

APEC

Energy Demand and Supply

Outlook 7th Edition

APEC Overview

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Asia Pacific Energy Research Centre (APERCC)



APEC addresses energy challenges

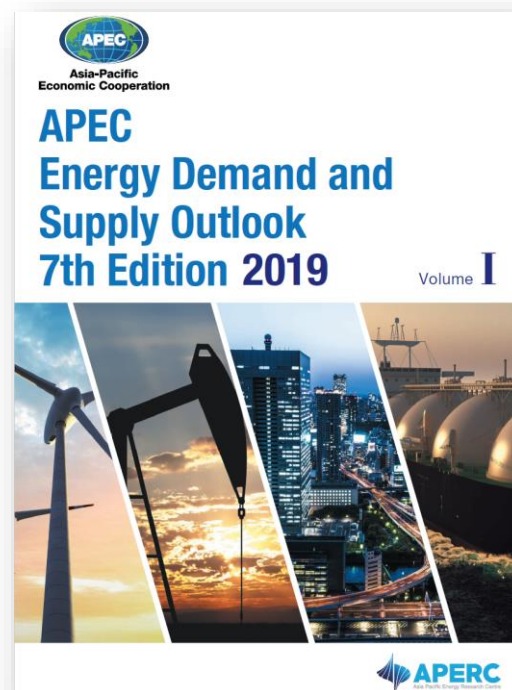


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Asia Pacific Energy Research Centre

- APERC is the energy research arm of Asia-Pacific Economic Cooperation (APEC)
 - Researchers from 16 of APEC's 21 economies
 - Located in Tokyo, Japan
- Two flagship publications
 - Annual Energy Overview
 - Triennial Energy Demand and Supply Outlook



APEC Energy Demand and Supply Outlook

Investigates challenges faced by APEC economies:

- Affordably meeting growing energy demand
- Reducing negative energy-related environmental impacts
- Enhancing energy security and resilience

The 7th Edition Outlook provides analysis and insight on the:

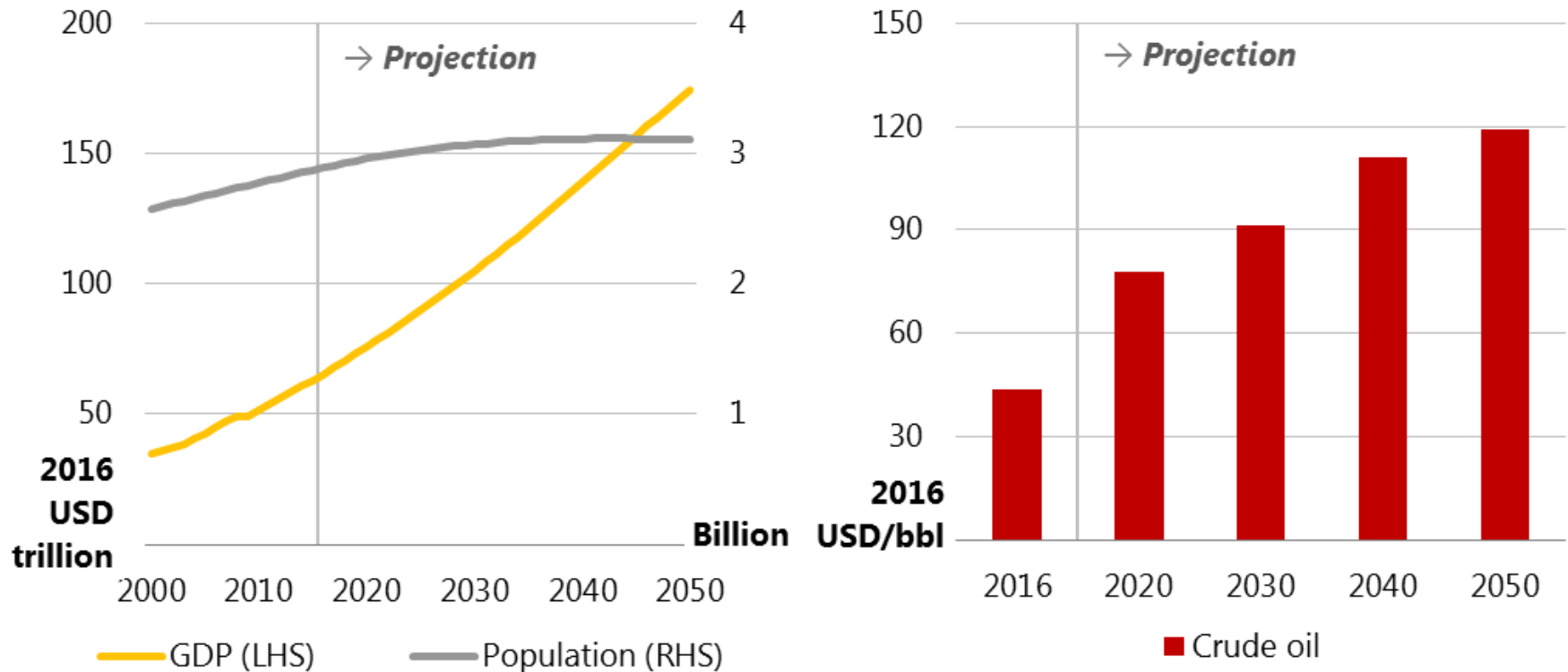
- Impact of existing and alternative policies on energy demand, supply, emissions and investments through 2050
- APEC energy intensity and renewables doubling goals
- Sectoral transitions that support Paris climate ambitions

Key APEC-wide trends through 2050

- Final energy demand continues to grow, driven mainly by buildings and transport.
- Fossil fuels continue to account for at least half of FED and TPES in 2050, in all scenarios.
- Electricity demand rises in all scenarios.
- Under the BAU, the APEC energy intensity goal is met but the renewable share doubling goal is not
- Electrification, efficiency, renewables, nuclear and CCS are all required to achieve a +2°C world.

GDP, population and oil prices all rise

GDP, population and world oil price in all scenarios, 2000-50



Sources: APERC analysis and IEA (2018).

APEC real GDP grows almost three-fold over the Outlook, despite population peaking in 2043. World oil prices rise steadily.

Outlook Scenarios

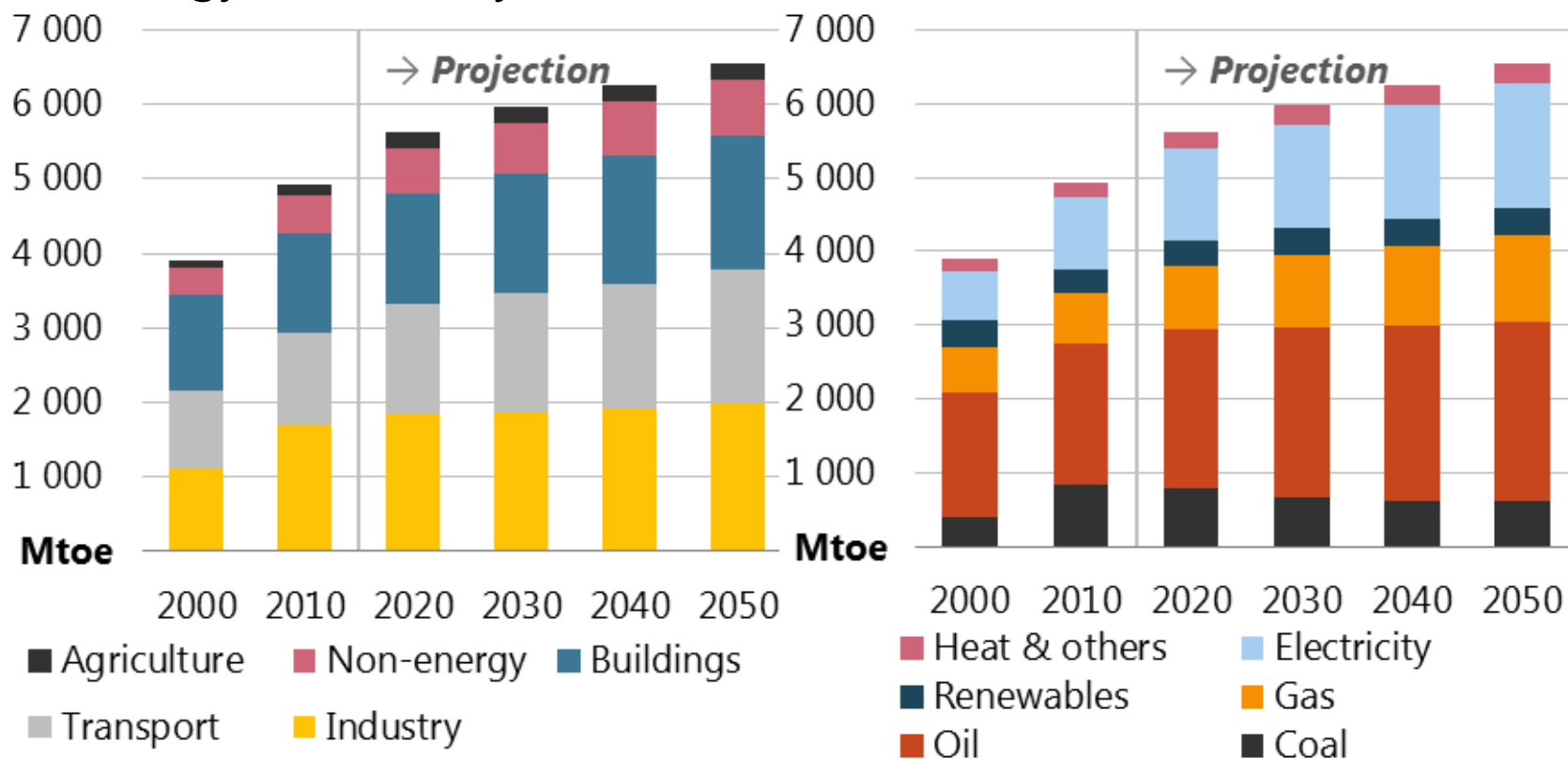
Business-as-Usual (BAU)	APEC Target (TGT)	2-Degrees Celsius (2DC)
Recent trends and current policies.	Pathway that achieves APEC-wide goals to <ul style="list-style-type: none">• reduce energy intensity 45% by 2035• double the share of renewables by 2030.	Pathway that provides a 50% chance of limiting the average global temperature rise to 2°C.
Provides a baseline for comparison.	Explores implications of alternative scenarios and identifies gaps to overcome.	



1. BAU Scenario

Buildings and transport drive final demand

Final energy demand, by sector and fuel in BAU, 2000-50

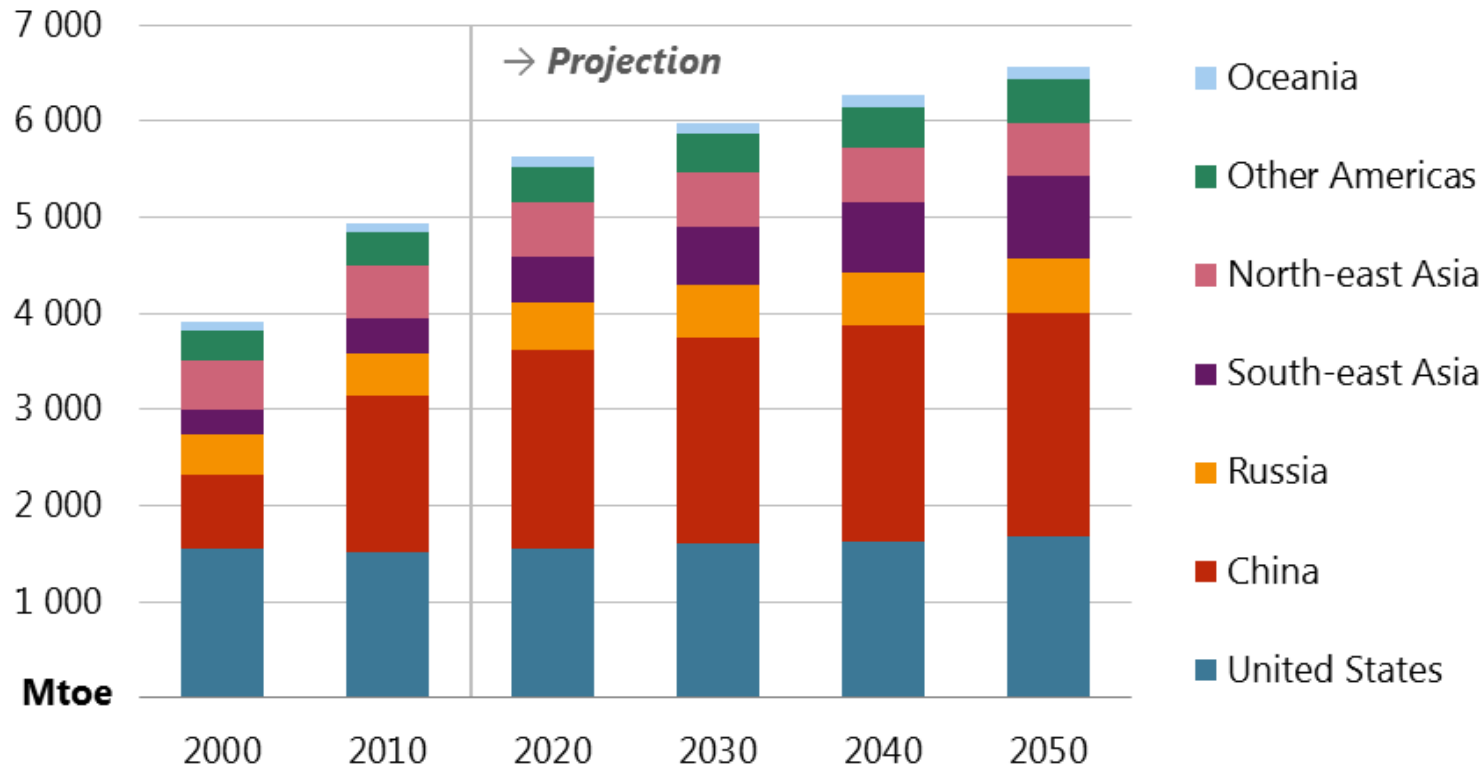


Sources: APERC analysis and IEA (2018).

Buildings and domestic transport grow most strongly, but industry remains largest.

South-east Asia, China lead demand growth

Final energy demand, by region in BAU, 2000-50

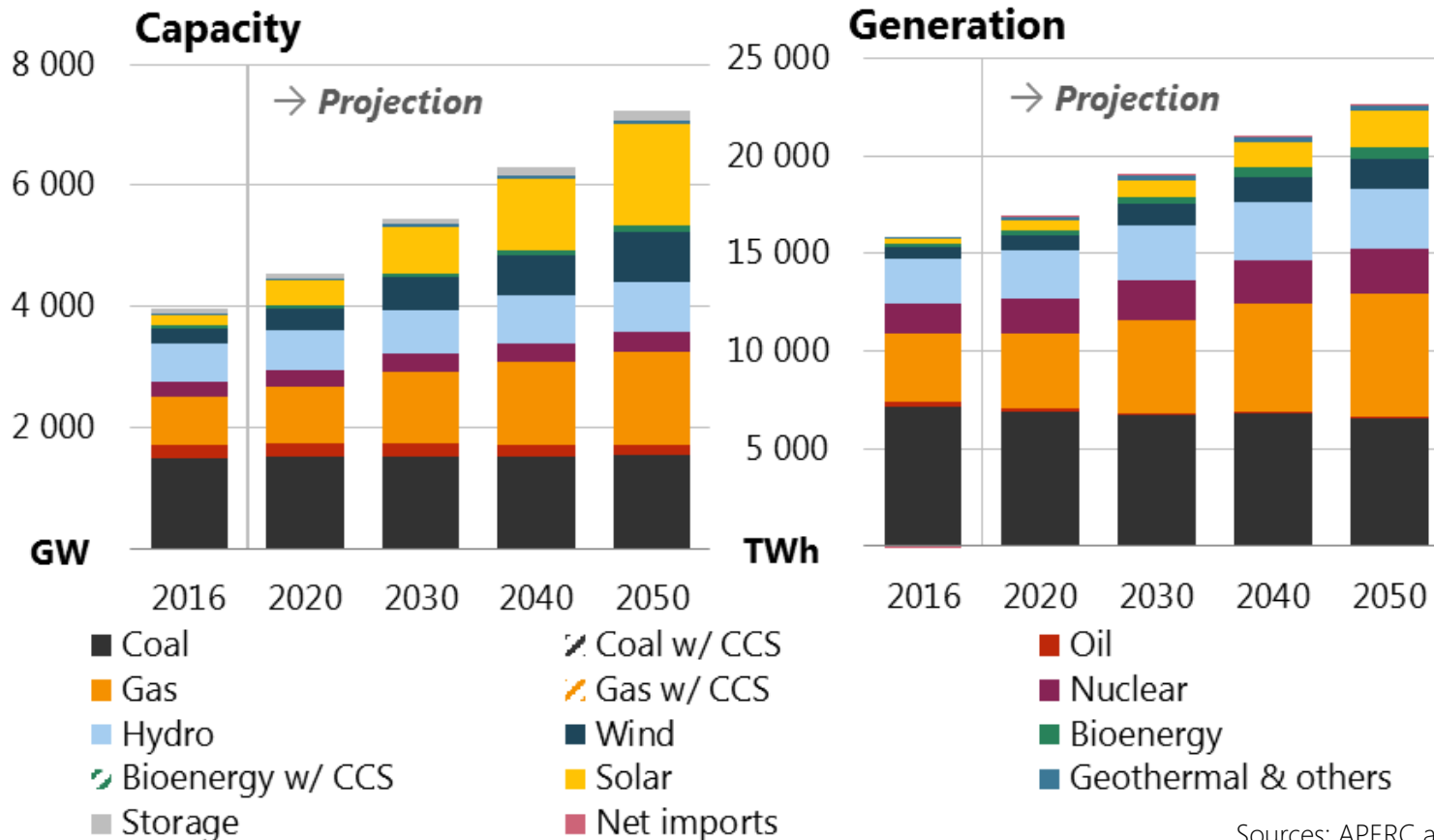


Sources: APERC analysis and IEA (2018).

