



Universidad del  
**Rosario**

# RESEARCH COLLABORATION OPPORTUNITIES SHOWCASE COLOMBIA

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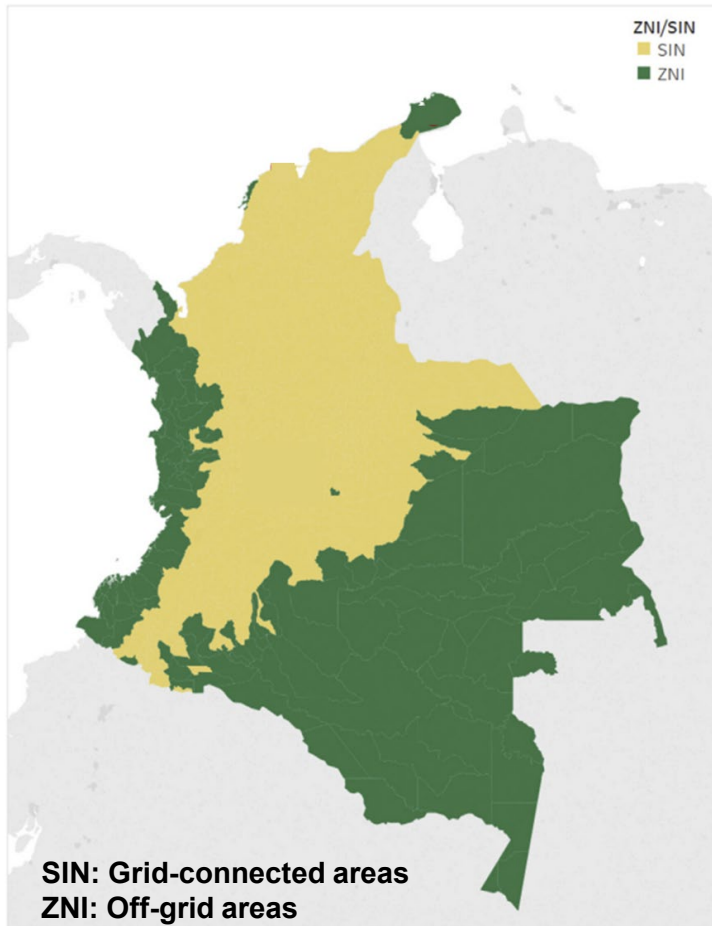
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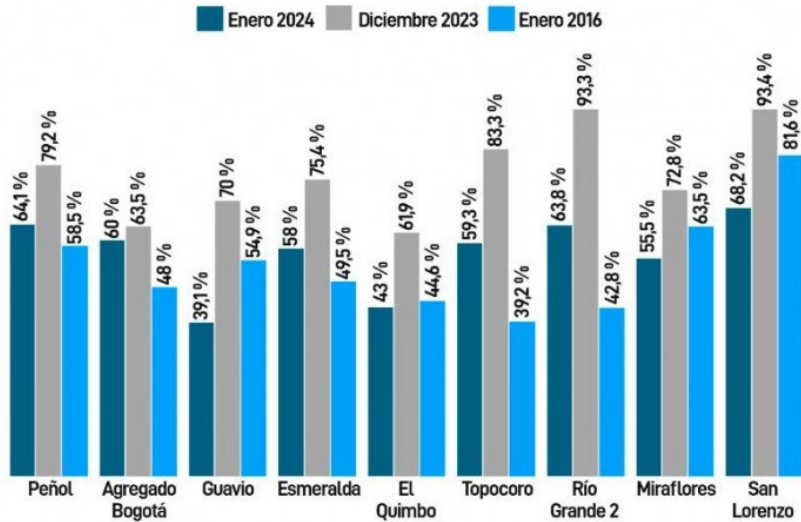
# COLOMBIA'S ENERGY SYSTEM



- Hydro-power generates more than 70% of Colombian electricity. Other renewable energy resources (RES) account for 0.10%
- Heavily relying on hydro-power, Colombia's electricity system will become more vulnerable with extreme weather patterns such as El Niño. The energy system is at risk
- Colombia faces several challenges to secure a reliable, affordable, and climate-friendly energy supply
- Non-hydro RES have the potential to increase the resilience of Colombia's hydro-heavy power system
- There are more than 1.2 million homes without energy service (off-grid areas)\*

