Monitoring the progress of Turkey's energy transition

10th International Forum on Energy for Sustainable Development

Workshop on Present and Future of Sustainable Renewable Energy

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Key messages

- **Accelerated deployment of energy efficiency and renewable energy** enabled by **ICT, smart technology, innovative policies, market instruments and finance models** drive today's global energy transformation
- Turkey is among the **fastest growing energy users and emitter of greenhouse gases**
- **Turkey has joined this global trend** to transition its energy system to a more **secure, clean and affordable** one
- The success of its power system transformation needs to **continue through long-term planning and a clear regulatory framework**
- There is **action needed in end-use sectors to accelerate the implementation of the National Energy Efficiency Action Plan and increase the uptake of renewables**

Turkey's strategic direction for the energy sector

Top policy priority

Increase "energy independence" and decrease "current account deficit", through "local and national energy resources", including lignite

Renewable energy

- Achieve 38.8% renewable power generation share by 2023 (today at around one-third of the total demand)
- 34 GW hydropower, 20 GW wind, 5 GW solar, 1 GW geothermal, 1 GW biomass by 2023
- INDC says 16 GW wind and 10 GW solar by 2030
- Commitment to reach 10 GW x 2 for wind and solar PV
- Improve transmission and distribution grids

Energy efficiency

- The National Energy Efficiency Action Plan aims to reduce the primary energy demand by 14% by 2023
- Reduce energy consumption in public buildings by 15% via energy efficiency measures

Coal & CO2

- Around 40 GW coal-fired power plant is at different stages of planning: 77% increase in CO2 emissions in energy sector (today Turkey's entire energy sector emits nearly 350 Mt CO2/year)
- Around only 1 GW is under construction
- Quality of lignite is poor with low heating value: inefficient combustion with high emissions of air pollutants
- INDC (not yet ratified) to reduce GHG emissions by 21% by 2030 compared to BAU, growth 2x

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National Energy Efficiency Action Plan of Turkey: 2017-2023

Turkey’s energy intensity has been declining by on average 1% per year since 2000

55 actions spanning across 6 sectors (including cross-cutting measures) with the aim to reduce Turkey’s total primary energy demand by 14% between 2017 and 2023

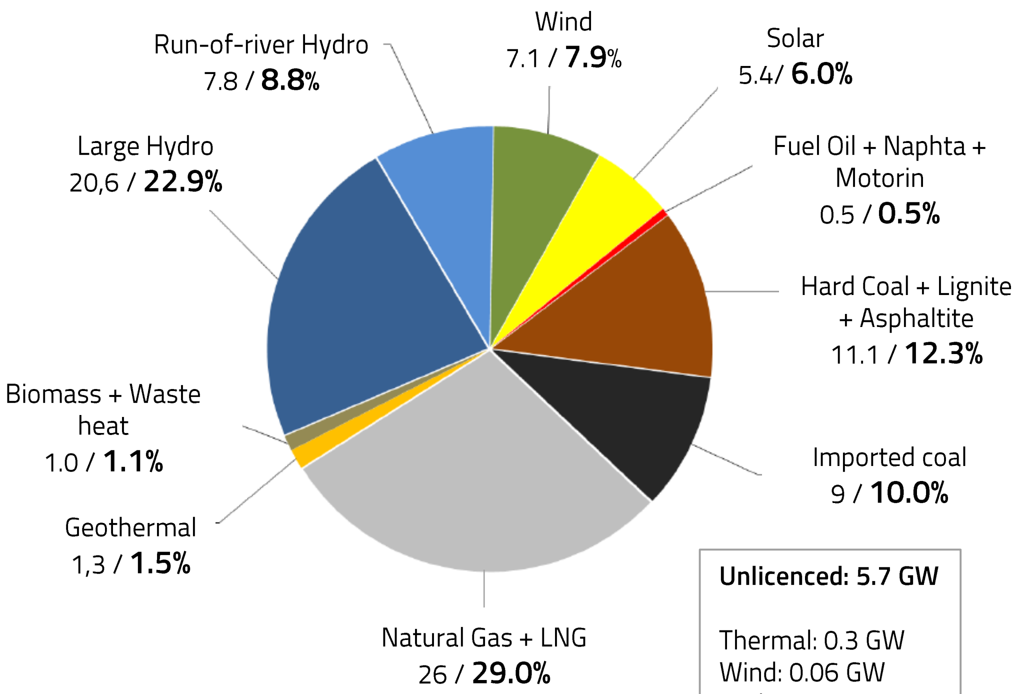
Total investment volume of US$10.9 billion over the same period