Final energy demand in South-east Asia nearly doubles from 2016 to 2050, while China remains the largest region.

Buildings boost electricity demand

Power capacity and electricity generation, by fuel in BAU, 2016-50

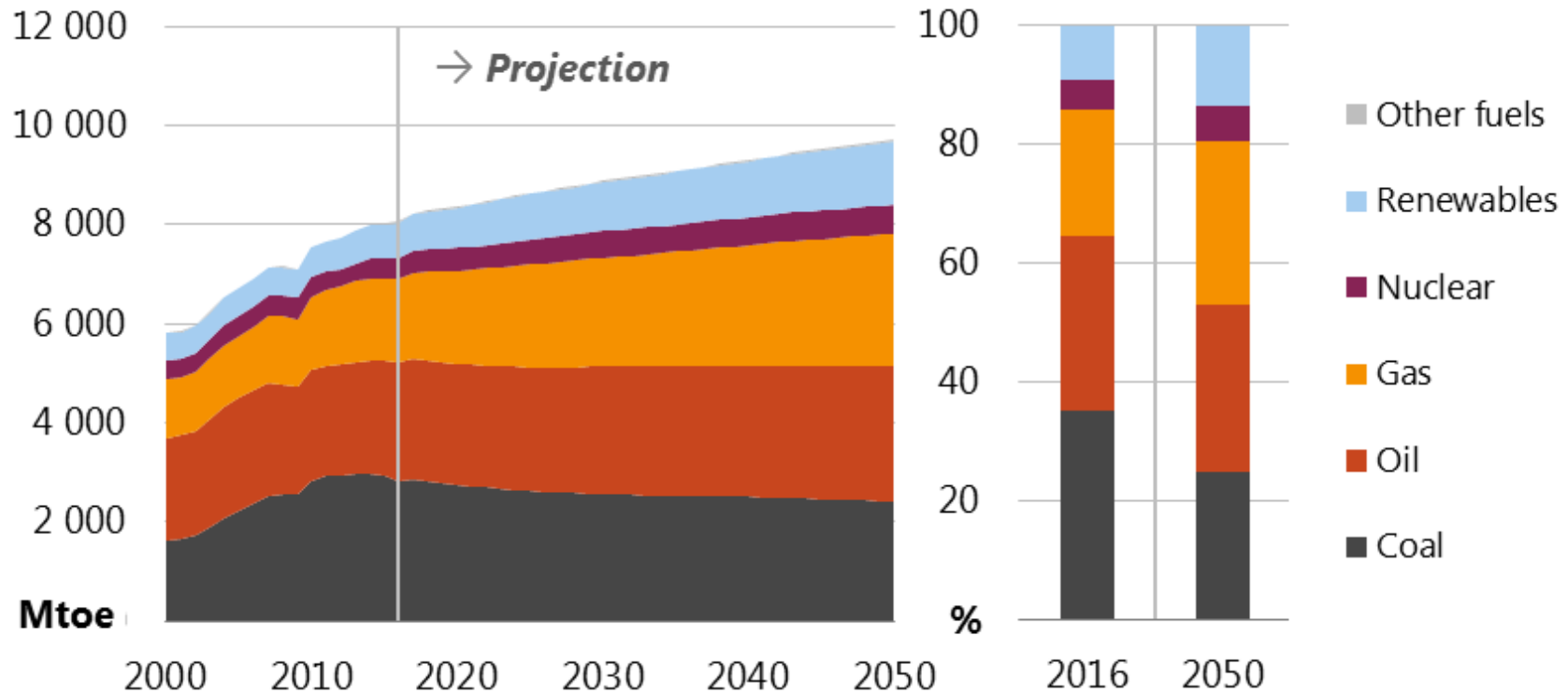


Sources: APERC analysis and IEA (2018).

*Steady demand growth is met mainly by gas and renewables.
Solar capacity grows most strongly over the Outlook*

Fossil fuels continue to dominate supply

Total primary energy supply by fuel in BAU, 2000-50

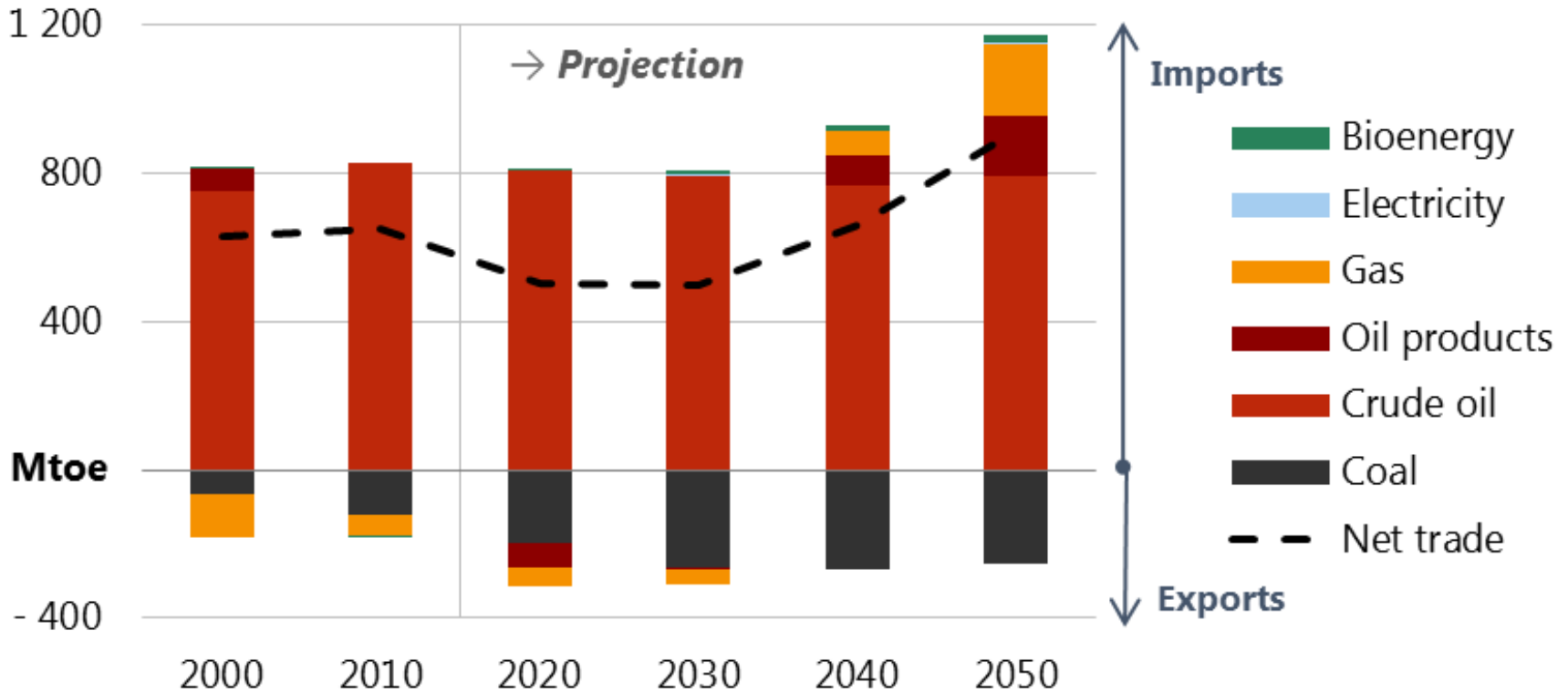


Sources: APERC analysis and IEA (2018).

Natural gas increasingly substitutes for coal in both power and industry, enabled by growing production and trade.

APEC remains a net oil importer

APEC net energy imports, by fuel in BAU, 2000-50



Sources: APERC analysis and IEA (2018).

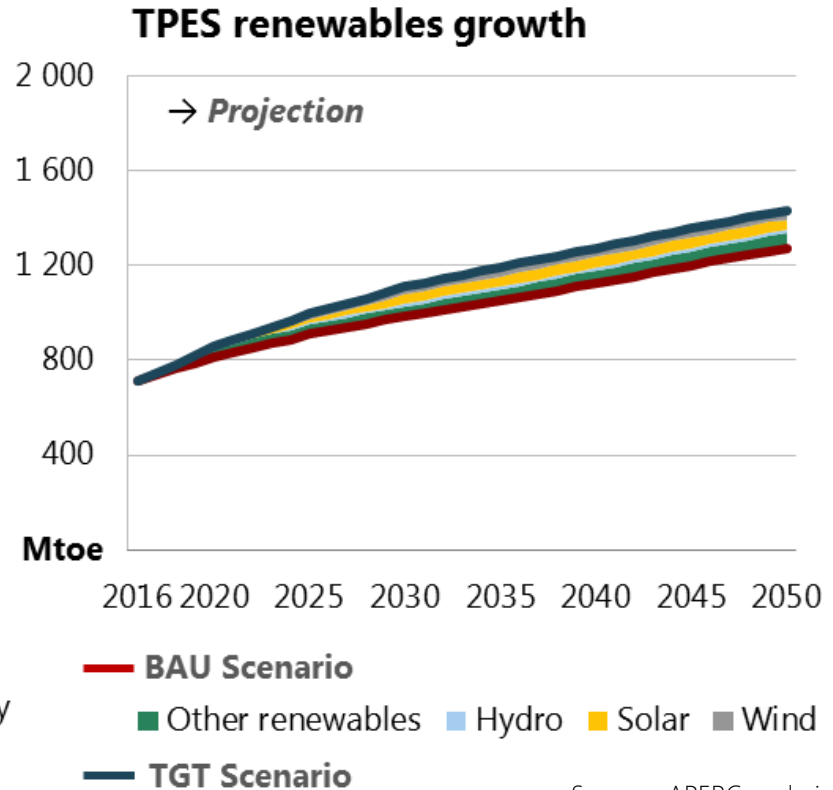
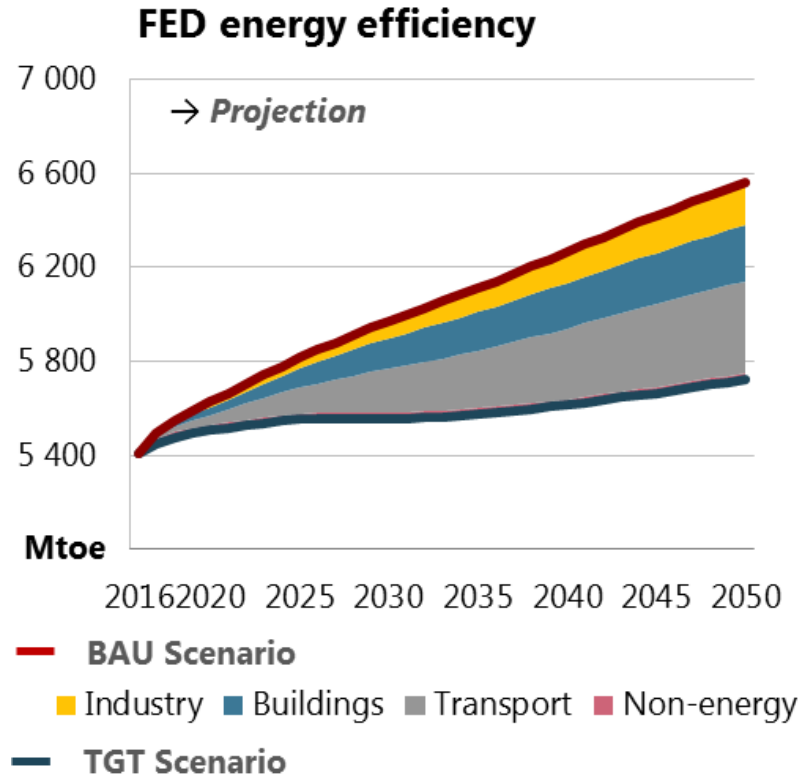
APEC becomes a net oil products importer in 2032 and a net natural gas importer in 2033.



2. Alternative Scenarios

Slightly more renewables in the TGT Scenario

Energy efficiency and renewables in the BAU and TGT, 2016-50

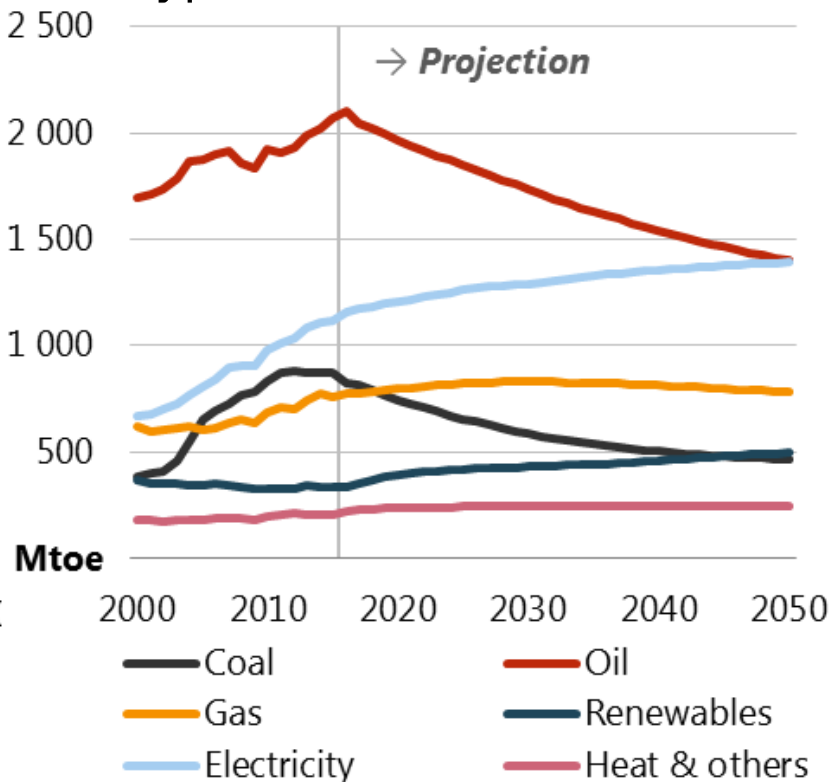
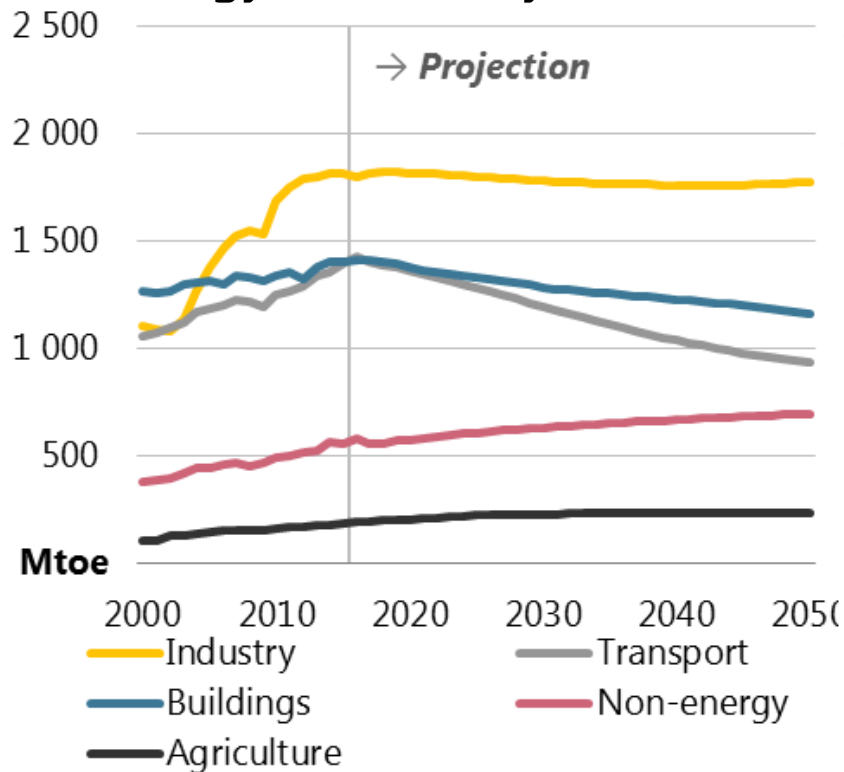


Sources: APERC analysis and IEA (2018).

Final energy demand falls (mainly transport), but renewable supply increases (mainly solar), which has a two-fold impact on the doubling goal.

