

# Climate finance and technology adaptation

## - Korea case -



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# I. KEITI Introduction

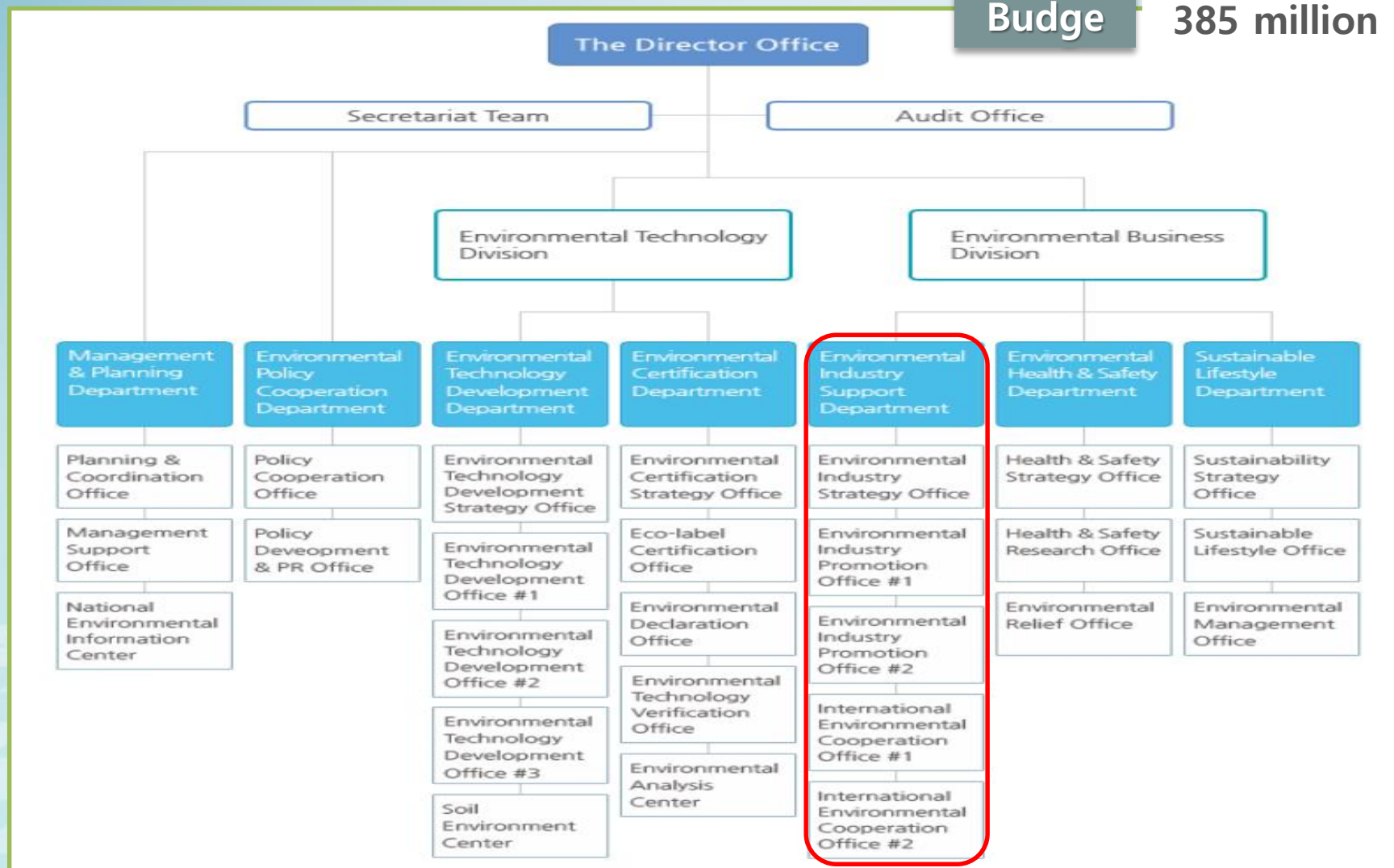
# I. KEITI Introduction

HR

430 employees

Budge

385 million USD



## Key Functions and Programs



### Environmental Technology R&D

- Environmental Technology (R&D)
- Planning, Evaluation, Management



### Train professionals and provide information

- Train environmental Industry · Technical professional and Create Jobs
- Collect Environmental Industry, · Technical Information, Utilization and Education, PR



### Certification Evaluation

- Operate Environmental Mark, Carbon Achievement Carbon score label
- Certification · verification environmental technology and certification of green technology



### Develop environmental industry

- Develop environmental industry and support expansion to overseas market
- Environment loan, Eco-friendly creative economy center
- operation of 5 overseas offices



### Distribute eco-friendly business models

- Promote green product life
- Promote eco-friendly management and low carbon management by company



### Support environmental health · safety management

- Relieve environmental damage and manage chemical materials
- Manage eco-friendly product, support environmental health · safety for the vulnerable social group