The average payback period of the planned actions is 7 years

Source: MENR (2018)

Total installed capacity and electricity generation in Turkey by resources 2018/2019

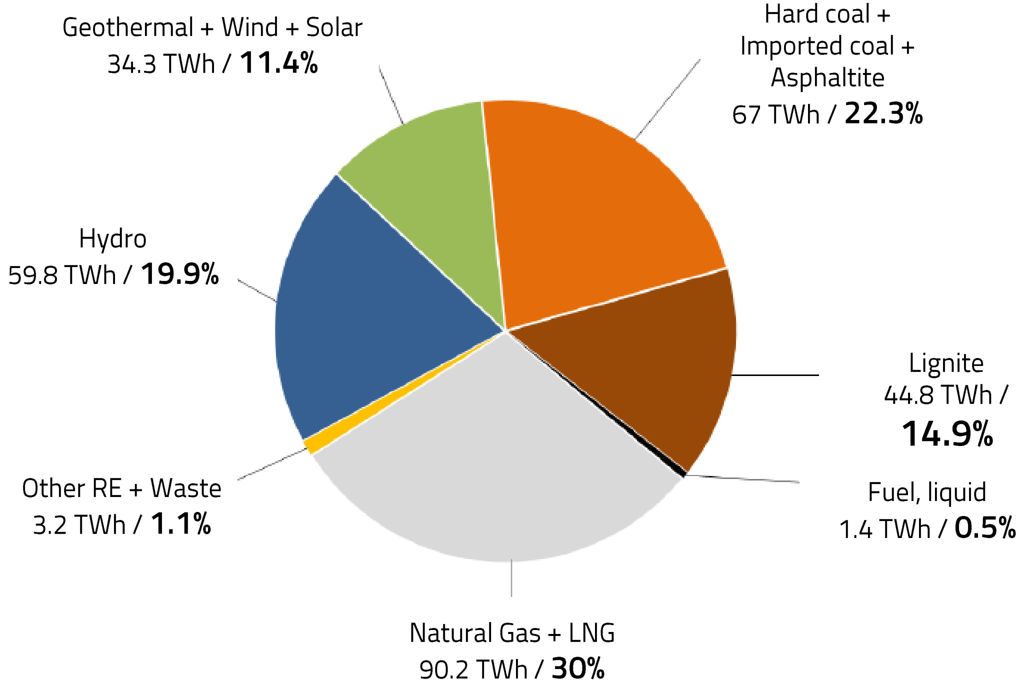
Total installed capacity (April 2019) (90 GW)



Unlicenced: 5.7 GW

Thermal: 0.3 GW
Wind: 0.06 GW
Hydro: 0.07 GW
Solar: 5.3 GW

Total electricity generation (2018) (300 TWh/year)

