

Waste Management Practices and R&Ds on WtE in Korea

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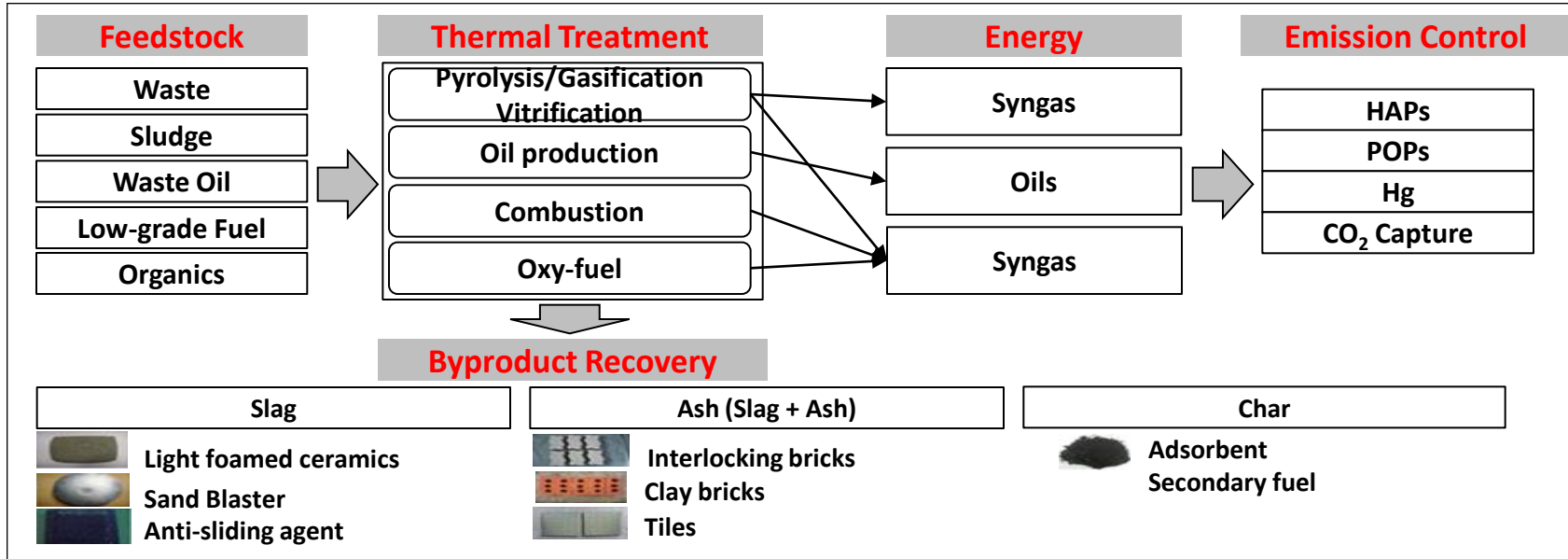
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Main Ref. : [Past, present and future of waste management in Korea](#)
by W-S Yang & Y-C Seo, JMCWM (2015)

Current Projects and Feature of R&Ds in AWEL, Yonsei Univ.



- Technology of thermal energy production and solid refuse fuel using mixing waste of low calorific value (w/Forcebel, Posco E&C, Institute for Advanced Engineering)
- Gasification of fluff type SRF from household waste (w/Samho Enviro-Tech Inc., Institute for Advanced Engineering)
- The Development of innovative gasification technology with tar free and purified product gas for MSW-RDF (Korea-India R&D Program, w/Chogen Powers Ltd., Samho Enviro-Tech Inc., Institute for Advanced Engineering)
- Development of the integrated treatment technology for high mercury content wastes (w/ Eco-Recycling Co., Ltd.)
- Estimation on natural emission of long range transported mercury and assessment of contributions by anthropogenic emission between surrounding nations (w/Seoul National Univ., Ajou Univ., Kangwon National Univ. & GIST)
- Development of Mercury Recovery and Waste Management System in Korea (MOE)





Content

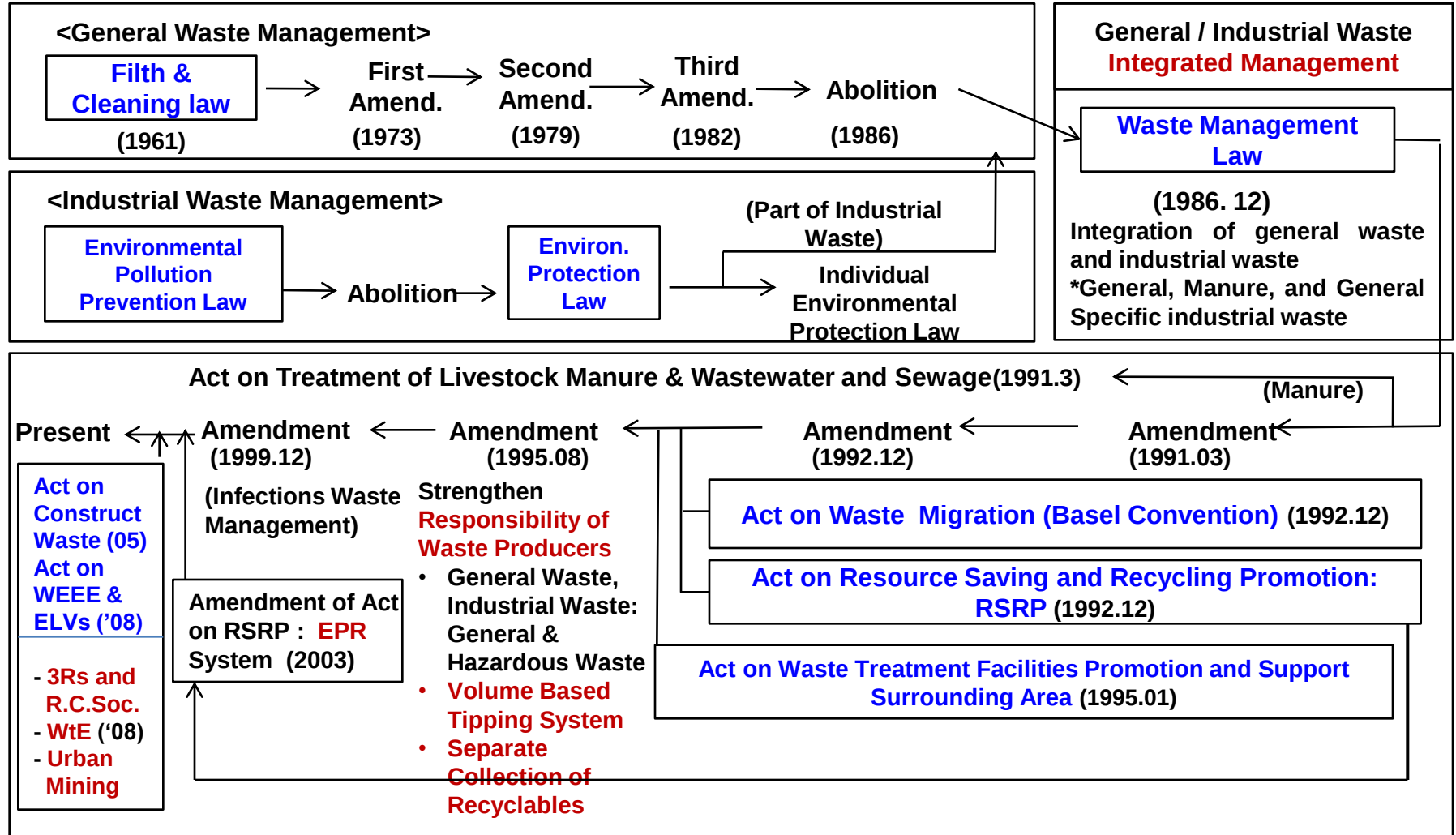
1. Historical review and status on waste management
2. Major waste management policies and systems
3. Waste to energy technologies
4. Conclusion



