



Supergen



Offshore  
Renewable  
Energy



CEMIE-Océano

Supergen ORE Hub Annual Assembly

# Ocean Energy in Mexico

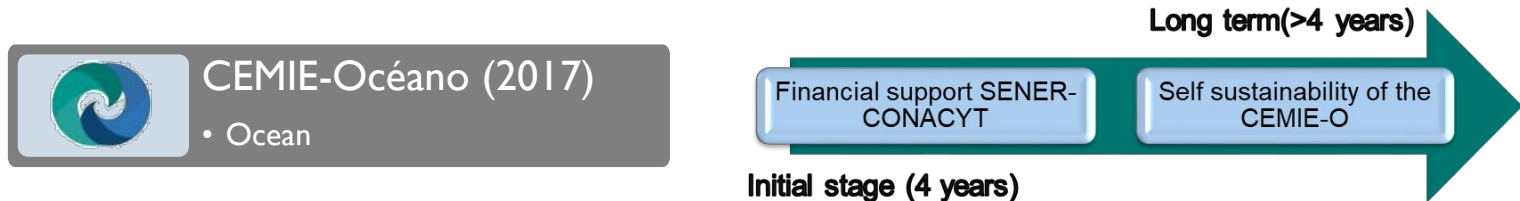
Edgar Mendoza



CEMIE-Océano

# In Mexico...

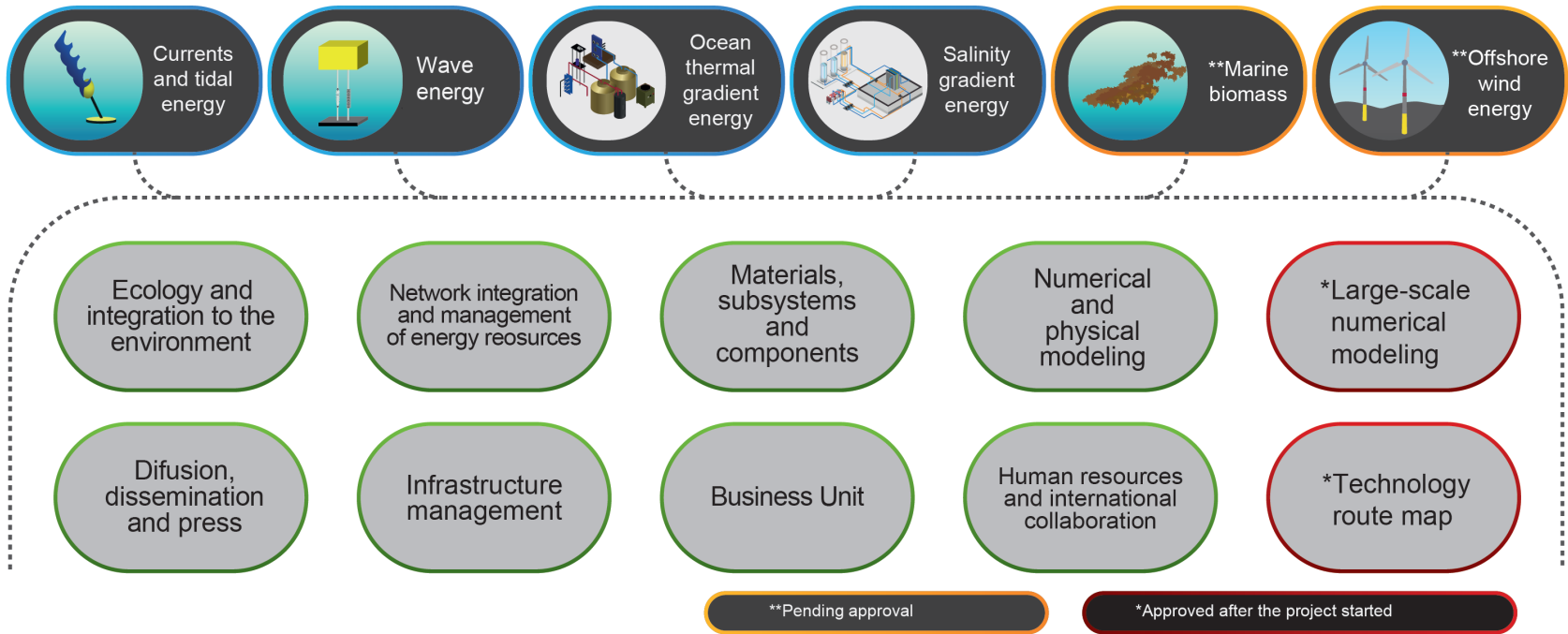
- Law for the Use of Renewable Energies and Financing of Energetic Transition (LAERFTE, 2008):
  - Targets for the maximum % of power generation from fossil fuels in Mexico  
**65 % by 2024, 60 % by 2035 and 50 % by 2050**
- Mexican Centres of Innovation in Renewable Energies (CEMIEs)



