Energy Efficiency Policy and Practices in the Republic of Korea

April 6, 2010

kwan taek, Jeon
Introduction of KEMCO
KEMCO Overview

History
- **1980** Establishment of KEMCO
- **2003** Foundation of the New & Renewable Energy Center (affiliated)
- **2005** Opening of the Korea GHG Reduction Registry Office and the CDM Certification Office designated by the United Nations

Organizations
- 4 Headquarters, 1 Renewable Center, 8 Regional Offices (Staff: 420 persons)

Budgets
- (2009) 756 million USD (Operating budget $50 million, subsidy and loans $703 million)

Major Activities

<table>
<thead>
<tr>
<th>Energy Efficiency and Saving</th>
<th>New and Renewable Energy</th>
<th>Climate Change Response</th>
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</thead>
</table>
| • Implementing Sectoral EE Programs (VA, ESCO, Soft Loan, etc.)  
  • Market Transformation for Energy Efficiency (Labeling and Certificates)  
  • Public Relations, Educations and Campaigns | • Deployment of 2 Million Green Homes  
  • Certification of New & Renewable Energy Systems  
  • Financial Supports (Subsidy, Loan), Public Obligation, RPA, FIT, etc. | • End-Use Energy & GHG Statistics  
  • Registration and Certification of Voluntary GHG Reductions (KCER*)  
  • Certification for CDM Projects |

* KCER: Korea Certified Emission Reductions
II Energy Situations in South Korea
Energy Use in South Korea

High Level of Energy Dependency

- **World’s 11th largest energy consumer** (96% of energy is imported, 84% fossil fuels)

- **Burden on the national economy balances due to increased energy imports**

  ➜ Energy imports of $141.5 billion in 2008 was much higher than the exports of semiconductors, autos, and mobile phones combined ($103.5 billion).

Steadily increasing fossil energy use and energy-related CO₂ emissions

- High increasing rate (’03~’08) in TPES compared with that of OECD countries

  - Korea: 2.0%
  - Japan: -0.5%
  - USA: 0.3%
  - UK: -1.5%
  - OECD: 0.4%

- 101% GHG increased over 1990 emissions (World’s 16th largest GHG emitter)
**Decreased Oil Dependency**: 61.1% (1980s) → 41.8% (2008)

- The share of oil in total energy consumption has been decreasing due to diversification of energy resources such as, nuclear installation ('78), natural gas introduction ('86), etc.

<table>
<thead>
<tr>
<th>Year</th>
<th>Oil</th>
<th>Coal</th>
<th>LNG</th>
<th>Nuclear</th>
<th>Renewables</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>61.1</td>
<td>22.5</td>
<td>7.6</td>
<td>2.0</td>
<td>6.8</td>
</tr>
<tr>
<td>2000</td>
<td>52.0</td>
<td>22.2</td>
<td>9.8</td>
<td>14.1</td>
<td>1.8</td>
</tr>
<tr>
<td>2008</td>
<td>41.8</td>
<td>27.6</td>
<td>14.4</td>
<td>13.5</td>
<td>2.7</td>
</tr>
</tbody>
</table>

※ Oil consumption by sector (761 million bbl, 2008)

- Industry: 55.3%
- Transportation: 33.6%
- Residential/Commercial: 8.7%
- Transformation: 2.4%
- Residential/Commercial: 8.7%

OECD average ('08, IEA)

- Oil: 37.3%
- Coal: 20.9%
- LNG: 23.7%
- Nuclear: 10.9%
- Renewables: 7.2%
Final Energy Consumption by Sector

- **Industry** [coal 23.5%, oil 51.2%(non-energy oil 40.9%), natural gas 5.6%, electricity 15.7%]
  - Final energy consumption is dominated by the industrial sector. (58.4% of TFC)
  - Relatively large share of non-energy use: 56% of industrial consumption

- **Transport** [oil 97.1%(gasoline 21.9 LNG 42.9 LPG 14.6), gas 2.2%, electricity 0.6%]
  - Increasing mainly from the vehicle deployment and customer preferences on the larger one

- **Residential/Commercial** [coal 3.0% oil 19.9%, gas 33.5%, electricity 12.5%]
  - Increasing mainly from the diffusion of electric appliances and relatively low energy cost
**High Energy Intensity** due to the heavy industries and their growth

- Energy intensity has been improved with the efforts of energy efficiency policy and the growth of low-energy industries since 1997.