1. Historical review and status on waste management



❖ History of legislation for waste management in Korea



Source: Waste resources management, University of Seoul

Main Ref: [Past, present and future of waste management in Korea](#)

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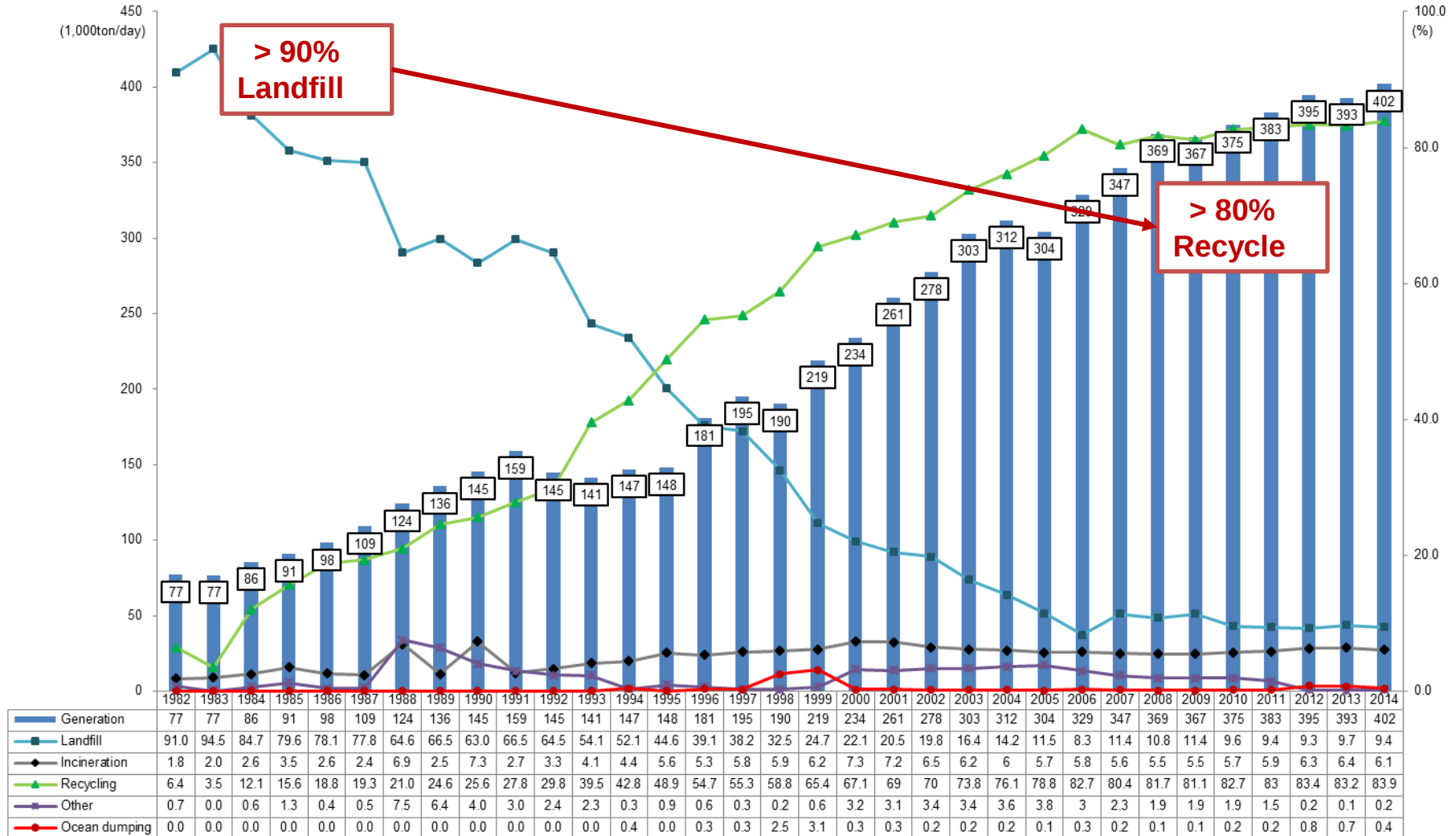


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1. Historical review and status on waste management



❖ Waste generation and treatment in Overall('82 ~ '14)



Source: Environment statistics yearbook, Korean Ministry of Environment

Main Ref: [Past, present and future of waste management in Korea](#)

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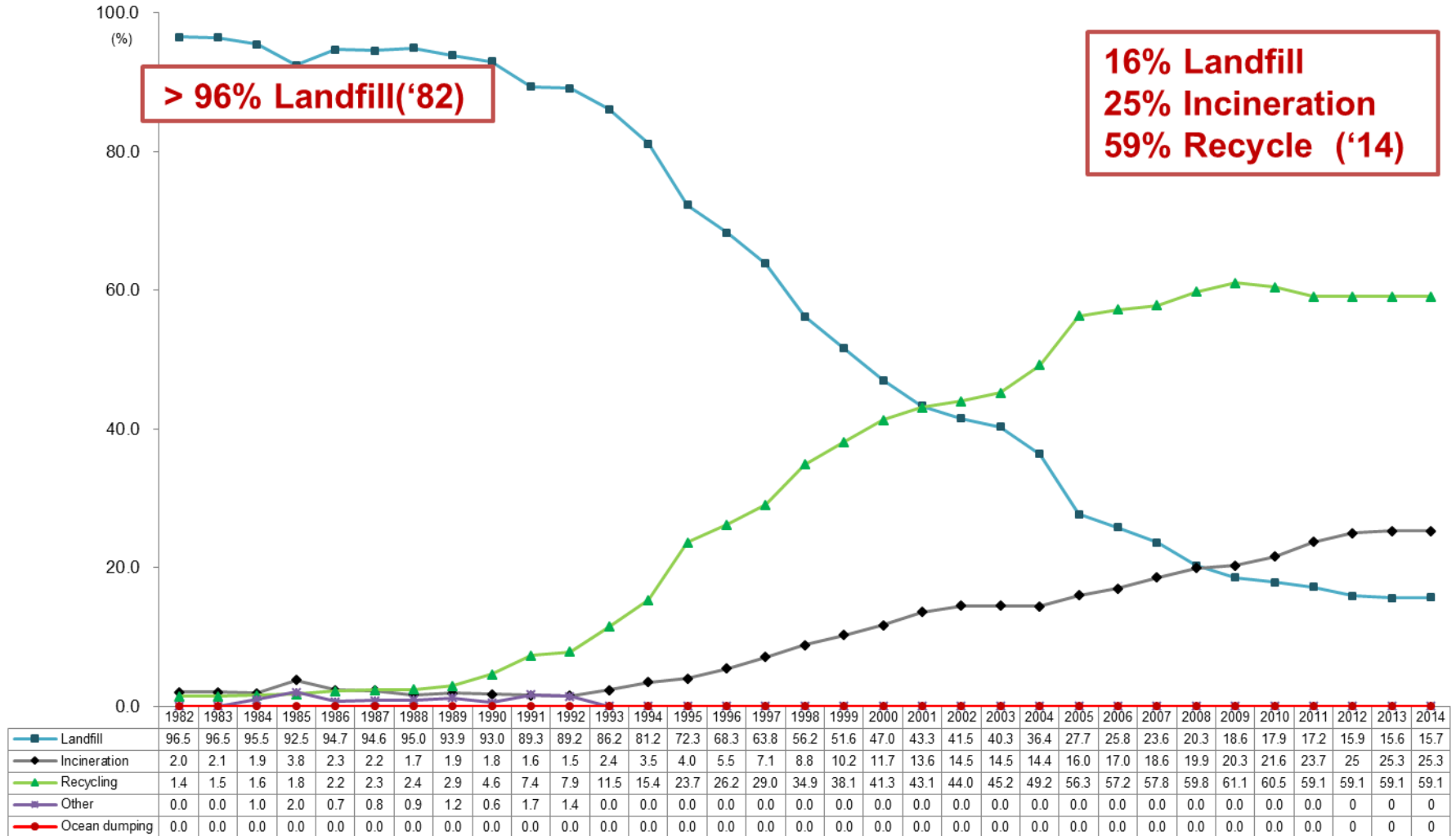


