# Status and Perspective of Transport Biofuels in Korea

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# Agenda

I. Introduction

II. Current status of transport biofuels in Korea

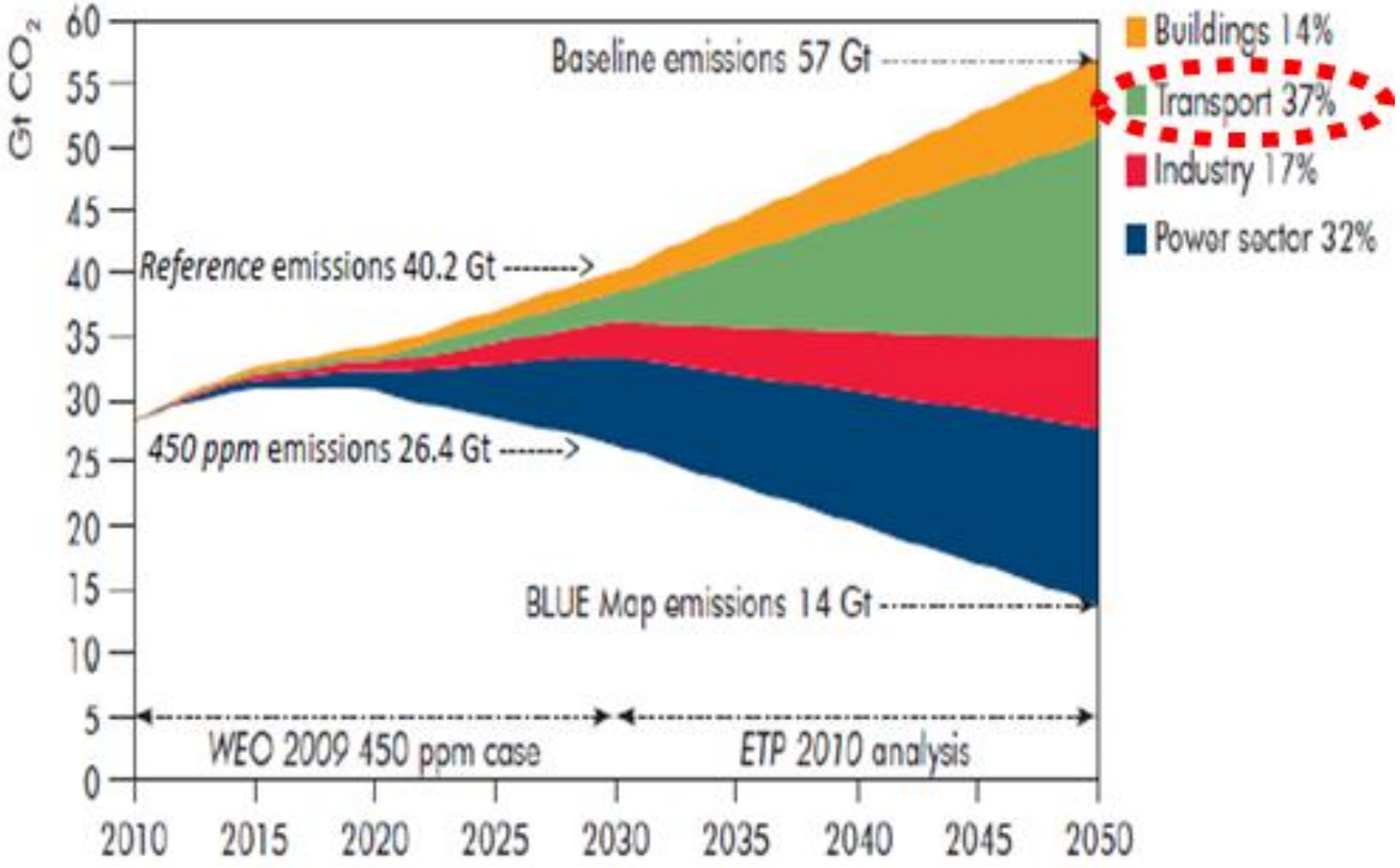
III. Research initiatives

IV. Summary

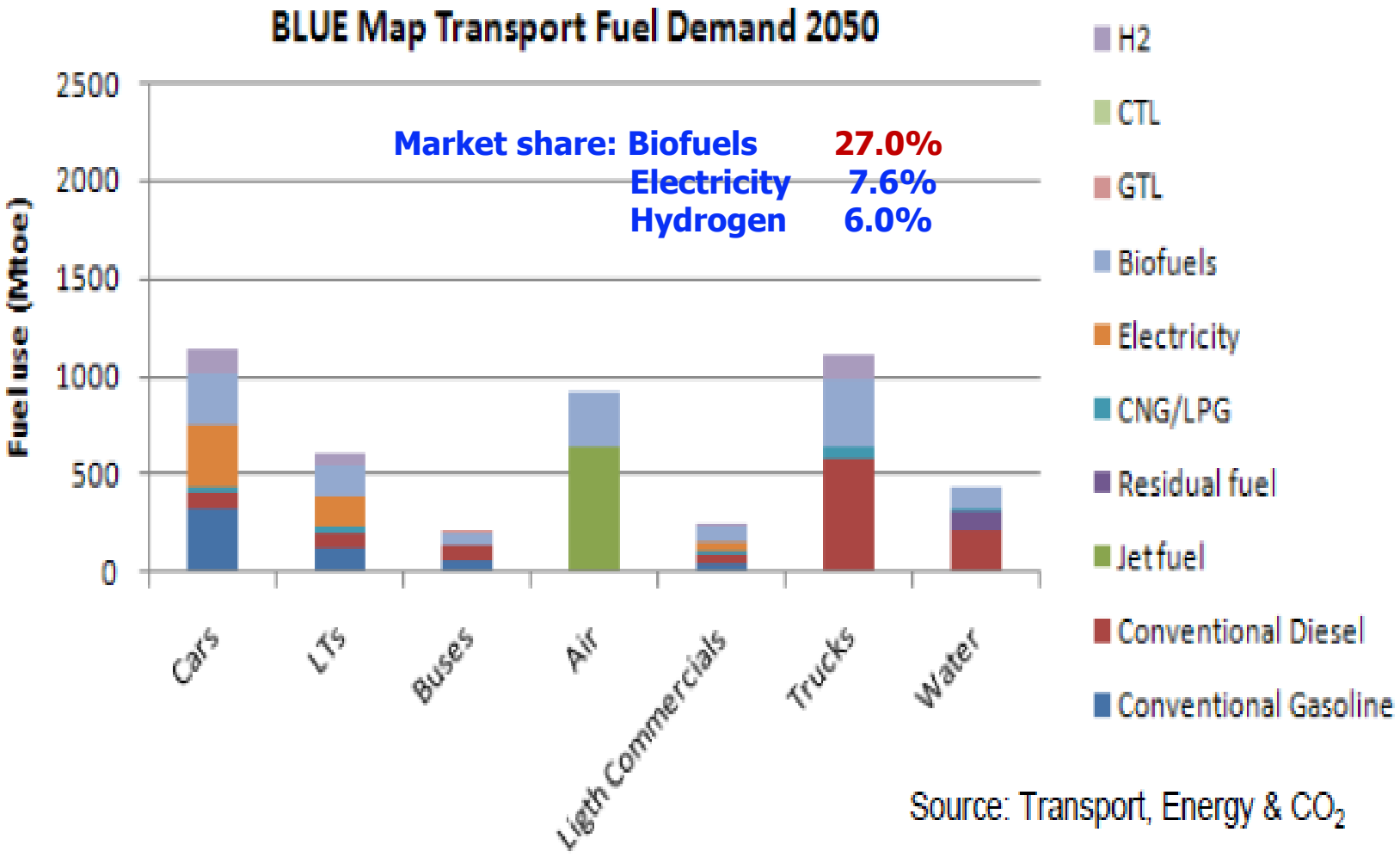
# I. Introduction

# Global $CO_2$ Mitigation Scenario

## (IEA, 2010)

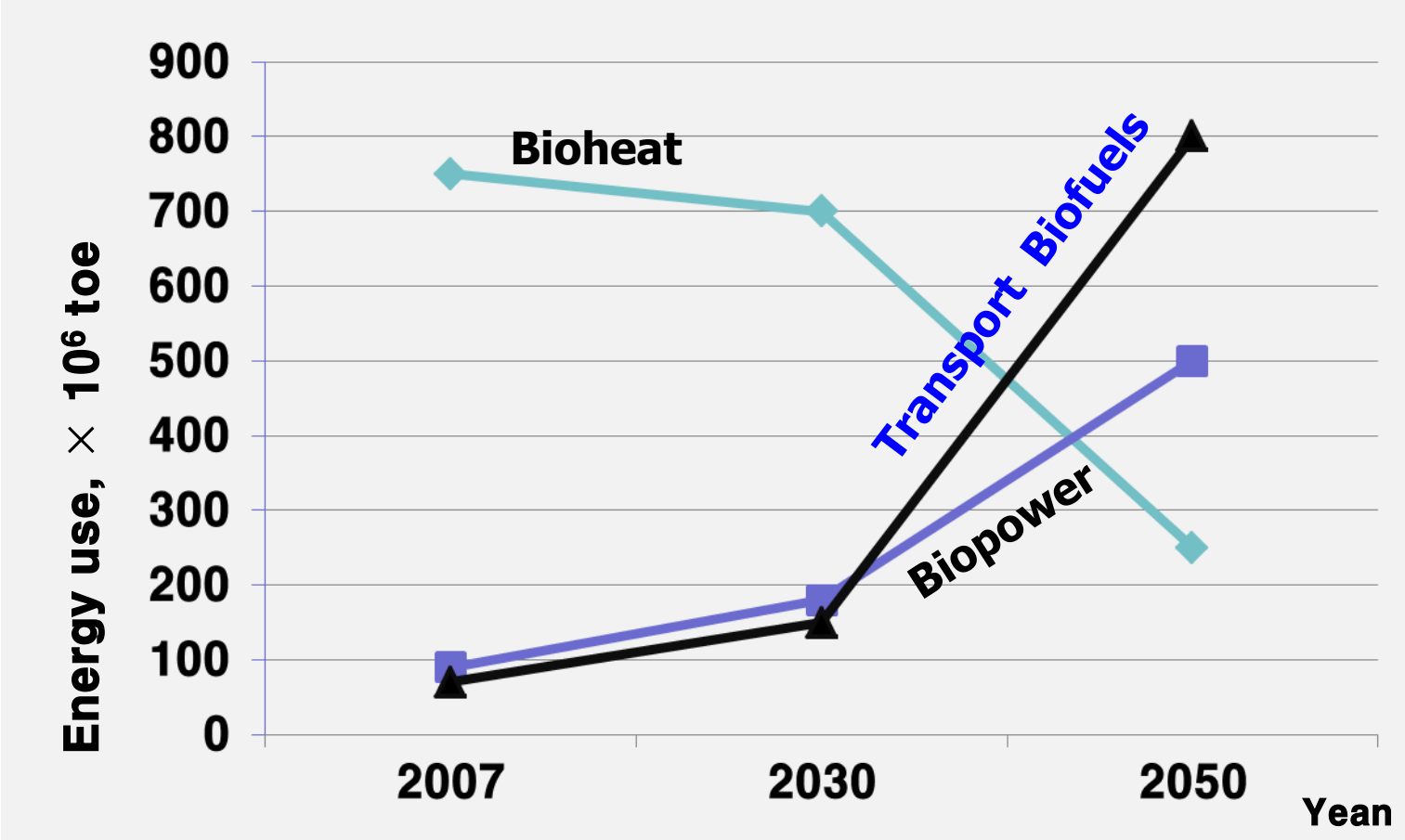


# Blue Map Transport Fuel Demand
## (IEA, 2010)




Source: Transport, Energy & $CO_2$

# Bioenergy Use Scenario
## (IEA, 2010)



# II. Current Status of Transport Biofuels in Korea

# Green Energy Vision in Korea

- **$CO_2$ reduction target**

