# **KRISO's Plan for Ocean Energy Utilization to Achieve SDGs in Pacific/Asian Coastal Areas**

KRISO



## 2018. 11. 28

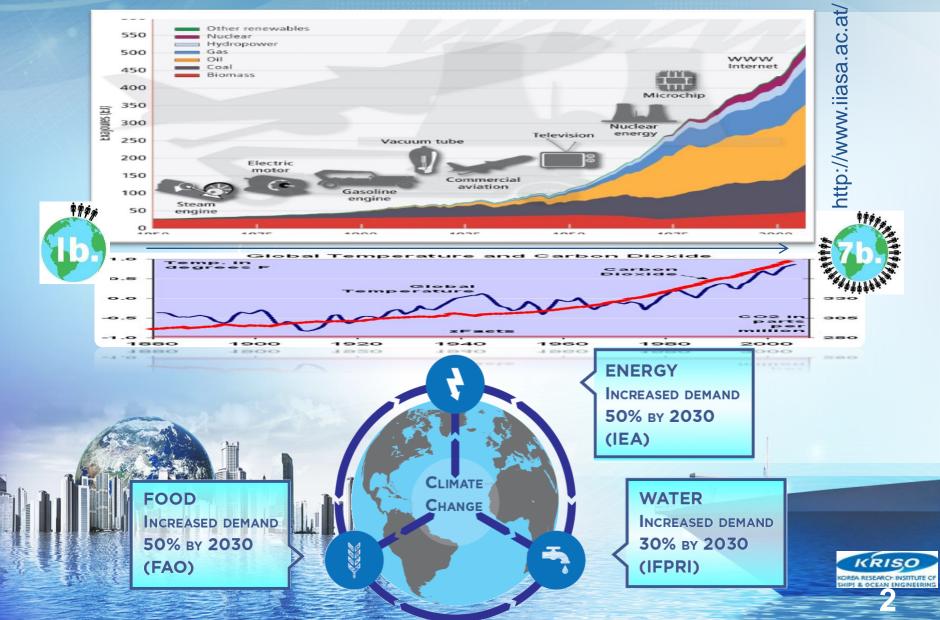
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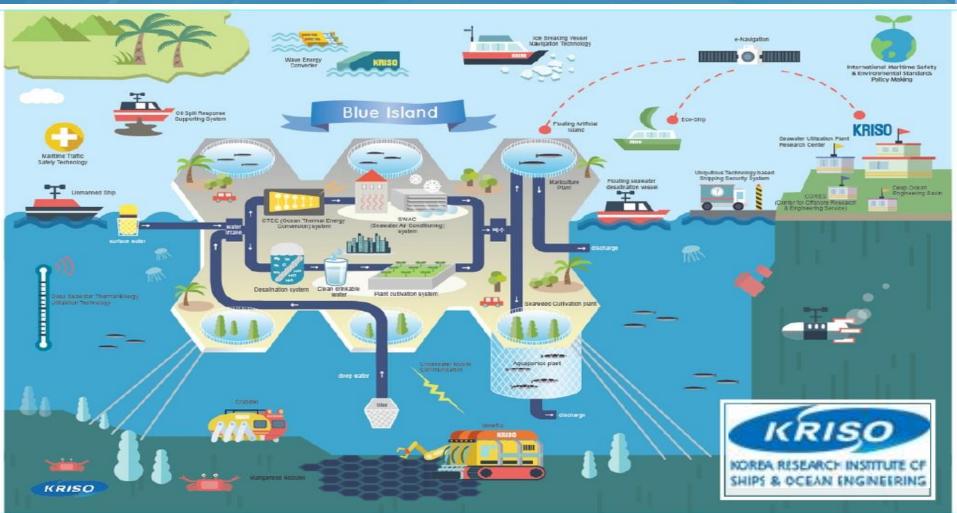


# Food, Energy and Water nexus with regard to climate change

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## **R&D and Activity areas of KRISO**



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- [All activity areas of KRISO is onto Blue Island]
  - Food : Aquaculture and hydroponic systems
  - Energy : OTEC and SWAC systems
  - Water : Desalination and Mineral balance system

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- Base structure : VLFS and ICT management etc.