## II. GPP & GHG reduction



## II. GPP & GHG reduction

### Act on Promotion of Green Products Purchase

- Purpose: energy and waster savings, prevent wasteful use of resources and environmental pollution, contribute to sustainable development by encouraging green purchasing in public sectors
- Public org. are obliged by the Act to produce and report to MOE
  - Implementation Plan with voluntary GPP targets
  - Performance Report with the amount of green product purchased



#### Korea Eco-Label

153 categories including office equipment, construction materials

2,092 companies, 13,345 products  
(As of Oct. 2015)

Ministry of Environment

<http://www.ecoi.go.kr>

Product groups

Number of Products

Certification Authority

Website

#### Good Recycled Mark



15 categories including waste paper, glass

183 companies, 224 products  
(As of Oct. 2015)

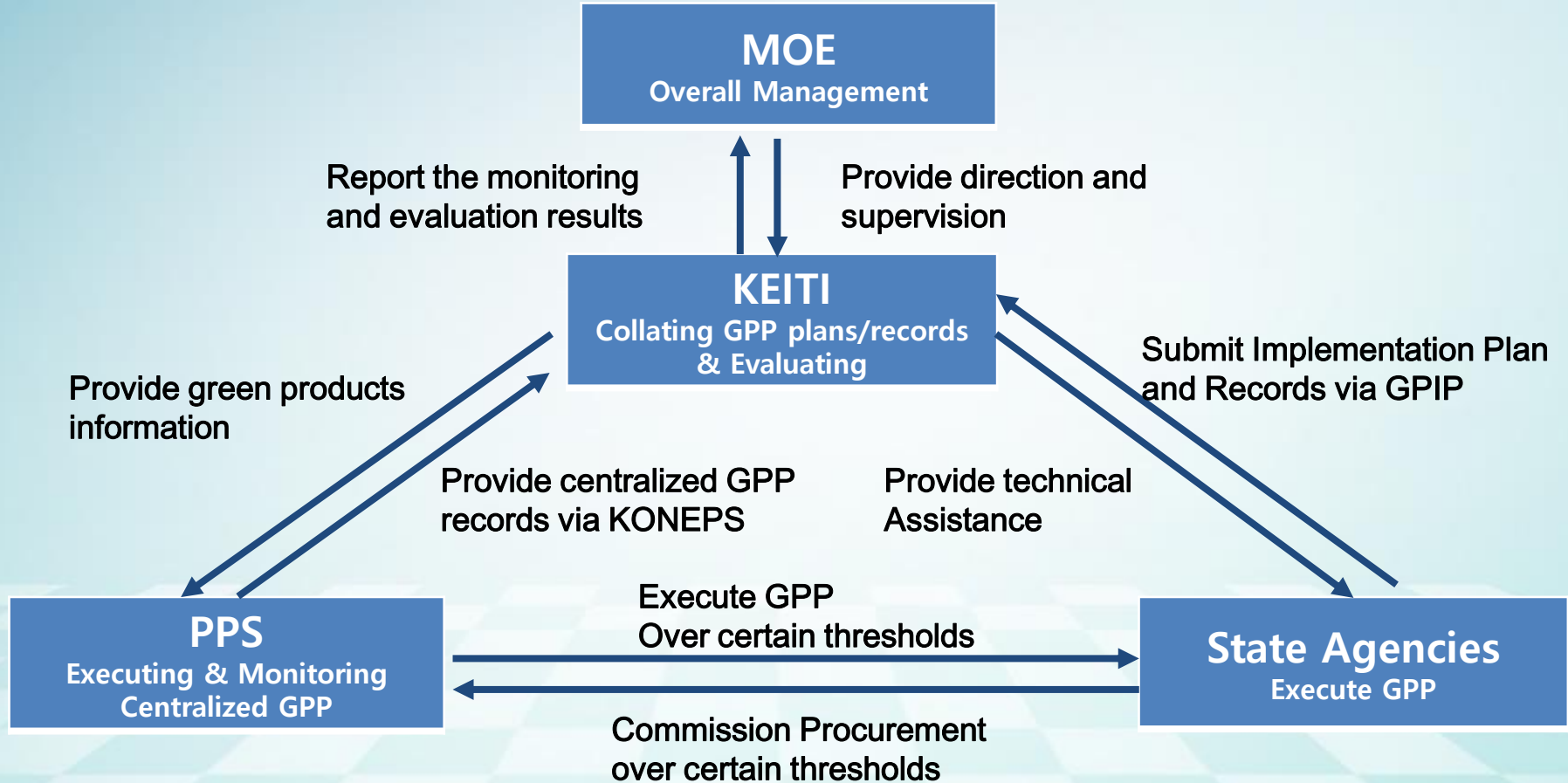
Ministry of Trade, Industry and Energy

<http://www.gr.or.kr>



# II. GPP & GHG reduction

## Institutional arrangement of GPP in Korea



# II. GPP & GHG reduction

## Performance of the GPP in Korea

- The total amount of green public purchase rose steadily following the adoption of the Act on Promotion of Green Purchase from 2005

