COBENEFITS POLICY REPORT

December 2020

Making the Paris Agreement a success for the planet and the people of Turkey

Unlocking the co-benefits of decarbonising Turkey's power sector

İPM | IPC İSTANBUL POLİTİKALAR MERKEZİ SABANCI ÜNİVERSİTESİ İSTANBUL POLICY CENTER SABANCI UNIVERSITY
IASS POTSDAM
UfU Independent Institute for Environmental Issues
IET International Energy Transition
COBENEFITS

Imprint

This COBENEFITS Policy Report has been realised in the context of the project "Mobilising the Co-Benefits of Climate Change Mitigation through Capacity Building among Public Policy Institutions" (COBENEFITS).

This project is part of the International Climate Initiative (IKI). The Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety (BMU) supports this initiative on the basis of a decision adopted by the German Bundestag. The COBENEFITS project is coordinated by the Institute for Advanced Sustainability Studies (IASS, lead) in partnership with the Renewables Academy (RENAC), the Independent Institute for Environmental Issues (UfU), International Energy Transition GmbH (IET) and in Turkey the Istanbul Policy Center at Sabancı University.

December 2020

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Acknowledgements

We particularly highlight and acknowledge the strong dedication and strategic guidance of the COBENEFITS Council members from the ministries of Energy and Natural Resources (MoENR), Environment and Urbanisation (MoEU), Treasury and Finance (MoTF, formerly Ministry of Economics, MoE), Foreign Affairs (MFA) and Health (MoH). Their contributions during the COBENEFITS Council meetings guided the project team to frame the topics of the COBENEFITS Assessment for Turkey and to ensure their direct connection to the current political deliberations and policy frameworks of their respective departments.

We are also indebted to our highly valued research and knowledge partners, Nadim Copty, İrem Daloğlu, Funda Gacal, Efşan Nas Özen, Bengisu Özenç, Göktürk Poyrazoğlu, Ali Kerem Saysel, EPRA (Engineering, Procurement, Research and Analysis), the SHURA Energy Transition Center and its director Değer Saygın for their unwavering commitment and dedicated work on the technical implementation and review of the assessment studies.

We also acknowledge the members of the organisational consortium that consists of the Institute for Advanced Sustainability Studies (IASS, lead), the Renewables Academy AG (RENAC), the Independent Institute for Environmental Issues (UfU), and International Energy Transition (IET).

Supported by:

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

based on a decision of the German Bundestag

INTERNATIONAL CLIMATE INITIATIVE (IKI)

Reviving Turkey's economy & health systems following the COVID-19 pandemic

Foreword in light of recent events

At the time this paper is being published, Turkey along with many economies around the world is being severely affected by the spread and impacts of the global COVID-19 pandemic. The broader consequences have already been devastating for millions of families, workers, and businesses, as well as for local economies and national health systems. Similarly to many countries worldwide, substantial political efforts will be needed to rebuild national and local economies and job markets, as well as to increase the resilience of health systems.

Recovering from the economic shocks of the COVID-19 pandemic, and avoiding severe future shocks triggered through the climate crisis, do not represent conflicting interests but rather a mutually reinforcing coping strategy.

This report and the recent studies on which it builds suggest that the new energy world of renewables and the decarbonisation of Turkey's energy sector have strong roles to play in reviving the economy and the health system by boosting employment, fostering energy independence as a foundation of economic resilience and, importantly, unburdening national health systems by reducing the prevalence of respiratory diseases.

By establishing the enabling policy environment necessary to unlock these co-benefits the government can provide important stimuli to recover from the impacts of the COVID-19 pandemic and revive the health system and the national economy. The Paris Climate Agreement and the 2030 Agenda offer important, internationally agreed frameworks to ensure economic recovery in the shorter term and to build resilient economies and health systems in the long run.

Under their shared responsibility, the Istanbul Policy Center (IPC) of Sabancı University (as the COBENEFITS Turkey Focal Point) and IASS Potsdam invited the ministries of Energy and Natural Resources (MoENR), Environment and Urbanisation (MoEU), Treasury and Finance (MoTF, formerly Ministry of Economics MoE), Foreign Affairs (MoFA), and Health (MoH) to contribute to the COBENEFITS Council Turkey and to guide the COBENEFITS Assessment studies along with the COBENEFITS Training programme and Enabling Policy roundtables. Their contributions during the COBENEFITS Council sessions guided the project team to frame the topics of the COBENEFITS Assessment for Turkey and to ensure their direct connection to the current political deliberations and policy frameworks of their respective departments.

We are also indebted to our highly valued research and knowledge partners, for their unwavering commitment and dedicated work on the technical implementation of this study. The COBENEFITS study at hand has been facilitated through financial support from the International Climate Initiative of Germany. The Government of Turkey has emphasised climate change as one of the most significant problems facing humanity, presenting wide-ranging threats to Turkey's future unless early response measures are taken. Within the scope of Turkey's National Climate Change Strategy, the government has laid out its vision for providing citizens with high quality of life and welfare standards while achieving low carbon intensity.

With this study, we seek to contribute to this vision by offering a scientific basis for harnessing the social and economic co-benefits of achieving a just transition to a low-carbon, climate-resilient economy and thereby also allowing Turkey to achieve a regional and international front-runner role in shaping the new low-carbon energy world of renewables, making it a success for the planet and the people of Turkey.

We wish the reader inspiration for the important debate on a just, prosperous, and sustainable energy future for Turkey!

Ümit Şahin
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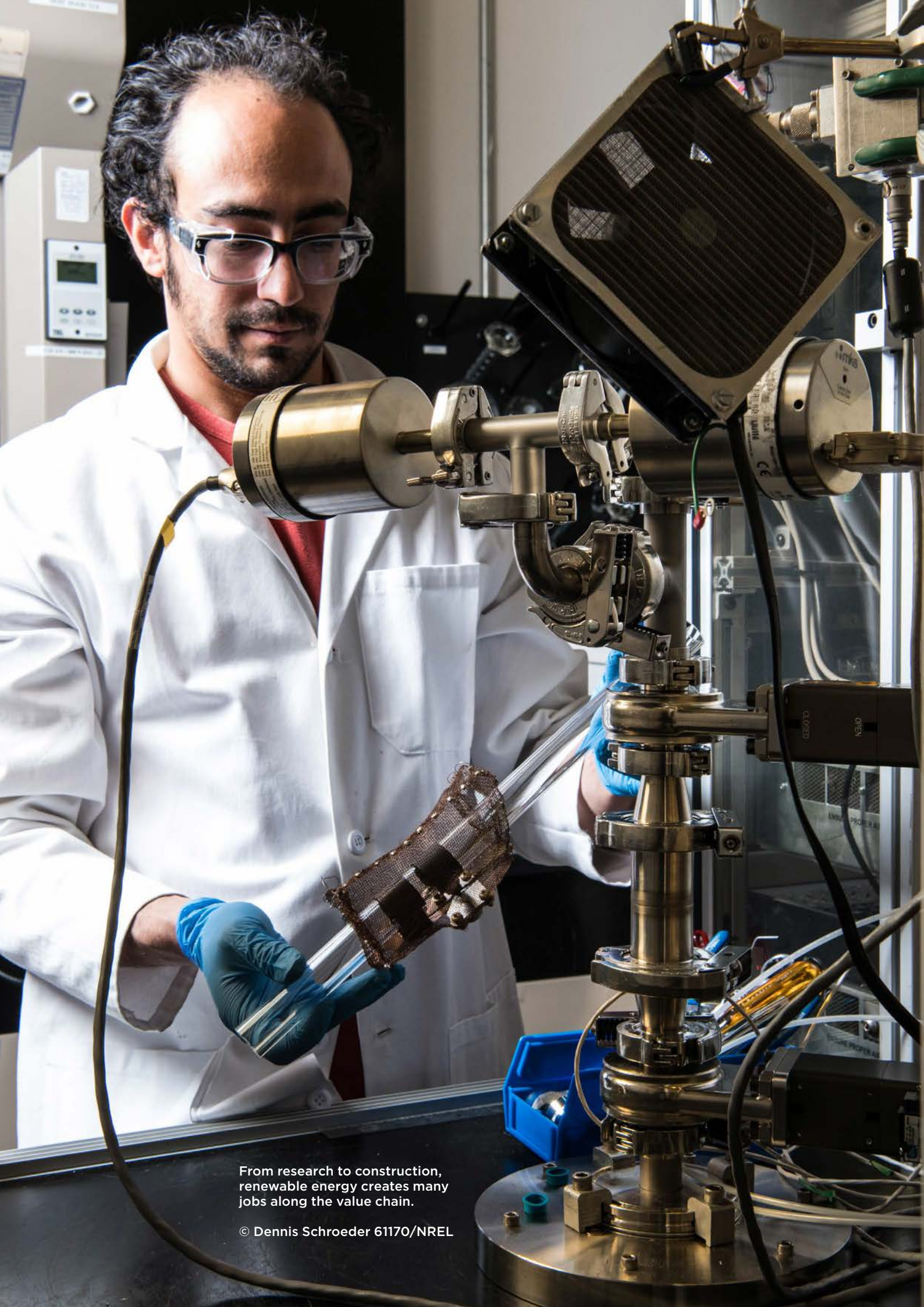


From research to construction, renewable energy creates many jobs along the value chain.

Executive Summary

Making the Paris Agreement a success for the planet and the people of Turkey

Unlocking the co-benefits of decarbonising Turkey's power sector to enable a just transition

Turkey is in the midst of an energy transition, with important social and economic implications, depending on the pathways that are chosen. Independence from energy imports; economic prosperity; business and employment opportunities as well as people's health: through its energy pathway, Turkey will define the basis for its future development. Political decisions on Turkey's energy future link the missions and mandates of many government ministries beyond energy, such as environment, industrial development, economics, foreign relations, and health.

Turkey's geography and climatic conditions are particularly advantageous for renewable energy generation, with strong potential for hydro, wind, solar and geothermal energy. However, the share of renewables in the energy mix has varied over the past decade in line with the changing water levels in the country's hydrological basins. Most of the increase in energy demand has been met using fossil energy sources. Turkey's plan for the next decade includes renewable energy targets for the energy sector, such as increasing solar generating capacity to 15 GW and wind capacity to 17 GW by 2028.

This report summarises the findings and policy messages of the four studies assessing the co-benefits of decarbonising the power sector in Turkey. The COBENEFITS Turkey Assessment series can be accessed at: www.cobenefits.info

Building on the opportunities presented, the report formulates a set of policy actions that will allow government institutions to create an enabling political environment to unlock the social and economic co-benefits of the new energy world of renewables for the people of Turkey. The policy options have been generated through roundtable dialogue and consultations with government institutions, industry associations, and expert and civil society organisations during the years 2018 to 2020.

In light of the current crisis, the findings of the report indicate that recovering from the economic shocks of the COVID-19 pandemic and avoiding running into severe future shocks triggered through the climate crisis do not represent conflicting interests but a mutually reinforcing coping strategy. The Paris Agreement and the 2030 Agenda offer important, internationally agreed frameworks to ensure economic recovery in the shorter term and to build resilient economies and health systems in the long run.

COBENEFITS Making the Paris Agreement a success for the planet and the people of Turkey

available on www.cobenefits.info

UNLOCKING THE CO-BENEFITS OF RENEWABLE ENERGY FOR THE PEOPLE OF TURKEY — 10 OPPORTUNITIES FOR POLICY MAKERS

1. **Boosting domestic manufacturing:** Public policy needs to specifically target the creation of a domestic manufacturing sector and to enable technology transfer. Domestic production capacity could be increased and greater investment could be channelled into the area of renewable energy machinery/equipment to avoid/reduce the risk of a growing trade deficit in the solar and wind value chain.
2. **Closing the technology gap:** Increased R&D activity could also help the renewable energy sector to close the technology gap and ease the trade deficit by shifting domestic production towards more technologically advanced solar and wind energy equipment positioned higher up the respective value chains.

Increasing domestic production and tackling the trade deficit

3 **Enabling small- and medium-size enterprises:** The Mini-REDA (Renewable Energy Designated Areas) scheme, as currently considered by the Ministry of Energy and Natural Resources, could assist small- and medium-size enterprises (SMEs) in the formation of a stronger domestic value chain.