Transport and buildings underpin 2DC

Final energy demand by end-use and fuel type in 2DC, 2000-50

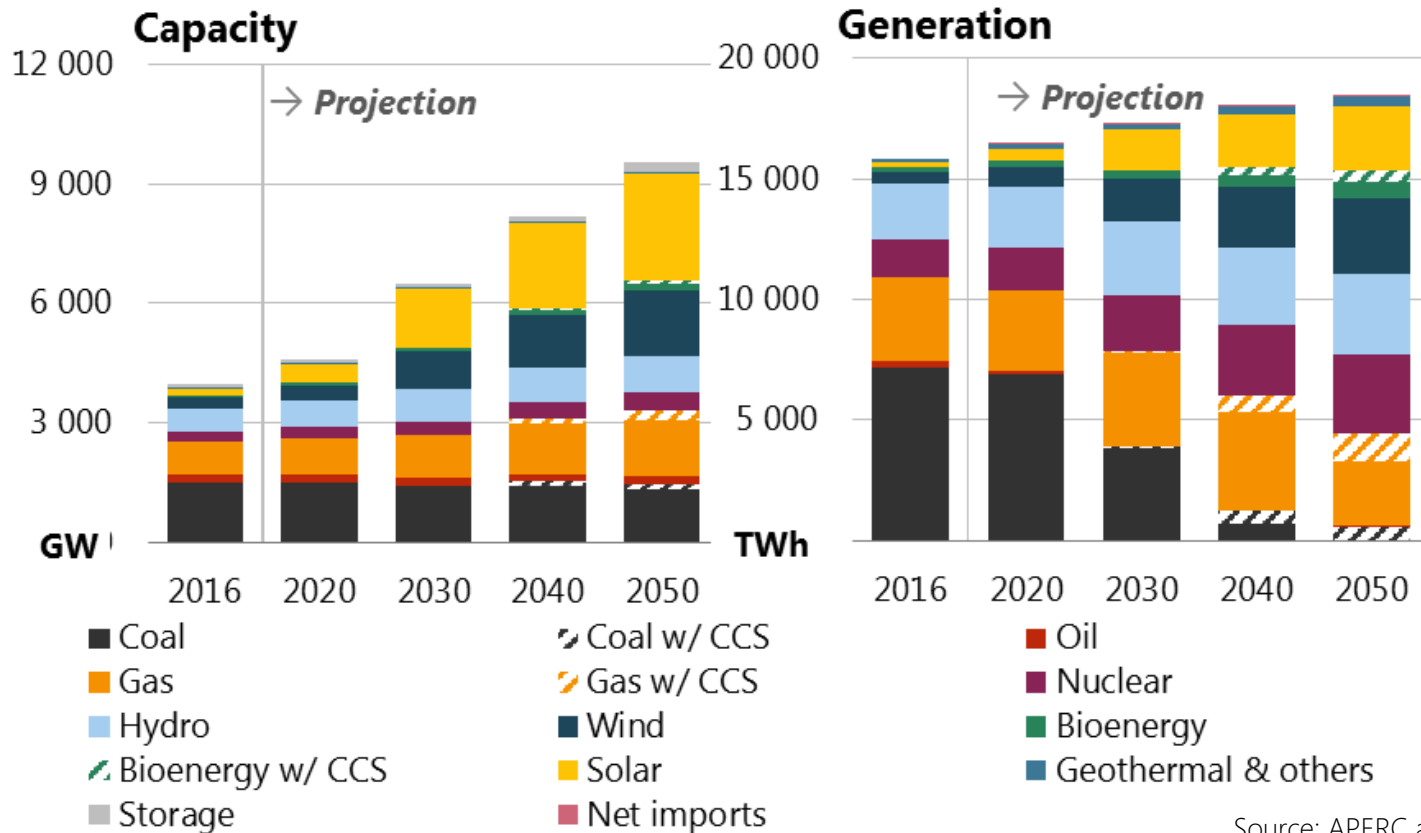


Sources: APERC analysis and IEA (2018)

Electrification and efficiency improvements are the two key drivers of demand reduction.

Varied approach required in the 2DC

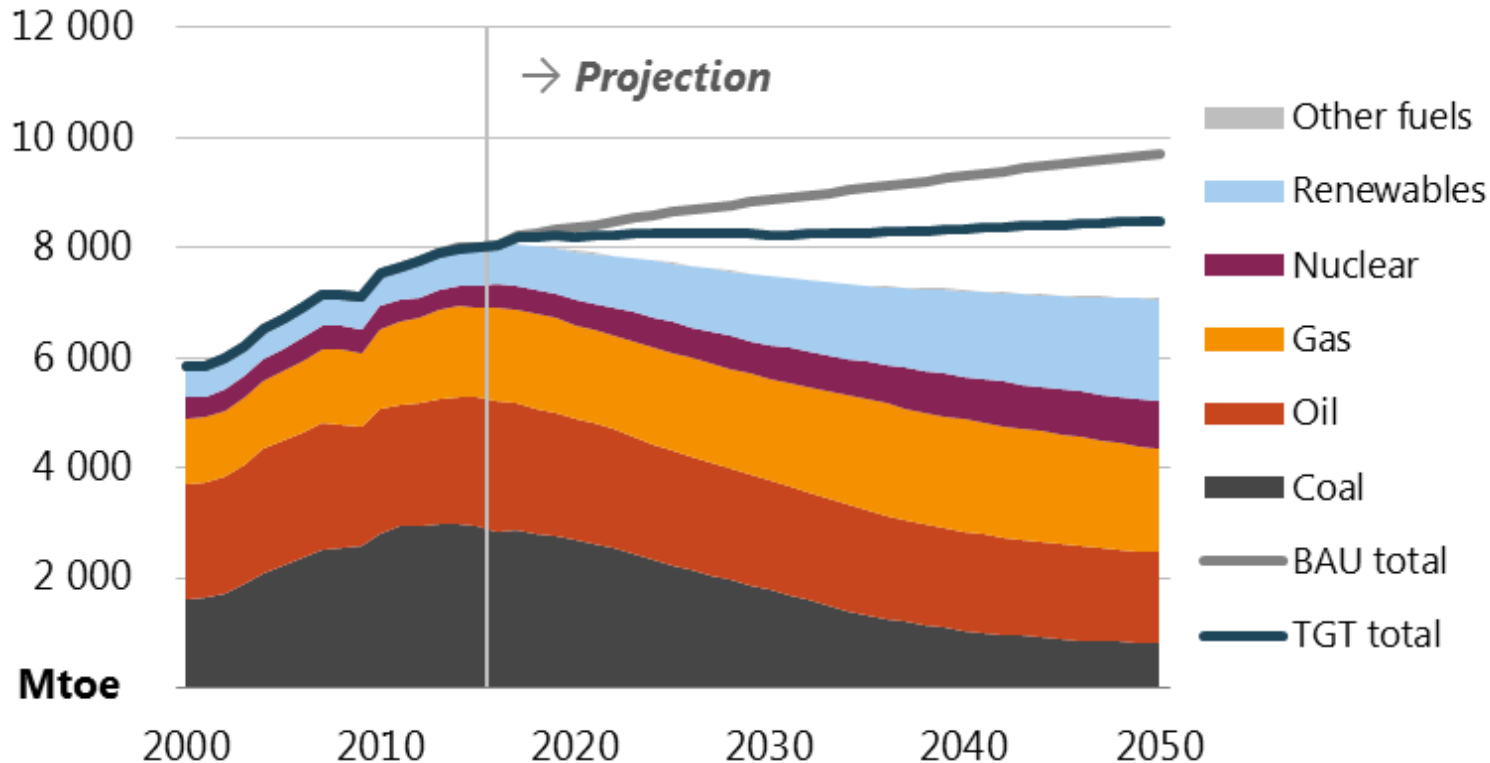
APEC power capacity and electricity generation by fuel in 2DC, 2016-50



Renewables, CCS for fossil fuel and biomass, and nuclear are all key to decarbonising the electricity sector while storage supports integration.

Lower energy supply with more renewables

Total primary energy supply by fuel in 2DC, 2000-50

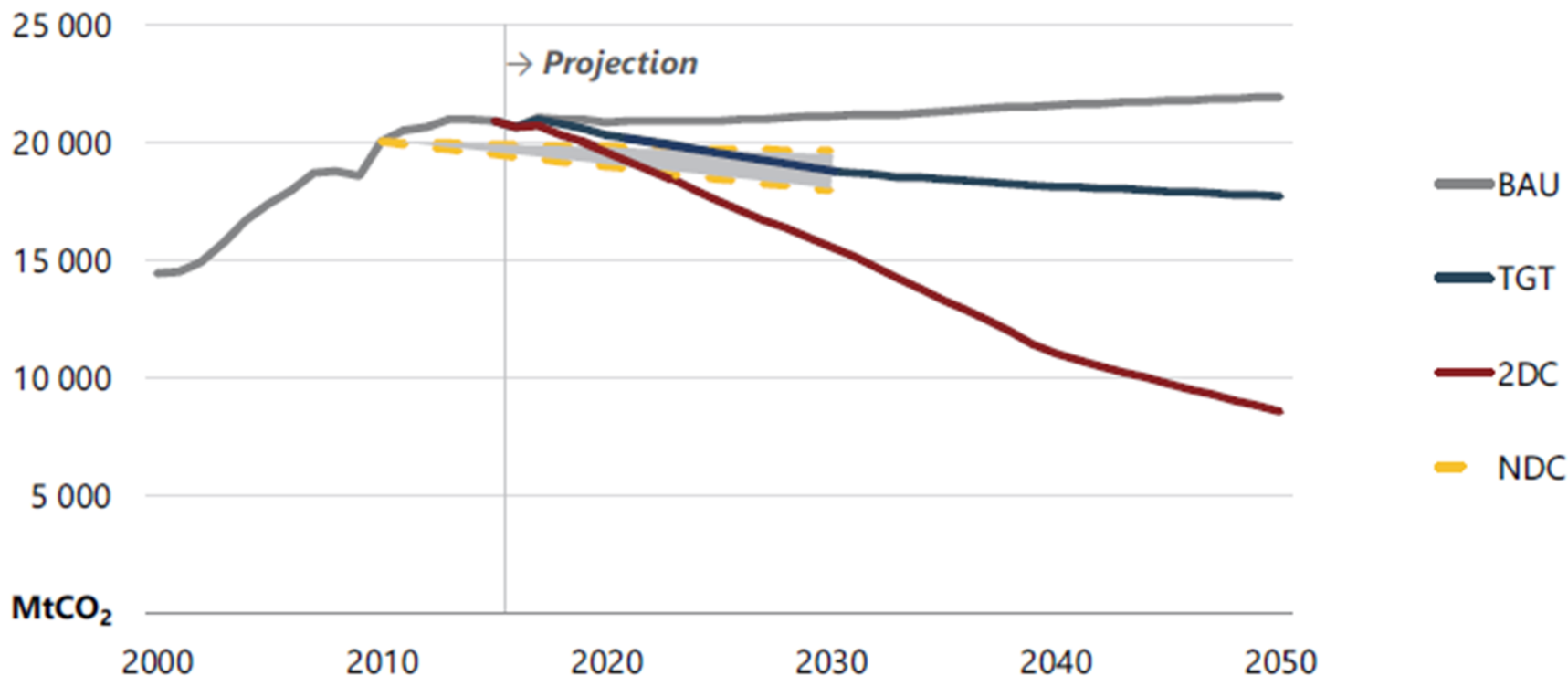


Source: APERC analysis and IEA (2018)

Renewables and gas dominate supply as coal is replaced in power and industry. Still significant oil use in transport though.

Cumulative APEC NDCs not achieved in BAU

APEC energy-related CO₂ emissions by scenario, 2000-50

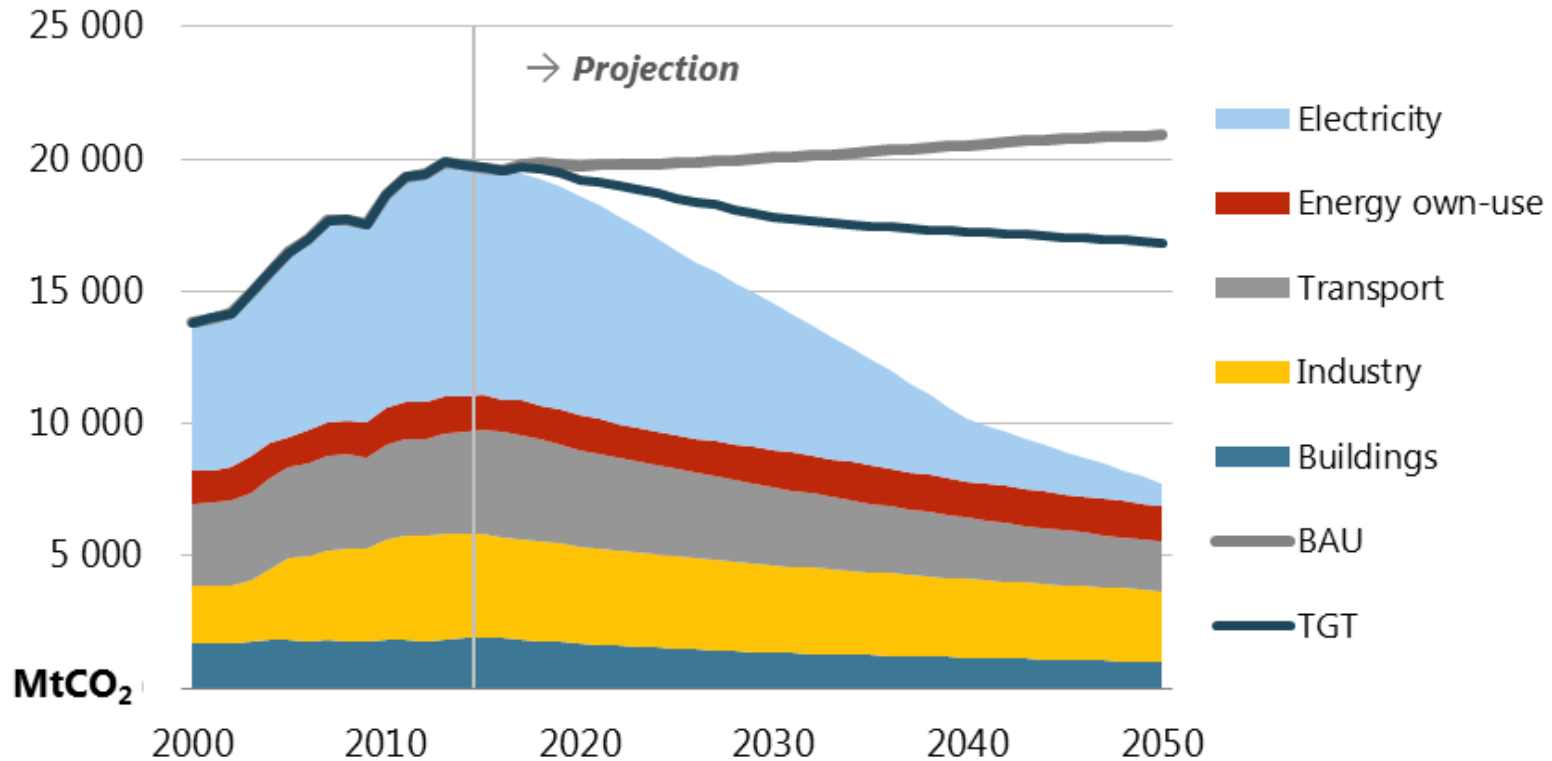


Sources: APERC analysis, IEA (2016 and 2018), IPCC (2018) and UNFCCC (2018).

The APEC region does not achieve its cumulative NDCs under the BAU scenario, but at least achieves unconditional in TGT.