# **Ocean Energy RD&D in KRISO**

#### **Wave Energy Converter**

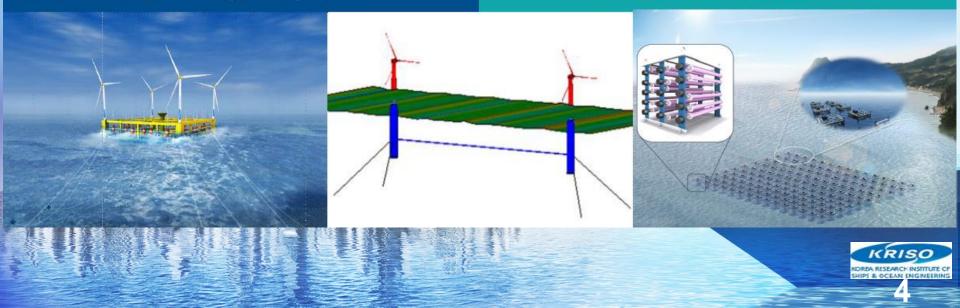
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#### **Ocean Thermal Energy Conversion**



#### **FOWT & Hybrid System**

#### **Tidal Current Energy Converter**





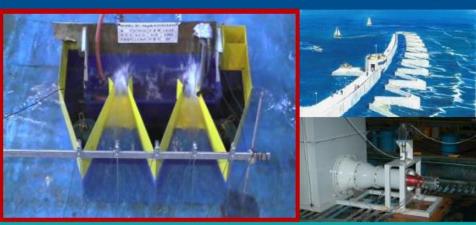
#### Jujeon-A, 2001 (OWC, 60kW)

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### KRISO Reef, 2010 (Wave Overtopping, 250kW)

#### KRISO, 2005 (Wave Overtopping, 100kW)



#### KRISO BBDB, 2007 (OWC, 150W)



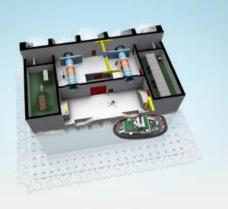
## WEC RD&D in KRISO after 2010

#### Yongsoo WEC, 2016 (OWC, 500kW)

#### FPWEC, ~2019 (Oscillating Wave Surge, 300kW)



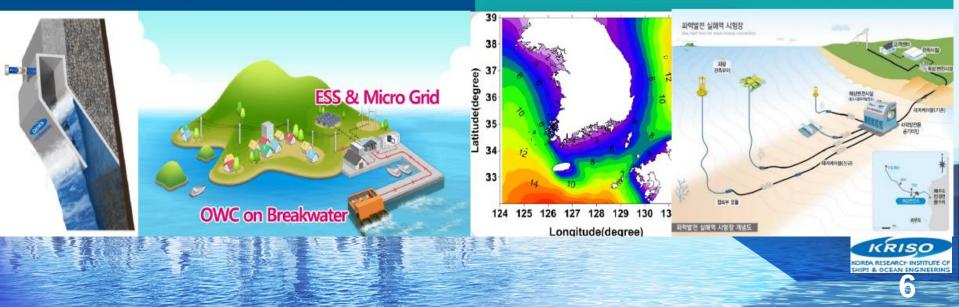
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## Island WEC-MG System, ~2021 (OWC, 30kW)

#### K-WETEC, ~2019 (WEC Test Bed, 5berths, 5MW)



# **OTEC RD&D in KRISO after 2010**

## 60RT(210kw) Tandem Heat pump, '10

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## **'10 500RT(**1.75мw) **Turbo Heat pump, '1**3



## 20kW R32-OTEC plant(20°CdT), '13

## 200kW R245fa-HOTEC plant (70°CdT),'14

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## **Ocean Energy and Seawater Utilization for Food**



## Hydroponics and aquaponics

#### Seaweed culture in open sea or tank

Deep seawater, rich with its nutrient salts, provides most ideal condition for seaweeds. Seaweeds are used as food, for cosmetic products, and can be also turned into bioenergy. Also, they absorb carbon dioxide through photosynthesis, which helps reducing global warming.

