



Title	Bioenergy : Key tool for Sustainable Society (Korean Experiences)
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Bioenergy: Key tool for Sustainable Society (Korean Experiences)

2013. 11. 5.

Jin-Suk Lee

Agenda

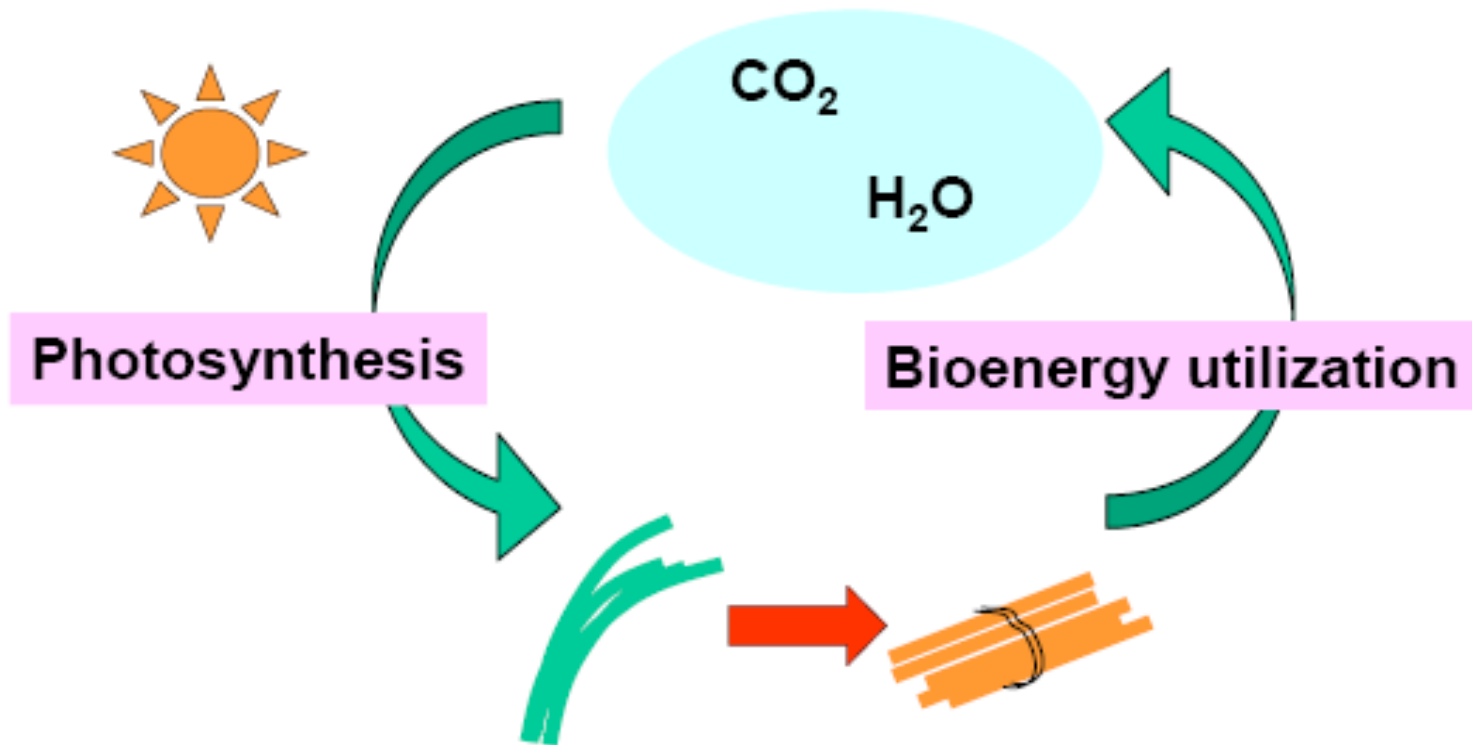
- I. Introduction**
- II. Bioenergy Experiences in Korea**
 - Biogas
 - Biodiesel
 - Wood Pellets
- III. Other Issues**
- IV. Summary**

I. Introduction

Advantages of Bioenergy

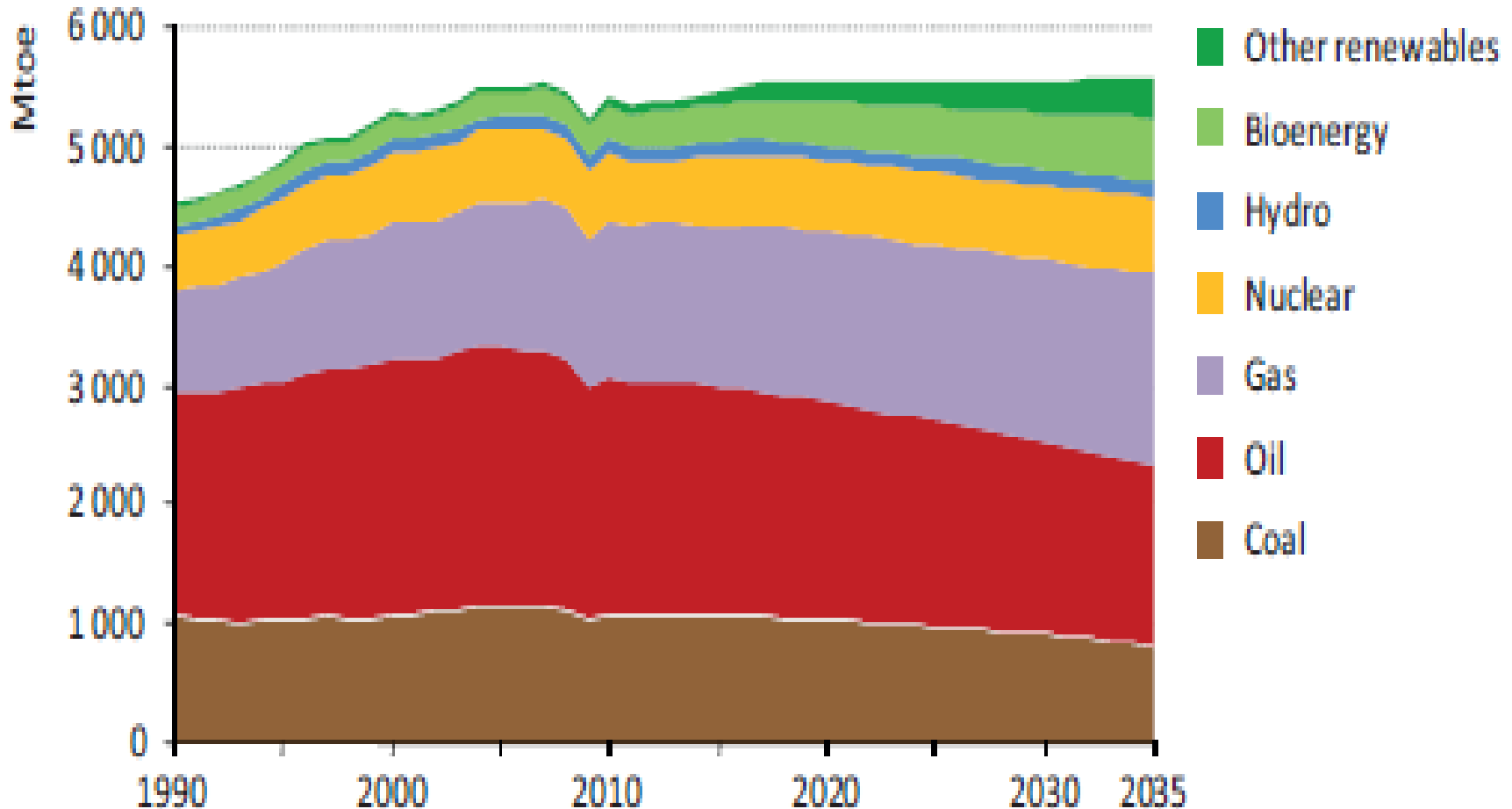
(Y. Matsumura, 2008)

