Midterm project

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Country: South Korea

Course sustainable net zero energy emission enabling

Taks 1: Energy balance for the year 2020

Data for the energy balance table for the year 2020 has been taken from IEA world energy balance and statistics 2022 [1].

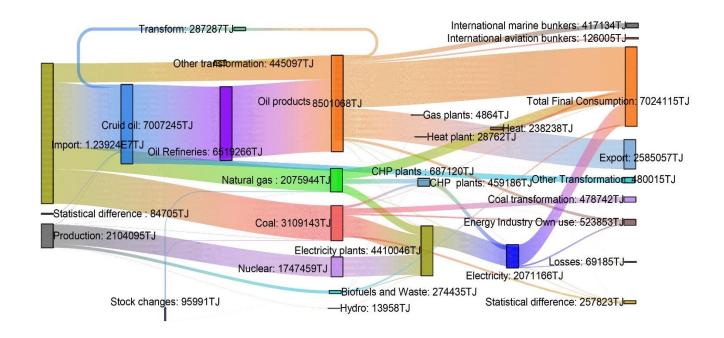
All the data is in Tera Joule (TJ).

South Korea Energy Balance Table-2020

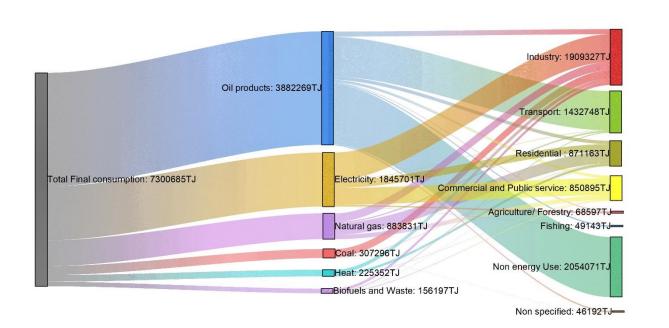
	Coal	Crui d oil	Oil Prod uct	Natur al Gas	Nucl ear	Hy dro	Solar, Wind, other	Biofuels and waste	Elect ricity	He at	Tota I
Production	197 53	407 83	0	6940	174 745 9	13 95 8	102212	273038	0	216 4	2206 307
Import	305 249 5	563 583 6	1691 887	2012 136	0	0	0	0	0	0	1239 2354
Export	0	- 270 4	- 2582 353	0	0	0	0	0	0	0	- 2585 056
International marine bunkers	0	0	- 4171 34	0	0	0	0	0	0	0	- 4171 34
international aviation bunkkers	0	0	- 1260 05	0	0	0	0	0	0	0	- 1260 05
Stock changes	368 95	- 526 0	6442	5265 4	0	0	0	-1397	0	0	8933 4
Total primary energy available	310 914 3	566 865 6	- 1427 162	2071 730	174 745 9	13 95 8	102212	271641	0	216 4	1155 9801
Transformation	0	287 287	- 2528 89	0	0	0	0	0	0	0	3439 8
statistical differences	- 175 961	833 08	- 2094 7	- 3446 9	0	0	0	1397	- 2143 4	- 501 2	- 1731 17
Electricity plants	- 2E+ 06	0	- 2952 0	- 7520 67	- 174 745 9	- 13 59 8	-90311	-72717	1823 762	- 114 4	- 2676 955

CHP plants
Heat plants 0 0 -2527 -3527 0 0 0 -22708 0 90 Gas plants 0 0 -4864 4214 0
Gas plants 0 0 -4864 4214 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Coal transformation 742
Coal transformation 478 0
plants other transformation 0
transformation 0 015 4450 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Energy industry own use 132 0 2439 -5644 0 0 0 0 1370 454 0 0 0 0 1370 454 0 0 0 0 1370 454 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Total final 307 3882 8838 1845 225
Total final 307 0 3882 8838 0 0 11901 156197 1845 225
consumption 296 269 70 0 0 11901 130197 701 352
Consumption 296 269 70 701 352 Industry 276 890 1724 92 2904 34 0 0 285 96957 96957 9445 54 128 54
Transport 0 0 $\frac{1348}{708}$ $\frac{4503}{3}$ 0 0 0 27232 $\frac{1177}{5}$ 0
Residential 985 4 0 1167 3999 0 0 2450 5042 2551 844 68 55
Commercial and public 0 0 8912 1484 0 0 7876 26815 5736 128 services 5736 128
Agriculture/for 0 0 1862 40 0 0 1296 151 4981 0 estry
Agriculture/for 0 0 1862 40 0 0 1296 151 4981 0
Agriculture/for estry 0 0 1862 40 0 0 1296 151 4981 7 0 151 7 0 151 1074 0

Shankey diagrams for the year 2020:



Shankey diagram for energy supply 2020



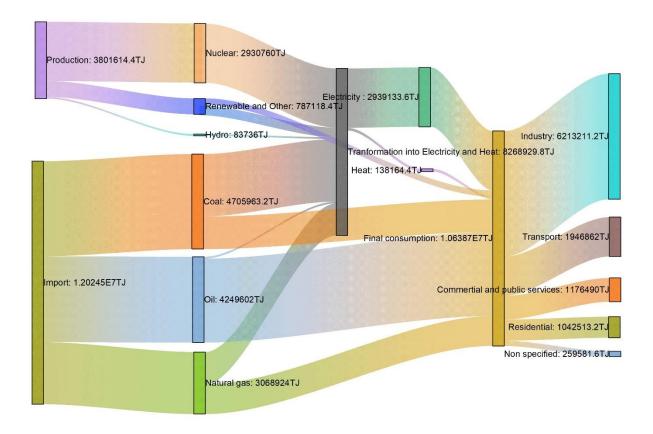
Shankey Diagram for energy consumption 2020

Task 2: Energy balance table for the projected year 2035:

The data for the projected year 2035 has been taken from the South Koreas master energy plan outlook and policies to 2035 [2], all the data was in million Tones oil equivalent (millions Toe) which was converted into Tera Joule (TJ).

South Koreas Projected energy balance table for 2035

	Coal	Oil	Natural Gas	Nuclear	Hydr o	Renewable and other	Electricity	Heat	Total
Production	0	0	0	29307 60	8373 6	787118.4	0	0	3801 614.4
Import	470596 3	42496 02	30689 24	0	0	0	0	0	1202 4489
Total primary energy available	470596 3.2	42496 02	30689 24.4	29307 60	8373	787118.4	0	0	1582 6104
Transforma tion into electricity and heat	309404 5	- 92109. 6	- 15909 84	- 29307 60	- 8373 6	-477295.2	2939133. 6	1381 64.4	
Total final consumtion	161191 8	41574 92.4	14779 40	0	0	309823.2	2939133. 6	1381 64.4	1063 8659
Industry Transport									6213 211.2 1946 862
Residential Commercial public servic Non specified									1042 513.2 1176 490 2595 81.6



Shankey diagram for projected year 2035 energy flow

Task 3: 1.Is the country on right path towards achieving net-zero emission by 2050

From the comparison of energy balance table for year 2020 and projected year 2035,

It seen that the share of renewable energy for the year 2020 in total energy supply without nuclear was about 3.5% of total primary energy supply and share of nuclear energy was about 15.11%. and for the projected year 2035 the share of renewable energy without nuclear will be 5.5% and share of nuclear energy will be 18.51% of total energy supply, it depicts that the transition towards the renewable energy supply will be at very low growth rate.

Similarly, share of renewable in final energy consumption for the year 2020 without the nuclear was 2.29% and for projected year in2035 will be 2.912%, which depicts negligible amount of increment of renewable in final energy consumption although in the generation of electricity and heat the amount of renewable is significant.

Above analysis depicts that country is transitioning with a very growth rate towards renewable energy, which is not sufficient achieve net zero by 2050.

2. Analysis of existing policies, laws to address climate change and emission reduction

- Low price policy has reinforced the energy consumption pattern and the disproportionate use of certain types of energy like electricity has been accelerated.
- Serious problems are occurring due to the electrification of energy consumption, during the generation and transmission process has a significant amount of energy loss happens which is about 63% [2].
- For electricity the sudden increase in demand may result in imbalanced supply demand profile if the supply infrastructure is insufficient.
- Expansion power of generation facilities will results in environmental degradation and transmission network overloading.
- Creation of new markets in less economical areas for renewables and smart grid are limited due to low electricity prices.
- A large scale centralise supply infrastructure was expanded to fulfil growing demand instead of reducing demand by aggressive measures. This expanded supply infrastructure results in expanded grid, large power generating facilities which further imbalance supply demand.
- A narrow focus on efficiency during the rapid growth of the nuclear power industry has been seen.

3. Measures and strategies to accelerate progress towards net zero emissions

- Reorient the energy policy to emphasize innovation in demand management, it will be achieved by improving energy efficiency by sector and optimised use of energy sources.
- Need to rationalise the energy pricing system, it will help in increasing the productivity of energy systems.
- Need to revitalise the demand management market.
- Need to increase the distributed power supply share and Improvement in power grid resilience
 which helps to reduce the imbalance in supply demand due to sudden demand increment in peak
 hours.
- Transition towards renewable and safe energy should be at a higher growth rate to achieve the net zero emission by target year 2050.
- Need to extend the deployment of renewable energy policies to power generation, heat generation, transport sectors. Also implementing a private sector driven deployment system.

4. Potential challenges country will face while transition towards net zero emission

• In South Korea the coal, oil and natural gas domestic production covers only about 1% of total energy demand [3]. Due to high dependency on imported energy supply, South Korea's energy policy need to focus on energy supply security.

• As high dependency on fossil fuel-based energy supply, South Korea will face difficulties in transitioning towards renewable energy sources as the current share of renewable is very less compare to fossil fuel-based energy supply.

References

- [1] "IEA world energy balance and statistics 2022," IEA.
- [2] "Korea energy master plan outlook and policies 2035," MINISTRY of trade, industry and energy south Korea.
- [3] "Korea energy policy review 2020," IEA.