# [ Seawater and heat supply for agriculture ]

#### [ Seawater and heat supply for aquaculture ]

CARROT \$3.50



Water

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## **Ocean Energy and Seawater Utilization for Water**

Desalination is the method of desalting salt from seawater to produce drinkable fresh water

- Membrane separation method : RO, NF, ...
- Phase change method : MSF, MED, FD





Energy

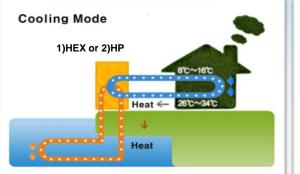
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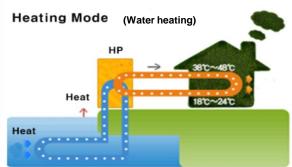
## **Ocean Energy and Seawater Utilization for Energy**

Cooling source can be acquired from

 direct heat exchanger by cold deep ocean water
 cold heat of evaporator of heat pump
 by use of seawater as a condensing heat source













The Seaside Momochi District Supplies Heat using the Unutilized Energy of the Sea



HP (Momochi district, Japan)

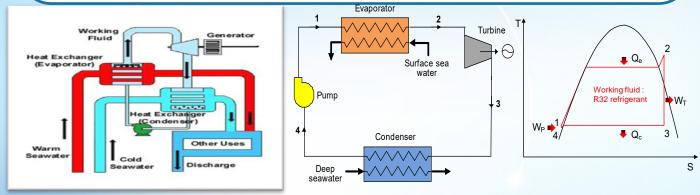


## **Ocean Energy and Seawater Utilization for Energy**

Energy OTEC2E

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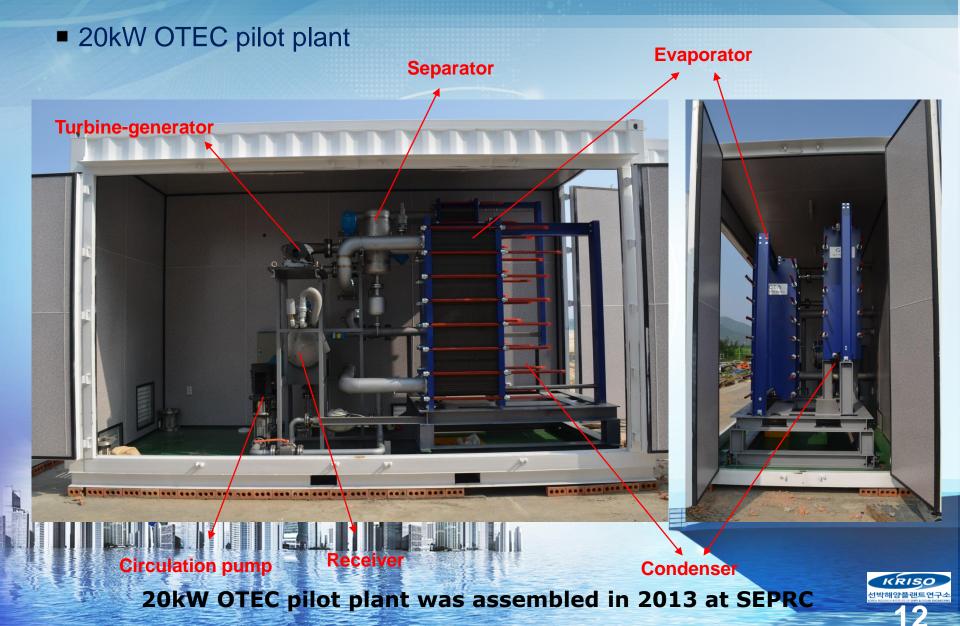
Electric power can be generated by rotating a turbine using gaseous flow of evaporated working fluid. Warm surface and cold deep seawaters are used for heat source and sink, respectively.