**Dams in Colombia have fallen during El Niño: in January 2024 they dropped 55%**

## Así están los embalses en Colombia en medio del Fenómeno de El Niño



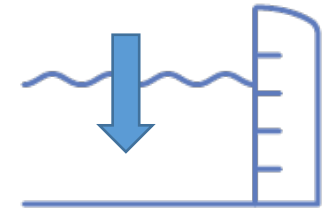
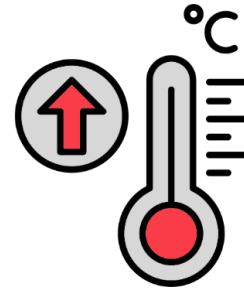
**51,3%\***

Nivel actual de todos los embalses

\*Con corte al 13 de febrero de 2024



Fuente: XM

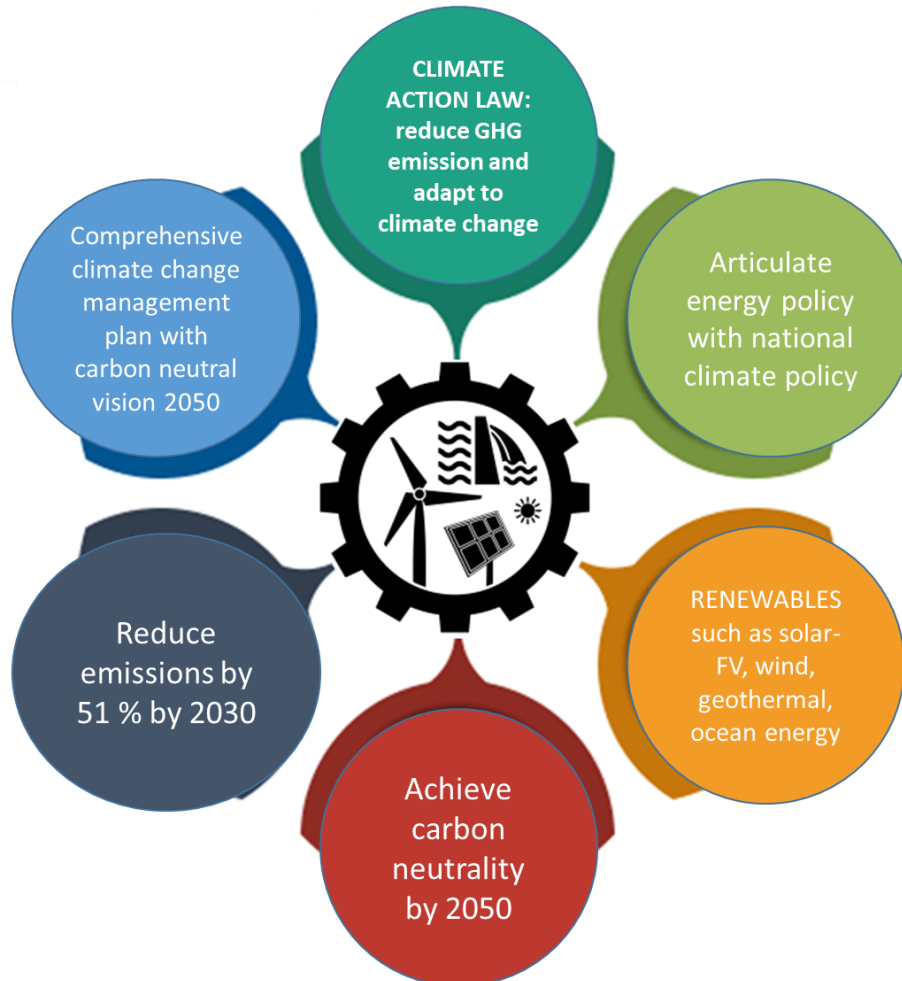


Dam Levels

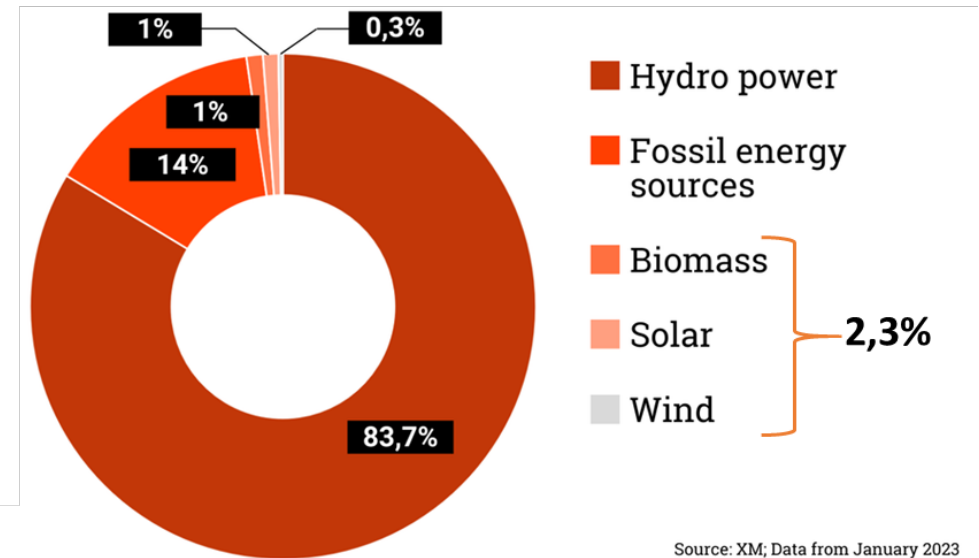


Fossil Fuel

# COLOMBIA'S ENERGY TRANSITION STRATEGY



Colombia's energy mix in 2023





# TYPES OF ENERGY THAT COLOMBIAN GOVERNMENT WILL BET ON



BIOMASS