  **By 2020, 30% $CO_2$ reduction based on BAU scenario**

- **Implementation of Renewable Energy**

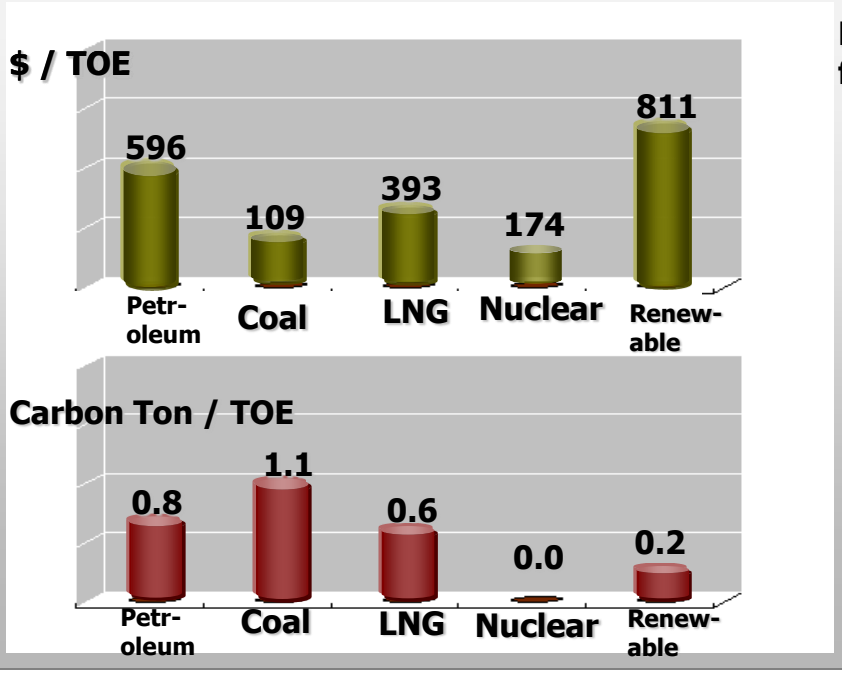
  **By 2030, 11% of primary energy consumption will be supplied by renewable energy**

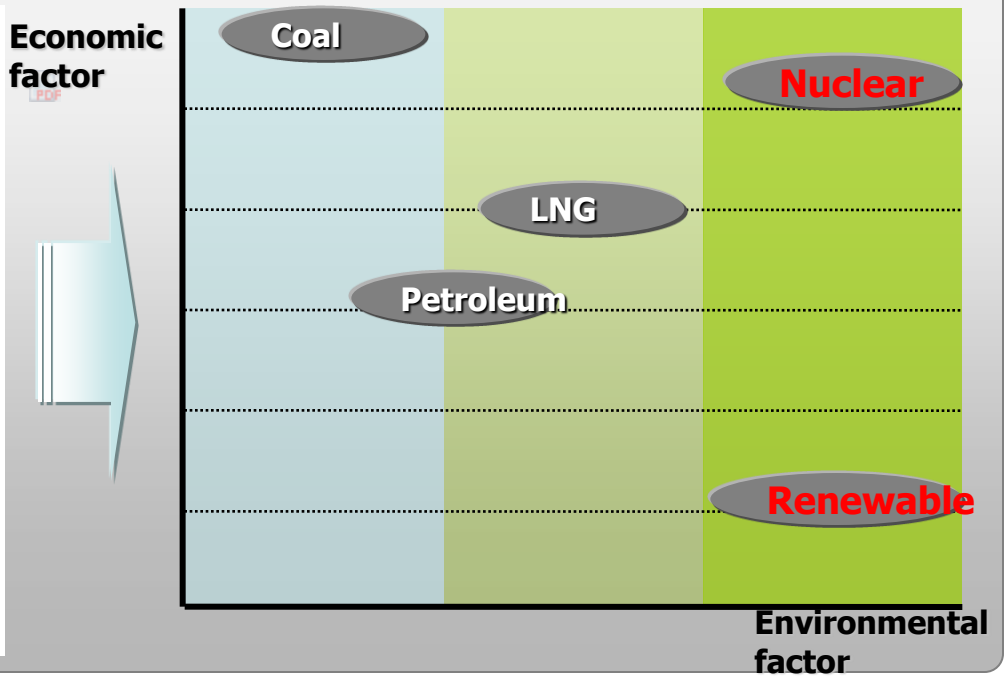
**Bioenergy will play the key role for realizing the Green Energy Vision in Korea**

# Optimum Energy Mix

## Consideration factors: Economy and Environment

### Economic & Environmental



# Fuels Consumption in Korea

- **General aspects on the fuels for the transport in Korea**

