Development of Ocean Thermal Energy Conversion in Barranquilla, Colombia

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SISSTEM

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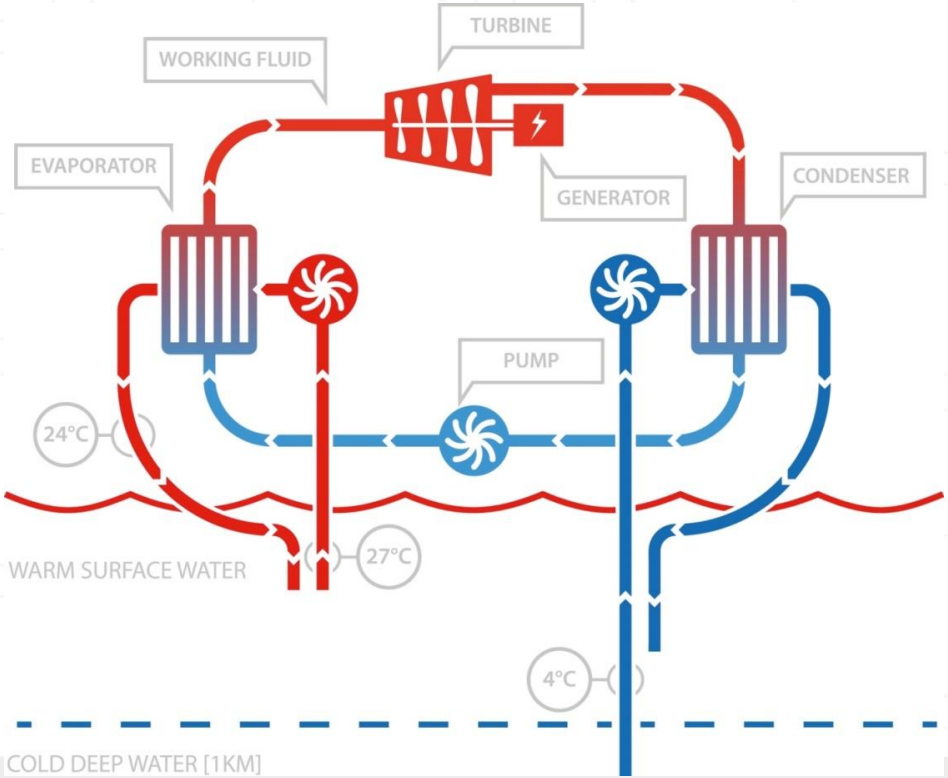
BSc. Mechanical and Engineering University of Florida (2003)
MSc. Sustainable Energy – TU Delft (2016)
PhD candidate – KU Leuven Chemical Engineering
(Sustainable uses for Reverse Osmosis Brine)

Parallel research/ Areas of Interest:

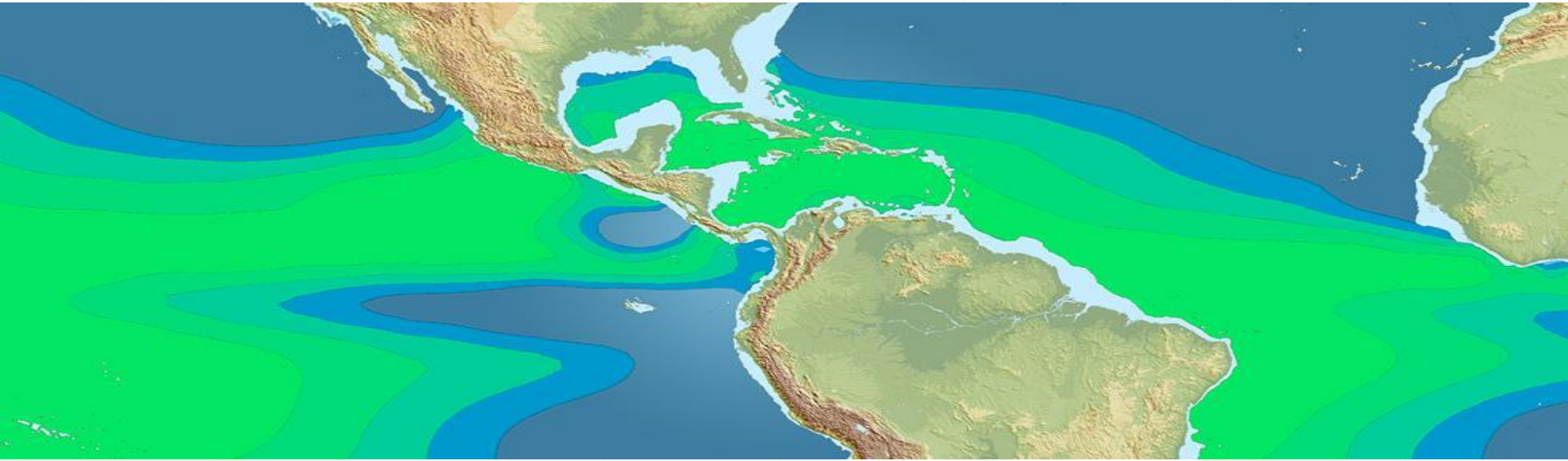
- Industrial Ecology
- Fresh water production systems
- Wastewater treatment systems
- Ocean Energy
- Tropical food production systems