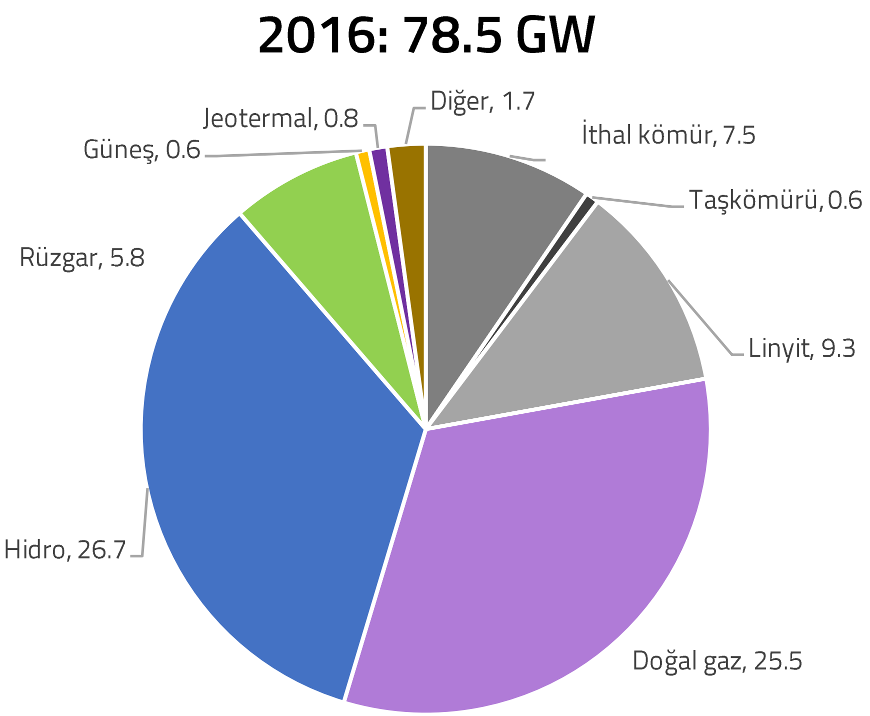


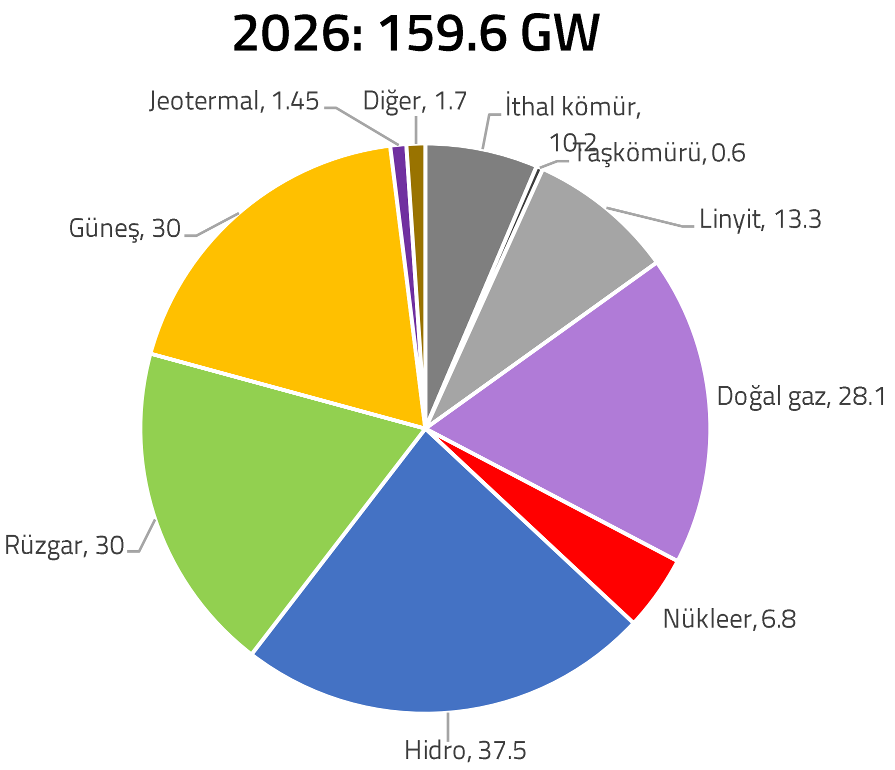
Solar and wind represent just below 10% of total generation

Geothermal 4th worldwide with 1.3 GW installed capacity

Source: TEİAŞ, MENR & ThinkeoEnergy (2019)

According to SHURA's transmission grid study, renewables can supply half of Turkey's total electricity demand by 2026