- ✓ Coordinates applied research, innovation and technology development associated with the extraction of ocean energy
- ✓ Is the most important multidisciplinary supplier of applied research, innovation and technology development in the field of ocean energy extraction in Latin America

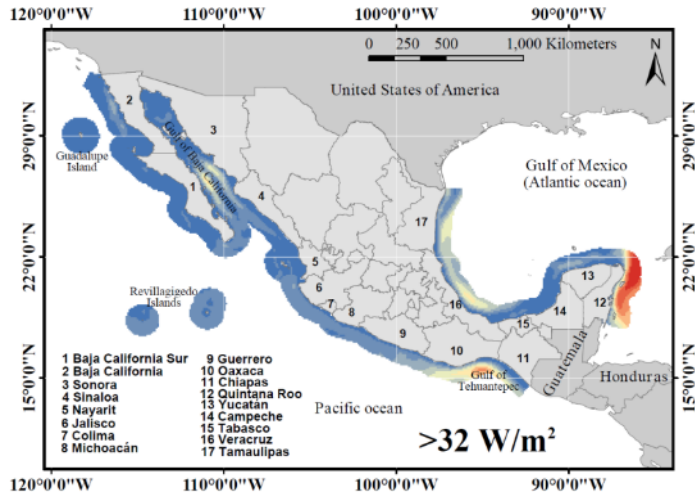
# CEMIE-Océano Teams for Technical Implementation

## ENERGY RESOURCES

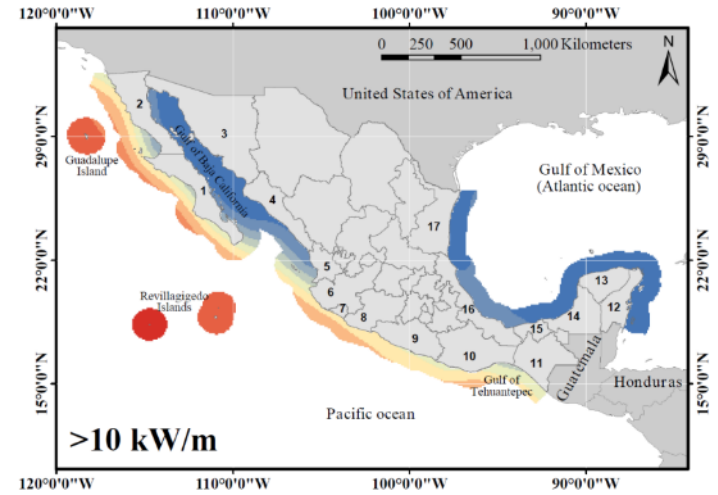


# Power Availability in Mexico

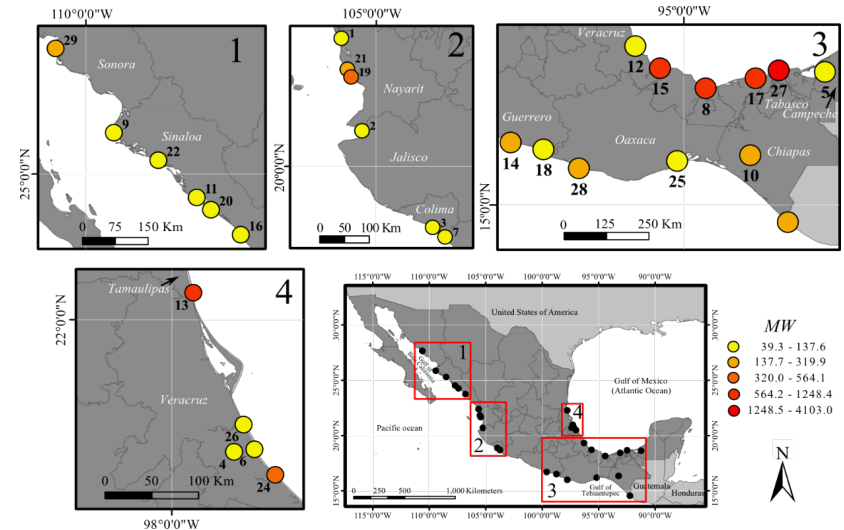
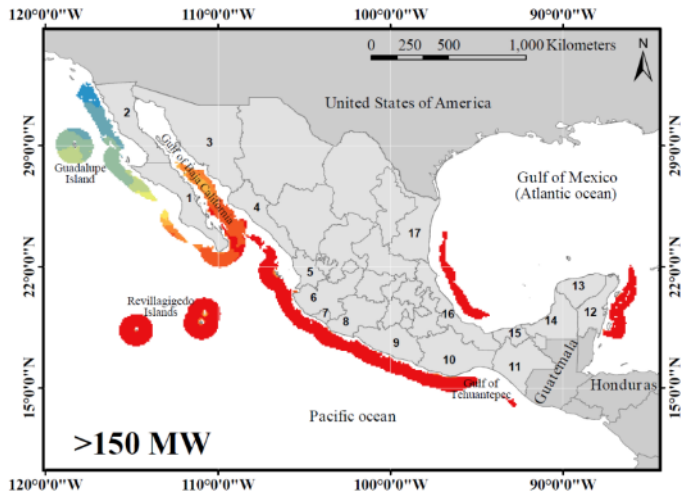
Ocean currents



