NEDO’s emission reduction technology development and deployment in developing countries

(e.g. energy efficiency and conservation technology)

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New Energy and Industrial Technology Development Organization

About NEDO

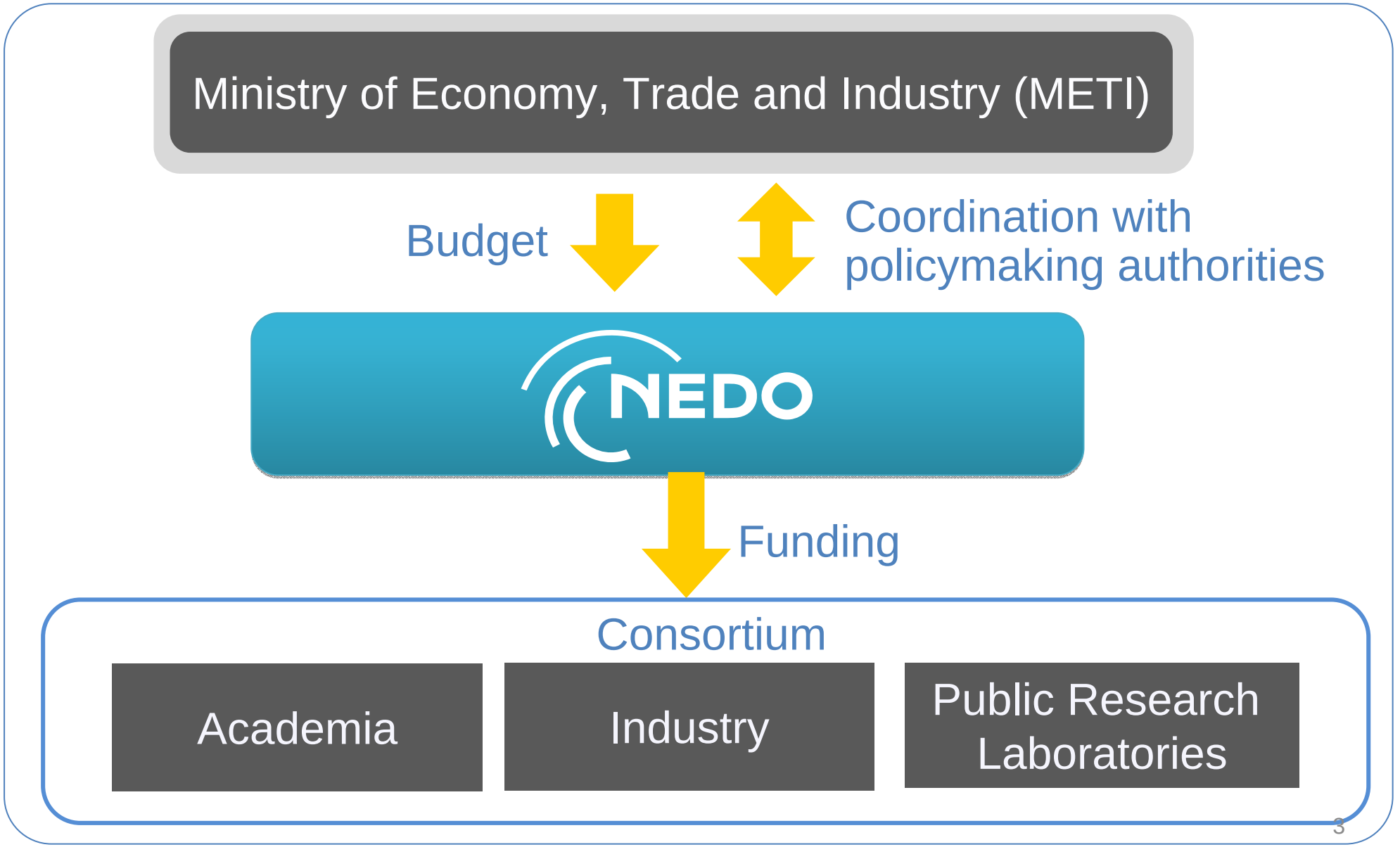
New Energy and Industrial Technology Development Organization (NEDO)

Promotes research and development as well as the demonstration of industrial, energy and environmental technologies.

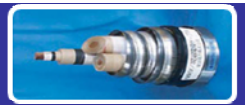
Mission

- Addressing energy and global environmental issues
- Enhancing Japan's industrial competitiveness

NEDO's Role


Ministry of Economy, Trade and Industry (METI)
Budget
Coordination with policymaking authorities
NEDO
Funding
Consortium
Academia
Industry
Public Research Laboratories

NEDO's Technology Development Activities


Energy Conservation

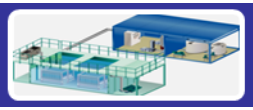

Renewable Energy

Storage Batteries


Smart Grids & Smart Community


Robots


High-efficiency Clean Coal


Water Treatment


Electronics

Materials & Nanotechnology


Biotechnology & Medical Technology

Technologies for Countermeasure against Climate Change

- Energy Conservation
  - Energy management – HEMS, BEMS, CEMS
  - Energy Storage
  - Heat Pump
  - Combined heat and power
- New Energy
  - Smart Grid
  - Photovoltaic power generation
  - Wind power generation
  - Energy from Waste
  - Fuel Cell technology (PEFC, SOFC)
  - Solar power generation
  - Ocean energy utilization

- Fuel for Transportation
  - E.V., Hybrid V., Fuel cell V.
  - Secondary battery
  - Gas to liquid (GTL) technology
  - Biomass fuel production
  - Hydrogen production
- Fossil fuel production and clean technology
  - Clean coal technology
  - CO2 capture and storage
  - New coke-making technology

- Non-fluorocarbon technology
  - Non-fluorocarbon refrigerator
  - Non-fluorocarbon insulator
  - Fluorocarbon decomposition