< Energy Intensity Trends of South Korea>

<table>
<thead>
<tr>
<th>Year</th>
<th>Energy Intensity (toe/1000 $)</th>
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</thead>
<tbody>
<tr>
<td>'90</td>
<td>0.328</td>
</tr>
<tr>
<td>'95</td>
<td>0.355</td>
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<tr>
<td>'97</td>
<td>0.377</td>
</tr>
<tr>
<td>'00</td>
<td>0.369</td>
</tr>
<tr>
<td>'05</td>
<td>0.329</td>
</tr>
<tr>
<td>'08</td>
<td>0.314</td>
</tr>
</tbody>
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Source: Energy Balances of OECD Countries 2009 (IEA)

**Energy Efficiency of the industrial sector**

- South Korea stands for the world-class energy efficiency in major industrial sub-sectors.

※ **Energy Efficiency Indicator** (Source: Worldwide Trends in Energy Use and Efficiency, IEA)

(Steel & Iron) Korea 0.88, Japan 0.86, USA 0.67  (Petro-chemical) Korea 12.5, Japan 14.3, USA 7.1
Korean Energy Efficiency Policy
Green Growth National Strategy

Low-carbon, green growth: A National Vision for the Next 60 Years

Three Objectives
1. Green Society: Implementing low-carbon and high energy efficiency
2. Green Economy: Promotion green technology and industry
3. Green Korea: Global leader promoting green growth

10 Policy Directions
1. Climate change response & energy independence
   - Efficient reduction of GHG
2. Securing energy independence and oil-free
3. Building up GHG adaptation capacity
4. Creation of new green industry
   - Sustainable green technology R&D
5. Greening business and industrialization
6. Moving towards advanced industry structure
7. Facilitating green growth infrastructure
8. Improving the quality of life
   - Greening the national territory and transportation
9. Green revolution in lifestyle
10. Leading country for international green growth
Target proposals for GHG reduction scenarios

3 scenarios for national GHG reduction
(Unit : million tCO2)

<table>
<thead>
<tr>
<th>Year</th>
<th>1990</th>
<th>2005</th>
<th>2020</th>
</tr>
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<tbody>
<tr>
<td>S1</td>
<td>298</td>
<td>594</td>
<td>813</td>
</tr>
<tr>
<td>S2</td>
<td>590</td>
<td>569</td>
<td></td>
</tr>
<tr>
<td>S3</td>
<td></td>
<td></td>
<td>642</td>
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Comparison of country-specific GHG reduction goals

<table>
<thead>
<tr>
<th>Country</th>
<th>EU</th>
<th>USA</th>
<th>JPN</th>
<th>KOR</th>
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<tbody>
<tr>
<td>2000</td>
<td>20-30%</td>
<td>17%</td>
<td>15%</td>
<td>4-8%</td>
</tr>
<tr>
<td>2020</td>
<td>20-30%</td>
<td>17%</td>
<td>15%</td>
<td>4-8%</td>
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※ 2020 reduction goal below 2005 level (1990 level for EU)

### Scenarios

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Reduction Goals (BAU levels)</th>
<th>Reduction policy standards</th>
<th>Major reduction programs (examples)</th>
</tr>
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<tbody>
<tr>
<td>S1</td>
<td>-21%</td>
<td>Implementing cost-effective technology and measures</td>
<td>Green homes, green buildings, LED, high-efficient products, industrial high-efficient process innovation, renewable energy, and smart grid, etc.</td>
</tr>
<tr>
<td>S2</td>
<td>-27%</td>
<td>Shouldering the reduction cost at international standards</td>
<td>Hybrid cars, bio fuel, and CCS (Carbon capture and storage), etc.</td>
</tr>
<tr>
<td>S3</td>
<td>-30%</td>
<td>Bring maximum reduction standards among developing countries</td>
<td>Introduction of green cars including electric vehicles and fuel cell vehicles, diffusion of advanced high-efficient products, and reinforced CCS.</td>
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2030 Energy Vision

**Low Energy Consumption and Low Carbon Society**
- Drastical energy intensity reduction in Korean economy (Improving 46% by 2030)

<table>
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<th>Energy Intensity (Unit: toe/1,000$)</th>
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<tbody>
<tr>
<td>KOREA</td>
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<tr>
<td>2007: 0.335</td>
</tr>
<tr>
<td>2030: 0.185</td>
</tr>
<tr>
<td>OECD</td>
</tr>
<tr>
<td>2007: 0.183</td>
</tr>
<tr>
<td>2030: 0.183</td>
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**Fossil Fuel-free Society**
- Deviated from the fossil fuel dependent energy system

<table>
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<th>Oil dependency</th>
<th>2007</th>
<th>2030</th>
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<tbody>
<tr>
<td>KOREA</td>
<td>44.6%</td>
<td>33%</td>
</tr>
<tr>
<td>OECD</td>
<td>2.4%</td>
<td>11%</td>
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**Industrialization for Green Energy**
- Securing world-best energy technology by 2030
- Promoting green energy industry by developing advanced technologies