- Sustainable Energy
- CO₂ neutral



OECD Primary Energy Demand

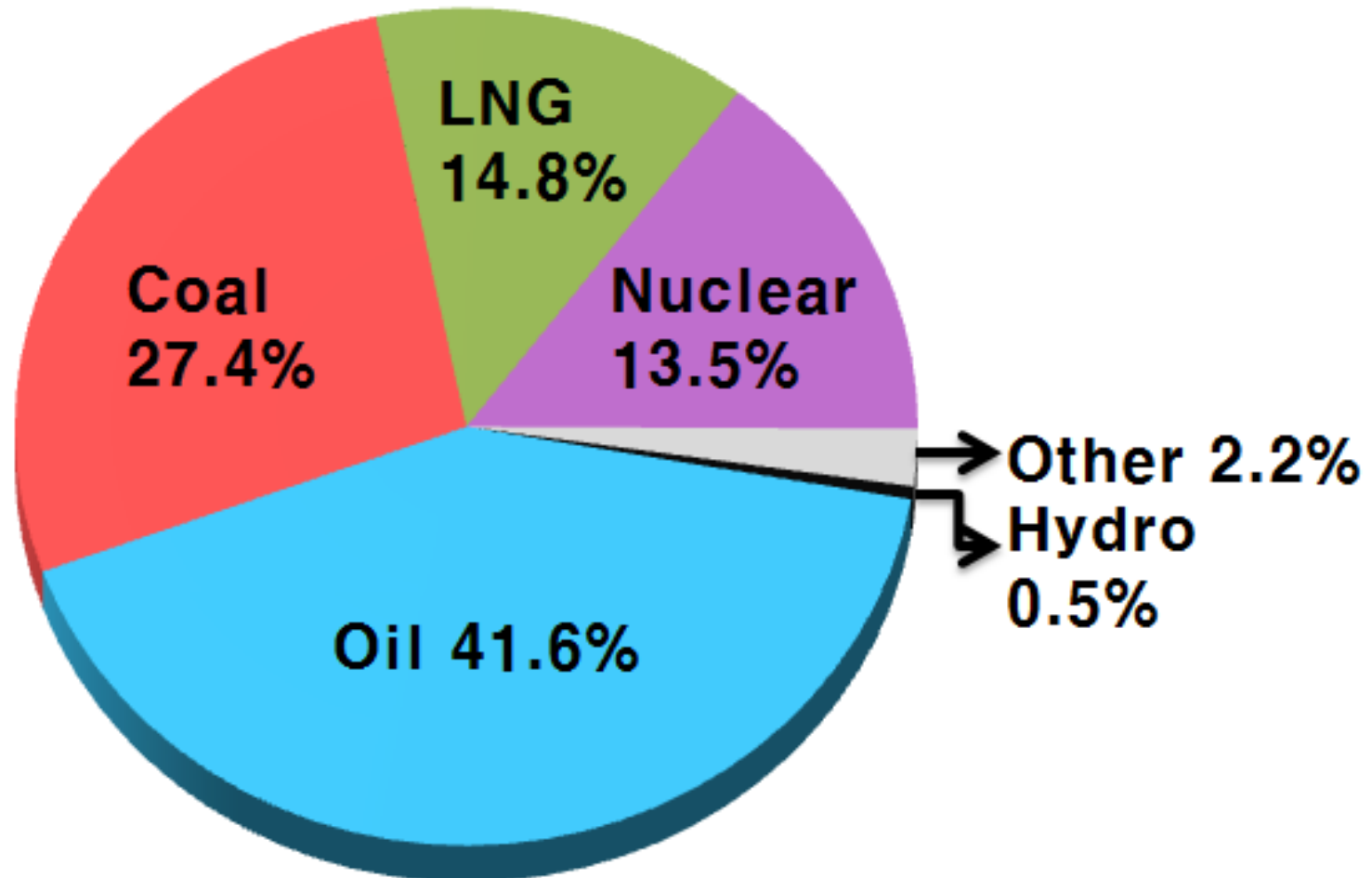
(IEA, WEO 2012)



II. Bioenergy Experiences in Korea

Energy Situation in Korea

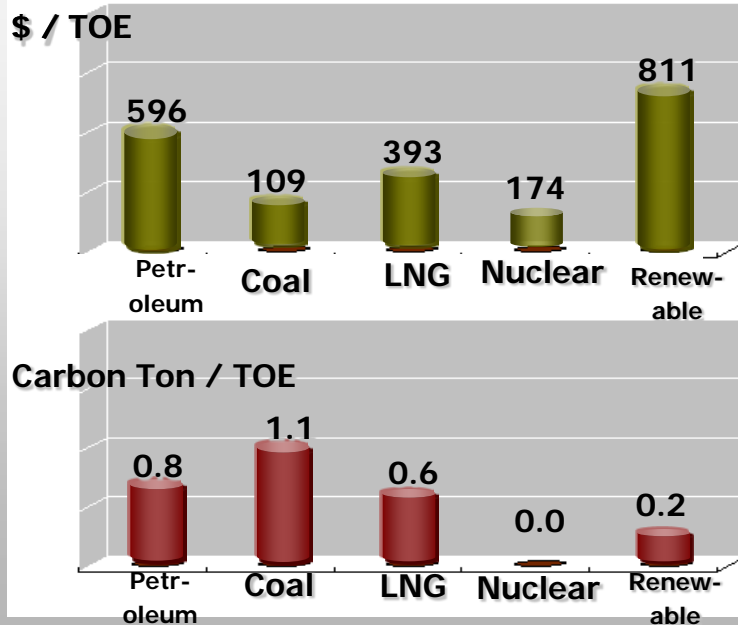
(MKE, 2008)