Renewable Energy

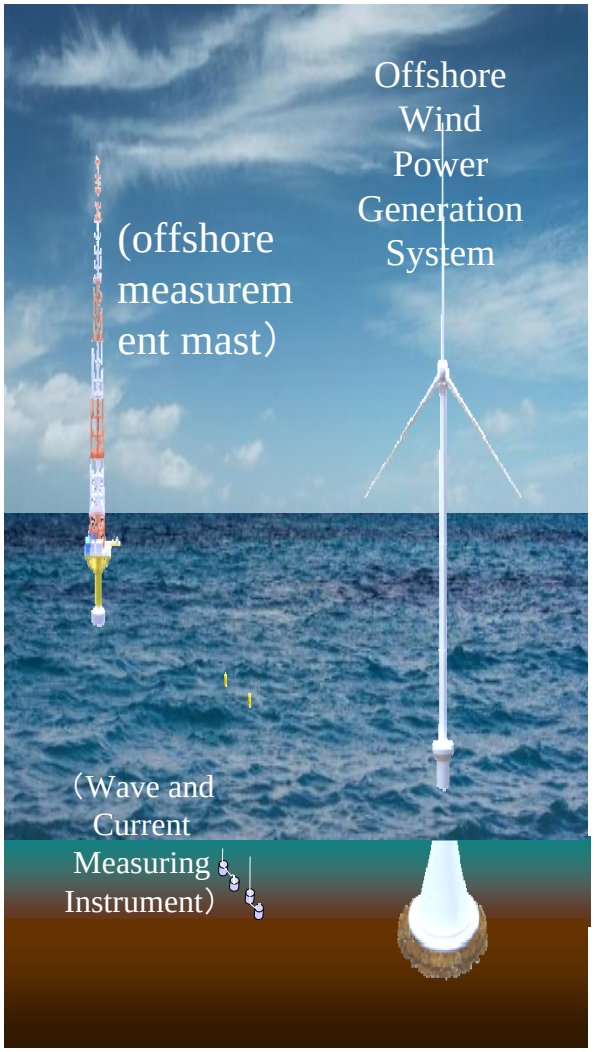
●Photovoltaic Technology

Mega Solar

Highest efficiency in the world

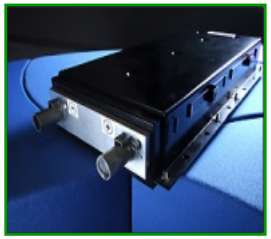
●Wind Power Generation

Wind Farm



●Storage Batteries

Electronic Vehicle

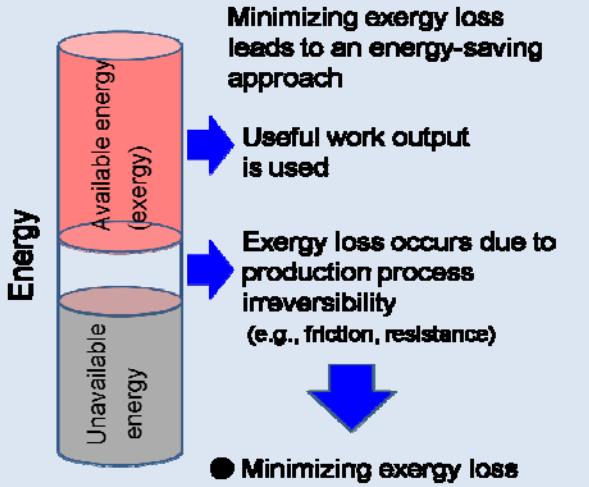


【Key technologies(1/4)】

Industrial Sector

Technologies to minimize exergy loss

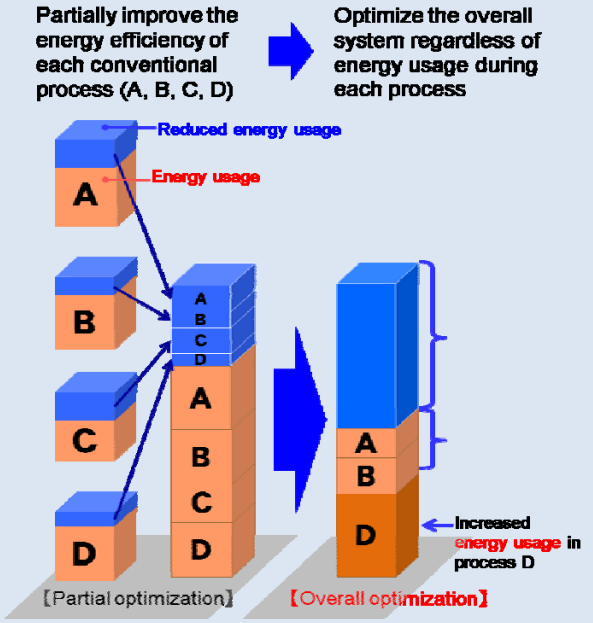
Technologies to minimize the loss of exergy (available energy) being used in various production processes



Examples:
・Energy-saving production
・Innovative iron-making technology
・Industrial heat pumps
・High-efficiency thermal power generation

Technologies to improve system energy efficiency

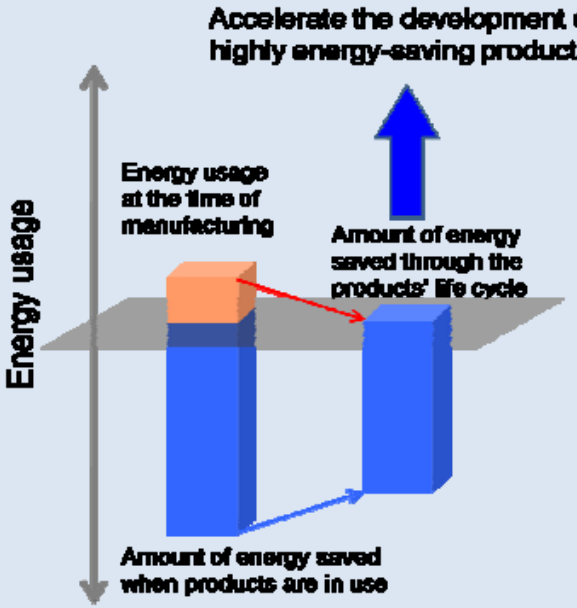
Technologies that are expected to achieve significant energy-saving effects when used in conjunction with other technologies or new concepts (flexible heat utilization by means of heat storage, heat transportation, etc.)



Examples:
・Cross-industry energy networks
・Laser processing

Technologies to manufacture energy-saving products

Technologies to manufacture products, which is not particularly energy-saving, but will offer significant energy-saving effects to the manufactured products



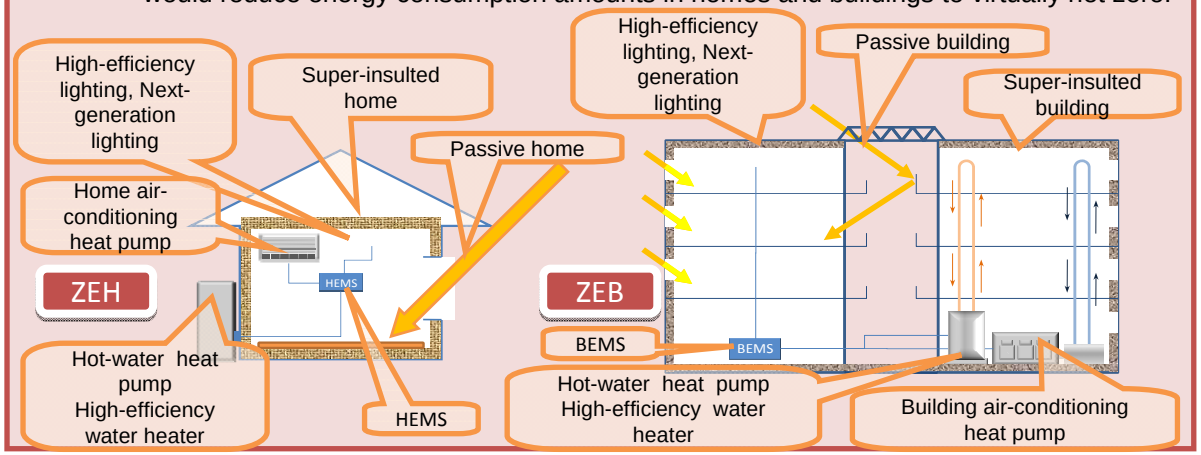
Examples:
・Ceramic manufacturing technology
・Carbon fiber/composite material manufacturing technology

【Key technologies (2/4)】

Residential and Commercial Sectors

ZEB (Net-zero Energy Building)
ZEH (Net-zero Energy Home)

Improving energy-saving efficiency for building frameworks and equipment in homes and buildings, and comprehensively designing systems such as load controls and integrated controls would reduce energy consumption amounts in homes and buildings to virtually net zero.



Energy-saving that suits personal comfort and preferences

New concepts and methods to develop energy-saving efficiency that focus on utilizing and applying the different personal comfort levels and preferences, and continue to regard such differences with respect to development.

Example:

Technologies that optimize energy-savings for residential and office environments by using control technologies and sensor technologies based on the understanding of human movements.