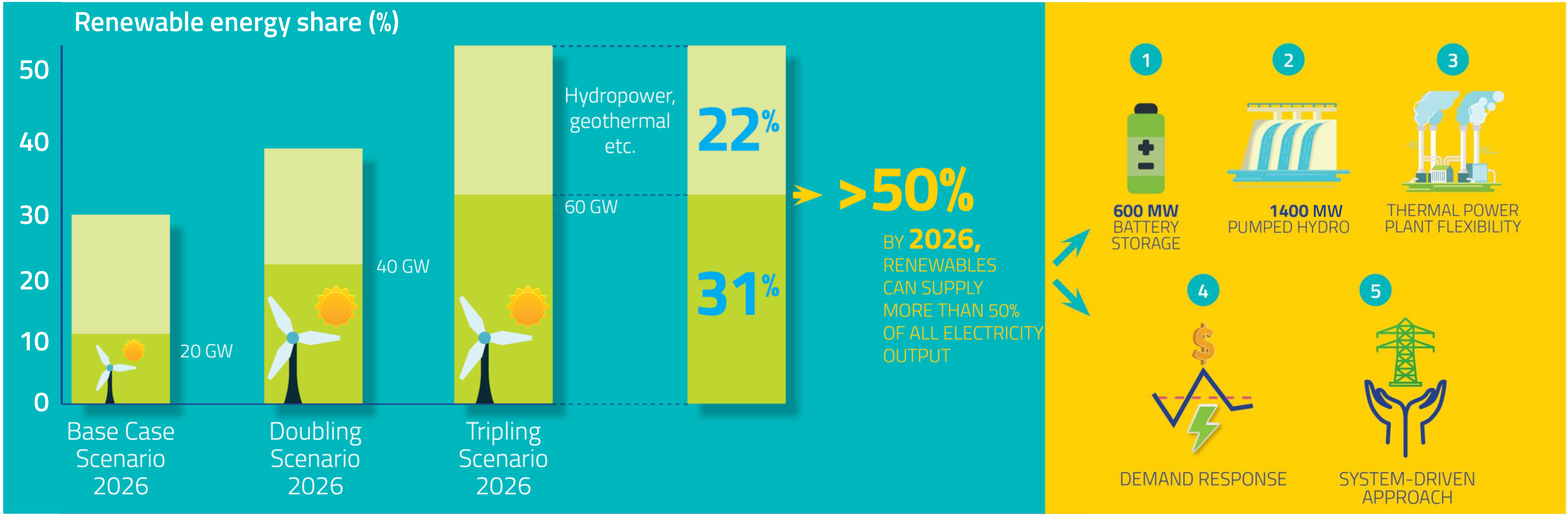


Electricity consumption reaches 440 billion kWh in 2026 up from 300 TWh per year

Share of wind and solar energy in total electricity demand triples to 30% from a total of 60 GW installed capacity

