A Simple Global Energy Model

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Model File (Excel)

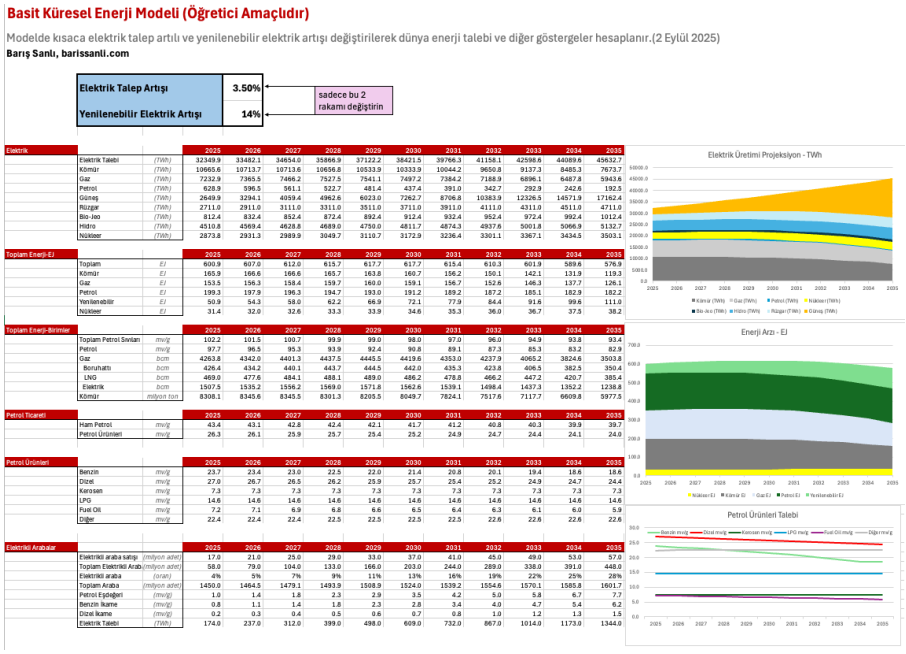
“All models are wrong, some are useful”, George Box, 1976

Modeling is one way to understand the global energy system and its future. These models rely on extensive data, specialized software, and regional optimizations. Very few models have open data and software. However, recent debates have shown us that all models are political.

Because models don't naturally favor coal or renewables . Different future scenarios can emerge, sometimes based on price, sometimes on political targets (climate targets declared by governments). But what does a non-political model entail? The first answer is open source, data, and understandability.

This article and the associated model file [1]are intended to allow users to easily view the content and operation of a simple global energy model and obtain results. Therefore, the model is both open source and open data. Furthermore, because the model weights are visible, it is a "non-political" model.

Simple Global Energy Model



[1]https://www.barissanli.com/calismalar/2025/DIY-EnergyOutlook.xlsx

No matter how complex and expert-infused a model, if it ultimately predicts a guaranteed oil future or a net-zero outcome, it's essentially a case of numbers being combined with political objectives. If the model is constructed this way, the political objectives, not its reality, are the outcome of the model.

In the Simple Global Energy Model, the two most important variables that will shape the future are highlighted so that everyone can easily understand the situation. These are:

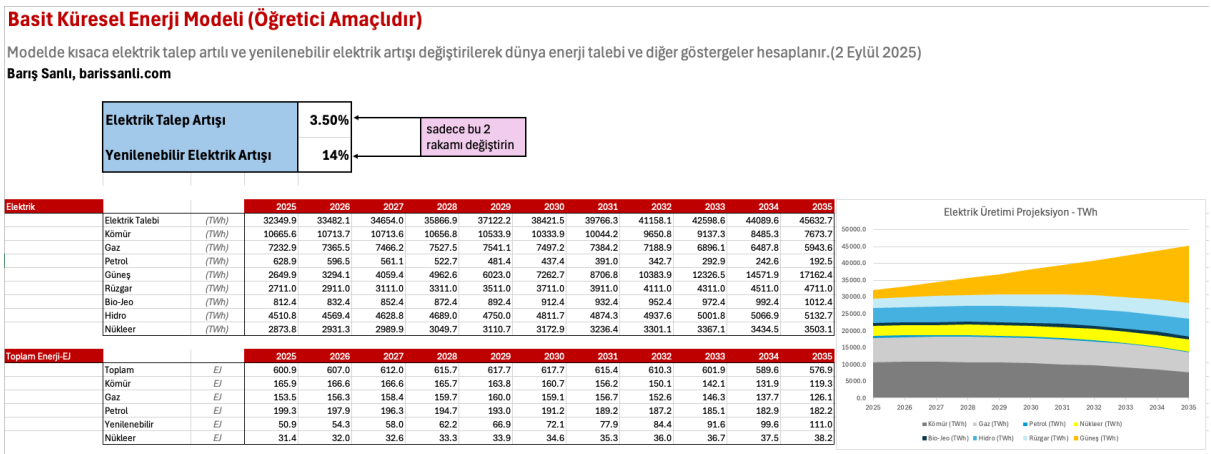
1. Electricity demand growth
2. Renewable electricity growth (excluding hydro)

Indeed, the two most important parameters in the energy system in the coming period are the increase in electricity demand and the increase in renewable electricity production. Oil and other parameters, on the other hand, are actually more stable year-to-year. For example, estimating a simple year-to-year increase in oil demand of 0.5-1 mb/d over the next 10 years can yield results as good as the most expert model. However, more expert models arrive at a result by multiplying and adding together the lengths of cars, vehicles, and roads.

Model Study

In the model, there are two variables taken from the user:

1. First, the electricity demand growth is calculated from the given electricity demand growth rate up to 2035.
2. Then, the increase in electricity production from renewables is calculated and subtracted from the total electricity demand.
3. If the electrification assumption is correct, coal and gas are calculated with a multiplication factor since a significant portion of other fossil fuels will already be used in electricity generation.
4. The impact of electric cars is excluded by assuming that product demand will be stable in oil demand. Then added on to the existing demand.



Basit Küresel Enerji Modeli (Öğretici Amaçlıdır)

Modelde kısaca elektrik talep artılı ve yenilenebilir elektrik artışı değiştirilerek dünya enerji talebi ve diğer göstergeler hesaplanır.(2 Eylül 2025)

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Elektrik Talep Artışı	**3.50%**
Yenilenebilir Elektrik Artışı	**14%**

sadece bu 2 rakamı değiştirin

Elektrik			2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
	Elektrik Talebi	(TWh)	32349.9	33482.1	34654.0	35866.9	37122.2	38421.5	39766.3	41158.1	42598.6	44089.6	45632.7
	Kömür	(TWh)	10665.6	10713.7	10713.6	10656.8	10533.9	10333.9	10044.2	9650.8	9137.3	8485.3	7673.7
	Gaz	(TWh)	7232.9	7365.5	7466.2	7527.5	7541.1	7497.2	7384.2	7188.9	6896.1	6487.8	5943.6
	Petrol	(TWh)	628.9	596.5	561.1	522.7	481.4	437.4	391.0	342.7	292.9	242.6	192.5
	Güneş	(TWh)	2649.9	3294.1	4059.4	4962.6	6023.0	7262.7	8706.8	10383.9	12326.5	14571.9	17162.4
	Rüzgar	(TWh)	2711.0	2911.0	3111.0	3311.0	3511.0	3711.0	3911.0	4111.0	4311.0	4511.0	4711.0
	Bio-Jeo	(TWh)	812.4	832.4	852.4	872.4	892.4	912.4	932.4	952.4	972.4	992.4	1012.4
	Hidro	(TWh)	4510.8	4569.4	4628.8	4689.0	4750.0	4811.7	4874.3	4937.6	5001.8	5066.9	5132.7
	Nükleer	(TWh)	2873.8	2931.3	2989.9	3049.7	3110.7	3172.9	3236.4	3301.1	3367.1	3434.5	3503.1