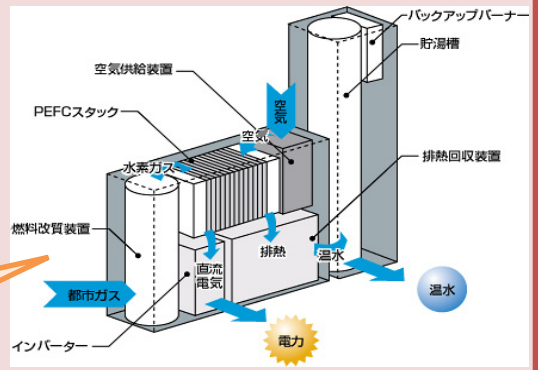
Energy-saving Information Equipment and Systems

Developing energy-saving technologies for devices and equipment in order to reduce power consumption increases due to the use of IT equipment and other devices.

Energy-saving next-generation network communication
Energy-saving information equipment
Technologies to reduce standby power consumption
High-efficiency displays

Stationary Fuel Cells

Solid oxide fuel cell（SOFC）, Polymer electrolyte fuel cell（PEFC）



【Key technologies (3/4)】

Transport Sector

Next-generation Vehicles

Next-generation vehicles such as electric vehicles have the potential for substantial improvements of fuel efficiency compared to conventional vehicles

Examples:
・Electric vehicles
・Plug-in hybrid vehicles
・Fuel cell vehicles







Intelligent Transport Systems (ITS)

Technology to promote optimization of traffic systems including people, freight and vehicles by utilizing information and communication technology and control technology.
ITS also includes developing technologies aimed at reducing accidents, mitigating traffic congestion, and promoting energy-saving and environmentally friendly systems.

Examples:


Example of ITS (Energy-saving driving support technology): platoon driving

・Energy-saving driving support technology
・Transportation demand management technology (TDM)
・Traffic control and management technology
・Traffic information provision and management information technology
・Traffic flow mitigation technology

Intelligent Logistics

Technologies to improve energy saving efficiency and logistics by using communication technologies which coordinates and controls information relating to freight, and transportation facilities for processes such as door-to-door transportation, storage, loading and unloading.

◆Visualization of locations and delivery status of freight, vehicles and storage, delivery management, quality management, and storage management. ◆Provide options for energy-saving methods of transportation	◆Matching technologies between freight information and transportation information	・System integration and unification of facilities and freight handling for transport freight and the coordination of storage facility information
	◆Traceability technology for actual transfer conditions ◆Measuring techniques for environmental performance	・Freight Information using microchips and IC tags ・Location information via GPS ・Visualization of energy consumption
	◆Modal shift ◆Node intelligence	・Optimal distribution coordination of automobiles, railways and vessels and node upgrades ・Consolidated freight transportation via platoon driving

【Key technologies (4/4)】 Cross-sector

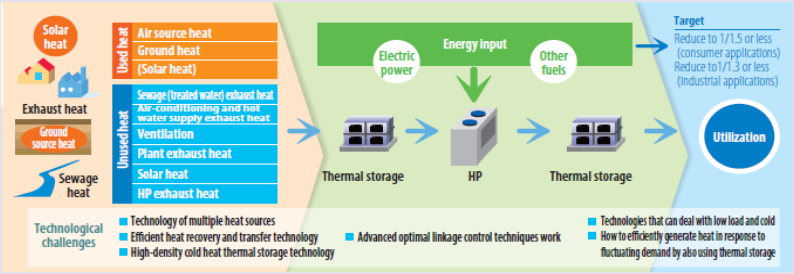
Next-generation Heat Pump Systems

System to achieve high-efficiency, low cost heat pumps and reduce greenhouse gas emission by developing systemization and innovative element technologies for heat pump.

●Systemization technologies: Technologies for utilizing unused heat, technologies for collecting and storing high-efficiency heat, technologies for streamlining low load areas, etc.

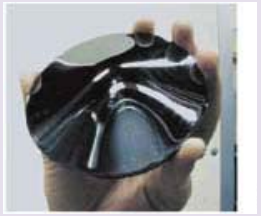
●Innovative element technologies: Technologies for high-efficiency refrigeration cycles, development of new refrigerants, high-efficiency heat exchange equipment, technology for high-efficiency compressors, etc.

Examples:
・HPs for home, office buildings and factory air-conditioning
・HPs for car air-conditioning ・Industrial use HPs
・HPs for hot water ・HPs for refrigerators, freezers, etc.



Power Electronics

Technology that supports high-efficiency electric power supply used by all fields, and meets the soaring energy consumption demand as a result of IT development.
Examples:
・Wide-gap semiconductors ・High-efficiency inverters

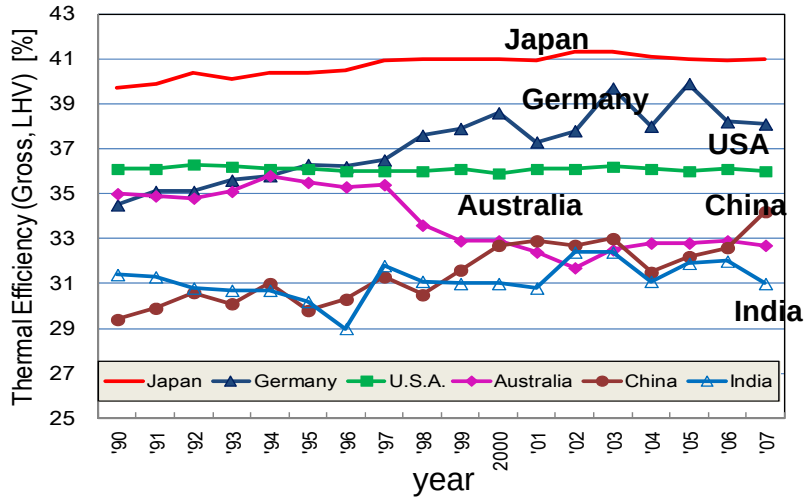


Next-Generation Heat and Power Networks

Comprehensive energy-saving technologies including heat networks designed for the efficient use of heat, next-generation energy management systems designed to optimize energy use within certain regions and next-generation energy transmission and distribution networks, which support the introduction of renewable energy.
Examples:
・Next-generation energy management systems
・Next-generation energy transmission and distribution networks
・Next-generation district heating networks
・Cogeneration
・Industrial fuel cells（SOFC）
・Heat transport systems
・Heat storage systems

High-efficiency Clean Coal Technology

~ Japan has achieved the world's highest efficiency levels for coal-fired thermal power generation technology. ~

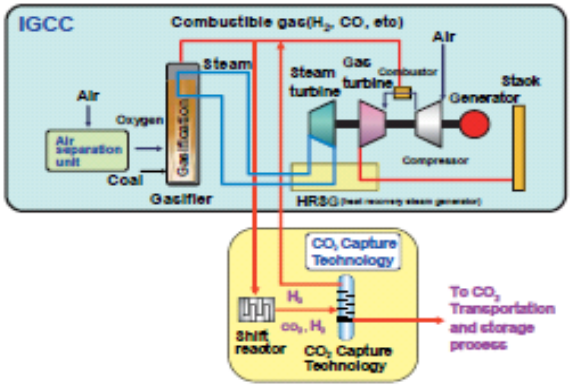


INTERNATIONAL COMPARISON OF FOSSIL POWER GENERATION EFFICIENCY (ECOFYS) (2010)

USC + CCS

Result of FS on 500 MW USC + CCS

IGCC + CCS



IGCC Technology Development
~EAGLE demonstration plant~

USC power plant

Misumi coal-fired power plant
1000 MW, 24.5 MPa×600℃/600℃
operation started in 1998