"People protect what they love, they love what they understand and they understand what they are taught."
- Jacques Yves Cousteau

OTEC

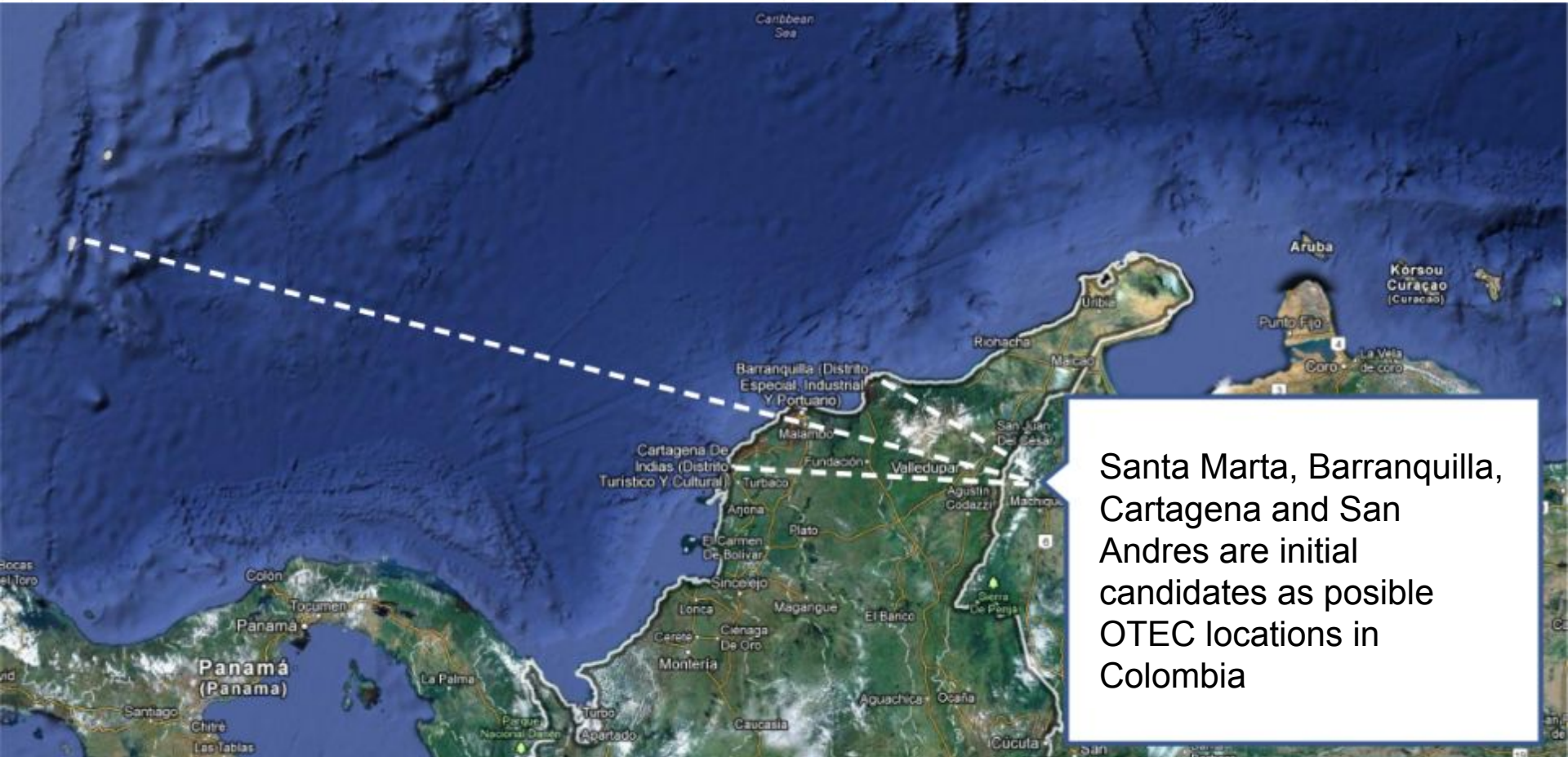

TURBINE
WORKING FLUID
EVAPORATOR
GENERATOR
CONDENSER
PUMP
24°C
27°C
WARM SURFACE WATER
4°C
COLD DEEP WATER [1KM]

OTEC



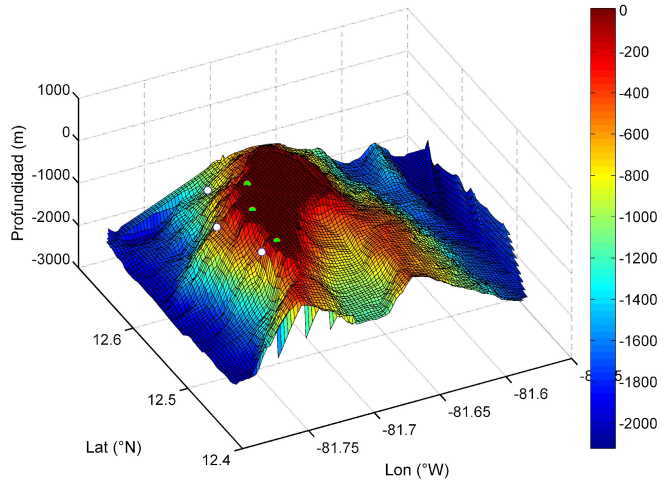
Around 100 countries and territories have access OTEC resource

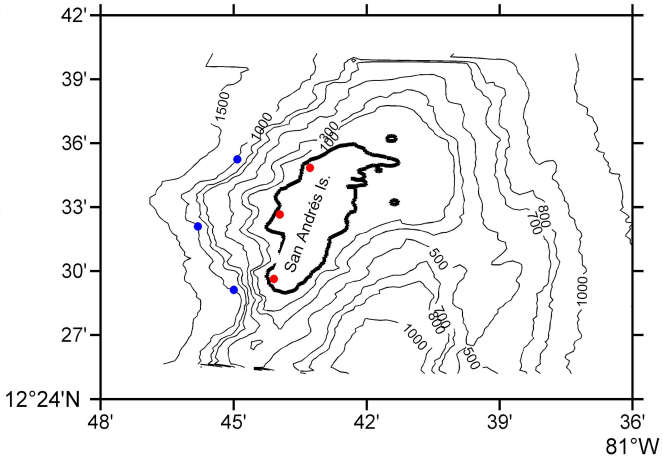
OTEC in Colombia



Santa Marta, Barranquilla, Cartagena and San Andres are initial candidates as posible OTEC locations in Colombia

OTEC in San Andres





Sitio	Ubicación en tierra	Ubicación de punto de extracción del agua profunda (1000m)	Distancia lineal (km)	Aplicación
Norte	81.7214°W - 12.5808°N	81.7486°W - 12.5875°N	3.0536	SWAC/OTEC
C.Morgan	81.7327°W - 12.5443°N	81.7635°W - 12.5350°N	3.4995	OTEC/ECOPARQUE
Sur	81.7349°W - 12.4940°N	81.7500°W - 12.4855°N	1.8920	OTEC/ECOPARQUE

Studies in collaboration with **Universidad Nacional de Colombia** y **Escuela de Ingenieria de Antioquia**