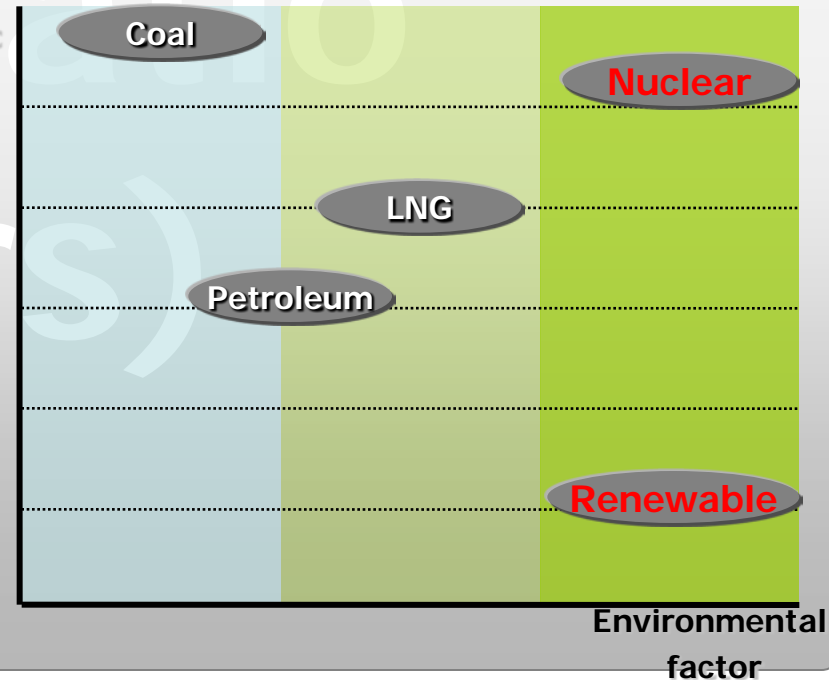
Optimum Energy Mix

Consideration factors: Economy and Environment

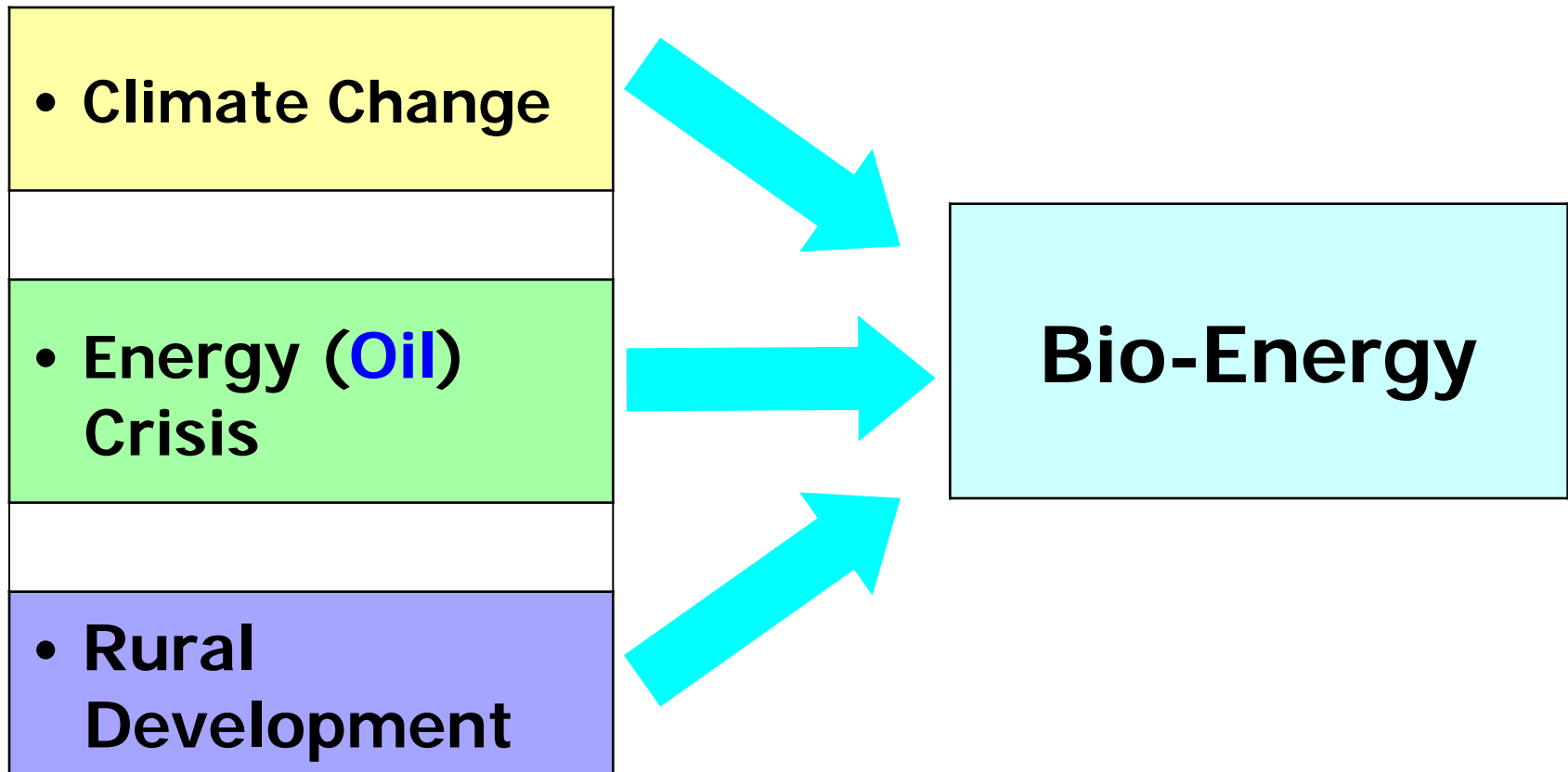
Economic & Environmental



Economic factor

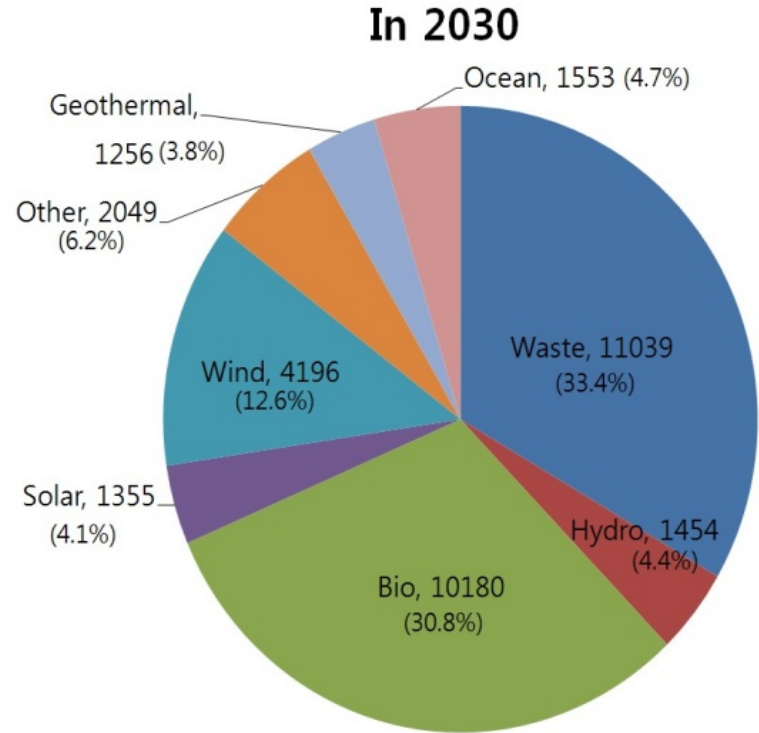
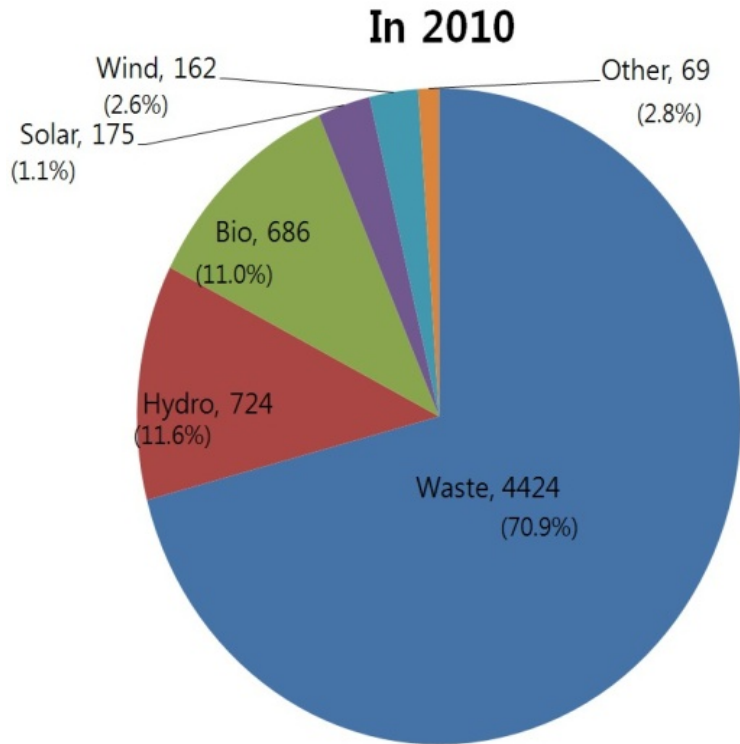


Key Barriers for Realization of Sustainable Society in Korea



Targets for Renewable Energy

(National Energy Roadmap, 2008)



x 5.1

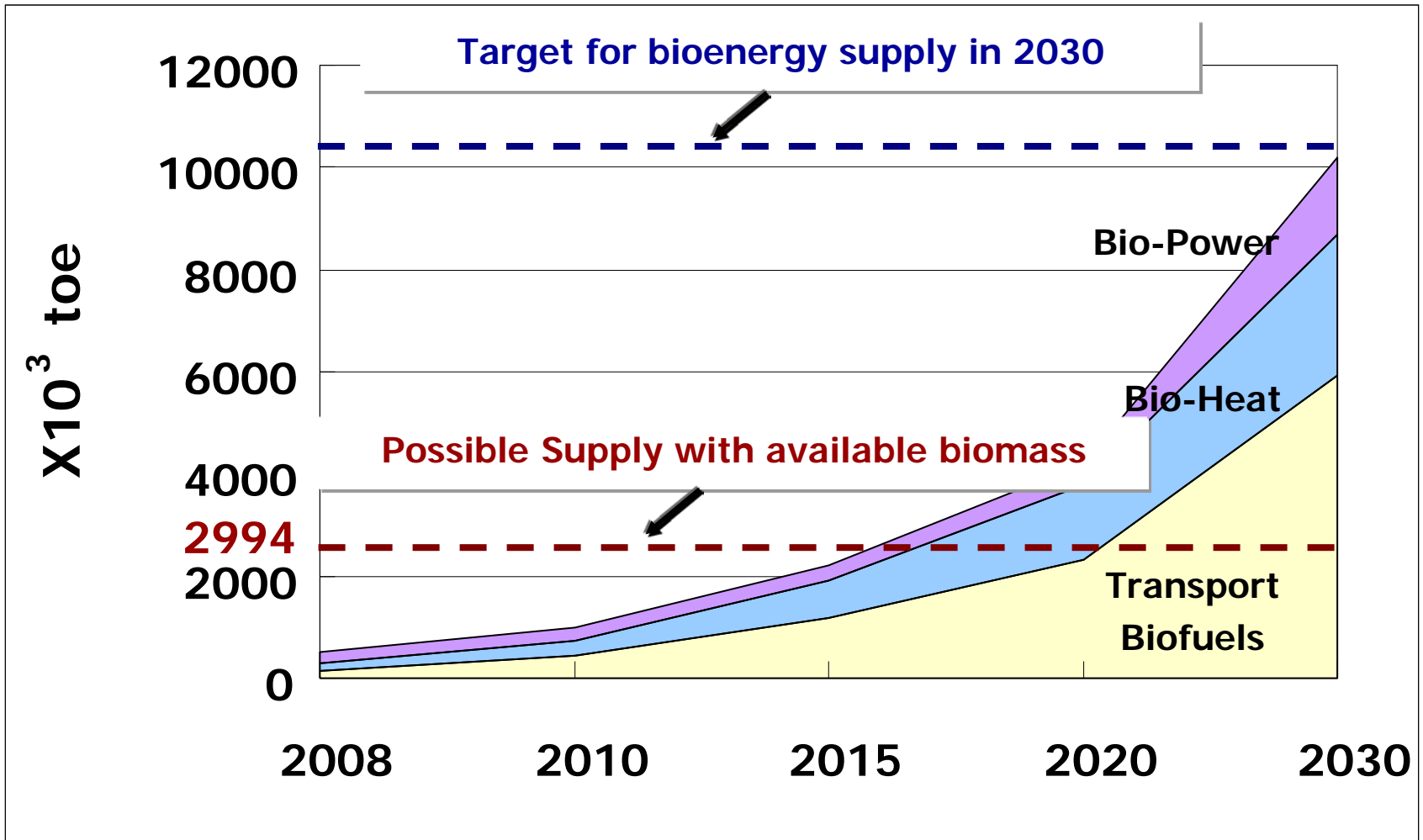
Renewable energy : 6.24×10^6 TOE -----→ 31.63×10^6 TOE

x 14.8

Bioenergy : 0.68×10^6 TOE -----→ 10.16×10^6 TOE

Targets for Bioenergy

(National Energy Roadmap, 2008)