SMALL HYDROELECTRIC  
PLANTS



SOLAR (FV)



MARINE



WIND



GEO THERMAL



GREEN HYDROGEN

# UR - EARTH SYSTEM SCIENCES PROGRAM



**PREGRADO EN**  
CIENCIAS DEL SISTEMA TIERRA



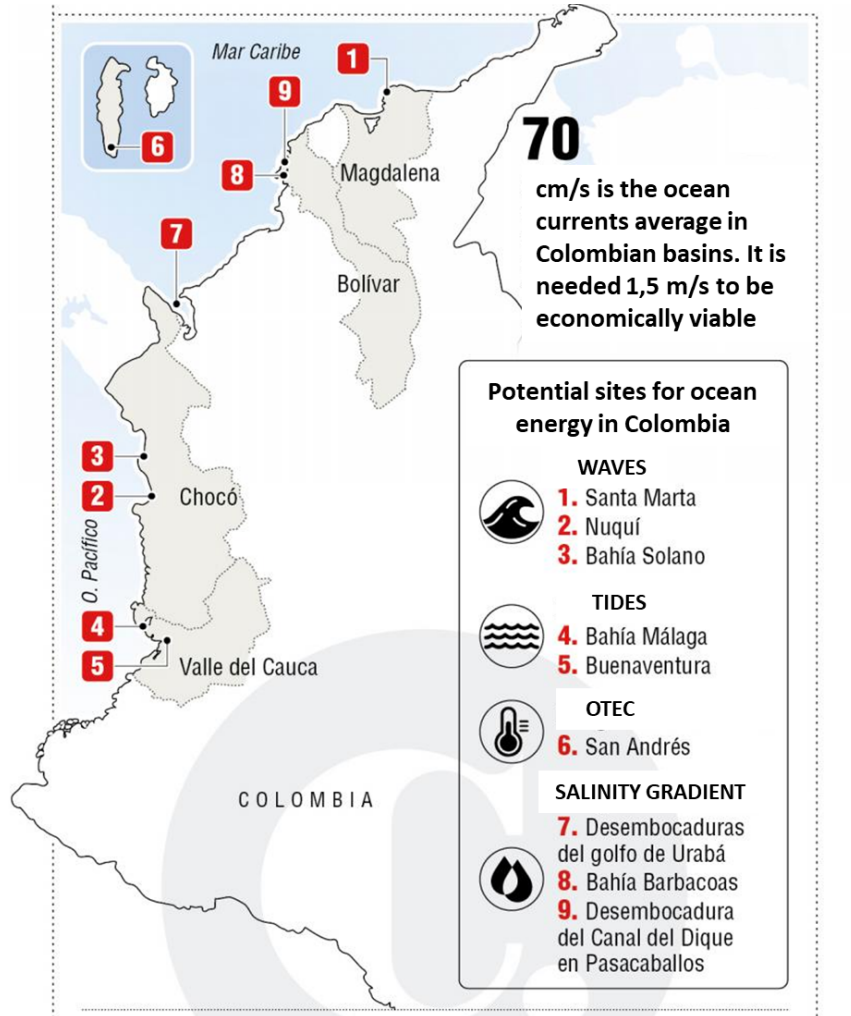
 <p>Solid Earth Sciences</p>	 <p>Atmospheric Sciences</p>	 <p>Life Sciences &amp; Biodiversity</p>	 <p>Earth System &amp; Energy</p>
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The Earth System Sciences program is the first in Colombia and Latin America. It is supported by national and international research groups with high-quality scientific production.