4 **Training for the future job market:** Increased domestic production of RE equipment, especially of high-tech components, would require a more highly skilled workforce. The need for technological development is targeted through higher-level education, whereas increased production and installation capacities should be complemented by vocational training.

Boosting job creation and developing future-oriented skills

5 **Reporting emissions and improving air quality:** Turkey can benefit from actively participating in the Gothenburg Protocol by reporting emissions from individual power plants to international bodies in order to improve air quality and reduce air-pollution-related health costs. Ratification of the Paris Agreement on climate change, and progressive improvements in national greenhouse emissions targets will also serve the same purpose.

6 **Fostering research by making data available:** Ensuring data availability and transparency in Turkey, for instance with respect to exposure–response relationships, mortality and morbidity statistics, and health costs would foster country-specific research as well as monitoring and analysis by researchers and other non-governmental bodies.

Improving air quality and reducing the health costs of air pollution

7 **Increasing the use of energy storage devices to increase flexibility and decrease intermittency:** Increasing the flexibility of the national power system will provide greater co-benefits for energy supply security. Enabling flexibility within existing energy supply technologies and mechanisms, such as expanding the use of energy storage devices, can mitigate the challenge of renewables intermittency and integrate renewables into the grid in more flexible ways.

Fostering energy independence and ensuring security of supply

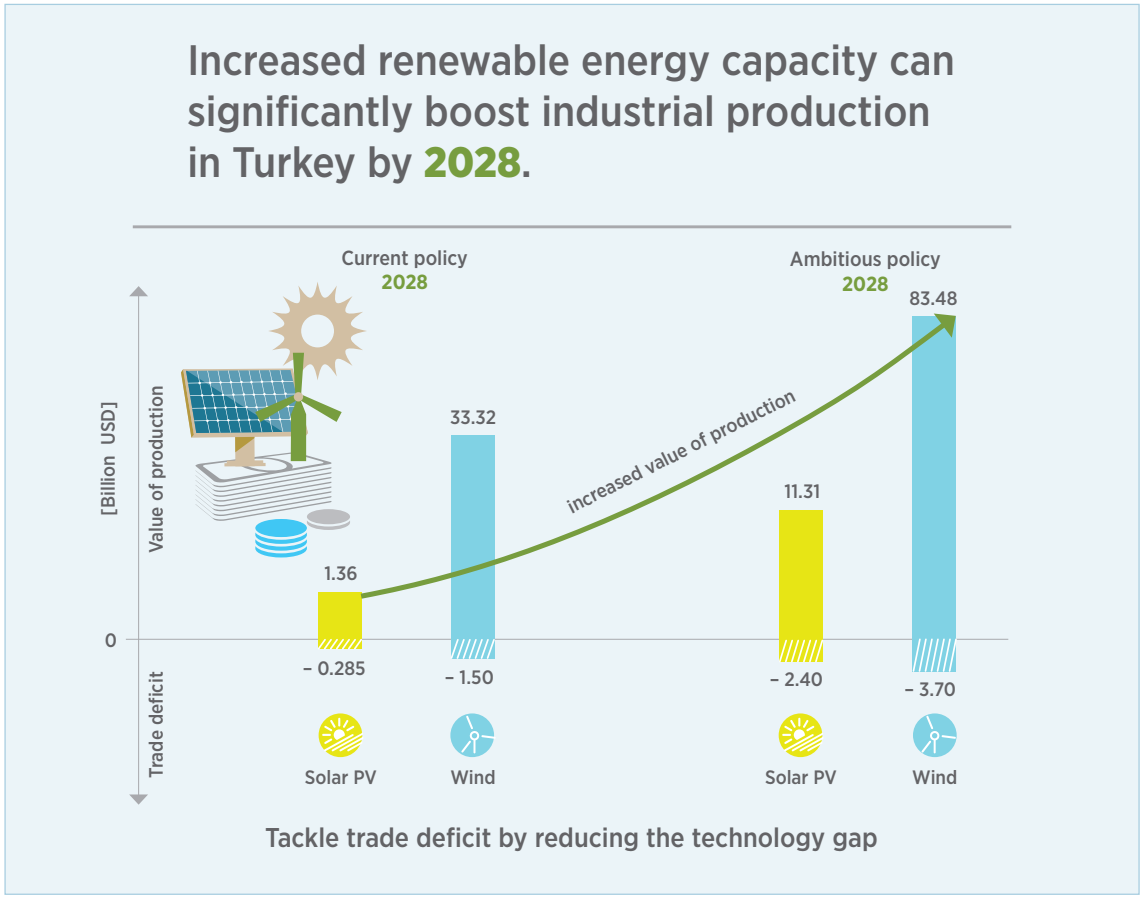
8 **Ending coal subsidies to create a level playing field:** Elimination of coal subsidies would create a level playing field between renewables and fossil-fuelled power plants, as those subsidies make coal power plants appear artificially attractive when compared to renewables.

9 **Involving diverse societal actors in policymaking to improve well-being of society:** In order to ensure a balanced contribution to the new climate regime and to improve the well-being of its communities and citizens, Turkey can enhance deliberative and participatory policy-building processes based on structured communication channels involving a broad range of societal actors.

10 **Supporting independent scientific research for best results:** Turkey is also likely to benefit tremendously from transparency and independent scientific research into employing long-term strategies for renewables in an environmentally benign way.

Making the energy transition a success for people and the planet

QUANTIFYING KEY CO-BENEFITS OF DECARBONISING TURKEY'S POWER SECTOR



Infographic ES-1: Industrial production potential with increased renewable energy capacity in Turkey.

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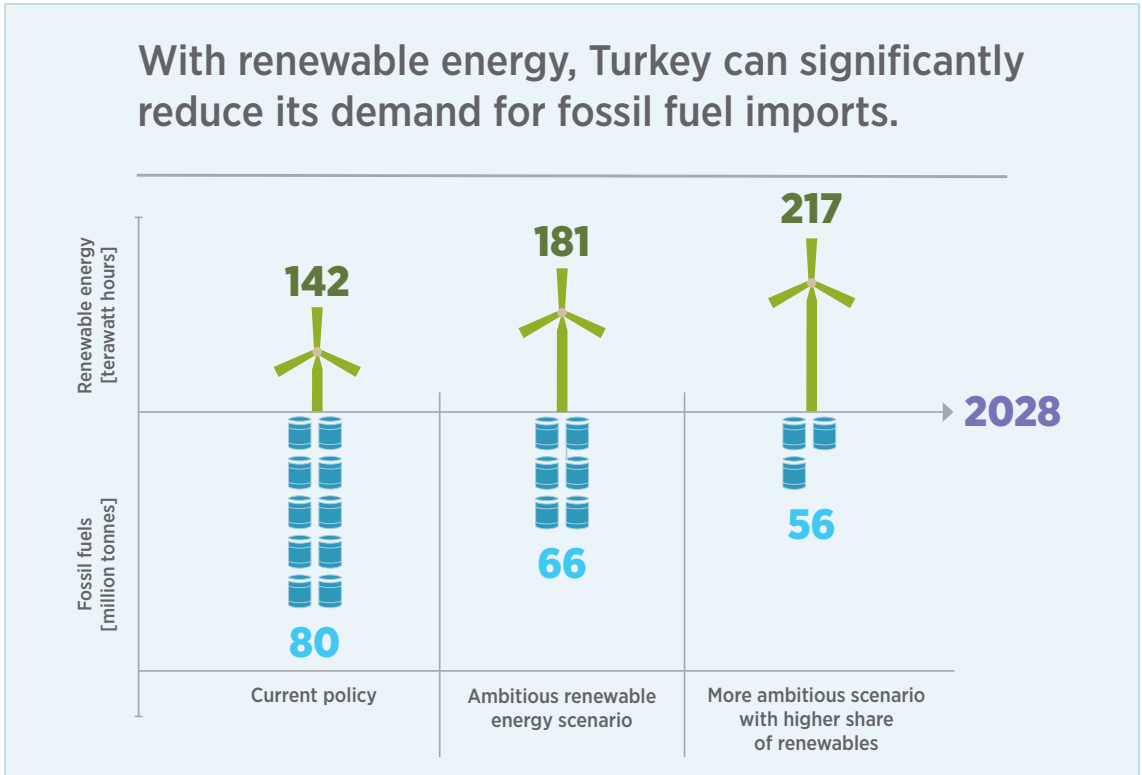

Infographic ES-2: Impact of increased renewable energy deployment on the demand for fossil fuel imports along different policy scenarios.

Source: own

BOX 1: POWER SYSTEM PATHWAYS FOR TURKEY

Four scenarios were analysed for the future development of the power sector in Turkey. The comparative scenario approach allows for estimating and comparing the timely impacts of different energy transition paths and their projected renewable energy capacities on employment, air quality and health, energy supply security, industrial development, and trade by the year 2028. The four scenarios are:

1. **Current Policy Scenario:** based on projections by the Turkish Electricity Transmission Corporation (TEİAŞ) for 2026, adjusted for 2027 and 2028 predictions.
2. **New Policy Scenario:** based on the Ministry of Energy and Natural Resources (MoENR) announcements of 1 GW annual increase in solar and wind capacity for 10 years, starting in 2018, as a part of its National Energy and Mining Policy (MoENR, n.d.).
3. **Advanced Renewables Scenario A:** based on a SHURA (2018) study, which reported that increasing installed wind and solar capacity to 20 GW each is feasible without any additional investment in the transmission system.
4. **Advanced Renewables Scenario B:** based on a SHURA (2018) study, which reported that increases of 30 GW each in the solar and wind sectors are possible with a 30% increase in transmission capacity investment and 20% increase in transformer substation investment.

The 2018 installed capacities are taken from TEİAŞ reports. The scenario analysis takes into account the additional capacity investments for each renewable energy technology for 10 years (2018–2028), to reach the expected total installed capacities by 2028.

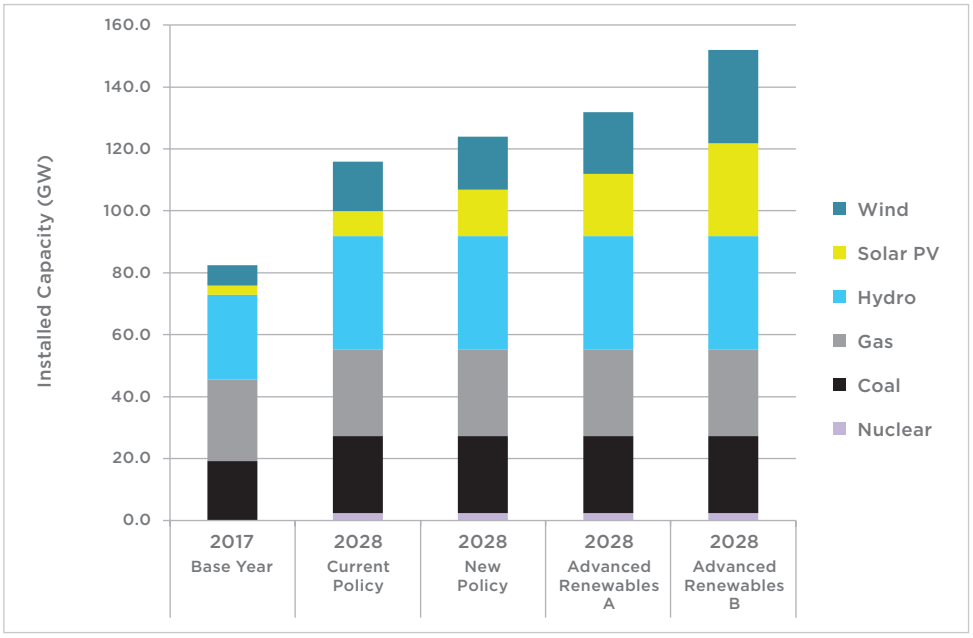

Figure ES.3: Electricity generation capacity projections under different scenarios (GW)

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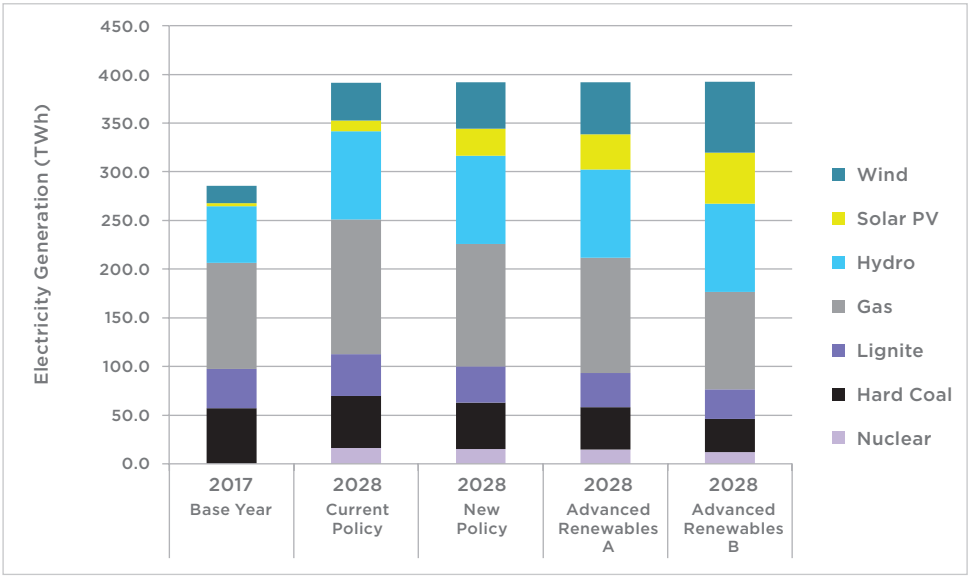

Figure ES.4: Electricity generation scenarios for different fuel types (TWh)

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Middle-skilled workers are the main beneficiaries of job creation across the whole wind and solar value chains.

