Offshore wind potential in Costa Rica: Boosting a plan towards road map

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National University of Costa Rica

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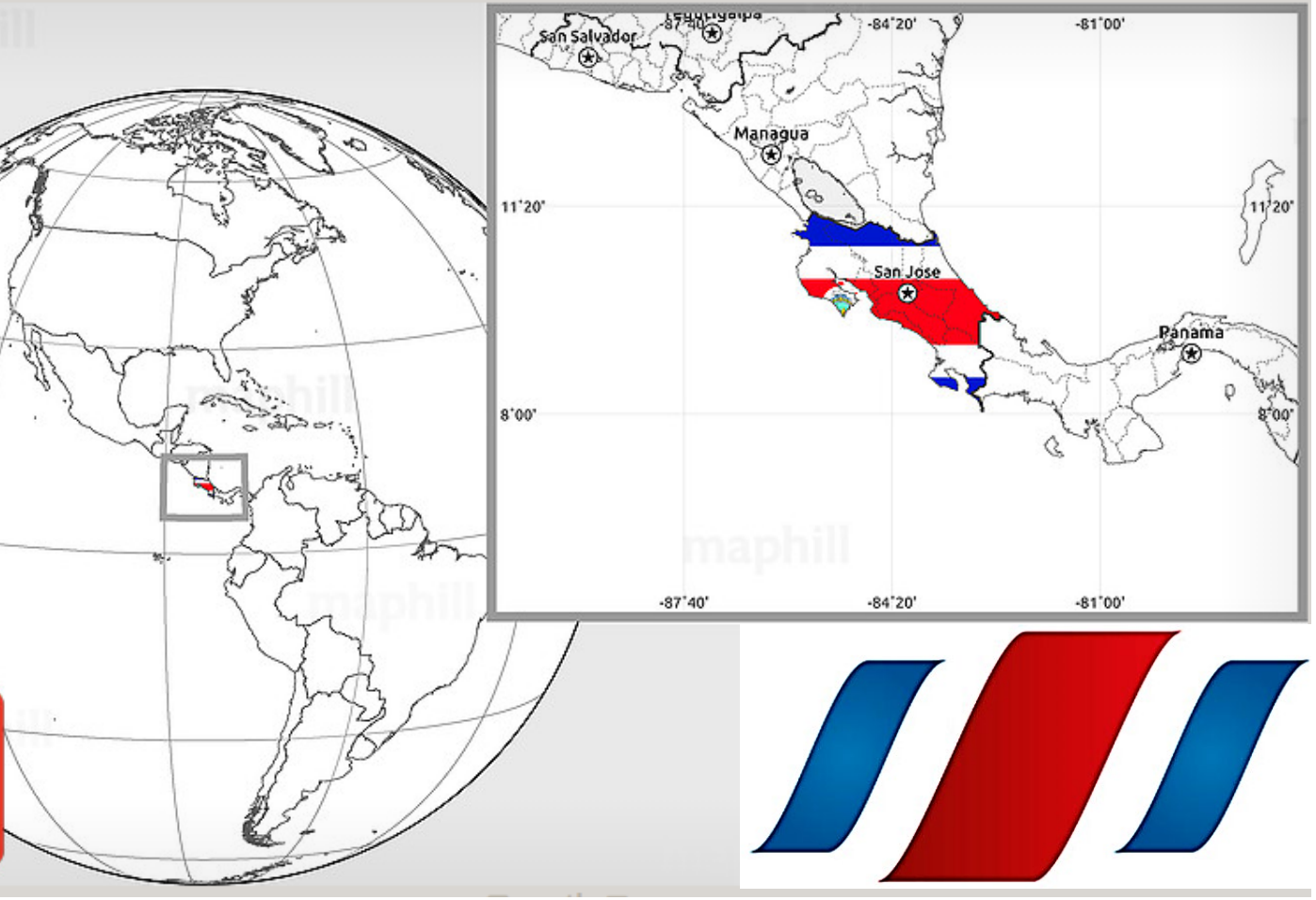


Milestones of Costa Rica

- Located in the middle of the Central America tropical belt
- The country is one of the greenest nations with 27% of its continental and marine territories protected under conservation areas system
- Currently features greater biodiversity than Europe or North America
- Although the country is small and it covers only 0.03% of the surface of the globe, it proudly shelters 5% of the existing biodiversity in the entire world.

Costa Rica a green small country with big global nature conservation agenda

This small emergent economy has shown commitment to renewable energy and the care of the environment, in last five years has achieved near of 100% of its electrical production from renewable energy sources and there is a commitment from the government to maintain and improve these levels

Hydropower

Installed capacity

The existing electricity matrix is based on onshore sources, in 2020 generated 68.6% from hydropower, 17% wind, 13.5% geothermal and 0.84% corresponds to biomass plus solar.

Geothermal

Target: resilient energy matrix

Based on this evidence, Costa Rica is at the forefront of environmental sustainability, climate action and driving the energy transition. The commitment is to keep producing almost 100% of its electricity from renewable energy.

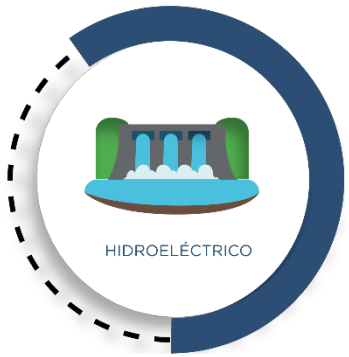
Onshore wind

Offshore energy

Offshore renewables should play a bigger role in diversifying its electricity mix, incorporating marine energy solutions, boost coastal economic dynamization and enhancement the creation of innovative job opportunities.

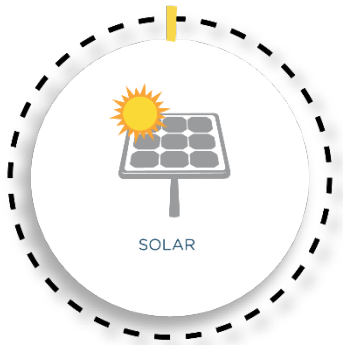
Electricity portfolio: diverse, sustainable, resilient, low cost and almost all the country with access to grid.

CONTINENTAL INSTALLED CAPACITY

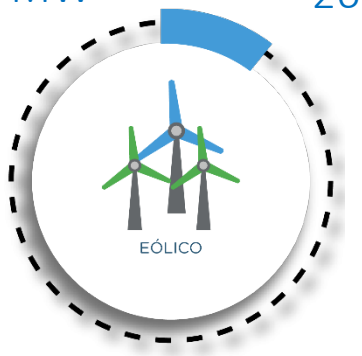


65,91%
2.331, 3 MW

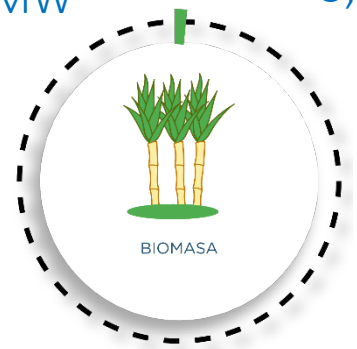
7,40%
261,9 MW



0,15%
5,4 MW



11,13%
393,5 MW

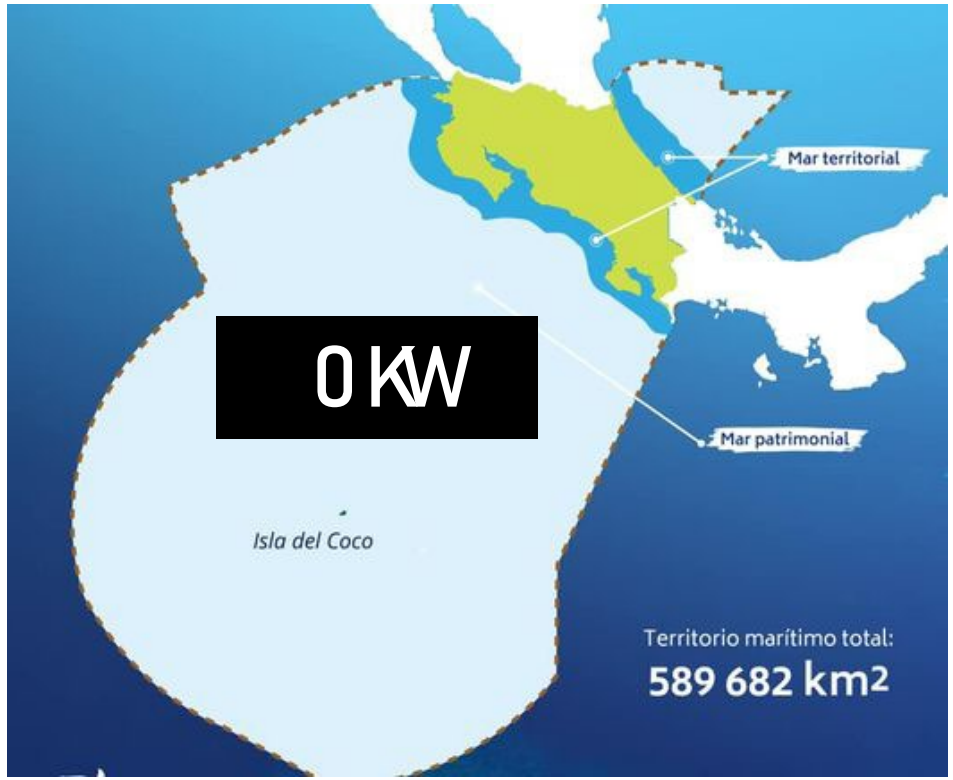


2,01%
71 MW

3063 MW

OFFSHORE INSTALLED CAPACITY

10 times



0 KW

Costa Rica represents a core zone with thousands of megawatts of non-conventional offshore energy available in the Pacific and the Caribbean coasts.