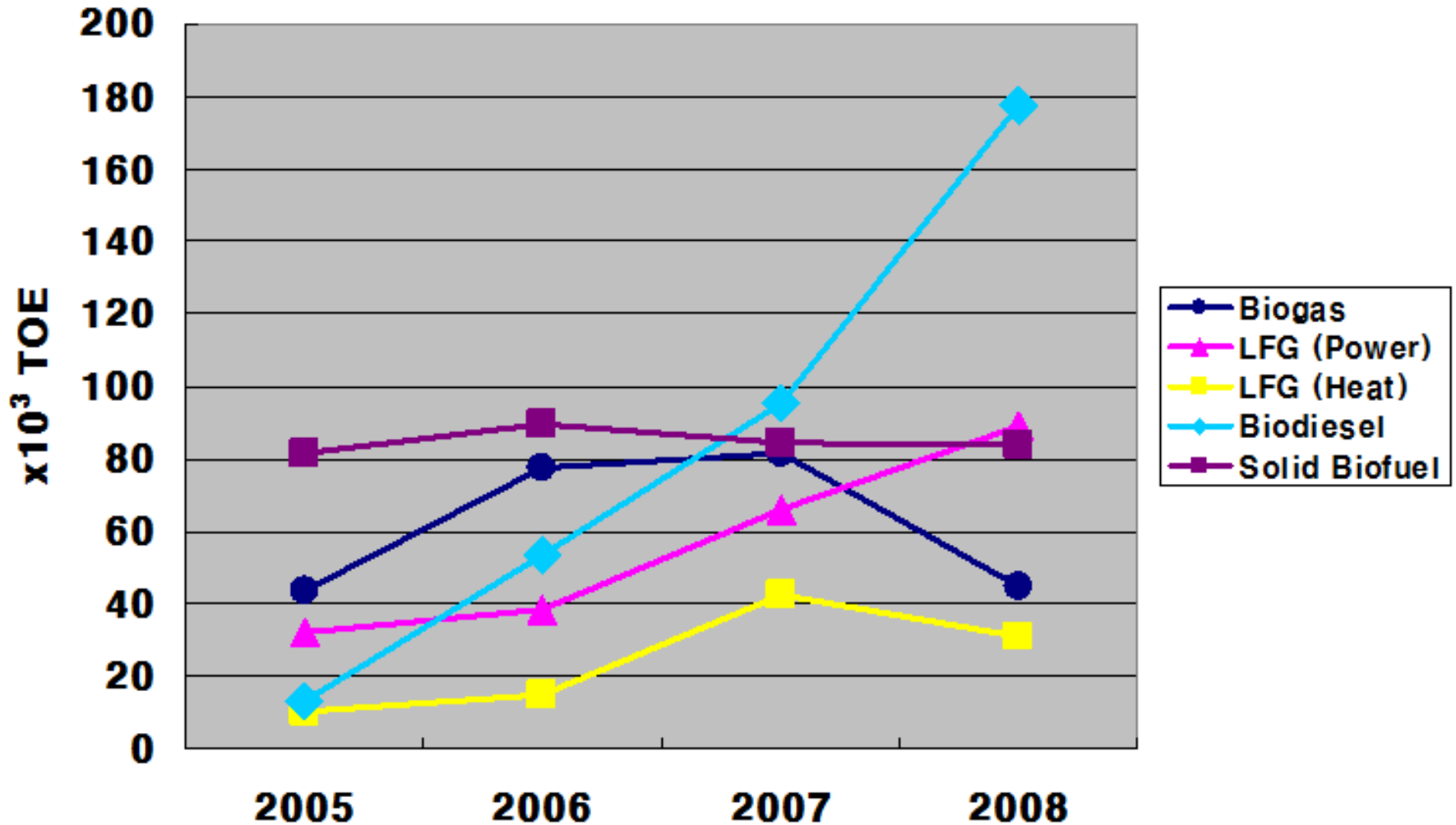


Priority for Bioenergy in Korea

- Utilization of Organic Wastes (**Biogas, Waste fats**)
- **Transport Biofuels**
- Unutilized Resources (Agricultural and Forest Residues)

Current Status of Bioenergy Supply

(KEMCO, 2009)



Challenges for Bioenergy Supply

- **High cost** of bioenergy
- **Limited biomass resources** in Korea
- **Low stakeholder-group acceptance** of transport biofuels

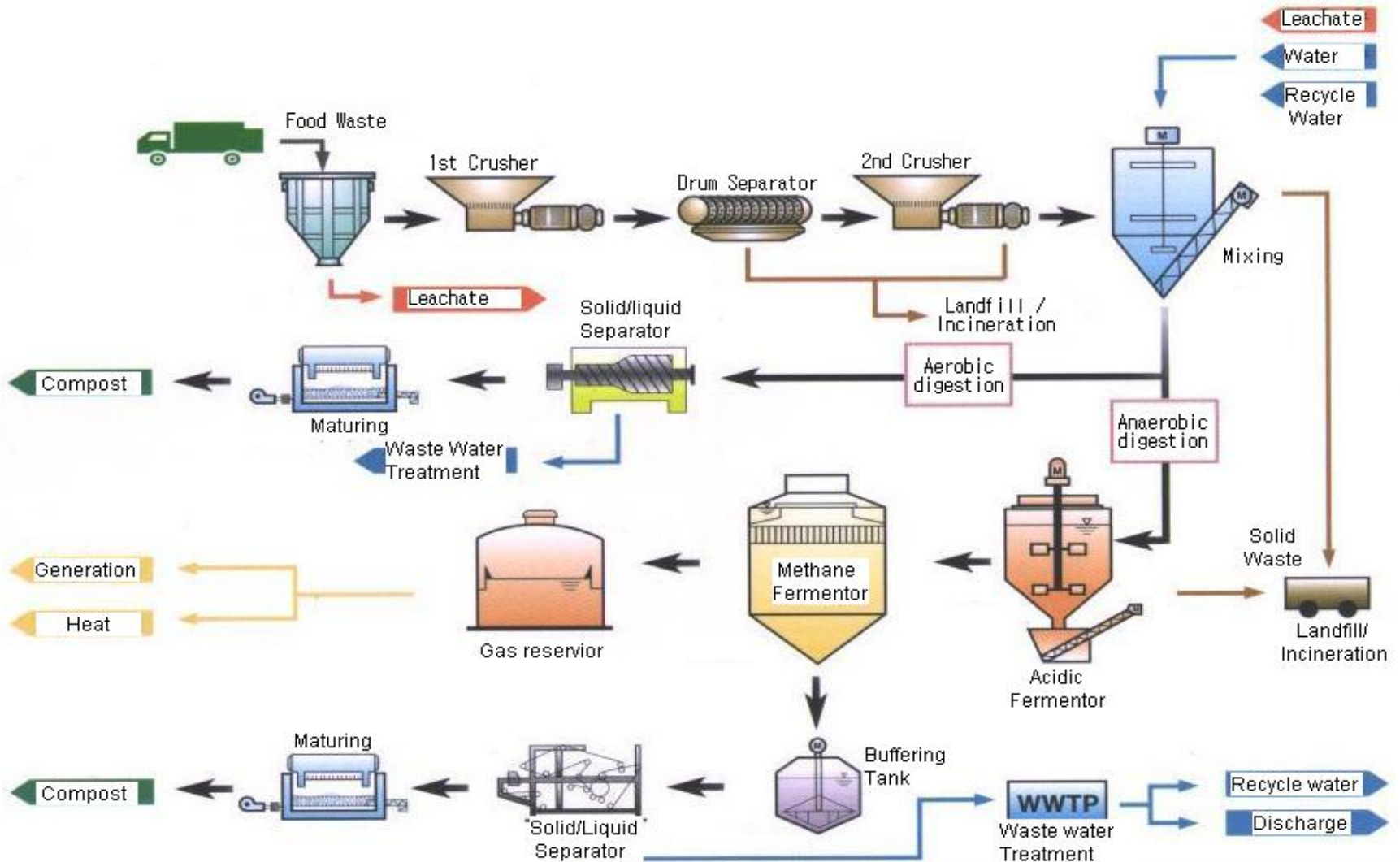
Feed-in tariffs for Biopower

	Maximum Capacity	Capacity	Compensation rates, \$/kWh		Remarks
			Minimum Baseline Compensation	Feed-in Tariffs	
LFG	≤ 50MW	20MW ≤	0.052	SMP+0.004	Fossil fuel lower than 30%
		≤ 20MW	0.058	SMP+0.008	
Biogas		150kW ≤	0.056	SMP+ 0.008	
		≤ 150kW	0.066	SMP+0.011	
Biopower		Wood	0.053	SMP+0.004	

Biogas from Food Wastes

- **Korean food waste takes about 30% of total organic wastes (6.6million ton/year). The water content of food waste is about 90%. Because of the characteristics, it is difficult to treat the waste by conventional technologies like land filling or incineration.**
- **KIER developed a two-phase anaerobic digestion process in which acidic fermentation and methane formation were done in separate reactors. The technology was found to be quite effective for the treatment of Korean food waste.**
- **After a series of test runs, the technology was commercialized. Two full scale commercial plants have been constructed to treat food waste and produce methane. The research for the electricity generation using methane was finished in 2008.**

Two-phase Anaerobic Digestion



Paju Biogas Plant (110 tons/day)



- 1996 : 30 (tons/day) food waste
- 2004 : 50/60 (tons/day) **food waste/**
manure

- 4,800 m³/day
- 600kW E.G.