In 2DC, CO₂ emissions more than halve

Energy-related CO₂ emissions by sector in the 2DC, 2016-50

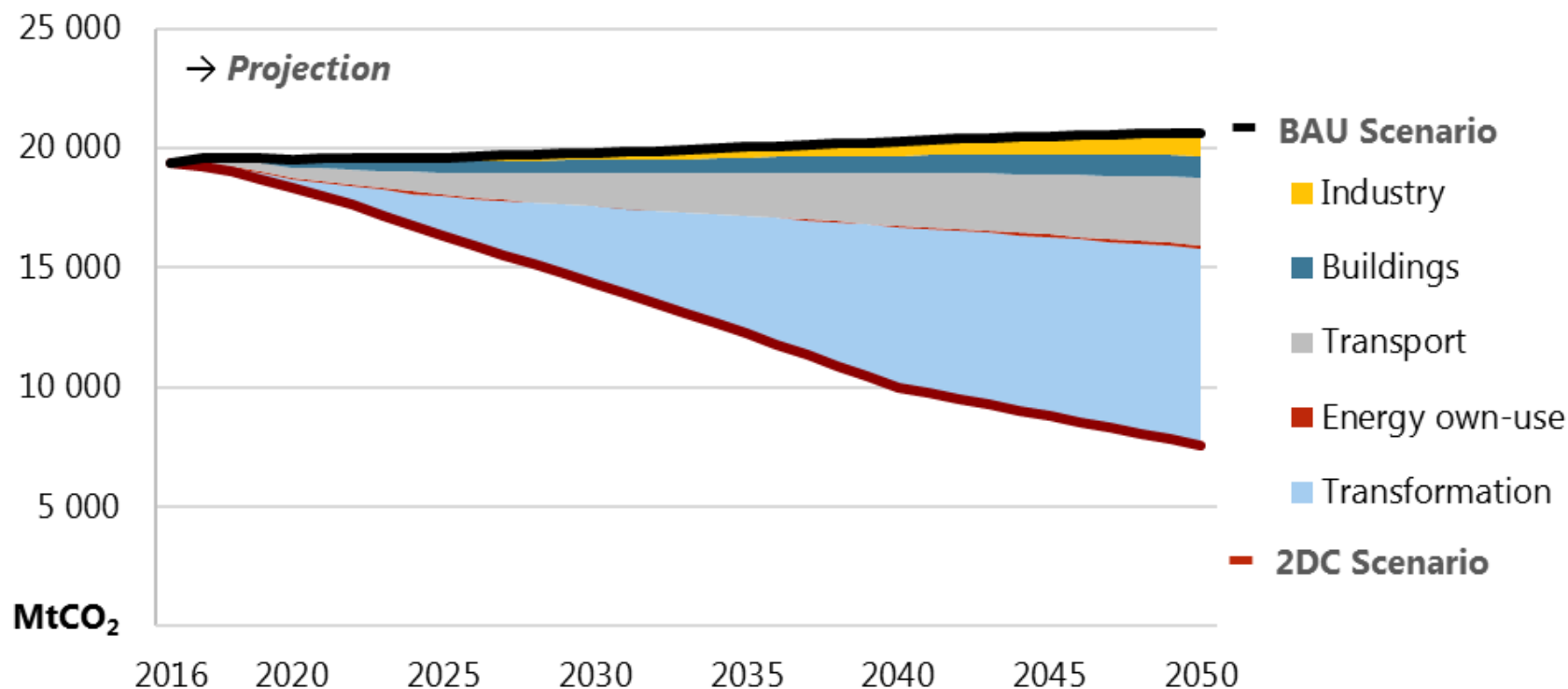


Sources: APERC analysis, IEA (2016 and 2018), IPCC (2018) and UNFCCC (2018).

Total emissions are significantly lower than under the other two scenarios, mostly due to electricity decarbonisation.

Electricity makes the largest contribution

Energy-related CO₂ emissions reductions by sector in BAU against 2DC, 2016-50



Sources: APERC analysis, IEA (2016 and 2018), IPCC (2018) and UNFCCC (2018).

More than half of the emissions reduction in the 2DC occurs in electricity, but transport is also a large contributor.

Key themes

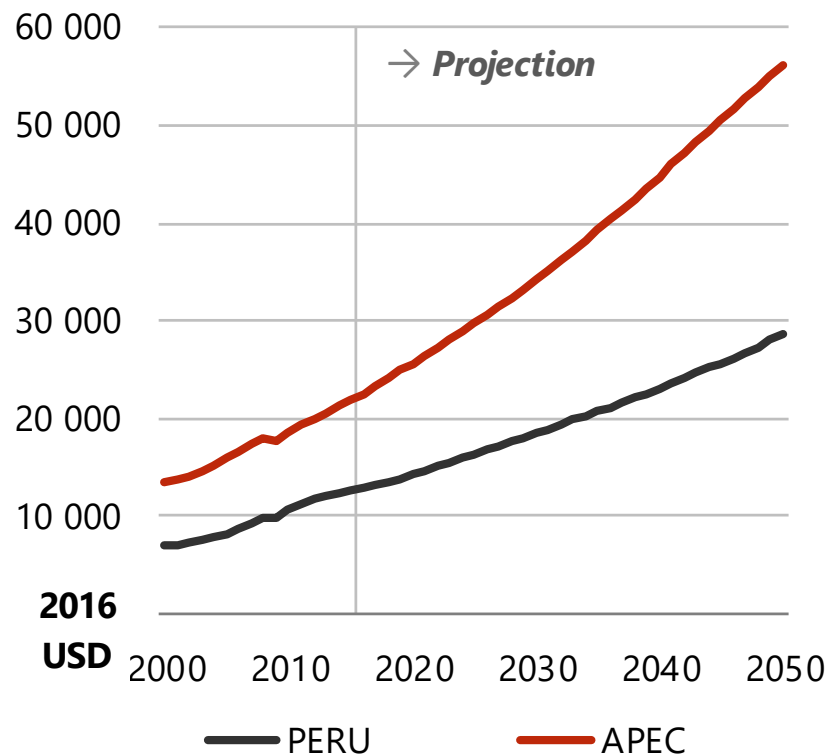
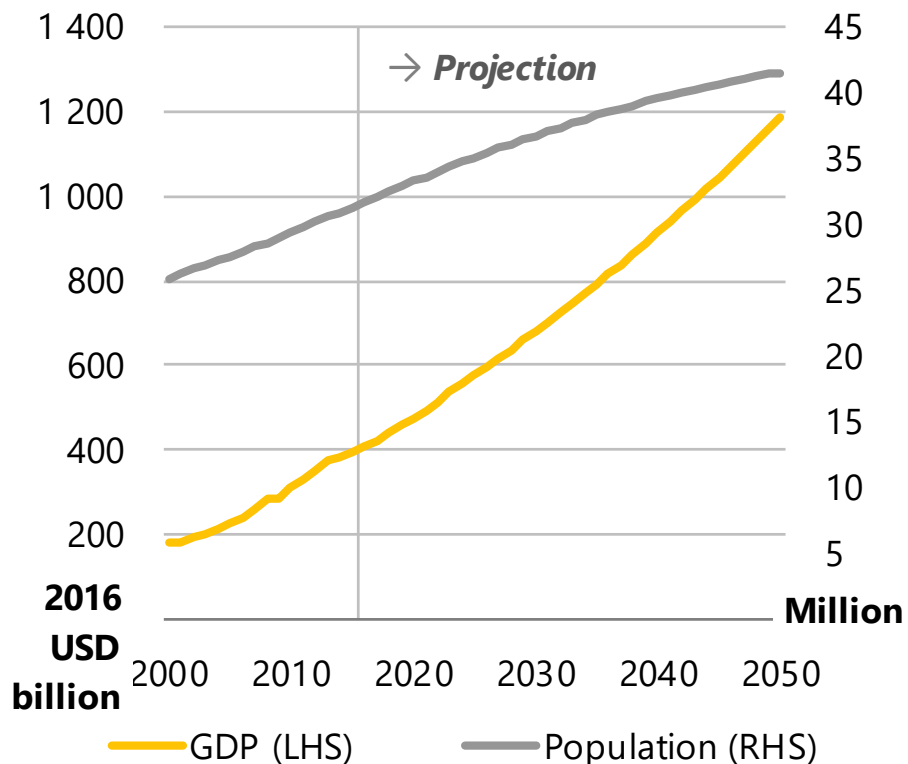
- Growing wealth is the key driver of energy demand.
- Renewables are essential to the energy transition, but improving efficiency and electrification make more of a difference in buildings, transport and industry.
- Renewables, nuclear and CCS are all required to achieve deep emissions reductions in the electricity sector.
- Despite these changes, fossil fuels remain the foundation of the APEC energy system in all three scenarios.
- Opportunity to update NDCs next year should be taken.
- Capital expenditure grows in the more ambitious scenarios, but this is outweighed by larger falls in fuel costs.



3. Outlook for Peru

Key drivers: GDP and population

Peru • GDP, population and GDP per capita, 2000-50



Sources: APERC Analysis and IEA (2018).

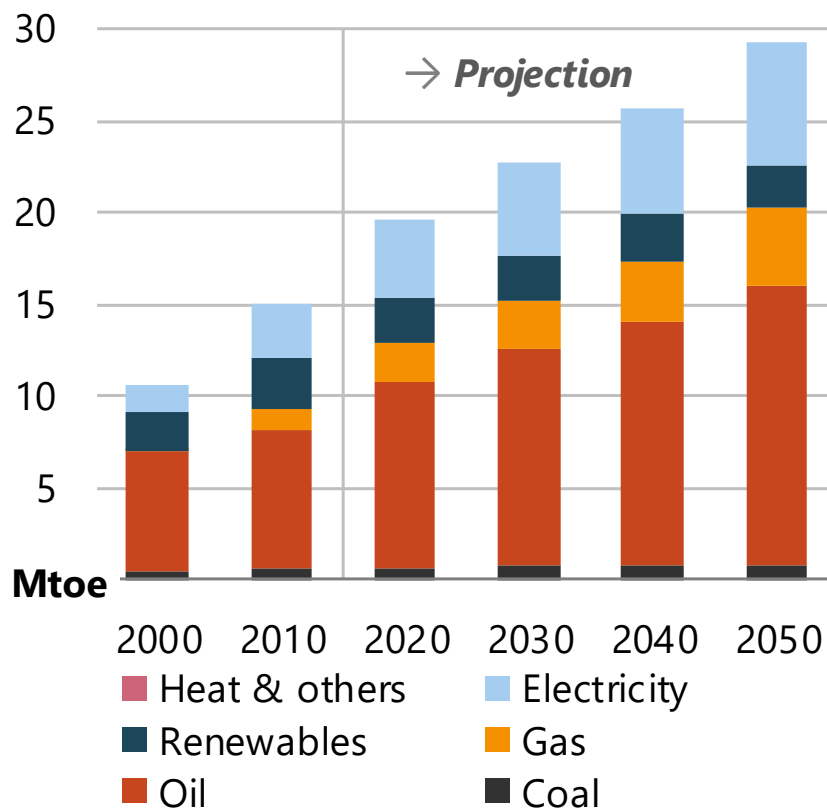
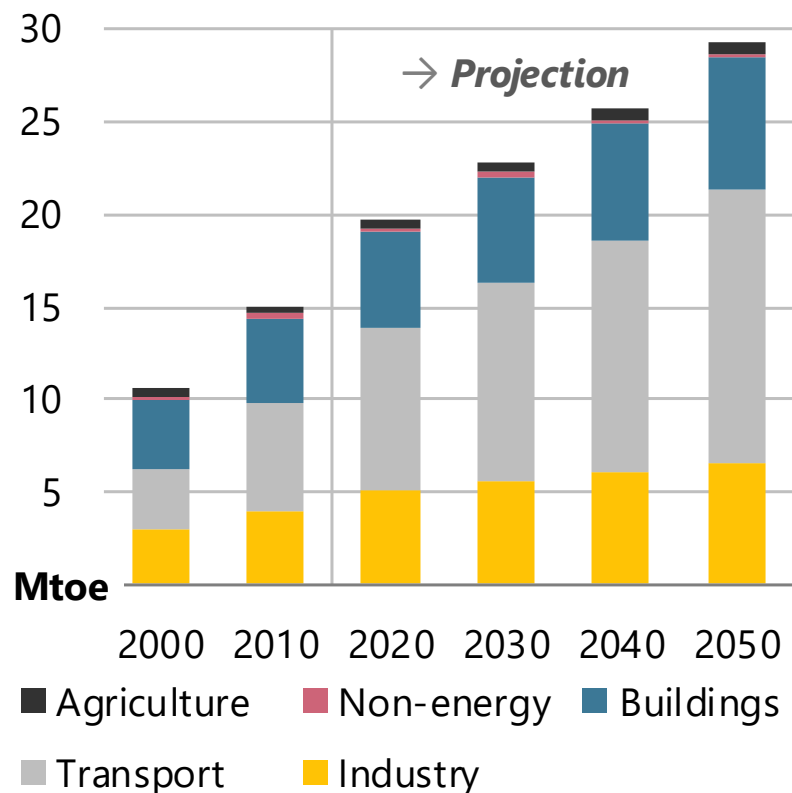
Strong economic growth sees GDP per capita more than doubling over the Outlook period as GDP outgrows population, driving up energy demand.



4. BAU Scenario

FED grows steadily through the Outlook (59%)

Peru • Final energy demand by sector and fuel in the BAU, 2000-50

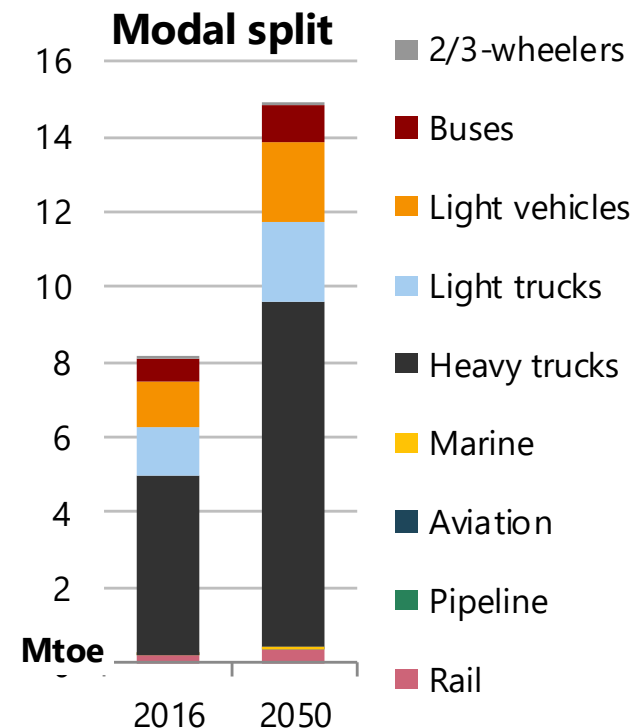
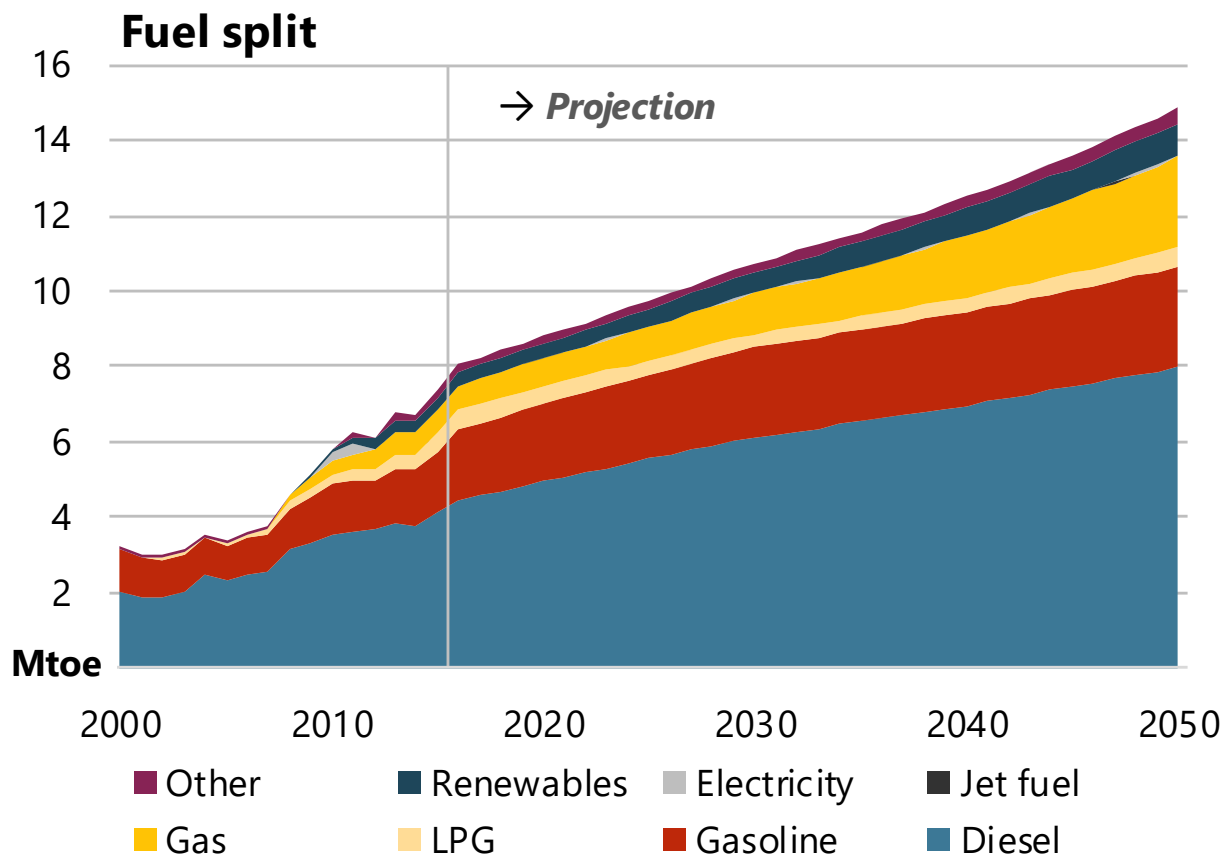


Sources: APERC Analysis and IEA (2018).

Transport almost double and industry largely continue unabated in the BAU as population and GDP both increase. Traditional biomass still large.