In the context of biodiversity loss and climate change, we are focused on solving environmental problems, which necessarily involves understanding the Earth as a complex and interconnected system.

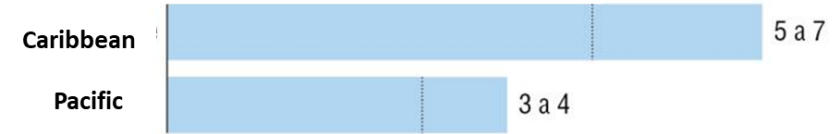


# MARINE ENERGY POTENTIAL IN COLOMBIA



## MARINE ENERGY IN COLOMBIA

WITH WAVES COLOMBIA COULD PRODUCE  
(values in kW per meter of wave front)



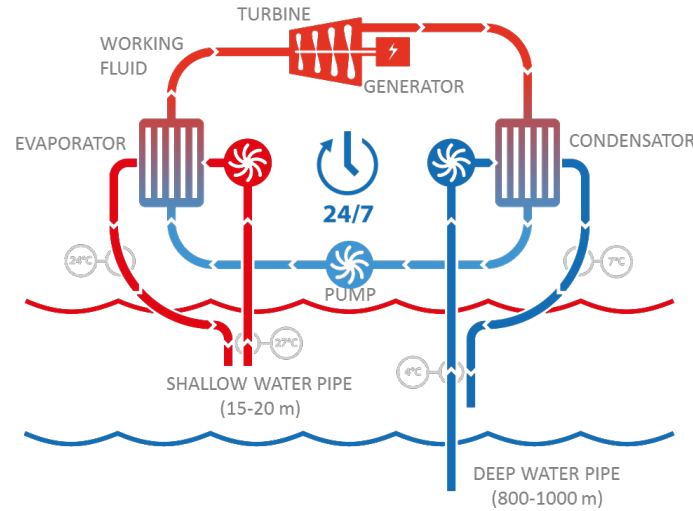
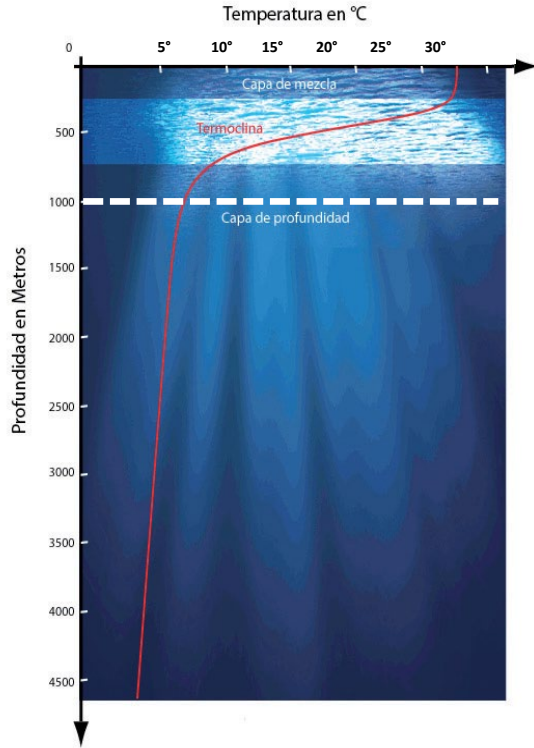
OCEAN CURRENTS  
(values in m/s)



