanding of offshore wind benefits, costs and considerations among relevant government agencies, regulators, and the

epistemic community in Costa Rica; as well as identify the strengths and gaps for offshore wind development.

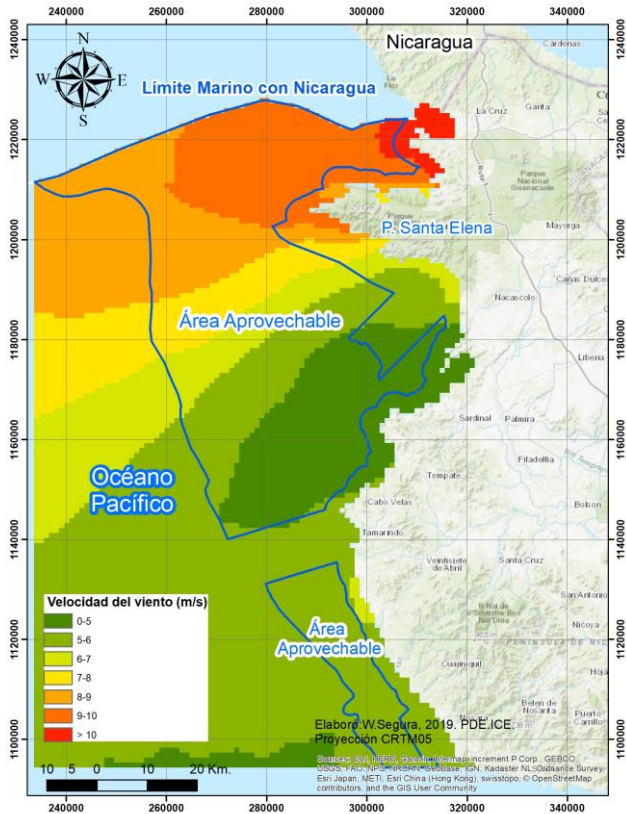


Fig. 1. Area of study, Punta Descartes, North Pacific, Costa Rica.

## II. METHODS

The road map activities were facilitated by GWEC, MINAE and ICE using an Offshore Wind Market Readiness Assessment (OWMRA) tool, which adopts a knowledge management technique regarding communities of practice and is based in 12 aspects: a. policy, b. stakeholders, c. legal, d. health and safety, e. consenting and permitting, f. grid connection, g. offtake and revenues, h. projects, i. services and supplies, j. finance, k. installation and commissioning and l. operation and decommissioning.

The OWMRA tool works in five steps to capture an evidence-drawn assessment of market readiness on a national level, transfer knowledge between practitioners and identify the knowledge/resource challenges across community practices. The steps are:

1. Identify a cross-section of experienced people who have an interest in one or more of the twelve practices, and who together cover all the practices.
2. Work through the model practice-by-practice, noting the strengths.
3. Consider the evidence for each chosen level and record the score for each of the 12 practices. (Scores: Level 1 = Foundation; Level 2 = Average; Level 3 = Good; Level 4 = Excellent; Level 5 = World Class)

4. Select four practices as priorities for improvement for the country and identify an objective score, two years from now, for each one.
5. Lastly the group should identify two practices where they are willing to share some information about as an area of strength, and two practices where they would appreciate input and experience from other members of the community.

In addition, MINAE, ICE and GWEC conducted a second workshop focused on knowledge-sharing, education about offshore wind and delivered over the market readiness assessment. Then, MINAE, ICE and GWEC organized and facilitated preparation of materials and presentations for participants; procuring speakers; conducting short pre-workshop interviews with each participant of the OWMRA meetings; organizing the logistics and communications; and compiling a written record and summary report on the workshops. These events were attended by key stakeholders with a real technical or political role in the offshore wind in Costa Rica, including delegates from academia, NGO's and public and private institutions.