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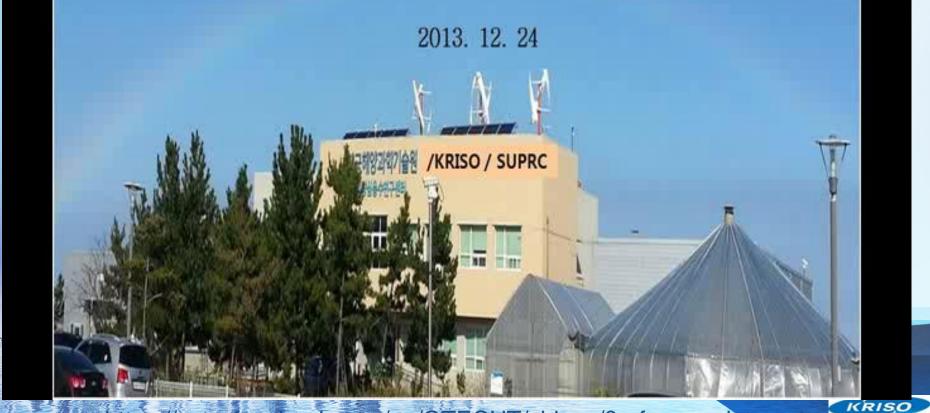
# Verification of pilot plant for 1MW OTEC Plant





# **Experiment of 20kW OTEC pilot plant**

Demonstration of 20kW OTEC pilot plant based on R-32 Rankine cycle developed by Korea Research Institute of Ships and Ocean Engineering



https://www.facebook.com/pg/OTECUT/videos/?ref=page\_interna

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## Manufacture of key parts of 1MW OTEC plant for performance test in Korean waters

#### **Turbine generator('16)**



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#### Condenser('17)



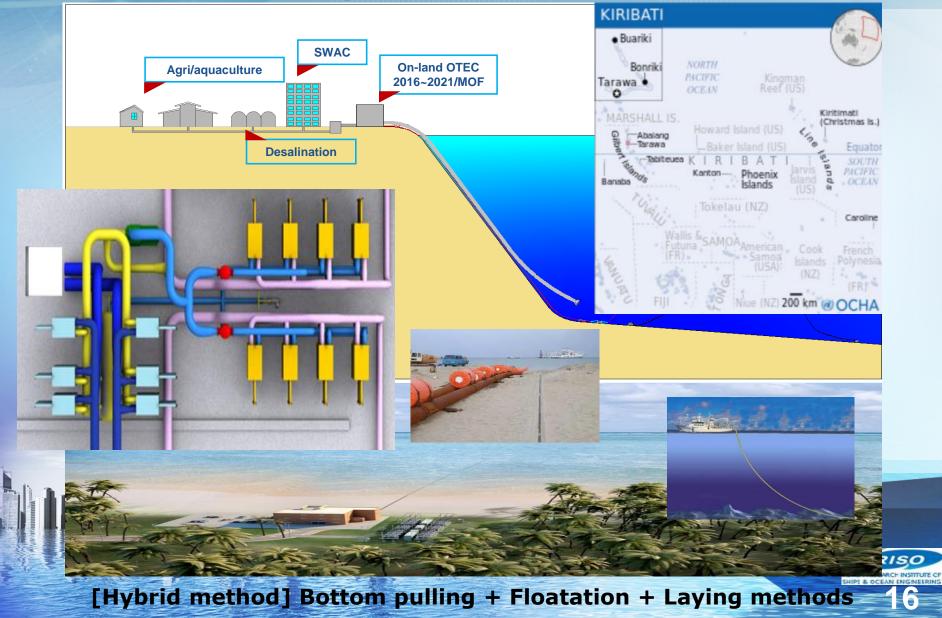
Key parts are under manufacturing to complete in 2019



<sup>KRISO</sup> 1<sup>st</sup> Demonstration plan of 1MW OTEC plant for performance test before transporting to install

