

**Terms of Reference for SHURA's next study on  
"Battery Energy Storage Roadmap for Türkiye"  
SHURA Energy Transition Center  
İstanbul, Türkiye**

June 2023

## Background

Higher integration of renewable energy generation requires new flexibility and power management services for all functions in the power system, including generation, transmission and distribution. There are numerous ways to help integrate more variable renewable energy (VRE) into the power grid such as flexible generation, grid extension, interconnectors, smart grid technologies, and storage technologies as well as improving market design. Energy storage systems, especially batteries, represent key flexibility tools and are often considered to be pivotal for the Turkish energy transition. Considering the current Turkish power system, there is limited demand response participation in the market and Türkiye has also limited interconnection capacities to neighboring systems. The supply in Türkiye, at least for the time being, is also relatively inflexible. Considering the long-term plans in terms of flexibility, the Ministry of Energy and Natural Resources (MENR) has published the National Energy Plan, in which the installation of 7.5 GW/15 GWh battery storage capacity by 2035 is targeted. Meanwhile, a record number of battery storage applications (over 220 GW) were submitted to the Energy Market Regulatory Authority (EMRA) by the first quarter of 2023, after the government passed legislation to increase domestic storage capacity.

SHURA's battery storage study that was published in 2019 investigated four battery technologies (lead acid, lithium ion, flow, and high temperature), and considered current technologies, market, costs and investments, barriers and innovations. A 2023 study conducted by SHURA investigated Türkiye's net zero emissions pathway with a focus on the electricity sector<sup>1</sup> and demonstrated that battery energy storage capacities could reach 30 GW/120 GWh by 2053. The study also shows that Türkiye's power system could be completely decarbonized by 2053, with wind and solar supplying 77% of total electricity demand.

Many countries are investigating support mechanisms (e.g., subsidies) along with market reforms to accelerate the deployment of behind-the-meter (BTM) and grid-scale battery energy storage systems. Several battery storage technologies have emerged that promise high efficiencies, long lifetimes, and encouraging performance ratios. To align public policies with research and development efforts related to battery energy storage use, it is crucial to understand which technologies and applications could provide the highest added value for Türkiye in the future and to identify possible synergies between different sectors, e.g., transport. It should be noted that battery systems are expected to be a crucial component in the energy transition of the transport sector, and therefore, such interactions should be included in any future R&D strategy. In that regard, this study aims to develop a roadmap for battery energy storage solutions and their area of service in the power and transport sectors considering the medium (2035) and long (2053) term milestones presented in the SHURA's net-zero roadmap study. The study will consider both grid-scale and BTM applications and provide an outlook into the technology, capacity, site selection, cost, and technical specifications for relative applications. The study will conclude with a discussion on the policy frameworks and strategies that can potentially provide the highest added-value in the integration of battery energy storage systems into the Turkish power system.

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<sup>1</sup> Net Zero 2053: A Roadmap for the Turkish Electricity Sector

## Objective and tasks

The study investigates a mid and long-term roadmap for Türkiye regarding the implementation of battery energy storage systems including the most suitable technological options, site selections and applications as well as policy options to ramp up the battery storage capacity in Türkiye. The study assesses different battery storage technologies against competing flexibility options in terms of costs, applications and services considering that the Turkish power system is expected to continue to grow while becoming increasingly dominated by renewables. The study will estimate the required investment needs and identify policies for incentivizing storage investments in the medium and long terms, coupled with synergies of other sectors such as transportation. The study will specifically focus on:

**Task 1: Assessing the currently available and expected future energy storage technologies and providing an outlook for Türkiye considering the existing targets, legislation and policies in energy storage.** This task will also include conducting a series of stakeholder meetings to discuss the study and receive their feedbacks. Within this task, a short presentation that summarizes the outline of the study is also requested.

**Task 2: Identifying the battery energy storage potential in Türkiye and selecting the most suitable technologies in the Turkish power and transport sectors toward 2053, based on the growth projections, technology cost estimations and the capacities aligned with SHURA net zero study<sup>2</sup>.** Assessing the costs and benefits of the required technology and infrastructure investments to reach the potential in transport and power sectors with 5-year time steps towards 2053.

**Task 3: Assessing the most suitable locations to install the grid-scale battery storage systems (selected in Task 2) and investigating the impact on the power grid in 2035 and by 2053.** Identifying impacts of batteries on the power grid in terms of benefits considering both transmission and distribution grid conditions, renewable energy integration as well as the wholesale power market.

**Task 4: Identifying a roadmap for battery energy storage solutions and implementation strategies considering medium (2035) and long (2053) terms to meet both e-mobility and power system requirements with respect to technology, capacity, site selection, cost, benefit and specifications for the relative applications.**

**Task 5: Identifying policies to maximize the overall system benefits of battery energy storage potential in Türkiye by 2053, considering power system, optimal locations and incentives for storage investments in the medium and long terms, coupled with synergies of other sectors such as transportation.** This task will include the benefits of exerting both direct subsidies and necessary market reforms to accelerate the installations of energy storage systems in Türkiye. It is also intended to evaluate the interactions of energy storage system with other grid flexibility options. Within this task, it is also required to conduct a series of stakeholder meetings to discuss the findings of the study and receive their feedbacks in the report.