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GERENCIA DE ELECTRICIDAD
PLANIFICACION Y DESARROLLO ELECTRICO

PLAN ESTRATEGICO PARA LA PROMOCIÓN Y DESARROLLO DE FUENTES DE ENERGIA RENOVABLES NO CONVENCIONALES
2016-2035

Since 2012

Offshore wind is part of the non-conventional energy portfolio of Costa Rica

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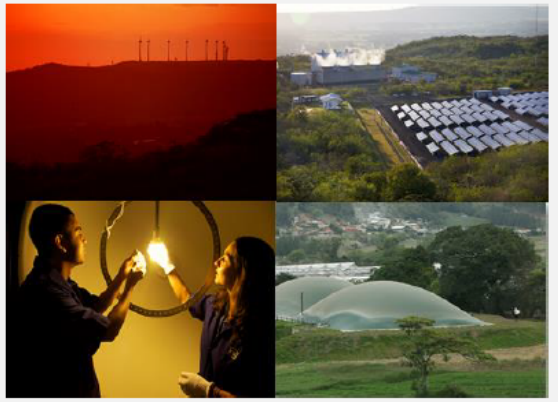
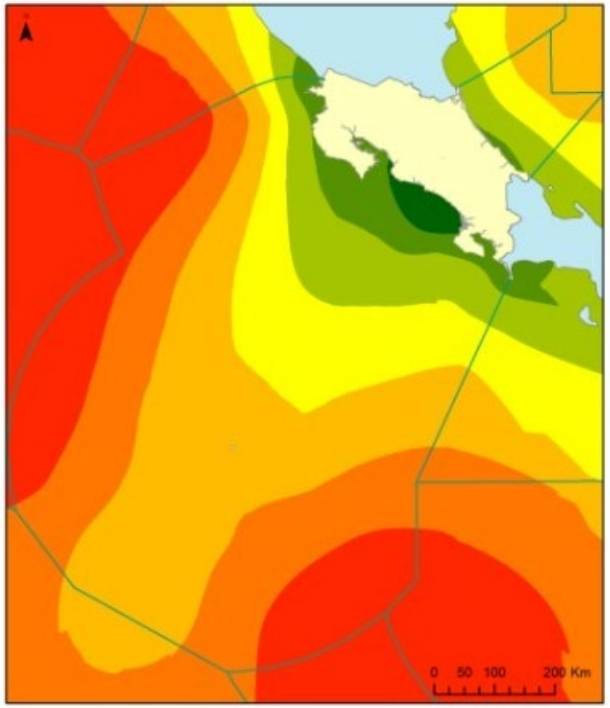
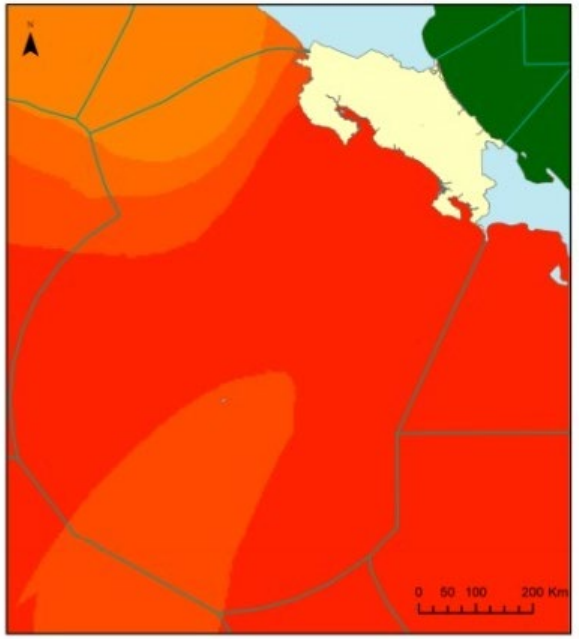
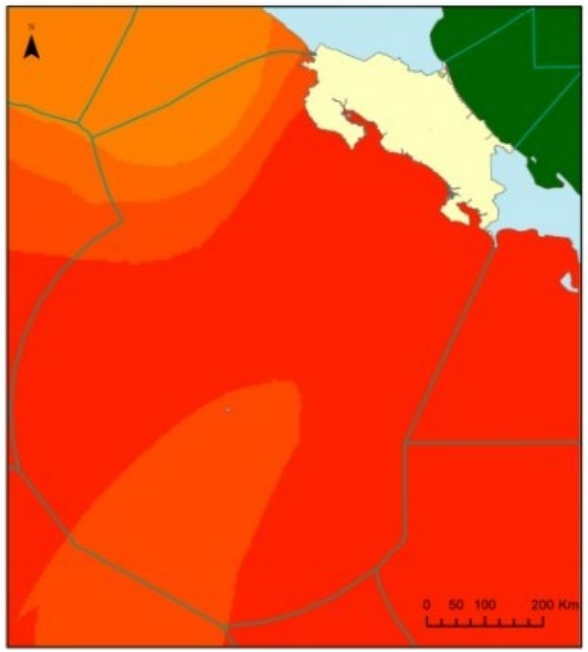


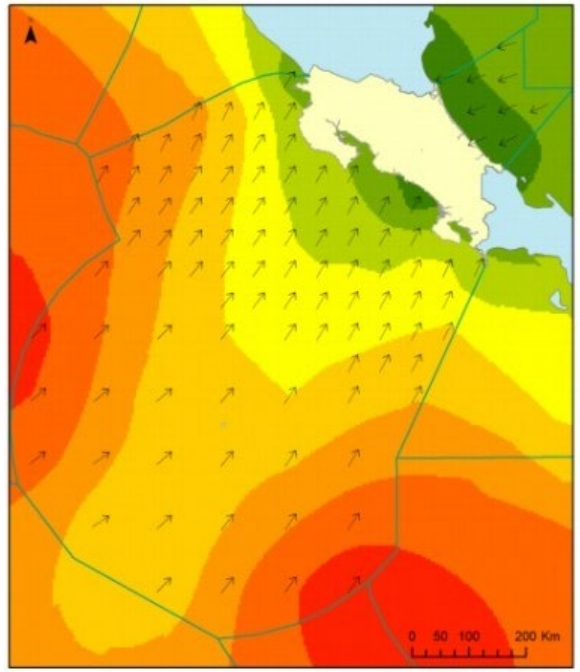
PLAN OPERATIVO DE PROYECTOS PARA LA PROMOCIÓN Y DESARROLLO DE FUENTES RENOVABLES NO CONVENCIONALES
2016-2019