  **- Gasoline consumption**
  **$1.0 \times 10^7$ ton/year**

  **- Diesel consumption**
  **$2.0 \times 10^7$ ton/year**

  **All crude oils are imported !**

# Distribution Infra of Biodiesel

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

**Biodiesel Suppliers**
(21 companies in 2009)
* 900,000kL/yr

*BD100*

**Refiners**
(4 refiners )

*BD5*

**Gas Station**

*BD5*

**Customer**

[1] 10% during winter season(11/1~3/13)

*BD20* [1]

**Bus, truck and construction equipment operators who are equipped with 'certified storage tank' and 'self-repair shop'**

# Action Plan for Biodiesel

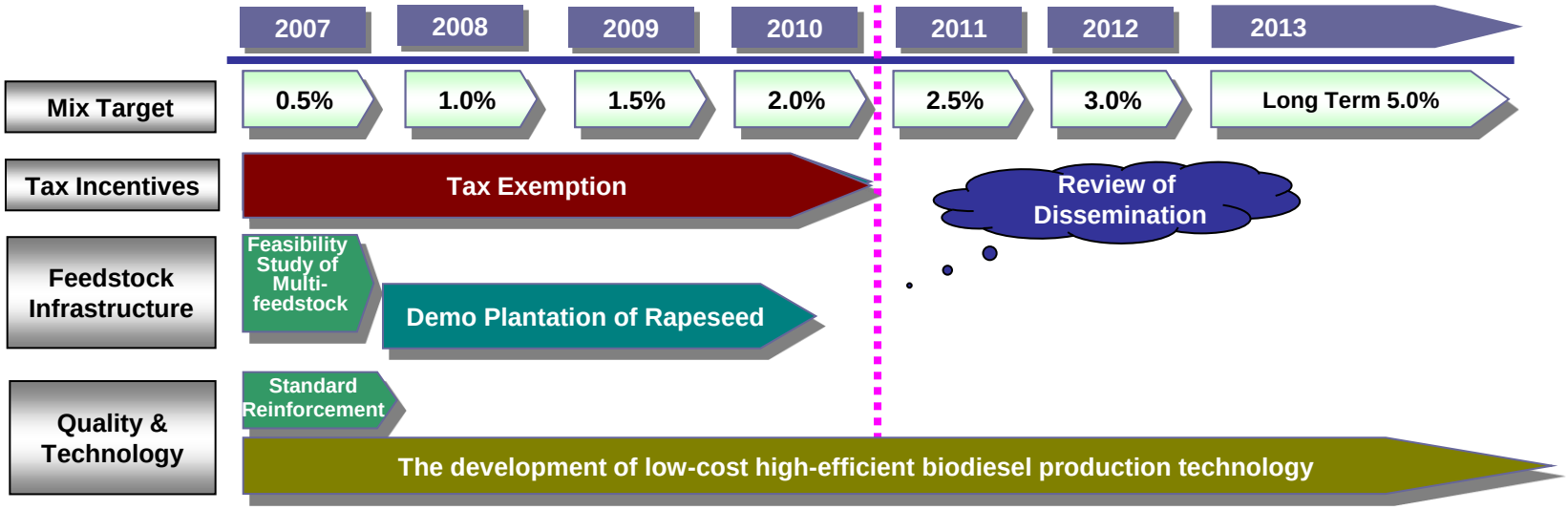
## (MKE, 2007)