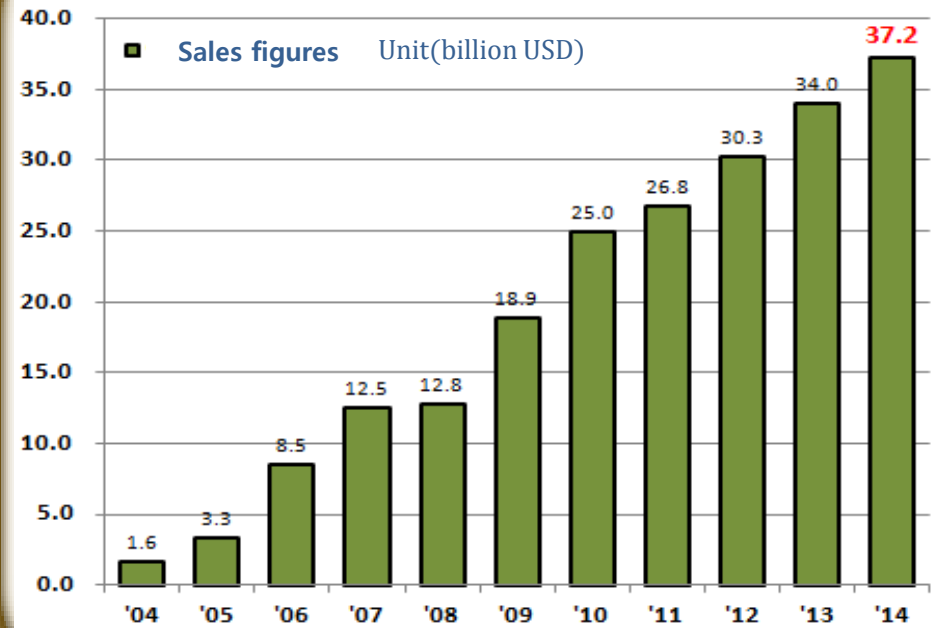
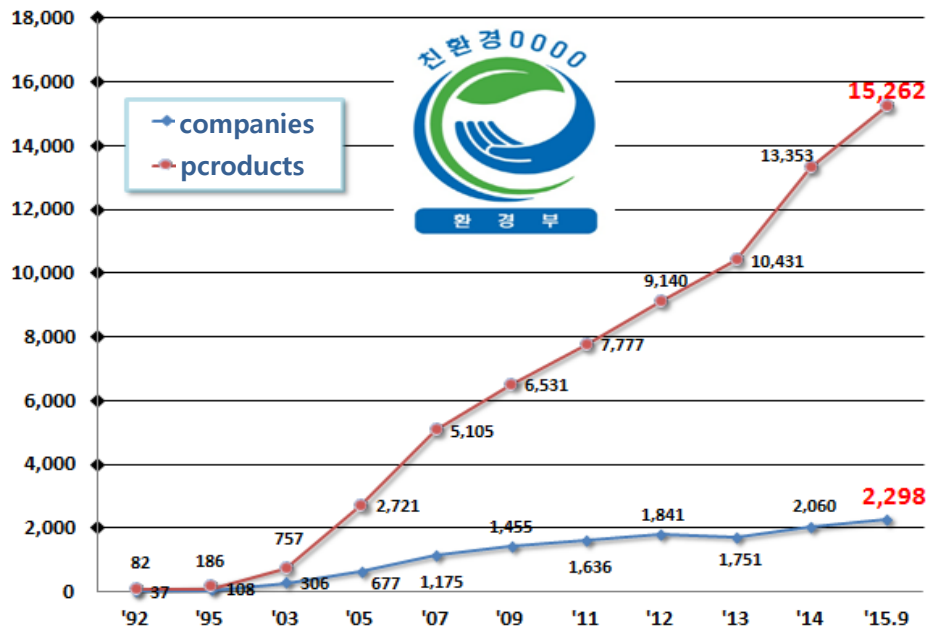


# II. GPP & GHG reduction

## Performance of the GPP in Korea

- The Act was instrumental in nurturing eco products and producers in both quantity and quality
- Market competitiveness of eco products increased in terms of price and quality

