Green Energy Policy of Korea

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Korea’s Renewable Energy - Electricity

Renewable Energy Capacity & Power Generation

RE share in Capacity:
- 2005: 7.08%, 4,970 MW
- 2006: 6.95%, 5,072 MW
- 2007: 7.06%, 5,400 MW
- 2008: 7.27%, 5,814 MW
- 2009: 7.73%, 6,265 MW
- 2010: 8.28%, 6,927 MW
- 2011: 8.57%, 7,460 MW
- 2012: 9.08%, 8,141 MW
- 2013: 10.46%, 9,937 MW
- 2014: 11.75%, 11,860 MW
- 2015: 12.99%, 13,729 MW
- 2016: 12.52%, 13,846 MW

RE share in Power Generation:
- 2005: 1.08%, 3,950 GWh
- 2006: 1.02%, 3,899 GWh
- 2007: 1.03%, 4,395 GWh
- 2008: 1.00%, 4,227 GWh
- 2009: 1.07%, 4,618 GWh
- 2010: 1.24%, 5,890 GWh
- 2011: 3.46%, 17,346 GWh
- 2012: 3.66%, 19,498 GWh
- 2013: 3.95%, 21,438 GWh
- 2014: 4.92%, 26,882 GWh
- 2015: 6.61%, 37,079 GWh
- 2016: 7.24%, 40,656 GWh
Korea’s Renewable Energy - Industry: PV

- Status of PV industry in Korea
  - PV export (hundred Million Dollars)

<table>
<thead>
<tr>
<th>Year</th>
<th>Export (M USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>19.7</td>
</tr>
<tr>
<td>2013</td>
<td>20.5</td>
</tr>
<tr>
<td>2014</td>
<td>24.2</td>
</tr>
<tr>
<td>2015</td>
<td>30.0</td>
</tr>
<tr>
<td>2016</td>
<td>35.8</td>
</tr>
</tbody>
</table>

- Capacity of Korean PV enterprises

  **Cell**
  1. Hanwha Q Cells (5,200MW/year, World 1st rank)
     - PERC (Passivated Emitter and Rear Cell)
     - Efficiency 19.5%, 1st commercialized for Polycrystalline Cell
  2. LG Electronics (1,100MW/year)
     - 22% efficiency for N-Type Monocrystalline Bifacial Cell
  3. Hyundai Heavy Industries (600MW/year)
  4. Shinsung E&G (600MW/year)
     - 21.7% efficiency of Monocrystalline PERC cell

  **Polysilicon**
  1. OCI (52,000ton/year, World 3rd rank)
  2. Hanwha Chemical (15,000ton/year)
  3. Hankook Silicon (15,000ton/year)

  **Module**
  - Global production capacity 10GW
  - Domestic production capacity 6.4GW
Korea’s Renewable Energy - Industry: Wind

- **Status of Wind industry in Korea**
  - 1,031MW installed by 2016
    - Onshore wind: 77 sites, 519 turbines, 996.22MW
    - Offshore wind: 3 sites, 12 turbines, 35MW

- **Domestic turbine market share**
  - 5.9% in 2010
  - 48.1% in 2016

- **Capacity of Korean Wind enterprises**

<table>
<thead>
<tr>
<th>Turbine</th>
<th>Doosan Heavy Industries</th>
<th>Hyosung</th>
<th>Unison</th>
<th>Hanjin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3MW on/offshore turbine, 5.5MW offshore turbine</td>
<td>5.5MW offshore wind turbine certified in Germany (July, 2015)</td>
<td>750KW, 2MW, 2.3MW wind turbine</td>
<td>1.5MW, 2MW wind turbine</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tower</th>
<th>CS Wind</th>
<th>Tae-woong</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wind tower global market share 6.5%</td>
<td>400 customers including world turbine top 10 enterprises</td>
</tr>
<tr>
<td></td>
<td>Manufacturing at Canada, China, Viet Nam and UK</td>
<td></td>
</tr>
</tbody>
</table>

*KOREA ENERGY AGENCY*
Korea’s Renewable Energy Industry (Outcome) (2016)

- **Manufacturer**: 405
- **Employment**: 14,412
- **Export**: $3.6bil
- **Overseas Factory**: $2.4bil
- **Domestic**: $4.1bil
- **Sales (USD billion)**: 10.1
Vision: **Energy transition 「RE3020」**
- Everyone’s participation & improving the quality of life -

**Target**

<table>
<thead>
<tr>
<th>Year</th>
<th>RE share in power generation</th>
<th>Citizen power plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>7.6%</td>
<td>0.29mil. 0.1GW</td>
</tr>
<tr>
<td>2022</td>
<td>10.5%</td>
<td>0.76mil. 3.3GW</td>
</tr>
<tr>
<td>2030</td>
<td>20%</td>
<td>1.56mil. 10GW</td>
</tr>
</tbody>
</table>

**Strategy**

- **Sources**: Focus on PV & Wind
- **Method**: Citizen participation & Sustainable development
- **Enhancing Economic feasibilities**: Promoting Large-scale project by deregulation

**Expanding PV in urban area**

**Expanding Agricultural PV**

**Expanding RE co-ops & social enterprises**

**Large-scale project**
Energy Transition – Renewable Energy 3020

20% of power generation by 2030: More than 95% of new capacity is PV & Wind

2017: 15.1GW

New capacity: 48.7GW

2030: 63.8GW

- PV: 30.8GW (63%)
- Wind: 16.5GW (34%)
- Waste: 3.8GW (6%)
- Bioenergy: 3.3GW (5%)
- Other: 3.4GW (7%)