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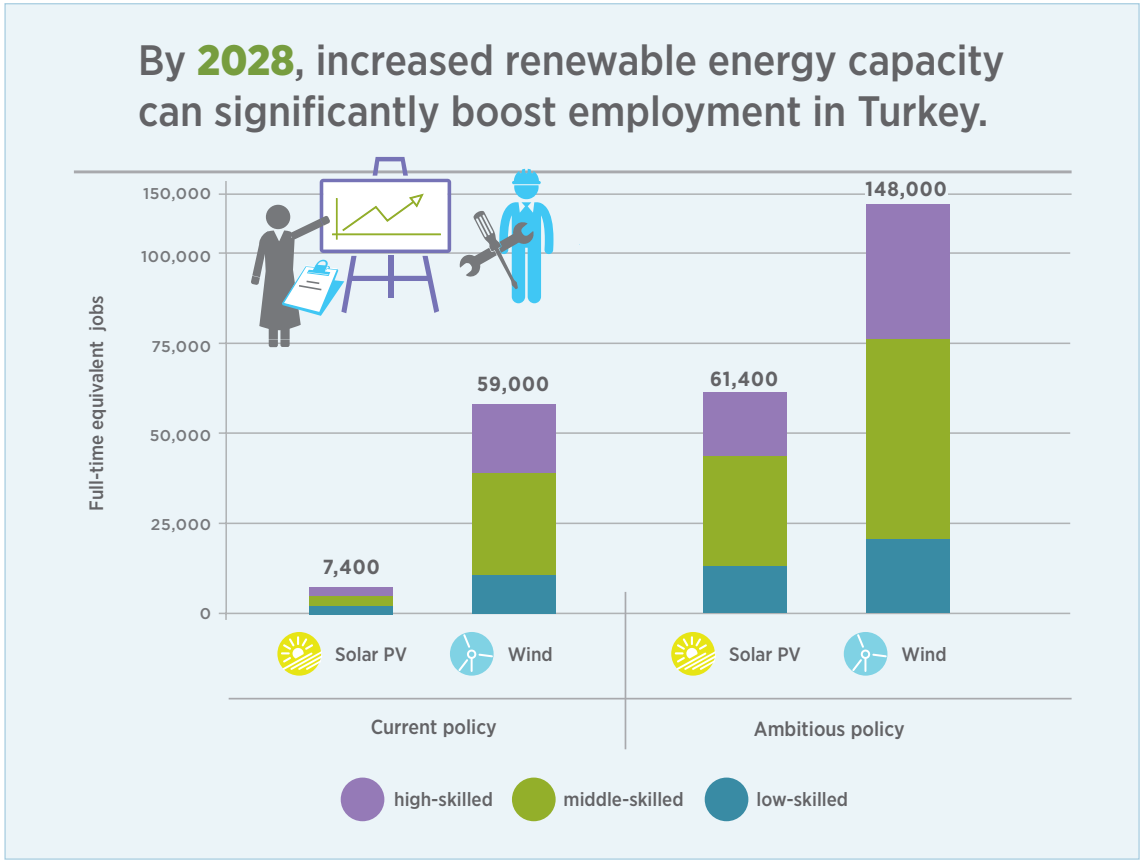

Infographic ES-5: Employment opportunities in Turkey related to increased renewable energy capacity by 2028.

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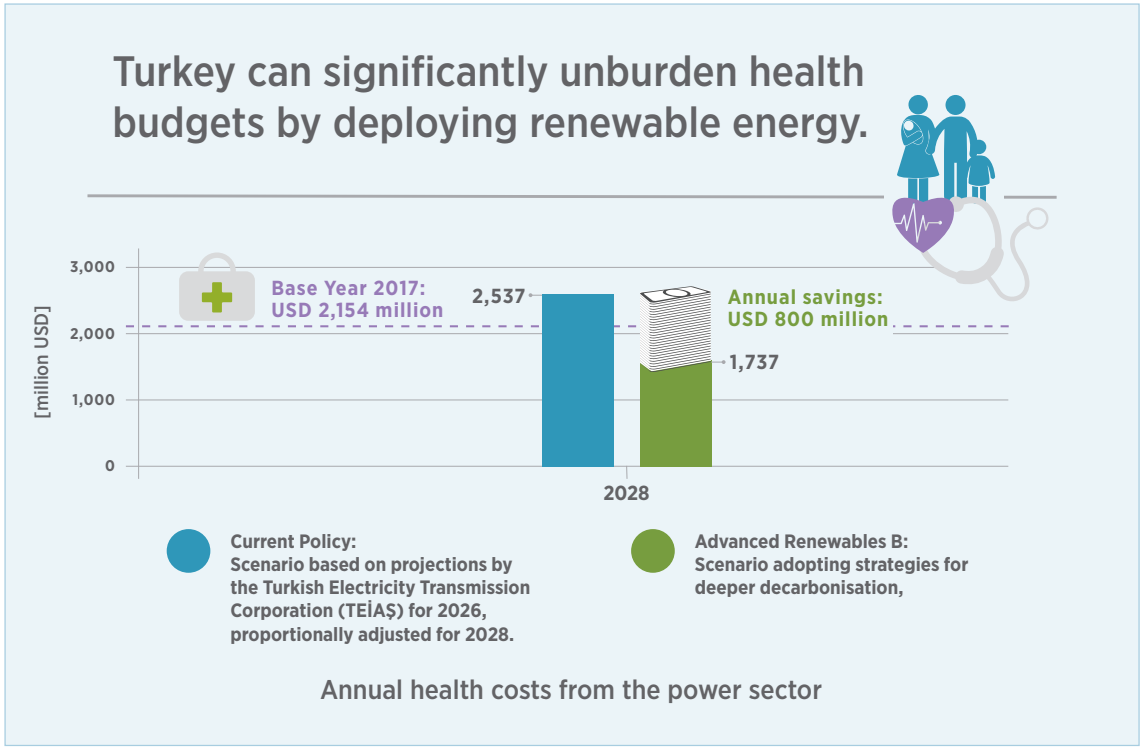

Infographic ES-6: Economic health impacts in Turkey along different decarbonisation pathways.

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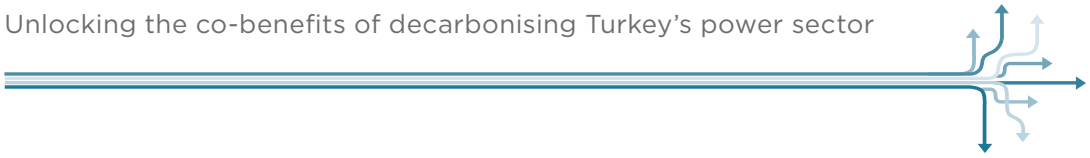

Contents

1. Creating opportunity and prosperity for the people of Turkey in the new energy world of renewables

Turkey is in the midst of an energy transition, with important social and economic implications, depending on the pathways that are chosen. Independence from energy imports; economic prosperity; business and employment opportunities as well as people's health: through its energy pathway, Turkey will define the basis for its future development. Political decisions on Turkey's energy future link the missions and mandates of many government ministries beyond energy, such as environment, industrial development, economics, foreign relations, and health.

The Government of Turkey has emphasised climate change as one of the most significant problems facing humanity, presenting wide-ranging threats to Turkey's future unless early response measures are taken. Within the scope of Turkey's National Climate Change Strategy, the government has laid out its vision for providing citizens with high quality of life and welfare standards while achieving low carbon intensity.

Recently, two encouraging developments have highlighted the country's move to combat climate change and to enter an energy transition: the initiative by 24 local municipalities (including 6 metropolitan municipalities) that signed the "We are in for climate" declaration on 5 December 2019, and the simplification of small-scale embedded generation (SSEG) systems, which has been made easier with the decision to increase the upper limit of unlicensed power generation to 5 MW.

But Turkey is also at a decisive crossroads in 2020, as this year the continuation of the YEKDEM scheme (feed-in tariffs for renewables) needs to be decided and further tenders for renewable energy plants are expected as part of the YEKA programme (equivalent to a REDA Renewable Energy Designated Area scheme).

In light of the current crisis, the results of the COBENEFITS Policy Report for Turkey indicate that recovering from the economic shocks of the COVID-19 pandemic and avoiding running into severe future shocks triggered through the climate crisis do not represent conflicting interests but a mutually reinforcing coping strategy. The Paris Agreement and the 2030 Agenda offer important, internationally agreed frameworks to ensure economic recovery in the shorter term and to build resilient economies and health systems in the long run.

Political decisions on Turkey's energy future link the missions and mandates of many government departments and agencies beyond energy and power, such as environment, industry and trade, and labour. Hence, the timely debate on Turkey's energy future boils down to assessing how renewables can improve the lives of Turkish people — and, in light of recent events, how the new energy world of renewables can play an important role in reviving the country's economy and health systems following the COVID-19 pandemic.

In the context of the COBENEFITS project a series of assessment studies were conducted to identify social and economic co-benefits of renewable energy in Turkey and to develop policy options for creating an enabling environment to unlock these opportunities for people, communities, and businesses. The key results of that process are presented in this COBENEFITS Policy Report for Turkey.

The COBENEFITS programme cooperates with national authorities and knowledge partners in countries worldwide, to connect national socio-economic development objectives with the joint efforts to act on climate change in a mutually reinforcing co-benefits approach. The project supports efforts to develop enhanced Nationally Determined Contributions (NDCs) with the ambition to deliver on the Paris Agreement and the 2030 Agenda on the Sustainable Development Goals (SDGs).

The term 'co-benefits' refers to simultaneously meeting several interests or objectives resulting from a political intervention, private-sector investment, or a mix thereof.

Sebastian Helgenberger, Martin Jänicke, & Konrad Gürtler (2019): Co-benefits of Climate Change Mitigation. Encyclopedia of the UN Sustainable Development Goals

In the literature on climate and sustainable development, the approach of studying, implementing, and replicating the positive externalities of an action is what we may understand as the co-benefits approach. Implementing this approach requires fostering an environment for problem solving by encouraging the idea that the solution to global problems, such as climate change and development, have more synergies with each other than trade-offs. It aims to peel through the layers of international politics and diplomacy in order to realise solutions on the ground.

For Turkey, ensuring that its economic challenges are met would require significant investment; not only in terms of infrastructure but also in terms of research and development. The co-benefits approach endorses an approach recommending multiple benefits, a significant one being economies of scale from collaborations, which would not be accrued by individual country action. Another benefit is that this approach can be studied at disaggregated levels and emulated successfully under similar circumstances.