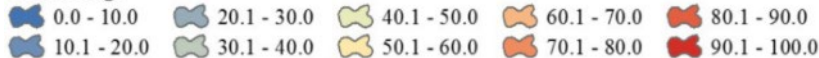
Waves



Thermal gradient

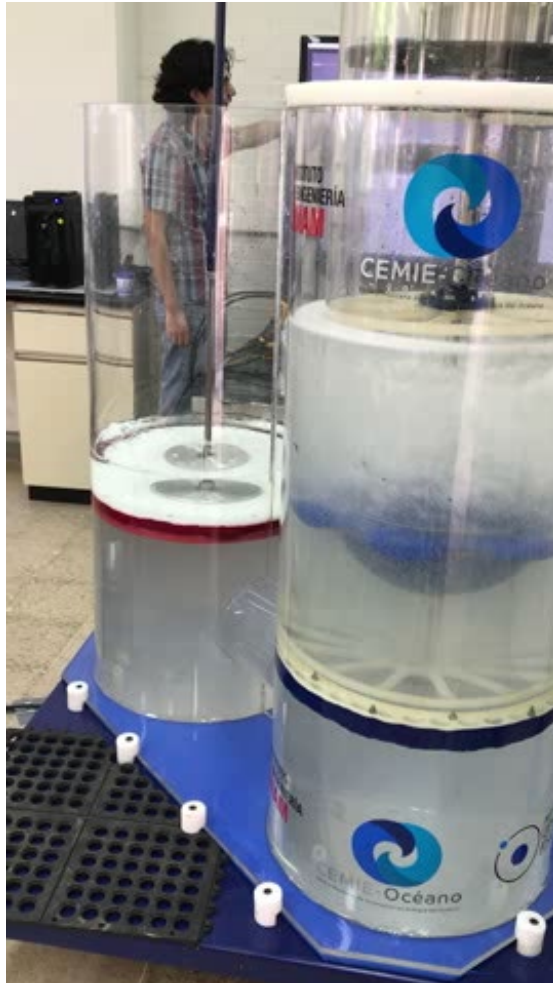


Percentage

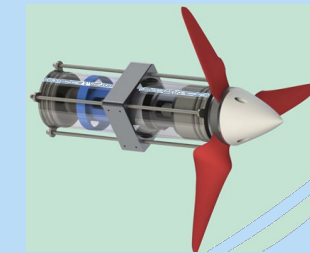
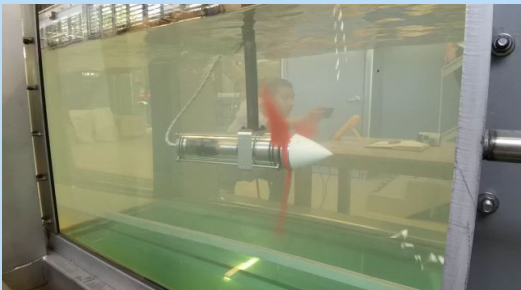


Salinity gradient

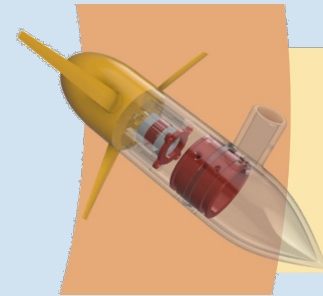
# Physical modelling



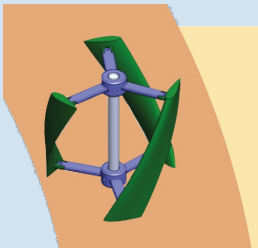
# Marine current turbines development



Three blade horizontal axis turbine (CIDESI)



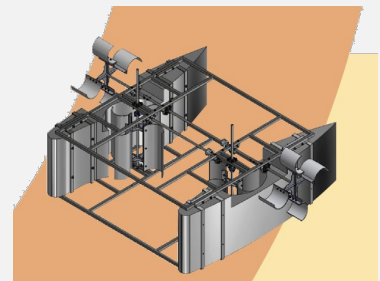
Three blade horizontal axis turbine (IIUNAM)



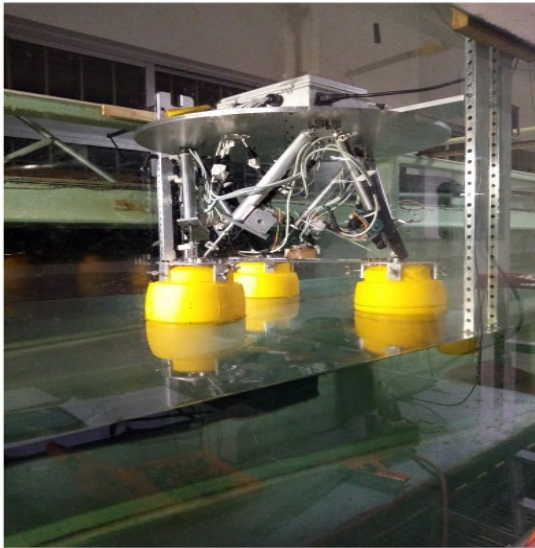
Vertical axis turbine with a helix shape for low velocities (IIUNAM)



