Regulators from Armenia, Georgia, and Kosovo Use Demand Forecasting Tools to Promote Informed Infrastructure Investment

August 2023 – When it comes to planning for future energy needs, demand forecasting is essential in helping regulators, utilities, and grid operators make decisions about how to ensure a balance between supply and demand. Underestimating demand can lead to supply shortages with the potential to inhibit productivity and economic growth, while overestimating demand can lead to overinvestment in generation, transmission, or distribution capacity, as well as higher electricity prices.[1] Most importantly, there must be enough power generation when demand is at its peak to maintain reliable and affordable service, and sufficient transmission and distribution such as towers, lines, and substations to deliver electricity to consumers.[2]

With funding from the United States Agency for International Development (USAID) Bureau for Europe and Eurasia, the National Association of Regulatory Utility Commissioners (NARUC) has worked with the national regulatory authorities (NRAs) of Armenia, Georgia, and Kosovo to develop demand forecasting tools that provide insight on medium- to long-term demand for energy commodities based on historical timeseries data. This work supports USAID's U.S.-Europe Energy Bridge goal of promoting infrastructure investments by equipping NRAs in the Europe and Eurasia (E&E) region with the information needed to optimize costs, manage resources, and approve informed infrastructure investments that will contribute to power grids that are self-reliant, resilient, and can meet the electricity needs of consumers more efficiently.

The Benefits of Demand Forecasting in E&E Energy Sectors

As the E&E region looks to transition its energy system away from carbon-emitting fossil fuels, electricity demand is rising, with sales of electric vehicles (EVs) and heat pumps for homes and businesses up by more than 30 percent and demand for electricity in iron and steel manufacturing up by 17 percent.[3] At the same time, energy supply throughout the region has suffered from various constraints; the Russian Federation's war on Ukraine, low output from hydroelectric plants, and the decreasing supply of Russian gas have all contributed to a reduction in easily dispatchable power.[4] Efforts made to avoid future power shortages for consumers through investing in new generation capacity with a lower carbon footprint will benefit from the market scenarios that demand forecasting tools can provide. For instance, NRAs can use the inputs to estimate when, how much, and where renewable energy resources will contribute to the reliability of the power grid and plan to complement this capacity with that of more traditional generation resources to meet demand.[5]

The ability to use a demand forecasting tool is particularly helpful for NRAs in that they can cross-check their own data with the energy demand forecasts submitted by utilities and decide whether they are reasonable. For example, if a utility requests an increase in tariffs to support infrastructure expansion, the NRA can independently assess whether the expansion is necessary without having to rely solely on information provided by the utility. As the energy systems of many countries in the E&E region are dominated by regulated monopolies for distribution and transmission, secondary sources for demand forecasts are a necessary best auditing practice – in the United States, they are an industry standard for regulators. Gaining this level of self-sufficiency also helps the NRA to better guide the

development of its country's energy infrastructure and more effectively monitor and oversee the energy markets under its authority.

Per M. Hisham Choueiki, Principal Technical Advisor at NARUC, "A regulator that has the technical capability to independently generate a long-term forecast of energy demand/consumption is more effective in (1) evaluating a change in tariff application, and/or (2) assessing the reasonableness of a ten-year network development plan submitted by an electric or natural gas utility. Whether a regulator is evaluating a proposed rate design or assessing the reasonableness of an infrastructure investment plan submitted by a utility, it is essential to have confidence in the energy forecasts produced by that utility."

To explain how the tool's value is understood by regional beneficiaries, Ymer Rudari, Acting Head of the Tariff Department at the Energy Regulatory Office (ERO) of Kosovo, adds, "Whenever the regulator makes decisions, they must be convinced that these decisions are based on reliable analysis. Some of the benefits of using a demand forecasting tool are that it enables the regulator to independently analyze the long-term balance provided by utilities and the demand forecast provided by network operators during the review of investment plans. This enables the regulator as well as the operators to come to an agreement on whether the results are objective and sustainable."