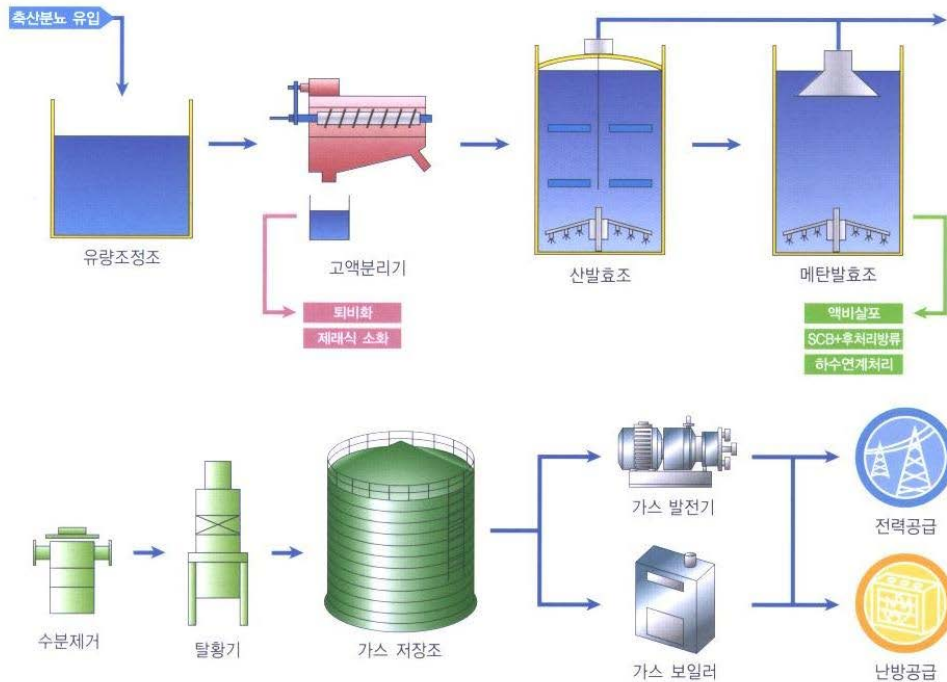


LFG Power Generation in Busan



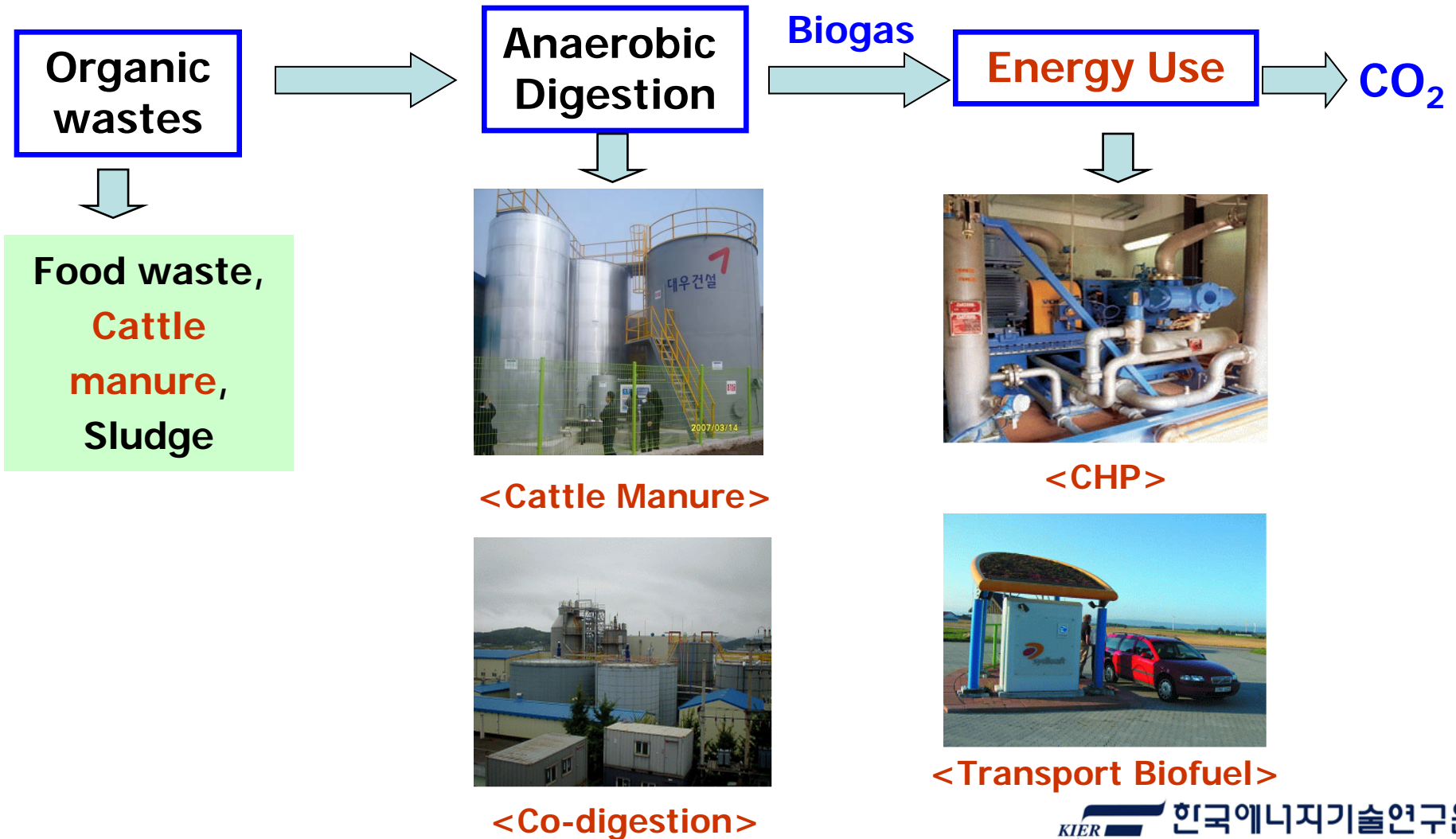
- Busan Sangkog Landfill
- Capacity : 6MW

Biogas from Waste Manure (Demo)



- Location : Mojun, Kyunggido, Korea
- Swine manure : 20 tons/day
- Process : 2 stage UASB treatment after solid removal
- Biogas : 250m³/day max. (30kW micro-gas engine)
- Fund : \$1 mil.