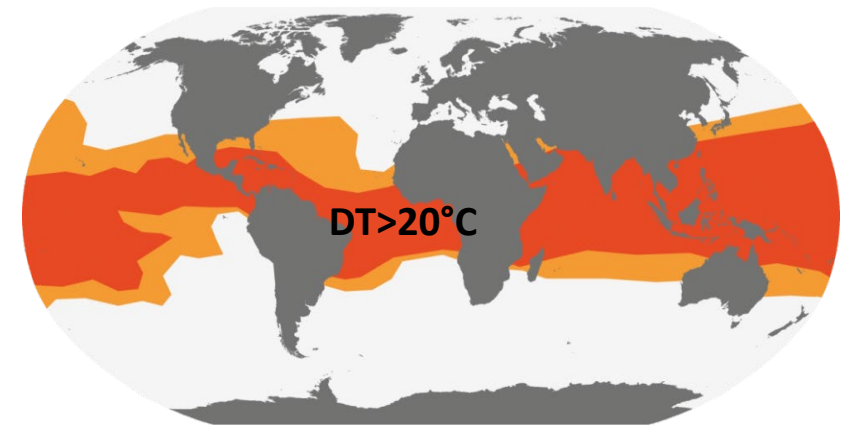
THERMAL AND SALINITY GRADIENTS



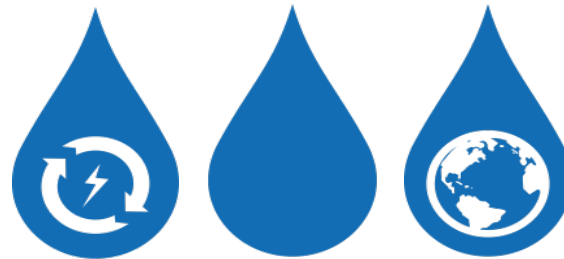
# OCEAN THERMAL ENERGY CONVERSION (OTEC) AND DEEP OCEAN WATER (DOW) APPLICATIONS



**COLOMBIA IS AN IDEAL LOCATION FOR OTEC/DOW**



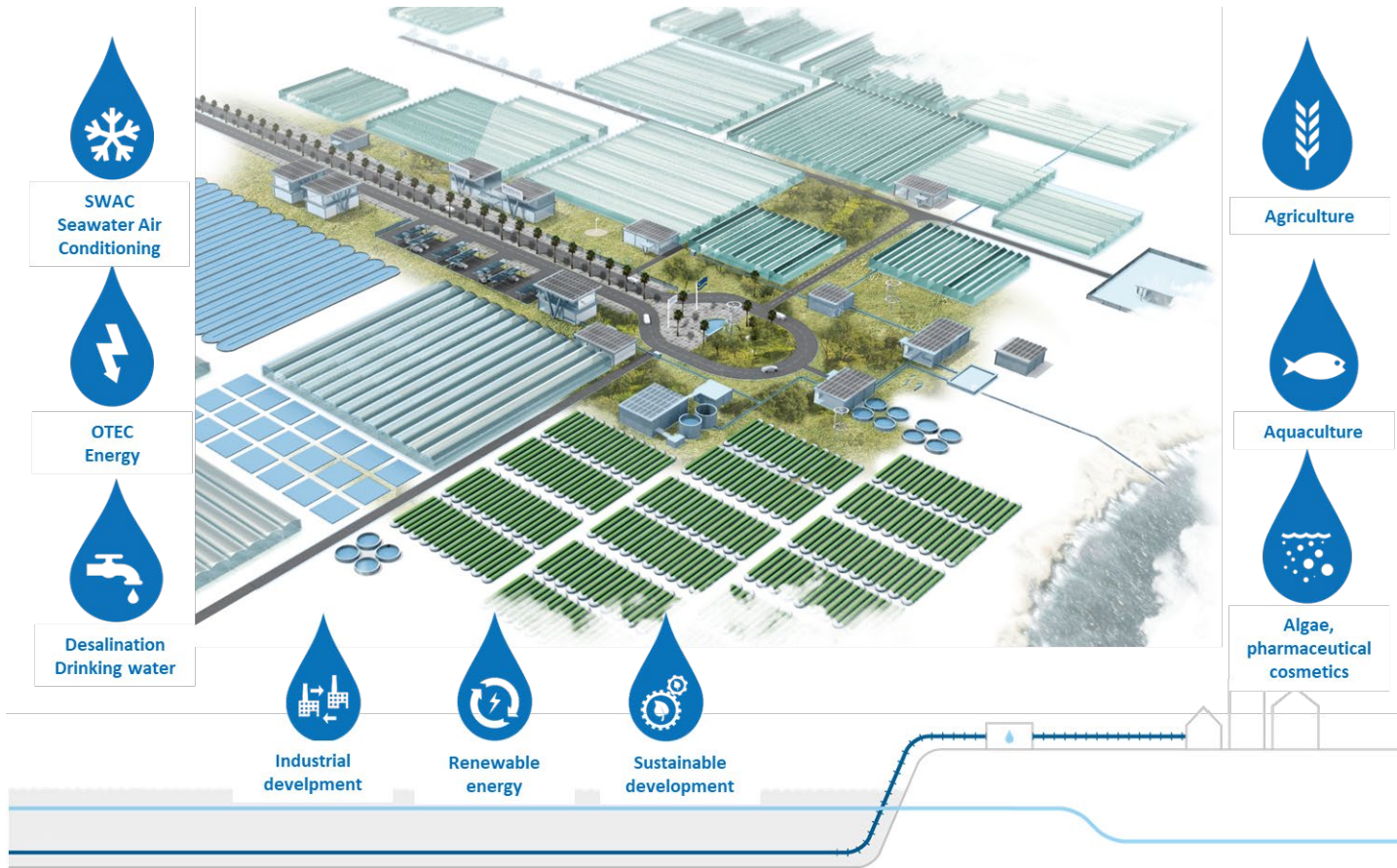
Ocean Thermal Gradient (DT > 20°C) availability (0 to 1000 m depth) in tropical regions.