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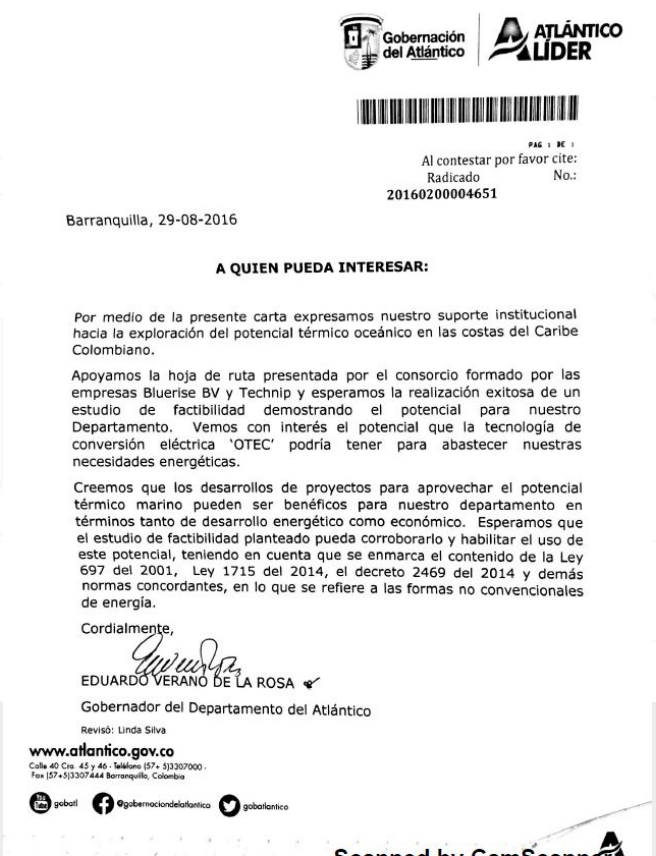
OTEC in Barranquilla



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Al contestar por favor cite:
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Barranquilla, 29-08-2016

A QUIEN PUEDA INTERESAR:

Por medio de la presente carta expresamos nuestro suporte institucional hacia la exploración del potencial térmico oceánico en las costas del Caribe Colombiano.

Apoyamos la hoja de ruta presentada por el consorcio formado por las empresas Bluerise BV y Technip y esperamos la realización exitosa de un estudio de factibilidad demostrando el potencial para nuestro Departamento. Vemos con interés el potencial que la tecnología de conversión eléctrica 'OTEC' podría tener para abastecer nuestras necesidades energéticas.

Creemos que los desarrollos de proyectos para aprovechar el potencial térmico marino pueden ser benéficos para nuestro departamento en términos tanto de desarrollo energético como económico. Esperamos que el estudio de factibilidad planteado pueda corroborarlo y habilitar el uso de este potencial, teniendo en cuenta que se enmarca el contenido de la Ley 697 del 2001, Ley 1715 del 2014, el decreto 2469 del 2014 y demás normas concordantes, en lo que se refiere a las formas no convencionales de energía.

Cordialmente,

EDUARDO VERANO DE LA ROSA

Gobernador del Departamento del Atlántico

Revisó: Linda Silva

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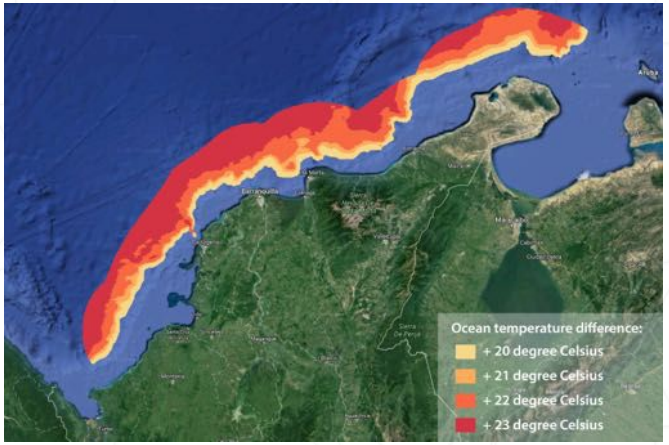
OTEC in Barranquilla