Toplam Enerji-EJ			2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
	Toplam	EJ	600.9	607.0	612.0	615.7	617.7	617.7	615.4	610.3	601.9	589.6	576.9
	Kömür	EJ	165.9	166.6	166.6	165.7	163.8	160.7	156.2	150.1	142.1	131.9	119.3
	Gaz	EJ	153.5	156.3	158.4	159.7	160.0	159.1	156.7	152.6	146.3	137.7	126.1
	Petrol	EJ	199.3	197.9	196.3	194.7	193.0	191.2	189.2	187.2	185.1	182.9	182.2
	Yenilenebilir	EJ	50.9	54.3	58.0	62.2	66.9	72.1	77.9	84.4	91.6	99.6	111.0
	Nükleer	EJ	31.4	32.0	32.6	33.3	33.9	34.6	35.3	36.0	36.7	37.5	38.2

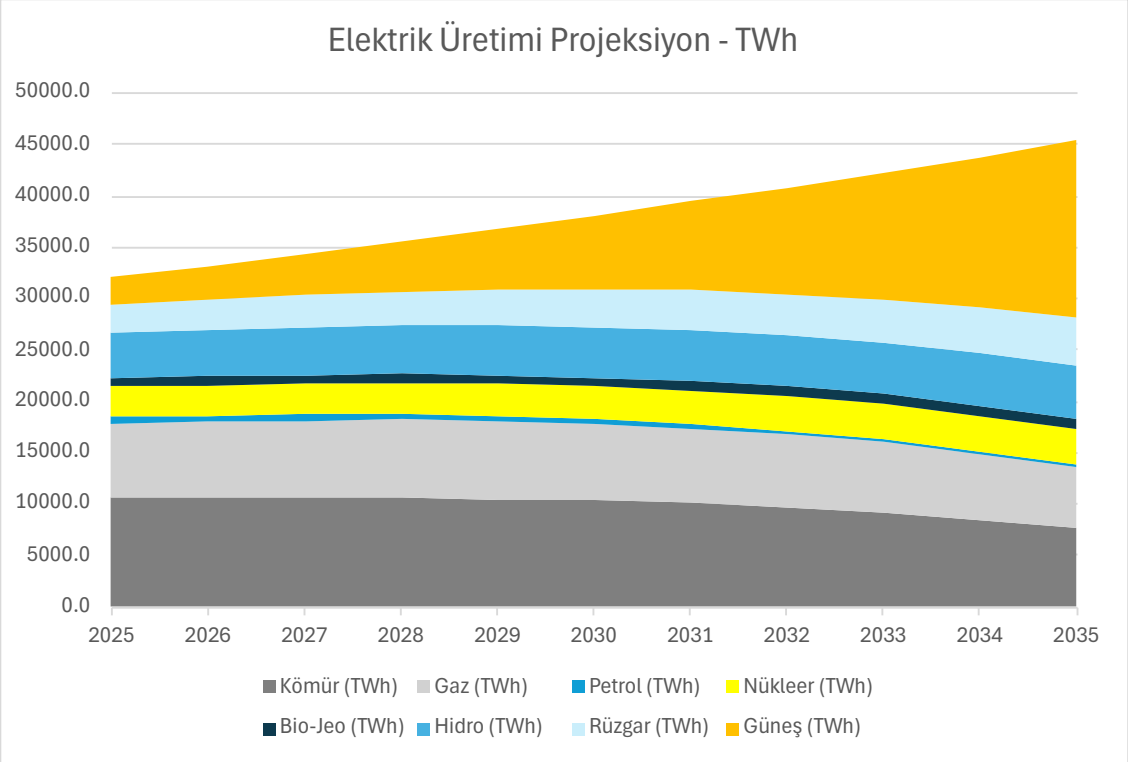
In addition to the model

- Distribution of global emissions by fuel
- The development of global oil and petroleum products trade, rate-based
- In gas, LNG and pipeline gas trade volumes are also calculated on a rate basis.