First study of marine energy was carried out, by WAVEC, in 2013



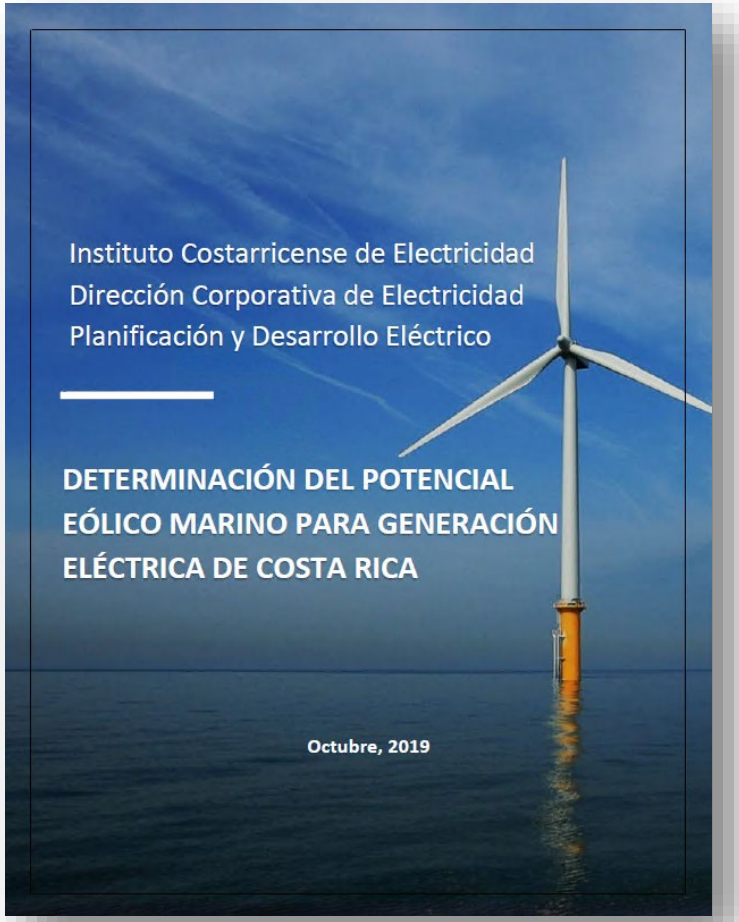


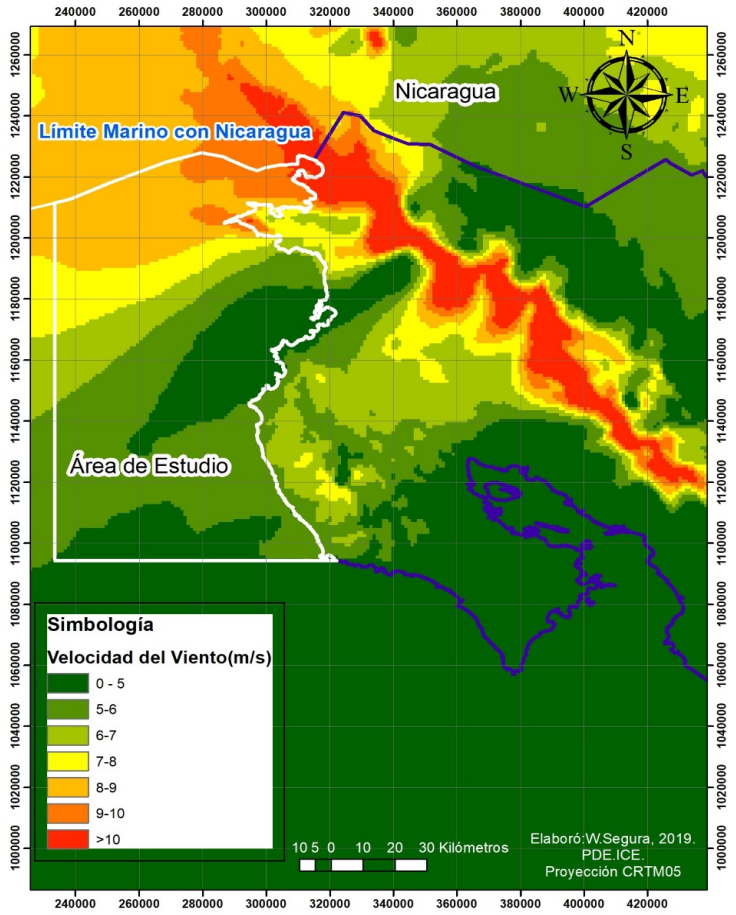
2018: START THE RESEARCH ON OFFSHORE WIND POTENTIALS

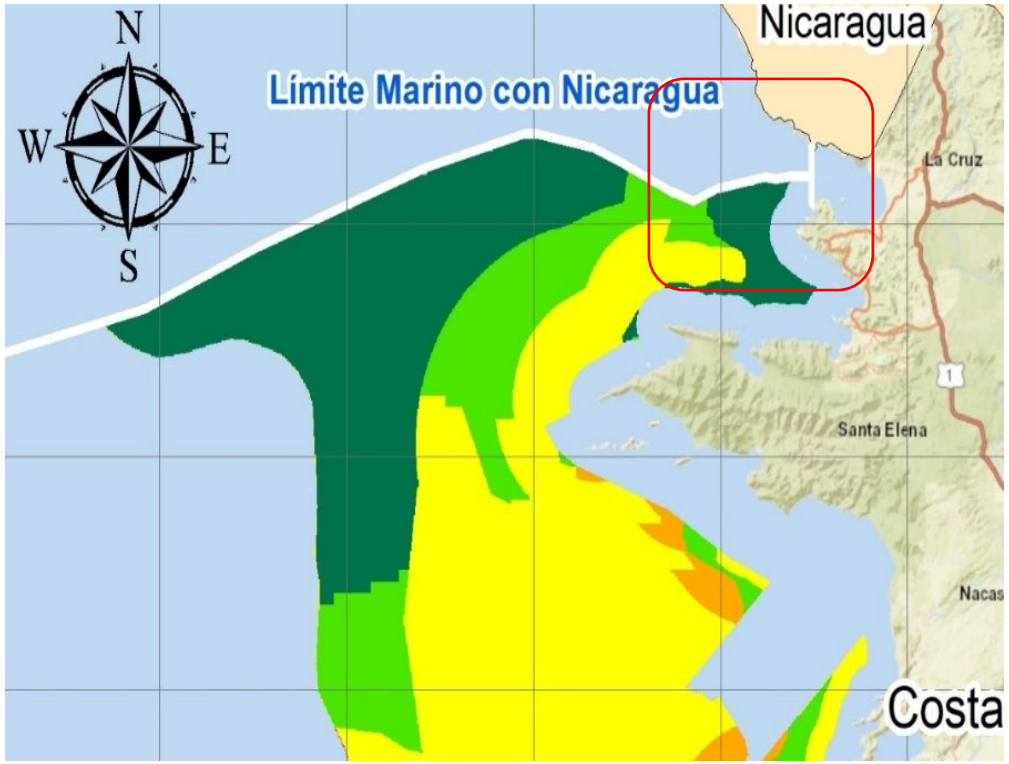
ONLY IN OFFSHORE WIND: INEXPLOITED 14 GW

2 GW from waves+currents and tides

2018-2020 research shows a marine band in the North of Pacific



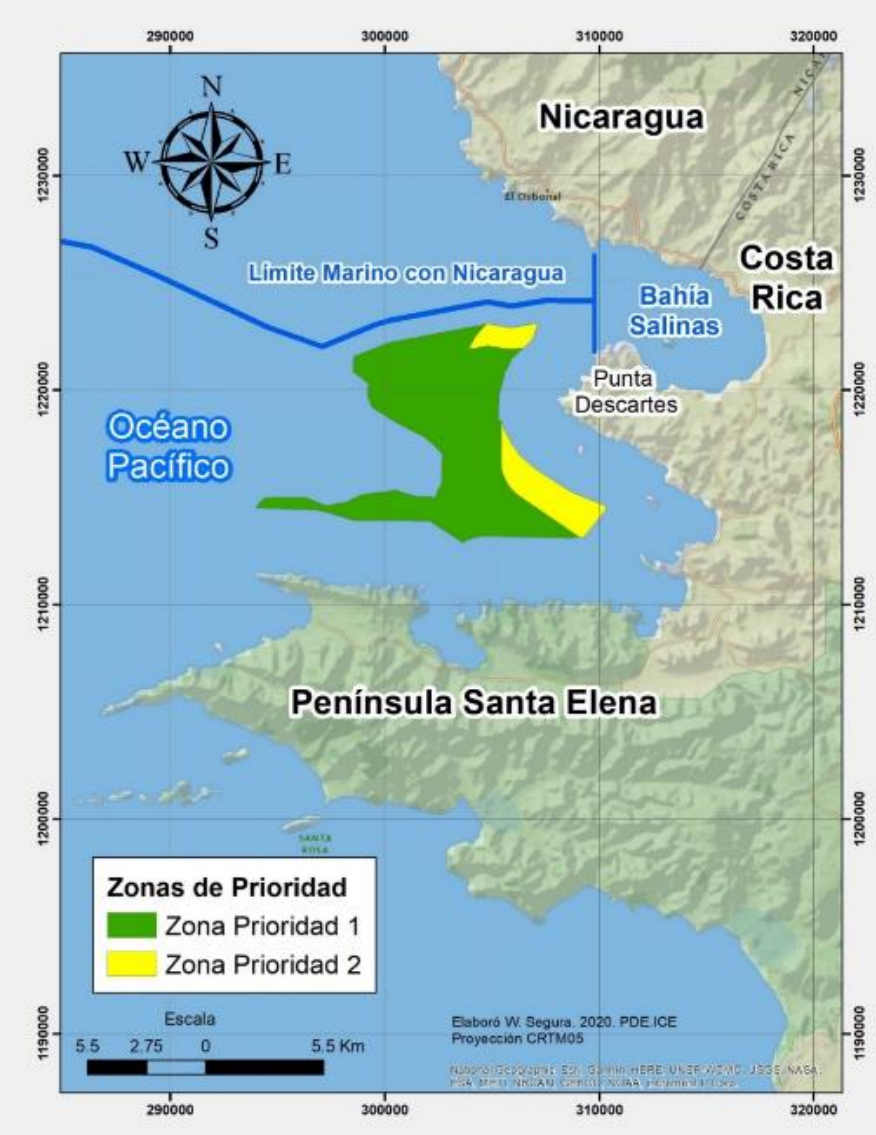




Area of study

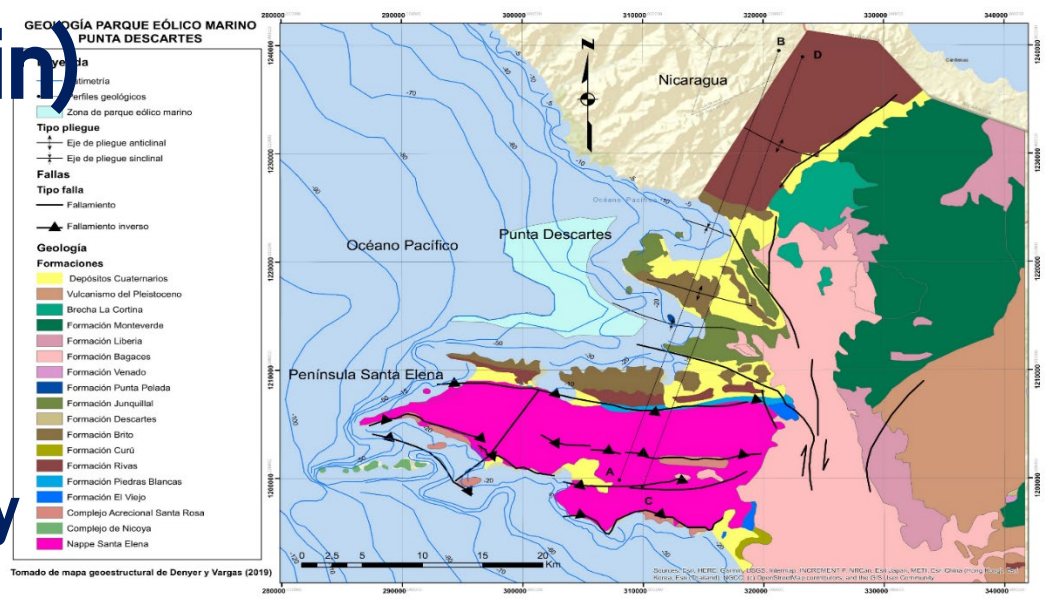
Floating and fixed bottom wind turbines

Meta-ocean investigations (supply chain)