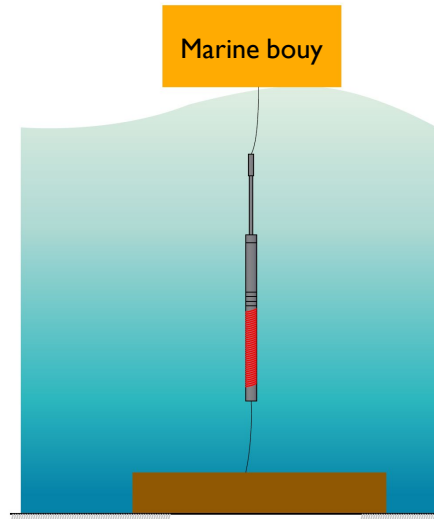
Combined horizontal and vertical hydro-generator (IIUNAM)



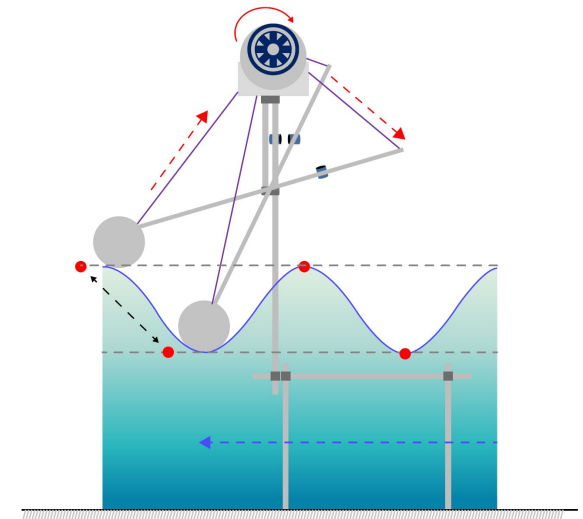
# WEC developments



Stewart-Gough  
platform with 6 PTO  
TLR3  
(CICESE)



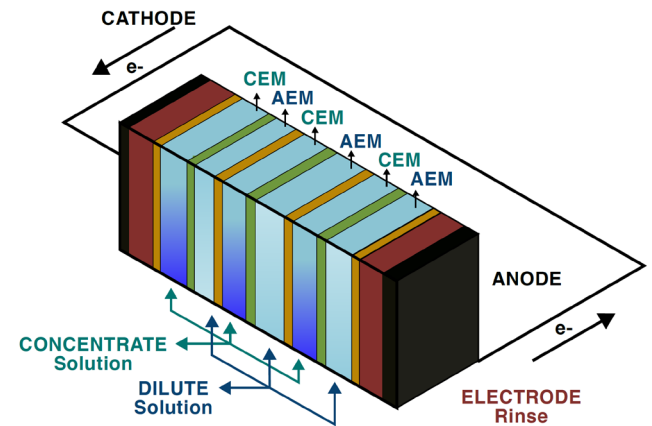
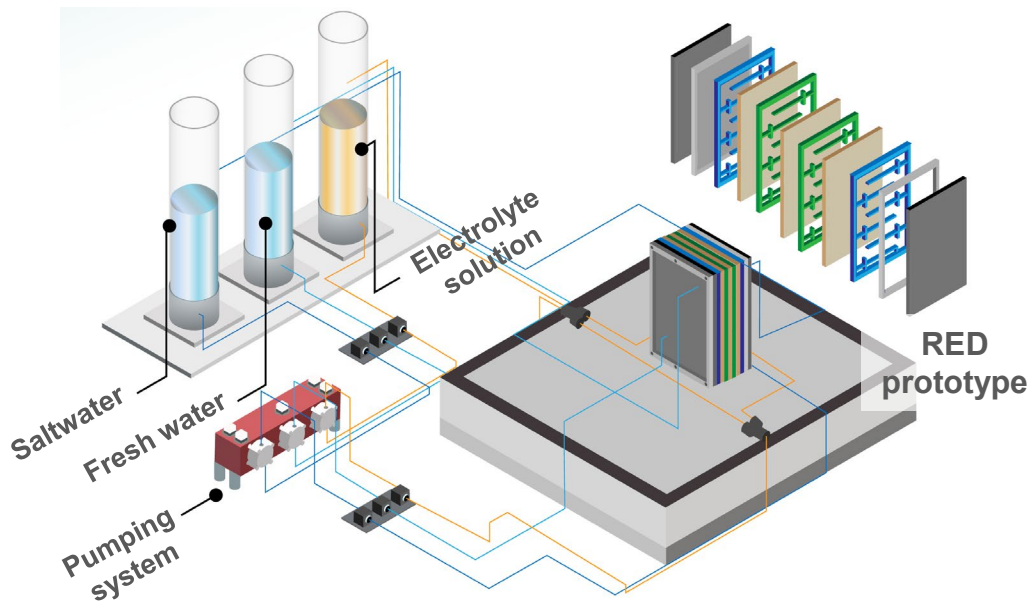
WEC-PAF: marine buoy  
and a PTO system  
TLR 6  
(CINVESTAV)



Marine water  
pressure system  
TLR 6  
(UCOL)

# Salinity gradient

RED prototype at laboratory scale, 0.5 W generation (IIUNAM).