IGCC plant

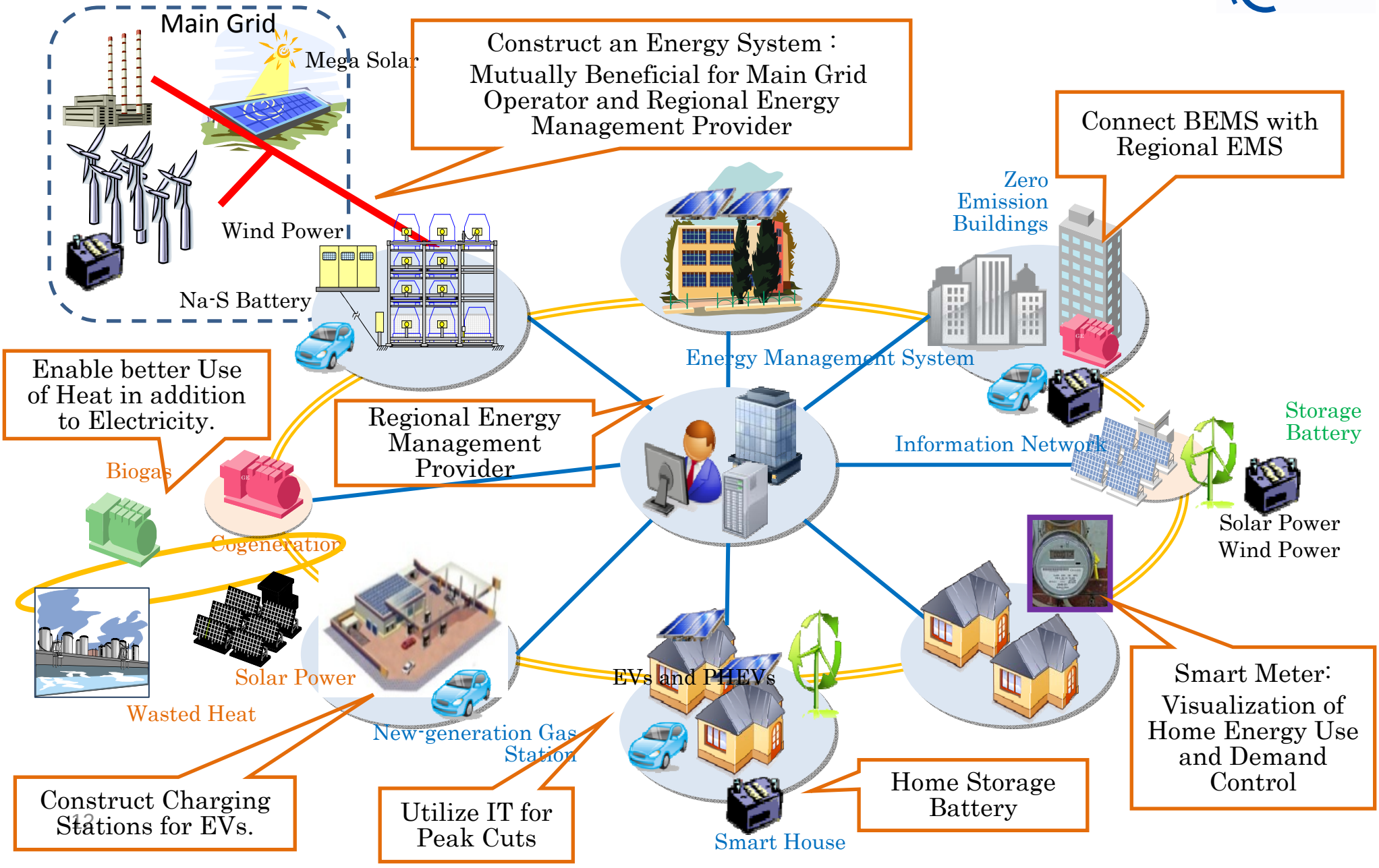
Nakoso IGCC demonstration plant
250 MW operation started in 2007