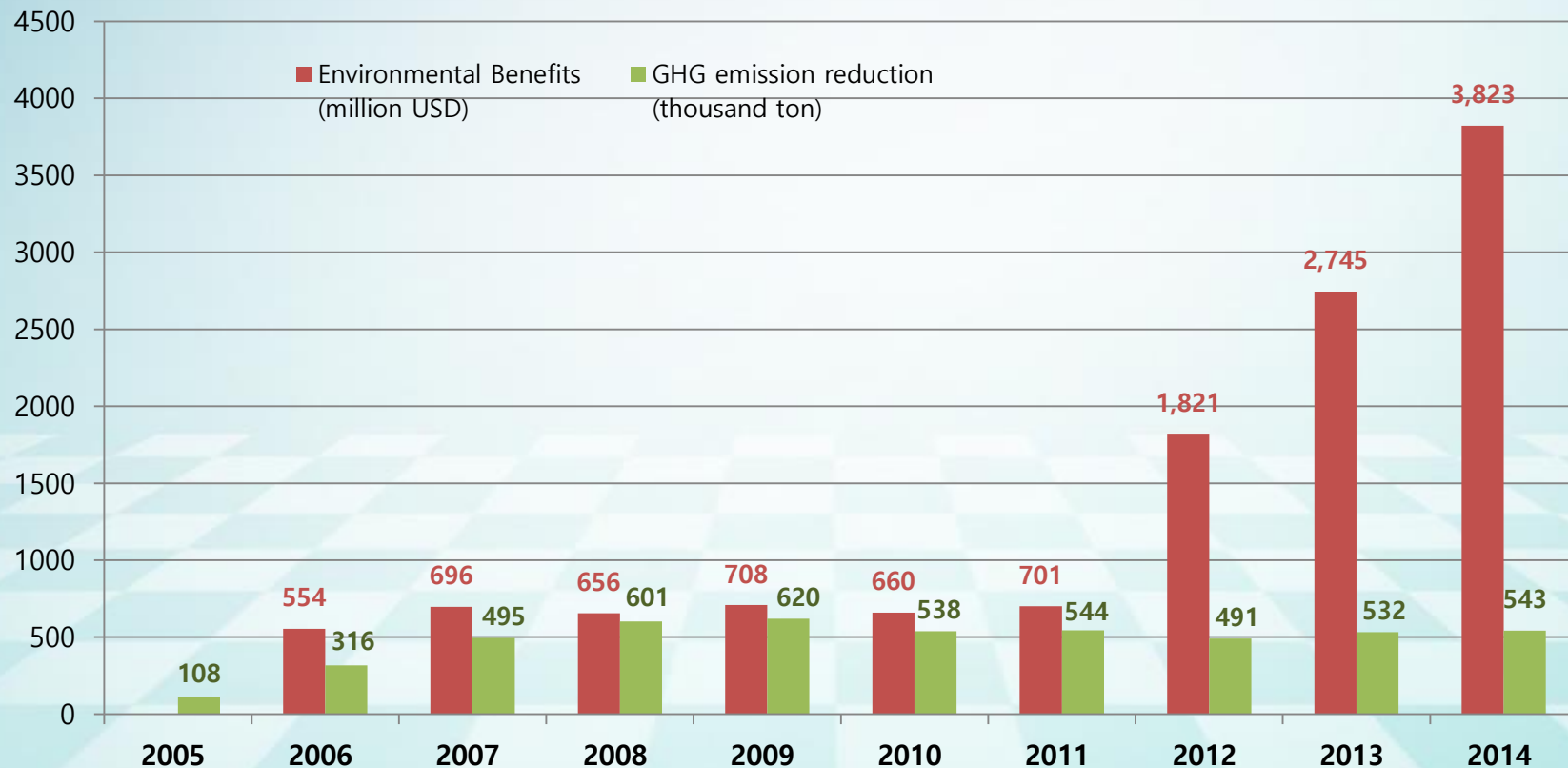
- The market share of eco-labeled products reached at 37 billion USD in 2014
- GPP play a key role in greening the relevant industries



# II. GPP & GHG reduction

## Performance of the GPP in Korea

- The purchase of energy and water saving products resulted in 543,000 tons of CO<sub>2</sub> reduction in 2014 and 4.8 million tons of CO<sub>2</sub> emission reduction for the past 10 years
- The environmental benefits from GPP are 3.8 billion USD in 2014, and 12.3 billion USD for the past 9 years



# III. Domestic Waste Management Policy

# III. Domestic Waste Management Policy

## Stepwise technologies for waste treatment in Korea

### Waste Discharge & Collection

- Separate waste discharge & collection
- Automatic waste collection system



### Waste Pre-treatment

- Waste Recycling
- Demolition waste Separation & Sorting



### Middle processing of waste

- Incinerators
- MBT
- Pyrolysis



### Waste to energy

- Combustible Waste to Energy
- Organic Waste to Gas Energy
- LFG Power
- Bioreactor



### Final Disposal

- Sanitary Landfill
- Maintenance & Restoration of non-sanitary landfill
- Sustainable landfill



# III. Domestic Waste Management Policy

## Advantages and disadvantages of waste treatment technologies

- To build Resource Recirculation Society, Waste to Energy Activities have been under study and commercially utilized

Process	Advantage	Disadvantage
Incinerator (WTE)	<ul style="list-style-type: none"> <li>Decrease of Final Waste</li> <li>Sanitary Treatment</li> <li>Energy Recovery (Heat + Power)</li> </ul>	<ul style="list-style-type: none"> <li>High Construction and O&amp;M Cost</li> </ul>
Refuse Derived Fuel	<ul style="list-style-type: none"> <li>Combustible Waste Recycling</li> <li>Energy Recovery</li> </ul>	<ul style="list-style-type: none"> <li>Not economical (Low Yield &amp; low sales cost)</li> <li>Difficult in Control</li> </ul>
Organic Waste to Biogas	<ul style="list-style-type: none"> <li>CH<sub>4</sub> Production (To be used as fuel)</li> <li>Sludge to Compost</li> </ul>	<ul style="list-style-type: none"> <li>High Cost &amp; Technology</li> </ul>
Landfill Gas to Energy	<ul style="list-style-type: none"> <li>GHGs Reduction (CH<sub>4</sub> Utilization)</li> <li>Energy Recovery (Heat + Power)</li> </ul>	<ul style="list-style-type: none"> <li>Irregular LFG Production</li> </ul>
Bioreactor + LFG Energy (Improved LFG Utilization)	<ul style="list-style-type: none"> <li>More GHGs Reduction(CH<sub>4</sub> Utilization)</li> <li>More Energy Recovery(Heat + Power)</li> <li>Landfill Early Stabilization</li> </ul>	<ul style="list-style-type: none"> <li>Added bioreactor system Cost</li> </ul>