Functionality of the Forecasting Tools

NARUC worked with the Georgian National Energy and water supply Regulatory Commission (GNERC), the Energy Regulatory Office (ERO) of Kosovo, and the Public Services Regulatory Commission (PSRC) of Armenia to develop demand forecasting tools in 2019, 2020, and 2021, respectively. Each of the tools uses a General Algebraic Modelling System (GAMS), runs via a Windows-based graphical user interface, and is tailored to the characteristics of each country's energy market. The tools make annual projections of energy consumption from 2010 to 2035, which are not only for the electricity market, but also for the complete energy mix of each country. They provide key energy sector metrics at a detailed level, such as:

- Energy demand by economic sector
- Modelling of energy efficiency possibilities
- Energy and electricity use
- Technological capacities
- Power generation
- Fuel prices and system costs from an end-user perspective
- Investments by sector and energy-related CO2 emissions

In addition, the tool estimates end-user electricity tariffs by sector based on commodity and grid costs as well as relevant taxes. Upon receiving this data, NRAs can then export the results into Excel-based files consisting of worksheets organized by the demand and supply sectors. To ensure that each NRA understood how to use and maintain the tools, between February and June 2023 NARUC provided additional training to GNERC, the ERO, and the PSRC on how to recalibrate the base year of the tools to reflect energy market developments (e.g., COVID-19 impacts, gas price spikes, etc.) and the availability of more recent energy balances.

The PSRC of Armenia is the latest partner to receive the tool for forecasting demand in their electricity and natural gas sectors. As the regulator is still working on integrating the tool, it has voiced enthusiasm about using all the features of the tool and gaining the capability to independently verify forecasts submitted by utilities. Meanwhile, the ERO of Kosovo noted that using the demand forecasting tool has been helpful in assessing long-term demand forecasts provided by grid operators, as well as for internal analysis by applying different scenarios that consider local and international policies related to renewable energy sources, efficiency, and taxes on CO2 emissions.

Revaz Geradze, Deputy Director of GNERC's Natural Gas Department, noted, "Starting from 2019, GNERC has used the demand forecasting tool for the long-term forecasting of yearly natural gas demand in Georgia. This has helped us in two ways: based on various scenarios, we are forecasting how demand for natural gas could develop in the future, and we are also double checking the aggregated demand forecast of the utilities. This gives us the opportunity to have a full picture of the system needs regarding sectoral demand and network development." He went on to say, "This tool gives us several opportunities. Reviewing individual utilities' demand forecasts is helpful in the framework of investment appraisal and the tariff setting process. Moreover, we can look at scenarios, based on different assumptions, which could change over time due to government policy, or any other circumstances that could affect behavior of the consumers and change demand or supply side factors."

Planning for the Future

With a combination of unprecedented energy supply constraints and the likelihood of growth in renewable resources such as solar, wind, and EVs, demand forecasting will become increasingly important to consumers in the E&E region to prevent future power outages and improve the reliability of electric service given the added variability and complexity of the grid. Further, by better understanding what energy infrastructure investments should be made to provide or secure supply, NRAs can also help to reduce costs for utilities and all consumers.[6] As the NRAs of Armenia, Georgia, and Kosovo work to ensure the security, affordability, and sustainability of their energy markets, USAID and NARUC will continue to support them in planning for the future and positively serving the needs of their citizens through demand forecasting.

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Photo Caption: Demand forecasting training with GNERC in April 2023. Photo Credit: NARUC

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[1] "Forecasting Electricity Demand." Saylor.org. https://learn.saylor.org/mod/book/view.php?id=61397&forceview=1

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[4] Ibid.

[5] Whaley, Jennifer and David Pope. "Load Forecasting: Ensuring supply meets energy demand." SAS Energy Practice. https://www.sas.com/en_us/insights/articles/load-forecasting.html

[6] Ibid.