The COBENEFITS Policy Report for Turkey compiles key findings from the COBENEFITS Assessment series, quantifying the co-benefits of decarbonising Turkey's power sector in view of future-oriented employment and skills development, industrial development, trade opportunities and innovation, secure energy supply, and health benefits related to a less carbon-intensive power sector, all of which can be instrumental in reviving the national economic system (IASS/IPC, 2019a/b/c; IASS/IPC, 2020 a/b).

Considering the determination of the government in making green energy one of the key enablers of future economic prosperity, the report shows that expanding the share of renewables with certain improvements in the energy sector can lead to significant opportunities. Building on the opportunities presented, the report formulates a set of policy actions to allow government institutions to create an enabling political environment through which to unlock the social and economic co-benefits of the new energy world of renewables for the people of Turkey. The policy options were generated through roundtable dialogue and consultations with government institutions, industry associations, and expert and civil society organisations during the years 2018 to 2020.

Securing Turkey's energy future with renewables.

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2. Unveiling the co-benefits in the renewable energy sector

This policy report section synthesises key findings from the COBENEFITS Turkey assessment series. The study findings have been processed to provide direct and useful input for policy makers and policy implementers who are working to further progress the social and economic environment for communities, businesses, and citizens in Turkey.

The co-benefits priority areas for Turkey — employment and skill development, air pollution and health, industrial development, trade opportunities and innovation, and energy supply security — as well as the reference policy pathways on which the co-benefits assessment are built have been defined and specified in consultation with the ministries of Energy and Natural Resources (MoENR), Environment and Urbanisation (MoEU), Treasury and Finance (MoTF, formerly Ministry of Economics MoE), Foreign Affairs (MoFA), and Health (MoH).

Key findings and figures are displayed in this section. The full reports, including detailed methodology and results sections, can be found at:

www.cobenefits.info

BOX 1: POWER SYSTEM PATHWAYS FOR TURKEY

Four scenarios were analysed for the future development of the power sector in Turkey. The comparative scenario approach allows for estimating and comparing the timely impacts of different energy transition paths and their projected renewable energy capacities on employment, air quality and health, energy supply security, industrial development, and trade by the year 2028. The four scenarios are:

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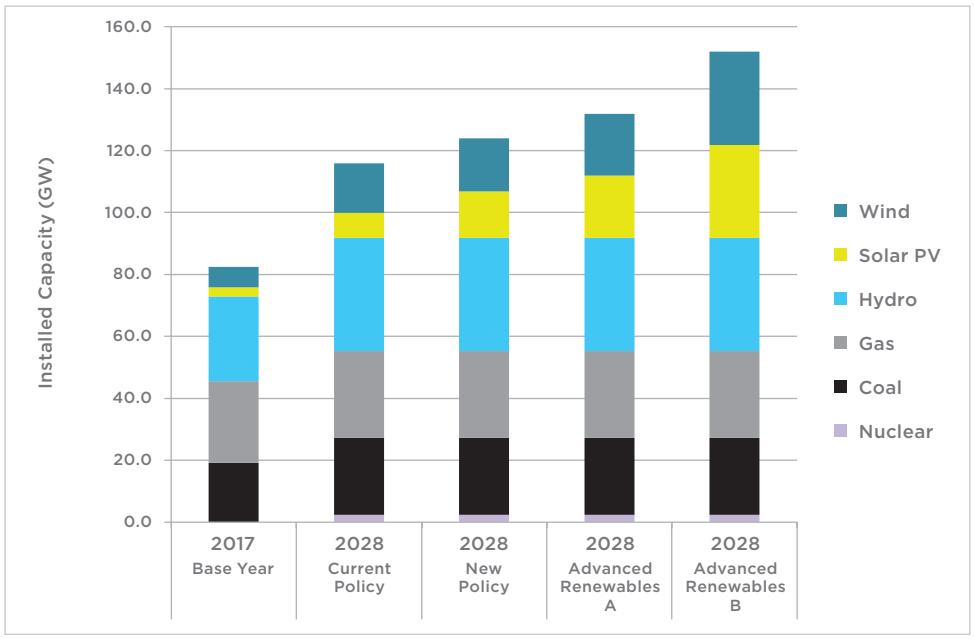

Figure 1: Electricity generation capacity projections under different scenarios (GW)

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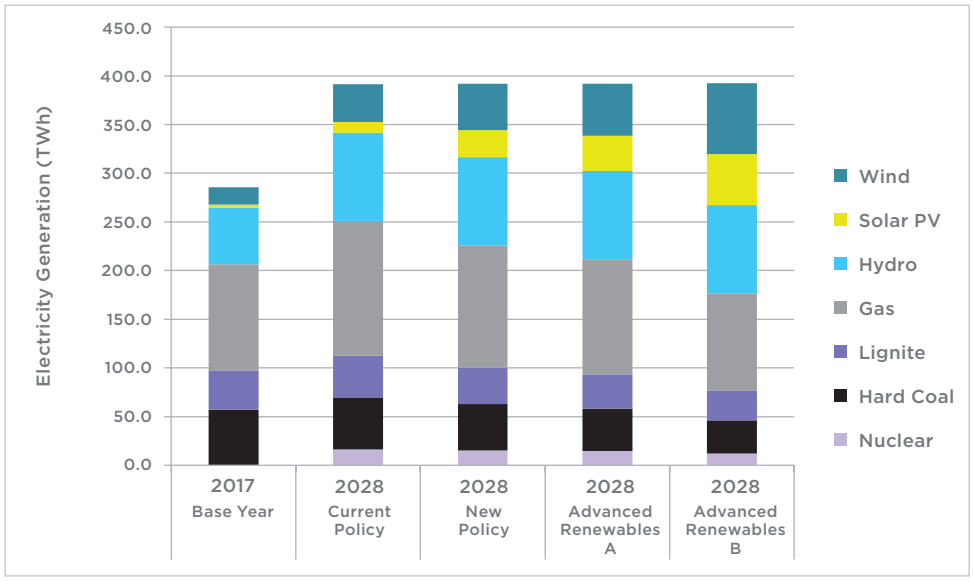

Figure 2: Electricity generation scenarios for different fuel types (TWh)

Source: own

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

The energy transition is inducing new investments in the electricity production and infrastructure sectors worldwide. By predominantly relying on fossil fuel resources to meet its increasing energy demand, Turkey faces significant risk of increased dependency 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 enable technology transfer.

***The COBENEFITS study on "Industrial development, trade opportunities, and innovation with renewable energy in Turkey"* examines the co-benefits of increased deployment of renewable energy to industrial development and the trade balance in Turkey (IASS/IPC, 2019b).**

Key policy opportunities:

- **Policy opportunity 1: Turkey can significantly boost the value of domestic industrial production by increasing the share of renewables.** With the decision by the Turkish Government to increase solar energy capacity by 60% and to more than double the installed wind capacity by 2028, the government paved the way for a fifteenfold increase in the value of production along the solar value chain, and more than 31% along the wind value chain by 2028. Nevertheless, there is scope for further advances:

- **Policy opportunity 2: By following more ambitious renewable pathways for Turkey, the expected increases in the value of domestic 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 by 2028 compared to 2016.

- **Policy opportunity 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 such products account for only 4% of exports (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.

KEY FIGURES

- Across the value chains, each additional MW of energy capacity 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 is concentrated within the first segment (intermediaries of good and services), with only 1% of value added by electricity producers. Greater industrial competitiveness requires integrating at the highest possible value-added level.

- 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 USD that is estimated for the current policy, if more ambitious solar capacity additions are achieved.
- Likewise, the wind sector could peak at a total value of 83.5 billion USD from the expected 33.32 billion USD by 2028 if RE capacity additions are put in place.

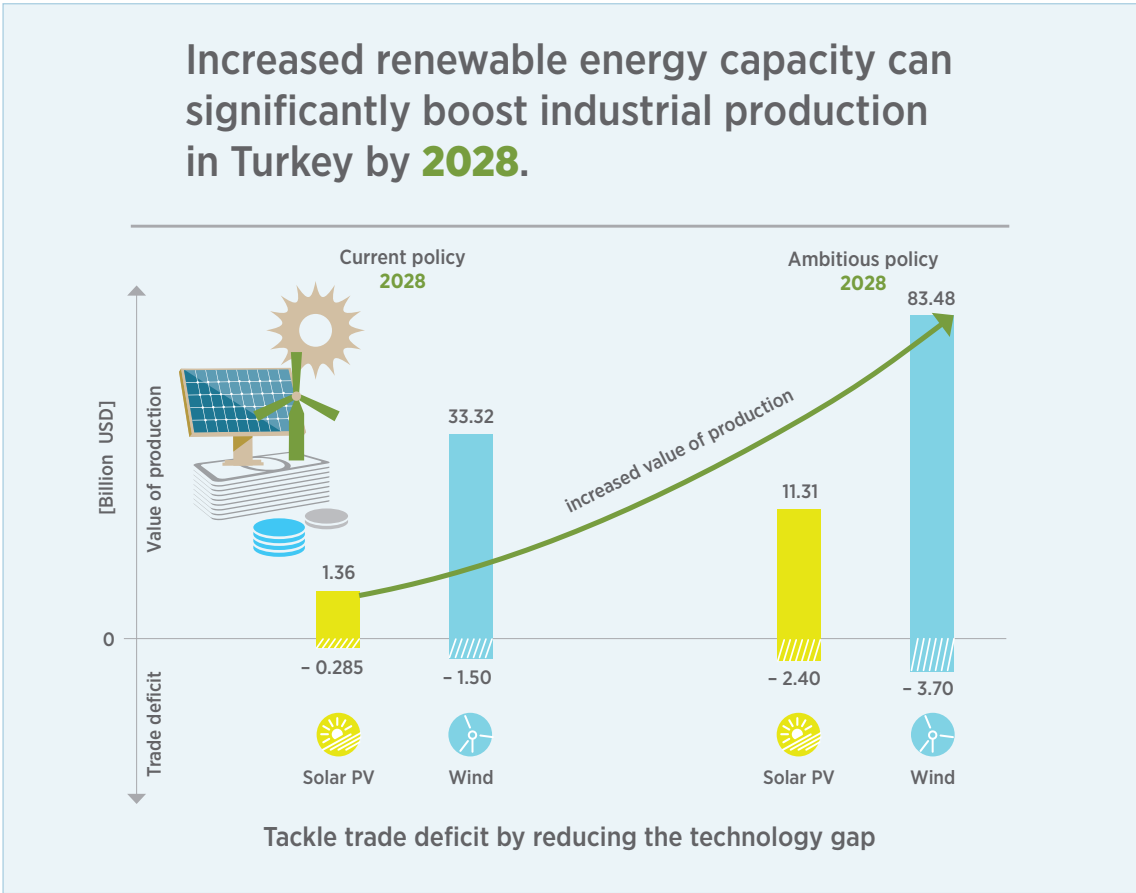

Figure 3:
Industrial production potential with increased renewable energy capacity in Turkey.

Source: own

KEY FINDINGS

- **The value of production is expected to rise under current policies, but there is room for further improvements.** 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 rise with increased solar energy deployment. Moderate additional capacity, ranging between 3 and 10 GW in the next 10 years, is expected to enable additional industrial production valued at between 1.3 and 4.96 billion USD by 2028. More ambitious capacity additions of 15–25 GW are expected to increase the value of 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 showed significant growth rates during 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 (with one exception) showed 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).

- **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 technological composition, with high-technology components accounting for 2% compared with 23% for low-technology components. Evidence suggests that greater industrial competitiveness tends to be integrated at higher levels within local and global value chains (UNIDO, 2012).

- **Those areas in which Turkey's RE equipment exports have 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.

- **The trade deficit is expected to increase unless the technological imbalance is addressed.** Industrial production in the **solar sector** entails a trade deficit of 19 million USD 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 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 involving 9.3–10.3 GW additions to 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. These potential future trade imbalances associated with renewables can — in contrast to fundamental trade and resource deficits that already exist for fossil fuels — be avoided by implementing the suggested measures to increase domestic industrial production. Furthermore, the energy transition will bring multiple co-benefits and opportunities beyond saved import costs and an improved balance of trade, as the results presented in this report show.

2.2 Future skills and job creation through renewable energy in Turkey

***The COBENEFITS study on "Future skills and job creation through renewable energy in Turkey" (IASS/IPC 2019a)"* examines the employment impacts of different energy transition pathways along with implications for required skills profiles.** The study also provides initial insights on the estimated occupational distribution, thus predicting the changes and employment opportunities available to Turkey in its solar and wind sectors.