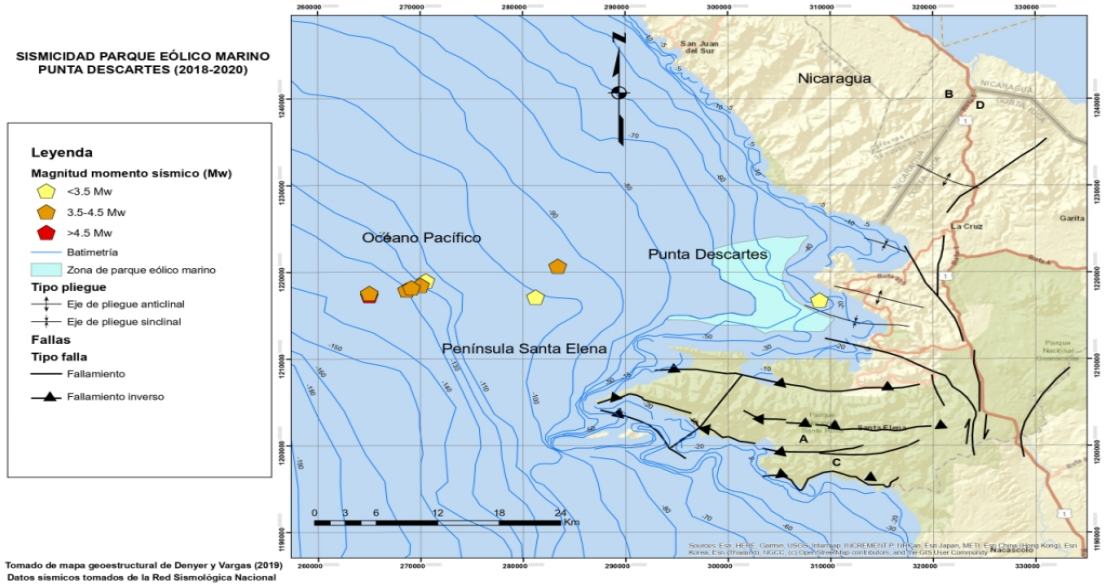


Environmental, economic and social restrictions

Infraestructure
Consenting process
Environmental viability
Grid
Transmission



Geological research

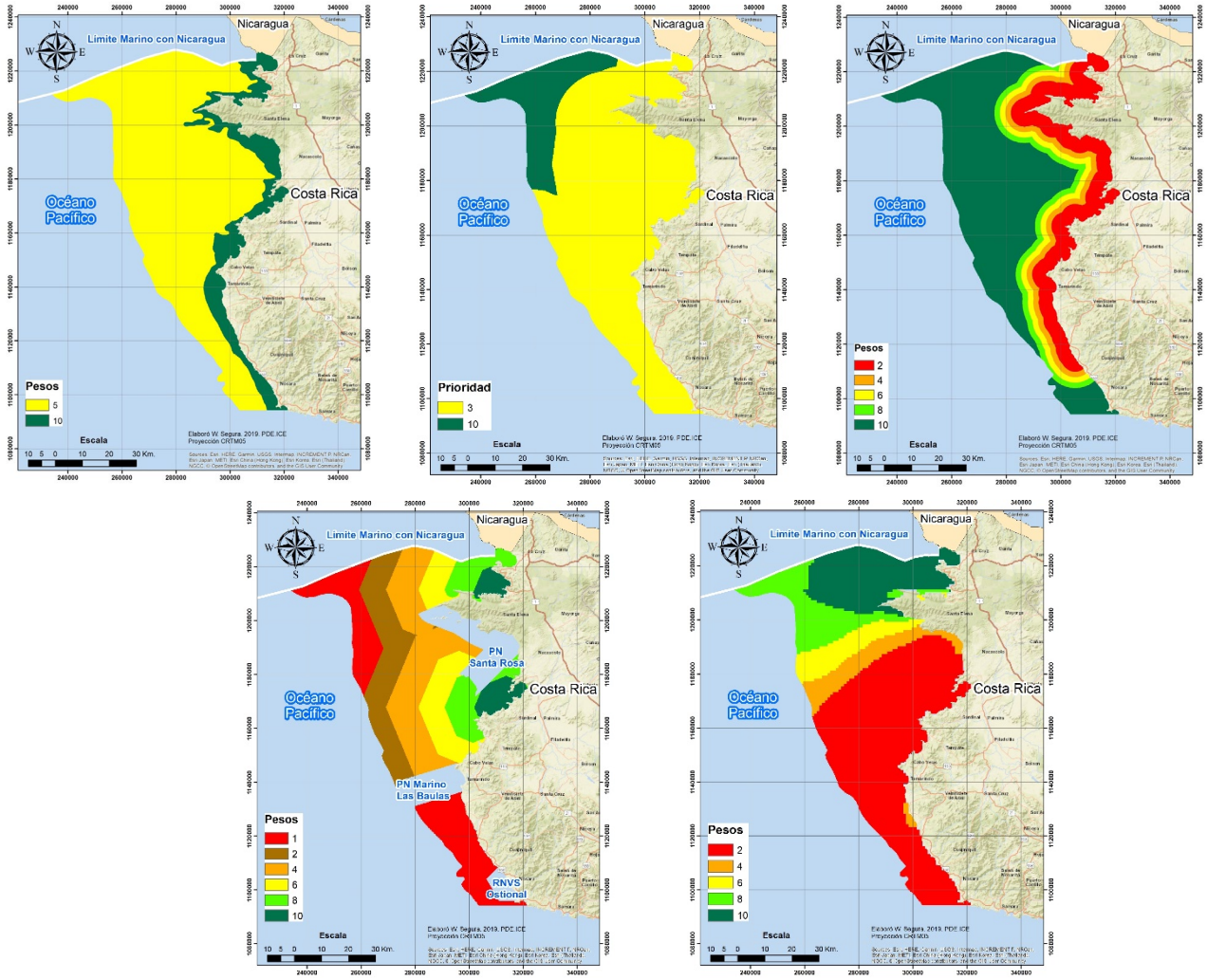


Geophisics analysis

Priorization of offshore wind areas by multicriteria análisis

Criteria selected:

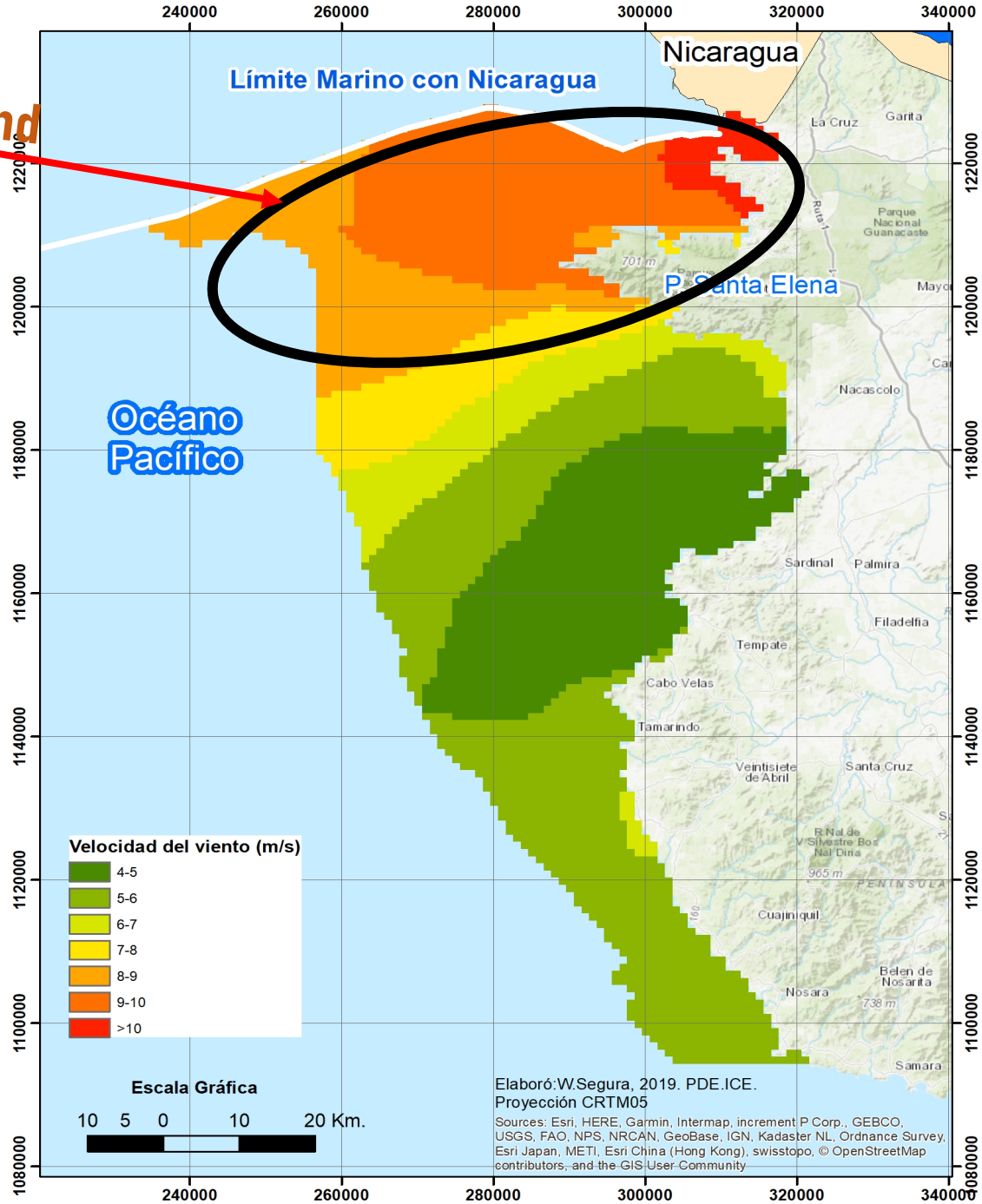
- Bathymetry profile
- Environment conditions
- Landscape perspective
- Social-economy frame
- Wind speed analysis



