

DECARBONIZATION PATHWAYS FOR TURKEY 2020–2050 – MODELLING STUDY

Terms of Reference

BACKGROUND

Turkey signed the Paris Agreement in 2016 but remained the only G20 country that was not a party to the agreement. One of the reasons for this position is Turkey's reluctance to commit to ambitious emissions reduction policies. But, this does not make research and projections regarding possible mitigation policies aiming at Turkey's future commitments less relevant. Turkey urgently needs a robust and quantitative narrative in support of its national climate policy and international negotiations.

Turkey is the 15th largest fossil fuel-related carbon dioxide (CO₂) emitter in the world, and its share in global emissions reached 1.2% by the end of 2018. Although Turkey's historical responsibility for emissions is small compared to the leading industrialized nations, its greenhouse gas emissions (GHG) have increased 137.5% between 1990 and 2018. The majority of the emissions are related to CO₂ (80.5%) stemming from the supply and demand of energy (71.6%), since the share of fossil fuels in the energy sector is still overwhelming. Turkey's per capita GHG emissions are 6.4 tons; however, that is not to say that Turkey's responsibility for climate action should be regarded as insignificant. On the other hand, Turkey is listed in Annex 1 of the UNFCCC, but its late accession to the convention left the country out of the Kyoto Protocol commitments. Turkey would face a similar delay in the case of the Paris Agreement if it maintains its observer position.

Turkey submitted its Intended Nationally Determined Contribution (INDC) in 2015 before the 21st Conference of the Parties (COP21) that was held in Paris, but the document remained "intended" because Turkey did not yet ratify the agreement. The INDC envisages a 21% reduction of Turkey's GHG emissions from the Business as Usual (BAU) Emissions Trajectory until 2030. The United Nations Environment Program (UNEP) stated in its latest Emissions Gap Report in 2019 that Turkey is one of the three countries that has "overachieved" in their INDC targets, because its current emissions trajectory is lower than its projected mitigation pathway (which is also the case in India and Russia). UNEP commented that this was because of Turkey's "weak targets."

Despite promising developments in renewable power in recent years and a comprehensive national energy efficiency plan that addresses the demand side, Turkey's coal policies are located on the other side of the climate policy coin. The share of coal in the power mix has expanded in the last few years, especially after Turkey declared 2012 "the year of coal." In 2019 the share of coal in its energy mix was 28% and 37% in its electricity generation mix. In a period that Turkey too should start considering its plans for a coal phase-out as in many other countries, these numbers represent a historical peak for Turkey and a clear indicator of the downward trend in GHG emission mitigation policies.

OBJECTIVES

The overall objective of this study is to provide a projection for the long-term decarbonization of the Turkish economy with a particular focus on the power sector, which represents more than 40 percent of the country's energy-related CO₂ emissions.

The relevant decarbonization pathway will aim to contribute to global emissions reduction efforts, according to the global carbon budget of 1.5–2°C set out in the Paris Agreement, based on the principles of equity and compliance.

The study will have two specific objectives:

- Identification of long-term decarbonization pathways compatible with the Paris Agreement and the Turkish economy in terms of emissions and energy mix, with a particular focus on the power sector.
- Preparation of a fossil fuel phase-out timetable and its technology pathway and cost impacts for the power sector in Turkey.

OUTCOMES

The research team will provide outcomes as tables, charts, and information (explanations) related to the assumptions, data, methodology, and results.¹

The outcomes of this study will be used in a policy report that will be prepared by Istanbul Policy Center at Sabancı University. The outcomes of the study may also be used in the policy report as an appendix.

The study will answer the following questions and objectives using the relevant macroeconomic and sectoral data in Turkey:

- 1- What is Turkey's fair-share out of the global carbon budget for the 1.5°C (and 2°C) targets separately between 2020–2050, assuming that Turkey fulfills
 - a. net-zero GHG emissions in 2050 (and 2070),
 - b. net-zero CO₂ emissions in 2050 (and 2070),
 - c. net-zero fossil fuel CO₂ emissions in 2050 (and 2070),
 - d. absolute zero GHG emissions in 2050 (and 2070),
 - e. absolute zero CO₂ emissions in 2050 (and 2070),
 - f. absolute zero fossil fuel CO₂ emissions in 2050 (and 2070).
- 2- Outline Turkey's emissions trajectory between 2020–2050 for 1.5°C (and 2°C) targets separately based on the allocated national carbon budgets relevant to the different options in Q1, for
 - a. total GHGs,
 - b. fossil fuel CO₂,
 - c. CO₂ from industrial processes.