Steady growth in domestic transport

Peru • Domestic transport energy demand by fuel and mode, BAU, 2000-50

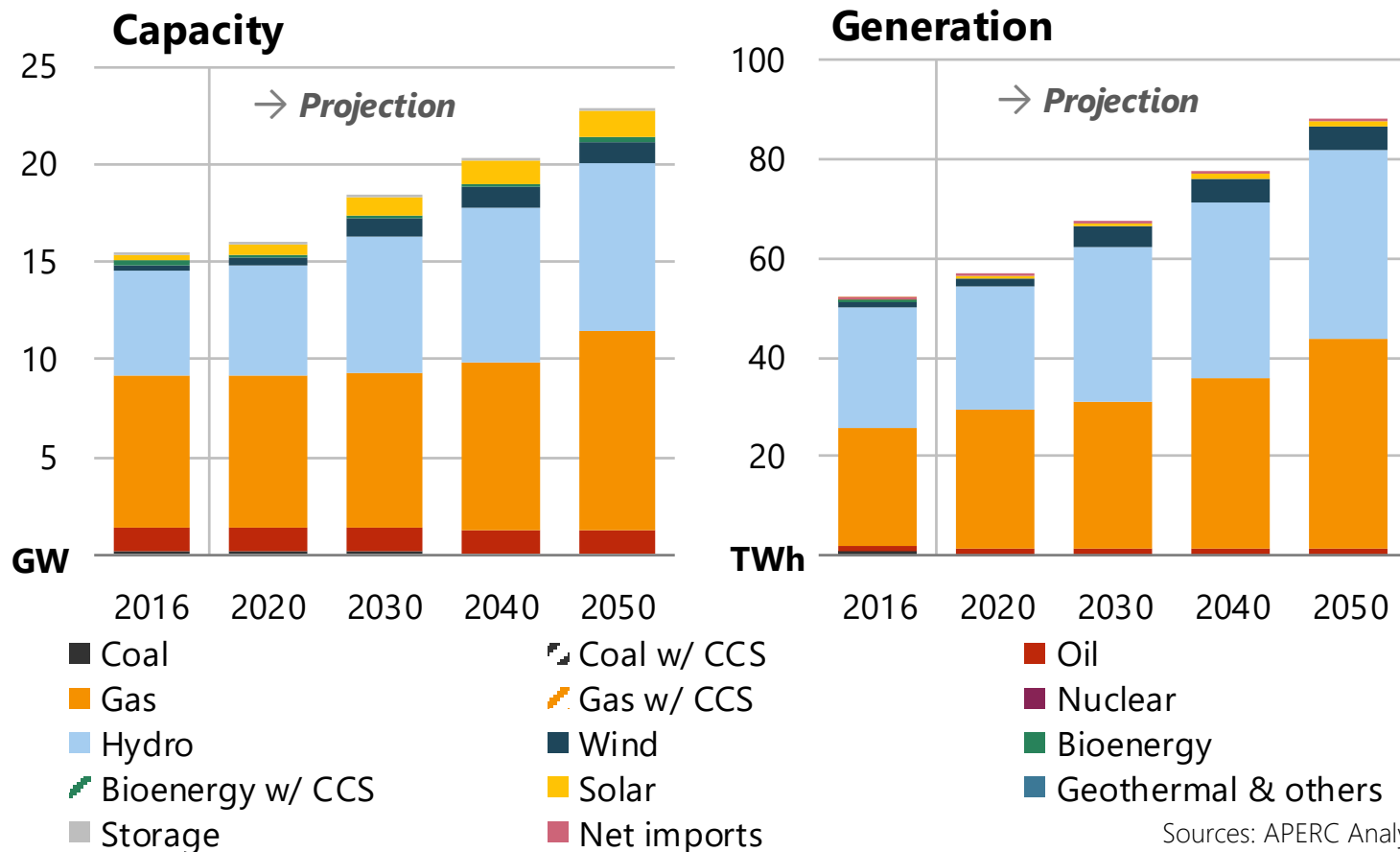


Sources: APERC Analysis and IEA (2018).

Road transport leads demand growth, great impact on diesel and gas. Limited diversification to rail. Electricity grows, but remains very low.

Gas and renewables dominate electricity

Peru • Power capacity and electricity generation by fuel in the BAU, 2000-50

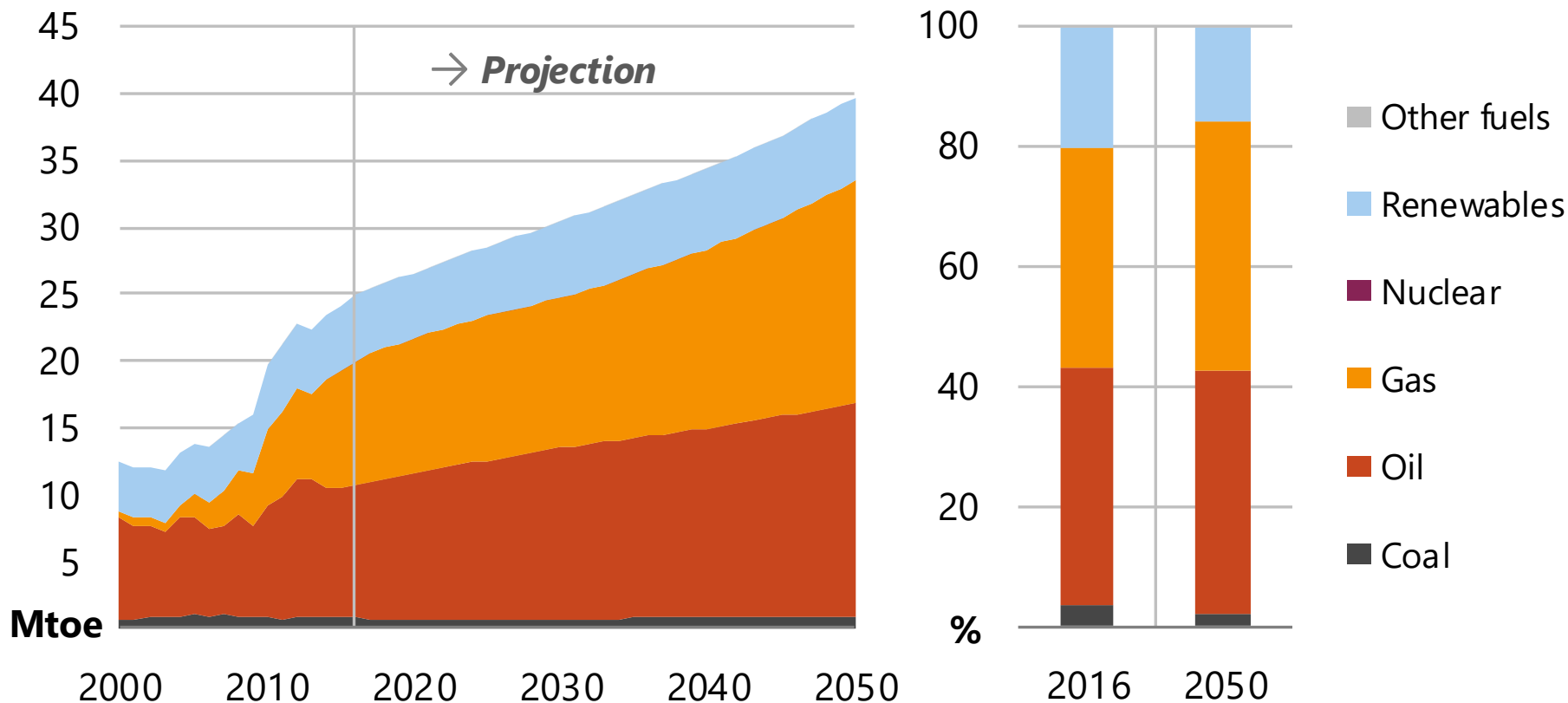


Sources: APERC Analysis and IEA (2018).

Capacity grows by 48% to supply rapid increasing demand. Oil and coal are replaced with gas and renewables, mainly hydro and wind. (generation, 70%)

Fossil fuels remains dominant with gas on top...

Peru • Total primary energy supply by fuel in the BAU, 2000-50

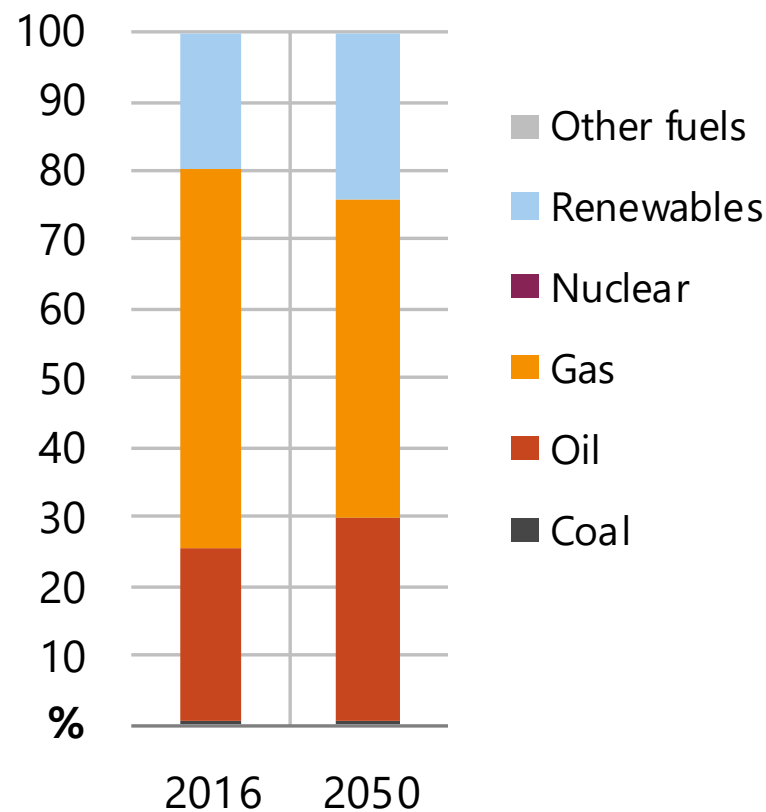
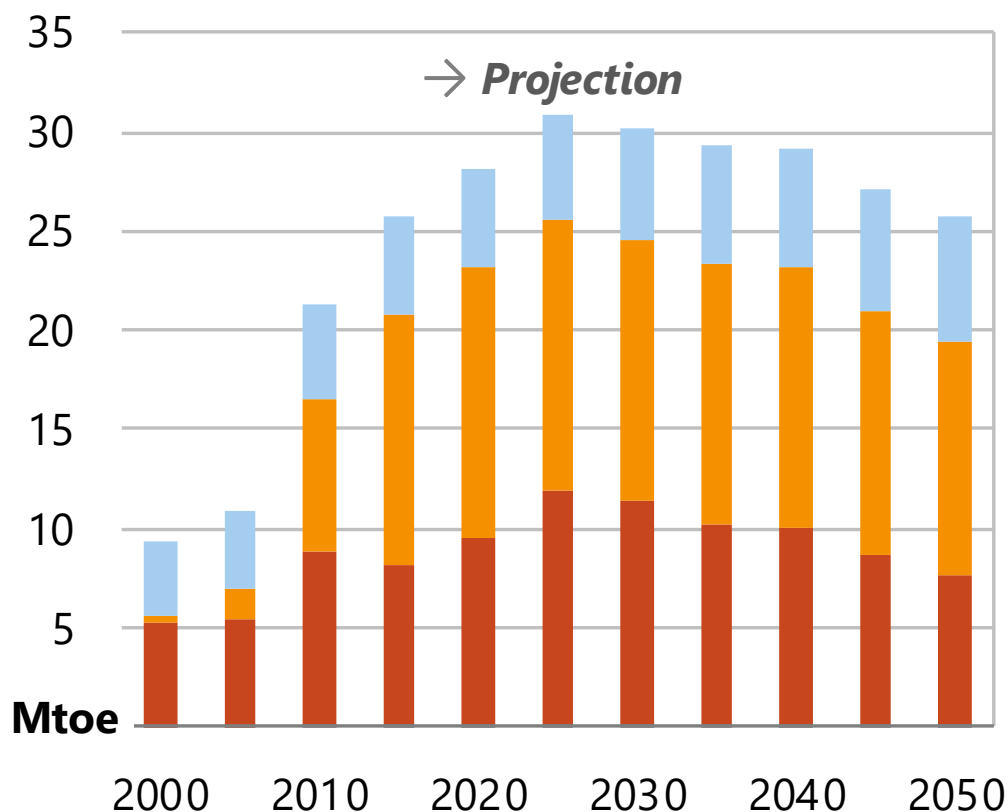


Sources: APERC Analysis and IEA (2018).

TPES grows 65% through 2050 with all fuels growing except coal and traditional biomass. Renewables grow but non-hydro REN accounts for 4%.

But renewables lead energy production growth

Peru • Total primary energy production by fuel in the BAU, 2000-50

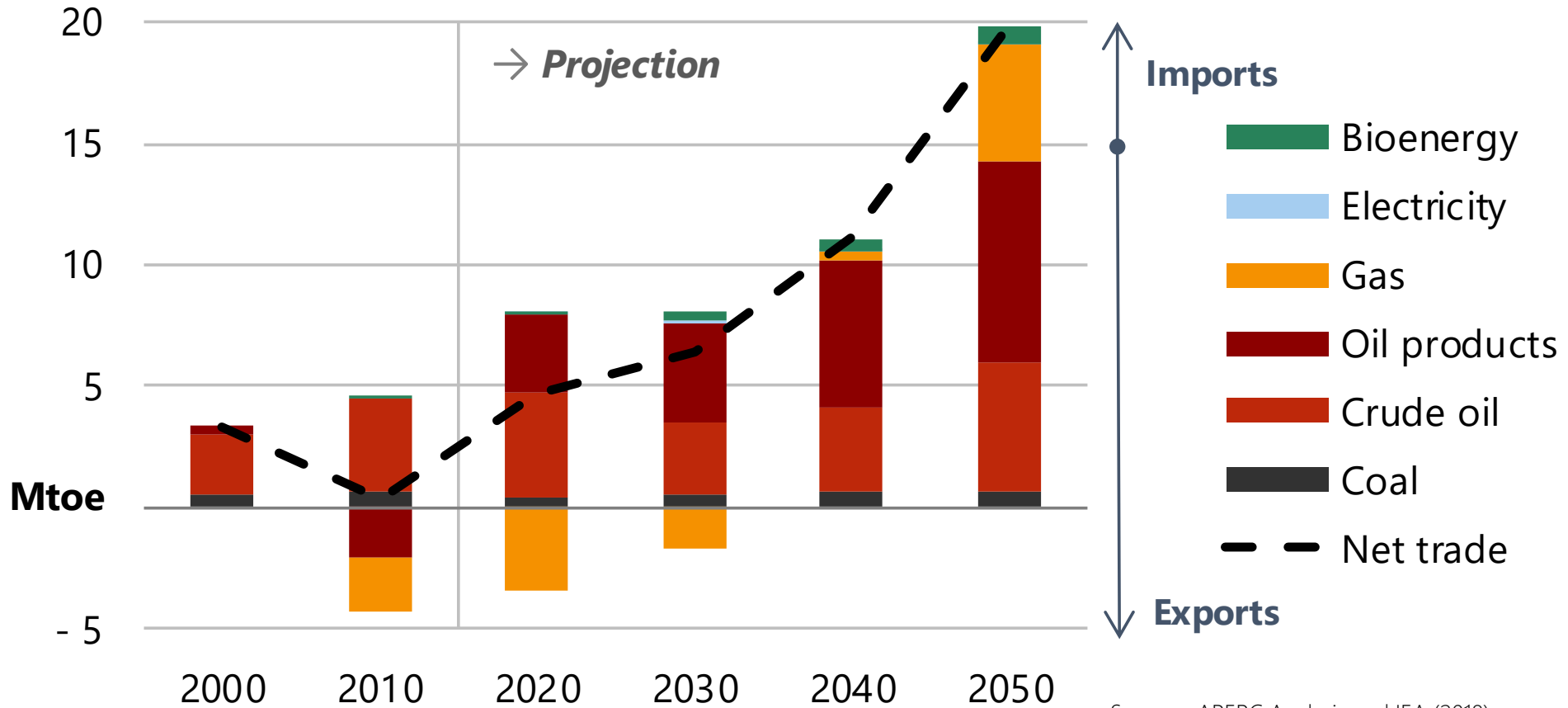


Sources: APERC Analysis and IEA (2018).

Gas production grows fast and peaks following the depletion of the Camisea field. Hydro, wind and solar electricity generation all expand.

Peru remains a major net crude oil exporter

Peru • Net energy trade by fuel in the BAU, 2000-50



Sources: APERC Analysis and IEA (2018).

