

KOREA

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Korea's share of renewables in its total primary energy supply (TPES) is the lowest of all International Energy Agency (IEA) countries (2.5% in 2009). About 75% of the renewables in Korea's 2009 TPES came from combustible renewables and waste. The remainder came from hydro (10%) and bio-energy (9.5%) and wind (2.4%) and solar (2.5%).

Although the share of renewables in Korea's TPES remains very low, it has been increasing at a relatively fast rate since the early 1990s, rising at an annual rate of over 7% over the last decade. Now renewables grow steadily, at the rate of 4%. The largest increase was in combustible renewables and waste, which grew at nearly 8% per year until 2005. But since 2006, Solar photovoltaic and Fuel cell increases rapidly, from twice to four times. In particular, solar photovoltaic has increased 400% at 2008, and Fuel cell increased 439% as at 2009.

Over the same period, hydro rather decreased at nearly 6~10% per year and Bio energy has increased 34~51% per year.

1. Objectives and Institutions

The Korean government set targets for penetration of new and renewable energy⁴ (NRE), targets of 6.1% of TPES in 2020 and 11% of TPES in 2030 and 20% of TPES in 2050. These targets, along with technology-specific targets, are detailed in the government's *Total basic plan for climate change*. To achieve these targets, the government passed the *Second Basic Plan for New and Renewable Energy Technology Development and Dissemination*, which was modified from the *Basic Plan for Alternative Energy Development and Dissemination*. The targets call for an increase in the share of renewable energy provided from sources such as wind and solar, and a reduced share provided by waste. The fuel-specific

targets are only indicative to provide guidance on funding priorities.

The Ministry of Commerce, Industry and Energy (MOCIE) is principally responsible for new and renewable energy development and dissemination, in co-operation with the Ministry of Environment (MOE) and KEPCO.

2. Policies and Measures

The government has invested over 2 trillion KRW in NRE in 2009, a relatively low level within the G-20. Therefore the government has designated hydrogen fuel cells, photovoltaics and wind as areas to receive the largest share of government support – 70%.

Funding in the form of loans is focused mostly on solar photovoltaics and biomass. The government sees photovoltaics as a potential export market for Korean industry.

Furthermore, the government announced the '5-years Green Growth National strategy', which is including 'Green technology, adaptation for climate change, Energy-independence, and Energy-welfare' in July, 2009.

2.1. ELECTRICITY SECTOR

(1) Feed-in tariffs

One of the government's principal means of promoting new and renewable energy is through a differentiated feed-in tariff programme. The government guarantees fixed rates for five years for small hydropower, biomass and waste, and guarantees the rates for 15 years for wind and photovoltaics.

The feed-in tariff varies by technology according to the energy sources.

The tariff for photovoltaics is nearly seven times larger than the rate paid for wind, which receives the second-highest subsidy. The government is considering gradually lowering the feed-in tariff for photovoltaics to take into account technology development.

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Table 1 Feed-in tariff

Technology	Feed-in Tariff	
	KRW/kWh	USD/kWh
Photovoltaics	439.56~606.64	0.408~0.563
Wind	107.29	0.099
Small hydro	66.18~94.64	0.061~0.088
Bio energy	68.07~85.71	0.063~0.079
Tidal/Ocean	62.81~90.50	0.058~0.084
Fuel cell	227.49~274.06	0.211~0.255

Source: Country submission

Table 2 Annual NRE goal ratio designated to 13 RPS participants

year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
ratio (%)	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0

The government has paid KRW 440.2 billion in subsidies since the programme began in 2002, up through to 2009, to 853 MW (1,308 systems) of renewable power. The total power generated by the support system was 5,162,823 MWh as at the end of 2009.

The government is considering introducing more market-based methods for promoting renewable power generation, including setting a renewable portfolio standard (RPS) with a green certificate system.

(2) RPS (Renewable Portfolio Standard)

The government has revised the law of NRE (Sep. 2010) for the introduction of RPS. RPS is now on the proceed as a shape of test, preparing for full-scale operation in 2012 (Table 2).

2.2. BUILDING SECTOR

(1) The 1,000,000 Green-home project

To promote renewable power, both to reduce domestic fossil fuel use and to develop a long-term export market, the government is supporting the construction of 1,000,000 green homes that rely on NRE power for some of their power needs. To meet this goal, the government has provided subsidies totaling KRW 276.3 billion to 43,862 projects between 2004 and 2009, and the total established capacity is

57,582kW + 93,314m² (solar photovoltaic 43,716kW, solar thermal 93,314m², Geothermal 5,024kW, small-sized wind 24kW, Bio pellet 8,818kW)

The 100,000 Green-home project is expected to make 9.4% (1,558,000 toe) of the total NRE supply.

(2) Public-sector buildings

In 2002, to promote the dissemination of new and renewable energy, the government passed legislation requiring that all newly built public buildings (including federal and local government buildings) with over 3,000 m² of gross area allocate over 5% of their construction costs to the establishment of new and renewable energy facilities. In 2009, the government provided KRW 232.6 billion with the accumulative total (2004~2009) at KRW 490 billion won.