X $10^3$ toe

| | 2004 | 2006 | 2008 | 2010 | 2012 |
|---|---|---|---|---|---|
| Biodiesel, ton | 15 | 50 | 200 | 400 | 600 |
| Biodiesel Blending, % | - | 0.5 | 1.0 | 2.0 | 3.0 |

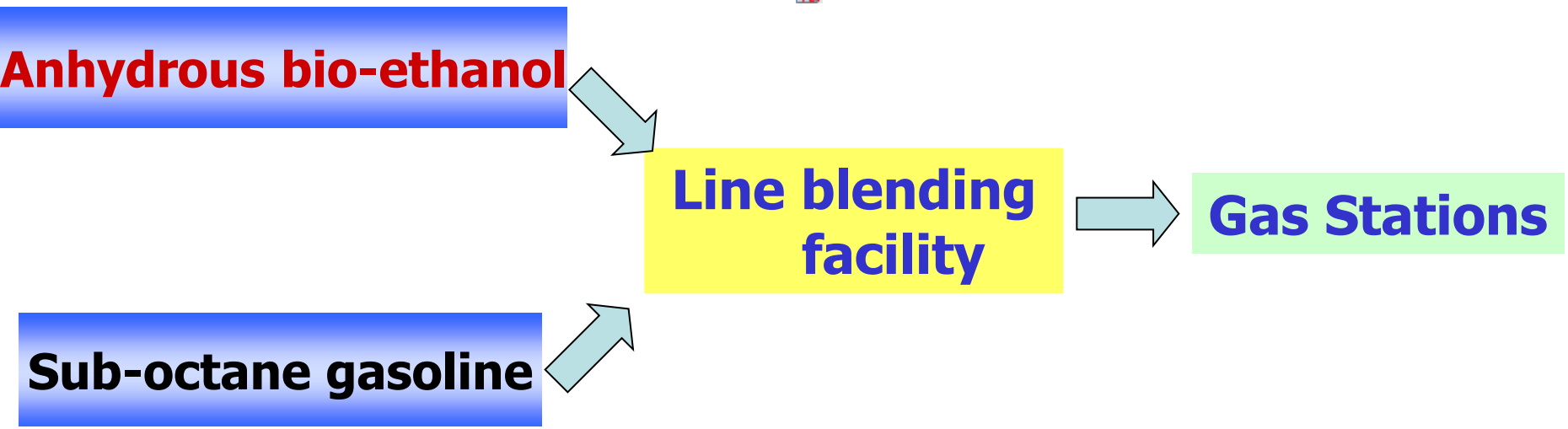
# Policy on Biodiesel

- 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.