Transport Biofuels from Waste



Organic wastes

Food waste,
Cattle manure,
Sludge

Anaerobic Digestion



<Cattle Manure>



<Co-digestion>

Biogas

Energy Use

CO₂



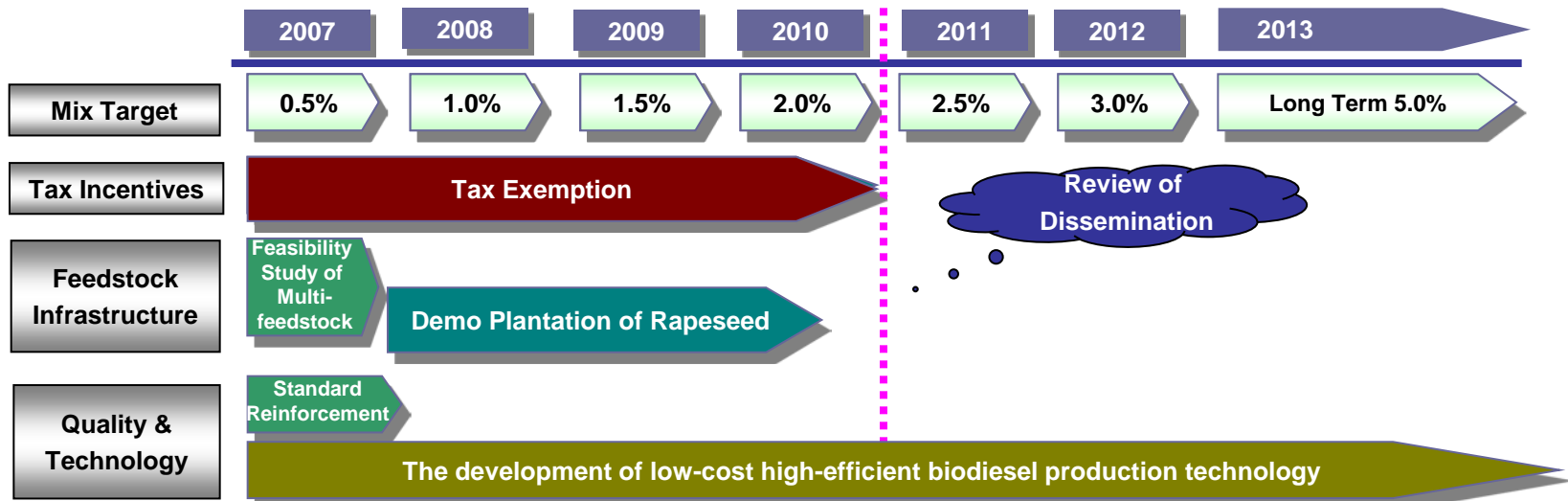
<CHP>



<Transport Biofuel>

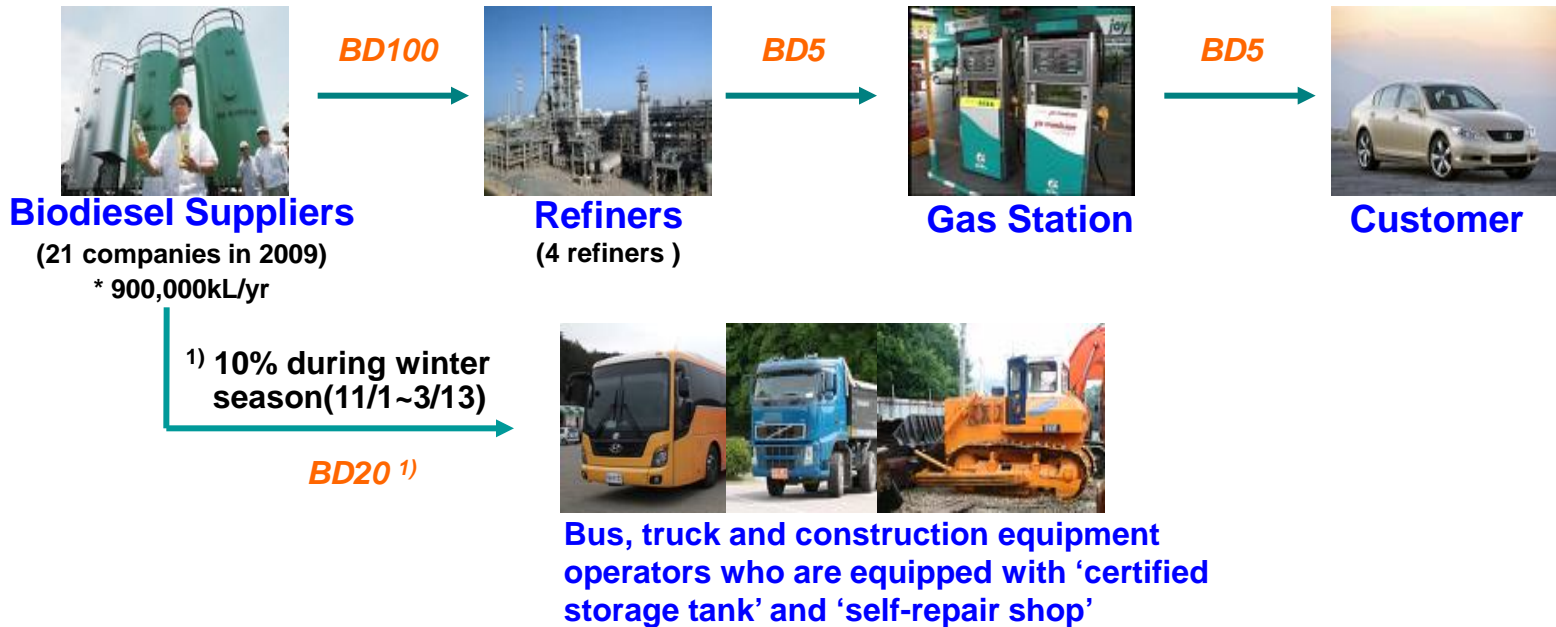
Tax Exemption on Biodiesel

- Began in 2002 as demonstration project.
- Biodiesel is used 1.5% in 2009, and 3.0% in 2012 of total diesel consumption.
 - 0.5% increases in each year
- BD5 is commercialized in Korea in 2006, marked as the first country in Asia.
- BD20 is limited on the vehicles enabling to repair in their own facilities due to the technological problems.



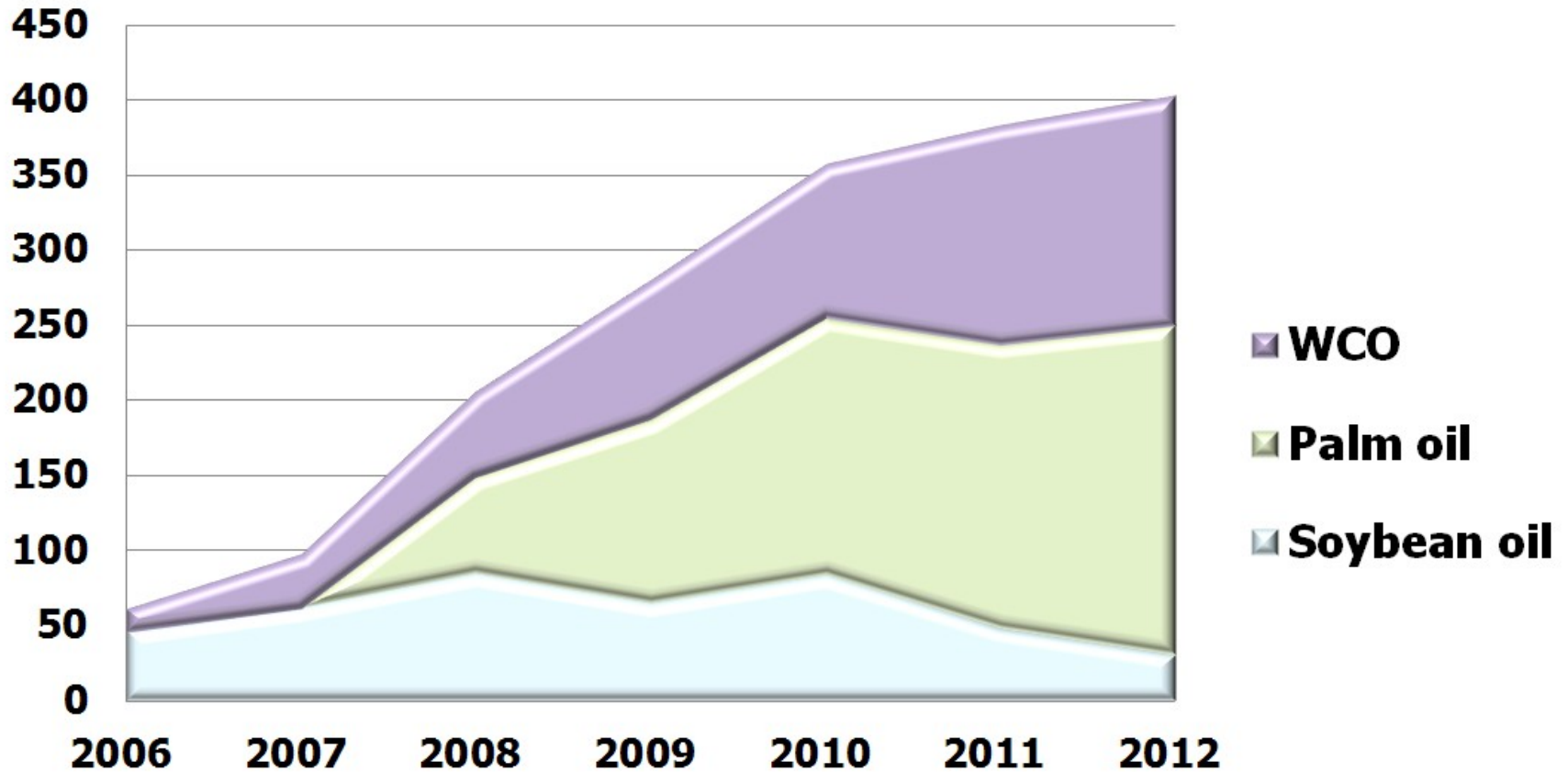
Biodiesel Distribution in Korea

- **BD5** is subject to diesel fuel specification, and supplied only by refiners.
- Bus and truck company can use **BD20** with their own accord.



Feedstocks for Biodiesel in Korea

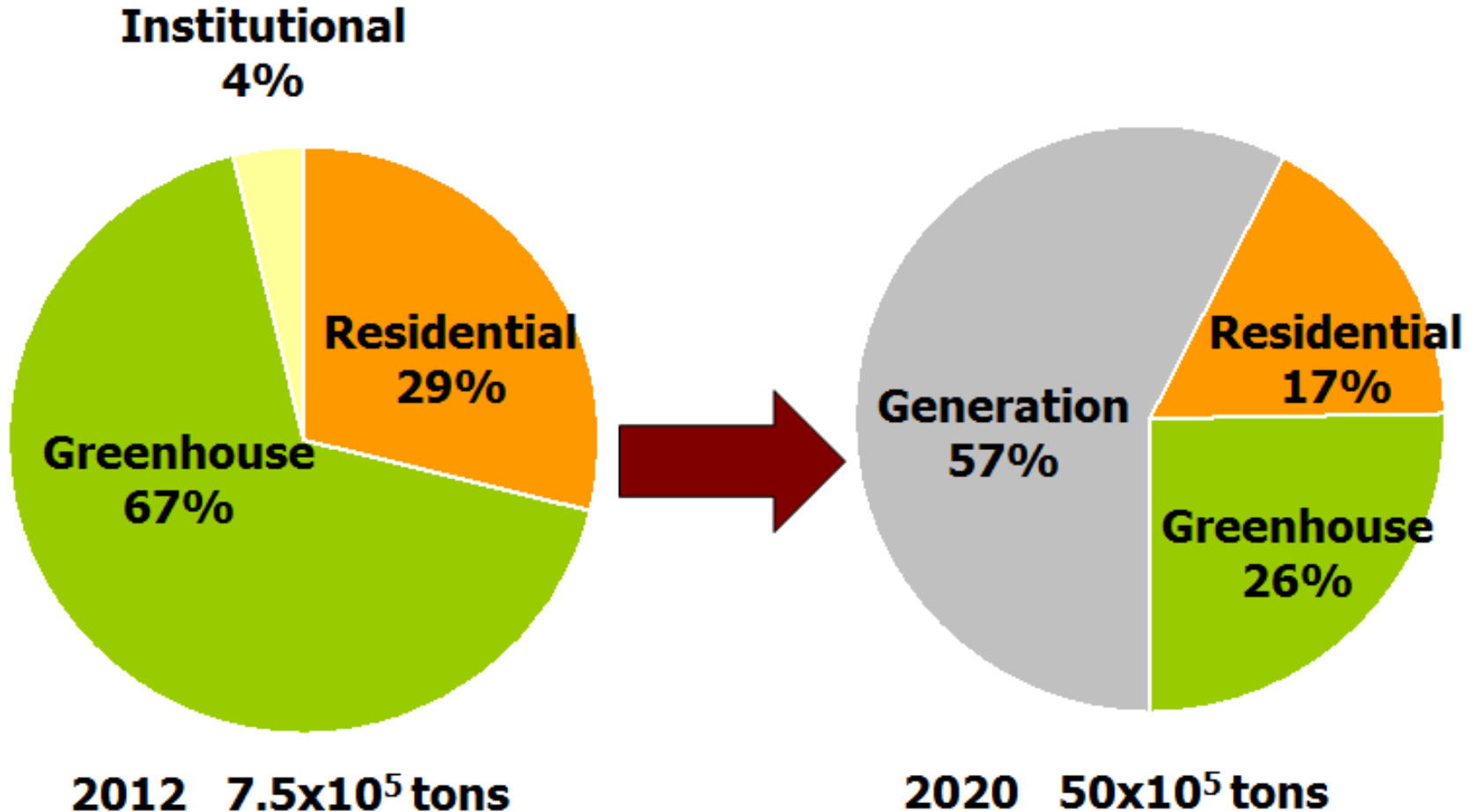
(Korea Bioenergy Association, 2013)



