IEA Bioenergy

Republic of Korea – 2018 update

Bioenergy policies and status of implementation

Country Reports

IEA Bioenergy: 09 2018

This report was prepared from the 2018 OECD/IEA World Energy Balances, combined with data and information provided by the IEA Bioenergy Executive Committee and Task members. All individual country reports were reviewed by the national delegates to the IEA Bioenergy Executive Committee, who have approved the content. General background on the approach and definitions can be found in the central introductory report[1] for all country reports.

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NATIONAL POLICY FRAMEWORK IN SOUTH KOREA

The Republic of Korea, South Korea, has been intensifying its efforts on expanding renewable power generation. In the past few years, an annual average of 1.7 GW of renewable capacity has been installed, amounting to a total 15 GW as of 2016 – including 7.8 GW in the past five years with the introduction of the Renewable Portfolio Standards. In particular, the shares of photovoltaics and wind power have seen a rapid increase, and reached 82% of the renewable capacity in 2016.

Korean government will expand its renewable generation share in the total electricity production from 7% today to 20% by 2030. In this context, MOTIE (Ministry of Trade, Industry and Energy) has been tasked with identifying measures to achieve this ambitious target as well as formulating Korea's 5th Renewable Energy Master Plan by 2019. To do this, the target contribution of the Renewable Portfolio Standard (RPS) will be gradually raised by securing a long-term fixed tariff on renewable energy production for 20 years to ensure economic predictability of project development. Government leads to promote actions related to secure economy of scale for the investment on large solar PV and offshore wind power. Incentives are provided to community-driven solar PV in order to facilitate local acceptance of renewable energy. Public and private investments are scaled up to improve grid integration on renewable option and create a favourable investment opportunity by way of identifying deregulation measures.

According to the 8th basic plan for long-term electricity supply and demand, Korea will produce more power from renewable energy sources and natural gas, while gradually reducing its reliance on coal and nuclear power. Between 2017 and 2030, the installed capacity of renewables would increase to 58.5 GW from the current 11.3 GW with the growth mainly coming from solar and wind power and thus would account 33.7 percent of the installed capacity in 2030 up from 9.7 percent in 2017.

Bioenergy supply is expected to increase its share as one of promising measures in RPS obligation. Also, bioenergy deployment can be supported by national renewable energy programs e.g. mandatory

[1] Available at https://www.ieabioenergy.com/iea-publications/country-reports/2018-country-reports/

biodiesel mix in transportation fuels, biogas infusion to the city gas pipeline, pellet boilers or heaters.

TOTAL PRIMARY ENERGY SUPPLY (TPES) AND THE CONTRIBUTION OF BIOENERGY

The total primary energy supply of Korea in 2016 amounted to 11,820 petajoule (PJ) and is still dominated by fossil fuels (82%). Oil products account for almost 40% (4,597 PJ), coal for another 30% (3,411 PJ) and natural gas for around 15% (1,730 PJ). Nuclear energy in nuclear power stations (which produce 28% of electricity) represents another 15% of total primary energy supply or 1,767 PJ. There is also a small share of energy from (non-renewable) waste (1.1% or 133 PJ). Renewable energy sources have a share of 1.5% or 180 PJ – 1.1% bioenergy and 0.4% other renewable energy sources.

Compared to 5 years earlier (2011) the primary supply levels of natural gas, coal and nuclear energy were relatively stable, but with increased overall TPES (9% higher in 2016 compared to 2011), their share in TPES went down slightly. On the other hand the share of oil products increased from 36.0% to 38.9%. There was an increase of renewable energy from 0.7% to 1.5%.