# OCEAN ECOPARKS

## SCIENCE AND TECHNOLOGY PARK AROUND THE USE OF DEEP OCEAN WATER (DOW)

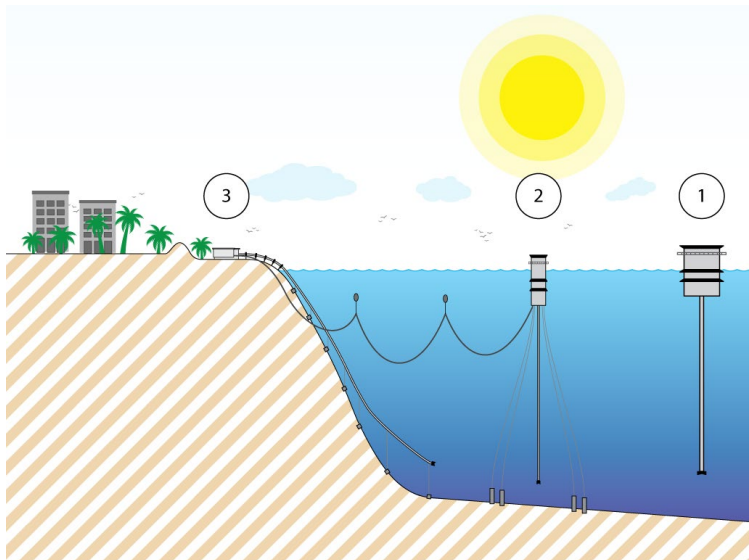


Interconnected OTEC and DOW industries could provide coastal and island communities in Colombia the opportunity for economic, social, and environmental development.

