

**Terms of Reference for**  
**“Updating the renewable energy grid integration study of SHURA to 2030”**

**SHURA Enerji Dönüşümü Merkezi**

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**1. Background**

Turkey aims to utilise its abundant potential of renewable energy resources to transform its fossil fuel import dependent power sector in achieving the country’s goals to transition to a low-carbon economy and to reduce its current account deficit. End of 2020, it is expected that nearly half of Turkey’s all electricity demand would be supplied from renewable energy. Hydropower accounts for around 30% of the total electricity demand with wind and solar energy representing a share that ranges between 10% and 15%. The increase in the share of wind and solar energy is promising compared to several years ago but this is still far from the potential Turkey’s resource availability offers.

A study released by SHURA Energy Transition Center in May 2018 showed that Turkey can achieve a wind and solar energy share of 30% by 2026 provided that its transmission grid is enhanced with the needed expansion investments and system flexibility is increased from options such as battery storage, pumped hydro and demand response. Strategies that enable grid integration of wind and solar energy would ensure that costs and operational aspect of the transmission grid would be maintained at low levels, such as redispatch volumes, curtailment of renewable power and transmission grid investments.

Power system dynamics are changing rapidly. Turkey’s electricity demand has been increasing much less than it was initially projected due to the economic slowdown in past years which CoVid-19 pandemic has contributed further. In addition, cost of renewables is continuing to decline, and new business models emerge along with advancing regulations. These result in a faster deployment of solar and wind energy compared to government projections. In view of these developments, SHURA’s findings of its initial grid integration study need to be updated with new data and developments in Turkey’s power system.

**2. Objective and scope of the study**

The aim of this study is to update and expand SHURA’s findings of its initial grid integration study that was initially carried out for a timeline till 2026. The study also assumed a 5% electricity demand projection between 2018 and 2026 that is much higher than the current levels and it has a baseline scenario that stands much below the current speed of renewable energy deployment. In view of the current market developments, the expectation is that wind and solar energy will account for much of the new capacity investments in the coming decade rather than new coal and gas plants. The study’s methodology follows an iterative approach that builds on a sequential simulation of the market and the transmission grid (including and above 154 kilovolts). The methodology that initially assumed an exogenous penetration of flexibility options was later complemented with an additional module that prioritised penetration based on the costs and benefits of these options.

Against this backdrop, the recent developments need to be accounted for and the following indicators need to be updated in the new study:

- Electricity demand of Turkey, including the impact of energy efficiency and electrification of end uses such as transport and heating/cooling
- Wind, solar and hydropower capacity that considers the recent developments in auctions, feed-in tariff mechanism update and in other regulations, that also addresses their locations in Turkey's geography
- Generation capacity fleet beyond wind and solar energy such as planned developments in local coal-fired power plants, the changing business case of gas generators, plans in nuclear capacity
- Transmission grid expansion plans as well as potential developments in interconnector capacity with neighbouring countries including the ENTSO-E system and others
- Flexibility options including pumped hydro, battery storage, demand response and thermal generators

The new study needs to develop a new baseline scenario for the period between 2020 and 2030 and a new SHURA scenario that projects the higher uptake of renewable energy technologies. For each scenario, the transmission grid expansion will need to be outlined in detailed that is in line with the plans of Turkey's transmission system operator and the additional investment needs for grid integration of renewables must be identified in accordance of the specific scenario needs.

As past trends show there is large uncertainty in any of these developments. Also, the grid cannot rely on a single solution of system flexibility, thereby requiring the deployment of a suite of options depending on their costs and benefits. This requires carrying out multiple scenarios and/or several sensitivity analyses to assess the impact of parameter changes on results.

The assessment should use the same or a similar network and grid simulation model that was applied in SHURA's initial grid integration study and the indicators for grid integration assessment such as capacity factors, load flows etc must be maintained, otherwise expanded in line with the needs of the new study.

The project will yield several knowledge products, including a policy-maker friendly technical report in English and in Turkish (including Annex) and its Executive Summary, a suite of easily digestible outreach and communication outputs that include a set of infographics and a slidedeck.

Given the assignment's technology scope and its relation to power system planners, several technical workshops and bilateral meetings will be organised with the transmission system operator, regulator, and policy makers. With the support of the consultants, SHURA will lead the stakeholder engagement par. Study outcomes will be disseminated through several outreach activities to the public and private sector actors.

As discussed in this Terms of Reference, based on the broad range of areas about grid integration of renewables, the consultant is expected to outline the focus, prioritization and methodology that will be developed and used in this study.

### 3. Deliverables and timeline

The project will start in January 2021 and will last till end of June 2021.

<b>Deliverables</b>	<b>Timeline</b>
Contract starts	January 2021
Development of study concept, methodology, identification of data sources and engaging the necessary stakeholders to the project	January 2021

Development of the baseline scenario and market and grid simulation	February 2021
Development of the SHURA scenario and market and grid simulation	March 2021
Carrying out sub-scenarios and sensitivity analyses	April 2021
First draft report	May 2021
Final report	June 2021
Report launch	August 2021

#### 4. Qualifications

The consultant must be a firm or a group of firms with project experience in:

- Power system analyses methodology development, power system analyses, scenario development, forecasting techniques and technology assessment,
- Energy efficiency, electrification, renewable energy, flexibility technologies and grid integration policies and regulation,
- Development of technology roadmaps that encompass multiple technologies, approaches, sectors and stakeholders,
- Engagement with stakeholders from Turkey's energy sector, regulator, transmission system operator, private sector,
- Drafting policy-maker friendly reports that draws conclusions from complex analyses.

Firms' team members should have the following minimum key expertise:

- Team Leader, with preferably at least 15 years of professional experience in
  - o Turkey's power sector and of other key countries
  - o Leading / supporting large projects with large data inputs, where multiple stakeholders with different views are involved and where the final goal is to create impact on policy making
  - o Proven record in drafting policy-maker friendly reports from complex datasets and analytical findings
  - o Fluency in both Turkish and English
- Technology expert(s), with preferably 10 years of professional experience in
  - o Knowledge of power system transformation technology, strategy, policy and approaches
  - o Good knowledge of English and preferably Turkish