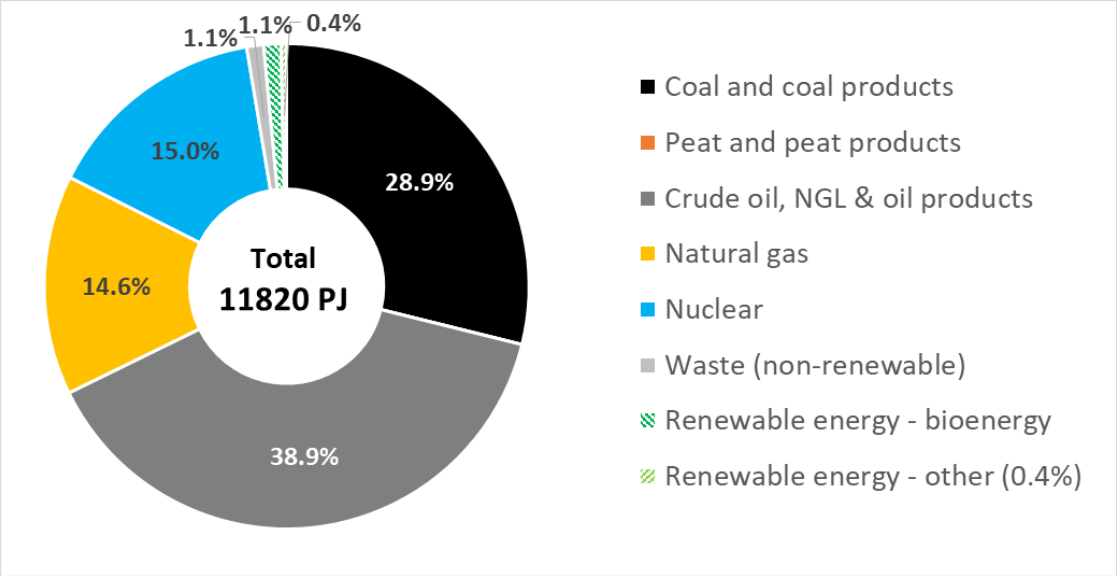

Figure 1: Total primary energy supply[2] in Korea in 2016 (Source: World Energy Balances © OECD/IEA 2018)

The total primary energy supply of renewable energy sources is mostly covered by energy from biomass, with 75% (135 PJ). Solar energy amounts for 11% (19 PJ); the rest is spread between hydropower (10 PJ), geothermal energy (7 PJ), wind energy (6 PJ) and a small fraction of tide, wave and ocean energy (2 PJ).

[2] TPES underestimates the actual role of pure electricity sources like PV, wind or hydro energy, and overestimates the role of resources producing electricity with a high share of unused waste heat (like nuclear). Korean statistics apply a multiplication factor of 2.5 for the TPES of pure electricity sources (*which is different from IEA statistics*).

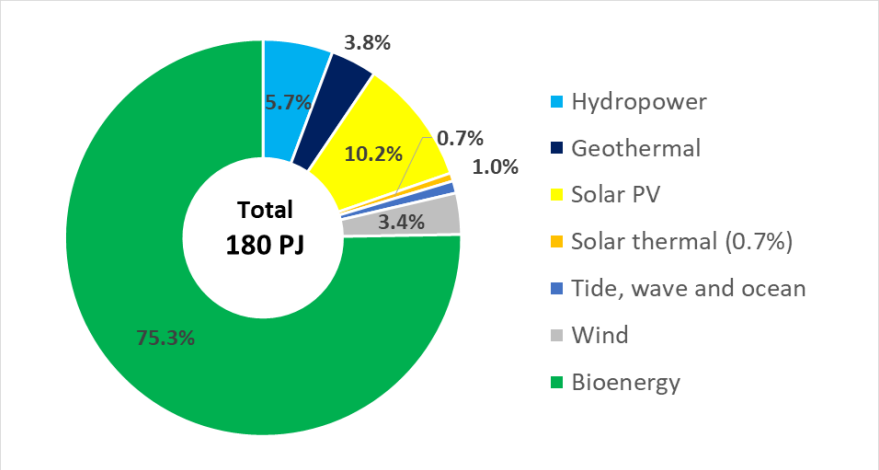

Figure 2: Total primary energy supply of Renewable Energy Sources in Korea in 2016 (Source: World Energy Balances © OECD/IEA 2018)

Over half of the bioenergy consumed in Korea comes from solid biomass (77 PJ), of which around 6 PJ is consumed in the residential sector. Biodiesel accounts for 15% (21 PJ), other liquid biofuels for almost 11% (15 PJ), renewable MSW for almost 12% (16 PJ), and biogas for 5% (7 PJ).

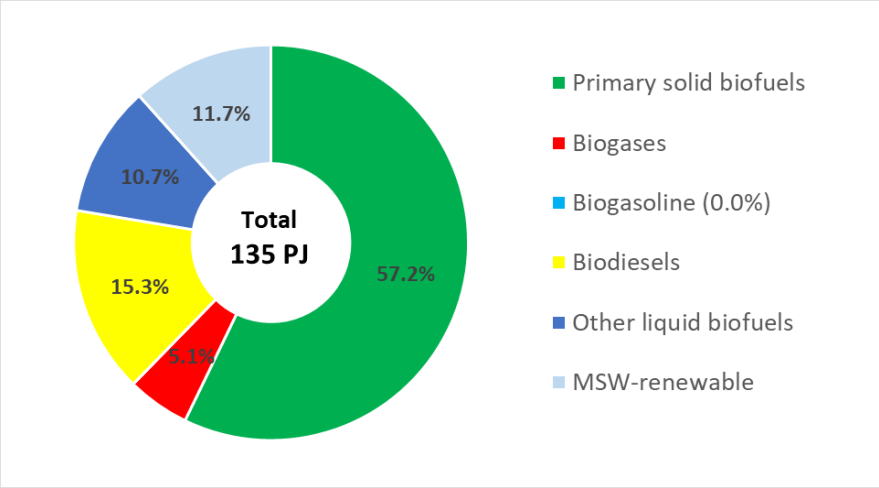

Figure 3: Total primary energy supply from bioenergy in Korea in 2016 (Source: World Energy Balances © OECD/IEA 2018)