Energy as a data set Institute statistical evaluation was used [2]. Generally, figures from the last two years were used for rates and growth. Because the COVID-19 period also entered the last five years, this figure may not be very reliable. Therefore, it was thought that the last two years would better reflect recent technological advancements.

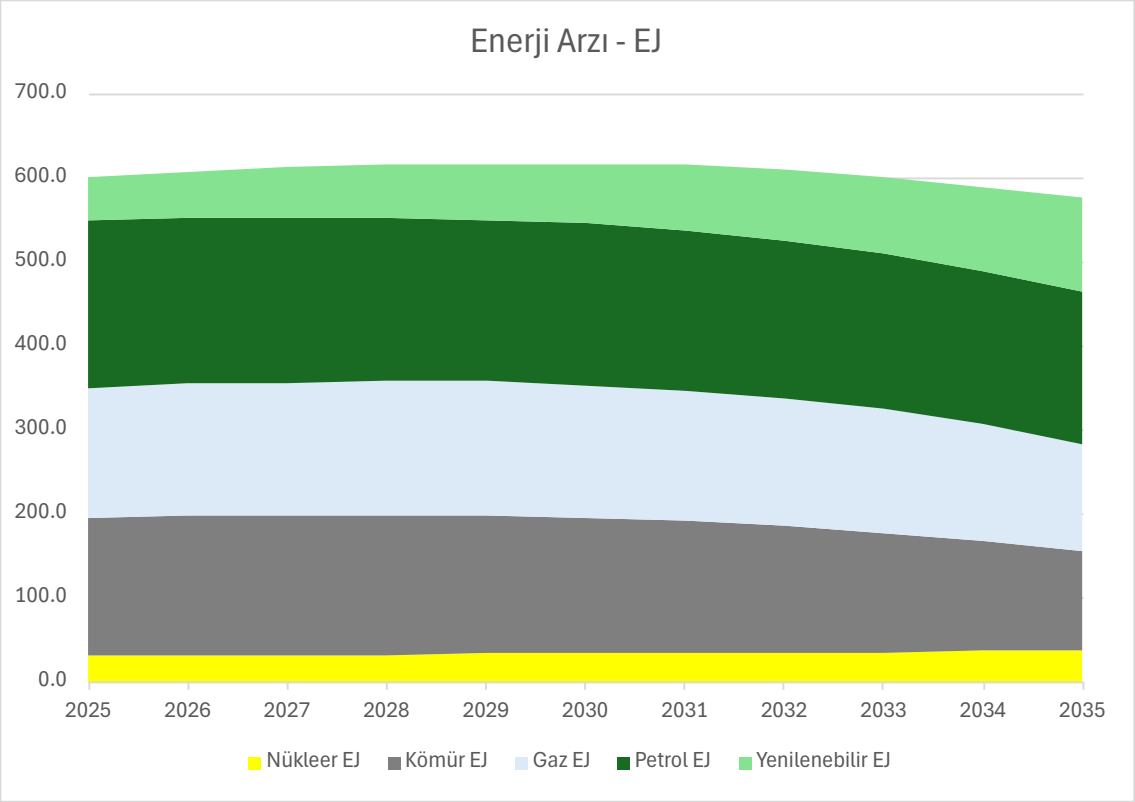
What is the Purpose?

There's a single key parameter in the transformation of the global energy system: the impact of renewable electricity production. This factor, which also influences the development of other fuels, is the primary determinant of electricity demand growth. So, what is the impact of this "key input" on other factors?