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1. Historical review and status on waste management



❖ Treatment of Household waste ('82 ~ '14)



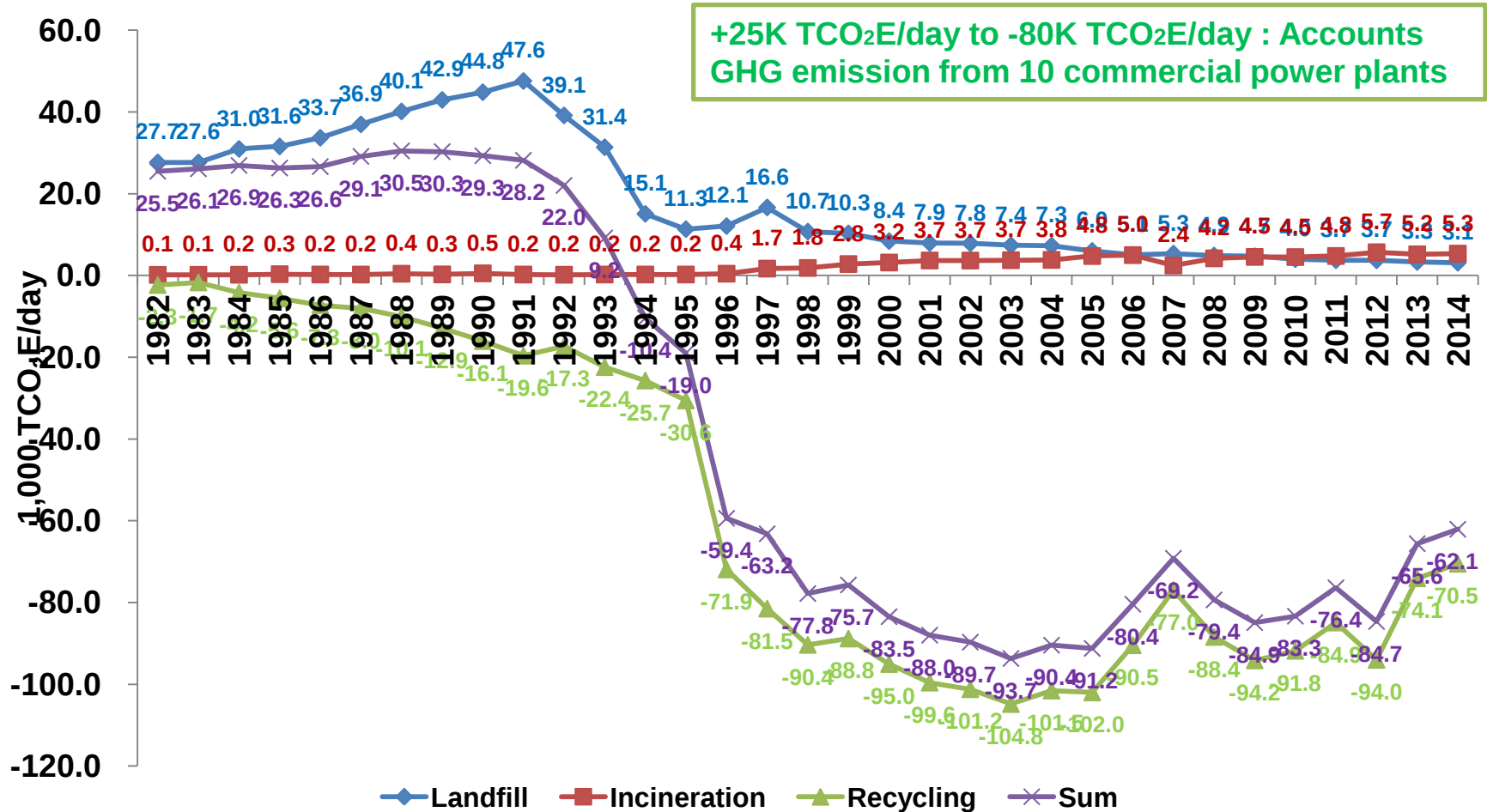
Source: Environment statistics yearbook, Korean Ministry of Environment

1. Major waste management policies and systems



❖ Estimation of greenhouse gas reduction (by WARM, USEPA)