Key policy opportunities:

- **Policy opportunity 1: Turkey can significantly boost employment by increasing the share of renewables.** The Turkish Government's decision — to increase solar energy capacity by 60% and more than double wind electricity capacity by 2028 — paved the way to create more than 7,400 jobs along the solar value chain and more than 59,000 jobs along the wind value chain by 2028 alone.
- **Policy opportunity 2: There is room for more: By following more ambitious renewable pathways for Turkey, the expected employment effect can be doubled across the wind power value chain and increased eightfold along the solar value chain,** creating more than 200,000 jobs by 2028.
- **Policy opportunity 3: The expected growth of Turkey's wind and solar power producers will increase the demand for high-skilled jobs, but middle-skilled workers are the main beneficiaries of job creation** across the whole wind and solar value chains, with 55% of job additions in this labour segment.

KEY FIGURES

- Up to 61,400 full-time equivalent jobs (FTE employment[1]) in the solar sector and 147,700 in the wind sector can be created nationally through the power sector transformation between 2018 and 2028.
- Over that ten-year period each additional MW in wind energy production leads to increased employment of 6.3 full-time equivalent workers across the entire value chain. Across the solar value chain each additional MW leads to an increased employment of 2.5 full-time equivalent workers.

KEY FINDINGS

- **Turkey can significantly boost employment by increasing investment in renewable energy technologies.** On the basis of current policy, employment can already be expected to increase by an additional 7,400 FTE jobs across the solar value chain and 59,000 FTE jobs across the wind power value chain by 2028. By following SHURA's high-ambition scenario (scenario B), these numbers can be increased eightfold along the solar value chain and more than doubled in the wind power value chain, in total providing more than 200,000 additional FTE jobs by 2028.

[1] The analysis uses full-time equivalent (FTE) employment, calculated as the ratio of the worked days registered by an individual during December, over 31 days (monthly maximum). For example, an individual who was registered for 31 days would have an FTE employment metric of 1, whereas an individual that was registered for 10 days would count as FTE employment of around one-third, and so forth.

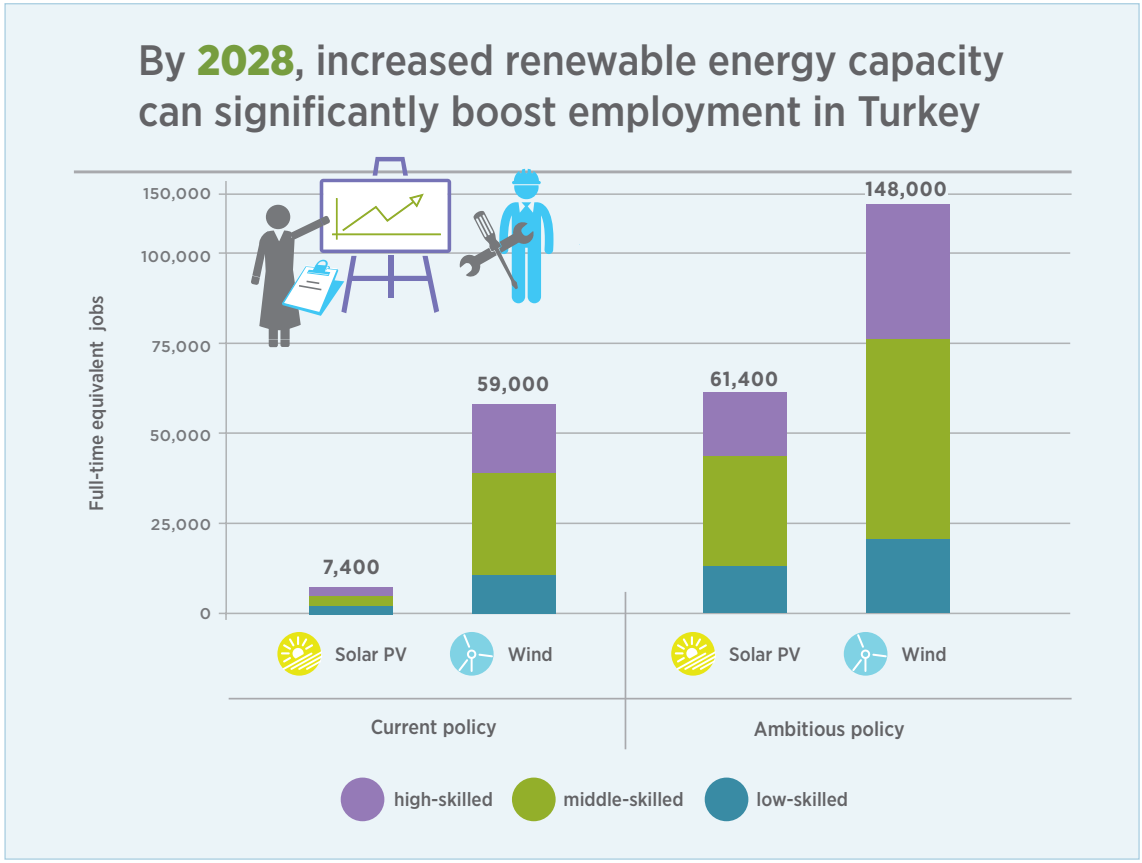

Figure 4: Employment opportunities in Turkey related to increased renewable energy capacity by 2028.

Source: own

- **A significant part of Turkey's workforce is already connected to renewable energy investments.** Among formally registered employees, almost 8 million are connected to the wind sector value chain, and more than 4 million to the solar sector value chain (available data as of 2016). With 16,200 FTE jobs directly in wind energy production firms and only an emerging solar energy production sector, at present this energy-producing segment only contributes a small fraction to total employment in the solar and wind value chains.

- **To date, a substantial share of the jobs created through renewable energy investment in Turkey are upstream of electricity producers.** For each job directly created among wind energy producers, 1.75 additional jobs are created indirectly in upstream segments of the value chain in the country, irrespective of the scenario assessed. Given the hitherto low numbers of licensed solar energy producers in Turkey, more than 9 out of 10 FTE jobs in the solar value chain are being created in upstream segments of the value chain, such as in manufacturing or the transport and construction sectors.

- **Large proportions of jobs created among wind and solar power producers are highly skilled, whereas middle-skilled workers are the main beneficiaries of job creation across the whole wind and solar value chains.** Across all scenarios, 55% of the FTE jobs generated are among the middle-skilled labour group, such as machine operators or sales workers. In the solar value chain a quarter of the additional jobs created are for high-skilled professions such as managers and technicians, whereas this is slightly higher for the wind power value chain, accounting for 30% of additional FTE jobs. Among wind power producing segment this figure increases to 40%. Jobs in renewable power generation are concentrated in the services, construction, and manufacturing sectors. However, employment opportunities are created in almost all sectors — including the mining sector, which is predicted to experience a net increase in overall employment despite job losses within coal mining.

2.3 Improving air quality and reducing health costs through renewable energy in Turkey

Coal- and natural gas-fired power plants in Turkey are significant sources of atmospheric emissions that are harmful to people's health and the environment. This study analyses the impacts of the pollutants CO, SO_2, NO_2, and PM_{10} on human health. Turkey's need for electricity will continue to increase in the coming years. Recognising that coal- and natural gas-fired electricity generation are major contributors to atmospheric pollutants and related health impacts, it is evident that an increased share of renewable energy in electricity generation would help lessen the problems of air pollution and reduce costs for the Turkish health system.

***The COBENEFITS study "Improving air quality and reducing health costs through renewable energy in Turkey"* (IASS/IPC, 2020a) examines the co-benefits to people's health and health cost savings resulting from increased deployment of renewable energy in Turkey.**

Key policy opportunities:

- **Policy opportunity 1: Turkey can significantly reduce the number of premature deaths related to air pollution emitted from fossil-fuelled power plants.** Under the current policy, mortality can be expected to increase from 2,100 cases in 2017 to more than 2,300 cases in 2028. By following an ambitious decarbonisation pathway (Advanced Renewables Scenario B), estimated mortality would be reduced to less than 1,600 cases in 2028, thus avoiding more than 750 deaths in that year alone.
- **Policy opportunity 2: Turkey can significantly unburden its health system by decarbonising the power sector:** Under the current policy, annual health-related costs can be expected to increase from USD 2.15 billion in 2017 to USD 2.5 billion in 2028. By following an ambitious decarbonisation pathway (Advanced Renewables Scenario B), health cost savings in 2028 can amount to USD 800 million in that year alone.
- **Policy opportunity 3: The Ministry of Energy and Natural Resources (MoENR) can support measures to track progress in reducing health impacts and related health costs by ensuring access to air pollutant emission data from individual power plants, detailing the relevant fuel, technological, and emission control standards.** Public monitoring and technical analysis of power plants can improve the quality and reliability of air pollution and health cost assessments. This can be facilitated by public access to technical data on thermal power plants, such as filtration methods, combustion techniques, water consumption, fuel usage, and releases of atmospheric pollutants.

KEY FIGURES

- 750 premature deaths can be avoided in the year 2028 by increasing the share of renewables in the power sector.
- Health cost savings can amount to USD 800 million in the year 2028 alone.
- Asthma among children younger than 14 years can be reduced by almost 1 million cases in 2028.

KEY FINDINGS

- The highest SO_2 concentrations are observed at the Edirne–Keşan, Amasya–Suluova, and Çorum–Mimar Sinan stations. The highest NO_2 concentrations are observed at the Ordu–Ünye, Samsun–Yüzüncüyıl, and Kayseri–Hürriyet stations. **Hourly CO concentrations are high at some locations, in some instances more than 10 times the Turkish air quality standards.**

- **Annual PM_{10} concentration (averaged over all available air quality stations) is 54 g/m³, breaching the air quality standard of 40 g/m³ and clearly revealing that the air pollutant of greatest concern in Turkey is PM_{10}.** The highest PM_{10} concentrations are observed at Iğdır, Kahramanmaraş–Elbistan, and Ankara–Kayaş.

- **The number of restricted activity days can be reduced by 18,100 days in 2028** under an ambitious decarbonisation policy (Advanced Renewable Scenario B with renewables accounting for 55% of total power generation) compared to the current policy, thus improving Turkey's economic output.

- **Turkey can significantly reduce the number of premature deaths related to air pollution from fossil-fuelled power plants, preventing more than 750 deaths in the year 2028** under an ambitious decarbonisation policy (Advanced Renewable Scenario B), compared to the current policy. This calculation is based on YOLL (years of life lost) data relating to the effects of CO, SO_2, NO_2, and PM_{10}.

- **Turkey can generate significant health cost savings, amounting to USD 764 million in 2028** under an ambitious decarbonisation policy (Advanced Renewable Scenario B), compared to the current policy. These cost savings result from reduced morbidity (chronic bronchitis, congestive heart failure, lung cancer) and mortality and from fewer hospital admissions and asthma cases.