Cluster with superior offshore wind speed (8-10 m/s)

Profile of offshore wind speed, at 120 meters high.

Using field data from monitoring tower in Salinas bay and satelital information in the study area



Exploitable energy area

Border line with Nicaragua

Wind power density model:

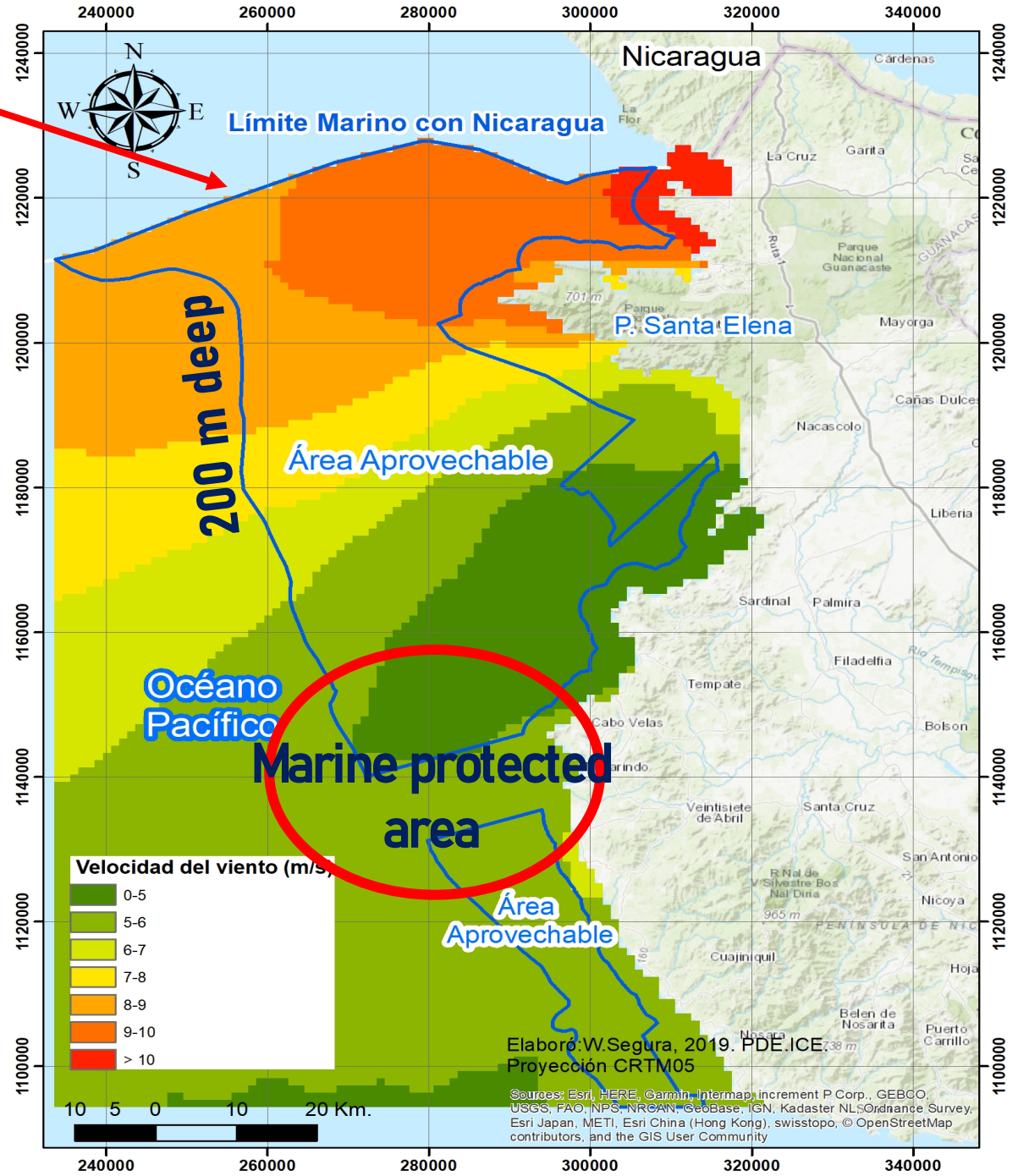
$$\frac{1}{2}\rho\sum_{j=1}^{c} f(V_j)V_j^3$$

Where, ρ is mean air density, j is the index of wind speed class, c is the number of wind speed classes, Vj is wind speed of the jth class, and f(Vj) is probability density function of Vj.

Technical potential: 14 400 MW

Annual energy: 59 058 GWh/y

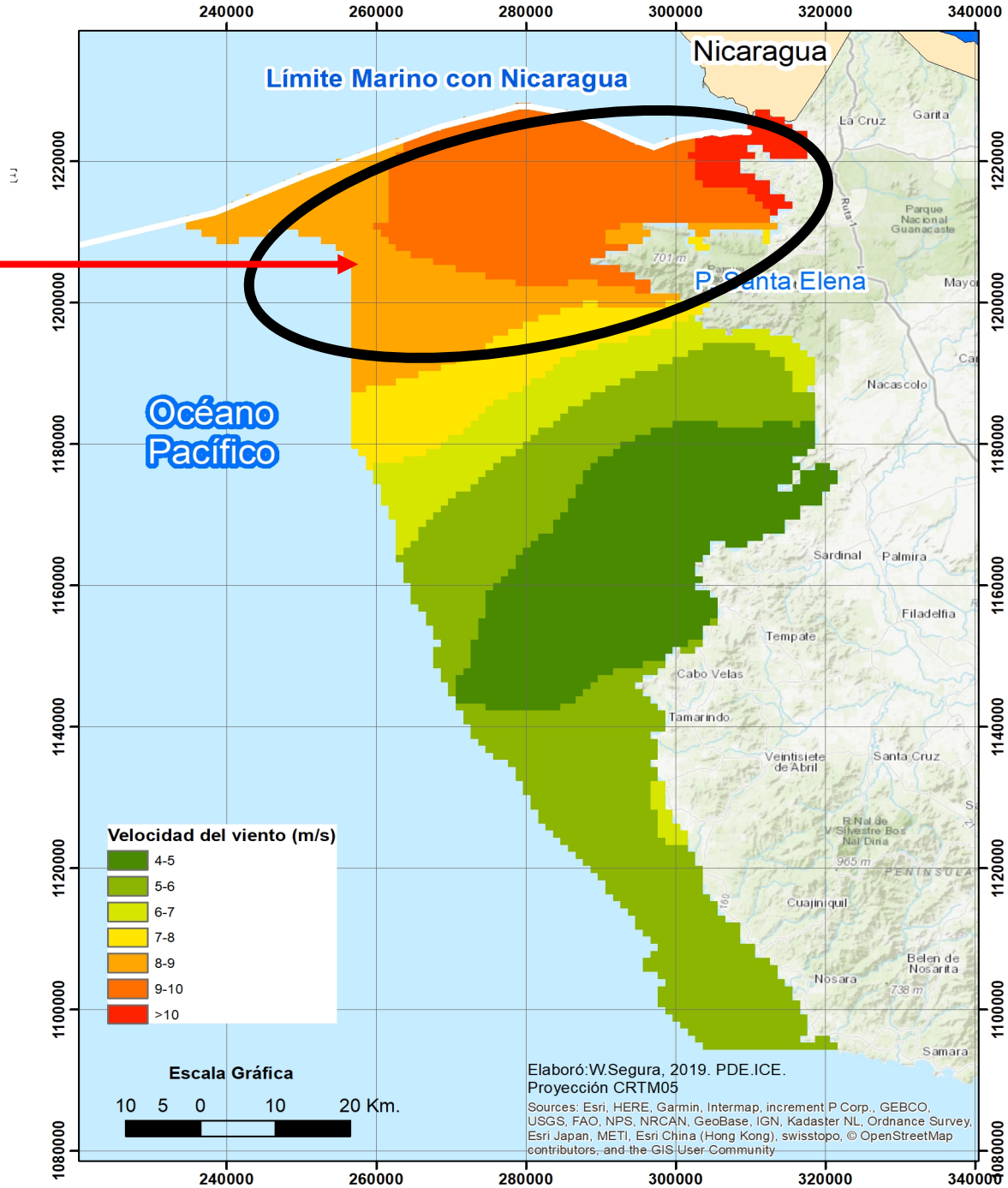
Power factor: 34%.