▪ Overall



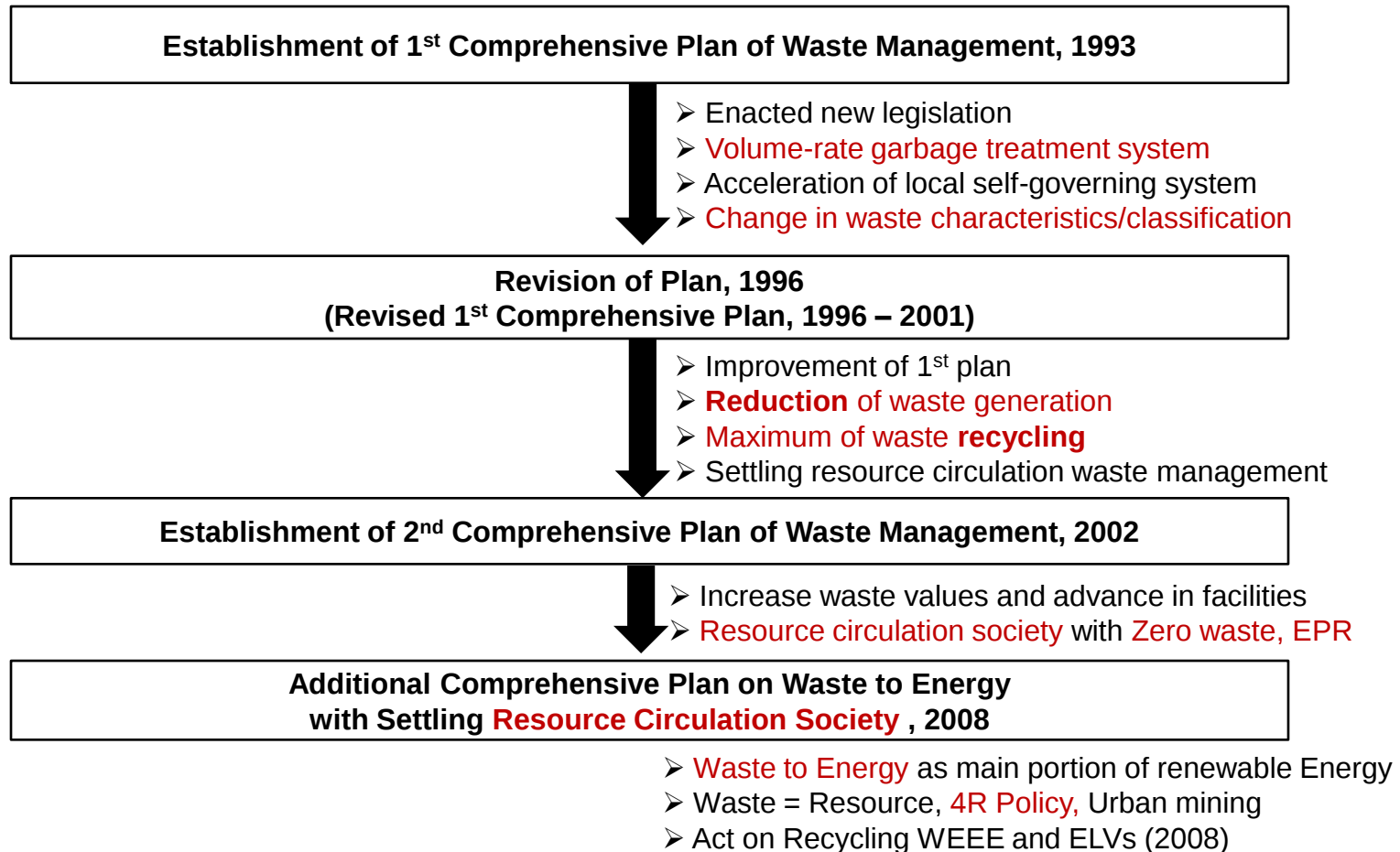
Source: Environment statistics yearbook, Korean Ministry of Environment



2. Major waste management policies and systems



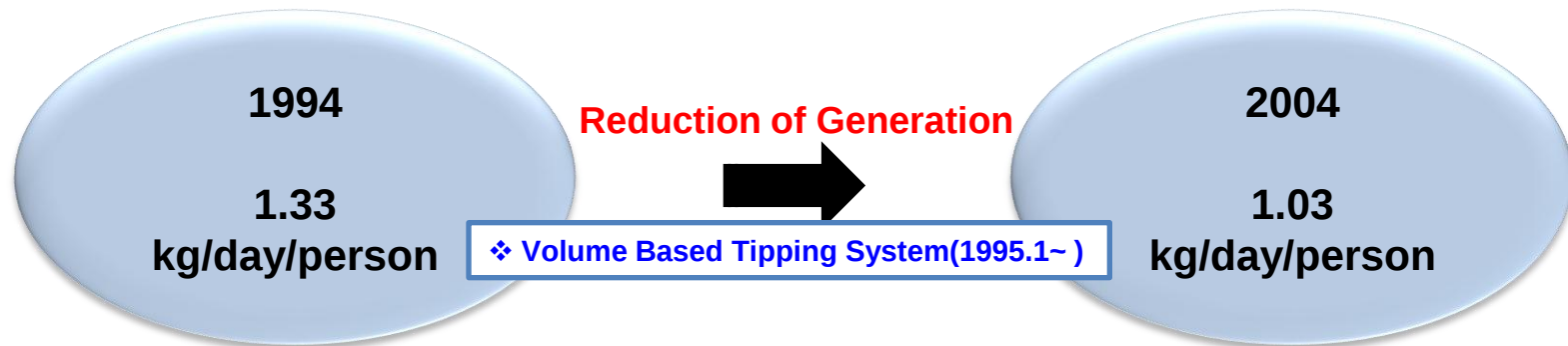
❖ Comprehensive plans of waste management since 1993



2. Major waste management policies and systems



❖ Volume Based Tipping System (1995.1~)



**Saving cost of transportation and landfill
: about 6 billions \$**

Households buy Bags (priced) from supermarkets. Price of a bag by volume will be determined by local governments depending on the cost of waste handling. (fractionally supported by gov.s.)