# III. Domestic Waste Management Policy

## Cost comparison in each technology

### Comparison of Construction Cost in South Korea (Capacity of treatment : 1,000ton/day)

Process	Construction Cost(USD/30y)	Energy Recovery(%)	Endurance Period(year)	Total Operating Cost(USD)	Days of operation(day/year)
Incineration	600 million (Excl. Landfill construction)	20 ~ 30	30	450 million	330
RDF	200 million (Excl. Landfill construction)	10 ~ 15	30	300 million	265
<b>Landfill Gas to Energy</b>	120 million	5 ~ 10	30+20 (Depends on the site size)	60 + 10 million	365
<b>Bioreactor + LFG Energy</b>	130 million	<b>7 ~ 15</b>	30+10 (During +After operation)	75 + 5 million (During +After operation)	365

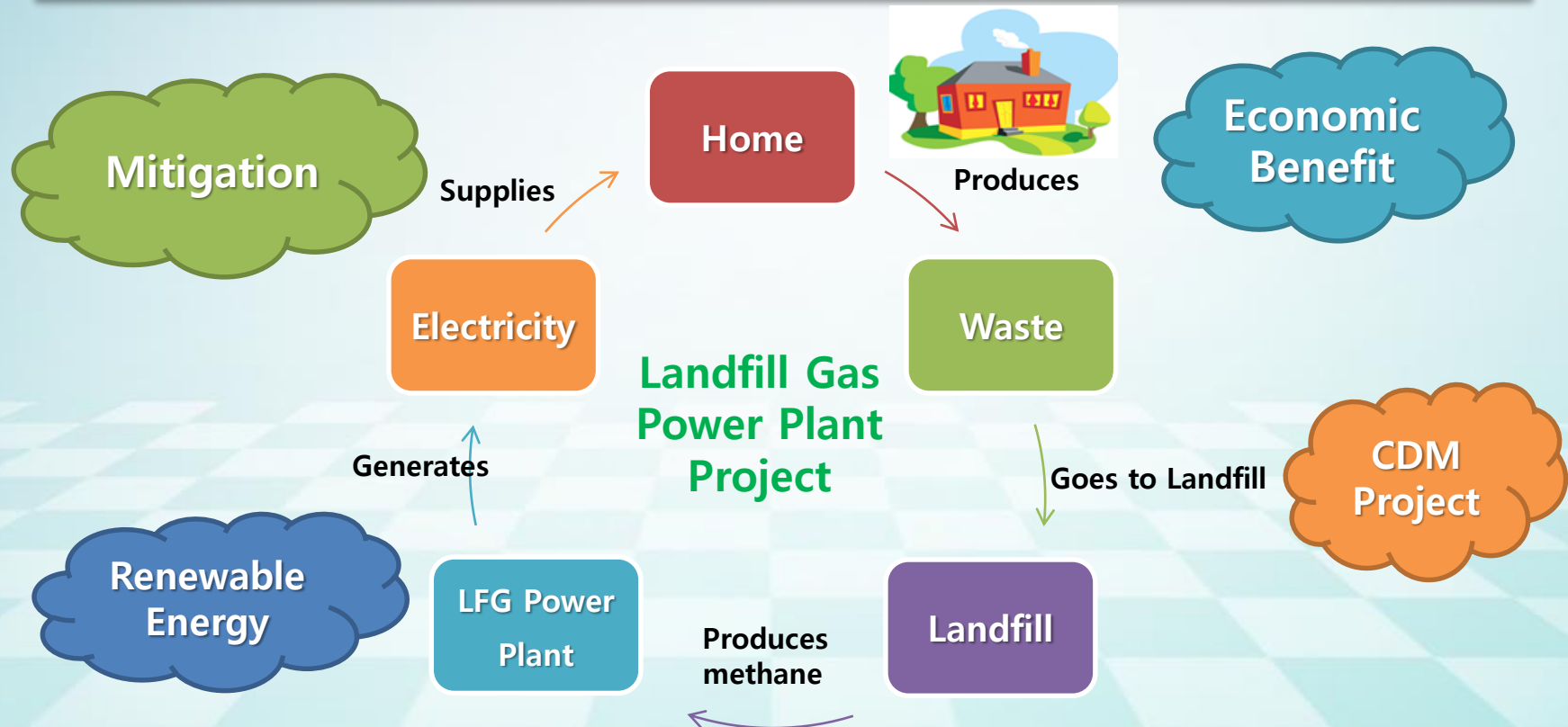
### UNFCCC's CDM projects of LFG

Country	No.	Business item	Registration date	Reduction (tCO <sub>2</sub> e/y)	IRR (%) Including CER
Peru	708	Huaycoloro landfill gas capture and combustion	2007.05	298,996	21.2
China	887	Shenzhen Xiaping Landfill Gas Collection and Utilization Project	2007.05	471,619	30.0
Korea	941	Sudokwon Landfill Gas Electricity Generation Project	2007.04	1,210,342	5.9
Mexico	1123	Ciudad Juarez Landfill Gas to Energy Project	2007.11	170,499	10.2