Through preparatory interviews and facilitated group discussion, the workshop probed into what offshore wind capability Costa Rica already has and which can be built upon, as well as the resource, legal, infrastructural, and other gaps that will need to be filled. The points raised were compared with the level descriptors for each of the 12 practices. Following the meetings, a separate seminar was held with MINAE, GWEC and ICE personnel and objectives were discussed and set. Focus is on creating projects plus developing equipment and services over the next 2-5 years.

## III. RESULTS

The main findings show that, regarding market readiness, Costa Rica is strong on the topics of policy, stakeholders, grid connection and finance. There are improvements to be made on elements specific to offshore wind, but they are made easier because the core practices are good.

Since no offshore wind is in development in Costa Rica, scores are naturally low on projects (related to offshore renewable energy), equipment & service supply, installation & commissioning, and operations & Decommissioning. These practices will improve once projects start to be developed. In the short term, these are not priority areas to focus on improving, but will become so in the medium to long-term.

The areas which most require attention in the short term are legal (regulation and permitting authorities, legal frameworks, procedures), health & safety, consenting & permitting and offtake & revenue. Again, there are topics that are specific to offshore wind but others which are

more general, to do with renewable energy and the electricity market. Concrete recommendations are made below which can be implemented in the next couple of years. Overall, Costa Rica scores well for a new market, above other new markets which are interested in offshore wind. What needs to be improved for offshore wind looks very possible.

#### **Recommendations for selected interested parties and communities of practice in Costa Rica.**

The following recommendations should be implemented over the next years.

**Policy:** Stakeholders suggested around 500 MW of capacity within the next 20 years, but this should be contextualized within the system and generation mix planning, including retirement of existing power plants. This may have implications beyond Costa Rica's energy policy, including the National Strategic Plan for regional development in specific aspects like scale of projects, rejuvenation of coastal communities, reduced land use, immaturity of the sector.

**Stakeholders:** Is urgent undertake marine spatial planning (MSP) including fragile ecosystems and the possibility of new marine protected areas, plus best wind resource areas with suitable water depths, to identify offshore wind zones. Also set up a working group with ocean regulators, authorities, and representatives of associations to work on an MSP roadmap together. Stakeholders' engagement, especially fisheries (including sport fishing), shipping and tourism chambers, university researchers, must sharing knowledge and perspectives on offshore wind. This will be vital to ensure that opinions from impacted communities are based on facts, and concerns can be responded to early. Identify a date when it is appropriate to issue a Request for an Expression of Interest (REOI) to offshore wind developers.

**Legal:** Clarify the legal framework for health & safety for offshore wind construction and operation through public organization would lease the seabed and grant exclusive rights to offshore wind developers for the Economic Exclusive Zone, territorial waters, and foreshore. Build up a fit-for-purpose regulatory framework to provide legal certainty to the overall structure of the projects.

**Health & Safety:** Identify the training needs of people coming into the offshore wind sector in Costa Rica, particularly for the value chain segments which are locally delivered, such as transport and logistics, construction, grid connection and operations & maintenance.

**Consenting & Permitting:** Is mandatory define the process flow of consents, permits, and licenses and select a single national public institution responsible for the overall consenting process, which can reconcile and coordinate between coastal and marine authorities.

**Offtake and Revenue:** Is required outline which organization will purchase power offtake and how corporate power purchase agreements (PPAs) could be

accommodated. Will be important to linking offshore wind supply to Costa Rica's long-term net zero and electrification strategy, such as for the transport sector.

**Projects:** With the marine spatial plan in place the project areas can be identified. These could be done by MINAE and ICE inviting developers to participate in offshore wind in Costa Rica. For early projects, ICE should consider undertaking surveys to characterize the offshore wind area identified by the marine spatial plan.

**Equipment & Services:** Once the offshore wind policy Gigawatts targets are set and flow of projects defined, the next steps is considering what supply chain will be needed.

**Installation:** The actions is identified potential construction ports, and their investment needs, for offshore wind deployment. No other actions are required at this stage for **Installation & Commissioning and Operation & Decommissioning**.

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*Note: This paper contains partial information prepared by GWEC for the Institute of Electricity, Costa Rica.*