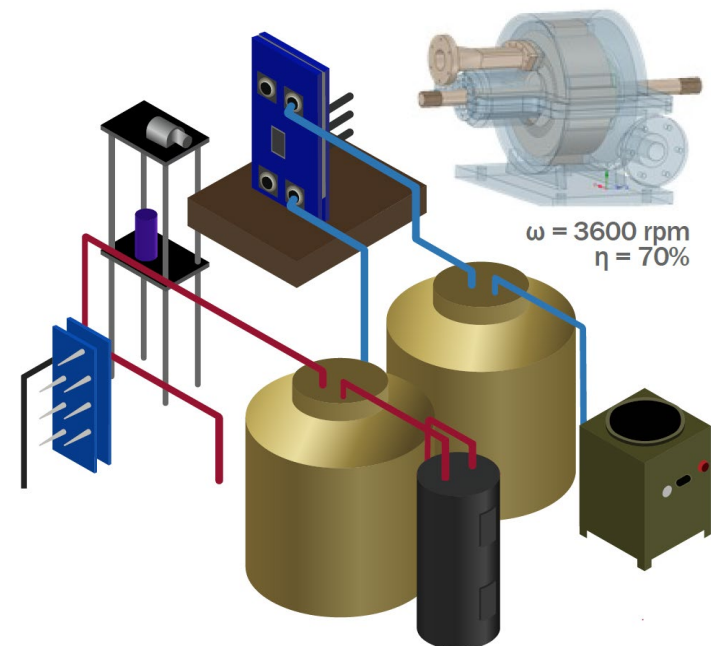
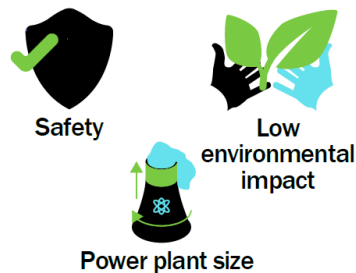


# OTEC plant prototype

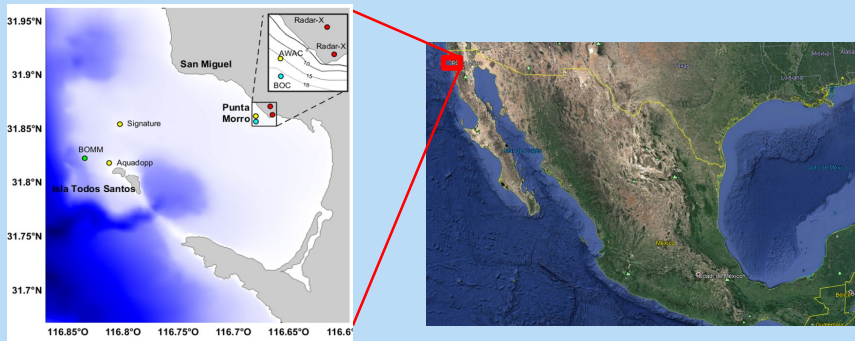
As part of the CEMIE-Océano project, researchers and students from the UNAM, UNICARIBE and UABSC, are developing a prototype Closed Cycle OTEC plant at laboratory scale that will generate 1 kW of electric energy.

The turbine was designed to work efficiently with the flow energy, reaching the required angular velocity without any other device.

The working fluid is a fluoride compound (R-152a liquid), chosen because



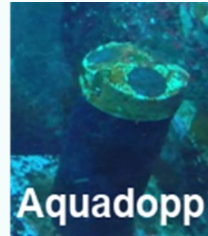
# CEMIE-Océano Natural Laboratory in Baja California, Mexico



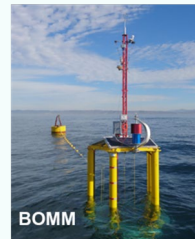
## Objectives:

- Conduct tests, field performance studies and WEC enhancement.
- WEC maintenance and operation, medium and long term.
- Implementation, calibration and validation of numerical wave models.

