

## Terms of Reference for

### “Analysis of business models, technologies and the needed regulatory scheme for the power system digitalisation in Turkey”

#### SHURA Energy Transition Center

#### 1. Background

Turkey aims to substantially reduce its energy consumption by rolling out extensive measures to utilize its local energy efficiency resources across all strategic sectors; i.e. building, industry and transport. Turkey has already made several moves in this direction and has implemented comprehensive strategies and regulations supporting this frame, including its 2007 Energy Efficiency Act. The Tenth Development Plan, which the Turkish Parliament adopted in 2013, contains extensive programmes targeting a minimum 20% reduction in energy intensity by 2030 compared with 2010, which is followed by a more ambitious strategy set out in the Eleventh Development Plan adopted in July 2019. In the building sector, the National Energy Efficiency Strategy Paper provides for the transition of at least 25% of building stocks to modern sustainable forms of energy by 2023. Furthermore, in keeping with the 2011 National Climate Change Action Plan, annual energy consumption in public buildings and facilities is scheduled to decrease by 20% within the same timeframe. A new legislation issued in August 2019 aims for a reduction in energy demand of 15% in public buildings. The Eleventh Development Plan also aims for at least 38.8% share of renewables in Turkey’s total electricity demand by 2023.

In order to accelerate the implementation of these targets and to pave the way forward after 2023, SHURA Energy Transition Center has released a series of studies that focus on how the power system of Turkey can be transformed in the coming decade:

- The study titled “The Most Economical Solution for Turkey’s Power System: Energy Efficiency and Business Models”<sup>1</sup> quantifies a potential of 10% savings in Turkey’s total electricity demand by 2030 compared to a baseline where the benefits of energy efficiency are 20%-50% higher than its costs.
- The study titled “Optimum electricity generation capacity mix for Turkey towards 2030”<sup>2</sup> shows how wind and solar penetration in Turkey can reach 30% by 2030 with another 20% provided by other renewables. Realising this would require up to 60 GW total installed wind and solar capacity by the same time depending on demand growth. Nearly 10-15 GW of this potential rely on consumers through rooftop solar PV systems according to another study by SHURA.<sup>3</sup>
- The study titled “Transport sector transformation: Integrating electric vehicles (EV) into Turkey’s distribution grids” showed that transforming 10% of Turkey’s passenger vehicle stock by 2030 with electric vehicles is possible since their impact on distribution grid operation and investments would be marginal provided that smart charging is enabled.<sup>4</sup>

<sup>1</sup> <https://www.shura.org.tr/turkiye-elektrik-sistemi-icin-en-ekonomik-katki-enerji-verimlilik-ve-yeni-is-modelleri/>

<sup>2</sup> <https://www.shura.org.tr/wp-content/uploads/2020/08/ExecutiveSum.pdf>

<sup>3</sup> <https://www.shura.org.tr/binalarda-cati-ustu-gunes-enerjisi-potansiyeli-turkiyede-cati-ustu-gunes-enerjisi-sistemlerinin-hayata-gecmesi-icin-finansman-modelleri-ve-politikalar/>

<sup>4</sup> <https://www.shura.org.tr/transport-sector-transformation-integrating-electric-vehicles-into-turkeys-distribution-grids/>



- While the growth in share of renewables is set on a promising trend over recent years, questions remain about how Turkey can integrate higher shares of wind and solar to its power system and what the impact of distributed energy resources (distributed generation, distributed batteries and demand response) and electrification (new loads such as electric vehicles etc.) will be on the traditional operation practices of the power system. In order to understand the role of demand response, SHURA is finalising a new study titled “The role of sector coupling for grid integration of wind and solar” where the potential of renewable energy and energy efficiency in residential, commercial and public buildings through increased electrification, distributed energy sources and energy management infrastructure is assessed. According to the study, the cumulative peak system demand reduction due to demand response deployment in end-use sectors is more than 10 GW, including heating, cooling and EV charging in buildings.

As a key enabler to amplify the energy transformation by managing large amounts of data and optimizing systems with many small generation units, digitalisation emerges as a common denominator across these four pillars; renewables, energy efficiency, electrification and demand response that combines them.

