Executive Summary

COBENEFITS

Industrial development, trade opportunities and innovation with renewable energy in Turkey

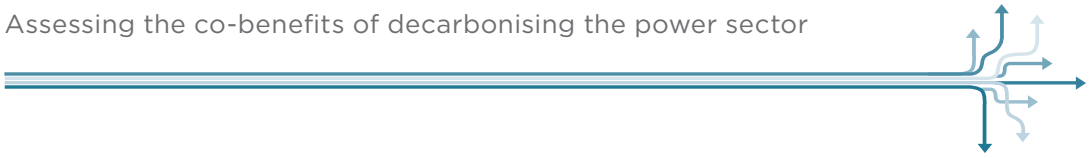
Assessing the co-benefits of decarbonising the power sector

The energy transition is inducing new investments in the electricity production and infrastructure sectors worldwide. Turkey, with its increasing energy demand met mostly by fossil fuel resources, faces significant risk of an escalation of its dependency degree on energy imports in the future. In order to address this issue, Turkey's public policy framework includes not only strategies to increase the share of renewable energy resources in its energy mix but also aims to develop a local manufacturing industry and to enable technology transfer. This study examines the co-benefits[1] to industrial development and trade of increased deployment of renewable energy in Turkey. The research is carried out in the context of the COBENEFITS project, which assesses a range of additional co-benefits of renewable energy in developing countries, besides reducing energy sector greenhouse gas (GHG) emissions, when compared to conventional energy systems. The study also provides initial insights on the regional trade opportunities available to Turkey, should technological gaps in the solar and wind sectors be narrowed.

The study methodology focused firstly on defining value chains for the solar and wind energy sectors in Turkey. This was done using licence and pre-licence information from the Energy Market Regulatory Authority and a unique administrative micro dataset (EIS) that includes all registered firms in Turkey and their domestic and export transactions. Secondly, coefficients for the value of production and trade were calculated. Finally, projections on industrial development and import–export values were estimated according to four scenarios for increased renewable energy (RE) capacity. As this study takes a static look at the scenarios, the current trade deficit resulting from low local value of production and technological gaps in the manufacture of renewable energy equipment are also observed as core issues that should be addressed by renewable energy policies.

- **Key policy message 1:** Turkey can significantly boost the value of production by increasing the share of renewables. With the decision by the Turkish Government to increase solar energy capacity by 60% and more than double the wind one over the next 10 years, the government paved the way to increase fifteenfold the value of production along the solar value chain, and over 31% along the wind value chain in the next ten years alone.
- **Key policy message 2:** There is room for more: By following more ambitious renewable pathways for Turkey, the expected increases in value of production can be more than doubled across the wind power value chain and increased eightfold along the solar value chain, pushing up the total value of production by more than 69 billion USD in the next ten years compared to 2016.
- **Key policy message 3:** Fostering competitiveness in manufacturing and closing the technology gap between imports and exports in both the solar and wind sectors is crucial to further improving the trade balance in Turkey's renewable energy sector. In solar energy, 48% of Turkey's imports are high-technology components whereas their share of exports is only 4% (in the wind sector these shares are 19% and 2% respectively). Given the increasing trade deficit and the fact that renewable energy equipment mainly comprises higher-technology components, investing in research and development (R&D) and competitiveness in those sectors, as part of a localisation policy, will increase the value-added of Turkey's industrial production.

[1] The term 'co-benefits' refers to simultaneously meeting several interests or objectives resulting from a political intervention, private-sector investment or a mix thereof (Helgenberger et al., 2019). It is thus essential that the co-benefits of climate change mitigation are mobilised strategically to accelerate the low-carbon energy transition (IASS, 2017a).



KEY FIGURES:

- By 2028 it is possible for the solar energy sector to increase its value by 9.9 billion USD above the expected 1.3 billion estimated under the current policy, if more ambitious solar capacity additions are achieved.
- Likewise, the wind sector could peak to a total value of 83.5 billion USD from the expected 33.32 billion USD in the next ten years should RE capacity additions are in place.
- Across the value chains, each additional MW capacity of energy increases industrial production by around 452.5 thousand USD in the solar energy sector, and around 3.6 million USD in the wind sector, on average.
- Given Turkey's present technological imbalance between low-tech exports and high-tech imports, each additional MW increase exacerbates Turkey's trade deficit by 95 thousand USD in the solar energy value chain and by 157 thousand USD in wind energy value chain.
- 76% of the total value of the solar supply chain concentrates in the first segment (intermediaries of good and services), only 1% of value is added by electricity producers. Greater industrial competitiveness requires integrating at the highest possible value-added level.