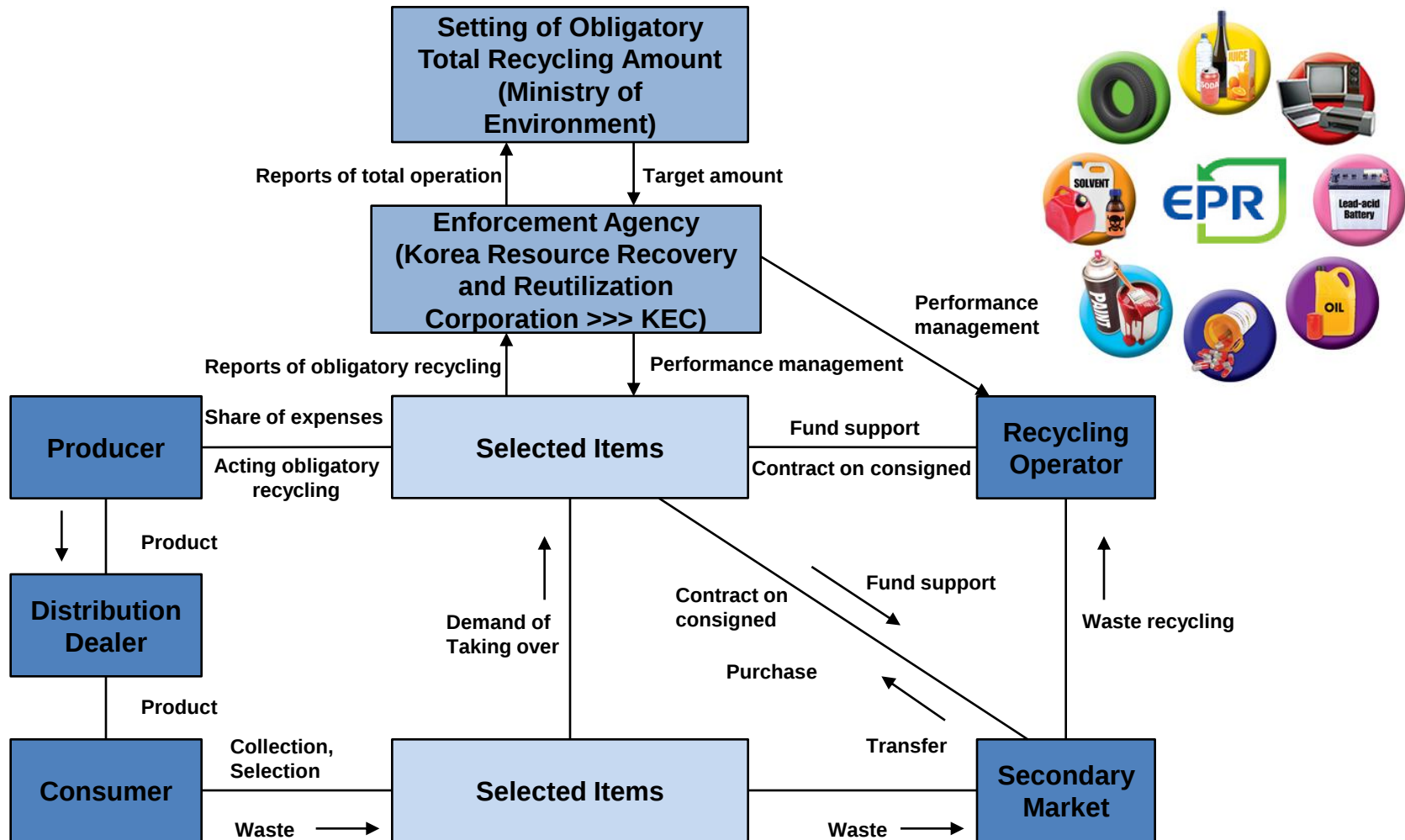


Source: Korean Ministry of Environment



2. Major waste management policies and systems

❖ EPR (Extended Producer Responsibility) System (2003.1~)

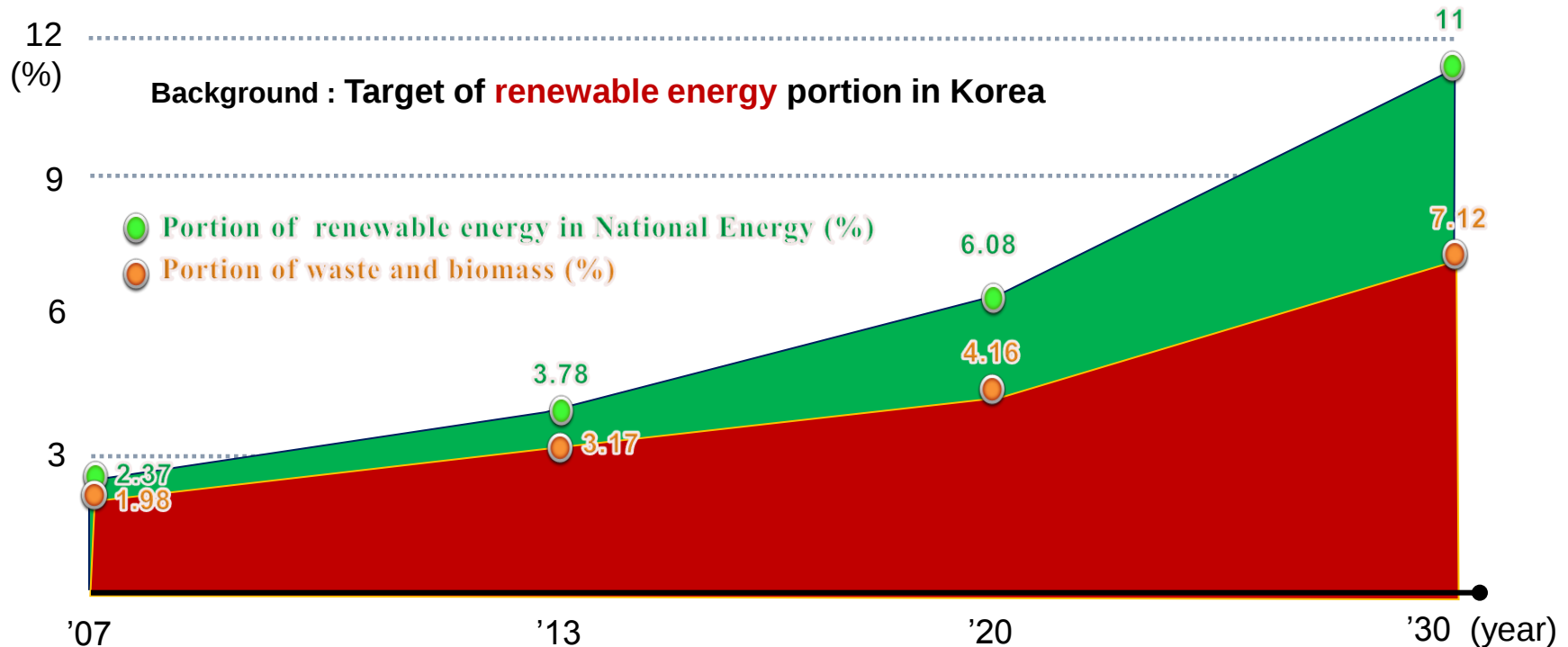


Source: Korean Ministry of Environment

2. Major waste management policies and systems



- ❖ WtE Plants were constructed by Integrated WM Policy since 1990
- ❖ New Waste to Energy Plan to Expand Renewable Energy (2008-)



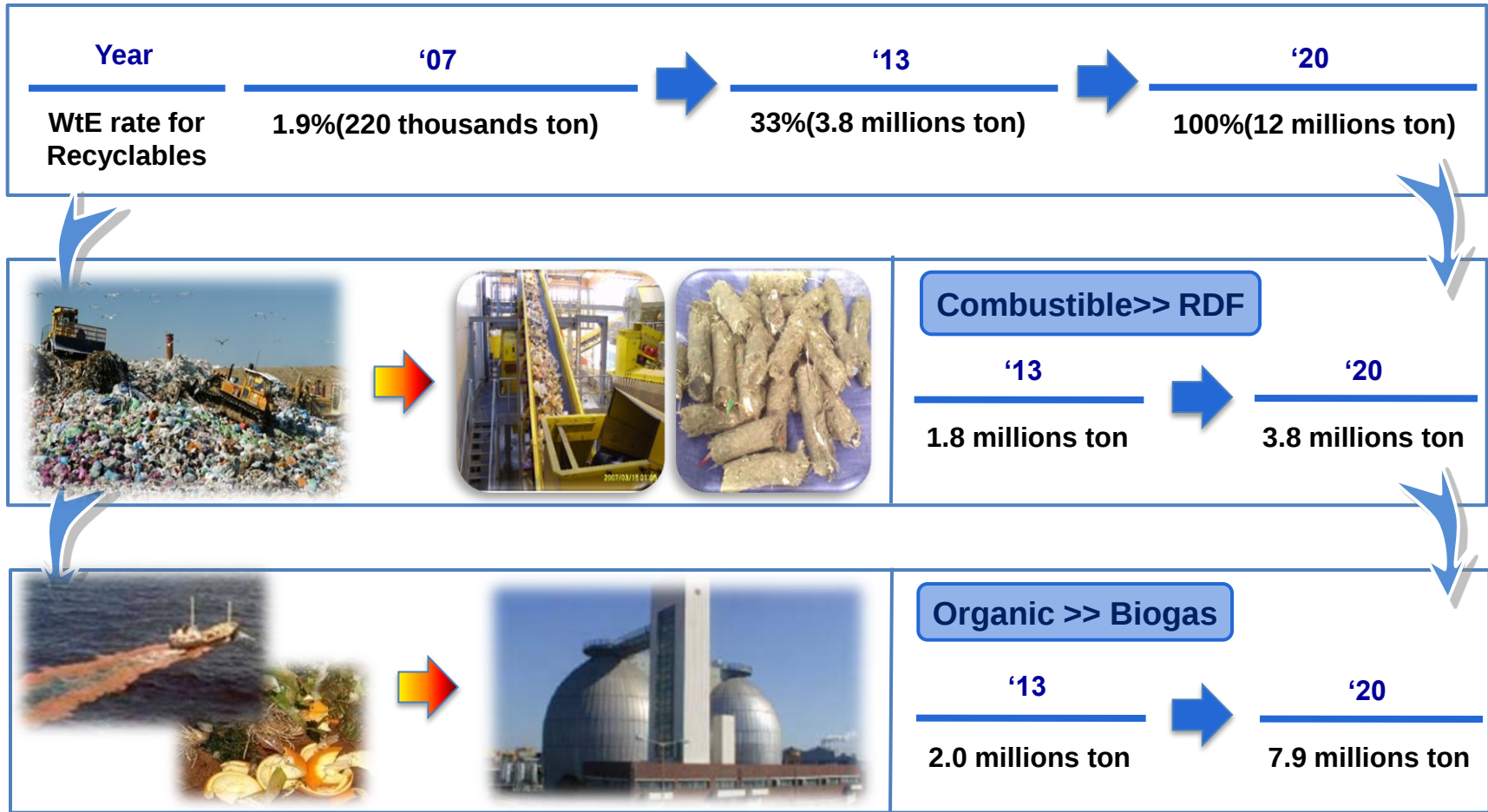
- For achieving to supply the share of national renewable energy (6.08 and 11% in 2020 and 2030, respectively), still around 70% of renewable energy would be supplied by utilizing waste and biomass to energy
- **Waste to Energy** has been in situation of main fraction in renewable Energy in Korea