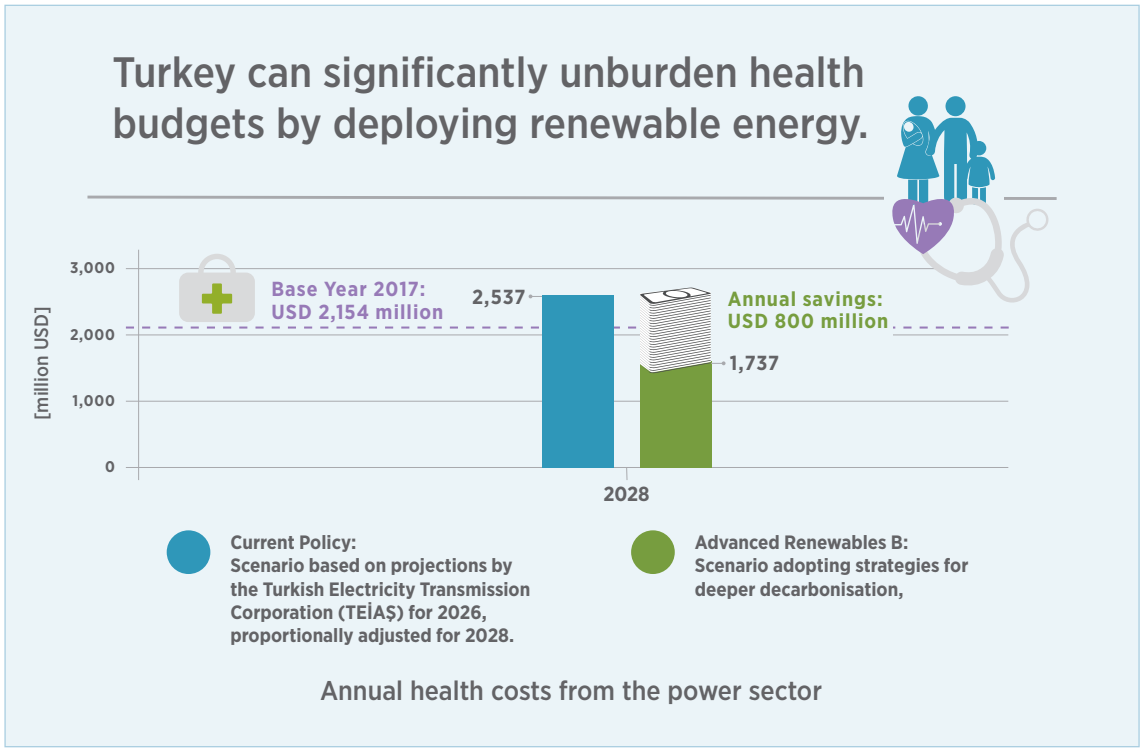

Figure 5:
Economic health impacts in Turkey along different decarbonisation pathways.

Source: own

Turkey can significantly boost the value of production by increasing the share of renewables.

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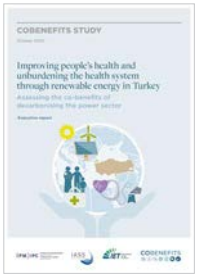
2.4 Energy supply security in Turkey

Turkey's socio-economic growth has been accompanied by increasing energy demand, thereby expanding the opportunities to enable multiple co-benefits involving both securing the country's future energy supply and utilising local and clean energy sources. The energy transition is inducing new investments in the electricity production and infrastructure sectors worldwide. By predominantly relying on fossil fuel resources to meet its increasing energy demand, Turkey faces significant risk of exacerbating the current account deficit in the energy sector's trade balance and also increasing its dependency on energy imports in the future. Electricity generation technologies that utilise renewable energy sources can contribute to reducing energy import dependency.



***The COBENEFITS study "Securing Turkey's energy supply and balancing the current account deficit through renewable energy" (IASS/IPC 2020b)* examines the contribution of renewable energy sources for reducing the demand for fossil fuels and thus associated fossil fuel imports to Turkey.**

Key policy opportunities:

- **Policy opportunity 1: Turkey can foster its energy independence and ensure security of supply by increasing the use of its renewable energy sources.** Increasing the share of renewable energy in power generation will contribute to increasing independence from fossil fuel imports and to reducing the current account deficit in the energy sector's trade balance.
- **Policy opportunity 2: By the year 2028 Turkey can reduce its natural gas consumption by 16 % and 155 million MMBTU** (million British Thermal Units) through scaling up renewable power generation without the need to increase foreseen investment in the transmission system.
- **Policy opportunity 3: Annual economic savings on fossil fuels and fossil fuel imports can amount to USD 2.1 billion by the year 2028** by increasing the share of renewable energy in power generation and making the transmission system renewables-ready.

KEY FIGURES

- Turkey is heavily reliant on fossil fuels imports: in 2017, more than 98% of the natural gas and 42% of the coal burned for electricity generation were from imported sources (EPDK, 2019).
- Turkey's coal reserves largely occur in the northwest of the country, and its natural gas resources are scarce[2]: 99% of natural gas used in the power sector was imported in the base year 2017. While lignite is available across the country, more than 90% of Turkey's domestic lignite reserves are of low calorific value with a heat rate of less than 3,000 Kcal/kg.
- Renewable energy sources accounted for 29% of total power generation in 2017, increasing to 32% in 2018. Aside from hydropower (accounting for 20 GW), solar PV (3 GW) and wind power (6.5 GW) accounted for the highest non-fossil generation capacities. In 2018, solar PV capacities and wind power increased to 5 GW and 7 GW respectively (EPDK, 2019).
- It is feasible to more than double power generation from renewable energy sources, from 85.1 to 181.5 TWh (46% of total power generation), without any additional investment in the transmission system (own calculations; based on SHURA, 2018).
- The target in the New Policy scenario for integration of renewables into the Turkish power system is 1 GW/year. With integration presently around 0.6 GW/year, this target is not being met under the current policy.

Annual economic savings on fossil fuels and fossil fuel imports can amount to USD 2.1 billion by the year 2028 by increasing the share of renewables.

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[2] In 2017, the first natural gas production started in Çanakkale. In this province, the production volume was 1.48 million Sm3 in December 2017. (EPDK, 2018: 3).

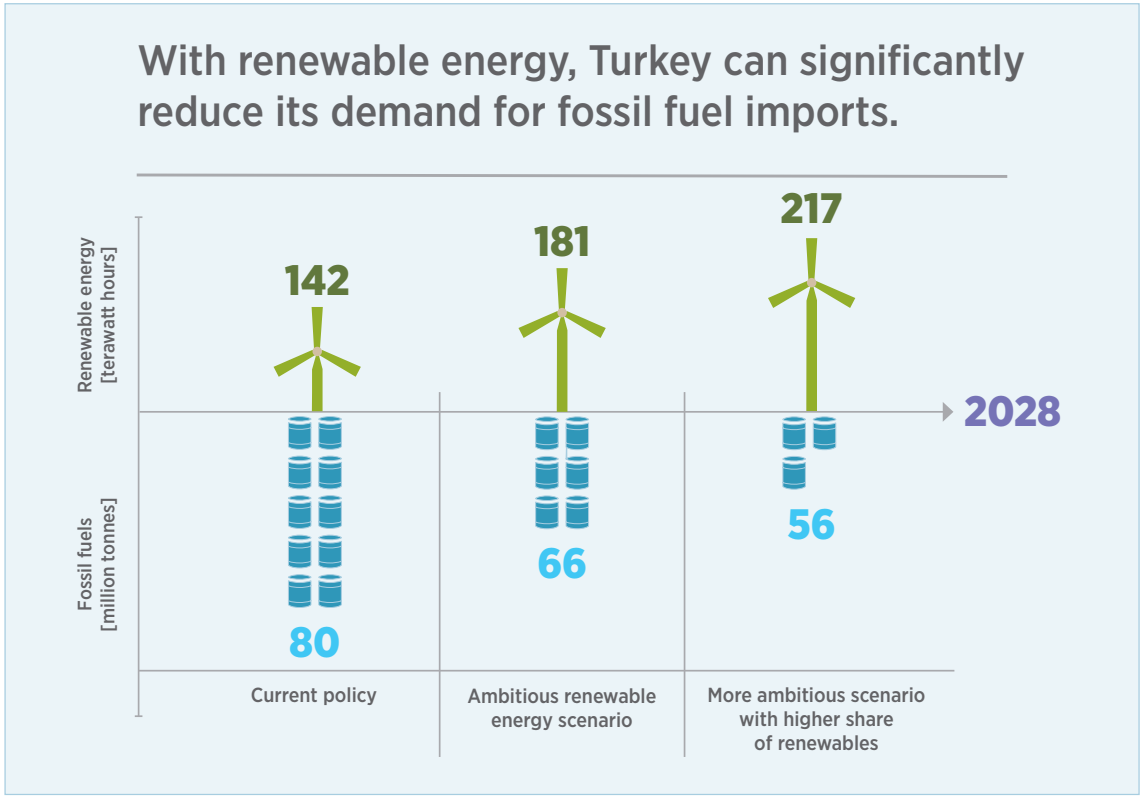


Figure 6:
Impact of increased renewable energy deployment on the demand for fossil fuel imports along different policy scenarios.

Source: own

KEY FINDINGS

- **Turkey can foster its energy independence and security of supply by increasing the use of its renewable energy sources:** By the year 2028, Turkey can reduce its natural gas consumption by 16 % and 155 million MMBTU through scaling up renewable power generation without the need to increase foreseen investment in the transmission system (Advanced Renewables Scenario A, compared to the current policy pathway).

- By additional investment in transmission capacity (+30% investment) and transformer substations (+20 % investment), **renewable energy can allow Turkey to reduce its natural gas consumption by 38 %** (300 million MMBTU) and overall fossil fuel demand in the power system by almost 30 % by the year 2028 (Advanced Renewables Scenario B, compared to the current policy pathway).

- Under the current policy pathway Turkey's power sector is expected to consume almost 80 million tonnes of fossil fuels in the year 2028. This **total consumption can be reduced by 17 %** (to 66 million tonnes) **and even by 30 %, by following the energy transition pathways Advanced Renewables Scenarios A and B** respectively.

- Under the New Policy Scenario, economic savings from reduced use of fossil fuels (including imports) are estimated as USD 728 million in the year 2028. Such savings could increase to more than USD 1 billion by increasing the share of renewable energy in power generation to 46 % (Advanced Renewables Scenario A). By additional investment in the transmission grid (Advanced Renewables Scenario B), allowing a 55 % share of renewable energy in power generation and reducing the levelised cost of electricity (LCOE) for renewable energy sources, **economic savings can be almost doubled to USD 2.1 billion.**

3. Unlocking the co-benefits of renewable energy for the people of Turkey

Creating future-oriented skill sets and employment opportunities; improving people's health and unburdening the public health system; ensuring energy supply security; and fostering industrial development, trade opportunities, and innovation:

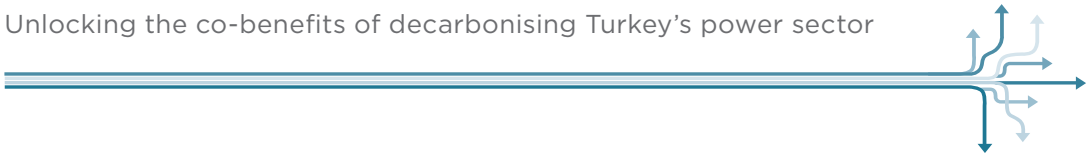
The COBENEFITS studies for Turkey compiled and quantified the evidence that decarbonising Turkey's electricity sector through renewable energy can yield considerable social and economic co-benefits. The findings also substantiate the strong interrelatedness of energy and climate policy with development action in Turkey.

How can policy makers and ministerial policy implementers shape an enabling political environment to unlock and maximise the social and economic opportunities for communities, businesses, and families?

Quantifiable evidence and knowledge on the socio-economic potentials are essential to the development of enabling policies to unlock the identified co-benefits. Thereby, government departments and other government institutions need to create an enabling environment that successfully maximises the social and economic opportunities for communities, businesses, and families in Turkey.

Building on the evidence from the COBENEFITS studies, a broad consultation and roundtable process hosted by the Istanbul Policy Center in partnership with the Independent Institute for Environmental Issues (UfU), with government institutions, industry associations, and expert and civil society organisations, has yielded concrete policy opportunities to deliver on the identified co-benefits for Turkey.

In this section, the identified policy opportunities are presented according to the four main co-benefits areas. After outlining stimuli for shaping favourable policy environments, selected High-Impact Actions are described in detail.



3.1 Enabling policy actions to boost industrial development, trade opportunities, and innovation

The COBENEFITS study on "Industrial development, trade opportunities, and innovation in Turkey" shows that the country can significantly increase its industrial production by expanding the shares of solar and wind energy in its energy mix. The total value of production within the **wind energy value chain** was calculated as 25.3 billion USD during 2016; this can be boosted to 47.6–83.5 billion USD under a more ambitious policy scenario involving a larger capacity addition of 13.3–23.3 GW. Similarly, the **solar energy value chain** is valued at approximately 1.3 billion USD under the current policy, but can be increased by an additional 9.9 billion USD if more ambitious solar capacity additions are achieved.

How can government agencies and political decision makers create an enabling environment to maximise trade opportunities and innovation in Turkey?