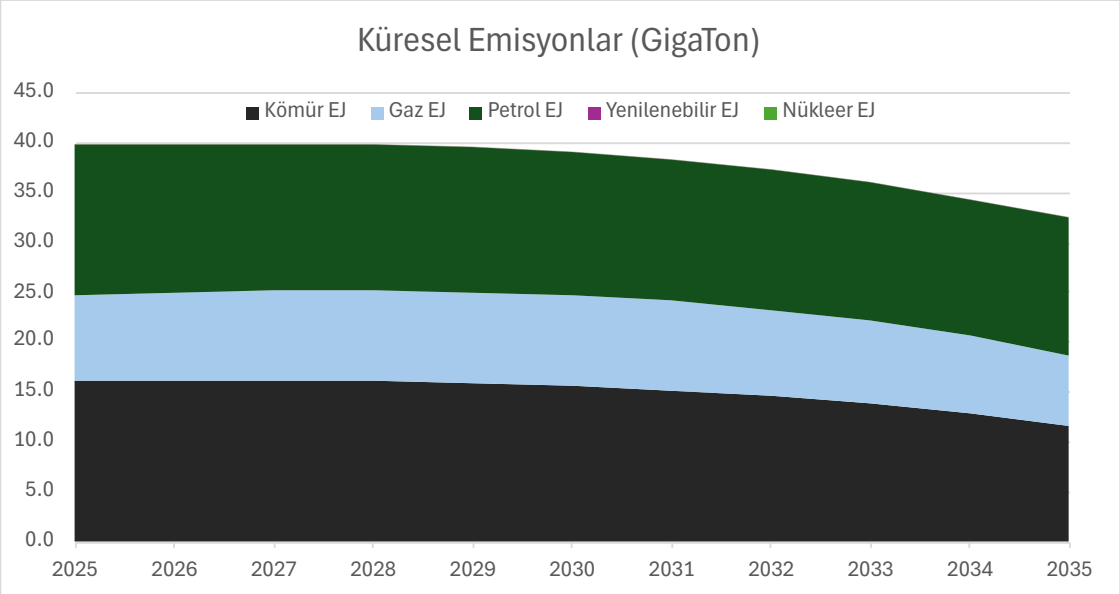


As an example, the impact of a 14% increase in renewable electricity production on total energy demand is shown below. Given that electricity will already account for a larger share of demand, the share renewables take from other fossil resources will also be reflected in total energy demand.

[2]https://www.energyinst.org/statistical-review



the average carbon emissions per ExaJoule (EJ).



The biggest advantage of calculating these data together is that it creates an idea of how the global system will be shaped with a single parameter, without the need to put together a scenario again.

Model Outputs

The model calculates 6 graphs and some side variables. These 6 graphs

1. Electricity production projection
2. Energy Supply
3. Demand for petroleum products
4. Total Energy Ratios (Fuel Based)
5. Ratios in Total Electricity Production (Fuel-based)
6. Global Emissions.

There are also variables calculated based on ratios. Figures from the IEA's latest Global Electric Car Outlook are used for the electric car section [3]. For example, the IEA estimates that 58 million electric cars replace 1 mv/g of fuel, with 80% of this being gasoline and 20% being diesel.

Additionally, the proportion of LNG and pipeline trade in gas demand was taken constant at 2023-2024 rates and carried forward. Similarly, many other datasets were also processed in this manner.

Fallacies in the Model

In real life, these models are created by aggregating the demand across sub-sectors and the fuel needs to meet it. Furthermore, to maintain neutrality in the oil-side modeling, growth rates for gasoline and diesel were not included. Therefore, it appears that oil demand will no longer increase. However, oil demand may continue to rise. For example, the fact that gasoline demand has not yet stabilized could be a sign.

Additionally, at many points, the ratio of fossil resources used for electricity, such as coal and gas, to the consumption of that resource in the overall energy system is taken as a constant. The user can change this.