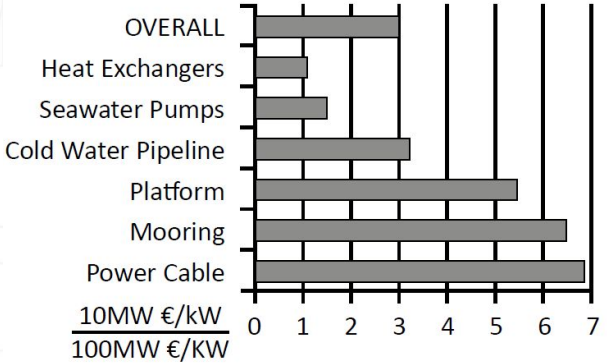
- Relatively close access to deep water
- Strong industrial capabilities
- Large electrical demand
- Proximity to largest Colombian shipyard
- Minimal storm/tsunami risks
- Colombia is a relatively large economy with access to the Caribbean basin (strong initial OTEC market potential)



Temperature differences of at least 20C between surface and deep water within 80km from coastline
(World Ocean Atlas and *GEBCO* datasets used)

Plant sizing

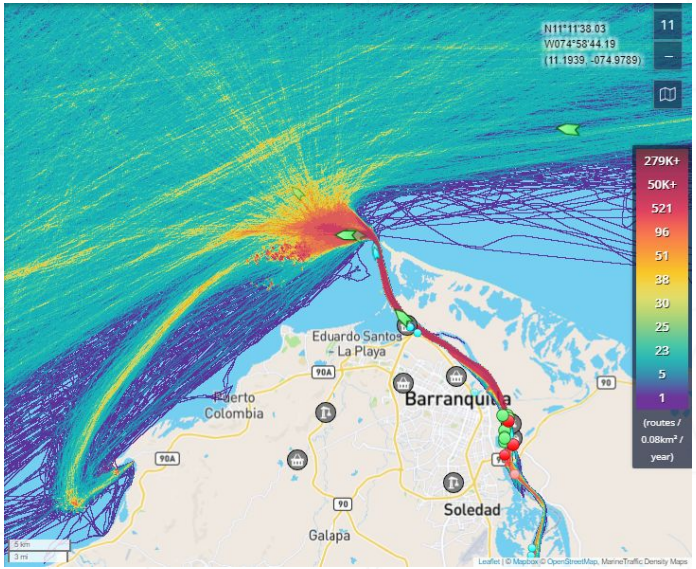
- Preparation for pilot demonstrator after onshore plants
- Pilot demonstrator at 10 MW (net) can be made with off-the-shelf components
- Important to demonstrate key power cycle components before scale-up



B. Cable, US Naval Facilities Engineering Systems Command

Considerations for plant siting

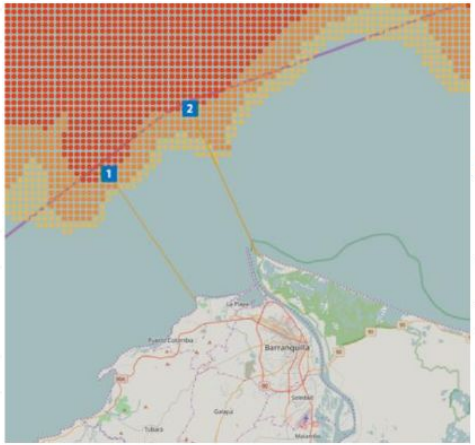
- Resource access
- Oceanographic conditions (waves, etc)
- Other marine uses (e.g. shipping)
- Port access
- Electrical substation access



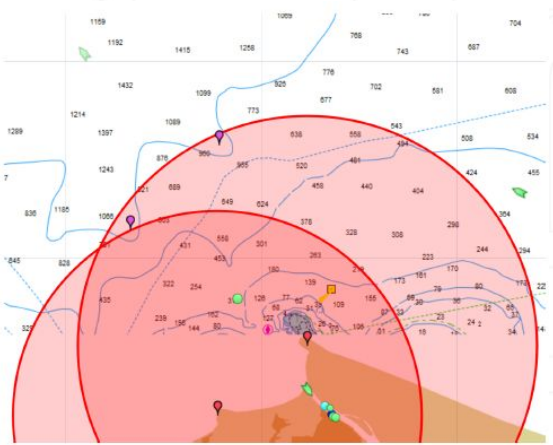
Marine traffic density (MarineTraffic, 2022)

Locations considered

Site 1	Site 2
-75.00, 11.04 decimal degrees	-74.89, 11.30 decimal degrees
~20km from shore and approx. 30km from population centers	
89 km from substation	112km from substation