Permant plume, with superior offshore wind speed (8-10 m/s)

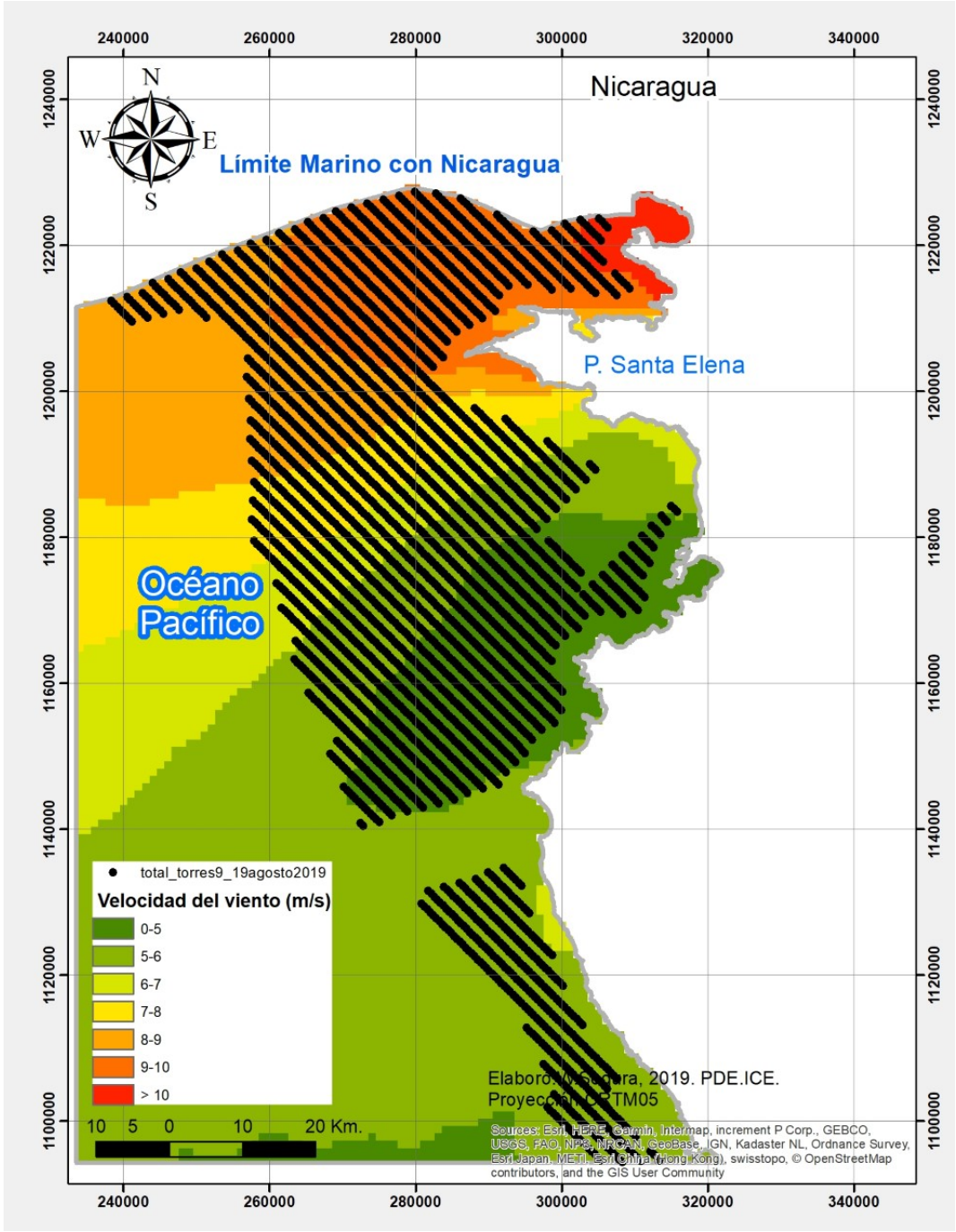
The power factor is higher than 50%

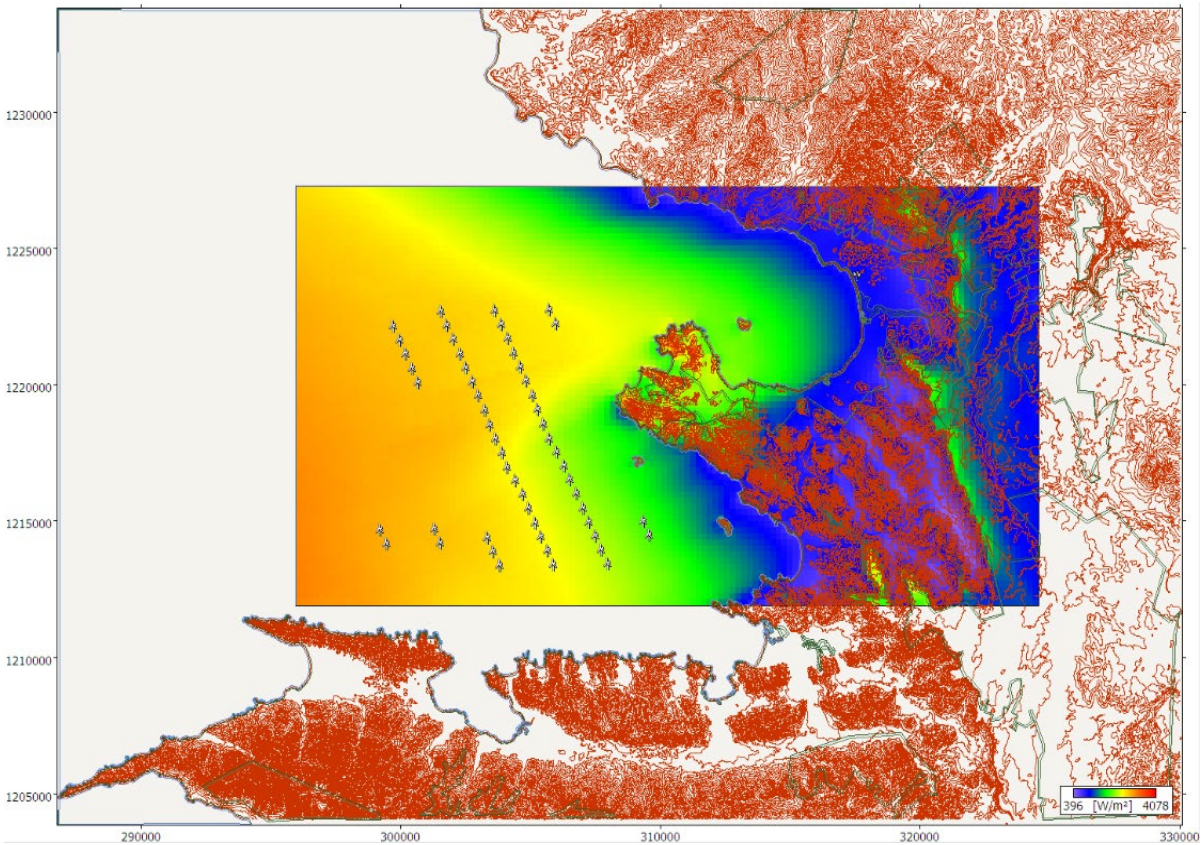
Technical potential is near of 4 780 MW and the annual energy production is 21 519 MW