KEY FINDINGS:

- **In 2016, the total value of production within the solar energy value chain is calculated as 88 million USD; in 10 years, following the current renewable energy policy, it is possible for the solar energy sector to reach a cumulative value of 1.36 billion USD.** The value of production is expected to increase with increased solar energy deployment. Moderate additional capacity, ranging between 3 and 10 GW in the next 10 years, is expected to bring an additional industrial production between 1.3 and 4.96 billion USD in the next ten years. More ambitious capacity additions of 15–25 GW are expected expected to increase production by 6.8–11.3 billion USD.

- **The total value of production within the wind energy value chain in 2016 is calculated as 25.3 billion USD. In 10 years, following the current renewable energy policy, it is possible for the wind energy sector to reach a cumulative value of 33.32 billion USD.** The value of production is expected to increase with increased wind energy deployment. A moderate additional capacity, ranging between 9.3 and 10.3 GW in the next 10 years, is expected to bring additional industrial production of between 33.3 and 37 billion USD by 2028, and a more ambitious capacity addition of 13.3–23.3 GW is expected to increase production value by 47.6–83.5 billion USD.

- **Turkey has the opportunity to become the regional leader in RE equipment trade.** In the solar energy equipment sector, four of the top export destinations are in the MENA (Middle East and North Africa) region and present significant growing rates in the period 2008–2016: Turkmenistan (9.7% share, 18.2% growth), Iraq (6.4% share, 3.1% growth), Algeria (4.8% share, 11.3% growth) and Georgia (4.1% share, 12.2% growth). In the wind energy equipment sector, three out of the five top export destinations are in the MENA region and show, with one exception, strong growth during 2008–2016: Saudi Arabia (7.9% share, 3.4% growth), Iraq (7.6% share, 3.4% decrease) and Turkmenistan (6.6% share, 17.5% growth).

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- **Although Turkey has a trade surplus in wind energy equipment, it imports high-technology equipment at a rate higher (19%) than the global average (12%).** Turkey's exports fall short regarding technology composition, where the high-technology components account for 2% whereas low-technology components are at 23%. Evidence suggests that greater industrial competitiveness tends to be integrated at higher levels within local and global value chains (UNIDO, 2012).

- **Turkey's RE equipment exports with a comparative advantage are mostly of low- or medium-technological composition.** Despite the comparative advantage of some of Turkey's exports, there is still a technological divide in the solar and wind sectors. In the solar sector, high-technology equipment comprises 48% of imports but only 4% of exports. In the wind sector, high-technology equipment comprises 19% of imports but only 2% of exports.

- **Industrial production entails a trade deficit of 19 million USD in the solar sector in 2016, which equals 21% of the total value created in this sector in the same year.** If the current industrial production structure persists over the next 10 years, this trade deficit may increase to a cumulative value of 2.4 billion USD. The solar energy value chain in Turkey exhibits both trade and technological deficits. The trade deficit was 19 million USD in 2016, whereas the technological deficit results from high-technology imports of 48% versus only 5% of exports. Unless this technological imbalance is addressed and local production capacity is built, the trade deficit is predicted to increase by a cumulative value of 285–951 million USD under a moderate scenario of 3–10 GW additions to the solar capacity in 10 years; and by 1.4–2.4 billion USD under a more ambitious scenario of 15–25 GW additional capacity.

- **Industrial production in the wind energy sector entails a trade deficit of 1.1 billion USD in 2016, which equals 4% of the total value created in this sector in the same year.** If the current industrial production structure persists over the next 10 years, this trade deficit may increase to a cumulative value of 3.6 billion USD. Similarly to solar energy, the wind energy value chain in Turkey also runs both trade and technology deficits, calculated as 1.1 million USD in 2016, with high-technology contents accounting for 19% of Turkey's imports yet only 2% of exports. Unless this technological divide is addressed and local production capacity is built, the trade deficit is predicted to increase by a cumulative value of 1.5–1.6 billion USD under a moderate scenario of 9.3–10.3 GW additions to the wind capacity in 10 years; and by 2.1–3.7 billion USD under a more ambitious scenario of 13.3–23.3 GW additional capacity.