# Demonstration Supply of Gasohol in Korea

**Project Period: August 2006 – July 2008**



# Demonstration Supply of Gasohols (E3, E5)


SK incheon oil

**Blending bio-ethanol fuel**

CHANGHAE ETHANOL

**Manufacturer of Anhydrous Ethanol**

**E5 Supplier of Gyeonggi**
(용인 남동 행복주유소)

SK energy

**E5 Supplier of Chungcheong**
(청주 흥덕 신봉주유소)

Hyundai Oilbank

**E3 Supplier of Yeongnam**
(울산 울주 온산주유소)

S-OIL 에쓰-오일

GS Caltex

**E3 Supplier of Honam**
(광주 광산 흑석주유소)

**Consumption of a gas station : 7,000L/month**
**Actual Consumer : City hall, provincial offices, and schools, etc**

# Transport Biofuels from Waste

**Organic wastes** → **Anaerobic Digestion** → **Biogas** → **Energy Use** → $CO_2$

**Food waste, Cattle manure, Sludge**


<Cattle Manure>

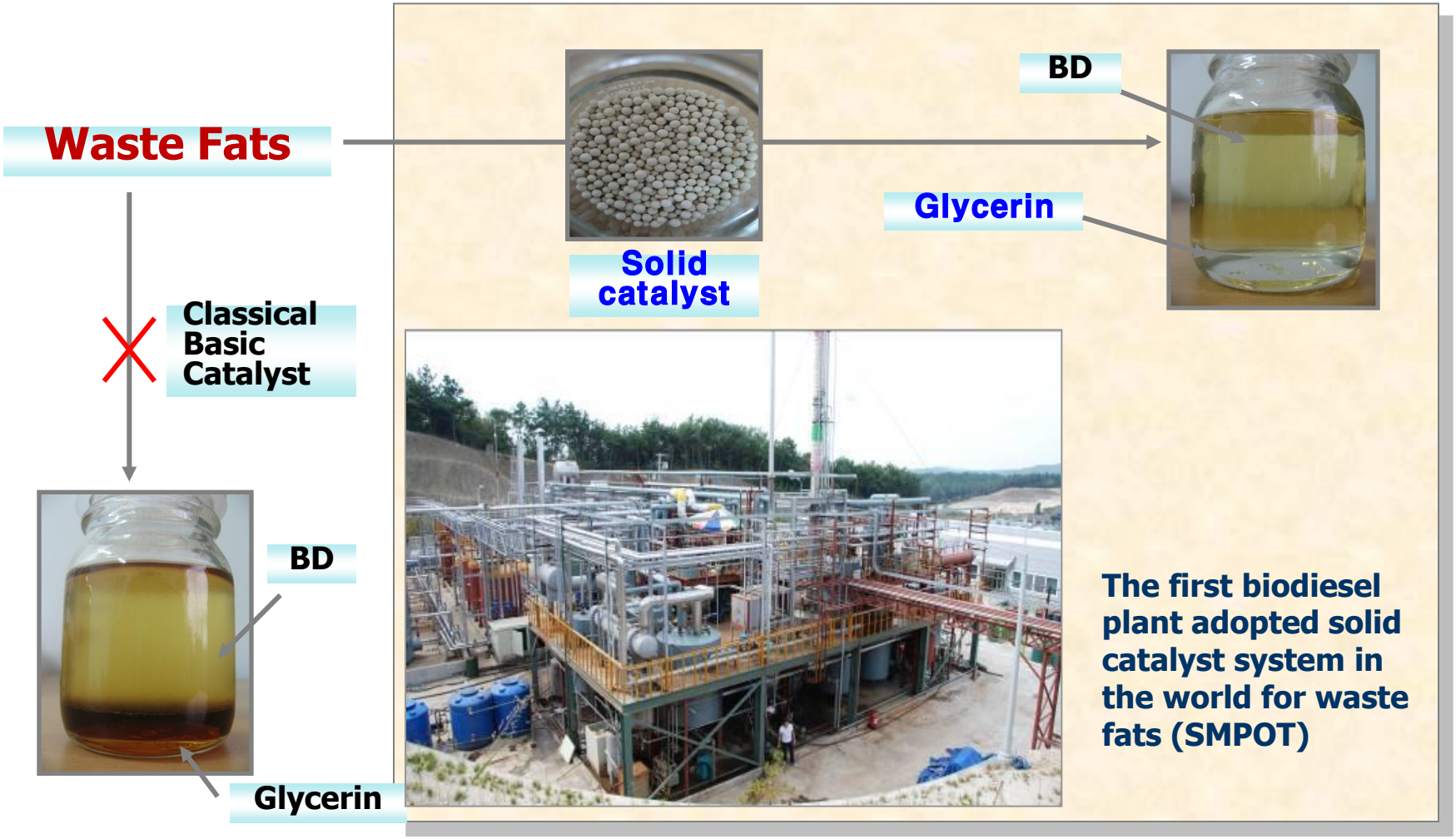
<CHP>

<Co-digestion>

<Transport Biofuel>

# Demonstration Biodiesel plant empoying **Solid** Catalyst

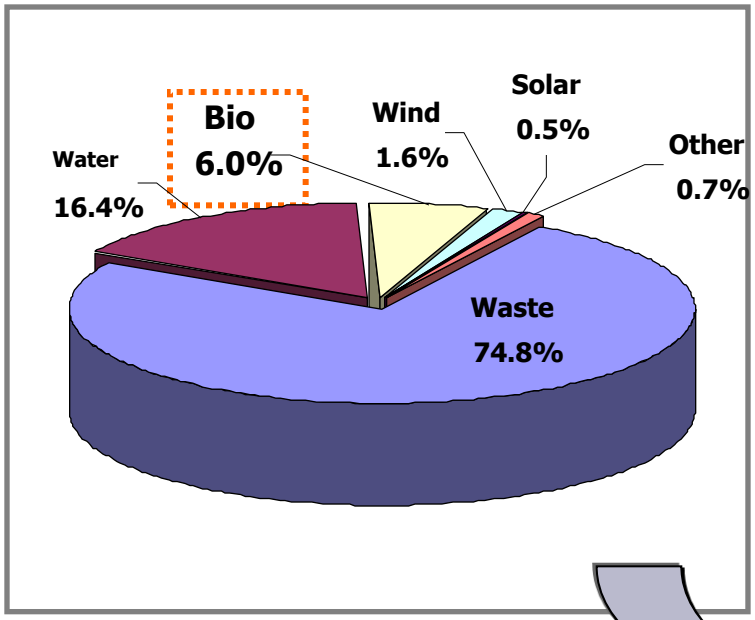
## (Courtesy of SM-POT Inc)