# III. Domestic Waste Management Policy

## LFG Power Plant Project

- Demand for Korean model is high among the developing countries
  - Economic and environmental benefit
  - Greenhouse gas reduction → Reduce the risk of global Climate Change
- ☞ **A strong chance as GCF business model**



## History of SUDOKWON Landfill Site



# III. Domestic Waste Management Policy

## SUDOKWON Landfill Overview



### Landfill size and Capacity

Total	Size (10,000 m <sup>2</sup> )		Capacity (10,000 tons]	Life Time
	Landfill	Others		
1,541	1,405	136	22,800	30 years from now



## SUDOKWON Landfill Overview



### Eco-Friendly Sanitary Landfill Operation

- Quick, Safe & Sanitary landfill operating system
- Eco-friendly Waste management technology



### Leachate Treatment Technology

- Design Capacity : 6,700 ton/d  
(Daily processing amount: 4,300 ton/d)
- Aim to 'Zero discharge Leachate Treatment System'



### Solid Recovered Fuel Plant

- Design Capacity: 200 ton/d
- Converting wastes into fuel and energy



### Sludge Recovery Plant

- Capacity : 2,000 ton/d
- Turning sewage sludge into fuel



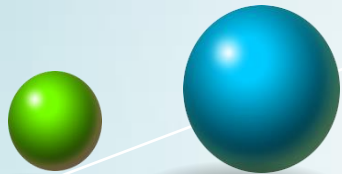
### 50MW LFG Power Plant

- CDM Project for Recycling LFG
- UNFCCC Issue more than 800,000 CO<sub>2</sub> tons of CERs annually to SL Corp.

# III. Domestic Waste Management Policy

## 50 MW LFG Power Plant & CDM Project

- Utilizing LFG generated from landfill waste processing as the source of energy  
→ import-substituting effect by generating new and renewable energy
- Recognized by UNFCCC as a CDM project  
→ Actively engaging in international efforts to respond to climate change



**Landfill**



**Manifold Station for Gas Transmission**



**50MW Landfill Gas Power Generation**

### Environmental Effect

- Odor prevention
- Greenhouse gas reduction
- Prevention of LFG explosion
- Equivalent to substitution for crude oil worth 55 mil. USD

### Economic Effect

- Sales of power \$40 million/y
- Energy supply 180,000 homes
- Job creation
- Possibility of overseas project

### CDM Project

- The total issued CERs : 6 million CO<sub>2</sub> tons (As of August, 2015)
- 2 million CO<sub>2</sub> tons sales: about \$ 3milions
- CDM project period for 10 years (2007 ~ 2017)
- Total CERs about 8million CO<sub>2</sub> tons