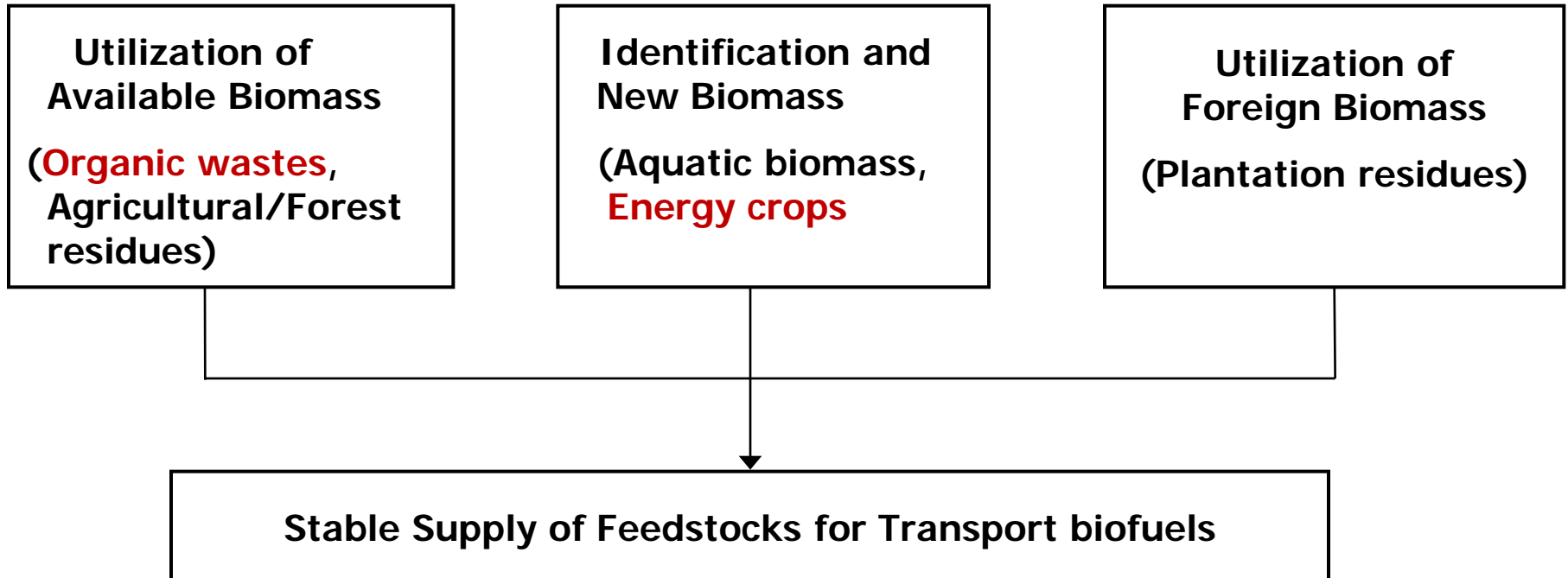
Solid Biomass Utilization in Korea



Demand for wood pellets in Korea

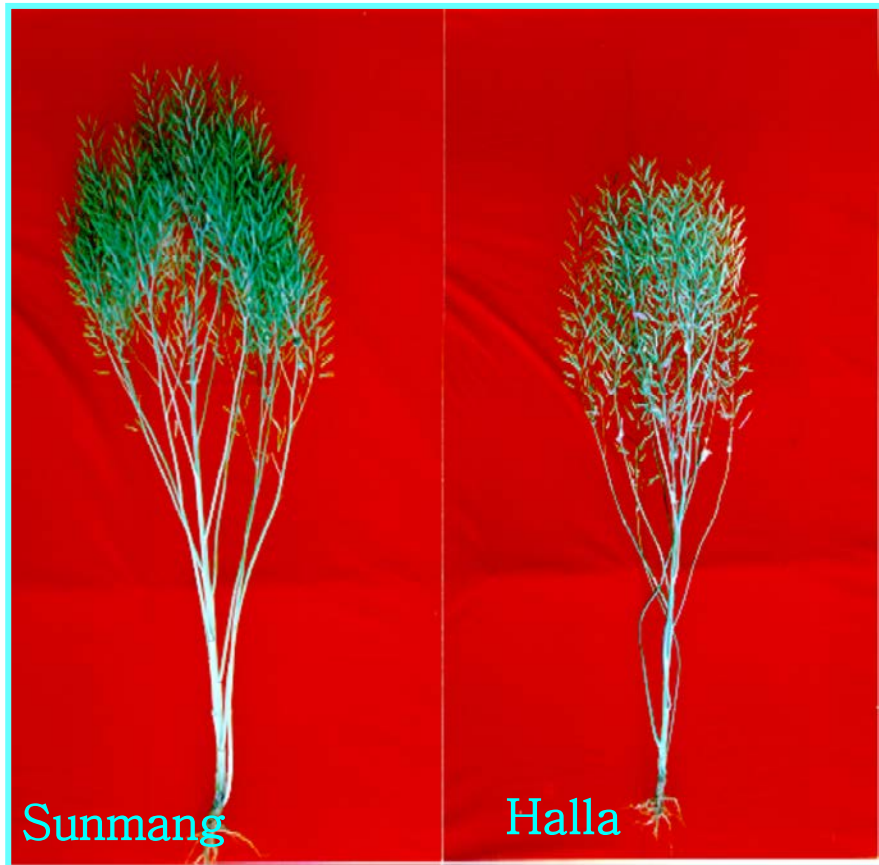


Strategy for Securing Stable Supply of Feedstocks



Demonstration Cultivation of Rapessed

(RDA Bioenergy Center, 2008)