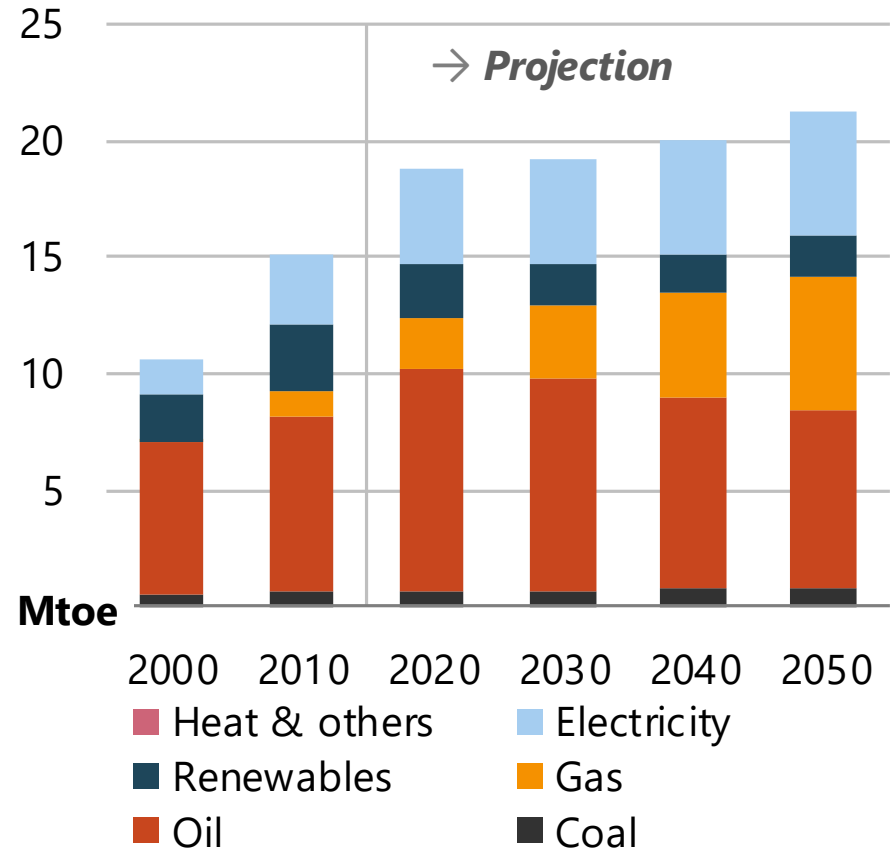
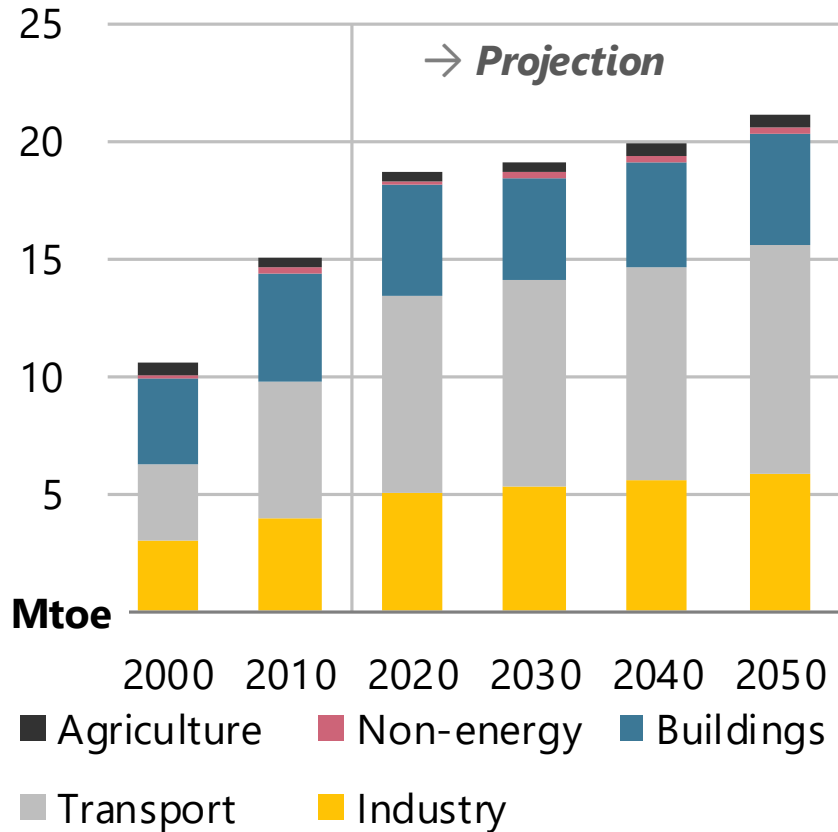
Peru continues being a natural gas net exporter until around 2035. Following economic growth, imports for oil products and gas increase through 2050.



5. Alternative scenarios

In the 2DC, FED grows moderately despite fast economic and population growth

Peru • Final energy demand by sector and fuel in the 2DC, 2000-50

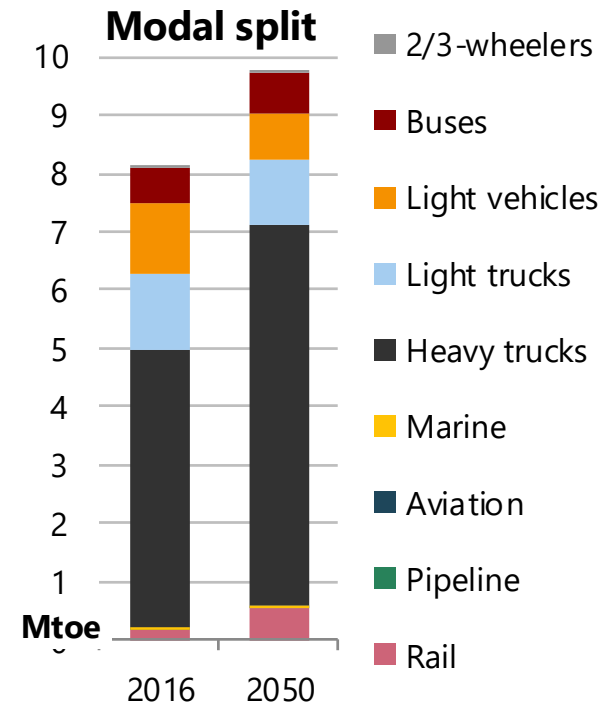
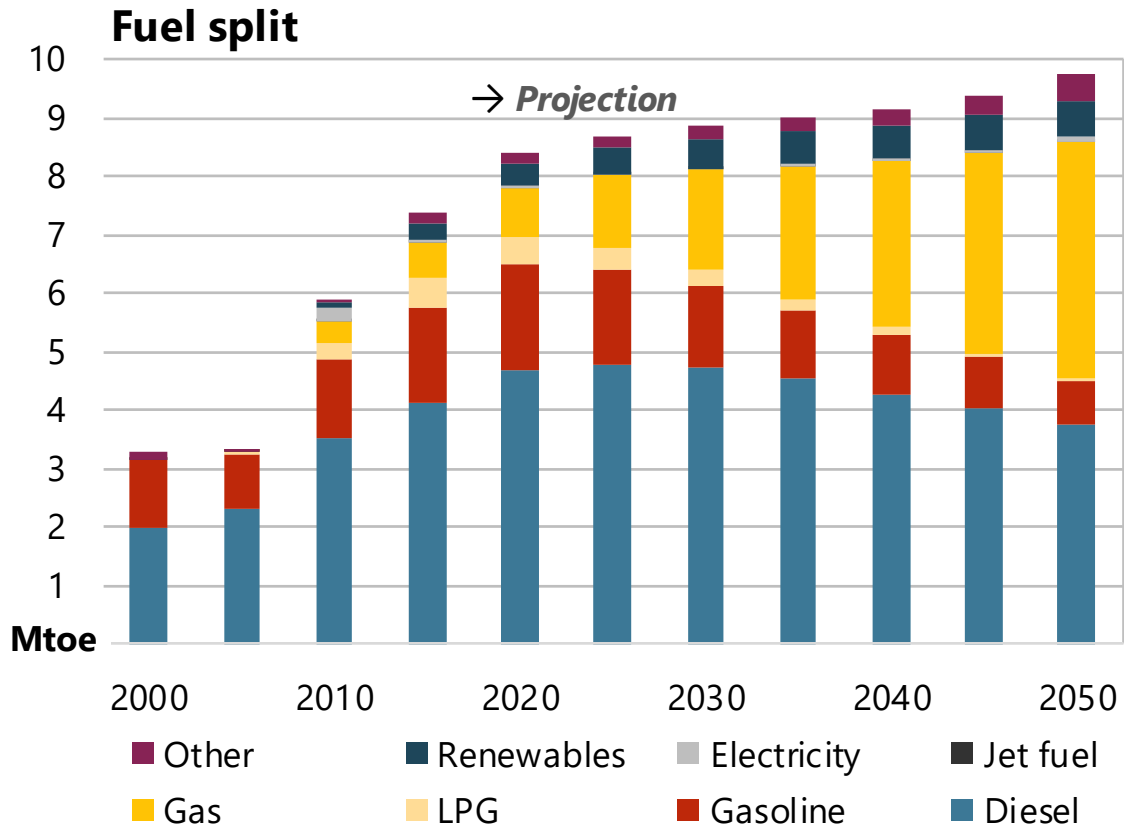


Sources: APERC Analysis and IEA (2018).

Like in the BAU and TGT, transport makes the biggest FED improvements in 2DC. Electricity and gas use still grow robustly.

Transport grows by 20% in the 2DC

Peru • Domestic transport energy demand by fuel and mode in the 2DC, 2000-50

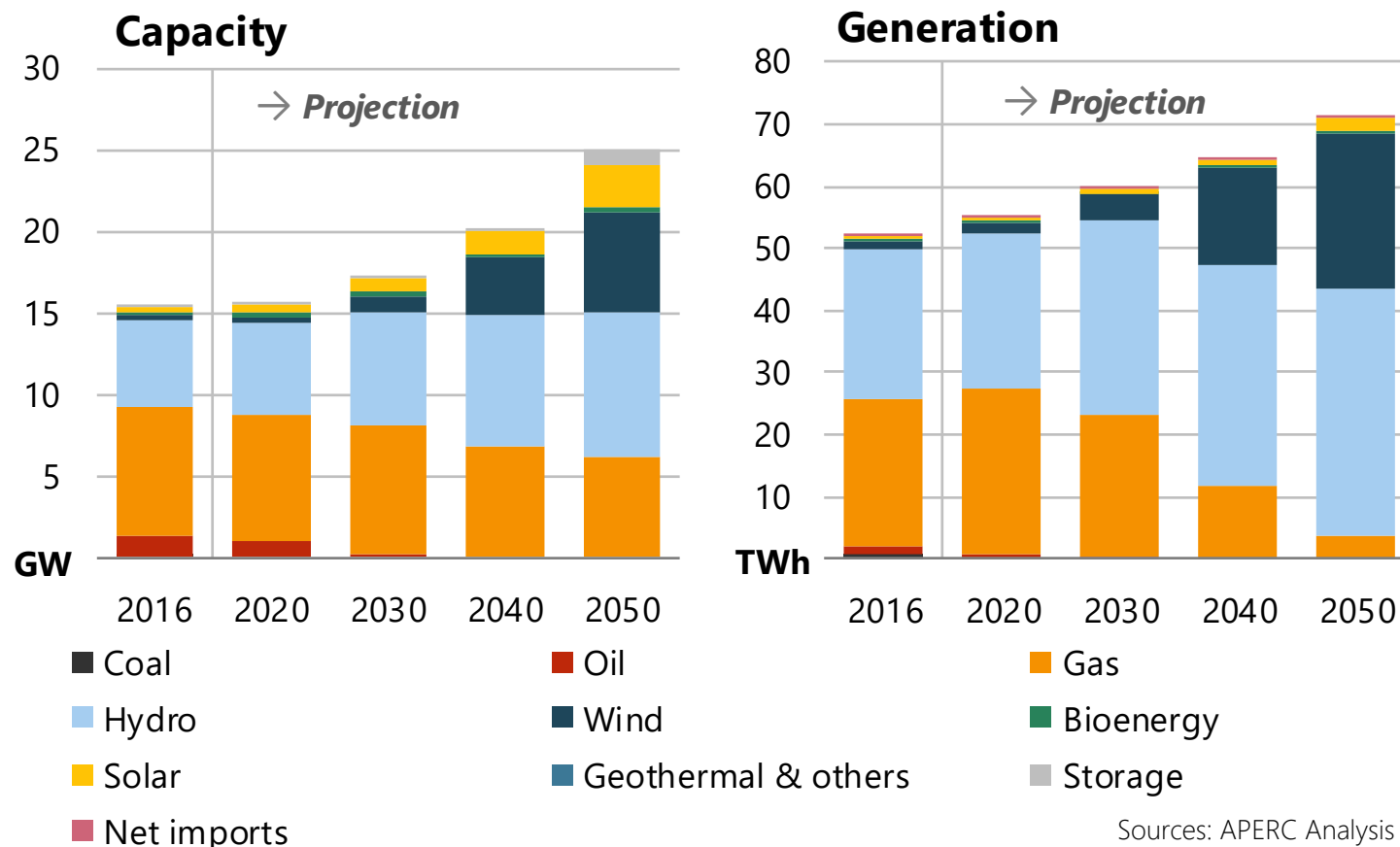


Sources: APERC Analysis and IEA (2018).

Gasoline and diesel remain dominant but its share decreases at the expense of natural gas. EVs, Rail and other modes remain marginal.

Non-fossil fuel generation accounts for 94%

Peru • Power capacity and electricity generation by fuel in the 2DC, 2000-50

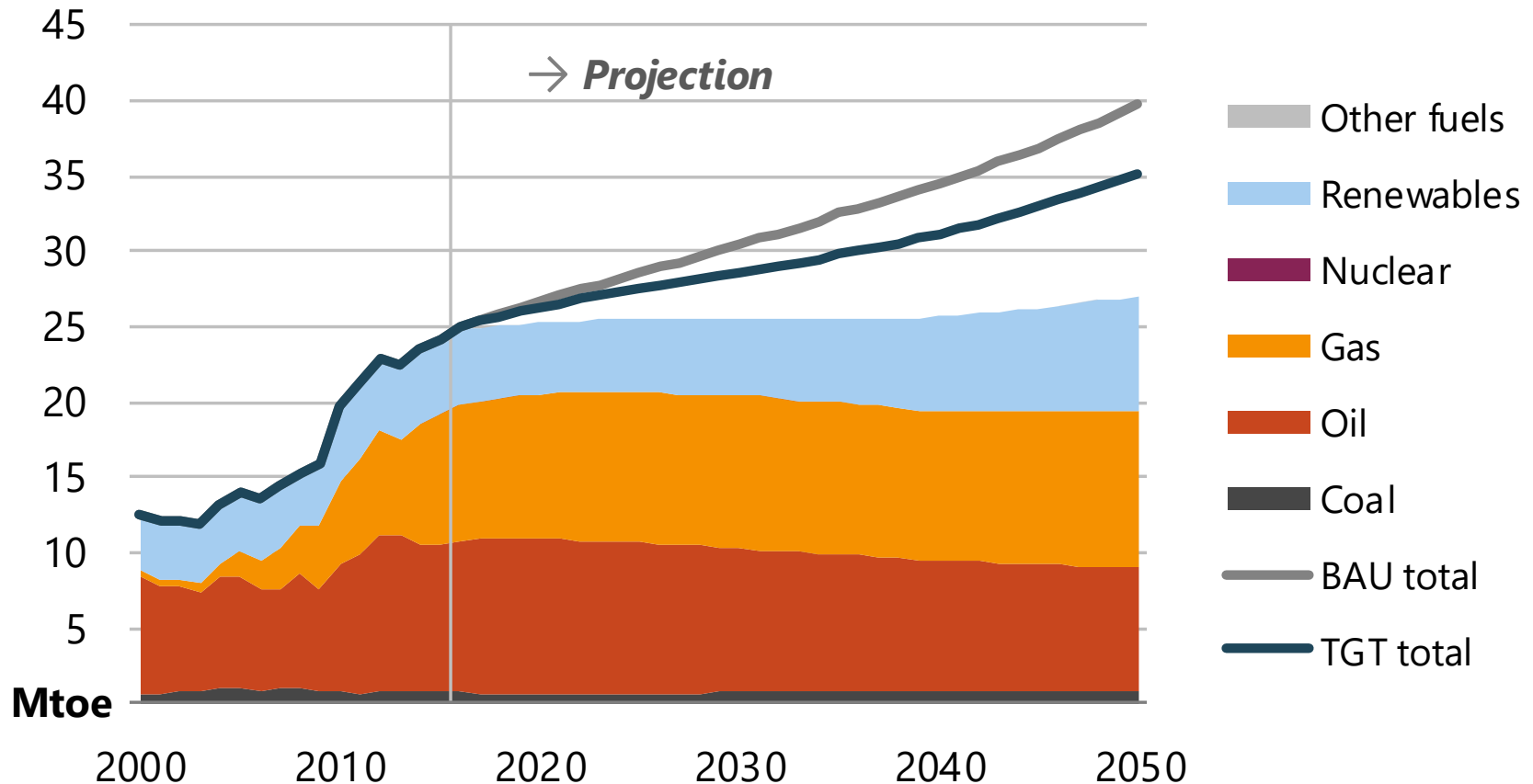


Sources: APERC Analysis and IEA (2018).

Wind and solar capacity are essential to the 2DC as they interact with hydropower and some are CCGTs. Oil and coal practically disappear.

TPES in the 2DC is 32% lower than the BAU...