In order to unlock the potential benefits of these alternative industrial development options, it is necessary to address the current trade deficit in the import and export of RE equipment. The renewable energy policy framework in Turkey should aim for increased installed capacity, building a domestic manufacturing industry, and enabling technology transfer. The resulting stimulus for R&D activities would also help the renewable energy sector to close the technology gap and ease the trade deficit by emphasising the domestic production of more technologically advanced items of solar and wind energy equipment located higher up the respective value chains. In order to drive the necessary social acceptance and also enhance local value creation and enable technology transfer, effective policies need to be developed and put in place, which combine the roles of the private and public sectors.

In the following areas policies and regulations could be introduced or enforced in order to maximise the co-benefits for industrial development and trade within the shift to a less carbon-intensive power sector:

Increase the domestic production capacity of renewable energy machinery and equipment

Increasing renewable energy deployment holds vast advantages for industrial development in Turkey. While increasing the share of renewable energy resources in its energy mix, public policy must aim to create a domestic manufacturing industry and to enable technology transfer. There are already some efforts to reap these advantages, such as the Renewable Energy Designated Area (REDA[3]) support scheme, but these efforts could be increased in order to maximise the benefits to Turkey. In order to avoid/reduce the risk of a growing trade deficit in the solar and wind value chain, domestic production capacity could be increased and greater investment could be channelled into the area of renewable energy machinery/equipment. A Mini-REDA scheme, as also considered by the Ministry of Natural Resources and Energy, would help small- and medium-size enterprises (SMEs) to also benefit from such support mechanisms extended to the renewable energy industry and enable the formation of a stronger domestic value chain within the respective sectors.

Introduce new R&D schemes to produce renewable energy technologies 'made in Turkey'

The future debate must also aim to increase R&D activities in the field of renewable energy by introducing new support schemes. Increased R&D activity would also help the renewable energy sector to close the technology gap and ease the trade deficit by shifting domestic production towards more technologically advanced solar and wind energy equipment located higher up the respective value chains.

In order to provide a reassuring long-term investment environment, Turkey could not only take advantage of its domestic market but also look for opportunities to serve as an industrial hub for renewable energy within the region. However, rather than serving the assembly industry, Turkey would benefit tremendously from moving up the value chain to higher value-added stages by means of active knowledge/technology development and transfer programmes.

[3] YEKA scheme in Turkish.

Position Turkey as an industrial hub for high-value RE manufacturing in the MENA region

Being located at the crossroads of major RE markets, Turkey has opportunities to improve its trade position in the region by building on its domestic manufacturing capacity. In the solar energy equipment sector, four of the top export destinations are in the MENA region and have shown strong growth in their imports from Turkey during the period 2008–2016. Public policy should aim to address the trade dynamics of RE machinery and equipment in the region, with Turkey as the leader in high-value manufacturing. Long-term targets could be set for renewable energy development through bi/multilateral agreements (both within Turkey and abroad), thereby providing market players with a stable trade environment for planning long-term investments.

Stimulate investment through long-term RE generation targets

Given positive public attitudes towards renewables, substantial human capital resources, and the high physical potential for solar and wind energy in Turkey, setting transparent long-term targets for renewables would greatly incentivise the increased deployment of renewable energy. A long-term macro perspective and specific long-term targets would be more likely to create market certainty and to render government support for wind and solar energy much more effective in terms of industrial development and innovation. Turkish citizens not only express positive attitudes towards wind and solar energy, but their experience with decentralised energy, for instance, in terms of using solar energy for domestic heating purposes, is also quite positive. From a political perspective, this represents another enabling factor supporting the renewable energy landscape. The declining cost of wind and solar energy in Turkey, in line with global trends, provides further public support for ambitious RE policies.

3.2 Enabling policy actions for future-oriented skill development and job creation

The COBENEFITS study on "Future skills and job creation through renewable energy in Turkey" showed that the country can significantly increase employment by expanding the shares of solar and wind energy in its energy mix.

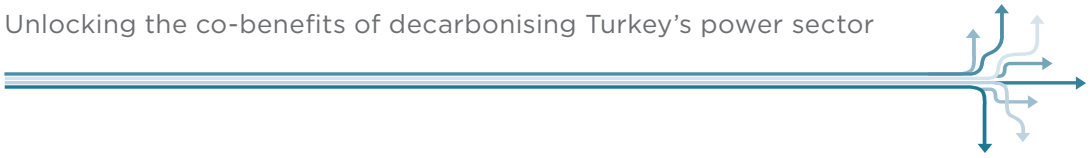
The total number of jobs in the renewables sector is expected to grow in Turkey. In the current policy scenario the solar and wind industries alone will account for about 66,400 FTE jobs. By following a highly ambitious scenario, these numbers can be increased eightfold along the solar value chain and more than doubled in the wind power value chain, in total providing more than 200,000 additional FTE jobs by 2028.

How can government agencies and political decision makers create an enabling environment to maximise employment benefits in the Turkish power sector, both in terms of job creation within the renewable energy sector and alleviating social impacts in the coal regions?

In order to fully realise the potential employment gains associated with renewable energy, the renewable energy policy framework in Turkey could aim for higher shares of domestic inputs within the manufacturing sector, focusing on technology transfer as a means of moving up the value chain. Effective policies are needed to enhance local value creation, combining the roles of the private and public sectors. Building on the COBENEFITS study results and the consultative dialogues with political and knowledge partners, the debate on employment benefits should address the following areas within the shift to a less carbon-intensive power sector.

Enhance government support for vocational training for the RE sector

In order to unlock the potential benefits of additional employment, the renewable energy policy framework in



Turkey should aim for higher shares of domestic inputs, building a domestic manufacturing industry that focuses on higher levels of value addition in the value chains, and enabling technology transfer. Increased production and installation capacities should also be complemented by more governmental support for vocational training in order to meet the greater need for medium-skilled workforces at all stages of the value chain. Furthermore, companies can prepare for the future by recruiting and training their own workforce now. Combining apprenticeships with a job guarantee would incentivise participation in vocational training. Small- and medium-size enterprises could play an important role in increasing employment in the renewable energy sector and in developing and retaining skilled workers at the local level.

Expand higher education programmes to enable the RE sector to close gaps in technology transfer

As Turkey increases the ambition of its renewable energy targets and aims for higher shares of domestic inputs, employment opportunities would expand — not only in numbers but also in quality. Increased domestic production of RE equipment, especially of high-tech components, would require a more highly skilled workforce. The study showed that Turkey already has a high level of human capital — it must now be developed for the renewables sector. Therefore, moving up the value chain to high value-added stages within the renewable energy industry will also translate into increasing demand for higher-skilled labour. To meet this demand, the expansion of the industrial base should also be matched by the development of appropriate skills at all stages. In order to foster technology development, additional higher-level educational programmes are needed.

Support re-skilling programmes towards jobs in the RE energy sector to compensate for declining employment in the coal sector

The creation of new renewable energy jobs could compensate for declining employment in the coal energy sector. This can be seen as an opportunity for a just transition towards non-fossil energy based jobs and will help with the acceptance of the transition. Increasing employment in renewable energy could also potentially compensate for the future loss of employment in agriculture due to climate change.

Increase data collection and availability for a broader evaluation of employment benefits

Data collection and statistical analysis should be reorganised in order to ensure the necessary harmonisation between training provision and the demands of the job market, and to monitor the transition of jobs in the energy sector and the employment effects of the new industry. Making such data publicly available will also enhance acceptance of the transition to a renewable energy world.

3.3 Enabling policy actions to improve air quality and unburden the health system

The analysis shows that Turkey can significantly reduce the number of premature deaths related to air pollution from fossil fuel power plants by increasing the share of renewables in its power mix.

Under the Current Policy scenario mortality is predicted to increase from around 2,100 in 2017 to more than 2,300 in 2028. Under the Advanced Renewables scenarios mortalities can be reduced to less than 1,550 cases in 2028, thus saving more than 750 lives annually. In addition, Turkey can significantly reduce health costs by decarbonising the power sector. Under the Current Policy scenario annual health costs will increase from around USD 2 billion in 2017 to USD 2.5 billion in 2028. By following the Advanced Renewables scenarios health costs could be lowered to USD 1.7 billion in 2028, representing savings of USD 800 annually.

What can government agencies and political decision makers do to create a suitable enabling environment to maximise health benefits for the Turkish people and unburden the health system?

- Eliminate existing subsidies for coal-fired power plants
- Follow the international environmental agenda regarding emissions reduction
- Ensure data availability and transparency about emissions, air quality, and health effects
- Incorporate the evaluation of health effects into the legal framework for Turkey's power generation planning

Harnessing these potential gains from increased shares of renewables in electricity production requires creation of an enabling environment for the overall electricity sector, in order to facilitate the transition to renewables-based generation. The enabling environment and the enablers of the desired change can be assessed along various societal dimensions, including visionary, cultural, policy/regulatory, organisational, and economic aspects, comprising multiple social actors and their interactions (Yazar et al., 2020).

Elimination of existing subsidies for coal-fired power plants

Elimination of coal subsidies would create a level playing field between renewables and fossil-fuelled power plants. Prior studies reveal that, among the G20 countries, Turkey is one of the heaviest subsidisers of coal (EEA, 2019a). These subsidies are implemented through various instruments that pervade the entire lifecycle of coal, from imports and extraction to its use in industrial processes and through direct household consumption. These subsidies — in the form of direct transfers, price controls, purchase guarantees, tax exemptions, capacity guarantees, and various other instruments — effectively reduce the investment, operation, and maintenance costs of coal power plants, thereby making them appear artificially attractive compared with renewable alternatives (Şahin, 2015).

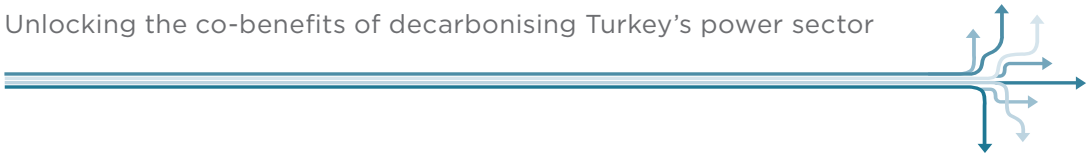
Following the international environmental agenda

Turkey can actively participate in the Gothenburg Protocol, and report emissions from individual power plants to international bodies such as the European Pollutant Release and Transfer Register (E-PRTR). Ratification of the Paris Agreement on climate change, and progressive improvements in national greenhouse emissions targets, will indirectly serve the agenda of improving air quality and reducing health costs associated with air pollution.

Ensuring data availability and transparency

There is currently a lack of data specific to the Turkish context, concerning the health impacts associated with burning fossil fuels. Relevant governmental bodies and research funding institutions can facilitate research on these issues in order to generate nationwide data on exposure–response relationships, mortality and morbidity statistics, and health costs. Furthermore, the Ministry of Energy and Natural Resources can ensure public access to air pollutant emission data from individual power plants, detailing fuel, technological, and emission control standards. This would improve public awareness of air pollution and its health impacts, empower citizens to pursue change, assist monitoring and analysis by researchers and other non-governmental bodies, and encourage compliance with environmental protection standards.

With growing public awareness of the harmful effects of fossil fuel use on health and the environment, the evaluation of air pollution and health effects could be improved by incorporating, for instance, $PM_{2.5}$ measurements into the legal structure, and specific health effects evaluation into formal environmental impact assessments. A requirement for Health Impact Assessments could also be added to the legislation, to judge the potential health implications of a policy. Even though limited data availability is a problem, the current rise in the number of high-quality scientific studies is promising for the evaluation of air pollution and the health effects of renewables.



3.4 Enabling policy actions for fostering energy supply security

The COBENEFITS analysis showed that through the increased use of renewable energy for power generation, Turkey can reduce its natural gas consumption by 16% by the year 2028 without the need to increase foreseen investment in the transmission system. Additional investment in transmission capacity and transformer substations would allow Turkey to reduce its consumption of natural gas by 38% (300 million MMBTU). With a higher share of renewables and an associated reduction of its fossil-based energy imports, Turkey has the opportunity to achieve savings of between USD 728 million and 2.1 billion, depending on the given scenario. With these data, the study confirms that the deployment of renewables in Turkey can foster the country's energy independence and security of supply, thus delivering associated economic savings and contributing to balancing the current account deficit of Turkey's energy sector.