**Energy Independence and Energy Welfare**
- Competitiveness of core energy technology: 60% → World Best

<table>
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<th>Self-exploitation capacity ratio</th>
<th>2007</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>KOREA</td>
<td>4.2%</td>
<td>33%</td>
</tr>
<tr>
<td>OECD</td>
<td>7.8%</td>
<td>0%</td>
</tr>
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*Excerpt from the National Energy Basic Plan (2008)*
Energy Efficiency Policy

The 4th Basic Plan for Rational Energy Utilization (2008~2012)

Direction

Implementation of low carbon economy by the development of technology innovation and demand-specific management

Objectives

- Improving economy-wide energy efficiency by 11.3% up to 2012
  - Energy intensity: 0.335(’07) → 0.297(’12) → 0.256(’17) → 0.185(’30)

- Curb the annual increasing of energy use by 2.3% up to 2012
  - Increasing rate of annual energy consumption: 3.1%(’02~’07) → 2.3%(’07~’12)

Mid-term and long-term targets of TPES

- Million toe (toe/1,000$)
- ’02: 203.5 (0.367), ’07: 236.5 (0.335), ’12: 299.3 (0.353), ’17: 368.8 (0.357), ’20: 398.4 (0.356), ’30: 544.0 (0.357)

- Targeted demand: 300.4 (0.185)
- Expected demand maintaining energy intensity of 2007: 46%

- Increase of 11.3% in ’12 compared to ’02

### Policy Directions of Sectoral Energy Efficiency

| Energy Efficiency R&D | ✓ Advanced technology development  
<table>
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<th>✓ (Core technologies of 7 clusters) Building energy management system, Power IT, Energy storage, Green vehicles, LEDs, Energy-intensive apparatus, Green home appliances</th>
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</table>
| Demand-side Management Innovation | Industry  
|                       | ✓ Mandatory energy audits for energy-intensive industries  
|                       | ✓ Promoting negotiated agreements and energy management system  
|                       | ✓ Spreading financial supports and tax-incentives  |
|                       | Transport  
|                       | ✓ Strengthen the fuel efficiency standards  
|                       | ✓ Deploying low-carbon high-efficient vehicles  
|                       | ✓ Reinforce public traffic system and modal shift measures (ITS, LRT, etc.)  
|                       | ✓ ITS(Intelligent Transportation System), LRT(Light Rail Transit)  |
|                       | Building  
|                       | ✓ Stringent building codes, promote the energy efficiency building certification, smart meters, community energy system  |

<table>
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<tr>
<th>Market Creation and Transformation</th>
<th>✓ Energy efficiency standards and labeling, rebates for EE products, Future efficiency Standards and MEPS, phase-out of low-efficient appliances (i.e. incandescent lamps)</th>
</tr>
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</table>

| Establishing Low-carbon Infrastructure | ✓ Rationalization of energy pricing structure, energy saving PR, promote early education, public-private partnership  |
Major Energy Efficiency Programs and Practices
Industry Sector: Energy-intensive factory

- **SKC**: PET film
- Used 94,000 TOE in 2002 (197,400tCO2)
- 79,000 TOE in 2007 (165,900tCO2)

**Policy & Results**

- **Voluntary Agreement (VA)**
  - Agreement period: 5 years
  - Goal: 9,751 toe (10.4%) 21,500tCO2

- **Energy Audit**
  - Securing additional 10% saving potentials in the processes

- **Low-interest Loans**
  - $36 million

- **Investment of Facilities**
  - Waste heat recovery
  - Replacement with high-efficient facilities
  - Adoption of high-performance Heat-pump

*PET*: Polyethylene Terephthalate

**Agreement**
Korean automakers (HYUNDAI, KIA) consecutively bring hybrids into the markets.

- **2009** hybrid car (LPG)
- **2010** hybrid car (Gasoline)
- **2012** PHEV and EV

**Development of advanced battery technology**

- **LG Chem** the exclusive Li-ion battery supplier of GM electric car, Chevy Bolt and Buick models from 2010 to 2016

- **SB LiMotive** (Samsung SDI and Bosch co-founded): the exclusive Li-ion battery supplier of BMW electric vehicle from 2011 up to 2020
Building Sector: 2 million Green Homes

Deployment of 2 million Green Homes up to 2020

- Building new Green Homes (1 million) and remodeling existing homes (1 million)
- Insulation improvement (passive), renewable installation (active) can save up to 93% of heating costs, 50% of cooling costs compared to conventional homes.
- Participants are to be provided with governmental subsidy and tax incentives.

* Green Home Model House demonstrated in front of central government office
**Building Sector**: LED lighting

**LED Lights 15/30 Deployment Programs** (launched in November 2006)

- **LED lights deployment target**: 30% by 2015 (energy-saving potentials: 4 Mtoe, $1.2 billion)
- **Public procurement for creating initial markets**
  - More than 30% of lights turn into LED lights by 2012 in public buildings
  - Rebates or subsidies will be provided for the lighting replacement.