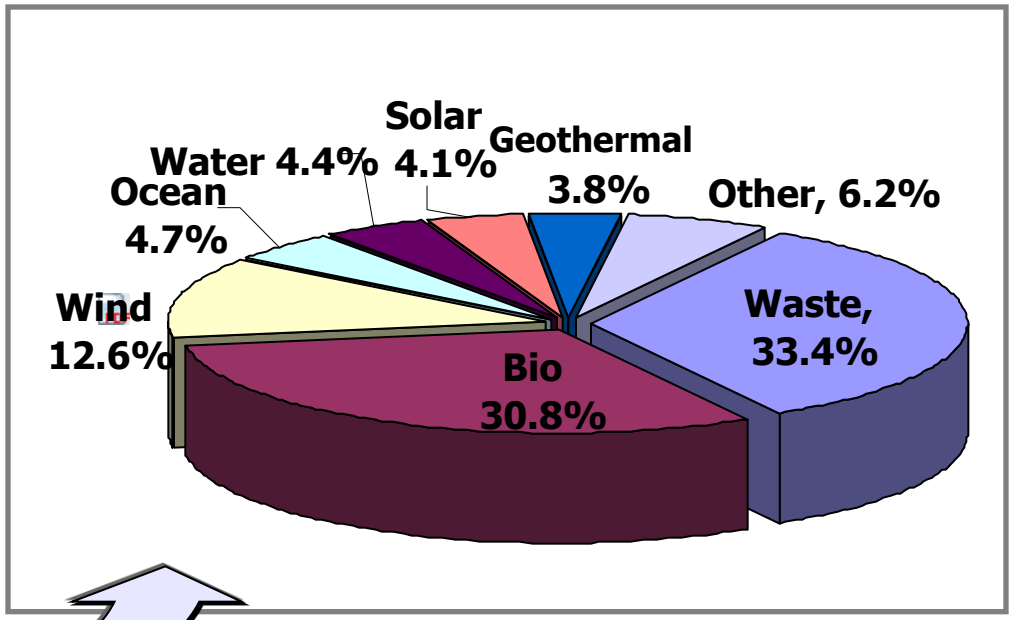
# Target for Bioenergy

## (National Energy Roadmap, 2008)

### In 2007




### In 2030




**RE : 5.61 x $10^6$ toe → RE : 33.3 x $10^6$ toe**

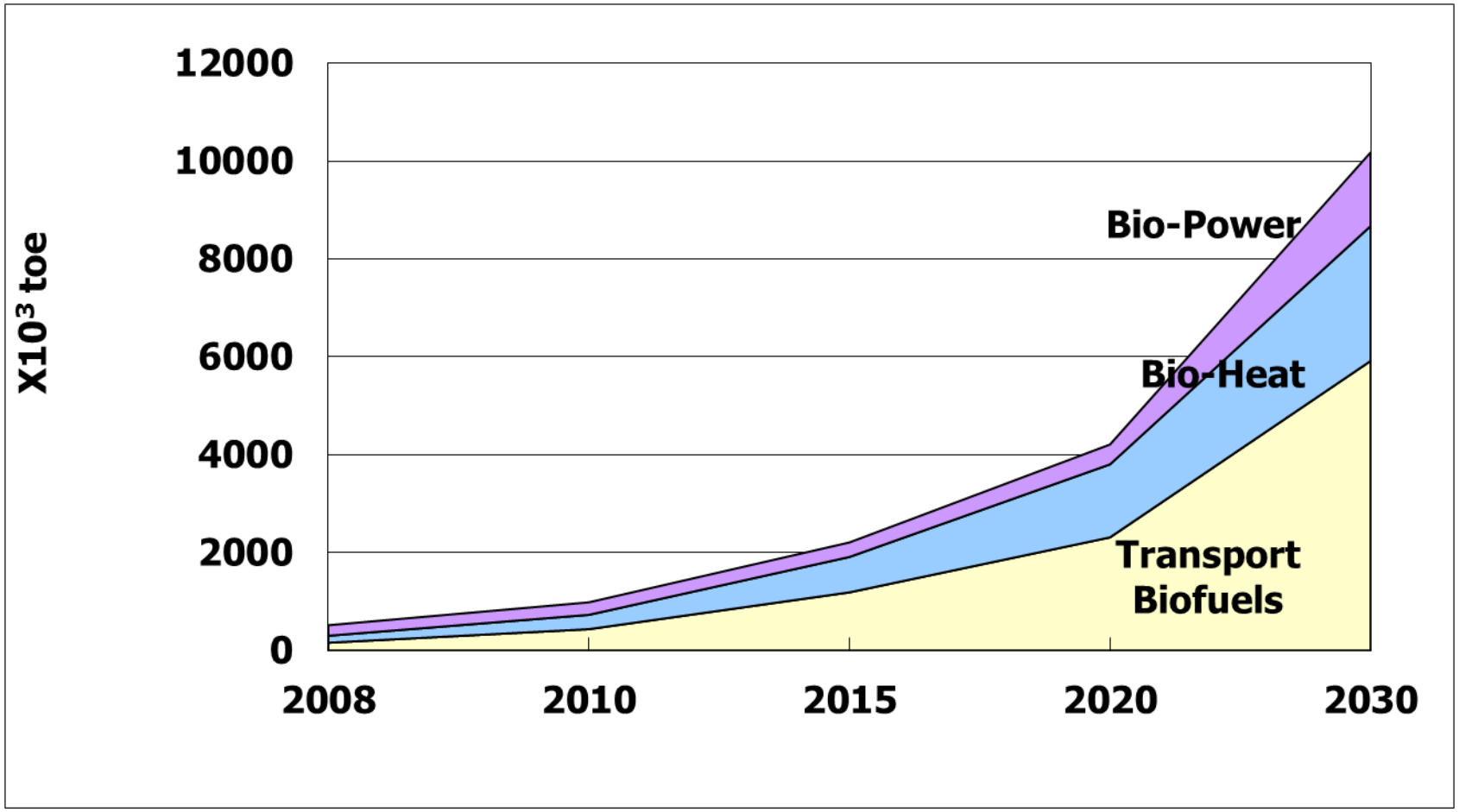
**X 5.9**

**BE : 0.34 x $10^6$ toe → BE : 10.18 x $10^6$ toe**

**X 29.9**

# Targets for Bioenergy

## (National Energy Roadmap, 2008)



# Challenging Issues

- **Supporting Policy**

  **Tax deficit due to biodiesel supply was 0.2 billion dollars in 2010, so considers the change of supporting policy from "Tax Exemption" to "Mandatory Use"**

- **Stable supply of feedstocks**

  **More than a half of total feedstocks needs to be supplied domestically**

# RFS Consiered

- **Due to high financial deficit, Korean government is now considering the introduction of mandatory use of biofuels in the transport sector (Renewable Fuel Standard, RFS)**

- **Now the Ministry of Knowledge and Economy (MKE) is preparing the draft of the policy. It will be enacted soon and be effective from 2013**

- **The mid- and long-term implementation targets of the transport biofuels may be achieved**