Digitalisation is the use of digital technologies to change a business model and provide new revenue and value-producing opportunities; it is the process of moving to a digital business. Digitalisation creates opportunities for utilities and energy companies to create new revenue streams whilst it also puts the consumer at a more central role in the power system. The core of this is the energy-as-a-service (EaaS) approach, which is a customer centric business model that emerged to share and monetise the value created by increased digitalisation and decentralisation of the power system. So it is not only the energy content of the electricity sold to the consumer but the provision of an entire energy service that goes beyond. The EaaS approach, by combining customer resources into a large ‘smart energy community’, shifts from asset-focussed, centralised power generation and the sale of it to passive consumers. Instead, it offers end-to-end management of a customer’s energy assets and services. EaaS model benefits consumers by promoting advanced technology and offers potential for expanding the deployment of low-carbon technologies.

Digitalisation is a key enabler of the power sector transformation, enabling the management of large amounts of data and optimising increasingly complex systems. The growing importance of digitalisation in the power sector is accelerating two other trends: decentralisation and electrification. Decentralisation is led by deployment of small power generators (mainly PV), connected to the distribution grid. Electrification of transport and buildings (heating and cooling) bring large quantities of new loads, such as electric vehicles, heat pumps etc. All these new assets on the supply and demand sides are adding complexity to the power industry, making monitoring, management and control indispensable for the success of the energy transformation. Through different service provision and revenue models, EaaS supports distributed generation deployment and demand-side management. This has a great impact on unlocking demand side flexibility, which further enables the integration of high shares of variable renewable energy integration in the power system and smooth integration of distributed energy resources in the system. In order for business models to be developed and implemented, digitalisation requires solid regulation in and out of the energy sector as the use of these business models is unprecedented and because they involve new data collection and management techniques that are new to stakeholders of the power system.

## 2. Objective and scope of the study

The aim of this new study is to investigate the needs and challenges of Turkey's energy sector in the path of digitalisation and to understand the business models and the regulatory framework needed for the deployment of power system digitalisation technologies in Turkey and the impact of these regulations to generators, distribution system operators (DSOs), the transmission system operator (TSO) and end-use sectors for higher renewable energy integration, improving energy efficiency and accelerating electrification at end uses.

This study will first describe the challenges and needs in the energy sector from the digitalisation perspective, based on the 2030 vision of the digitalised energy sector in Turkey. The study will then assess how digitalisation can help the energy industry in the framework of electrification (integrating EVs to grid), renewable energy integration along with distributed energy resources and energy efficiency, through business models (aggregators etc.) and flexibility methods such as demand response, via using digitalisation technologies (internet of things, blockchain, big data, artificial intelligence etc.), along with the review of international best practices to find out what suitable models and technologies can be deployed in Turkey. In a subsequent step, it will assess the needs for regulations to enhance a more digital power system transformation of Turkey. Some of these regulations may already exist to some extent in Turkey or there is so far no mention of them. In addition, there could be conflicting regulations and barriers to the needed regulations to enable digitalisation. These will need to be understood and subsequently the regulations should be matched with the individual digitalisation business models as well as the transformation pillars that will be impacted from them. The principles for regulations will also involve the role of the power system actors and how they will be impacted. Stakeholder consultation will be a cornerstone to receive guidance on the priorities and the principles of the needed regulatory framework.

Keeping these objectives in mind, the project is planned to be carried out through the following tasks:

### **Task 1: Investigating the challenges and needs for digitalisation in Turkey's energy sector and review of digital technologies along with international experiences accelerating energy transition in Turkey**

- Assessing gaps and challenges to be addressed in Turkey's power system, exploring EaaS and digitalisation technologies such as automation, control systems, sensors, ICT, blockchain, AI and smart systems along with integrated flexibility methods such as battery storage, electric vehicle charging and demand response etc. till 2030, and the impact of these technologies in increasing the renewable energy share and electrification and in improving the energy efficiency of Turkey's power system. In addition, investment and R&D needs in implementation of these technologies will also be investigated at high level.
- An analysis of international examples, experiences, benchmarks and latest trends on digitalisation of the power sector and assessment of how these business models (virtual power plant (VPP), peer to peer trading (P2P), virtual metering, smart charging etc.) can be adapted into Turkey's power system.

### **Task 2: Assessment of how particular digitalisation technologies and business models can help Turkey's the energy sector transformation**

This task will inquire how relevant specific digital technologies as components of EaaS; 1) the internet of things, 2) artificial intelligence and big data, 3) blockchain, and 4) energy management infrastructure

(e.g. smart metres, sensors, controllers) and business models such as aggregators, P2P trading etc. will support the improvement of energy efficiency, electrification and VRE in Turkey's power system through the necessary regulatory scheme which will be brought forward in the following task. Recommendations on overcoming the conflicts and barriers to the needed regulations and on matching the regulations with the individual digitalisation business models as well as the transformation pillars that will be impacted from them will be put forward. The recommendations will also involve the role of the power system stakeholders, how to meet their needs and to adapt them to the impacts of the transformation.