The model's main objective is to see the entire global energy system as it appears if the parameters for 2023-2024 were to proceed in the same way, making these errors acceptable. Indeed, even the most experts in the field, even with the most advanced models and comprehensive data, disagree on the future of energy system [4].

Similarly, it's mathematically difficult to achieve 14-15% growth in renewable electricity generation over 10-15 years. This is because, as production increases, investments must increase even faster to achieve 10-15% production. Therefore, a fixed increase could have been used instead of a percentage increase.

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[33]https://www.iea.org/reports/global-ev-outlook-2025

[4]https://www.bloomberg.com/news/articles/2025-08-28/exxon-says-global-emissions-goals-have-slipped-as-coal-use-rises

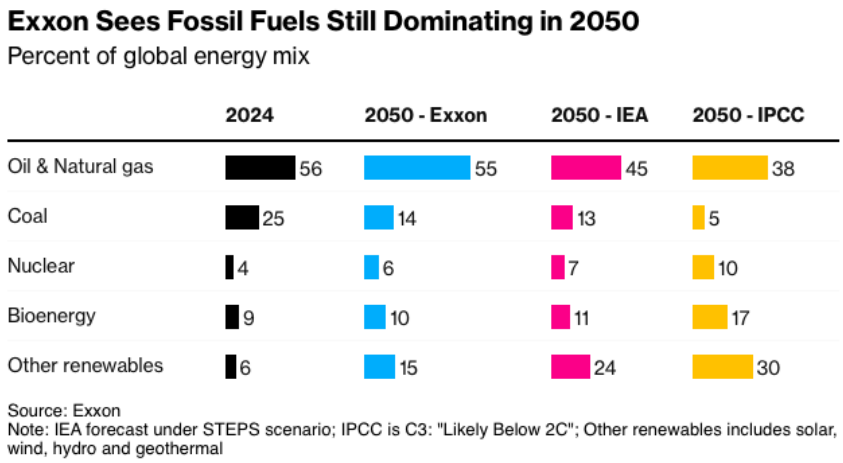

Figure 1- Ratios in future forecasts of different institutions

Results

The number of possible outcomes in the model is virtually infinite; only two scenarios will be highlighted. These relate to the rate of increase in renewable electricity generation. In the scenario that projects a continuation of this momentum in 2023-2024, the model defaults to a 14% increase in solar and wind. This reduces emissions, total energy consumption, and so on .

But when this ratio in the model is reduced from 14% to 10%, the decrease in emissions and the change in energy demand stop.