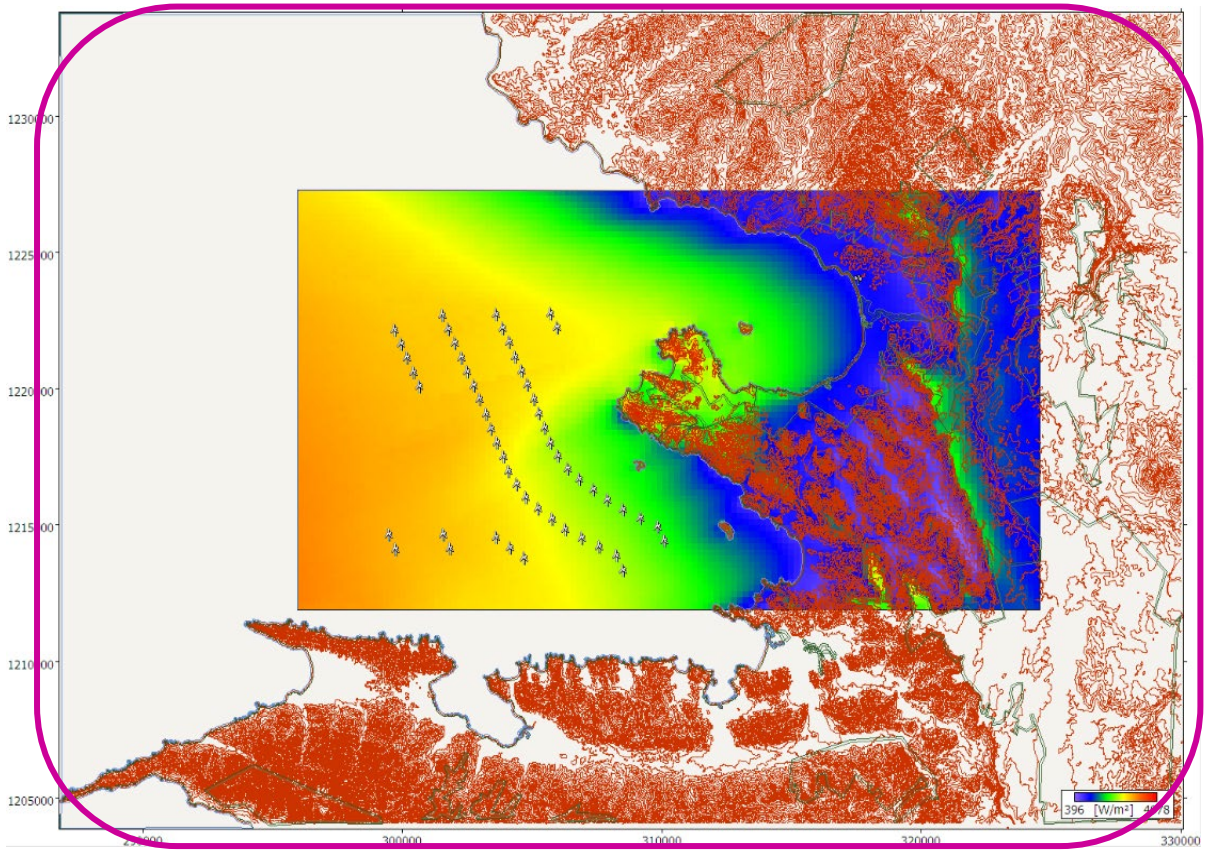


Layout (in draft) of wind farm turbine distribution in the exploitable area

Technical potential: 14 400 MW







Fixed bottom wind turbines

Technical potential: 540 MW

Annual energy: 2 986 GWh/y

Power factor: 63.1%.

MILESTONES

Marine energy potentials, 201

Offshore wind potentials 2019

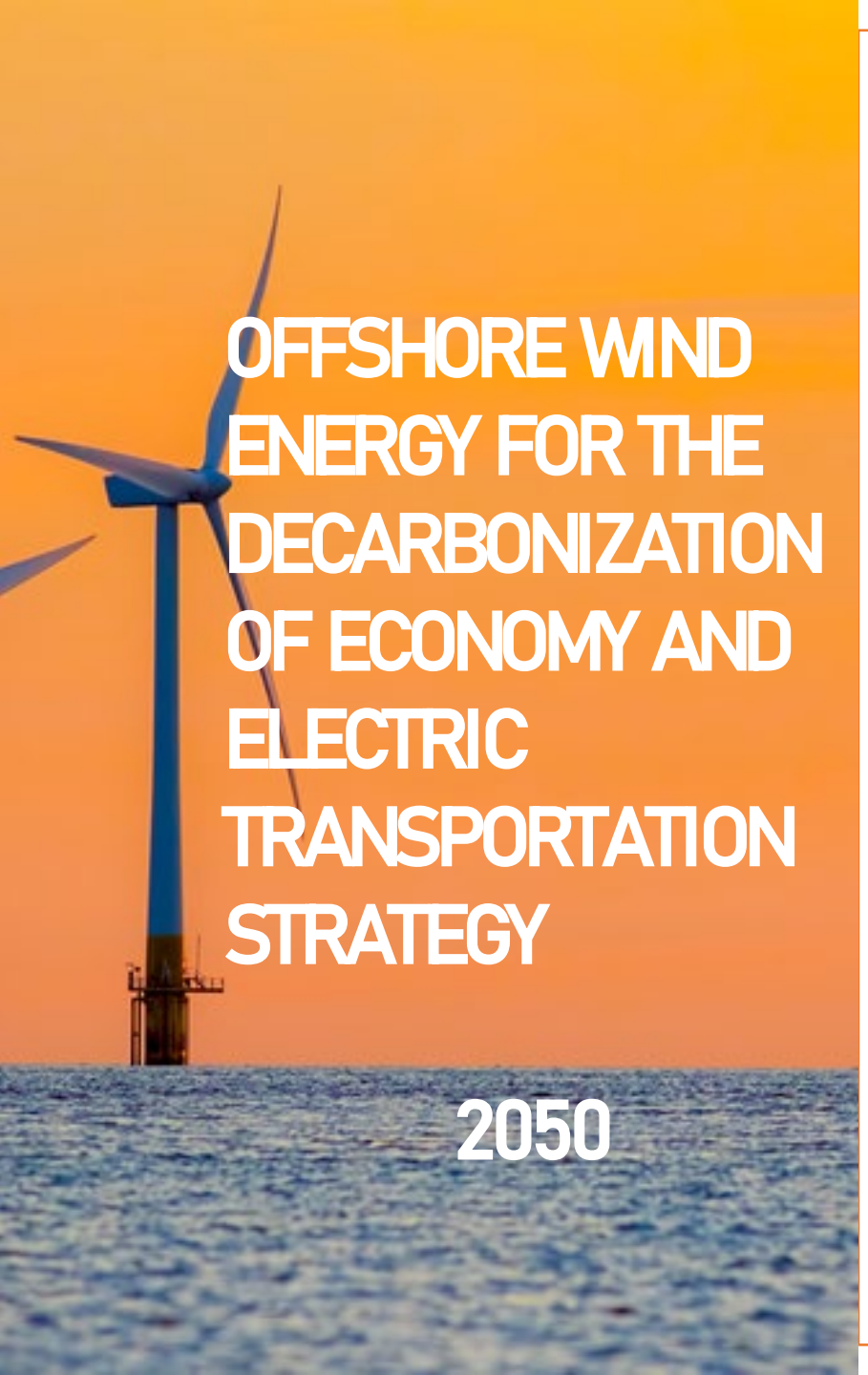
PAMEC 2020

Punta Descartes offshore wind Project (phase of identification)

2020

Road map with GWEC 2021

BOOSTING THE ROAD MAP



OFFSHORE WIND ENERGY FOR THE DECARBONIZATION OF ECONOMY AND ELECTRIC TRANSPORTATION STRATEGY

2050

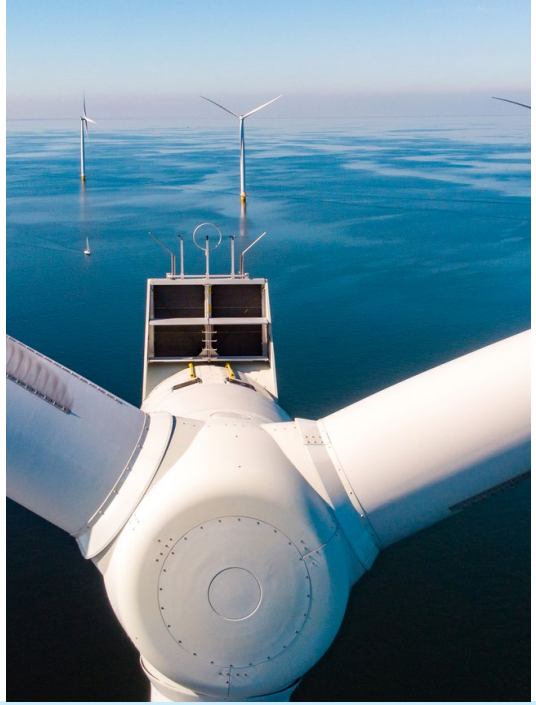
Compliance with the Paris Agreement requires the transformation of national economies to meet net-zero carbon dioxide emissions by mid-century.

To accomplish this, countries need to define long-term decarbonization strategies. The nation been working to ensure total power generation from clean energy sources, as well as supporting the economy to meet net-zero carbon dioxide emissions by 2050.

Aiming to ensure country's resilient paths, offshore wind might play a bigger role in diversifying its electricity mix and incorporating marine energy solutions, boost coastal economic and innovative job opportunities.

Challenges

National plan of decarbonization requires installing 4.4 GW more of renewable power plants by 2050



Opportunities

Offshore energy, particularly, offshore wind will plan mayor role in this plan

NATIONAL TEAM SUPPORTING OFFSHORE WIND DEVELOPMENT

GRUPO ICE

minae

MICITT MINISTERIO DE CIENCIA, TECNOLOGÍA Y TELECOMUNICACIONES

MARVIVA

esencial COSTA RICA MI ELECCIÓN, NATURALMENTE.

