Terms of Reference (ToR) for SHURA's next study on
"Electrification with renewables – Transforming Turkey's industry and heating sectors"
SHURA Energy Transition Center
06/09/2022

1. Background

Energy efficiency and renewable energy offer enormous opportunities to transform Turkey's energy system. They play a primary role in the Turkish power system transformation. However, the end-use sectors of heating (buildings and industry) and transport delay in decarbonization efforts, with more than 80% of their total final energy consumption coming from fossil fuels. The potential of energy efficiency and renewable energy is significant to replace fossil fuels for space/water heating & cooling in buildings, process heat in the manufacturing industry and motor drive in transport. Nonetheless, their potential for a zero-emissions pathway is insufficient due to such varying factors as heat temperature level and building stock characteristics. An emerging option is electrification with renewables, replacing traditional combustion-based technologies with renewable electricity. As long as this electricity comes from zero-carbon or low-carbon sources, CO_2 emissions can be significantly reduced or completely eliminated.

Due to decreasing costs for new renewable energy generation and the high potential for expansion – both in Europe and everywhere else in the world – electrification is of great importance for all final energy sectors. Discussions of electrification are taking place primarily in the transport sector (electric vehicles) and in building heating (heat pumps), but electrification also has considerable potential for reducing CO_2 in the industrial sector (Lechtenböhmer et al., 2016; Schneider et al., 2018). Many sectors, especially the chemical industry, can replace much of the fossil fuel used for low- to high-temperature processes with power-to-heat technologies such as high-temperature heat pumps and electrode boilers. In the future, special solutions could be used to meet the high- temperature requirements of steam crackers, basic chemicals, and electricity-based cement manufacturing.

The advantages of an electrification strategy in the basic materials industry includes the high overall energy efficiency of power-to-heat plants. This is particularly true of high temperature heat pumps that use waste heat. Other power-to-heat technologies have high levels of energy efficiency and are more efficient than hydrogen (whose production is associated with conversion losses). The use of electricity in some applications allows a more precise provision of heat compared with combustion processes and can also contribute to efficiency gains. Moreover, because electrical and electrode boilers have fairly low investment costs, they can initially be deployed at relatively low costs, including for hybrid use, i.e. alongside existing conventional plants such as CHP plants in the chemical industry. The fundamental technological challenge of a widespread electrification is its significant demand for zero-carbon electricity, which requires a rapid expansion of renewable-energy capacity. In the medium to long run, however, direct electrification can reduce the demand for more electro-intensive energy carriers, such as hydrogen and e-fuels.

Taking all of the above information into consideration, the potential and future opportunities of electrification with renewables in industry and buildings sector need to be analyzed and better understood for a decarbonized energy system in Turkey by 2053. This study is based upon this necessity to open the way for higher decarbonization levels in Turkey's energy sector with all technology areas stimulated by greater levels of electrification.

2. Objective and tasks

The objective of this study is to quantify the potential of electrification in the heating sector – both in buildings and process heat in industry up to 2053, for energy sector decarbonization, reduction of fossil fuel use (gas consumption, coal etc.) and import dependency, as well as the impact on carbon emission savings. The study will also investigate the policy framework with the market analysis including the current incentives / price structure for fossil fuels (gas, coal etc.) and electricity. If there is not sufficient incentives to move to electricity use in the market, measures to shift the incentive structure will also be assessed. While the analysis will have a long-term focus, it will pay attention to early opportunities by 2030 and medium-term opportunities by 2040 to chart a pathway for the next three decades.

The project will build on SHURA's earlier studies on power system transformation, grid integration of renewables, energy efficiency, green hydrogen and flexibility to quantify the potential of electrification for power end-use sectors up to 2053. The study will end with a discussion on the policy framework, implementations and strategies that can potentially generate high value in the integration of heat pumps and industry heating into Turkey's energy system.

The study will specifically focus on:

Task 1:Identification of energy consumption, CO_2 emissions and existing technologies in the industry and buildings in Turkey

Industry: Identifying key energy consuming industries in Turkey (steel, chemicals, cement, etc.), their share in energy consumption, CO_2 emissions and development perspective, including data on major industrial sites/plants of these sectors.

Buildings: Energy demand for heating, number of buildings (residential, commercial, public etc.), currently used technologies and their shares in buildings, CO_2 emissions, expected developments, will be identified.

Task 2: Identification of the key electrification technologies in the industry and buildings

Industry: Identification of the key electrification technologies in Turkey's industry sector considering international experiences. The consultant may benefit from an existing analysis for the industry[1].

Buildings: Heat pumps technology introduction, costs, trends should be analyzed considering international best practices, and then potential investment needs in Turkey should be identified.

Task 3: Identifying electrification and CO2 emission reductions potential in Turkey's industry and buildings sectors towards 2053.

Assessment of potential for fossil fuel (coal, gas etc.) use reduction via electrification for both **industry sector and buildings**, with analyzing impact on total electricity demand. Electrification potential and carbon savings in **buildings and industry sector** to 2053 based on growth and technology projections and investment needs on a 5-10 year basis will be identified, taking into account expected technology readiness discussed in previous tasks. Demand side flexibility benefits to the power system will also be identified considering end use electrification potential to 2053.