Source: Korean Ministry of Environment



2. Major waste management policies and systems

❖ Comprehensive plan on waste to energy (2008-2020)



Source: Korean Ministry of Environment

2. Major waste management policies and systems

❖ New waste management policy

- Strategy and Actions for Establishing Resource Circulation Society

Establishment of Resource Circulation Society

Increase of Recycling Rate by WtE and other Activities(Waste = Resource)
Zero Landfill (3 % by 2020)



Enactment of “Resource Circulation Law” (June, 2016. Effective from 2018)
& Amendment of Other Related Regulations



Maximum Securement of Recycled Resources

- **EPR Items Expansion**
- **Free Collection to Door by Call for WEEE**
- **Fund Establishment for RCS (Landfill Tax etc.)**

Support of Recycling Business & Market Creation

- **Moderating Regulations and Market Support**
- **Trade Center for Recycled Products**
- **Demand Expansion of Recycled Resources**

Expansion of Recycling Infrastructure

- **Establishment of Resource Circulation Complexes**
- **Expansion of WtE Facilities and R&Ds Support for WtE Technologies**

Source: Korean Ministry of Environment

3. Waste to energy technologies

- ❖ **Waste to energy:** Most of incineration plants constructed since 1990.
Comprehensive plan on Waste to Energy in 2008.

Waste = Resource

- ◆ Materials of waste generated in home and industries – recycling : valuables
- ◆ Waste converting to energy – Producing different types of energy or fuels

Category of waste and energy conversion

Combustible waste
(paper, vinyl, plastic, wood, etc)



Solid fuel (SRF)
production

Organic waste
(Food waste, sewage sludge, etc)



Biogas fuel
production

**Max. utilization of heat in
incineration**
(paper, vinyl, plastic, wood etc)



Heat, electricity
production

**Electricity from
Landfill gas**



Heat, electricity production
Vehicle fuel(oil refinery)

**Industrial
Waste gas**



Heat, electricity
production

Characteristics of waste

◆ High calorific value

- ✓ **Combustible waste**
2,500 ~ 3,500 Kcal/kg
- ✓ **Solid fuel**
4,500 ~ 5,000 Kcal/kg
(Anthracite 4,600 Kcal/kg)

3. Waste to energy technologies



❖ Status on Commercial Plants of Waste to Energy

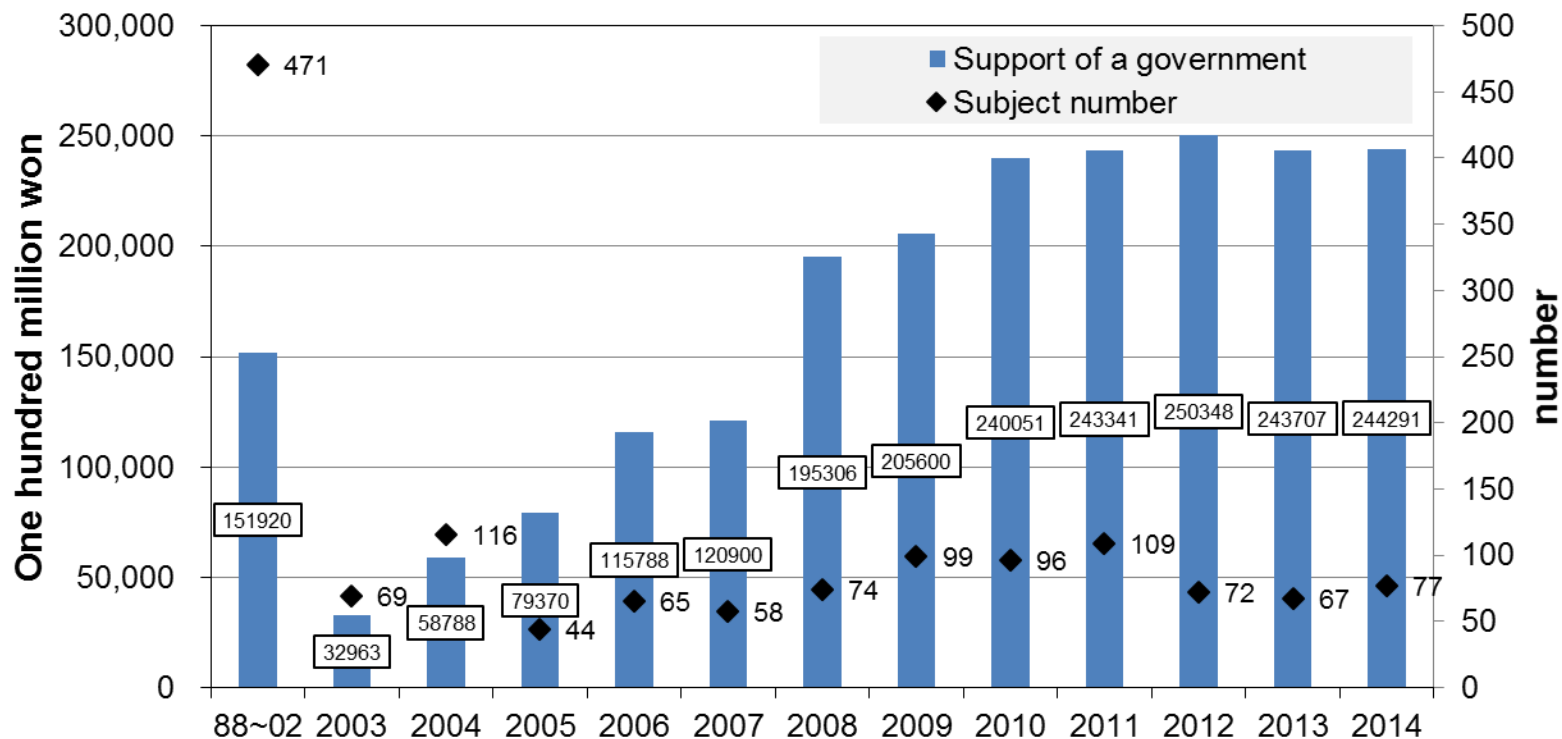
- ❖ MSW Incinerators in operation : ~200 plants, ~16,800 tons/day
 - Most of incineration plants have been constructed from 1990 to 2005.
 - Less generation of electricity with low efficiency of energy conversion.
 - Replacement period is coming so planning is needed.
- ❖ Gasification plans in operation : 10 plants, ~700 tons/day (const. in '03-'08)
 - A few plants for MSW in the beginning of 2000, less efficient, no electricity.
- ❖ SRF (RDF) : 19 plants (constructed in ~'08: 100 tons/day, '08~ : 5,440 tons/day)
 - Based on the plan on WtE in 2008, SRF manufacturing plants planned
 - But many troubles followed so some are delayed or cancelled.
 - Several power plants have been constructed and planned.
- ❖ Bio-gas from organic wastes: 61 plants (140MWe capacity – 13,000 tons/day)
 - Mainly electricity generation with low efficiency. Less utilization as vehicle fuel.
 - More biogas plants under construction to treat food waste and leachate.
 - Struggling to resolve operational problems and odor reduction.
- ❖ Utilization of landfill gas : 21 locations (154MWe capacity)
 - Pushing to construct electricity generation plant at all locations.
 - Efficiency is very low, but CO2 reduction can be achieved.