The potential co-benefits from greater integration of renewables into the power system can be harnessed if an enabling environment is created that incentivises the deployment of renewables within Turkey's electricity sector. The following enablers of desired change have been identified through the COBENEFITS activities in Turkey:

What can government agencies and political decision makers do to harness and maximise the combined benefits of renewable energy solutions to enhance Turkey's power supply security?

- Enable individual consumers to select electricity consumption schedules based on 100% renewables
- Increase the flexibility of Turkey's power system
- Set ambitious and transparent long-term targets for renewable energy deployment in Turkey
- Build and expand a capacity market for renewables to act as an incentive to scale up renewables
- Incentivise renewables at operational expenditure level to prevent a cost increase in the LCOE of renewables, so that more renewables could be integrated into the system when competing in the electricity market.

Enable individual consumers to select electricity consumption schedules based on 100 % renewables

The Ministry of Energy and Natural Resources recently announced that individual consumers and firms will have the option to choose electricity produced solely from renewables (Green Tariff).[4] Constructing a solid, supportive policy framework for those tariff options would respond to the quite positive attitudes towards wind and solar energy in Turkey and address demands from citizens to use renewables as a replacement for fossil fuel use rather than simply as additional installed capacity. More diverse tariff options would also offer the opportunity to support decentralised energy systems and renewable energy cooperatives.

Increasing grid flexibility

Maximising the co-benefits of energy security will depend on increasing the flexibility of the national power system. Enabling flexibility within existing energy supply technologies, and mechanisms such as increasing the use of energy storage devices, can reduce the impact of renewables intermittency and integrate renewables into the grid in more flexible ways. A lack of grid flexibility results in higher LCOE for renewables, due to renewable curtailment under ambitious renewable integration scenarios. Increasing system flexibility through storage, increasing the flexibility of existing power plants, and improving demand response can help further drive down grid-related costs.

[4] See: https://www.enerjiportali.com/enerji-bakani-donmez-yesil-tarife-yeta-donemi-basladi/ and https://www.dailysabah.com/business/energy/turkey-to-offer-green-only-power-tariff-as-of-august (last accessed: 05.11.2020)

Build and expand a capacity market for renewables to act as an incentive to scale up renewables

Turkey's electricity regulatory authorities can design mechanisms to incentivise and attract local and foreign investment in renewables within the structures of capital or operational expenditures.

Green certificates for renewable generators, issued by the energy market operator EPİAŞ, could provide a positive incentive to scale up renewables.[5] Furthermore, building and expanding a capacity market for renewables can also act as an incentive to scale up renewables in Turkey. The Government of Turkey has successfully completed two tenders to build 1,000 MW wind and 1,000 MW solar PV plants (TEİAŞ, 2019).

Incentivise renewables at operational expenditure level to prevent increased LCOE of renewables, to integrate more renewables into the system when competing in the electricity market.

Turkey's electricity regulatory authority already introduced a feed-in tariff in 2013 to incentivise renewables. The tariff allows the sale of renewables at higher than market prices. However, with the proliferation of renewables, a feed-in-tariff might be regarded as less efficient, as it might reduce the competitive nature of the electricity market. The COBENEFITS assessment showed that a shift from the Current Policy to the New Policy Scenario may reduce the LCOE of renewables relative to gas, which implies that the LCOE of renewables is more competitive in the electricity market. However in the Advanced Renewables Scenarios the LCOE of wind and solar energy is less competitive than in the New Policy Scenario because of constraints within the power system. To prevent increased cost, renewables need to be incentivised at operational expenditure level through an accessible and predictive grid maintenance structure enforced by EPDK (Turkey's energy market regulatory authority).[6] The continuation of a form of feed-in-tariff mechanism is mostly regarded as beneficial for greater development of renewables in Turkey.

Considering the operational capabilities and accountabilities of the power system, Turkey's energy planning should consider the intermittency of renewables at the planning stage. A common practice when undertaking energy planning in the power system is the implementation of peak and off-peak conditions. However, the generation profiles of renewables should also be considered when planning to increase their contributions to the future electricity mix. Focusing on renewables planning will not only increase the potential for their integration but will also reduce associated LCOE by easing curtailments.

Set ambitious and transparent long-term targets for renewable energy deployment in Turkey

The Turkish Government can unlock these co-benefits and make use of the country's high physical potential for solar and wind power by setting transparent long-term targets for renewable energies in the power sector. Ideally, this should comprise targets for installed RE capacities and power production, as well as targets based on the share of renewables within the country's power sources. Detailed and transparent long-term planning creates market certainty for RE power producers and will effectively render government support towards wind and solar, thus fostering inter-sectoral cooperation to increase Turkey's supply security and independence in the power sector.

[5] Green certificates are tradable commodities which verify that specific electricity supplies were generated using renewable energy sources (Green Energy World, 2015).

[6] For more detail see: IASS/IPC, 2020b. Securing Turkey's energy supply and balancing the current account deficit through renewable energy. Assessing the co-benefits of decarbonising the power sector. Potsdam/ Istanbul. p. 24.

4. Making the Paris Agreement a success for the planet and the people of Turkey

The Paris Agreement started a new international climate regime for the planet as well as for Turkey. Rendering the annexes of the previous climate regime almost irrelevant, the Paris Agreement required each signatory to determine its own contribution to climate change mitigation efforts. This gives an invaluable opportunity for Turkey to become more active in the new regime.

By strengthening its mitigation targets and ratifying the Paris Agreement, Turkey can unlock the co-benefits of climate change mitigation viaa more ambitious renewable energy deployment strategy.

Turkey can greatly benefit from low-carbon development outcomes such as substantial increase in employment, industrial development integrated with high-tech skills, improved air quality and reduced health costs, as well as more secure, reliable, and affordable electricity supply.

By ratifying the Paris Climate Agreement Turkey can use this opportunity to enhance its national interests in terms of economic benefits and improved well-being for its citizens in line with the United Nations Sustainable Development Goals.

Becoming an active participant in the new regime will also ensure further climate-related funding, which can provide for a more sustainable future involving a higher share of renewables in the national energy mix. As the energy sector is the main source of Turkey's greenhouse gas emissions, ambitious renewable energy policies to replace fossil fuel use will likely shape the carbon-dependent trajectory of economic policies to date towards a low-carbon developmental path. Given the widespread public recognition in Turkey of the current and future threats of climate change, ambitious RE policies will be perceived as a positive step towards tackling the adverse effects of climate change, such as heat waves and droughts as well as possible losses in agricultural production.

Activating the 2030 Agenda for Turkey: The COBENEFITS assessments for Turkey reveal that increasing the share of renewables (wind and solar) in the

energy mix can address SDGs 3 (Good health and well-being), 7 (Affordable and clean energy), 8 (Decent work and economic growth), 9 (Industry, innovation, and infrastructure), and 13 (Climate action) by increasing employment in the renewable energy sector, fostering industrial development, reducing air pollution from the use of fossil fuels, and securing more reliable electricity supply.

In order to ensure a balanced contribution to the new climate regime and to improve the well-being of its citizens, Turkey can enhance deliberative and participatory policy-building processes based on structured communication channels involving a broad range of societal actors.

The country is also likely to benefit tremendously from transparency and independent scientific research towards employing long-term strategies for renewables in environmentally benign ways. This can form a crucial part of environmentally sound mitigation strategies and just sustainable development policies.

Improving air quality and reducing health costs through renewable energy.

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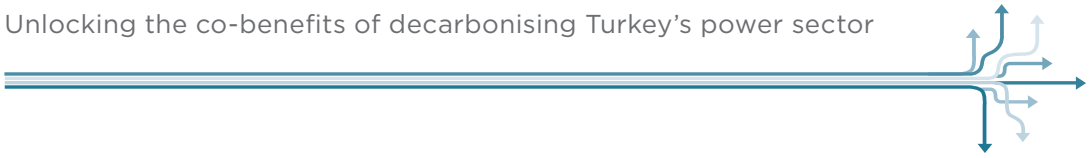
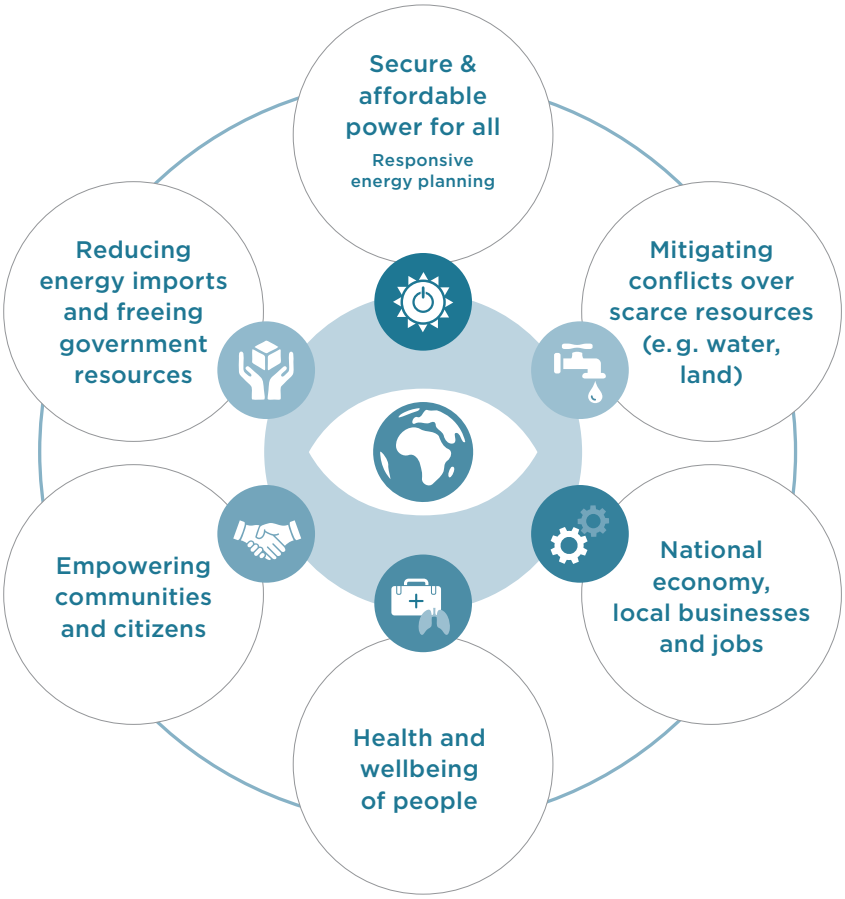


Abbreviations

BMU	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
EPDK / EMRA	Enerji Piyasası Düzenleme Kurumu/Energy Market Regulatory Authority
EPRA	Engineering, Procurement, Research, and Analysis
FTE	Full-time equivalent
GW	Gigawatt
IASS	Institute for Advanced Sustainability Studies
IET	International Energy Transition GmbH
IKI	International Climate Initiative
IPC	Istanbul Policy Center, Sabancı University
LCOE	Levelised cost of electricity
MW	Megawatt
MENA	Middle East and North Africa
MMBTU	Million British thermal units
MoENR	Ministry of Energy and Natural Resources
MoEU	Ministry of Environment and Urbanisation
MoFA	Ministry of Foreign Affairs
MoH	Ministry of Health
MoTF	Ministry of Treasury and Finance
NO_2	Nitrogen dioxide
PM	Particulate matter
PV	Photovoltaics
R&D	Research and development
RE	Renewable energy
REDA	Renewable Energy Designated Area (REDA)
RENAC	Renewables Academy
SDGs	Sustainable Development Goals
SHURA	SHURA Energy Transition Center
SMEs	Small- and medium-size enterprises
SO_2	Sulfur dioxide
SSEG systems	Small-scale embedded generation systems
TEİAŞ	Turkish Electricity Transmission Company
TWh	Terawatt hours
UfU	Independent Institute for Environmental Issues
YEKA programme	Renewable Energy Resources Zone Areas programme; equivalent to REDA
YEKDEM scheme	Turkish Renewable Energy Resources Support Mechanism (Turkish feed-in tariff scheme)



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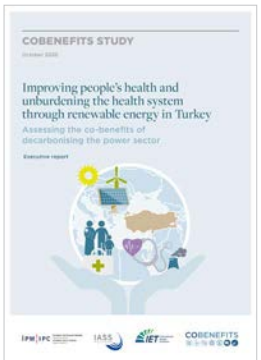

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