USC
: Ultra-supercritical

IGCC
: Integrated coal gasification combined cycle

CCS
: Carbon dioxide capture and storage

Smart Community

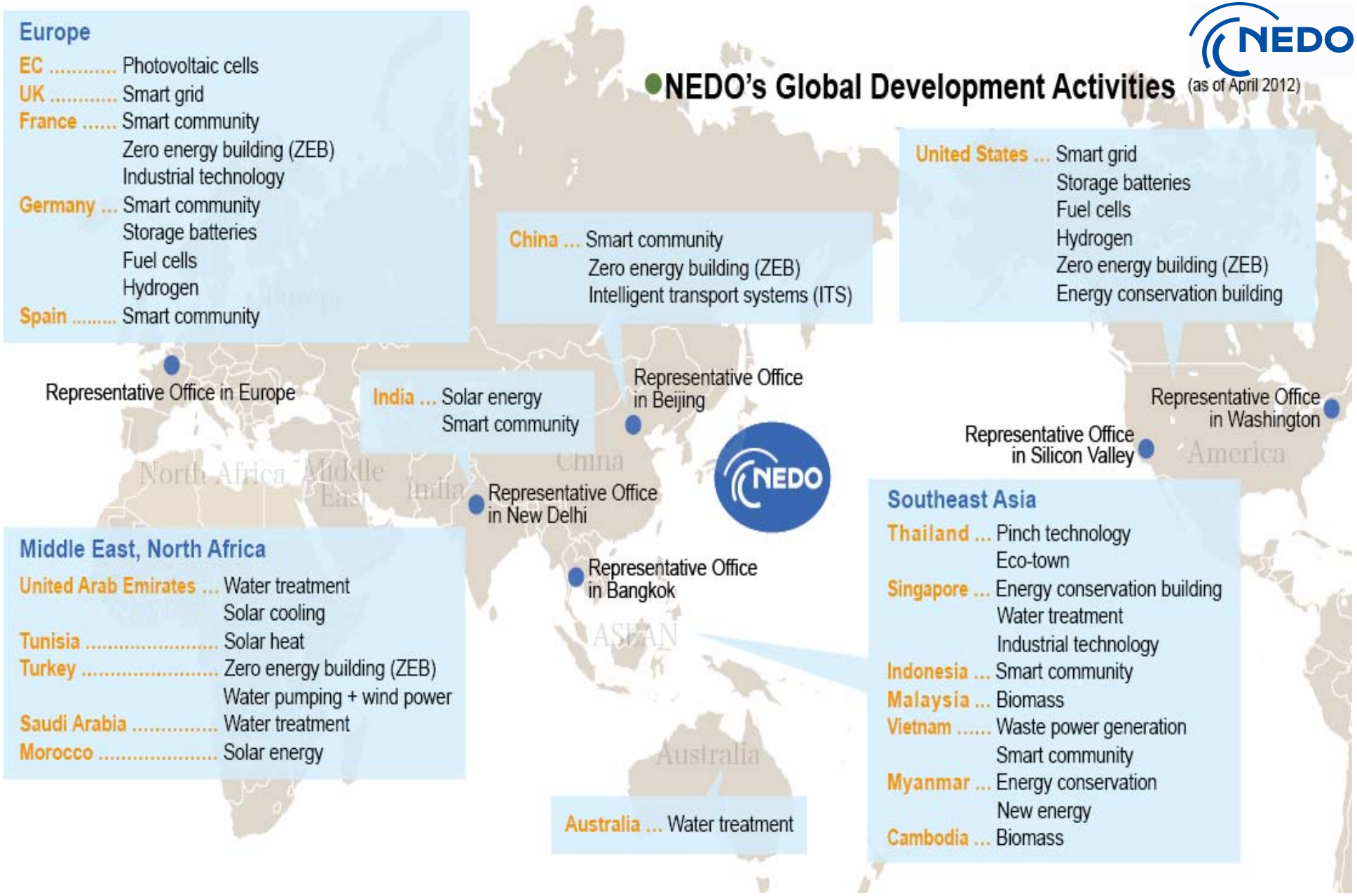


The way to realize a low carbon society through technology

Development of low carbon breakthrough technologies

Dissemination of low carbon technologies
to all over the world

It leads to reduce the emission of global warming gases worldwide

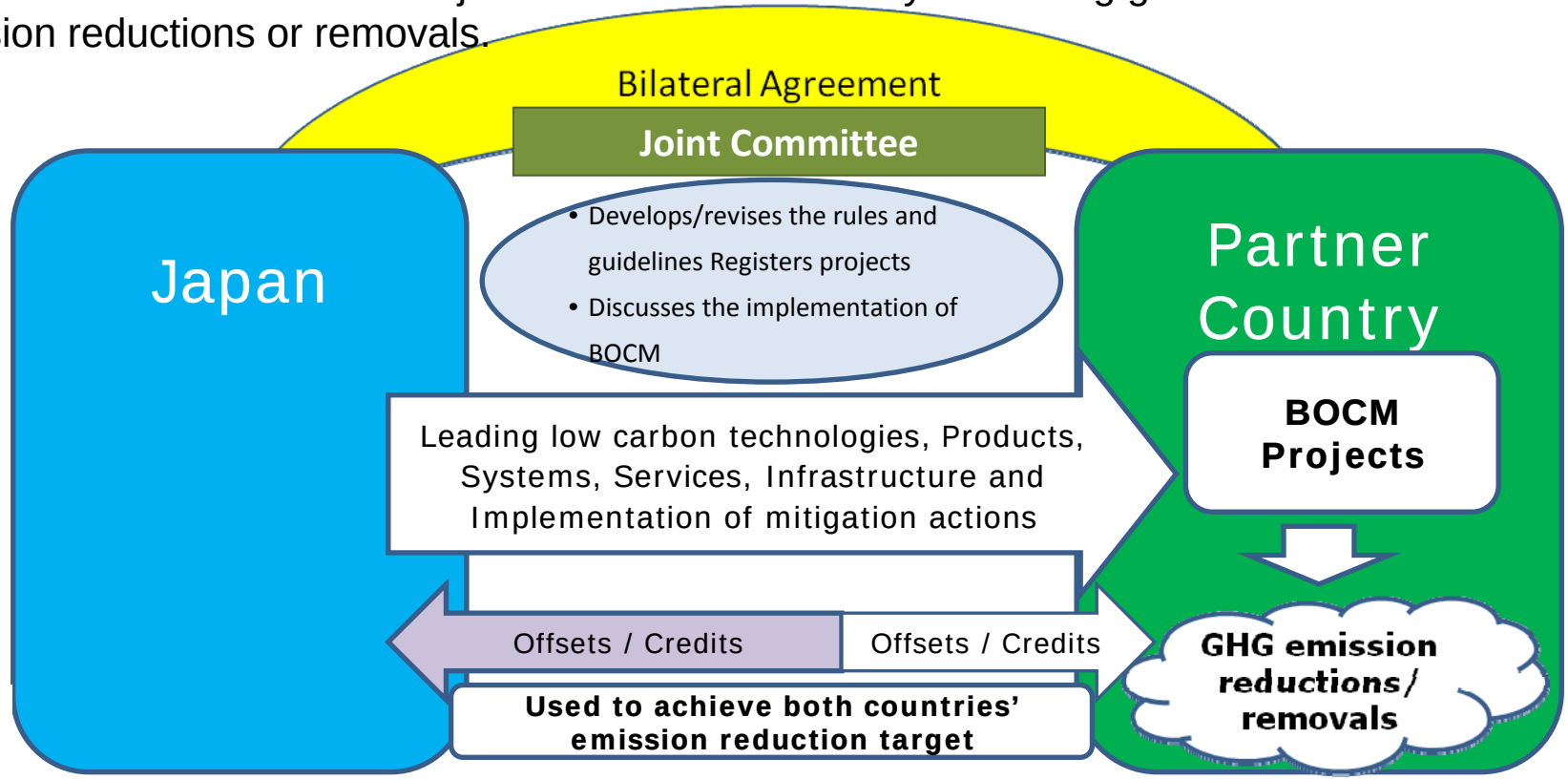

NEDO's Global Development Activities (as of April 2012)
Europe
EC ..... Photovoltaic cells
UK ..... Smart grid
France ..... Smart community
Zero energy building (ZEB)
Industrial technology
Germany ... Smart community
Storage batteries
Fuel cells
Hydrogen
Spain ..... Smart community
Representative Office in Europe
China ... Smart community
Zero energy building (ZEB)
Intelligent transport systems (ITS)
India ... Solar energy
Smart community
Representative Office in Beijing
Representative Office in New Delhi
Representative Office in Bangkok
United States ... Smart grid
Storage batteries
Fuel cells
Hydrogen
Zero energy building (ZEB)
Energy conservation building
Representative Office in Washington
Representative Office in Silicon Valley
Middle East, North Africa
United Arab Emirates ... Water treatment
Solar cooling
Tunisia ..... Solar heat
Turkey ..... Zero energy building (ZEB)
Water pumping + wind power
Saudi Arabia ..... Water treatment
Morocco ..... Solar energy
Southeast Asia
Thailand ... Pinch technology
Eco-town
Singapore ... Energy conservation building
Water treatment
Industrial technology
Indonesia ... Smart community
Malaysia ... Biomass
Vietnam ..... Waste power generation
Smart community
Myanmar ... Energy conservation
New energy
Cambodia ... Biomass
Australia ... Water treatment

About Bilateral Offset Credit Mechanism(BOCM)