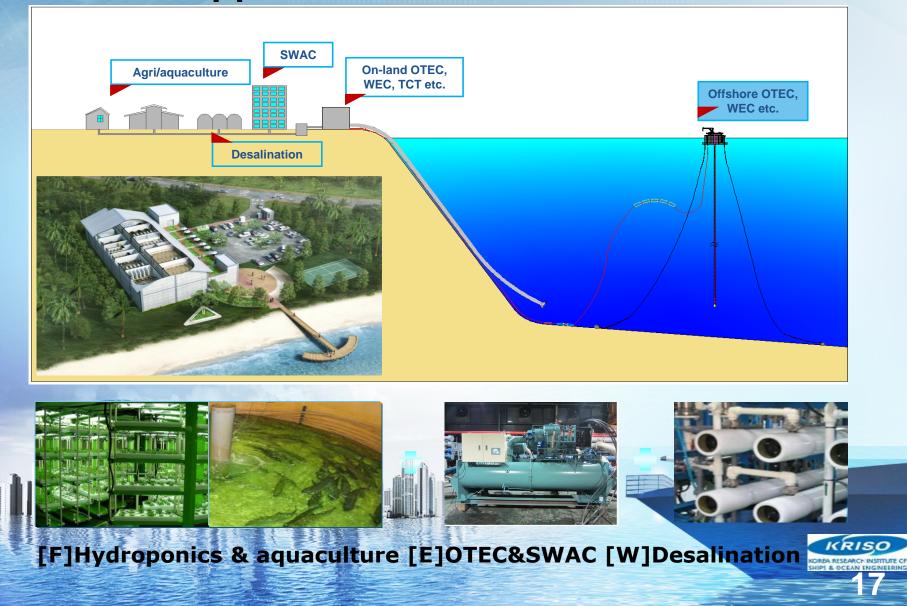
Verification experiment (2019) Assembling Canadim a Trana Performance test in situ will be done in late summer in 2019 < 7th International OTEC Symposium will be held in Busan >

# **Construction of cold and warm water pipes** for long term operation (2020)

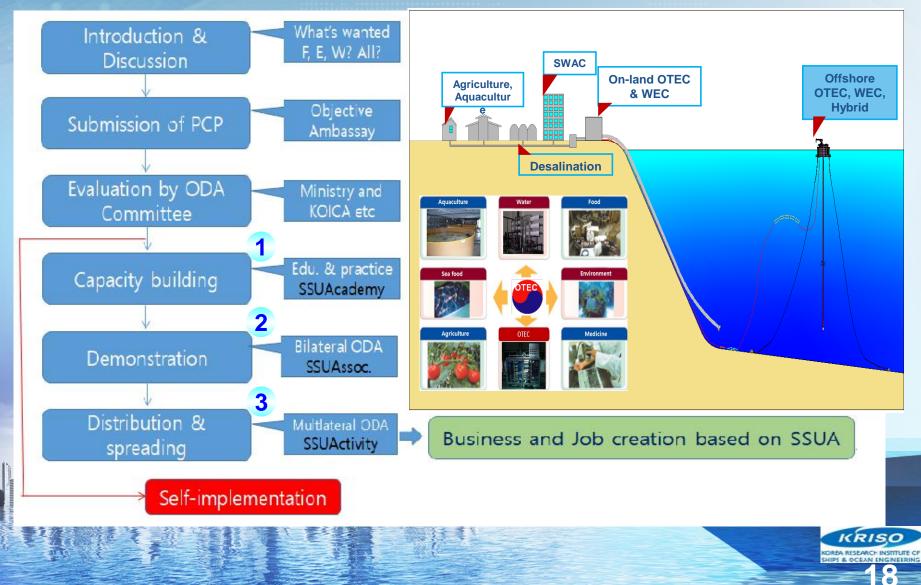


# Power supply and cascade utilization to support achievement of SDGs

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## Framework of Ocean Energy & Seawater Utilization for SDGs achievement



## Capacity building('16) and Activity('18) in Kiribati





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Sustainable Seawater Utilization Academy













## **Ocean Energy & Seawater Utilization** to Achieve SDGs in Pacific/Asian Coastal Areas





## Thanks a lot for kind attention!