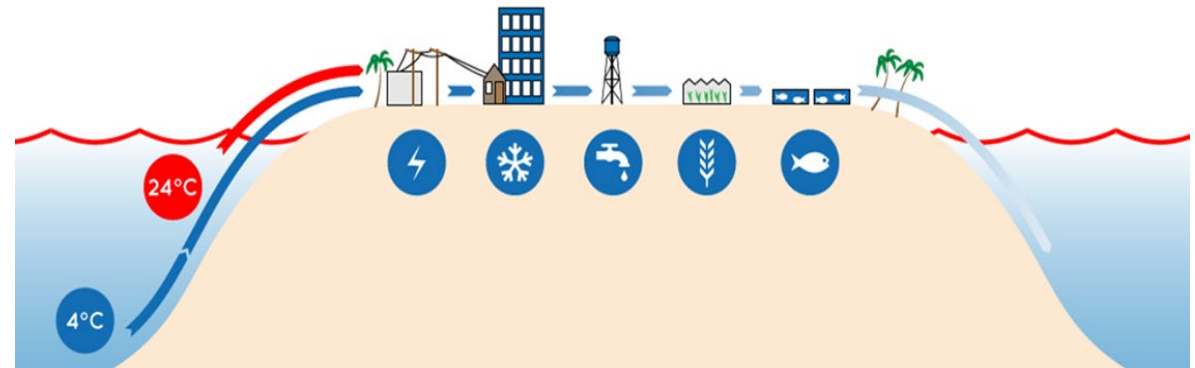
The “**ocean ecopark model**” could be an efficient use of local sustainable resources to meet community needs for energy, food, and water.

## DETERMINE POTENTIAL SITES FOR OTEC/DOW IN COLOMBIA WITH *IN SITU* DATA

- Resource availability
- Bathymetry
- Marine risks
- Environmental impacts
- Economic feasibility
- Business model



# FUTURE RESEARCH PROJECTS



## IDENTIFY TECHNOLOGIES & EVALUATE LOCAL ECOSYSTEMS

Infrastructure should avoid any damage to fragile marine and coastal ecosystems: corals, mangroves, seagrasses, fishing areas, national parks, natural aquifers, nesting areas, etc.



## **Drought, Disease and Isolation: The Urgent Situation of the communities in La Guajira**

The consequences of climate change are inducing drought, health issues, children malnutrition and a humanitarian crisis.

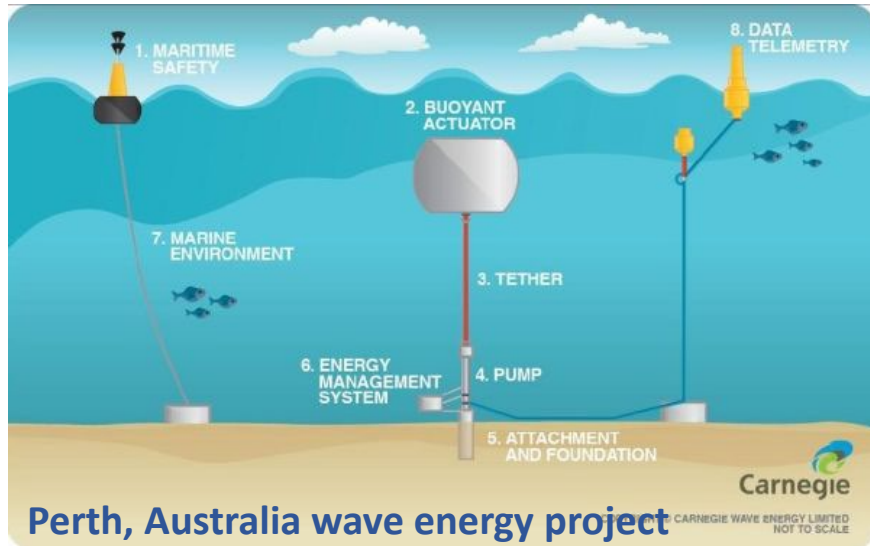
### **OTEC/DOW FOR LA GUAJIRA**



### **FROM SEAWATER TO DRINKING WATER**

- ❖ We need to produce desalinated water
- ❖ OTEC+SOLAR could power new desalination plants
- ❖ DOW could provide food, water and a new economy
- ❖ We need to improve drinking water security and support the local economy and agricultural industries





We need to map Colombia's tidal and wave energy resource in detail and assess its economic feasibility, ability and available technology to contribute to the country's renewable energy needs.

## MULTI-CRITERIA EVALUATION OF POTENTIAL COLOMBIAN WAVE & TIDAL ENERGY SITES

IDENTIFY SPECIFIC LOCATIONS AND ADEQUATE TECHNOLOGY FOR THESE ENERGY RESOURCES



Example: The Australian Tidal Energy (AUSTEn) project



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