Source: Environment statistics yearbook, Korean Ministry of Environment



3. Waste to energy technologies

❖ R&D status and budget of KETEP(Ministry of Industry)



'88 ~ '13 R&D cost

Unit: one million won

Field	Subject number	Private share	Support of government
Bio	163	56,880	126,876
Waste	97	88,373	71,591

Source: http://www.ketep.re.kr/home/information/information08_4.jsp?flag=4

3. Waste to energy technologies

❖ R&Ds on WtE Technology Development (KEITI: MOE)

New R&Ds for WtE (KMOE, 2012)

Objective

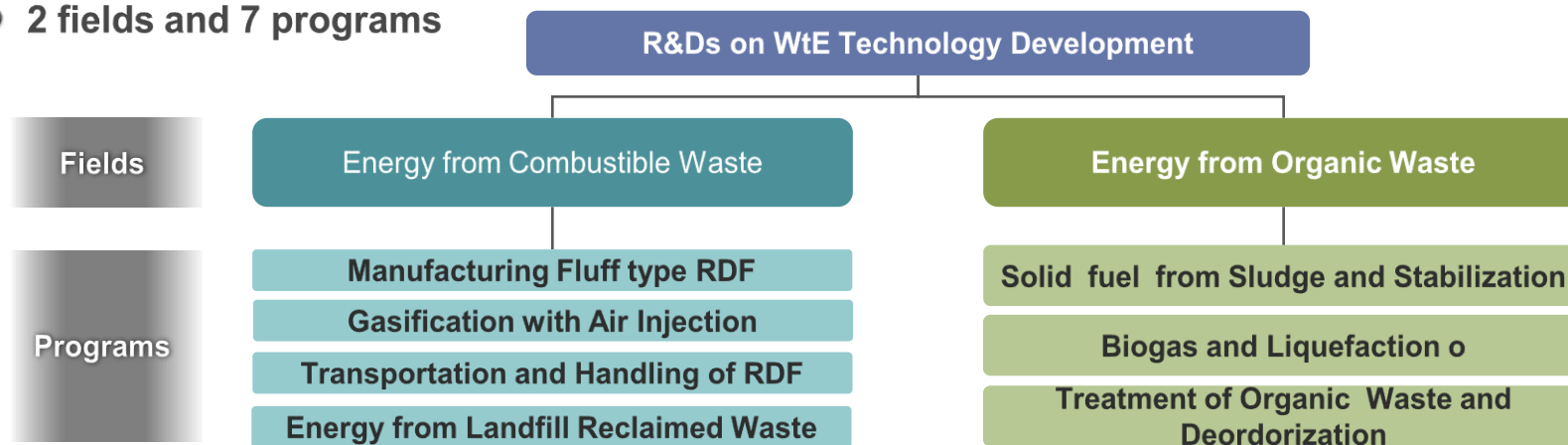
- (Domestic Technology development) – Demonstration system and exportable technology by integrating existing elemental technologies and adjusting to domestic waste streams