Peru • Total primary energy supply by fuel in the 2DC, 2000-50

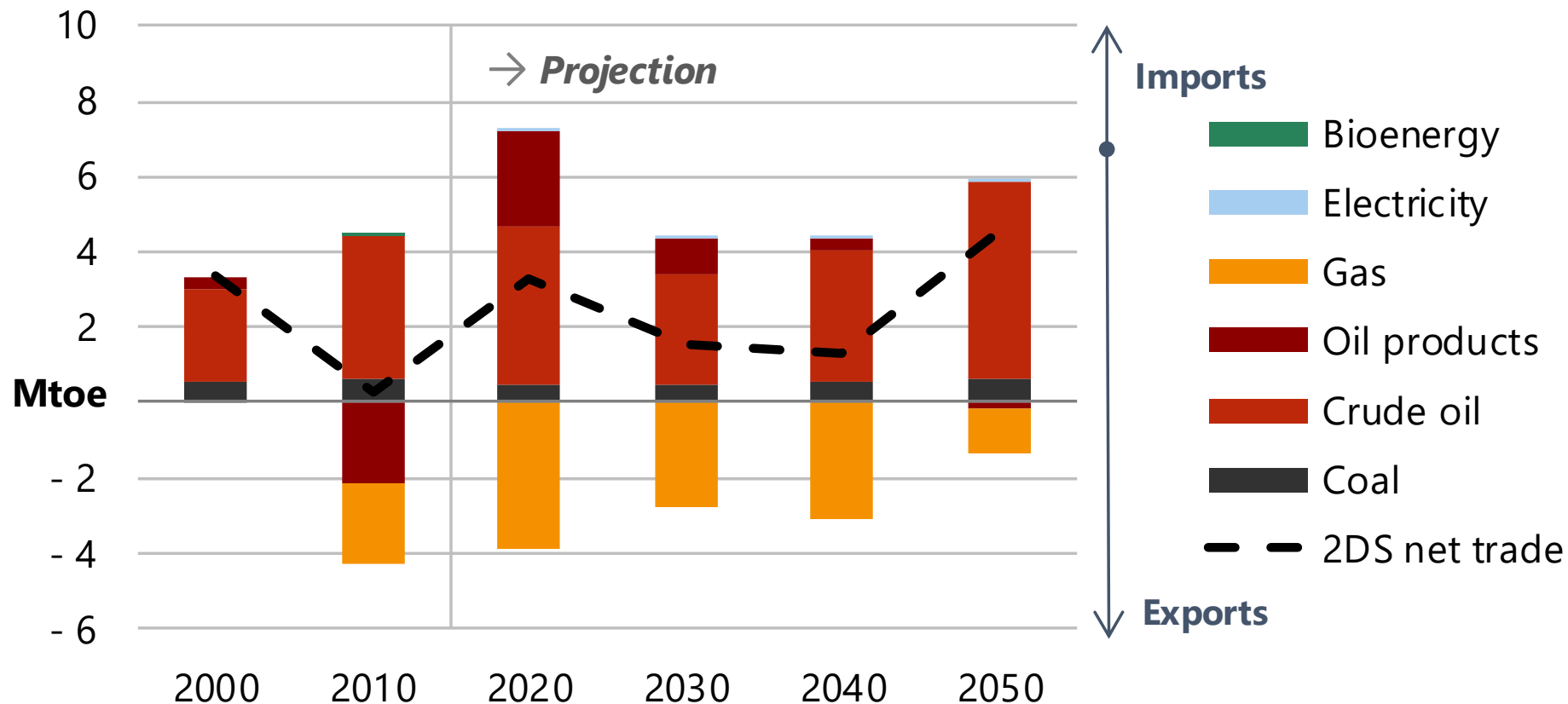


fasSources: APERC Analysis and IEA (2018).

Lower demand and robust growth on renewables. Gas almost completely replaced by renewables by 2050. Transport, tougher to decarbonize.

Efficiency gains reduce imports dependency

Peru • Net energy trade by fuel in the 2DC, 2000-50



Sources: APERC Analysis and IEA (2018).

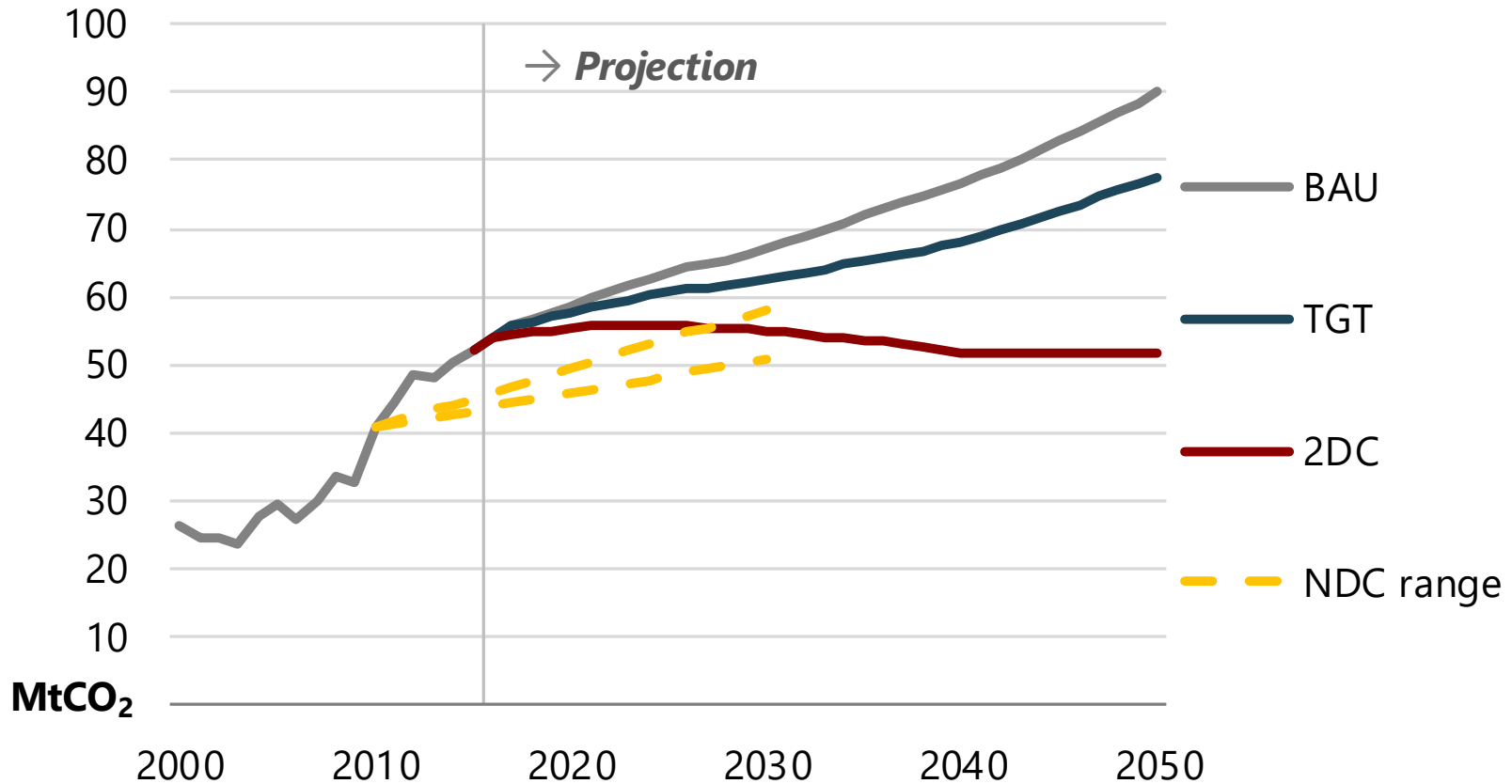
Gasoline and diesel imports are significantly lower in the 2DC, while Peru remains as a net gas exporter. Demand efficiency gains enhance energy security.



6. Emissions and investment

Peru only achieves its CO₂ emission goals in the 2DC

Peru • Energy related CO₂ emissions by scenario, 2000-50

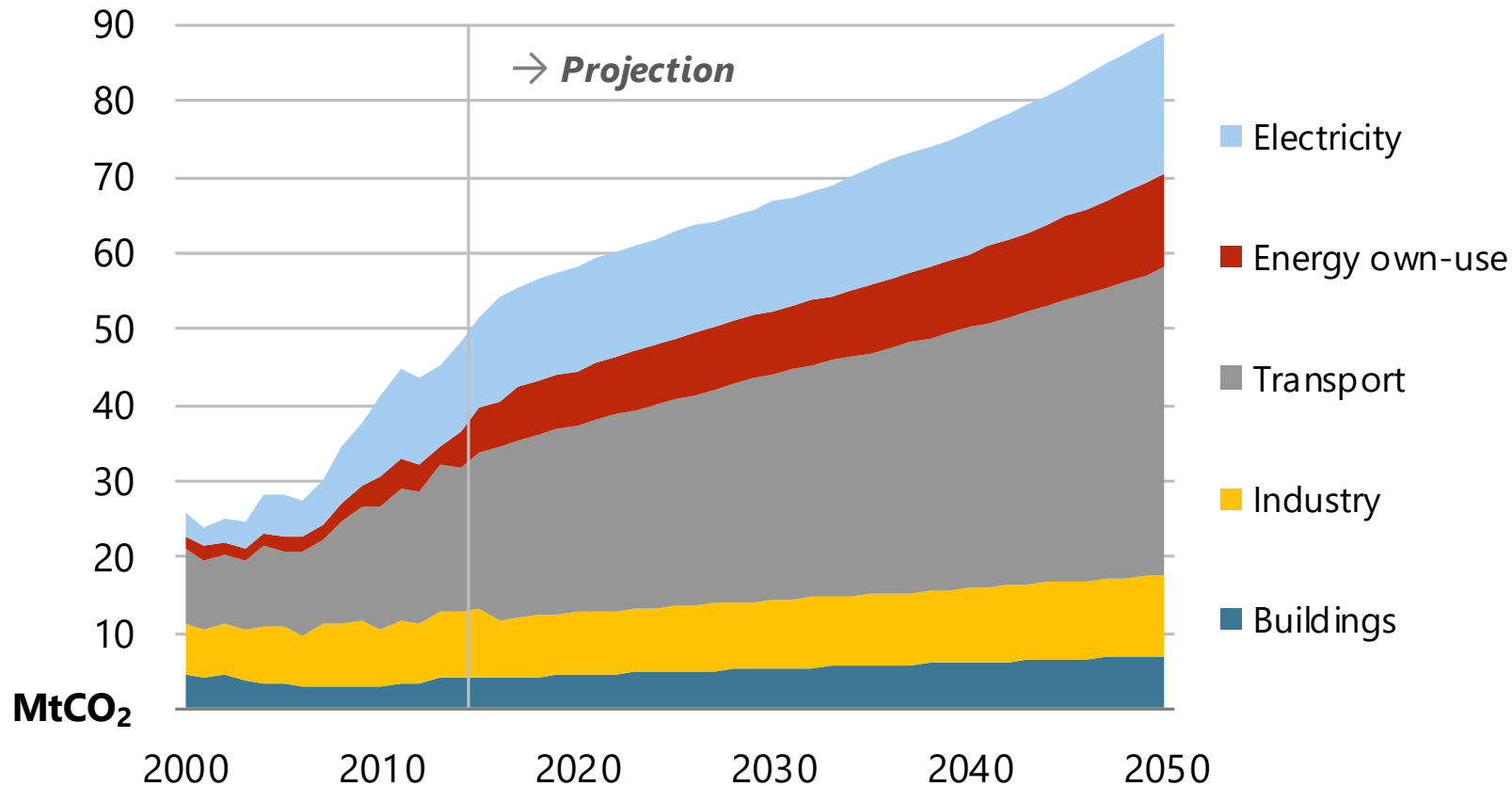


Sources: APERC Analysis and IEA (2018).

Despite progress, current policies are not aligned with Peru's NDC and domestic emissions goals and strategies.

Little progress outside electricity in the BAU...

Peru • Energy related CO₂ emissions by sector in the BAU, 2000-50

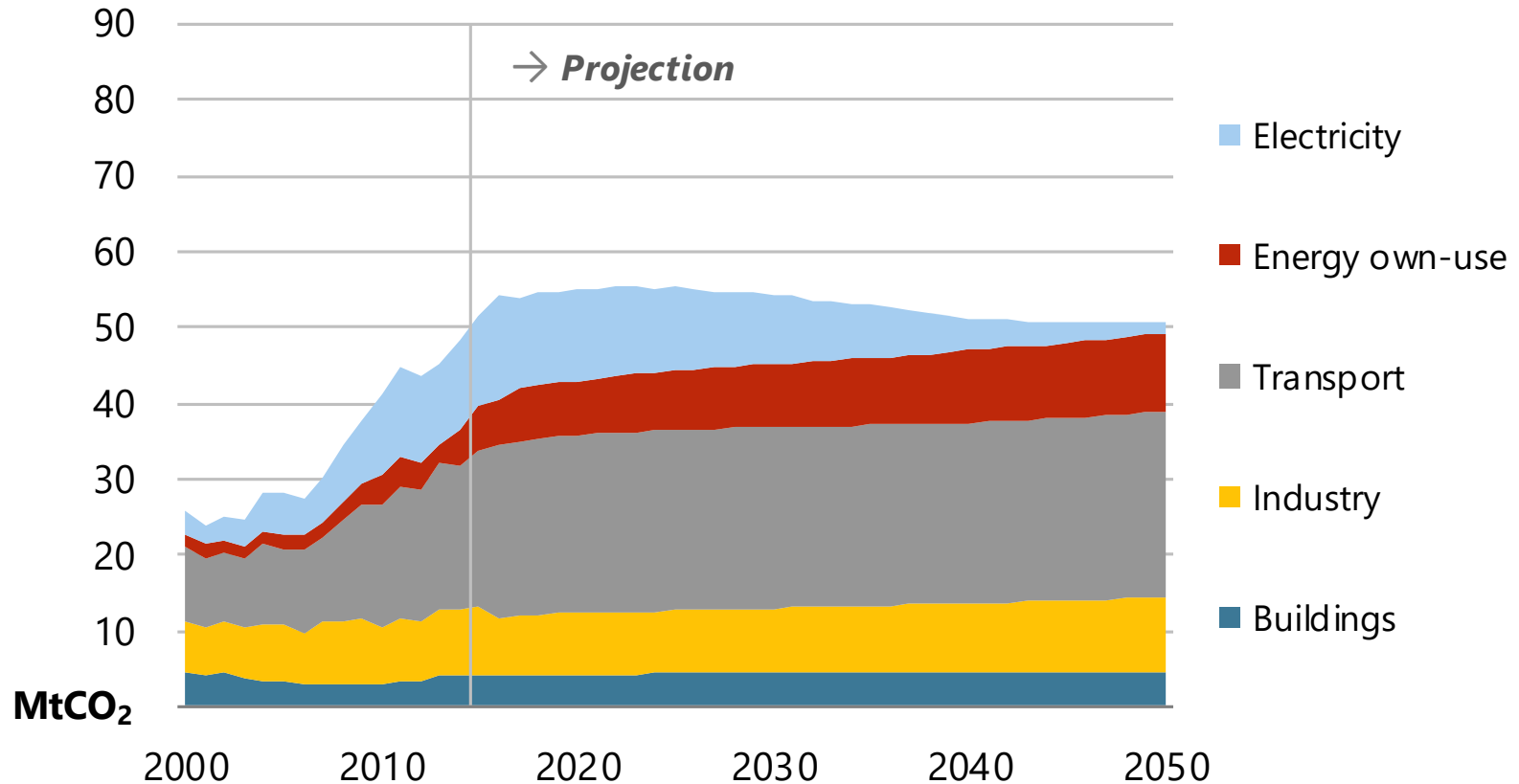


Sources: APERC Analysis and IEA (2018).

Following energy demand growth and despite current energy efficiency measures, CO₂ emissions rise in all sectors through 2050.

But massive improvement in electricity and transport in 2DC

Peru • Energy related CO₂ emissions by sector in the 2DC, 2000-50



Sources: APERC Analysis and IEA (2018).

Accelerated decarbonisation efforts via intensive renewable development, and a profound transformation in the transport sector, bring down CO₂ emissions.

Final thoughts

- Energy demand growth driven by robust economic expansion and population, but pollutant emissions follow the same path.
- This requires an urgent energy transition to a lower-carbon energy system capable of meeting increasing demand and ensuring affordability. Thorough assessment on the role of gas in this transition.
- Essential to enact energy efficiency measures, such as enhancing fuel economy standards, developing intermodal transportation (particularly in public transport) and promoting electric vehicles.
- Huge untapped renewable potential, contributing to sustainability, energy security and energy affordability. Auctions ? Turn-key projects?
- Enhancing energy security: increasing transmission capacity, building storage capacity and diversifying imports. Discrete but indispensable investments.
- Energy efficiency, progress on standards but still much to do, especially in high-intensity sectors.

Muchas gracias!