<Japanese Government>

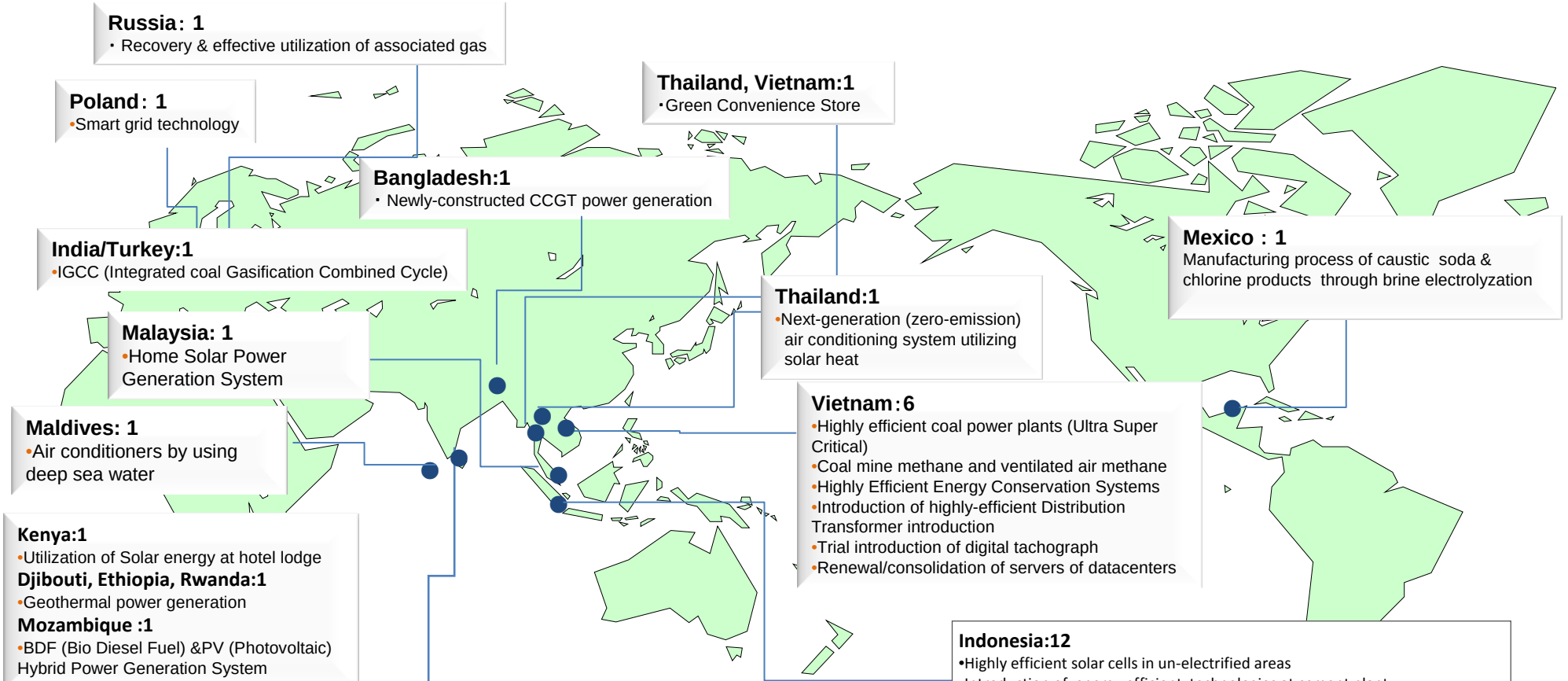
NEDO

- To facilitate diffusion of leading low carbon technologies, products, systems, services, and infrastructure as well as implementation of mitigation actions, and contributing to sustainable development of developing countries.
- To appropriately evaluate contributions to GHG emission reductions or removals from developed countries in a quantitative manner, through mitigation actions implemented in developing countries and use those emission reductions or removals to achieve emission reduction targets of the developed countries.
- To contribute to the ultimate objective of the UNFCCC by facilitating global actions for emission reductions or removals.



BOCM Feasibility Studies (FSs) by NEDO in FY2011

40 projects were selected (17 countries)



Russia：1
・Recovery & effective utilization of associated gas

Poland：1
•Smart grid technology

Thailand, Vietnam:1
・Green Convenience Store

Bangladesh:1
・Newly-constructed CCGT power generation

India/Turkey:1
•IGCC (Integrated coal Gasification Combined Cycle)

Mexico ：1
Manufacturing process of caustic soda & chlorine products through brine electrolyzation

Thailand:1
•Next-generation (zero-emission) air conditioning system utilizing solar heat

Malaysia: 1
•Home Solar Power Generation System

Vietnam：6
•Highly efficient coal power plants (Ultra Super Critical)
•Coal mine methane and ventilated air methane
•Highly Efficient Energy Conservation Systems
•Introduction of highly-efficient Distribution Transformer introduction
•Trial introduction of digital tachograph
•Renewal/consolidation of servers of datacenters

Maldives: 1
•Air conditioners by using deep sea water

Kenya:1
•Utilization of Solar energy at hotel lodge

Djibouti, Ethiopia, Rwanda:1
•Geothermal power generation

Mozambique :1
•BDF (Bio Diesel Fuel) &PV (Photovoltaic) Hybrid Power Generation System

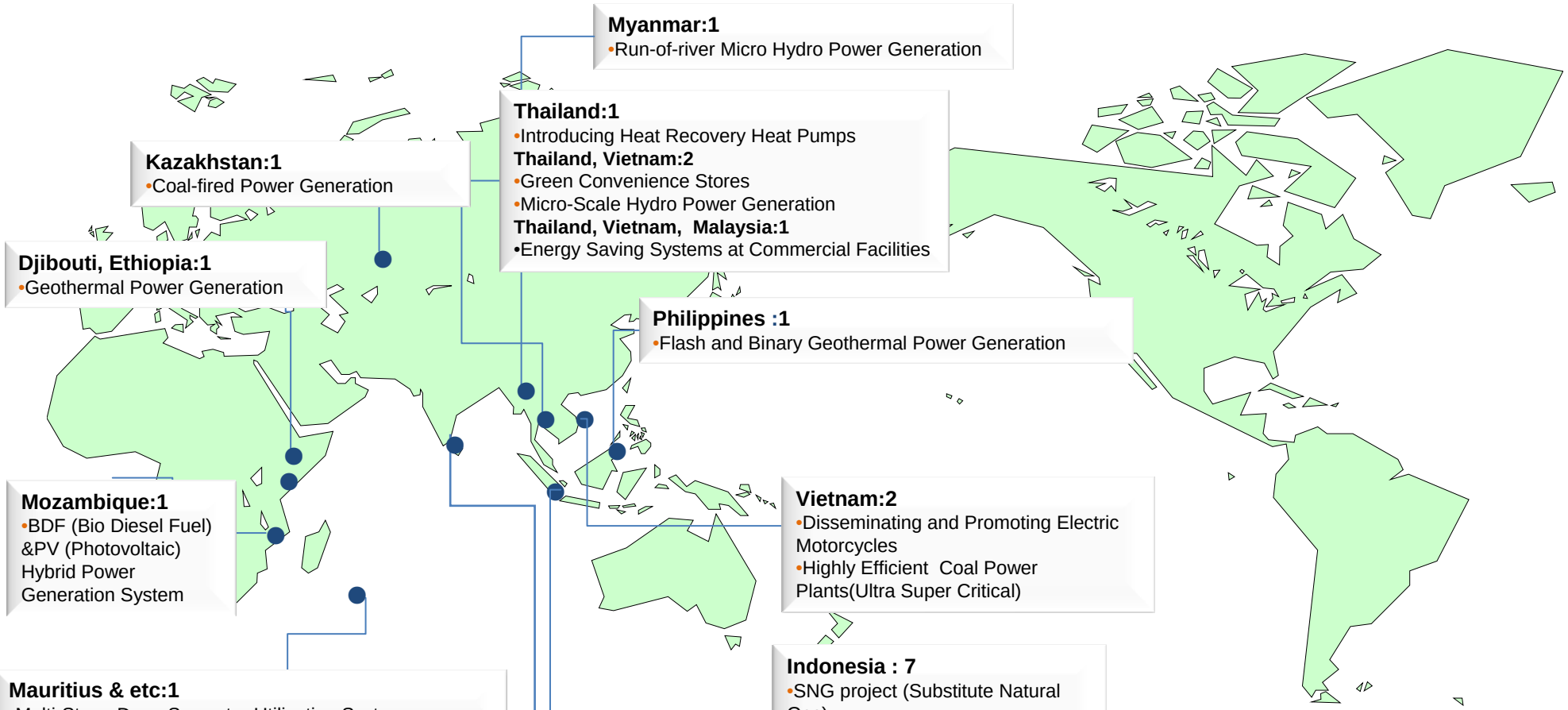
Indonesia:12
•Highly efficient solar cells in un-electrified areas
•Introduction of energy efficient technologies at cement plant
•Newly-constructed geothermal power generation
•Introduction of steam tube drying system at low rank coal power plant
•SNG project (Substitute Natural Gas)
•Biomass Boiler Power Generation Project
•CCS (Carbon dioxide Capture and Storage)
•Small Hydroelectric Generation
•Eco-Shipping Support System
•Flash and Binary Geothermal Power Generation Plants
•Energy Consumption Optimization at Facilities using IT
•Optimum control of plant equipment (by IT)