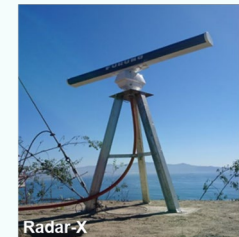
## ADCPs



## Buoys



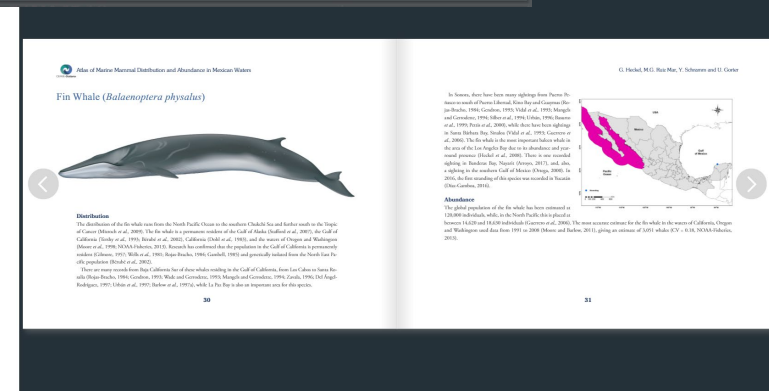
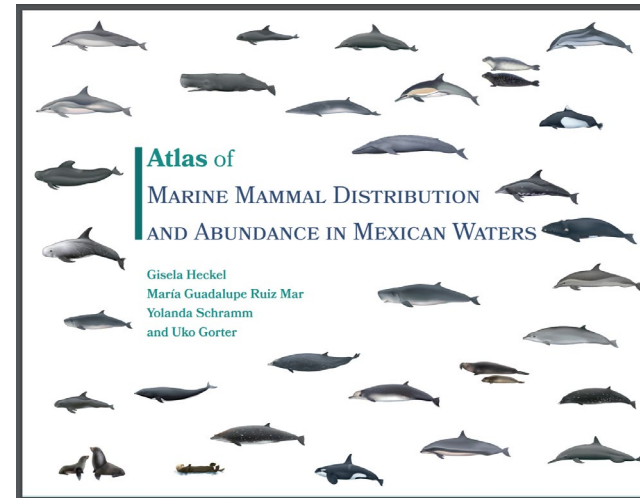
## Radars





# Environmental impact data bases

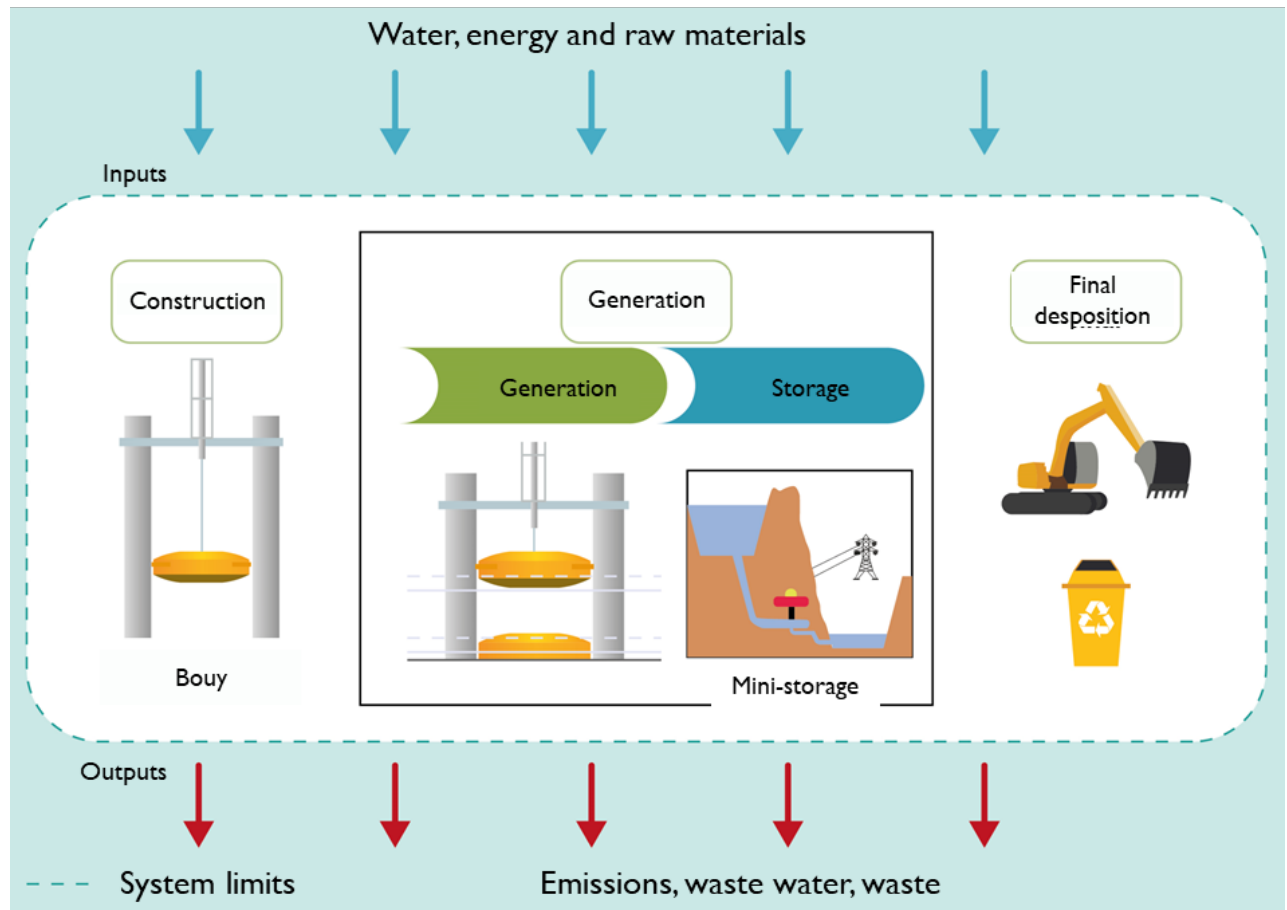
- a) Marine mammals
- b) CO<sub>2</sub> Life Cycle evaluation of marine devices
- c) Bioclimatic estimations for improving the forms of energy consumption in coastal areas
- d) Determination of morphologically adequate coastal sites for wave and tide energy extraction
- e) Ecological niche assessments
- f) Coastal species