**Task 6: A policy maker friendly report that derives policy recommendations that are necessary for the deployment of battery energy storage systems and its implementation to maximize the synergy between transport and power sectors.** This task should include a short presentation that summarizes the outcome of the study.

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<sup>2</sup> <https://shura.org.tr/net-sifir-2053-turkiye-elektrik-sektoru-icin-yol-haritasi/>

Stakeholders that are related with battery energy storage can provide inputs for a deeper analysis on the regulatory framework. Siro, Aspilsan, Kontrolmatik etc. (Turkish battery manufacturers), TSO, DSOs, Ministry of Transport and Infrastructure (MoTI), Ministry of Energy and Natural Resources (MENR), Energy Market Regulatory Authority (EMRA), TEİAŞ, solar and wind associations can be potential partners. Policymakers and public sector including Ministry of Environment, Urbanization and Climate Change (MoEUCC), MoTI, EMRA, TEİAŞ, energy companies, Siro, E-MOD, sector associations, DSOs, energy service providers and end-use sectors could be the target audience.

The draft report will be submitted to SHURA for concurrence and comments. The consultant will prepare the final report considering SHURA's comments. The Consultant shall document the overall study results in a comprehensible manner in a final report that includes at least the following elements:

- An executive summary both in English and Turkish at native level.
- A long version of the study results, with a focus on strong visual representation of the results, and a transparent description of the methodological approach;
- Appendices with descriptions of the models, data sets, and assumptions used;
- A PowerPoint presentation summarizing the study results.

#### Deliverables and timeline

Deliverables	Responsible	Timeline
Contract starts	SHURA	June 2023
<b>Task 1: Assessing the currently available and expected future energy storage technologies and providing an outlook for Türkiye considering the existing targets, legislation and policies in energy storage.</b>	Consultant	July 2023
<b>Task 2: Identifying the battery energy storage potential in Türkiye and selecting the most suitable technologies in the Turkish power and transport sectors toward 2053, based on the growth projections, technology cost estimations and the capacities aligned with SHURA net zero study.</b>	Consultant	July-August 2023
<b>Task 3: Assessing the most suitable locations to install the grid-scale battery storage systems (selected in Task 2) and investigating the impact on the power grid in 2035 and by 2053.</b>	Consultant	August-September 2023
<b>Task 4: Identifying a roadmap for battery energy storage solutions and implementation strategies considering medium (2035) and long (2053) terms to meet both e-mobility and power system requirements with respect to technology, capacity, site selection, cost, benefit and specifications for the relative applications.</b>	Consultant	October 2023
<b>Task 5: Identifying policies to maximize the overall system benefits of battery energy storage potential in Türkiye by 2053, considering power system, optimal locations and incentives for storage investments in the medium and long terms, coupled with synergies of other sectors such as transportation.</b>	Consultant	November 2023
<b>Task 6: A policy maker friendly report that derives policy recommendations that are necessary for the deployment of battery energy storage systems and its implementation to maximize the synergy between transport and power sectors.</b>	Consultant	December 2023

■ Some more details on the process:

- 1) SHURA provides earlier SHURA studies to consultant/s
- 2) Consultant/s, based on know-how and input received by SHURA prepares key parameters for discussions and presents them to SHURA. These will need to be agreed upon and approved by SHURA.
- 3) The work will be carried out in close consultation with SHURA's project management team: At least biweekly progress meetings will be organized and all task results will be discussed with SHURA. The task outputs will need to be agreed upon and approved by SHURA.
- 4) At least one stakeholder workshop will be held by the Consultant with the support of SHURA. The results of the stakeholder meeting/s will be used by the consultant/s to adjust the model.
- 5) The consultant should submit a detailed technical proposal specifying the methodology, approach and expertise they will use for each task. The consultant/s should elaborate how they will handle complex interactions such as economic and sectoral dynamics in the proposal.

### Qualifications

The consultant must be a firm with comprehensive knowledge on the Turkish energy sector and battery energy storage development as well as existing technologies in power sector, transport sector, transmission and distribution grid and power market. The consultant must have cost-benefit analysis experience in the energy and transport sectors and have experience on writing policy-maker friendly reports that include policy/regulation suggestions.

The consultant needs to be a firm that has a team of experts with the following qualifications:

- Team with a proven record of analytical skills in the field of power and transport sectors analyses and battery storage systems.
- Experienced team with a proven track record of applying a suitable method in a number of similar analyses.
- Advanced university degree (master or equivalent) in economics, engineering, environment or natural science, or other relevant field related to energy;
- A senior expert with a minimum of ten years of progressively responsible experience with regulatory/policy analysis of the energy sector and an expert with skills in electrification analysis;
- Track record of publications in relevant fields;
- Track record of establishing successful and effective engagement with policymakers, regulators and the utility is an asset;
- Excellent written and spoken language skills in Turkish and English

The proposal to be submitted as part of the tender offer should clearly state and elaborate on the methodology and types of background data to be used in the study and include information regarding the qualifications stated above.