In carrying out this assessment, supporting information from Turkey's situation on technology and regulations will be obtained via interviewing stakeholders and running stakeholder engagement meetings. The selection of technologies that will be covered will be defined upon consultant's proposal.

### **Task 3: Assessment of Turkey's needed regulatory and policy scheme for energy sector digitalisation**

Following the analysis of the potential of digital technologies and business models, Turkey's needed regulatory framework for the power system transformation will be investigated. This assessment will elaborate the current regulatory situation in Turkey from digitalisation perspective, the needed principles and metrics of the regulations as to form and substance, the bottlenecks and barriers, and the opportunities in unlocking the potential benefits of EaaS and digital technologies in the power system.

### **Task 4: Preparing a policy maker friendly report**

The project will yield several knowledge products, including a policy-maker friendly 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. As discussed in this Terms of Reference, based on the broad range of areas about digitalisation, the consultant is expected to outline the focus, prioritisation and methodology that will be developed and used in this study.

Given the assignment's technology scope, several technical workshops and bilateral meetings will be organised with technology licensors and developers, project developers and other relevant private sector members that work on digitalisation methods and technologies. The public sector organisations that prepare the necessary regulations and policies will also be involved in the project. The consultant will lead the stakeholder engagement part with the assistance of SHURA. Study outcomes will be disseminated through several outreach activities to the public and private sector actors. In Turkey, the Energy Digitalisation Association (EDİDER) plays a crucial role in the engagement of sector stakeholders to the specific topics of energy system digitalisation. Engagement with its activities and stakeholders will need to be ensured in the project.

The methodology, background data, assumptions, the scenarios that will be developed and information regarding the qualifications stated below should be clearly explained in the tender offer with an elaboration of the choices that are made.

### **3. Deliverables and timeline**

<b>Deliverables</b>	<b>Timeline</b>
Contract starts	March 2021
Development of study concept, methodology, identification of data sources and development of an expert working group	March 2021

Task 1: Investigating the challenges and needs for digitalisation in Turkey's energy sector and review of digital technologies along with international experiences accelerating energy transition in Turkey	March 2021
Stakeholder consultation meeting	End March 2021
Task 2: Assessment of how particular digitalisation technologies and business models can help Turkey's the energy sector transformation	March – April 2021
Task 3: Assessment of Turkey's needed regulatory and policy scheme for energy sector digitalisation	March – April 2021
Task 4: Preparing a policy maker friendly report	April 2021
SHURA approval of the final deliverables	April 2021
Report launch	April 2021

#### 4. Qualifications

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

- Thorough understanding buildings energy use, smart homes, digitalisation and power system transformation, their technology, business models, flexibility methods, market needs, and their system-wide and value chain impacts,
- Electrification and digitalisation technologies in buildings, innovation, policy and financing, with particular experience in key countries which have advanced in transforming their power systems with them and that can transfer this knowledge to Turkey,
- Techno-economic assessment of low-carbon technologies and evaluation of energy and climate policies, regulatory scheme for digitalisation,
- Development of technology roadmaps that encompass multiple technologies, approaches, sectors and stakeholders, and ability to conduct effective desktop research, innovative workshops, interviews, surveys,
- Engagement with stakeholders from Turkey's energy sector, including various public sector actors (e.g. Ministry of Energy and Natural Resources, Ministry of Environment and Urbanisation), private sector (e.g. distribution companies, technology licensors, aggregators) and civil society (e.g. buildings sector associations industry sector associations).

Firm's team members should have the following minimum key expertise:

- One or more Team Leader(s), with preferably at least 15 years of professional experience in
  - o Turkey's energy sector and of other key countries, good knowledge in electricity market and/or digitalisation concepts covering areas from policy, regulation to operational level
  - 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
- A steering committee with senior experts, making key decisions and supplying resources to the project
- Expert(s) and preferably a project team, fluent in English and Turkish, with preferably at least 5 years of professional experience and knowledge in

- Energy efficiency and renewable energy technologies, strategy and approaches, digitalisation business models, flexibility, innovation, advanced analytics, big data
- Techno-economic assessment, survey design, reporting of findings