Source: SHURA (2019a)

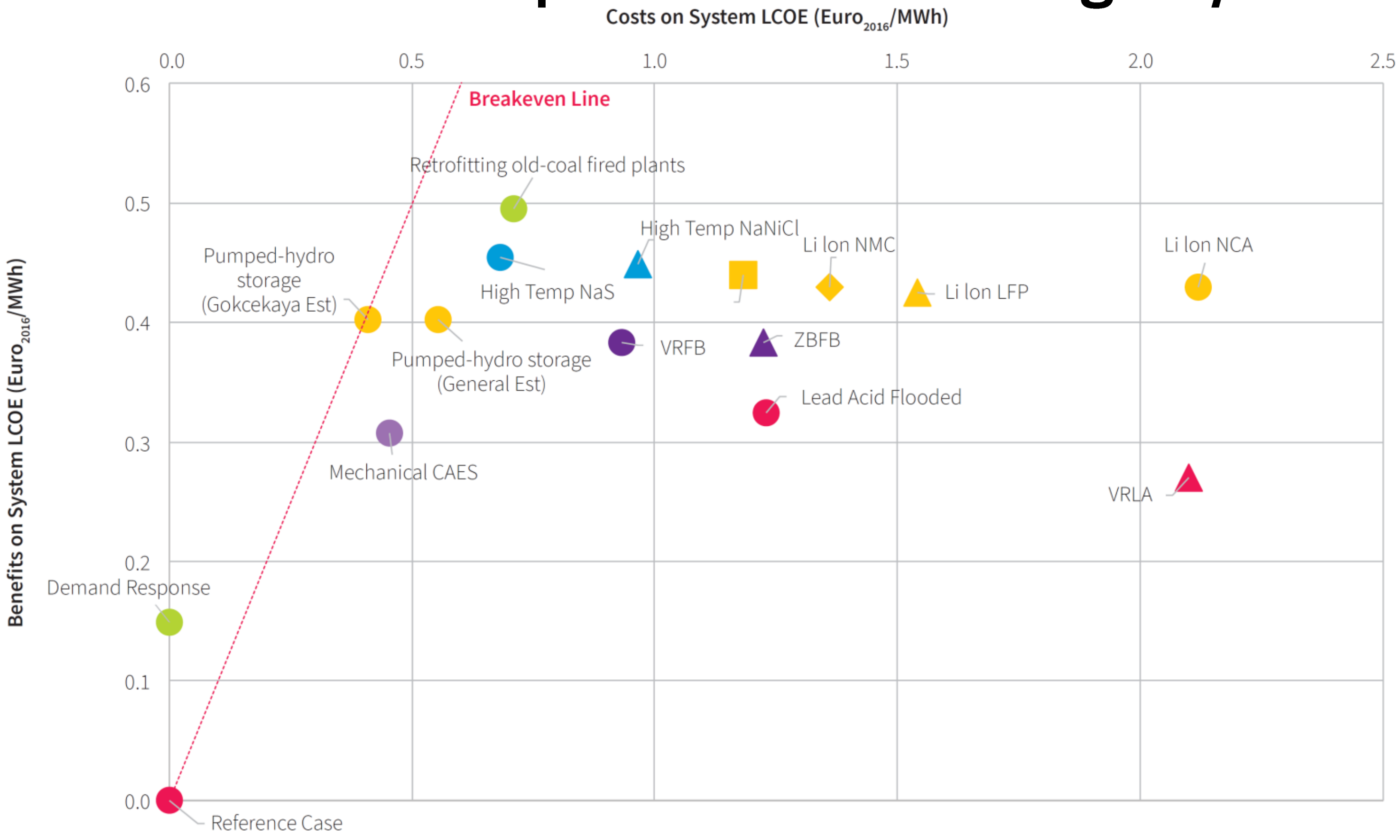
Integration of 30% wind and solar share in Turkey's power system requires flexibility offered by a suite of options



