High Gas Dependence for Power Generation – the Case of Türkiye:

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In a study about Thailand's energy markets, the author tried to analyze dependency of gas on electricity generation and the cost of such a dependency on the country's economy. That study inspires our study. As known, gas is very important source in Turkish generation mix and most of the gas is imported. In other words, we see similar conditions with Thailand's case.

In this study, we focus on 2015-2021 period due to healthy and consistent data constraints. In the first part, the study focuses on some figures about Turkish gas and power markets such as imported gas share in total, total gas consumption of the country and gas dependency in power generation. In the second part, we calculate total gas bill of Türkiye and put its relation with other parameters like total GDP and total energy consumption and we try to discuss the outputs. In the final part, we share general discussion about the figures.

Let's start with trend in Turkish gas consumption, as a developing country, Türkiye's gas consumption increased in 2013-2021 period. Details can be seen in the graph.



Graph-1: Total Gas Consumption of Türkiye (2013-2021) (millions sm3)

Source: EMRA's annual reports

Türkiye's gas consumption increased %30 between 2013 and 2021. As known, not only the level consumption but also the way of meeting that demand is also important in energy supply security approach. In that sense, we look production/import balance in gas. The figures shared in graph below.



Graph-2: Share of Gas Import and Gas Production (2013-2021)

Source: EMRA's annual reports

As seen from the graph, the gas is a pure imported goods for Türkiye. Taking that situation under consideration, we also need to look diversification level of Türkiye in energy supply security perspective. The state of diversification can be seen in the graph.





Source: EMRA's annual reports

Russia is the largest gas supplier with declining share, but Russia continues to keep its importance. Moreover, gas coming from Azerbaycan and spot LNG are balancing tools for Türkiye to limit dependency on Russia. The picture confirms the importance of both TANAP pipeline and investments on FSRU/LNG facilities for Turkish energy supply security. Thanks to those moves, Türkiye is able to balance dependency of Russia, on the other hand, Russia's

share is still very high and supply coming from Iran, the second largest supplier of Türkiye, is technically unreliable.

Türkiye uses one third of its gas in power generation. The rate was %45,85 in 2023, while the share reduced %34,81. The gas dependency in power generation is another parameter that should be taken under consideration. In that sense, we look the share of generation coming from gas-fired plants in total.





Source: EXIST

As seen, the share of generation of gas-fired power plants reduced from %43 to %33. Hydro generation (mostly dams) seemed to offset the reduction, furthermore, we can state that there is substitution relation between gas-fired plants and hydro power plants (dams). On the other hand, we see weaker relation between coal-fired plants and gas-fired plants, in spite of the increase in the share of generation based on coal. At that point, it is possible to discuss the impact of incentive given for generation based on domestic coal. When we come to other renewables such as wind and solar, although we see stable increase in the share, the increase did not substitute the power generated from gas. On the other side, we can conclude that thanks to increase in wind, solar and other renewables, the increase in the share of gas plants was limited.

Dependency on gas in terms of power generation brings three risks. First, the gas may be the most political commodity in the world and the dependency on imported gas and lack of supplier diversification may reduce the bargaining power of Türkiye with source countries like Russia and Iran. The second risk is associated with finance, in fact, the dependency on a commodity,

whose price is directly connected with exchange rates, may lead to high energy bills in the case of unstable exchange rates. Finally, we can talk about the risk of sustainability, even though gas seen as a "transition fuel", high dependecy on the gas may be an obstecle before Türkiye's climate and sustainability targets.

When we calculate gas bill for Türkiye, we need to look two parameters the price of gas used in power generation and the amount of gas used in power generation. The graph below indicates development of those parameters.



Graph-5: The Amount and The Price of Gas Used in Power Generation (2015-2021)

Source: EXIST and İGDAŞ¹

As known, the use of gas reaches its peak in July-August and Hanuary-Febrary periods as a result of increasing demand. When we consider graph-4 and 5 together, we see that the degree of drought determines the amount of gas used in power generation. That is a critical factor that drives up Turkish gas bill.

In terms of price, we apparently see a structural break in August 2018 in the pricing mechanism. August 2018 when BOTAS began to use more "cost based pricing" approach. We can state that due to unstable exchange rate, the gas price increased.

The gas bill of Türkiye associated with power generation and its share in Türkiye's GDP shared below.

¹ Due to lack of histrical data, we use İGDAŞ's historical price tariff for the gas used in power generation. We take multiplie-stage structure of tariff, so we average each price of relevant stage.



Graph-6: The Gas Bill of Türkiye and Its Share in GDP

Unfortunately, despite all efforts (increase in renewables, diversification (TANAP/LNG/FSRU), the gas bill in 2021 is higher than the gas bill in 2015.

The dependency on gas in power generation affects the energy intensity of general economy. The table below shows the energy intensity.

Year	Türkiye's GDP (\$)	Electricity Generation (TOE)	Energy Intensity
2015	864.000.000.000	22.906.464,90	0,00003
2016	869.000.000.000	25.590.558,51	0,00003
2017	859.000.000.000	27.258.058,65	0,00003
2018	759.000.000.000	28.569.082,14	0,00004
2019	778.000.000.000	27.813.797,84	0,00004
2020	720.000.000.000	27.778.516,68	0,00004
2021	819.000.000.000	30.565.977,80	0,00004

Table-1: Türkiye's GDP, Electricity Generation (TOE) and Energy Intensity

Source: EXIST and the Ministry of Energy and Natural Resources

Both TOE of power generation and energy intensity have increased in 2015-2021 period. Rise in use of gas and coal in power generation seems to contribute to the output. On the other hand, renewables such as solar, wind and other ones have met the increasing demand.

In conclusion, gas will keep its importance in Turkish generation mix in short term, because we expect more arid climate and that will reduce hydro potential of the country, which is the most powerful balacing of gas use. Furthermore, increasing penetration of renewables and distributed generation will increase the need of fast and reliable balancing mechanism. Gas-fired power plants may also have such a function in near future. Therefore, it does not seem possible to reduce the amount of gas used in electricity generation.

In that context, focusing on the price, the supply security and peak demand shaving measurements might be short terms options for our country. In terms of price, the increase in domestic gas production (Sakarya field) gives Türkiye an opportunity to reduce the price,

moreover, stable exchange rates also help Türkiye keep gas price under control. In the case of supply security, completing storage facilities and constituting necessary legal framework that makes Türkiye's gas market more attractive are other steps on the top of diversification efforts such as TANAP, LNG/FSRU facilities. Lastly, gas-fired plants meet the peak load in Türkiye and the picture in summer season confirms that statement, so methods like demand-side participation, energy efficiency projects that can reduce the peak demand should be promoted to reduce Türkiye's overall gas bill associated with electricity generation.