[1] For example, "Agora E.: Breakthrough Strategies for Climate-Neutral Industry in Europe" https://static.agora-energiewende.de/fileadmin/Projekte/2020/2020_10_Clean_Industry_Package/A-EW_208_Strategies-Climate-Neutral-Industry-EU_Study_WEB.pdf, p.62ff.

Task 4: Identification of cost gaps between new electricity based technologies and existing ones and proposal for policies/incentives for accelerating electrification in both **industry sector and buildings** (shift to heat pumps) based on international examples. Potential of gas savings & thus import bill, and impact on carbon emissions will also be identified.

Task 5: Stakeholder interviews. (Review of Tasks 1-2-3-4)
Multiple stakeholders from Turkey's private sector are working on electrification, as is public administration as part of Turkey's energy agenda (heat pumps, stakeholder engagement in data collection, methodology development, and policy aspects). The study will prioritize the options for electrifying buildings and industry in a highly digitalized future over alternatives of improving energy efficiency and direct use of renewables. It will pay attention to the need for vast expansion of renewables and smarter, much more flexible grids in a more electricity-intensive energy system.
Collecting stakeholders' views for the encountered problems in the existing regulatory environment, the gaps in the regulatory and the needs for the policy approach and targets will be a leverage for SHURA's assessment from the sector side. Public and private sector stakeholders will be interviewed bilaterally on different dates, then the outcomes will be discussed collectively in a half-day workshop to better identify the regulatory needs and policy vision for the electrification. SHURA to initially contact stakeholders.

Task 6: A policy maker friendly report that includes the detail results with a list of major policy recommendations for policy makers and other stakeholders that are necessary for deployment of electrification maximizing the synergy between buildings, industry and power sectors.

The preliminary final 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:
■ A concise summary 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 of the overall study results.

3. Deliverables and timeline

Deliverables	**Responsible**	**Timeline**
Contract starts	SHURA	October 2022
Task 1: Identification of energy consumption, CO2 emissions and existing technologies in the industry and buildings in Turkey	Consultant	October 2022
Task 2: Identification of the key electrification technologies in the industry and buildings	Consultant & RAP	October 2022
Task 3: Identifying electrification and CO2 emission reductions potential in Turkey's industry and buildings sectors towards 2053.	Consultant	October-November 2022

Task 4: Identification of cost gaps and proposal for policies	Consultant & RAP & SHURA	November 2022
Task 5: Stakeholder interviews. (Review of Tasks 1-2-3-4)	SHURA & Consultant	December 2022
Task 6: A policy maker friendly report with a slide deck to present study results	Consultant	December 2022

- Some more details on the process:
    1) SHURA provides earlier SHURA studies to consultant
    2) Consultant/s, based on knowhow and input received by SHURA prepares key parameters for discussions, and presents 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; all task results will be discussed with SHURA via several internal sessions. The task outputs will need to be agreed upon and approved by SHURA.
    4) At least one stakeholder workshop will be held by Consultant with the support of SHURA, then consultant/s could adjust the model.
    5) The consultant should submit a detailed technical proposal specifying methodology/approach/expertise they will use for each task. It will be important to include in the proposal how complex interactions such as economic and sectoral dynamics will be handled.

4. Qualifications

The consultant must be a firm with comprehensive knowledge, solid experience and previous work on Turkey's energy system fundamentals, existing technologies in Turkey's industry sector and buildings, electrification, existing policies, regulations, implementations and targets. The consultant must have experience to analyze cost and benefits in the energy system and write policy maker friendly reports that include policy/regulation suggestions. The consultant needs to be a firm that has a team with experts having the following requirements:

- Team with proven record of analytical skills in the field of energy system and energy end use sectors analysis especially building and industry sector.
- Experienced team in applying a suitable method with a proven track record for a number of similar analyses.
- Advanced university degree (masters 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 energy sector and an expert with skills on electrification analysis;
- Track record of publications in relevant field;
- Track record of establishing successful and effective engagement with policy makers, regulators and the utility is an asset;
- Excellent written and spoken Turkish and English

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

5. Criteria for Evaluation of Proposals

If the submitted proposal contains all the documents specified in the Sabancı University's tender offer and the requirements in this TOR, it will be evaluated according to the following criteria:

Criteria for Evaluation for SHURA's Study "Electrification with renewables – Transforming Turkey's industry and heating sectors"		
Technical Bid-70 points		
Criteria	**Minimum Requirement**	**Scoring**
Understanding of the TOR	Proposal displays a good understanding of the TOR	10
Scope of Work	Scope of work fulfills all requirements of the TOR	10
Methodology and Its Strength	Methodology for each task is presented in detail. The methodology proposed is sound and well-suited to the tasks identified.	10
Final Deliverables	Final deliverables are in line with the TOR.	10
Time Line	Time line is in line with the TOR	10
Team Composition	Proposed team is in line with the qualifications stated in the ToR.	10
Previous Work References	The proposal includes references displaying the consultant's expereince in line with the qualifications stated in the ToR	10
Financial Bid-30 points		
Criteria	**Minimum Requirement**	**Scoring**
Financial Bid	The offered price meets the entire service requested in TOR	30
Final Weighted Score (70% Technical/30 % Financial)		**to be calculated**
Qualification Threshold		**70**