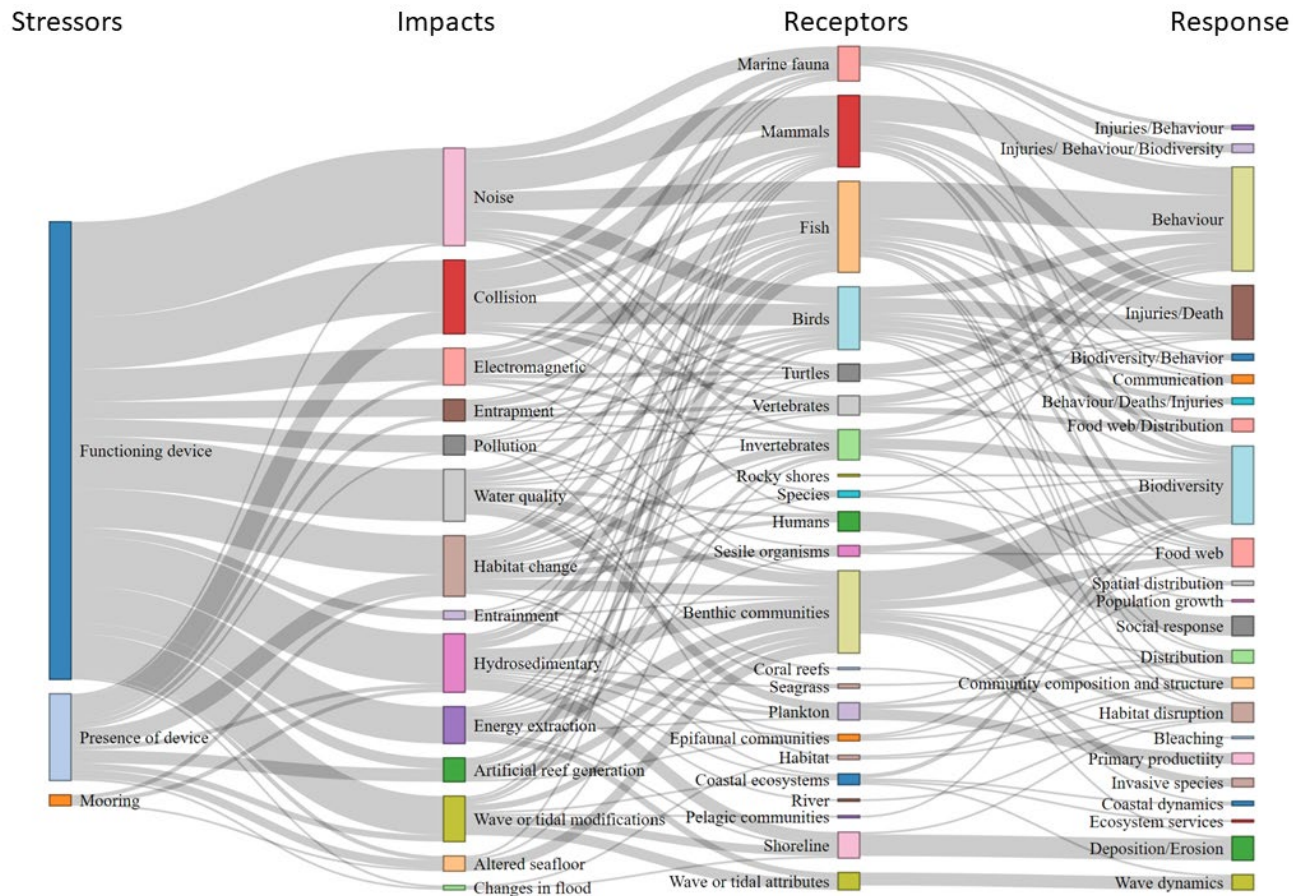
# Life-cycle Assessment for a WEC



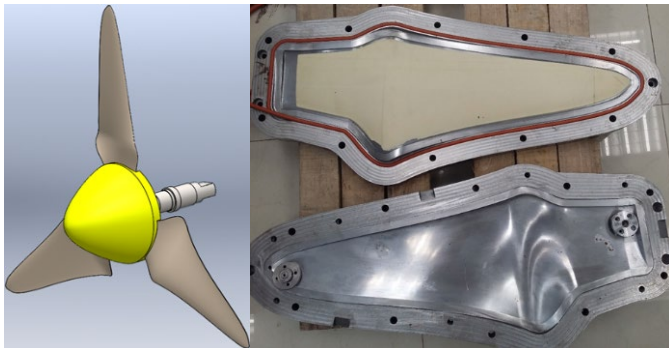
Brusseau, 2019



# Systematic analysis of the environmental impact of MRE

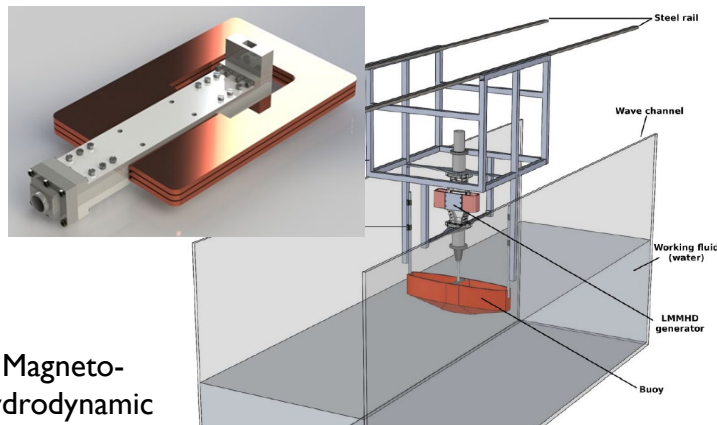
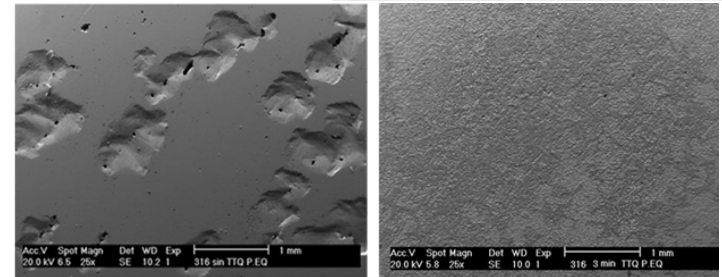
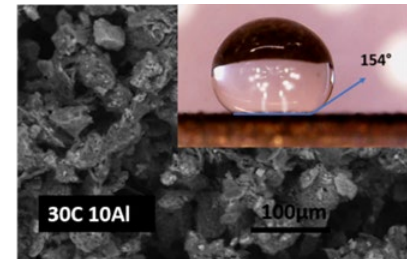


# Materials, Subsystems and Components



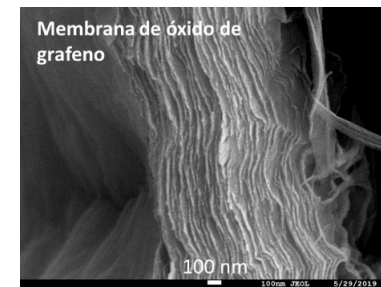
Polymer matrix blades for marine currents

Superhydrophobic, nitride and polymer nanostructured coatings that prevent corrosion of steel



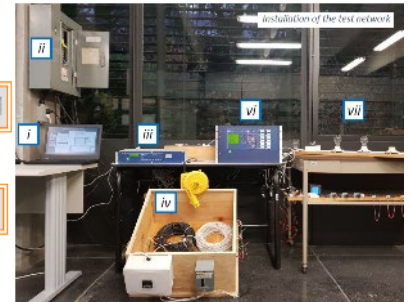
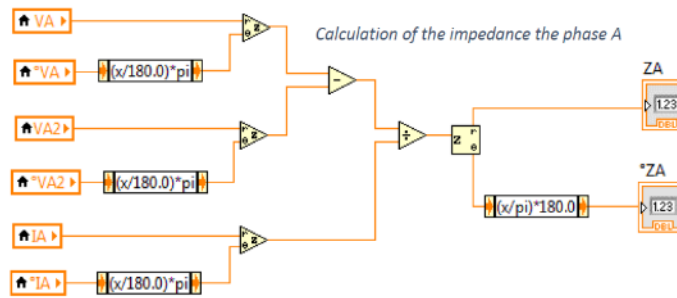
Magneto-hydrodynamic generator for wave energy

Graphene oxide membranes selective to Cl and Na for energy per saline gradient



# Integration to the electrical network

Real-time calculation of overhead line impedance profiles through PMU considering temperature fluctuations



## Production of Hydrogen

Test and change in the variables for painting membrane electrode assemblies



# Conclusions

- Mexico has great opportunities in developing marine energy technology.
- CEMIE-Océano project is Mexico's first step in the exploitation of renewable and sustainable marine energy.
- What's next?



CEMIE-Océano  
Asociación Civil



**¡Gracias!**



**CEMIE - Océano**

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