The Korean Roadmap to OTEC Industrialization

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Background and Purpose

- Population increase and industrialization based on fossil fuel
  1) Shortage of essential resources such as Food, Energy & Water
  2) CO$_2$ emission, Global warming, Climate change, albinism etc.

- Requirement of OTEC for global and domestic needs
  1) ODA activity as a donor shifted from receiver since 1996 based on experience and technical potential => Low dT OTEC + SWAC
  2) Alternative energy utilization aims to increase by 11% in 2030 to reduce the dependency on imported fossil fuels => High dT OTEC + SWAC

- OTEC roadmap was established to meet such demands on time by contribution of Korea, a leading producer of ships, steel and so on
Master Plan and Development Strategy

[ National Master Plan 2030 of Renewable Energy Utilization ]

- National supply of new & renewable energy in 2030: 11% of national energy demand
- Development of 80% resources of available ocean energy until 2030
- Early development of tidal barrage power plant

[ Phased Development Strategy ]

- Classifying ocean energy technologies into tidal barrage, tidal current, wave, ocean thermal energy conversion (OTEC) and hybrid system
- Promotion based on 3 stages (short/mid/long term) of development

- Phase 1 (2008~2012)
  - Building a Technologically Independent basis
  - Supply Goal: 120kTOE/yr
  - Develop core technologies
  - Development of coastal area
  - Government leading

- Phase 2 (2013~2020)
  - Verification / Technology Advancement
  - Supply goal: 900kTOE/yr
  - Utilization of technologies
  - Development of open sea
  - Participation of Industry

- Phase 3 (2021~2030)
  - High Value-Added Industrialization
  - Supply goal: 1,500kTOE/yr
  - Commercial use
  - Develop Hybrid system
  - Industry leading
Ocean Energy Potentials in Korea

- Estimated ocean energy in Korea: 14,600MW

- LdT OTEC application of surface and deep layers in tropical seawaters

- HdT OTEC utilization using solar/geothermal heat or power plant discharge
R&D and Industrialization Needs for OTEC

To meet the needs from R&D, industrial sectors and ODA receiver based on the technological strength of Korea and international cooperation (JPA, ADB, GCF etc.)

Phased needs

2020~2030
50~100MW OTEC plant
- Energy supply for nations populated over 50,000 people

2018~2020
5~20MW OTEC Plant
- Self energy-sufficient offshore bases for fisheries and deep sea mining
- 2nd stage ODA in tropical nations

2016~2018
1MW OTEC plant
- 1st stage ODA for tropical islands (LdT OTEC)
- Deep sea mining at small mining pilot plants

2014~2016
~0.2MW OTEC plant
- LdT OTEC plant for cooling power plant
- HdT OTEC plant sourced by multi-heat for practical use in Korea (wood incineration...)
Final Goals and Approaching Steps

**Design, manufacture, installation and operation of 100MW commercial OTEC plants in tropical waters**

**Final Goals**

- **100W & 20kW OTEC Experiments**
  - Educational demonstration of OTEC mock-up in 2011
  - Public demonstration of small OTEC pilot plant in 2013

- **200kW HdT & 1MW LdT OTEC Pilot Plant**
  - Design and fabrication of small practical OTEC plant
  - Installation and operation for domestic (HdT) and tropical (LdT) implementation of Blue Infrastructure

- **10MW OTEC Practical Plant**
  - Practical OTEC plant for multi-staged use
  - ODA project and deep sea mining assistance

- **100MW OTEC Commercial Plant**
  - Prototype 100MW OTEC plant for commercialization

**Steps**

- **2010~2013**
  - 100W & 20kW OTEC Experiments

- **2014~2017**
  - 200kW HdT & 1MW LdT OTEC Pilot Plant

- **2018~2020**
  - 10MW OTEC Practical Plant

- **2020~**
  - 100MW OTEC Commercial Plant
# The Annual OTEC R&D Plan in Korea

## Pipe (Riser) & Structure

| 1st year | 2010 | Design small scale pipe  
| Installation skill |

| 2nd year | 2011 | Installation simulator  
| Hydraulic model test of deploying pipeline  

| 3rd year | 2012 | Design of middle scale pipe  
| Heat flow simulator |

| 4th year | 2013 | Self-cleaning system  
| OTEC structure design |

| 5th year | 2014 | Installation simulator  
| Integrated model test in Ocean Eng. basin  

| 6th year | 2015 | 10/100MW design concept  
| Prototype manufacture of large diameter riser |

## OTEC

| 1st year | 2010 | Design of turbine concept  
| Mock-up turbine design |

| 2nd year | 2011 | Develop cycle simulator  
| 100W Mock-up design & experiment |

| 3rd year | 2012 | Eco-friendly working fluid  
| OTEC-20kW design & TG manufacture |

| 4th year | 2013 | OTEC-20kW pilot plant  
| OTEC-200kW design |

| 5th year | 2014 | OTEC-200kW test-bed  
| High efficiency/large scale |

| 6th year | 2015 | Design of practical model (1MW)  
| 10/100MW plant c. design |

## Environment improvement

| 1st year | 2010 | Green city Investigation  
| Multipurpose direction |

| 2nd year | 2011 | Investigate resources around Korean waters  
| Freezing desalination |

| 3rd year | 2012 | Freezing desalination after SWAC  
| Survey of target waters |

| 4th year | 2013 | Investigate resources at oversea research bases  
| LTD Desalination |

| 5th year | 2014 | Mitigation method for OTEC/SWAC application area  
| Creation of subsea forest |

| 6th year | 2015 | Management of subsea forest  
| Cascade Utilization Model |
OTEC Industrialization with cascade utilization

Multi-purpose utilization before/after OTEC (SWAC, desalting, extraction, aquaculture, agriculture and thalassotheraphy etc.) for Blue Infrastructure

[ The OTEC technology and its industrialization will assist not only Korea for supplying clean energy up to 11% of national demand, but also the small islands(tropical nations) for their green growth ]