

# ***HOW CAN TURKEY BENEFIT FROM NATURAL GAS FIRED ELECTRICITY GENERATION?***

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## **Overview**

Current energy mix of Turkey exhibits the dominance of natural gas, and increasing demand for natural gas raises the question of overdependence to this source. Considerable debate has been ongoing regarding Turkey's dependence on natural gas fired electricity generation. However, if the current conditions of Turkey is taken into account, it can be observed that flexibilities of natural gas fired power plants may offer significant side benefits. These advantages are to be discussed under below headings:

1. Extensively diffused natural gas use into residential sector exhibiting significant seasonality, leads to difficulties in management of contractual obligations for natural gas importers which are usually agreed upon without much flexibility. Summer electricity peaks as a result of air conditioning requirements induces wider use of natural gas fired power plants and their climbed natural gas demand in an off-season against the expected use for heating purposes in winter flattens the gas consumption pattern and facilitates the monthly contractual quantity (MCQ) management.
2. By collecting water in their reservoirs, dam type hydroelectric plants seize the generation flexibility, and thus act as some sort of energy storage facility. If the hydro power plants do not seize the maximum benefit resulting from such flexibility, a sub-optimal result is achieved from a commercial and operational perspective since the invaluable water sources are misspent and overall cost reduction in peak hours is not realized. Considering the fact that reservoirs can be sustained for winter periods through the optimization of hydroelectric power plants and natural gas fired power plants in tandem, gas can be directed to residential use in winter periods without any electricity short-coming problem. This means, existence of natural gas fired power plants lessens the burden on hydroelectric power plants over the year and creates flexibility for utilizing at the most required periods.
3. Ancillary services are highly important for the electricity transmission system security and system operator maintains stability through orders given to the ancillary services capable power plants. Since the number of power plants with such capabilities are limited, sometimes large hydro sources are needed to be utilized for ancillary services resulting in valuable hydro sources, which are scarce and have ability to suppress the electricity prices with their competitive advantages, cannot be reserved for such cost optimization purposes.
4. Natural gas fired power plants support system security enhancing via their start-ups flexibility and ancillary service capabilities. In turn, they support the development of renewable generation with their backing up abilities.
5. Gas fired power plants participation in a natural gas demand response mechanism can act as a balancing factor in a market with limited storage and significant natural gas transit. The development of liberal gas markets in Turkey oils the wheels for integration with European natural gas markets. Geographical position of Turkey is significant as it serves as a transit route for new gas supplies from various sources around. There are many significant areas in the countenance of Turkey to benefit from contractual management if treated strategically

In order to give a good grasp of the close relation of electricity and natural gas, this paper provides a brief introduction of the said markets in Turkey at the beginning, and then strives to summarize issues related to natural gas that can create value if managed carefully. This part is supported with statistical analysis and simulation studies concerning the mentioned issues. The final section summarizes the asserted ideas based on the results obtained throughout the studies and extensive research in the field and consequently structures constructive recommendations for the Turkish Natural Gas Market.

## **Methods**

In order to assess the natural gas and electricity market dynamics of Turkey, various analysis methods are applied on the relevant market data. Since price signal is the key element for investment decisions, impacts of natural gas fired power plants on renewable energy development are investigated by long term market simulation and price forecasting via stochastic dual dynamic programming which includes autoregressive hydro modelling. Technical capabilities of natural gas fired power plants are simulated and analyzed through mixed integer linear programming model under the given predicted electricity prices. Forecasts for the future natural gas prices are conducted using the linear programming based natural gas price forecasting models.

## Results

Natural gas demand patterns analyzed exhibit that the demand characteristics of different segments help managing the annual and monthly contracted quantities. Considering the availability of hydro sources and natural gas in different seasons, hydro sources can be optimized and could be saved for the most required periods. Historical data suggests gas fired electricity generation plants have played important roles in peak shaving, rapid response in times of dispatch irregularities due to renewables, and supply projections together with market expectations confirm the continuity of this role.

Within the presence of a liquid Turkish gas trading platform, supply abundance backed up with technically adequate connections with Europe would assist in creating a gas to gas price competition. Studies also indicate that natural gas fired power plants create signals for future development of the supply stake.

## Conclusions

This study just reminds that if managed wisely, considering the current conditions of Turkey, benefits of gas fired power plants can be seized and does not overrule the renewable expansion; on the contrary, paves the way for development. The authors' aim in this paper is to extract the maximum benefit from the current investments in Turkey and minimize the deadweight losses occurring from the avoidable events by better management and strategies. Instead of criticizing and blaming the presence of natural gas fired power plants, the authors seek to find ways to benefit from these already made investments and investment commitments.

Especially, in a period when European authorities are looking for ways to keep natural gas fired power plants alive in order to enhance supply security and quality, additional supply development is important for Turkey. As the increasing and urbanizing population of Turkey is taken into account, electricity and gas demands are expected to climb. Foreign energy dependency is something that needs to be managed and Turkey needs highly efficient market mechanisms, robust energy diplomacy and contract management tools to cope with its energy problems. Natural gas fired power plants corresponds to large share of the market but can serve for better market structure if cleverly utilized. Compared to Europe, where power generation investments are rare or stagnant, Turkey is advantageous with its developing supply stake; however, the regulatory and market environment should be shaped to enhance this advancement.

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