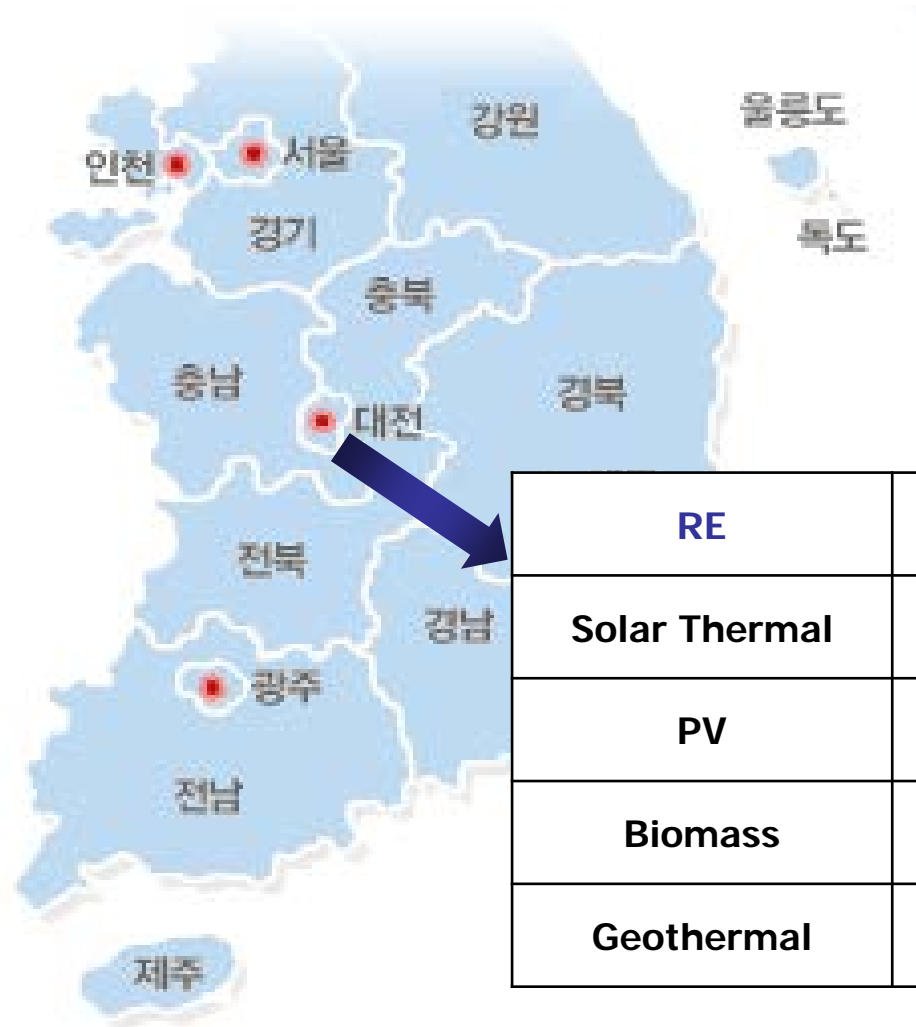
III. Other Issues

Issues for RE Implementation

- **Map of RE sources**
- **Financial deficit**

Map of Renewable Energy Resources

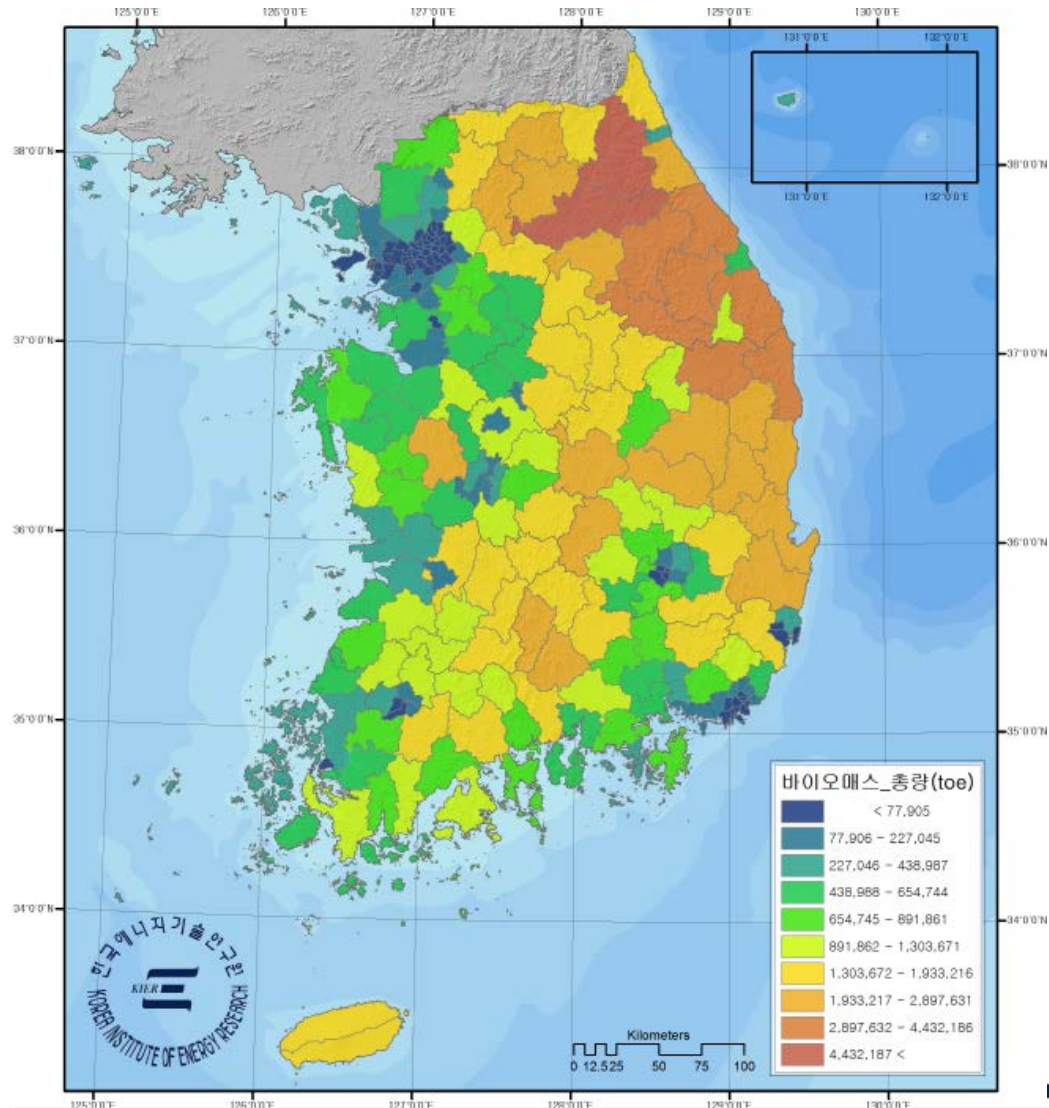
(New & Renewable Energy Data Center, <http://www.kredc.net/>)



RE	Potential, x 10 ⁶
Solar Thermal	22,054 Gcal/yr
PV	2560 GW/yr
Biomass	12.6 Gcal/yr
Geothermal	11.4 kTOE

Map of Biomass Resources

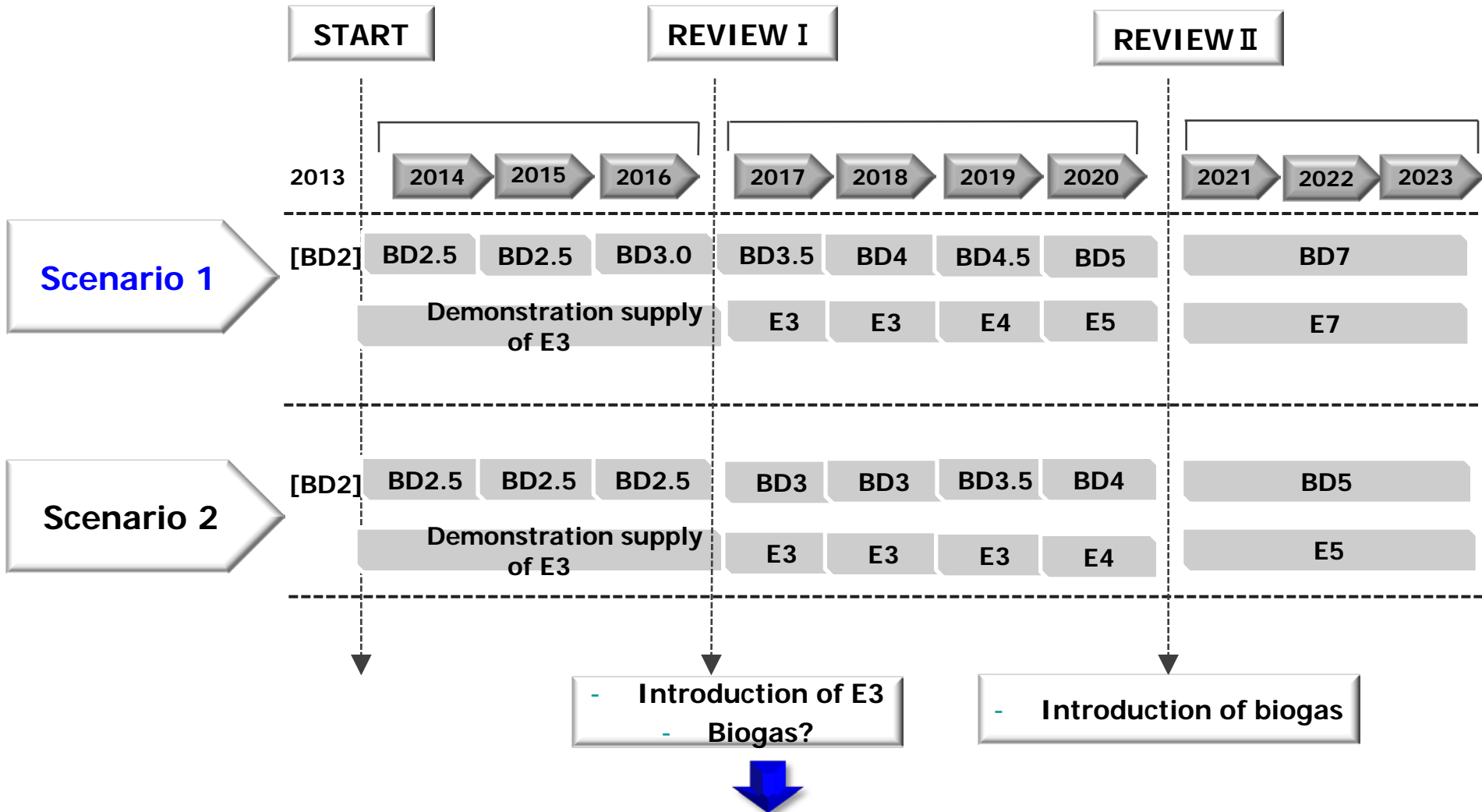
(New & Renewable Energy Data Center, <http://www.kredc.net/>)



RPS

- **Effective in Korea from 2012**
- **Accelerates the implementation of renewable energy**
- **Impose quota for each renewable energy**
- **Total installed capacity – 1,914 MW**

RFS in Korea



Scenario 1 is effective from September, 2015!

IV. Summary

- Korean supporting policy for renewable energy implementation is changed from "Subsidy" to "Mandatory" (RPS (2012), RFS (2015) and RHO (2016))
- Bioenergy will play a key role for realizing the sustainable society in Korea
- Securing stable supply of the feedstocks will be the most challenging issue
- Organic wastes and energy crops may be the promising candidates as the feedstocks for bioenergy production

Thank you for your kind attention!

For questions, bmjslee@kier.re.kr!