*Except for non-renewable waste

Method
Achieving target by Citizen participation & Large-scale projects

Citizen participation: 19.9GW

- Self-consumption for home & building: 2.4GW
- Small-scale projects, co-ops: 7.5GW
- Agricultural PV: 10.0GW
- Large-scale projects: 28.8GW

Large-scale projects: 28.8GW

Short term (2018~2022): 12.4GW
- 0.7
- 3.4
- 3.3
- 5.0

Long term (2023~2030): 36.3GW
- 1.7
- 4.1
- 6.7
- 23.8

Energy Pledges from the New President
Energy Transition – Renewable Energy 3020
Energy Transition – Way to Achieve

- To achieve 20% target by 2030

1. Increasing RPS mandatory rate

2. Promoting large scale RE projects: Offshore wind farm, etc

3. Local community participation: Agricultural solar villages, etc

4. Investment for grid stability: T&D improvement, securing backup power

5. Efficient demand side management using smart grid infrastructure

6. R&D investment $1.4bil including RE($1.0bil) (2016–2020)
Renewable Portfolio Standard (RPS)

Overview
- Enforces 21 power producers to supply certain amount of the total Power generation by NRE (Implemented in 2012)
- ※ Obligators: power producers with capacity of 500MW or above

Goal and Current Status
- Goal: (’12) 2.0% →...→ (’16) 3.5% → (’17) 4.0% → (’18) 5.0% →...→ (’20) 7.0% →...→ (’23~) 10.0%
- Current Status: RPS achieved 10.1 times of total FIT installed capacity (proceeded for 10 years) in 7.3 years

<table>
<thead>
<tr>
<th>RPS(’12~)</th>
<th>FIT(’01~’11)</th>
<th>Rate of change</th>
</tr>
</thead>
<tbody>
<tr>
<td>10,546MW</td>
<td>1,042MW</td>
<td>1,312.7%↑</td>
</tr>
</tbody>
</table>

Best Practice
- Converting rooftop of the factory and parking lot into Solar PV Power Plant (Busan)
- The largest Solar PV Plant for the single factory utilized existing facilities in the world (20MW, Renault Samsung Motors)
- Generated electricity (26GWh/yr.) provides 7,300 households
  * Ave. usage rate 15%, 1 household uses 300kWh/month
# Evaluation Criterion
- Economic feasibility, Environmental effect, Potential, Industrial promotion effect, Policy priority
(Govnt. Revises every 3 years)

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Multiplier</th>
<th>Eligible Energy Sources</th>
<th>Installation Type</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar PV</td>
<td>1.2</td>
<td></td>
<td>On Land</td>
<td>Less than 100kW</td>
</tr>
<tr>
<td></td>
<td>1.0</td>
<td></td>
<td>On Land</td>
<td>More than 100kW</td>
</tr>
<tr>
<td></td>
<td>0.7</td>
<td></td>
<td>On Land</td>
<td>Exceed 3,000kW</td>
</tr>
<tr>
<td></td>
<td>0.7</td>
<td></td>
<td>On Forest Land</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.5</td>
<td></td>
<td>On Building &amp; Existing Facilities</td>
<td>Under 3,000kW</td>
</tr>
<tr>
<td></td>
<td>1.0</td>
<td></td>
<td>On Building &amp; Existing Facilities</td>
<td>Exceed 3,000kW</td>
</tr>
<tr>
<td></td>
<td>1.5</td>
<td></td>
<td>Floating on the Water Surface</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.0</td>
<td></td>
<td>Self-generating Facilities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.0</td>
<td>ESS(with Solar PV Facility)</td>
<td></td>
<td>2018, 2019</td>
</tr>
<tr>
<td></td>
<td>4.0</td>
<td>ESS(with Solar PV Facility)</td>
<td></td>
<td>2020</td>
</tr>
<tr>
<td>Other REs</td>
<td>0.25</td>
<td>Bio-SRF, IGCC, Byproduct Gas, Waste</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.5</td>
<td>LFG, Wood Pellet, Wood Chip</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.0</td>
<td>Hydro, Onshore Wind, Other Bioenergy, Tidal(with Embankment)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.5</td>
<td>Unused Forest Biomass(Co-firing), Hydro Thermal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.0</td>
<td>Unused Forest Biomass, Fuel Cell, Tidal(without Embankment), Current Power, Geothermal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.0 ~ 2.5</td>
<td>Geothermal, Tidal(without Embankment)</td>
<td></td>
<td>Variable Type</td>
</tr>
<tr>
<td></td>
<td>2.0~3.5</td>
<td>Offshore Wind(Connection Distance <del>5km: 2.0, 5</del>10km: 2.5, 10<del>15km: 3.0, 15km</del>: 3.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.5</td>
<td>ESS(with Wind Facility)</td>
<td></td>
<td>2018, 2019</td>
</tr>
<tr>
<td></td>
<td>4.0</td>
<td>ESS(with Wind Facility)</td>
<td></td>
<td>2020</td>
</tr>
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</table>
Renewable Portfolio Standard (RPS)

TOTAL RPS CAPACITY: **9.4GW** (2017)

- **PV**: 4.4GW, 47%
- **Waste**: 865MW, 9%
- **Bioenergy**: 2.1GW, 22%
- **Fuel Cell**: 232MW, 3%
- **Hydro**: 694MW, 7%
- **Wind**: 726MW, 8%
- **IGCC**: 346MW, 4%

**TOTAL RPS CAPACITY**: 9.4GW (2017)
Thank you