South Africa:2
•Energy Efficient Technologies for steel plant
• Highly efficient gas turbine

India:8
•Energy Efficient Technologies for Steel sinter process
•Development of Energy Saving Technology such as CDQ
•Highly efficient coal power plants(Ultra Super Critical)
•Energy Efficient Technologies for Integrated steel works
•ACCC technology(Automatic coal control system)
•Solar Energy Technology
•Run-of-river micro hydro power project
•Highly efficient server in Data center

BOCM Feasibility Studies (FSs) by NEDO in FY2012

21 projects were selected (12 countries)



Myanmar:1
- Run-of-river Micro Hydro Power Generation

Thailand:1
- Introducing Heat Recovery Heat Pumps

Thailand, Vietnam:2
- Green Convenience Stores
- Micro-Scale Hydro Power Generation

Thailand, Vietnam, Malaysia:1
- Energy Saving Systems at Commercial Facilities

Kazakhstan:1
- Coal-fired Power Generation

Djibouti, Ethiopia:1
- Geothermal Power Generation

Philippines :1
- Flash and Binary Geothermal Power Generation

Mozambique:1
- BDF (Bio Diesel Fuel) &PV (Photovoltaic) Hybrid Power Generation System

Vietnam:2
- Disseminating and Promoting Electric Motorcycles
- Highly Efficient Coal Power Plants(Ultra Super Critical)

Mauritius & etc:1
- Multi-Stage Deep Seawater Utilization System

Indonesia : 7
- SNG project (Substitute Natural Gas)
- CCS (Carbon dioxide Capture and Storage)
- Biomass Power Generation
- Eco-shipping for Coastal Cement Tanker
- Small Hydro Power Generation

India: 2
- Highly Efficient Coal Power Plants(Ultra super critical)
- Energy Efficient Technologies for Integrated Steel Works

NEDO's Feasibility Studies with the Aim of Developing a Bilateral Offset Credit Mechanism

Country : Thailand, Vietnam　Sector : Energy Conservation

"Feasibility Study on Green Convenience Stores with High-Efficiency Equipment in Thailand and Vietnam" (Studies for Project Development and Organization)

This study adopts convenience stores as the model of chain store business that is expected to grow fast in the future in the businesses and commercial sectors in Thailand and Vietnam. We aim to contribute CO2 reduction, by disseminating Japanese low carbon equipments and systems and promoting Green Convenience Stores applying Bilateral Offset Credit Mechanism.

Survey in Summary

Introducing Japanese high-efficiency equipment to the lighting, air conditioning, and refrigerated showcases, which are accounted for 3/4 of the power consumption of the convenience store, to reduce power consumption.

Survey Items

① Evaluation of the prospect for business and the finance and other investment environments to be developed as required for materializing the business.

② Identification of the MRV methodology for the quantification of the reduction volume.

③ Spillover effect

Partner / Site

○ Thailand (FamilyMart)

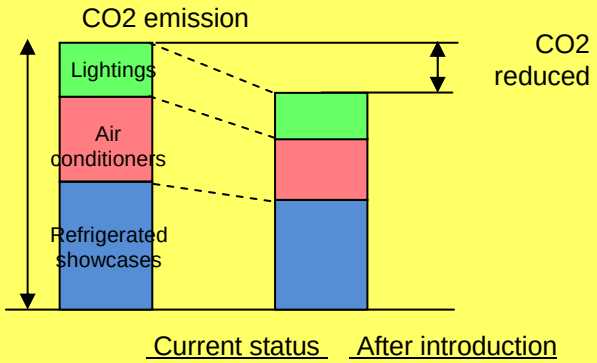
○ Vietnam (FamilyMart)

Estimated Reduction amount

Reduction amount ; 7,480tCO2/y

Reference scenario

- The existing stores use the lighting products of Philips, air-conditioners of the U. S. or Asian manufacturers, and refrigerating showcases of the local manufacturers.
- No inverters have been installed in those stores yet.



Emission reductions by project

- Lighting apparatus: Lit at a high-frequency combined with inverter ballast (reduction: about 27%)
- Air conditioner: Energy-saving operation by using inverters and optimal control (reduction: about 46%)
- Refrigerated showcase: Energy-saving operation by adopting LED lighting, inverters, and low-pressure shift control (reduction: about 27%)

Summary of Introduced Technology

Lightings

Lit at a high-frequency combined with the inverter ballast, reducing power consumption (about 27%).
- Improve efficiency [lm/w] (140% higher than the conventional products)
- Can be turned on instantly because the electrodes require less pre-heating hours.
- Flickering can be mitigated by raising the lighting frequency.
- Little noise is emitted from the apparatus.

Air conditioners

Both indoor and outdoor units are operated in energy-saving mode by the adoption of inverters and optimal control, reducing power consumption (about 46%).
- Power consumption can be reduced also by the weekly schedule control.

Refrigerated showcases

Operated in the energy-saving mode by the adoption of the LED lighting, inverters and low-pressure shift control, and high-precision linkage operation of the refrigerator and showcase, reducing power consumption (about 27%).
- The operation with rare switching on/off and little change in temperature reduce power consumption.
- The refrigerator unit adjusts its performance based on the signals received from the showcase unit, attaining the operation intended for at a constant temperature.

"FS for CO2 Capture and Storage (CCS) in Indonesia" (Follow-up Study for Project Development and Organization)

Company proposed : Arabian Oil Co. / Marubeni / Mitsubishi Research Institute

This project is the first CCS project for CO2 emitted by the natural gas production in the southeast Asia and combines the Japanese technology for GHG reduction and the enhanced recovery technology for oil production.

Survey in Summary

Investigate the MRV/assessment methodology for CO2 emission, the technological and economic analysis for CCS and enhanced oil recovery, and the feasibility of the project.

Survey Items

① CCS/EOR Subsurface Storage Reservoir Study
② Modification of Surface Facilities Design
③ Pre-FEED and Planning of Pilot Test
④ Investigation of CO2 Recovery from Refinery
⑤ Investigation of law and tax system in Indonesia
⑥ Feasibility of the Project and Future Schedule
⑦ Investigation of seismic monitoring method for CO2 storage and behavior
⑧ Investigation on MRV/Assessment methodology for GHG emission

Partner / Site

○ Pertamina
Indonesia Jawa Island

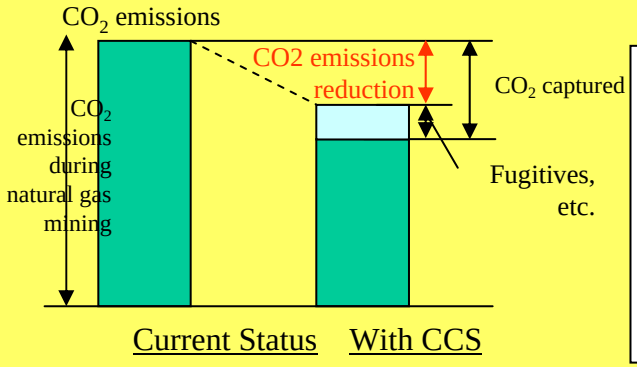
Estimated Reduction amount

Reduction amount ; 100,000-1,000,000tCO2/y

Reference scenario

- During natural gas extraction, CO2 impurities have been vented to atmosphere.
- On the other hand, there are many oilfields where the oil production has been declining.