Period and budget

- 2013 ~ 2020 (8yrs), 134 M \$

Project contents

- 2 fields and 7 programs



3. Waste to energy technologies -KETEP (Ex: Oil from Biomass)



- Period : 2009 ~ 2011
- Institution : Yonsei Univ.
- Capacity : Lab Scale



- Period : 2012 ~ 2013
- Place : Goisan, Chungbook, Korea
- Capacity : 1 ton/day



- Period : 2015 ~
- Place : Hwasung, Gyunggi, Korea
- Capacity : 1 ton/day

UPGRADE

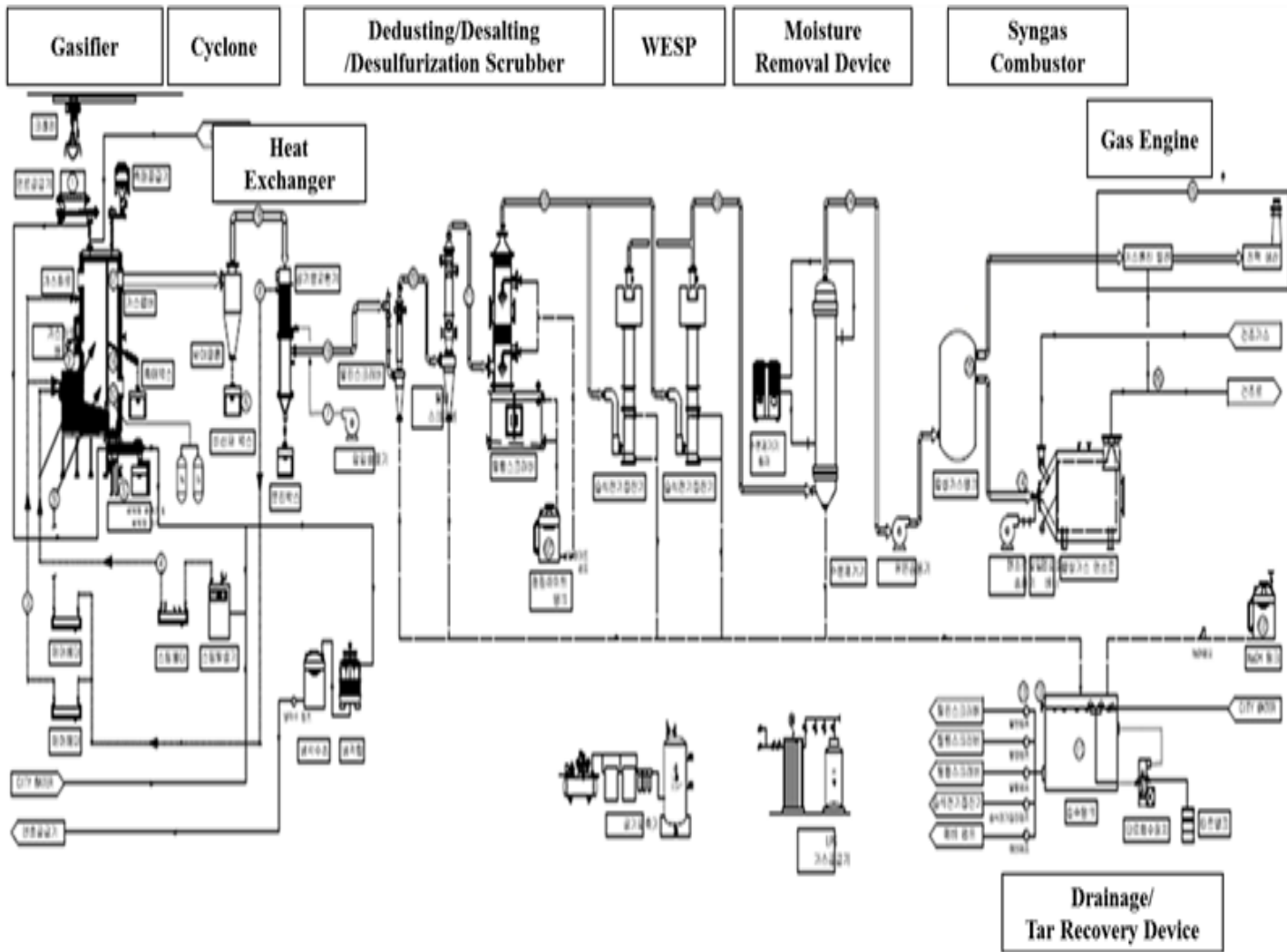


- New Project Started : 2015 ~ 2018
- Production of Transportation Oil from Biomass by Upgrading Technology
- Capacity : 1 ton/day, Design of 100 tons/day Plant



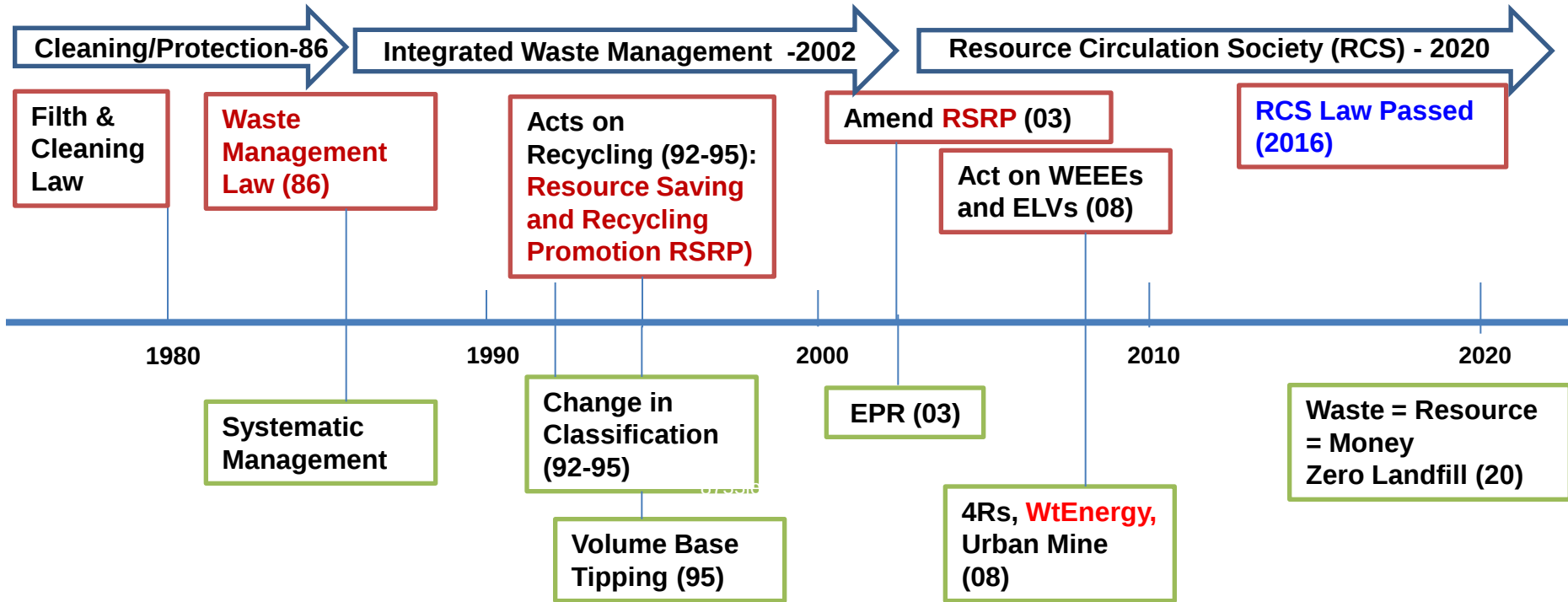
3. Waste to energy technologies(Ex: Gasification of waste)

❖ Gasification with less tar generation (Pilot plant: 8 tons/day)



Commercial Scale Plant (80 tons/day) is under design

4. Conclusion



Landfill	95% (83)	45% (95)	16% (03)	9% (11)	3% (20)
Recycle	3.5% (83)	49% (95)	74% (03)	83% (11)	87% (20)

Greenhouse Gas(GHG) Reduction by such efforts for effective Waste Management by 30 years ('82 – '12) is accounted more than GHG emission from more than 10 commercial power plants

Around 20% of waste is converting to energy with appropriate technologies and still some R&Ds on advanced technologies are being conducted for better efficient conversions.





❖ Project Overview

- Project Title : Human Resource Development Project for Waste to Energy (KEITI, MOE)
- Project Period : 2010. 3. 1 ~ 2016. 2. 28, Leader: Prof. Yong-Chil Seo
- Project Fund : 0.4 M\$ /year (6 yrs: 2,4M\$)

❖ Project Organization

- Faculty : 7 professors, 1 research professor, 2 post doctors, 1 adm. staff
- Academy-Government-Industry Research Network
 - Wonju city local government, Korea association of waste to energy technology
 - 8 WtE industry companies (including 4 local industry companies)

❖ Main Objective

- Educating graduate students to environmental experts on waste (biomass) to energy (WtE).
- Supply experts in WtE to Industries.
- Building up of global networks (WTERT) and encouraging international research exchange programs

Good News !!! KETEP Announced Yesterday !!

- ❖ WTE Center will be continued by getting a new GRANT from KETEP (Ministry of Industry) for 5 years from next month for 5 years.
- ❖ New Leading Professor : **Prof. Hang S CHOI**
- ❖ Same Project but more fund 0.5 M\$/yr for 5 years



The aim of WTERT Korea is the development of sustainable waste management in Korea, which includes the whole life cycle of the wastes, through maximizing the recovery of energy and materials and minimizing the environmental impacts on the basis of the scientific knowledge of the effects of various waste treatment technologies in our country and worldwide...

[Organizers of WTERT Korea]



People



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