Bioenergy consumption in Korea increased steadily from 0.1% in 1995 to 0.7% in 2013, and a step increase to 1.2% in 2014. Since 2014 overall of bioenergy levels have stabilized. From 2011 to 2014 there was a large increase of solid biomass, from 17 PJ in 2011 to 88 PJ in 2014. Afterwards levels have stabilized around 80 PJ. Liquid biofuels were introduced between 2005 and 2010. They stabilized between 2010 and 2013 around 14 PJ, and increased again up to 30-35 PJ in the past few years. Renewable MSW has stabilized around 16 PJ since 2010. Biogas also stabilized around 9 PJ between 2010 and 2014, and experiences a small decline (down to 7 PJ) in the past few years.

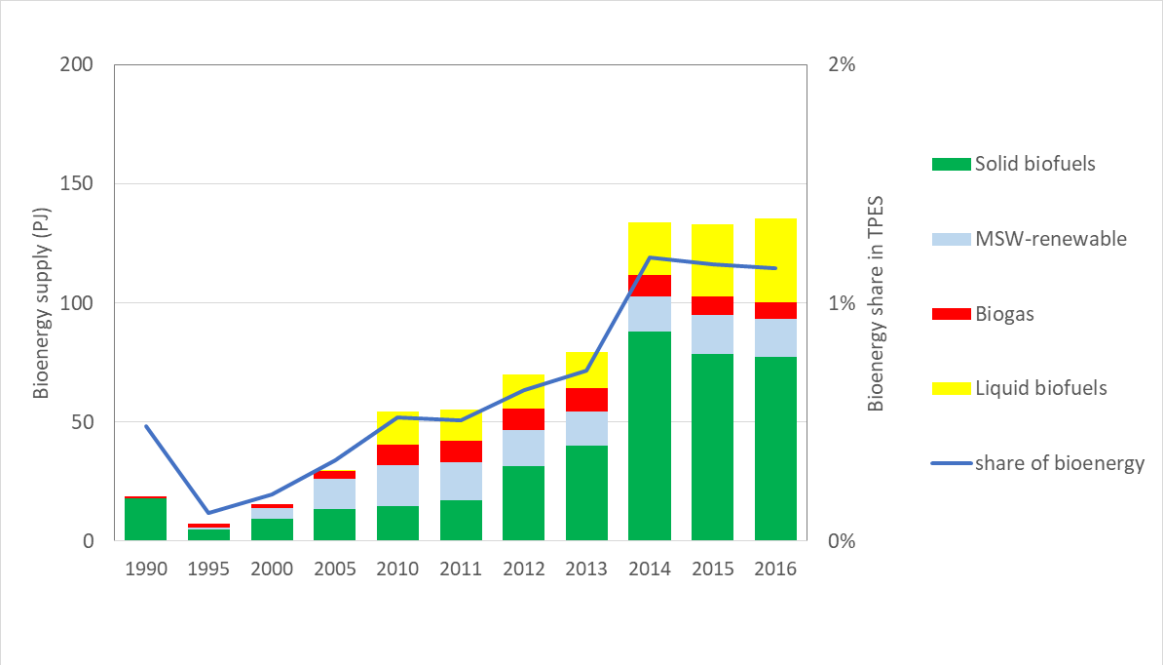

Figure 4: Development of total primary energy supply from bioenergy in Korea 1990 – 2016 (Source: World Energy Balances © OECD/IEA 2018)

Table 1 expresses the 2016 TPES figures per capita, considering South Korea's population of 51.2 million people. Compared to the other 22 member countries of IEA Bioenergy (expressed per capita), South Korea ranks halfway for liquid biofuels and renewable MSW, and in the low end for solid biofuels and biogas.

***Table 1**: Total primary energy supply per capita in 2016*

	GJ/capita
Total energy	230.7
Bioenergy	2.6
Solid biofuels	1.5
Renewable MSW	0.3
Biogas	0.1
Liquid biofuels	0.7

Source: World Energy Balances © OECD/IEA 2018

Role of bioenergy in different sectors

South Korea has a low share of around 3% renewable electricity in 2016, with a modest role of bioenergy in electricity.

The share of biofuels for transport is also modest at 1.4%.

Overall, the direct share of biomass for heating in the different sectors is around 3%. In the residential sector biomass represents less than 1% of fuel/heat consumption. Heat output generated and sold by CHP plants and heat plants represents around 10% of fuel/heat provided, of which on average 4% is

produced from biomass.