# V. Overseas Project on Waste to Energy



## Type of financing on Environmental Project



Governmental financial support



Grant & Loan combined support



PPP



ODA Fund



Joint International Localization



Attract investment to countries for export



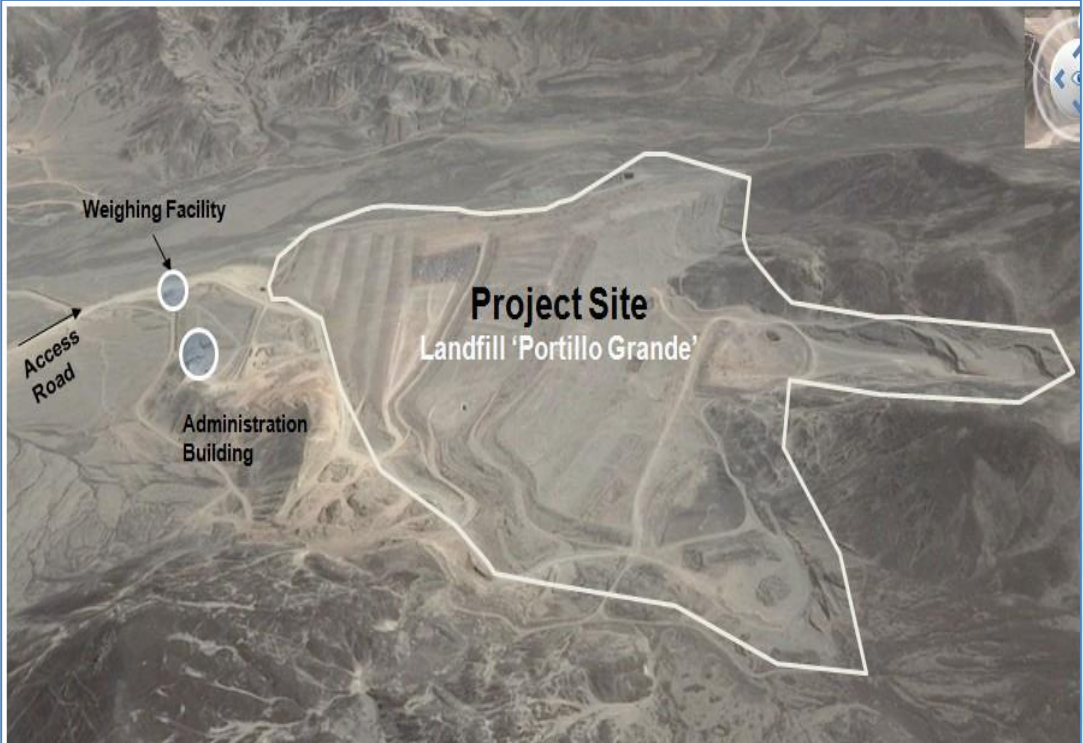
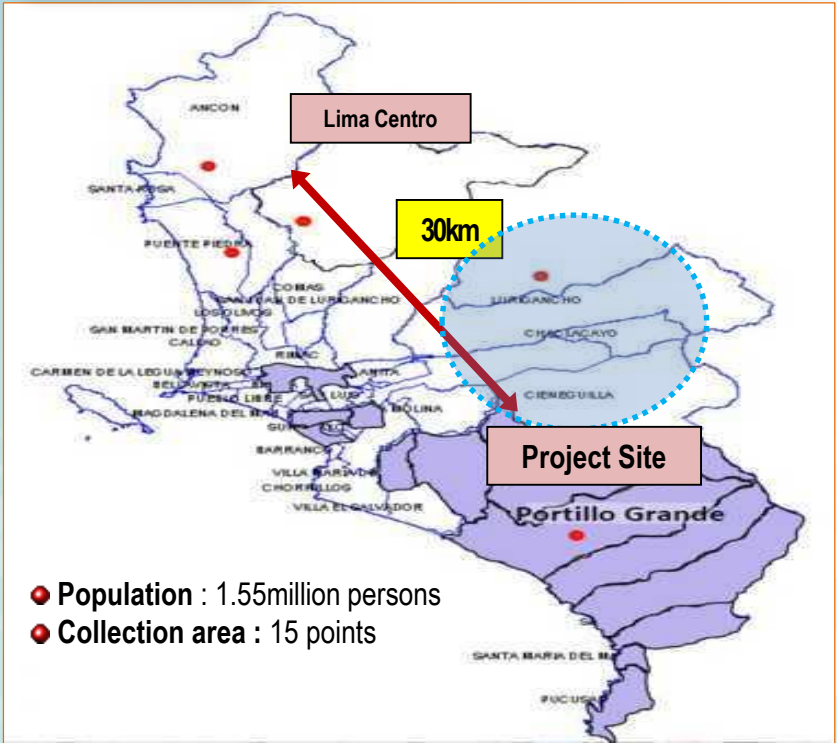
R&D Support

# V. Overseas project on Waste to Energy

## Development of Landfill Power Plant at Lima, in Peru

### Project Background

- Lima city's landfills emit a large amount of LFG and cause global warming even though the city has proper waste collection systems
- Collecting LFG utilizing it as fuel to produce electricity will reduce the GHG emissions and bring economic benefits



## Executive Summary

### Project Summary

- **Waste generation** : 7,918 ton/d
- **Landfill size** : 107 ha, waste in-take 1,500 ton/d
- **Project Scope** : Construction of 7.4 MW LFG power plant, LFG collection system with bioreactor, Power generation system, power grid system
- **Project Period** : 22 years (Construction: 2 years, operation: 20 years)
- **Project Cost** : USD 26.69 million