¹ All final XLS tables, data, methodology, etc. will be owned by Istanbul Policy Center at Sabancı University.

- 3- Test possible peak years and corresponding annual reduction rates of CO₂ emissions (all sources and fossil fuel) until 2050, according to immediate and delayed climate action options.
- 4- What are the possible future mixes related to the emissions trajectories until 2050 for power generation?
- 5- What are the possible future changes related to the emissions trajectories until 2050, regarding energy intensity and carbon intensity?
- 6- In what year will coal phase-out in energy supply and power generation (separately) be possible according to different options of emissions trajectories outlined in Q1 and 2 (i.e., 1.5°C and 2°C targets, net or absolute zero options, different peak years)?
- 7- In what year will gas phase-out in energy supply and power generation (separately) be possible according to different options of emissions trajectories outlined in Q1 and 2 (i.e., 1.5°C and 2°C targets, net or absolute zero options, different peak years)?
- 8- In what year will internal combustion engine (i.e., fossil fuel motor vehicles) phase-out be possible according to different options of emissions trajectories outlined in Q1 and 2 (i.e., 1.5°C and 2°C targets, net or absolute zero options, different peak years)?
- 9- What is the mix of the remaining GHG emissions (i.e., from waste, land use, industry, transport, etc.) in 2040–2050 and beyond for the net-zero target in 2050 for 1.5°C and 2°C (separately), assuming that an absolute zero emissions target for the power sector is fulfilled?
- 10- What is the impact of the electrification of transport and heating on the energy demand and power generation?
- 11- What are the investment costs and stranded assets according to different emission trajectories (i.e., 1.5°C and 2°C targets, net or absolute zero options, different peak years)?
- 12- What is the required carbon price (and its change) for the power sector according to different emission trajectories (i.e., 1.5°C and 2°C targets, net or absolute zero options, different peak years)?

The study will provide the following data annually (or every five years in select cases):

1. Power sector

- a. Lignite – GW, generation, number of plants
- b. Imported coal– GW, generation, number of plants
- c. Hard coal– GW, generation, number of plants
- d. Gas– GW, generation, number of plants
- e. Hydro– GW, generation, number of plants
- f. Solar PV – utility– GW, generation, number of plants
- g. Solar PV – distributed– GW, generation, number of plants
- h. Onshore wind– GW, generation, number of plants
- i. Offshore wind– GW, generation, number of plants

- j. Geothermal– GW, generation, number of plants
 - k. Biogas– GW, generation, number of plants
 - l. Total primary energy supply by fuel type
 - m. Total electricity output by fuel type
 - n. CO₂ emissions by fuel type
- 2. Transport sector**
- a. Number of vehicles – passenger vehicles, buses, 2/3 wheelers, bikes, tractors, trucks, airplanes etc. by fuel type, (diesel, LPG, gasoline, electrification, liquid biofuels)
 - b. Total final energy consumption by fuel type and transport mode
 - c. CO₂ emissions by fuel type and transport mode
 - d. Driven passenger-kms by fuel type and transport mode
 - e. Driven freight-kms by fuel type and transport mode
- 3. Other sectors**
- a. Energy balances by fuel type and sub-sectors
 - b. CO₂ emissions by fuel type and sub-sectors
- 4. CO₂ emissions**
- a. Total CO₂ emissions by sector and fuel type
 - b. Development of emissions against the carbon budget
- 5. Investments by sector and technology type**
- 6. Costs by sector and technology type**

TASKS

The research team is expected to perform the following tasks:

Task 1: Organization of the Study, Literature; Data and Modeling Framework

Task 2: Implementation of the Modeling Methodology

Task 3: Obtaining and reviewing the quantitative outcomes

Task 4: Preparing the outputs (tables, charts, and explanations)

The research team and IPC project team will have regular meetings with stakeholders, which will be organized by IPC, during the study for review and feedback.

TIMELINE

The study is due to be completed six months after the research has begun.

APPLICATION

Please apply with your letter of intention, technical proposals regarding data and methodology, and CVs of all members of the study team.

The deadline for the application is July 27, 2020.

Please send your documents to ipcadmin@sabanciuniv.edu and umit.sahin@sabanciuniv.edu