Increasing system flexibility requires energy storage (distributed battery systems and pumped hydro), more flexible thermal generators, demand response and system friendly location of wind and solar capacity

Source: SHURA (2018a;b)

Cost & benefit of flexibility options vary with a net additional cost of between 1%-5% compared to the average system cost



Short-run system cost: 38.5 Euro/MWh

While battery storage applications offer large benefits for system integration of renewables, they also come with high costs

Demand response and pumped-hydro storage come with no additional costs or with net benefits

Source: SHURA (2019a)

Renewable energy regulatory framework

YEKDEM (feed-in tariff) in place until end of 2020 – post-YEKDEM unclear

- Investors racing for capacity installations in solar PV, reached 5 GW target
  - Effectiveness for utility-scale grid connected licensed projects were limited
  - Predominantly unlicensed small-scale projects with capacity of <1 MW

At current installation rates, **wind power will most likely fall short of reaching 20 GW target**

- Unclear the extent 3.3 GW licensed and 2.1 GW pre-licensed wind capacity will be built
- Negative prices, reduced profitability and questions on securing financing
- **Pre-license auctions** for 2 GW postponed for third time, now to end 2020

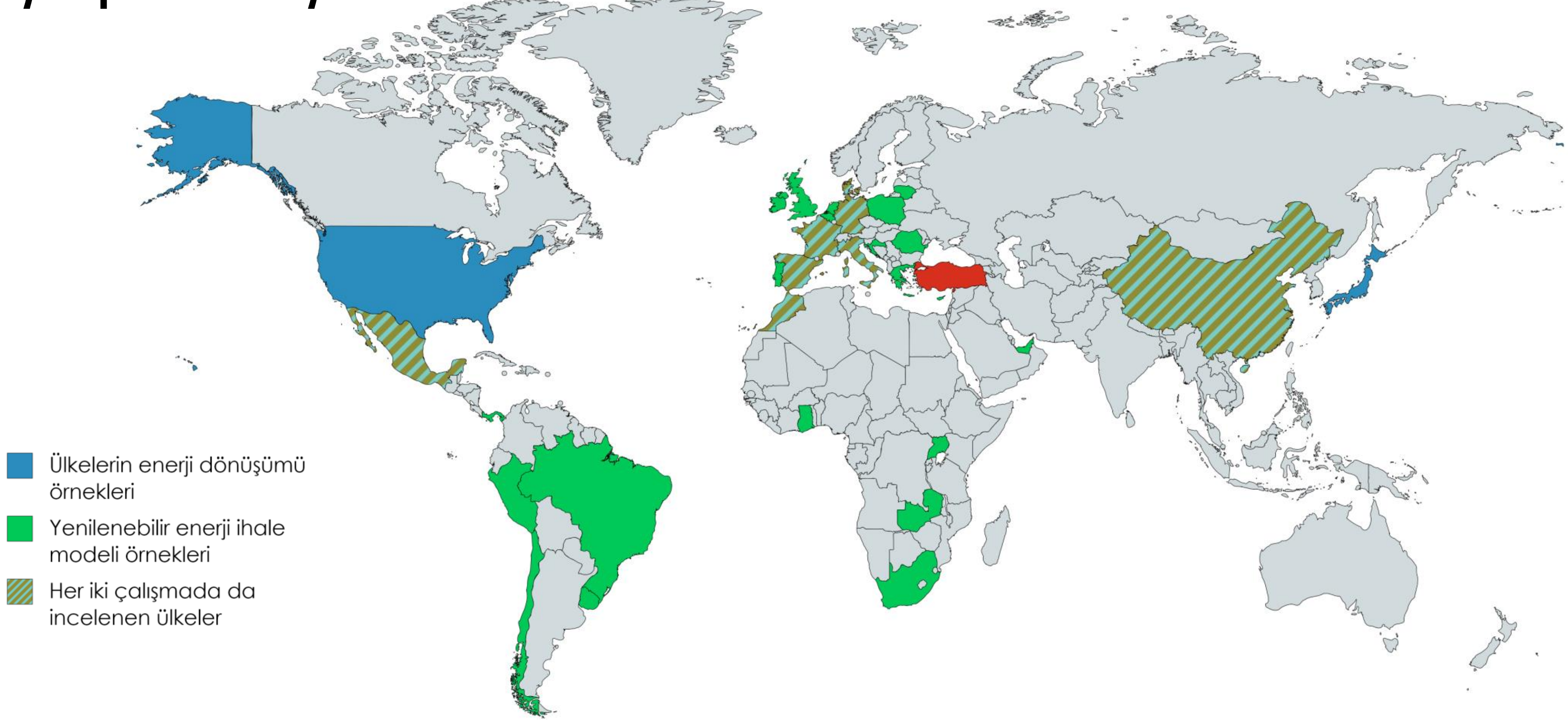
Renewables auctions in 2017 were successful but next rounds and progress with mixed success

- No applications to offshore wind auction in Oct 2018 of 1.2 GW – postponed to 2019
- Equipment manufacture of wind turbines and solar PV suffer from lack of financing
- 2018 solar PV auction of 1 GW is cancelled, 2018 onshore wind auction of 1 GW (4x250) first postponed, then the winning bid was between US$3-4/kWh

Commitment from government to continue with auctions (10 GW x 2 in the next 10 yrs)

Source: Various public sector sources

Learnings from international experiences to accelerate Turkey's power system transformation



Evaluation of the renewable energy auction scheme and implementation experiences of 29 countries

Evaluation of the energy transition experiences of 10 countries that represent 75% of the total installed wind and solar capacity worldwide

Source: SHURA (2018c;2019b)

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Several areas emerge to strengthen Turkey's existing renewable energy auction scheme

- Consider system impacts when determining location and size
- Create investor confidence through regularity/periodicity
- Diversify capacity size
- Increase access to sustainable financing
- Ensure timely delivery of projects
- Promote technological dynamism
- Monitor and evaluate the effects of YEKA auctions on the market
- Support the YEKA model with other policy mechanisms
- Transfer learnings to other dispatchable renewable energy techs