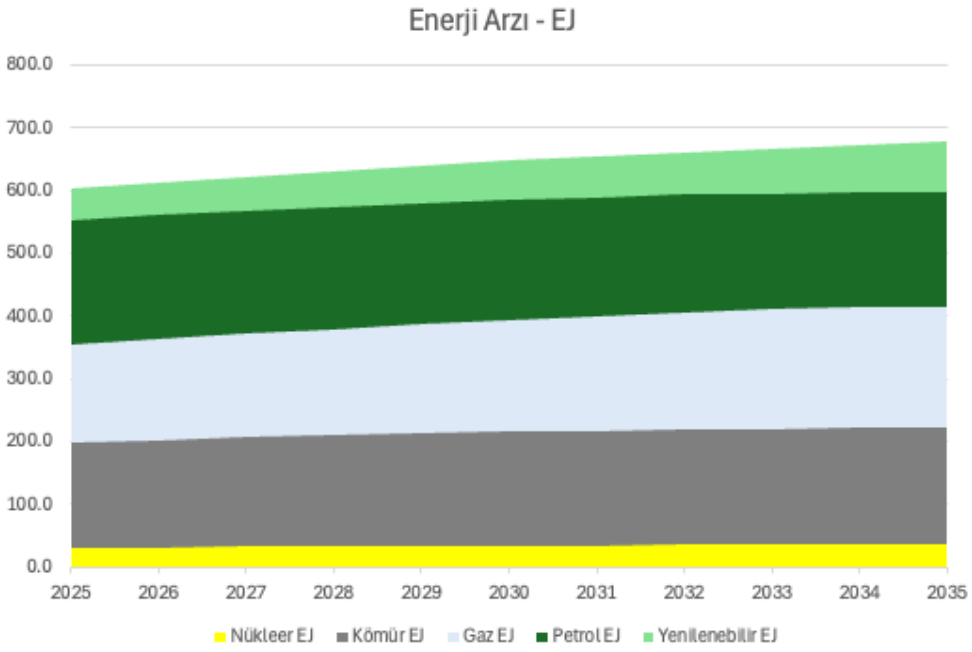

Figure 2- If electricity production from renewables increases by 10% instead of 14%, the energy supply

While making these calculations, the assumption that electric car sales will increase by 5 million from year to year (from 17 to 22, from 22 to 27 million vehicles/year) was maintained.

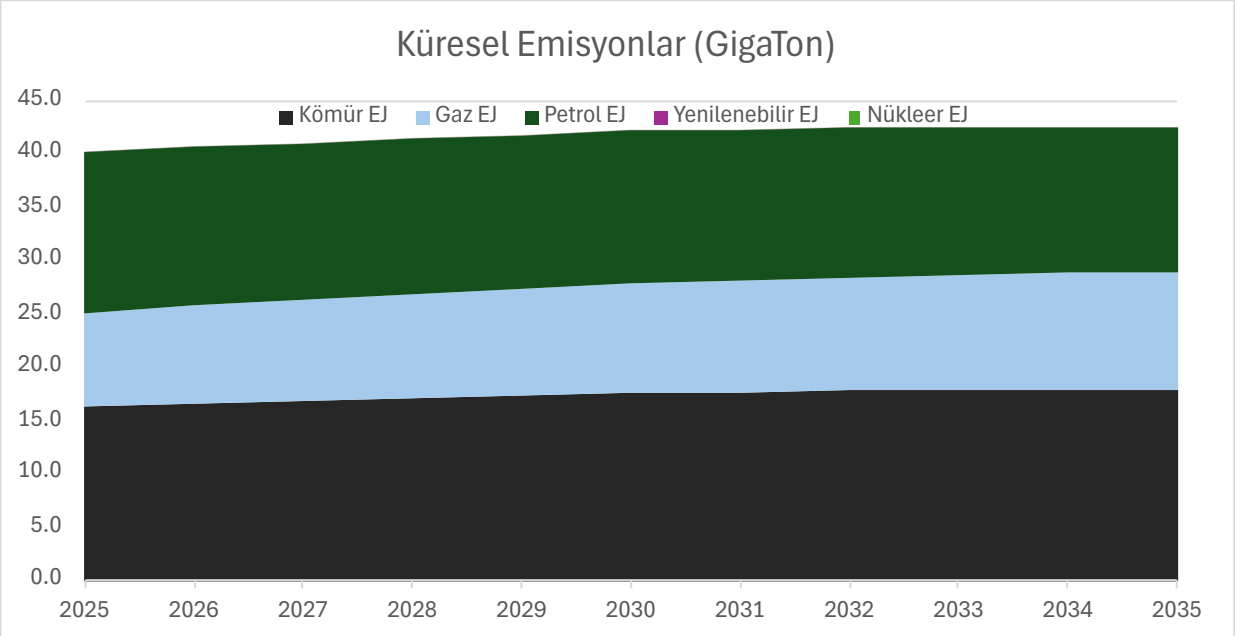

Figure 3- If electricity production from renewables increases by 10% instead of 14%, the emission change

As mentioned earlier, all models are wrong, but some are useful. The simple global energy model in this single-sheet Excel file is also useful for illustrating such simple results. At least it doesn't incorporate the highly political agendas of coal, oil, or green activists.