# III. Research Initiatives

# R&D on Biofuels Derived from Inedible Biomass

- **Biofuels from Lignocellulosics**

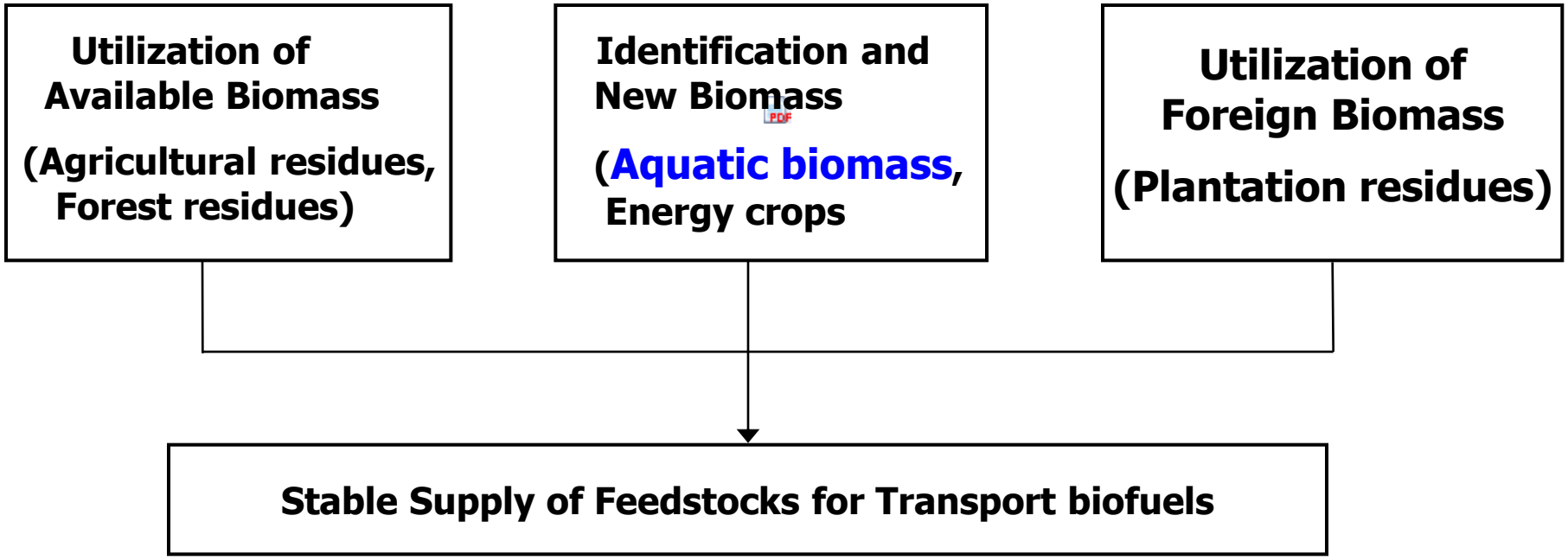
  **- Bio alcohols**

- **Biofuels from Aquatic Biomass**

  **- Macroalgae**

  **- Microalgae**

# Strategy for Securing Stable Supply of Feedstocks

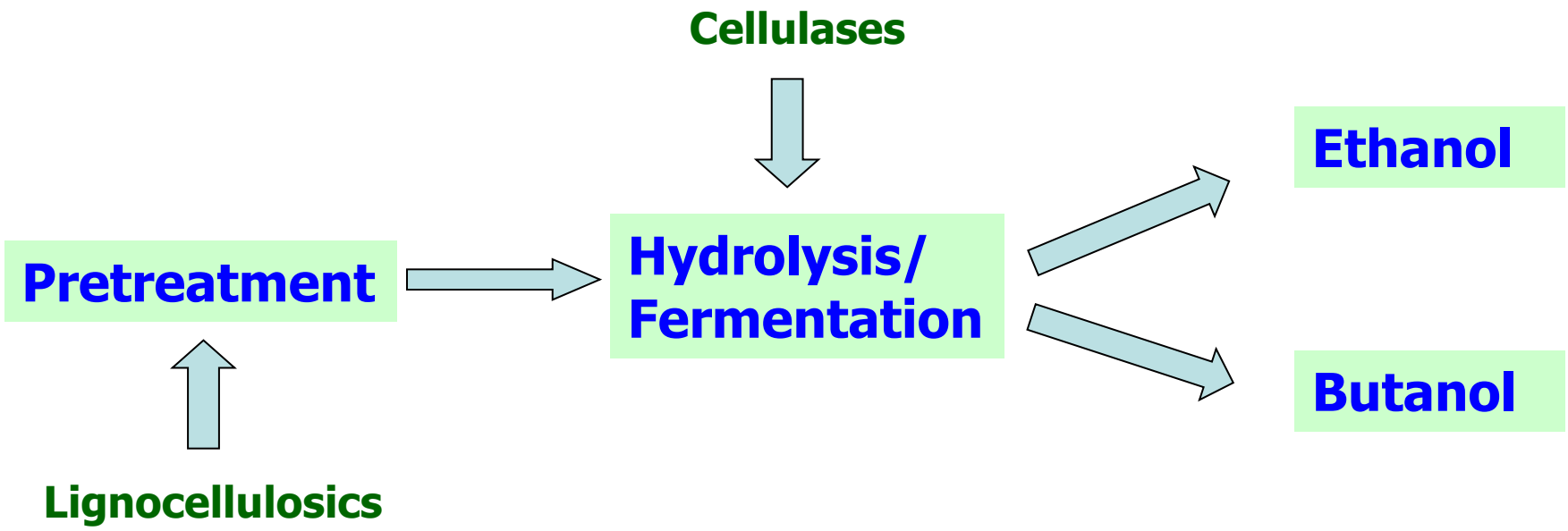


# Lignocellulosic Biomass

## New Energy Crops
(Courtesy by B.C. Koo)


## Palm Plantation residues
(Courtesy by Samsung C&T)

# Process Flow of Cellulosic Alcohols



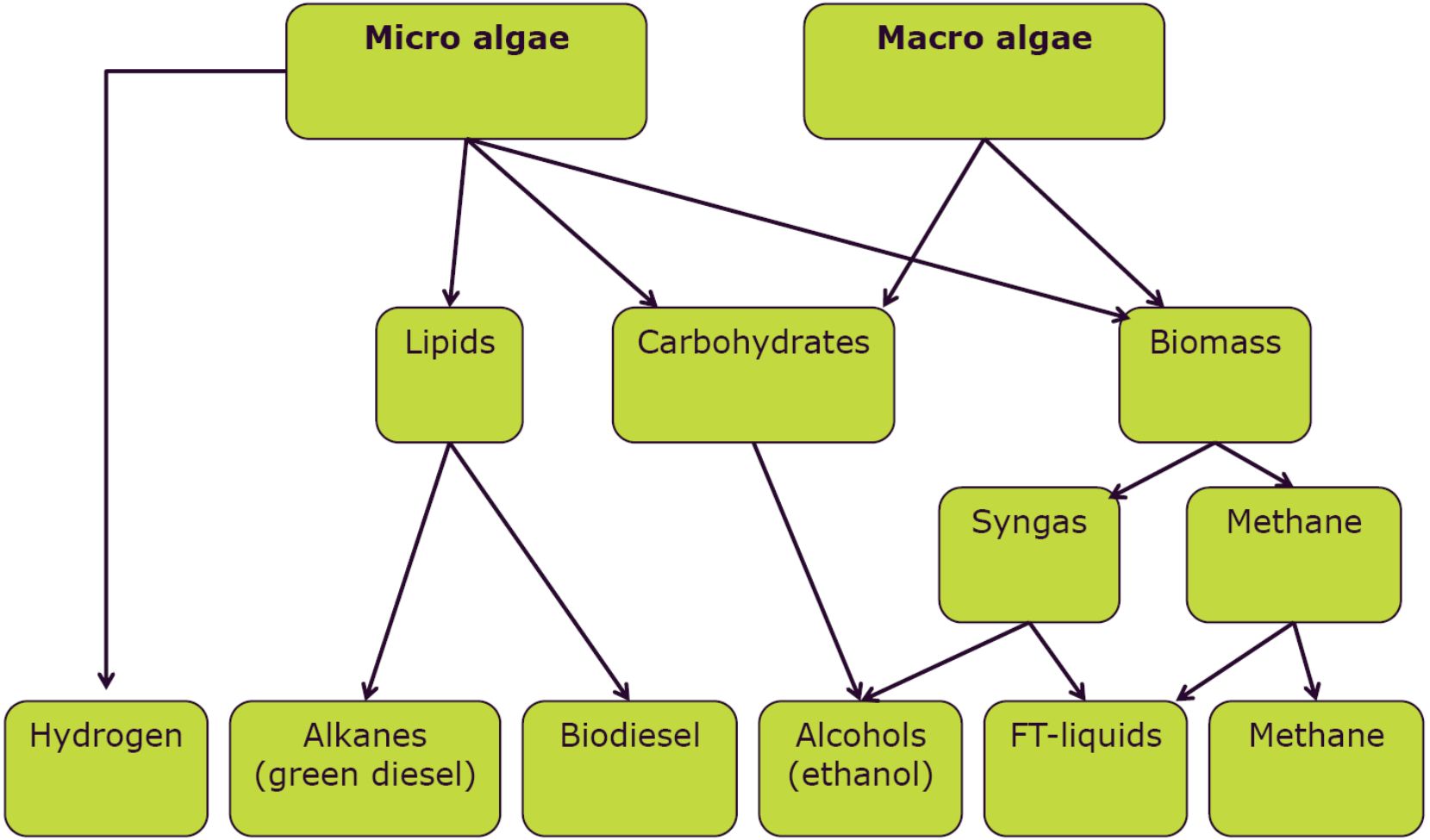
# F-T Fuel Synthesis

Compact heat-exchanger typed F-T reactor

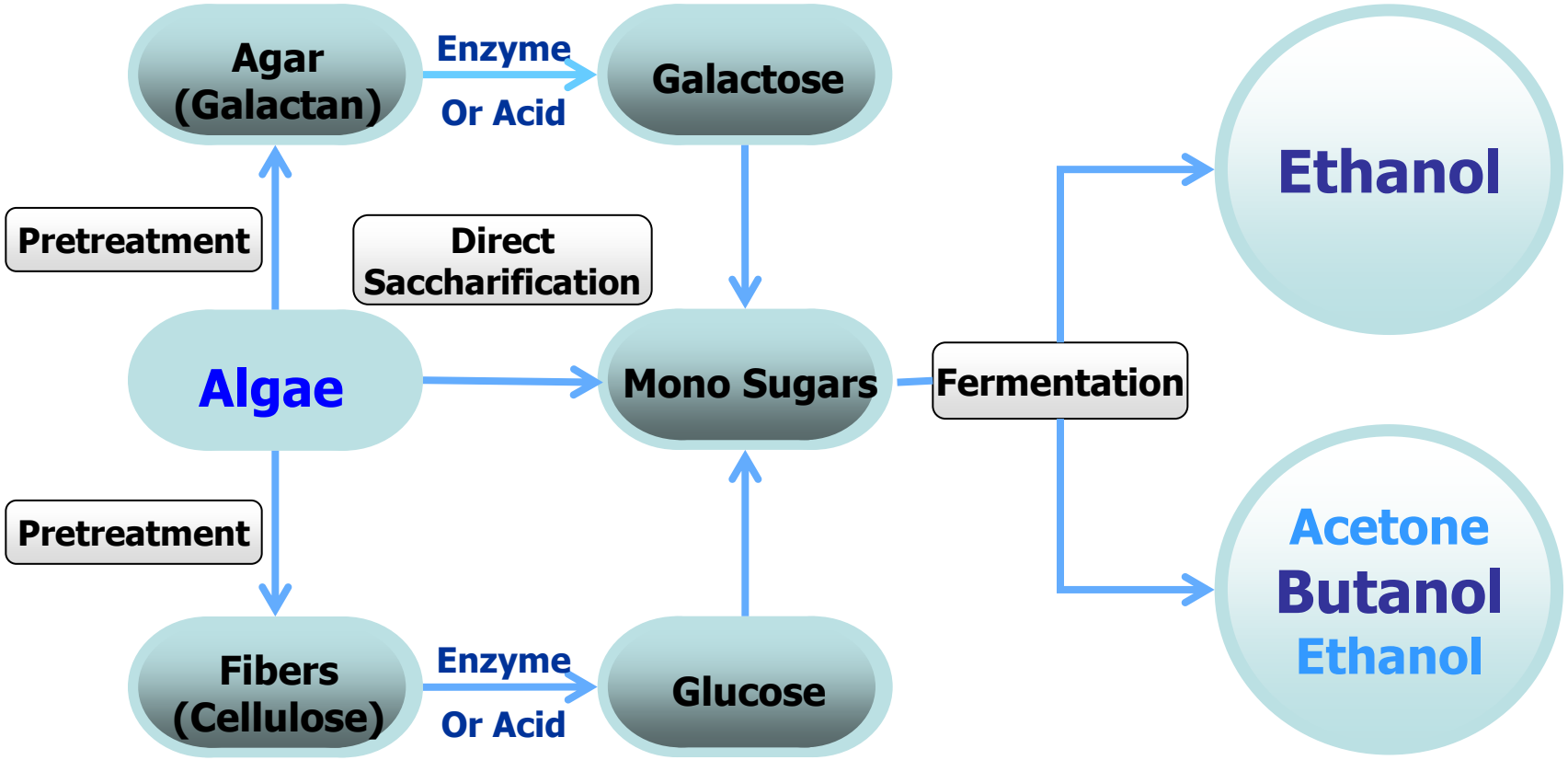
- **Target: Compact F-T reactor (GTL based)**
  - **Feed: Synthesis gas**
  - **Capacity : 0.01 bbl oil/d**
  - **Technology :**
    - **Fischer-Tropsch synthesis**
    - **Fixed-bed reactor**