January 2019

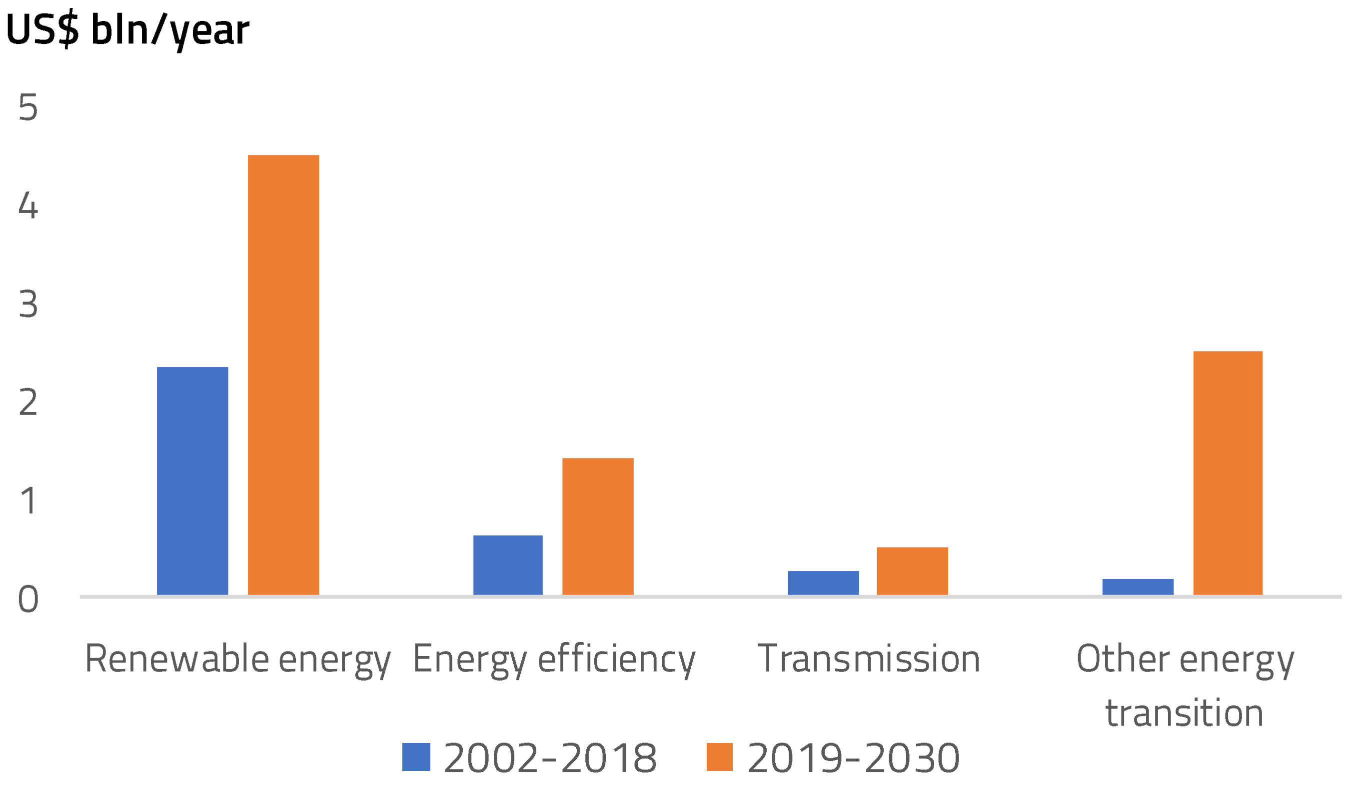
Source: SHURA (2019b)

International experiences point to long-term planning and system-wide innovation for grid integration of renewables

	Success factors
Long-term planning and regulatory framework	- Long-term planning by including environmental and socio-economic benefits - Integrated policy making beyond power system - Increasing the ambition level of targets over time - Inclusive policy making with the participation of all stakeholders
Existing policy mechanisms and	- Updating policy mechanisms with market and technology developments - Synergies from energy and industrial policy (localisation) - Embracing small and medium size market players - Expanding the regulatory framework towards distributed generation
System integration of renewables	- System planning and developing grid integration strategies - Integration with energy efficieny strategies and supporting flexibility options
Innovative business and finance models	- Innovative policy tools, finance and business models for grid management, new market designs, increasing distributed generation and reducing the risks of financing energy transition, and improving energy efficiency on the demand side

Source: SHURA (2018c)

Annual average investments in energy transition need to increase by at least 2 times to 2030



Increase is needed notably for energy efficiency and enabling infrastructure (other energy transition)

Source: SHURA (2019c)

Thank you!

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