3. Comments

Korea has set ambitious goals for the penetration of new and renewable energy into its energy mix, a step the IEA commends. Furthermore, since the last in-depth review the government has increased its financial support for renewables. The IEA commends these efforts, as they will help lower Korea's reliance on fossil fuels and imported energy, and enhance the country's energy security at the same time as it puts action behind its environmental goals.

Korea's share of renewables in its total primary energy supply (TPES) is the lowest of all IEA member countries. Thus the IEA commends Korea's bold target for 3% of TPES to be supplied by new and renewable energy in 2006, rising to 5% in 2011. However, given that in 2004, new and renewable energy accounted for 2.1% of Korea's TPES, it is unlikely that forthcoming data will show that Korea met its 2006 target. Furthermore, this will make meeting its longer-term 2011 target even more challenging than originally envisioned, necessitating that Korea step up its renewables promotion policies and modify the implementation of existing policies so that government policies and funding bring the largest gains in the supply of renewables. To ensure the 2011 target is met, the government should establish a detailed timetable, with monitoring at regular intervals so that policies can be revised and strengthened if interim mile-

stones are not met.

In the current funding plan, photovoltaics and hydrogen fuel cells receive the largest share of funding. However, photovoltaics and, in particular, hydrogen fuel cells are expected to make up a relatively small share of total NRE in 2011 compared with other sources such as wind and geothermal. Thus the funding scheme for hydrogen and photovoltaics highlights the country's commitment to reduce the unit cost of these technologies so that they can make up a larger share of Korea's energy supply in the long term. Nevertheless, the current funding allocation scheme underscores the need for Korea to undertake rigorous cost-benefit analysis when deciding how to allocate government funding for renewables. While it is understandable that the government wants to encourage development of the domestic photovoltaics market in order to develop this high-tech export market, the risk is that the government is only raising the overall cost of promoting renewables, and developing an industry with artificial and, therefore, unsustainable economics. To avoid this outcome, the government should undertake cost-benefit analysis of various renewable fuels—including environmental and other benefits—when deciding how to allocate NRE funds and subsidies.

Currently, the government has various measures to directly support renewables deployment, including a feed-in tariff, direct support, tax benefits and R&D funding. While various measures are often warranted, an *ad hoc* approach to renewables deployment—where policies are added one by one without co-ordination—often results in inefficient government investment. A better approach is a streamlined promotion policy with clearly defined government authority, roles and responsibilities. Establishing an efficient renewables promotion policy will also require comprehensive cost-benefit analysis and co-ordination across MOCIE, the Ministry of Science and Technology and other relevant ministries and entities.

Korea's feed-in tariff is one of the government's main policy tools to achieve its NRE target. It is a differentiated feed-in tariff, in order to take into account the difference between power generation cost and sale prices for various NRE technologies. Direct subsidies for installations as well as tax incentives are

also provided for projects. As the guaranteed feed-in tariff for photovoltaics is more than six times that of wind, this policy works to ensure that all technologies, regardless of cost, have an equal opportunity to receive feed-in tariffs and supply renewable power. In general, these differentiated feed-in tariffs are provided so that technologies at different stages of cost and development can attain critical mass and sufficient market penetration to become economic. However, differentiated feed-in tariffs could lead to oversubsidisation of technologies because as a technology becomes more economically viable, its feed-in tariff does not evolve to reflect it. Furthermore, there is a risk of creating entrenched oversubsidisation that is difficult to remove rather than short-term development support that is eliminated when the particular technology reaches market maturity or is proven unviable. As has been seen in the global coal industry, as well as in all industries that receive subsidies, it is politically difficult to remove a subsidy once it has been given. As a result, it is important that the government outline feed-in tariff levels for the long term. The IEA is pleased to see that the government is considering lowering differentials in feed-in tariffs over time to reflect the technology learning curve. This would help avoid entrenched oversubsidisation for particular technologies as it may be difficult for the government to introduce feed-in tariff reductions in the future.

Additionally, feed-in tariffs can be a very expensive way of funding technology development. As an example, Korea's USD 0.70 per kWh feed-in tariff rate for solar photovoltaics would provide a payment of USD 1 600 annually per 2-kW panel⁵, equivalent to a ten-year simple payback time, a favourable rate considering that payments are guaranteed for 15 years and the operational lifetime of a solar panel is about 20 years. The government should consider more market-based alternatives to feed-in tariffs, such as, for example, establishing a green certificate scheme like the mandatory renewable energy target in Australia. Under this and other green certificate schemes, the government sets a target for a certain percentage of power to come from renewables and, possibly, new energy sources, but leaves it to market participants to procure the power most cheaply in a way that automatically

lowers support for renewables as technologies advance. This flexible, market-based approach continues to promote renewables and reflects the costs of environmental externalities, but allows support levels to adapt to market conditions instead of guaranteeing a fixed and permanent subsidy.

While the government has begun to focus on biofuels, no targets for biofuels penetration have been set. A successful biofuels policy would help reduce

Korea's reliance on oil, particularly relevant as the country relies relatively heavily on imported oil in its total energy supply. The government should enhance its biofuels policy, in particular by establishing realistic and cost-effective targets along with clear timetables and milestones for implementation. The government should put in place promotion policies and measures that allow the biofuels target to be met in a flexible, market-based and cost-effective manner.