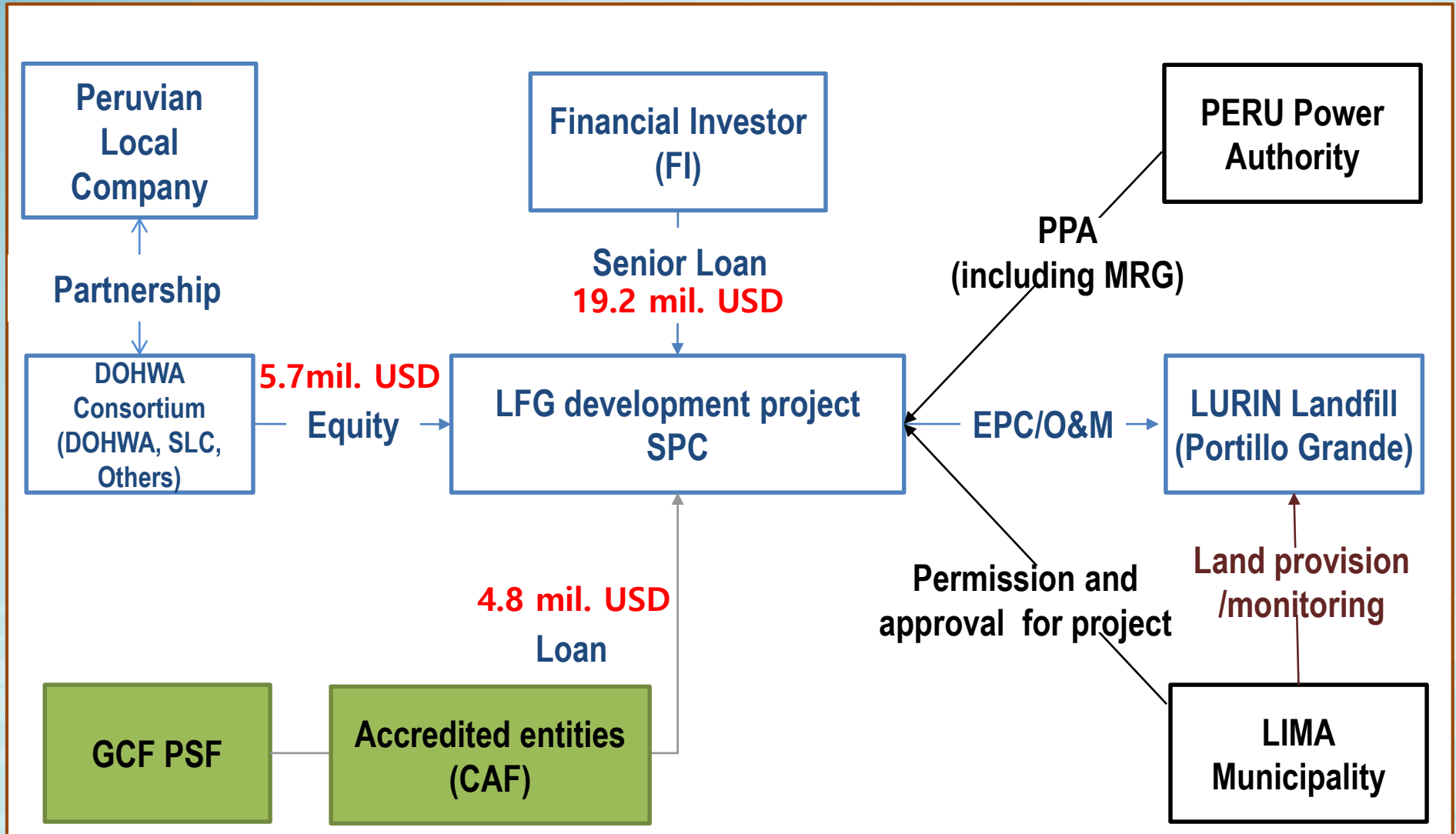
### Propulsion Details

- **March 2012** : Completion of Feasibility Study supported by KEITI
- **July 2015** : Submission of GCF Proposal (DOHWA → CAF → GCF Secretariat)
- **Dec., 2015** : PPP proposal preparation & SPC establishment
- **Early 2016** : Final approval of GCF proposal (expected)

# V. Overseas project on Waste to Energy

## Governance Structure of the Project

29.69 mil. USD



# V. Overseas project on Waste to Energy

## Expectation of Landfill Gas & CO<sub>2</sub> emission reduction (Normal condition)

- LFG generated is estimated to be average of **61.2 m<sup>3</sup>/ min** during the project period
- Power production the LFG is expected to be up to **7.4 MW (average 6.43MW)**
- Reduction of **5.4 million tons of CO<sub>2</sub>eq** for 20 years

Year	LFG emission (m <sup>3</sup> /min)	LFG collection (70%)	Baseline methane Emission (tCO <sub>2</sub> )	Average Power generation (MW)	Baseline Power Plant Emission (tCO <sub>2</sub> )	Project emission (tCO <sub>2</sub> )	Total Emission Reduction (1,000 tCO <sub>2</sub> eq)	Cumulative Emission Reduction (1,000 tCO <sub>2</sub> eq)
2016	72.86	51.00	200,962	5.30	26,022	3,361	224	440
2020	81.99	57.39	226,141	6.30	30,932	3,361	254	1,410
2025	89.86	62.90	247,853	6.30	30,932	3,361	275	2,747
2030	95.24	66.67	262,708	7.40	36,333	3,361	296	4,182
2034	98.40	68.88	271,416	7.40	36,333	3,361	304	5,386
Average	87.41	61.19	241,107	6.43	31,570	3,361	269	



# V. Overseas project on Waste to Energy

## Benefits of the project

- Revenue from electricity generation
- Lima city could receive excess earnings
- Job creation : Job opportunity of local community during construction and operation

### Economic Benefits

- Reduce Greenhouse gas  
5,400,000 tCO<sub>2</sub>eq for 20years  
(269,000 tCO<sub>2</sub>eq per year)

- Reduce potential gas explosion and fire on the landfill
- Becoming successful case of GHG reduction activity

### Social Benefits

- LFG collection : odor reduction, well-being of its citizens
- Systematic treatment of leachate- environmental enhancement such as prevention of water pollution

### Environmental Benefits

- Technical Transfer & Training
  - Bioreactor method
  - Soil covering technology
  - LFG refining & storage tech
  - Gas engine generation tech
  - Monitoring Tech on LFG emission and reduction

### Technical Benefits



THANK YOU