Current Status

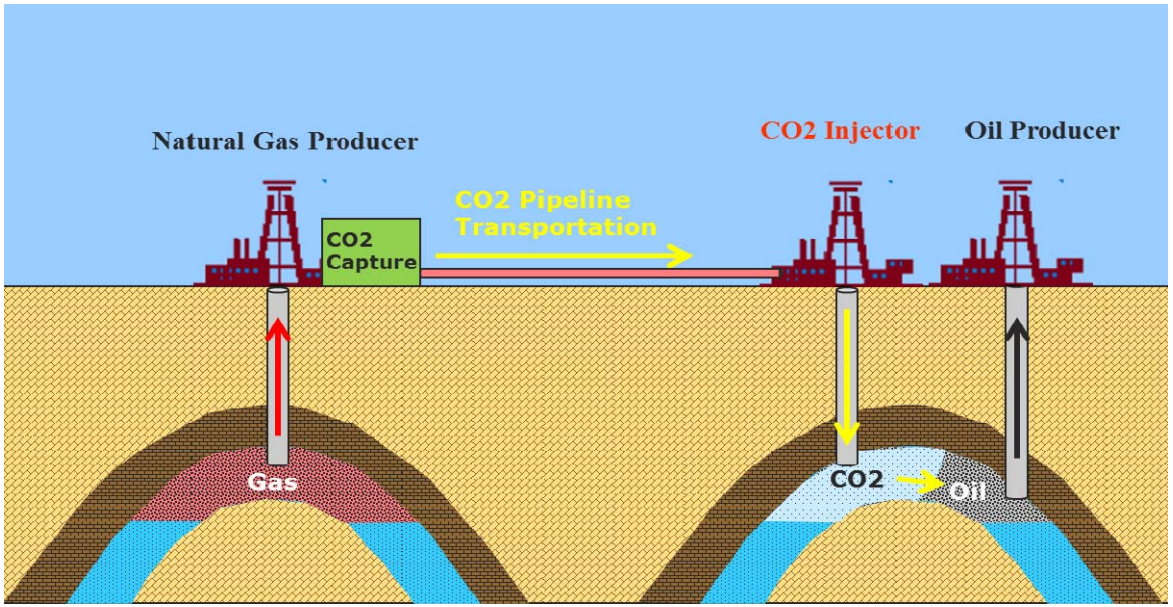


Emission reductions by project

- Separating and capturing CO2 contained in natural gas decreases the amount of CO2 vented to atmosphere.
- Captured CO2 is transported through pipelines and injected into an oilfield to be stored underground.
- At the same time, CO2 injection enables enhanced oil recovery (EOR).

With CCS

Summary of Introduced Technology



1. Background

The underground storage of carbon dioxide (CO_2) is a promising technology for the reduction of CO_2 emission into the air. The evolution of this technology is widely expected in the world. However, the following problems have been pointed out:

(1) This method requires high costs.

(2) There is a possibility of CO_2 leakage from the formation.

The measures to solve those problems have been discussed and some possible solutions have been proposed.

2. Technology Introduced: "CO_2-EOR/CCS"

A process called "CO_2-EOR/CCS" can be a solution for those problems and may bring the CO_2 underground storage into widespread use. In this process, CO_2 is injected into an oil reservoir (i.e. geological formation bearing oil) as shown in the above figure, and the oil is efficiently displaced by CO_2, leading to an increase of oil production (i.e. EOR, or Enhanced Oil Recovery). At the final stage of this process, the injected CO_2 is to be left in the reservoir and sequestered there.

3. Advantages of CO_2-EOR/CCS

(1) The cost of CO_2 sequestration is, at least partly, offset by the profit from the additional oil recovery.

(2) For preventing or minimizing CO_2 leakage, this process can effectively utilize the high ability of oil reservoirs to store fluid, which has been verified by the fact that they have been holding the crude oil inside for a geological time span.

(3) Oil companies have plenty of data for oil fields and reservoirs. In addition, the infrastructure has already been built. They can be used for CCS.

(4) Since the oil reservoirs, the already "developed" formations, are used for CO_2 storage, the risk of directly contaminating virgin formations is avoided.

Technology outline

What is deep seawater

Deep sea water is seawater deeper than the compensation depth (approx. 200m in general) where respiration and photosynthesis are balanced. The seawater is cooled and starts down-slope flow at northern Atlantic and moves to Indian ocean. So the seawater temperature below 1,000m is stable at about 5 degree .
The deep seawater has features, such as "Stable low temperature", "Cleanliness", "Rich nutrients" and "Sustainability".

Multi-stage deep seawater utilization system

The system creates chilled water for air conditioning effectively using of deep seawater features and contributes to GHG emission reduction. Also deep seawater supplies for several Industries, and local water safety and industry promotion are achieved

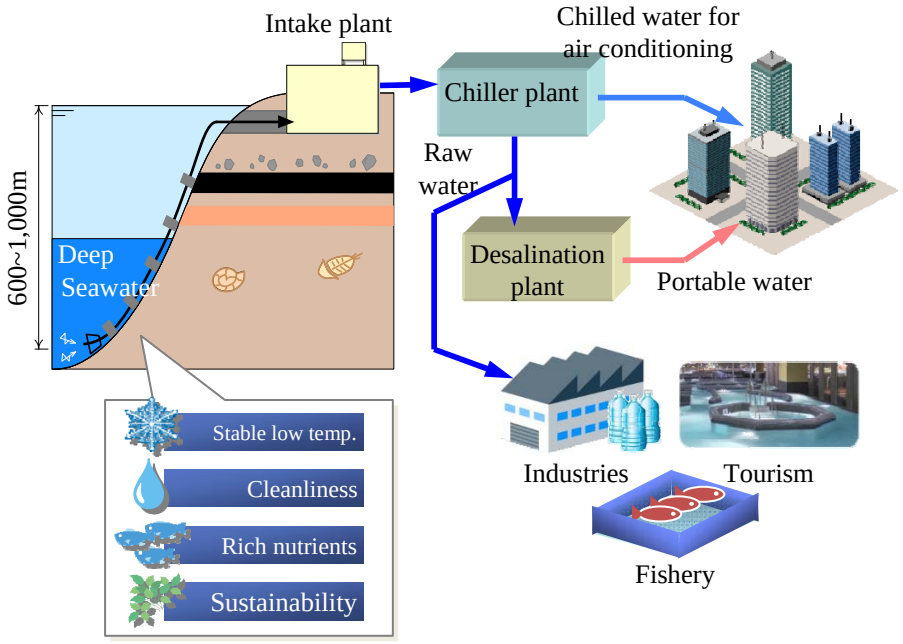
Features of the system

1. Air conditioning without chillers.
   Use only 5 degree deep seawater to create chilled water.

2. Achieve 82%* of GHG emission for air conditioning
   Chilled water supply for 24hrs operated airport at tropical island.
   *Compared with conventional system

3. Local industry promotion
   The deep seawater after chilled water creation is used as desalination raw water and so on.

4. Establish deep seawater business model
   The deep seawater business model contributes energy saving at tropical island countries.



Multi-stage deep seawater utilization system

Summary

- Through R&D and/or demonstration projects, low carbon technologies will make huge potentials to reduce GHGs.

- NEDO supports collaboration between Japanese enterprise and developing country's that is eager to introduce low carbon technologies.

- Considering each country's condition ,BOCM may be effective approach to disseminate low carbon technologies.