I·C·T INSTITUTO COSTARRICENSE DE TURISMO

UNIVERSIDAD DE COSTA RICA

RIDE3R Red de Investigación y Desarrollo de Energías Renovables y Eficiencia Energética

CIMAR

iMARES UNIDAD DE INGENIERÍA MARÍTIMA, DE RÍOS Y DE ESTUARIOS

MIO

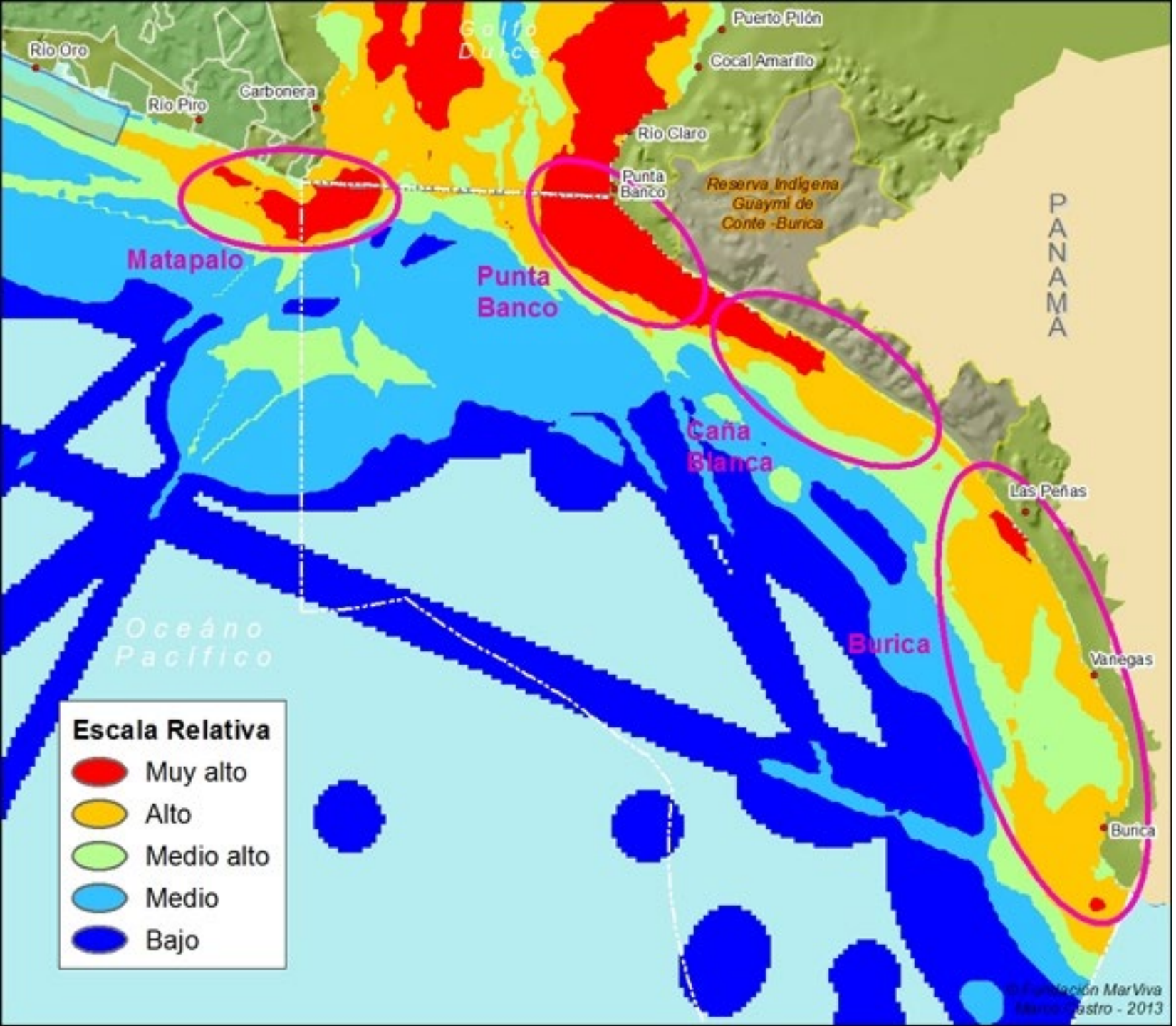
TEC | Tecnológico de Costa Rica


TEC | Tecnológico de Costa Rica
UTN Universidad Técnica Nacional
CEMarin Corporation Center of Excellence in Marine Sciences
COMISIÓN COLOMBIANA DEL OCÉANO
UNIVERSIDAD NACIONAL DE COLOMBIA
UNA
UNIVERSIDAD DEL NORTE
ecopetrol ENERGÍA PARA EL FUTURO
ice
UNIVERSIDAD DE MEDELLÍN
MERIC marine energy research & innovation center
UTN.BA
UNED
Universidad del País Vasco
Euskal Herriko Unibertsitatea
UTN FRCH FACULTAD REGIONAL CHUBUT
aquatera environmental services and products
PRDW Consulting Port and Coastal Engineers
WavEC Offshore Renewables
Ciemat Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas
iMARES
RIBEMAR RED IBEROAMERICANA DE ENERGÍA MARINA
Amorina WavEC
anaju
INTERNATIONAL SUPPORT: ALL IBEROAMERICA

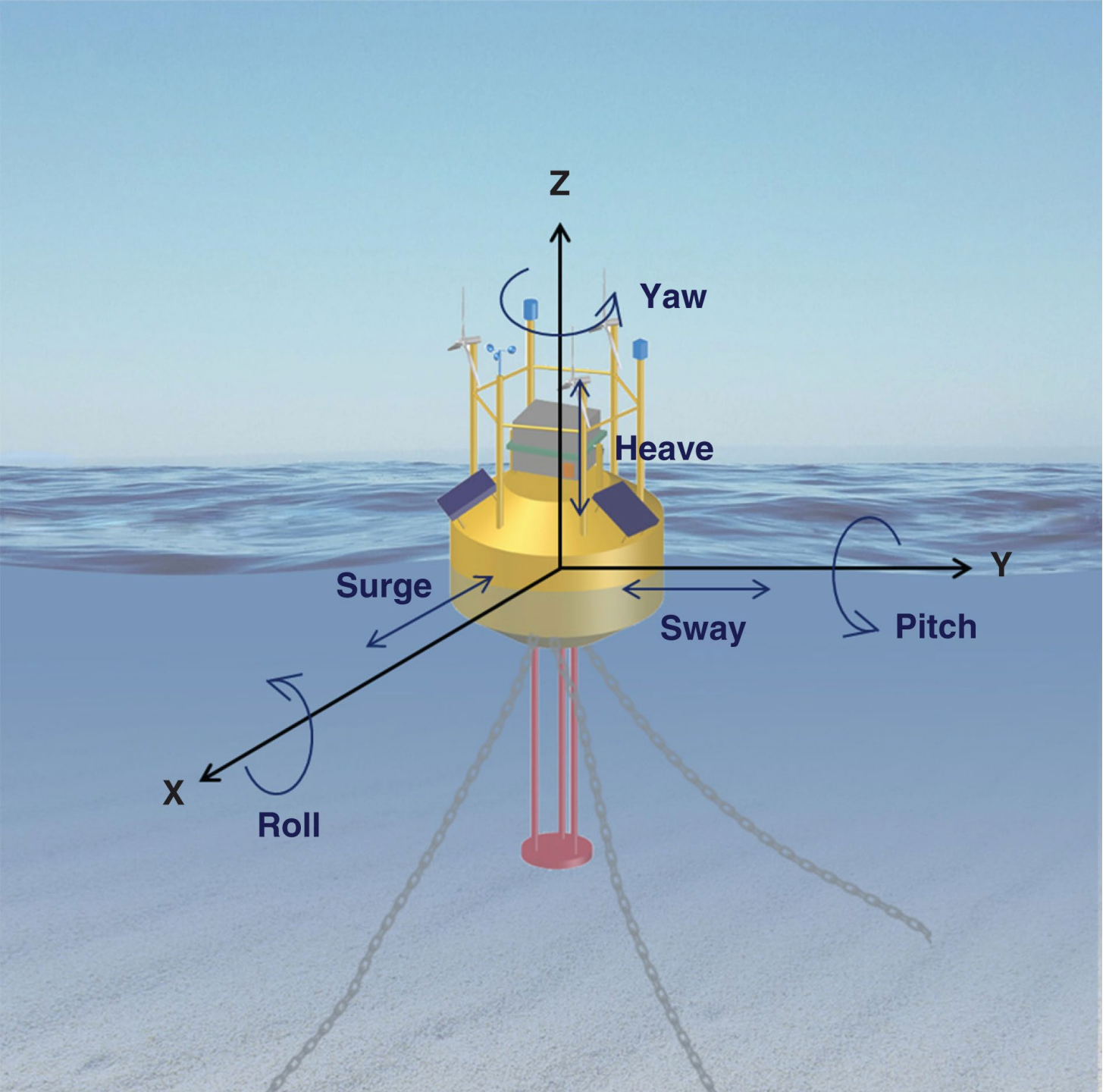
- Energy efficience
- Grid in all the country
- Oceanography
- Numeric modelation
- Infraestructure (onshore)
- Marine ecology
- NGOs vinculates
- Marine planning
- Basic ports infraestructure
- Blue economy plan
- Marine and coastal planning

Strengths for boost the offshore wind plan

Nexts steps and gaps to overcome



Offshore wind plans in the marine governance plans



Field data base

Floating lidar as an advanced offshore wind speed measurement technique

Coastal infraestructure

New generation of experts in offshore wind supply chain


MUCHAS GRACIAS
THANKS