(A) Surface temperature

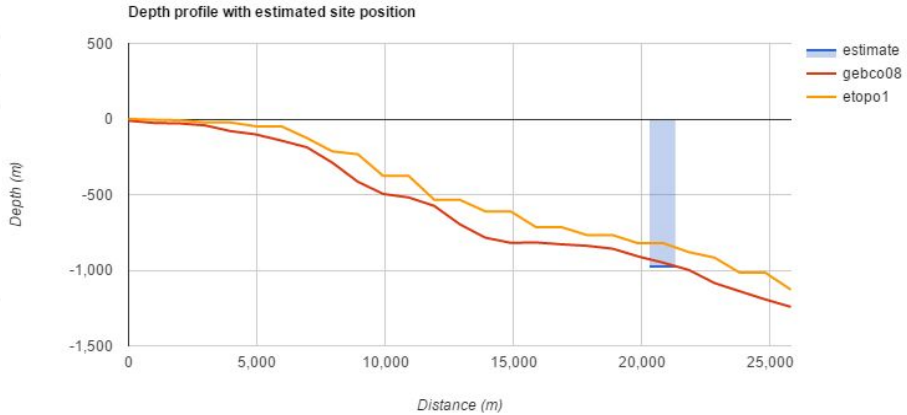


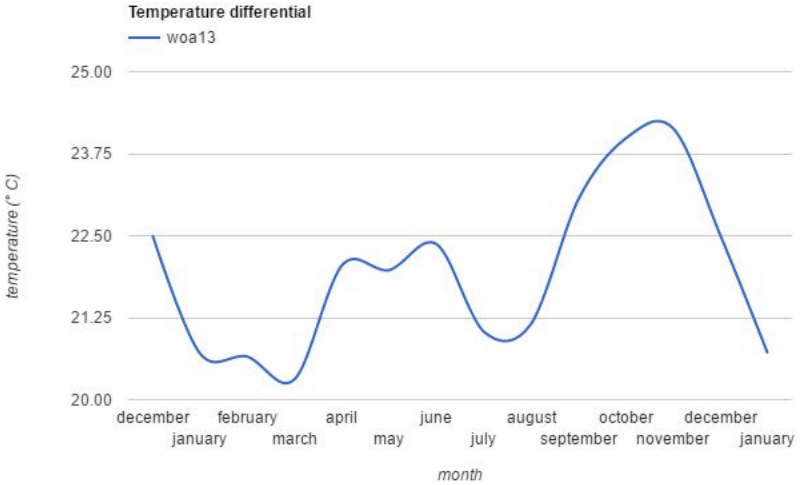
(B) Depth

Proposed plant locations

Site 2 details

Seawater Surface Temperature	Seawater Inlet Temperature	Distance Range	Depth Range
27.2 ° C	5.2 ° C	20.3 to 21.3 km	925 to 975 m





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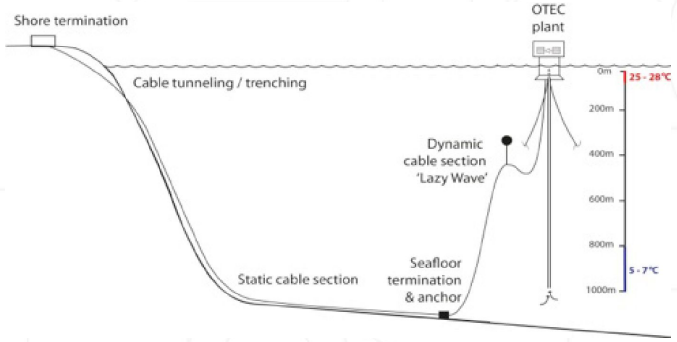
Outlook

- Development of knowledge and technological transfer
- Colombia has significant international partnerships and local expertise
- Sufficient local industrial capabilities for integration, key components could be initially sourced abroad but industry can be developed
- Colombian Shipyard (COTECMAR) could be used for the construction of the first industrial OTEC plant
- Significant resources can be mobilized for construction alone, rough estimates of over 900 jobs that can be created
- New renewable energy resource for Colombia and the Caribbean
- Potential for export of services and creation of a new industrial hub



Connection possibilities

Artist impression 10 MW plant