Table 2: Role of bioenergy and renewable energy in electricity production, transport and heat production/consumption in 2016

Sector	Share of bioenergy	Share of renewable energy	Overall production/ consumption
Electricity production	1.0%	2.8%	559 TWh (2,012 PJ)
Transport energy (final consumption)	1.4%	1.4%	1,462 PJ
Overall fuel and heat consumption[3]	Direct biomass: 2.4% Biobased heat: 0.4%	3.2%	1,997 PJ

Source: World Energy Balances © OECD/IEA 2018

RESEARCH FOCUS RELATED TO BIOENERGY

Bioenergy industry can be classified into solid biomass, biogas and biofuel manufacturers. This includes fuel processing or manufacturing industry and energy supply industry, e.g. electricity and heat.

Table 3: Major technology research focus in bioenergy industry

Solid biomass (pellet)	Biogas	Biofuel for transportation
Pulverized timber, high pressure compression	Pre-processing system (impurities elimination), methane conversion (digester)	Catalyst conversion (biodiesel), pre-processing and fermentation (alcoholic fuels)

In 2016, bioenergy industry in South Korea consisted of 116 companies - most of them were SME - and their total sales accounted for 91.5 million USD. Annual investment from the Korean bioenergy companies reached 2.7 million USD, and 1,604 persons were working in the domestic bioenergy industry. Recently GS Caltex constructed a biobutanol plant in Yeosu where annual production can be 400 ton per annum using pre-processing wood composites and saccharification technologies.[4]

Hansol EME deployed a biogas production plant which can supply 300 Nm3/h capacity linked to the city gas pipeline in Busan region.[5]

MOTIE and KEA have invested an annual budget of 20 million USD to bioenergy R&D. R&D areas include increasing production efficiency of biodiesel, improve generation efficiency using solid biomass, …

[3] This includes final consumption of fuels and heat in industry, the residential sector, commercial and public services and agriculture/forestry. Transport fuels are excluded. Energy used for transformation and for own use of energy producing industries is also excluded.

[4] www.gscaltex.com/eng

[5] www.hansoleme.com/eng

Table 4: *Bioenergy Technology R&D Budget in South Korea (in million USD)*

	2013	2014	2015	2016	2017	2018
Bioenergy R&D	25	21	21	26	25	20
NRE R&D Total	203	189	180	180	170	173

NRE = New and Renewable Energy

RECENT MAJOR BIOENERGY DEVELOPMENTS

Korean government has promoted bioenergy supply along with renewable energy policy direction by increasing bioenergy share in electric power generation, city gas distribution and local district heating. Renewable Fuel Standards has implied to the vehicle fuels. Since July 2015, biodiesel has been mixed with 2.5% in conventional diesel and the rate of biodiesel mixture is increased to 3.0% from 2018 to 2020. Oil refinery companies has attained the required mixture targets and try to find an economical way of bio-included materials e.g. extracted oil from food waste or animal stock.

Power generation suppliers who operate generation facilities above 500MW should meet annual renewable supply target directed by the Renewable Portfolio Standards. Mandatory share of renewable supply is 5.0% in 2018, and annual share is requested to expand, step by step, up to 2030. To facilitate renewable supply and account for the quantity of implementation, Renewable Energy Certificate (REC) is issued for the renewable generation and can be traded as a REC unit of 1 MWh. Therefore, the renewable supply in RPS can be evaluated as a multiplication of supplied renewable electricity and weight factor for the renewable option. As for the bioenergy supply, weight factor for REC is applied with 1.0 for typical bioenergy, 0.5 for landfill gas and 1.5 for biomass power generation not applied to co-firing, respectively. In 2017, bioenergy contribution share to the renewable energy target requested from RPS scheme reached 36.6%.

Table 5: *Bioenergy supply share in Korean RPS scheme*

Index	2013	2014	2015	2016	2017
Renewable supply target (kREC)	10,897	12,905	13,839	16,970	18,975
Implementation result (kREC)	10,897	12,905	12,486	15,377	17,626
Bioenergy supply result (kREC)	1,211	4,153	4,946	5,655	6,449
Bioenergy contribution (%)	11.1%	32.2%	39.6%	36.8%	36.6%

Source: 2017 RPS Implementation Report (Korea Energy Agency)

LINKS TO SOURCES OF INFORMATION

Press release on the 8th basic plan for long-term electricity supply and demand in South Korea, MOTIE, 2017.12.14: https://english.motie.go.kr/www/main.do

Renewable Portfolio Standard (RPS), Renewable Fuel Standard (RFS) in South Korea: https://www.energy.or.kr/renew_eng/new/rfs.aspx

New and Renewable Energy Statistics in South Korea: https://www.knrec.or.kr/pds/statistics.aspx

2016 NRE Industry Report in South Korea (KEA, Sep. 2017)

2017 RPS Implementation Report (Korea Energy Agency)

Korea energy statistics: https://www.knrec.or.kr/pds/statistics.aspx (in Korean)