*<Installed LED lights at the National Assembly>*

*<LED lights at governmental offices>*
**EE Labeling and Standby Power Program**

### Energy Efficiency Rating and Labeling

(22 items including refrigerator, air conditioner, car)

- Mandatory labeling and MEPS are applied to major energy-consuming end-uses

*55% drop in annual power consumption*

1996: 1.75 kWh/ℓ  
2008: 0.78 kWh/ℓ  
Refrigerator

*22% reduction in power consumption*

2004: 15 Wh/kg  
2008: 12 Wh/kg  
Washing Machine

### Standby Power Reduction

(20 appliances including PC and monitor)

- Promote the standby power criteria less than 1W in major home and office appliances
  - Standby warning label should be attached to the forefront of the device (7 products including TV and PC)
Public Campaign: Creating Green Lifestyle

Green Energy Family Partnership

- Public-private partnership to widespread the use of energy efficiency products and the voluntary participation on the energy saving measures (Entrepreneurs, NGOs, Local governments and Public institutes)

Energy – Love +
(Less Energy with More Love)

Donation of Energy saving benefits from the participants in summer will be transferred to the low income families for the energy cost in winter.

Home Energy Doctor

Consultants from appliance manufacturers will be dispatched to provide home energy saving tips.

CO₂ Reduction Campaign

Carbon Cash Bag Program
Customers can get repayable points when purchasing low carbon products.

Carbon Neutral Program
Voluntary participation on the carbon mitigation or projects
Further Considerations on the EE Programs
Mandatory energy saving targets for heavy energy-intensive industry and building

- Companies used more than 20,000 toe per annum (414 factories) and buildings used more than 10,000 toe per annum (39 buildings) ※ Targeted audiences will be gradually expanded.

To meet the target, companies can be supported with financial and technical assistances.

- If the target is not accomplished, penalties can be imposed.

**Energy Intensive Energy Intensive**

**Buildings Buildings**

**Factories Factories**

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**kemco**

Reporting (Plan, Progress, Results)

- Energy Intensive Buildings
  - Negotiating the targets, M&V, Certifications, etc.

- Energy Intensive Factories

- Inspection, Incentives
  - Financial Incentives (Loan, Tax)

- Consulting, Assessment

- Local Governments
- Central Government
- Public Research Institutes
Set regulatory vehicle standards on fuel efficiency and GHG emissions to raise the fuel economy considering internationally compatible measurement criteria (Jul. 2009)

The basis of vehicle taxation will be changed from the exhaust gas (vehicle size) to the fuel economy or GHG emission.

Companies must meet the target of fuel economy 17km/ℓ or GHG 140g/km by 2015.

- New fuel efficiency or emission standards will be permitted within 30% of total sales to the automakers in 2012, and the permission is gradually raised to 100% by 2015.
  * 30%(2012) → 60%(2013) → 80%(2014) → 100%(2015)

- If automakers can’t meet the obligations, penalties can be imposed.
**Promotion of more efficient products**

- **Raising energy efficiency standards of electric appliances by 2010**
  - Considering the model distributions in the market, the span of EE rating standards will be shifted upwards to intensify the efficiency of products. (planned in 2010)

  ![Graph showing energy efficiency standards for different grades of appliances](image)

- **Targeted future energy efficiency in home appliances**
  - Set up the targeted standards based on benchmarking the most efficient model → All products must comply with the standards of the target year.
  - Air conditioner will be piloted in 2010.

- **Individual consumption taxes are planned to levy on the home appliances with large capacity.** (Air conditioner, Refrigerator, TV, Laundry Machine)
  - Tax rate of 5% will be applied for next 5 years from April 2010.
Concluding Remarks

- **Energy saving, as the 5th energy, is the most cost-effective measure for GHG reductions.** *(TIME, Jan. 2009)*
  - Energy efficiency alone can reduce the one third of GHG emissions. *(IEA)*

- **Stress on Code Green strategy as a new paradigm for survival and prosperity in the 21st century of Energy·Climate·Era** *(Thomas L. Friedman, Sep. 2009)*
  - Important is not a resource reserve but a technology innovation.

- **Upfront investment in efficiency measures with NPV-positive opportunity can save energy consumption roughly 23% of projected demand in U.S. industry and building.** *(Mckinsey & Company, July 2009)*
  - Solutions available: ① Information and education, ② Incentives and financing, ③ Codes and standards, ④ Third-party involvement

KEMCO makes every effort to raise more than 46% of efficiency upgrade up to 2030 and to contribute the best practices to the global society.
Thank you!

"Save energy, Save earth"