  - ***Reaction heat control***

# Algal Biomass

## (Adapted from Novozymes Inc)



# Bio-alcohols from Macroalgae

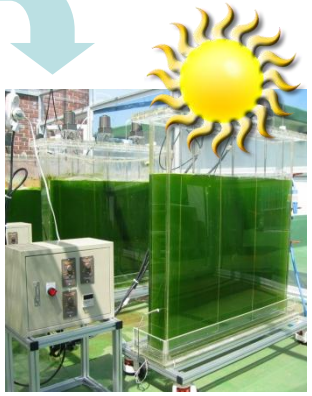



**Utilization of anhydrogalactose (AHG) is the main challenging issue!**

# Biodiesel from Microalgae (I)

Coal power plant

$CO_2$



Mass-cultivation

Biomass

Extraction

Lipid


Chemical conversion

Carbohydrate Biomass

Biogasoline
Power / Heat
Hydrogen

Thermo-chemical conversion

**Mass cultivation of microalgae is the main challenging issue!**

# IV. Summary

- **Transport biofuels will take the key role for realizing the sustainable society in Korea**

- **Identification of the suitable feedstocks is the major challenging issue**

- **Biofuels from non-conventional feedstocks may be a promising option to meet the target of the biofuels implementation**

# Thank You for Kind Attention!