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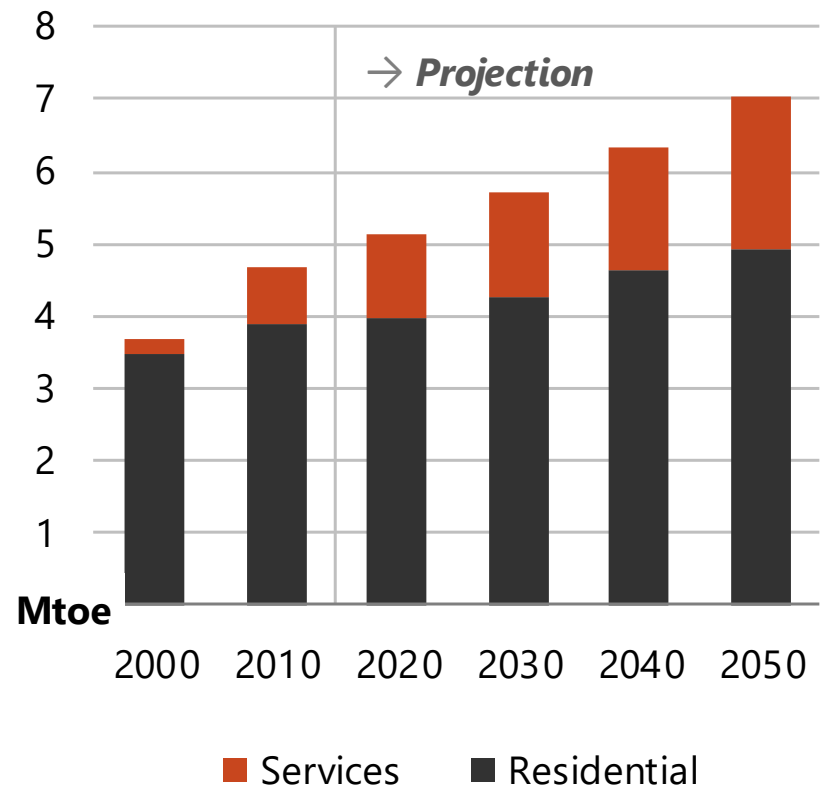
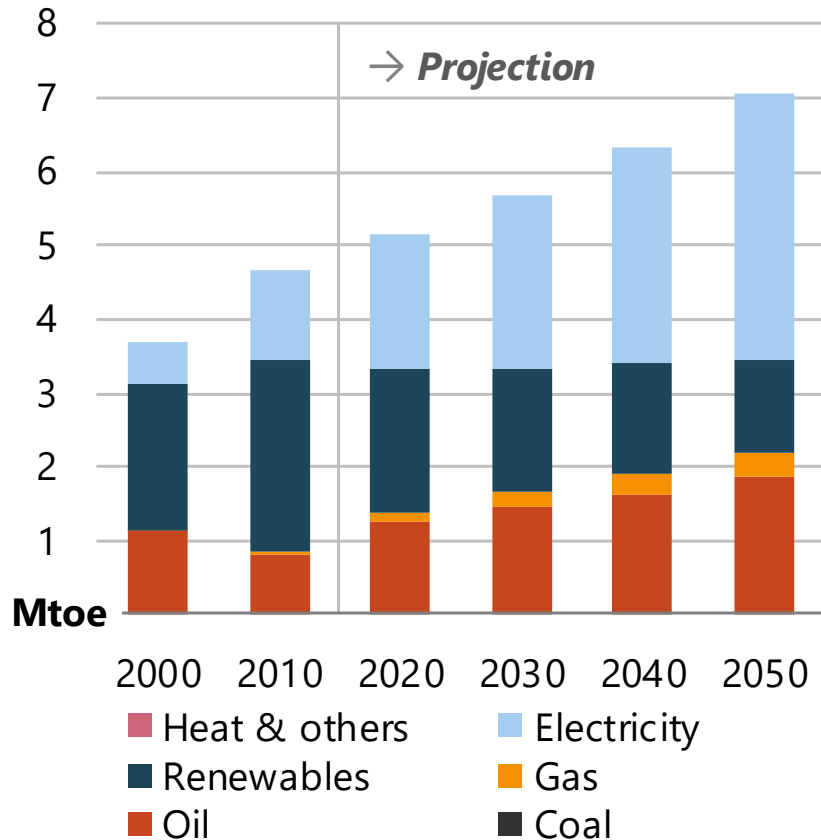
Asia-Pacific
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43

Buildings demand grows by 46%

Peru • Buildings energy demand by end-use and fuel in the BAU, 2000-50

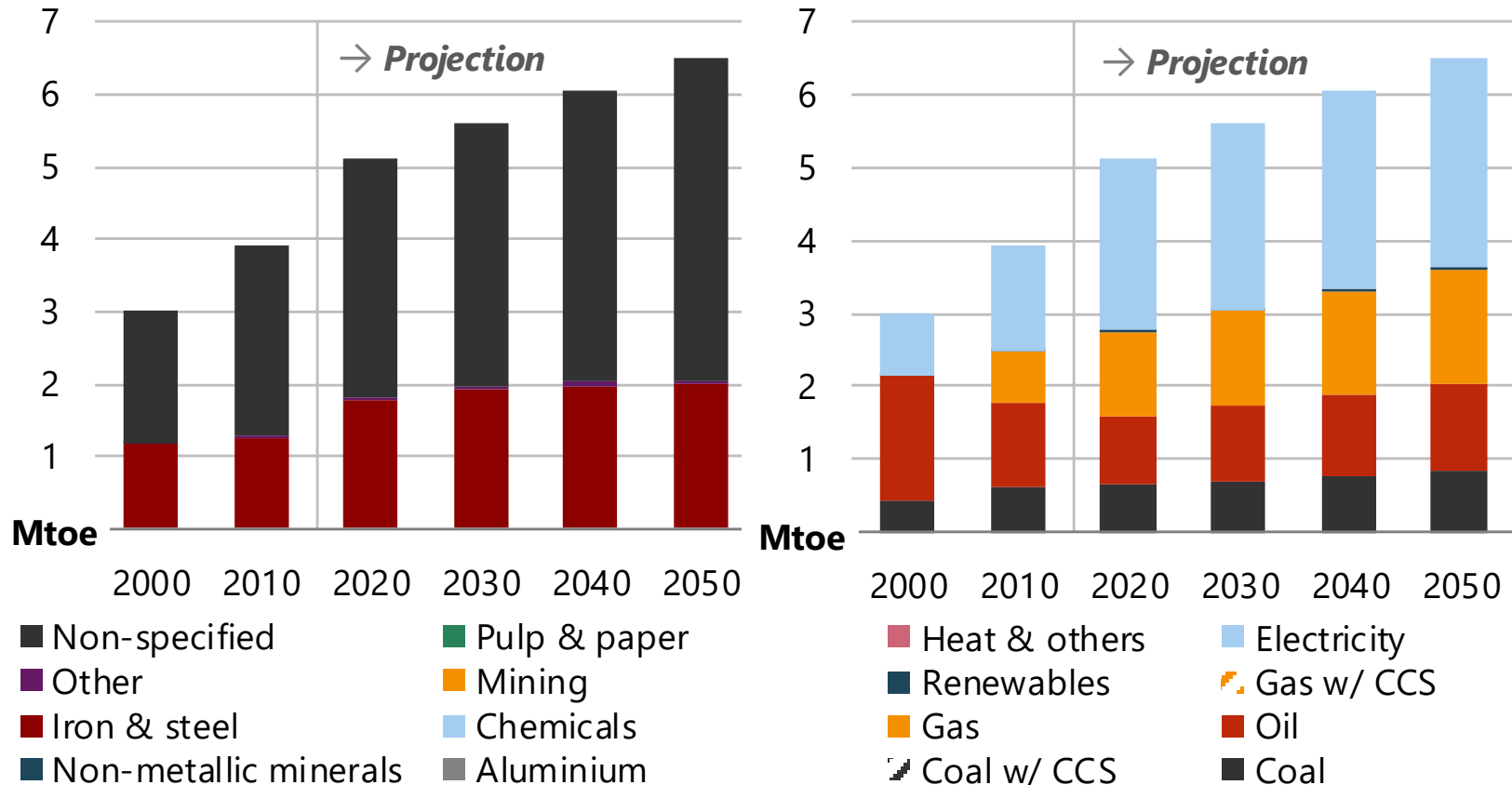


Sources: APERC Analysis and IEA (2018).

Demand growth is driven by population and economic expansion as well as better living conditions, traditional biomass decreases but remains large.

Growth in industry demand is more subdued

Peru • Industry energy demand by end-use and fuel in the BAU, 2000-50

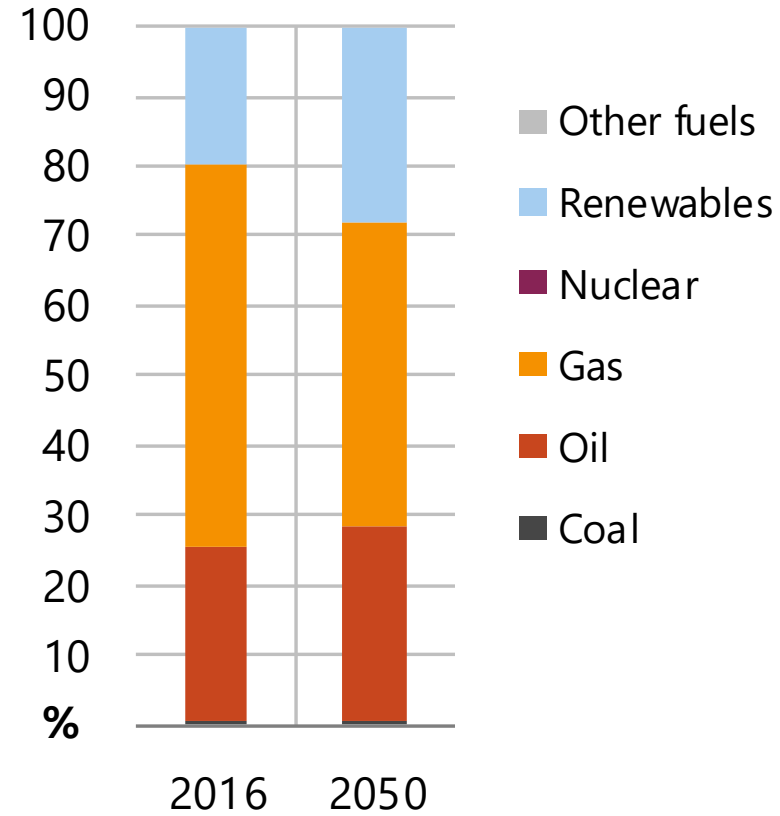
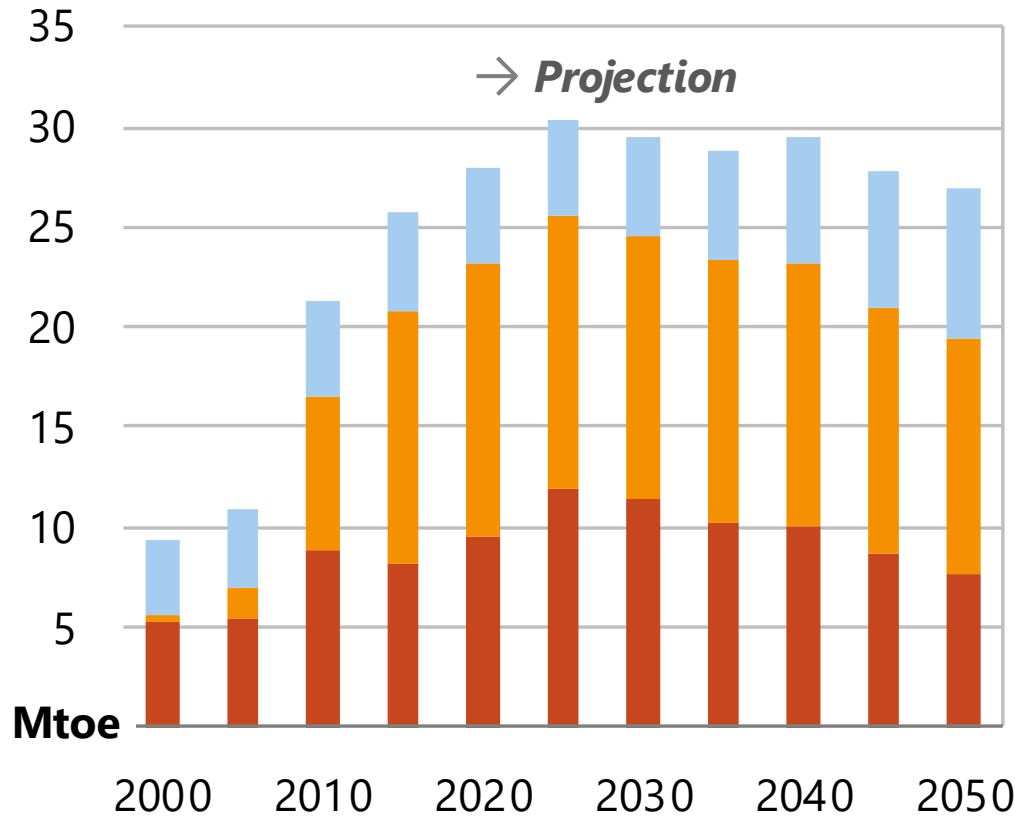


Sources: APERC Analysis and IEA (2018).

'Gasification' of the industrial sector, covering demand growth and substituting oil and coal. Room for efficiency in cement and iron.

But fossil fuels still dominate production...

Peru • Total primary energy production by fuel in the 2DC, 2000-50

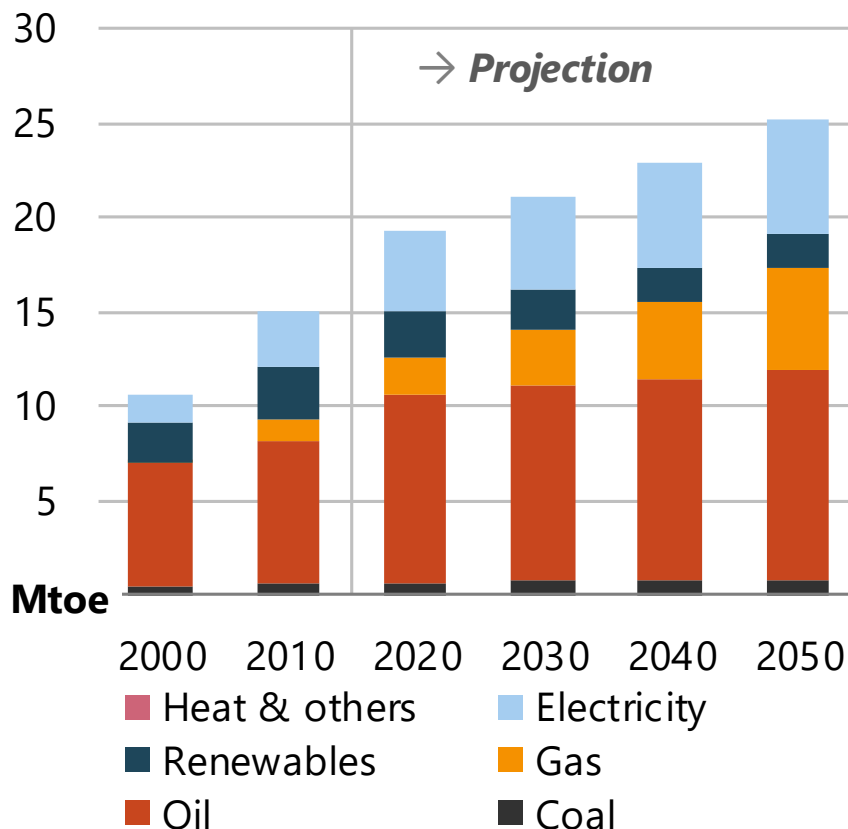
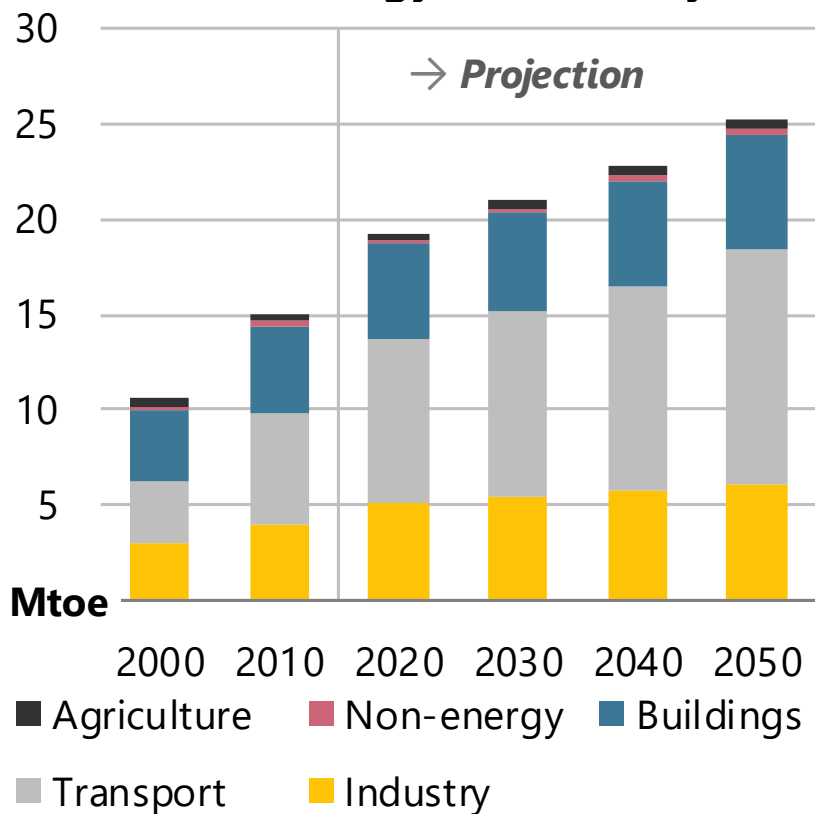


Sources: APERC Analysis and IEA (2018).

Energy production remains almost unchanged across scenarios, with gas remaining in the lead and...

FED grows at a slower pace in the TGT...

Peru • Final energy demand by sector and fuel in the TGT, 2000-50

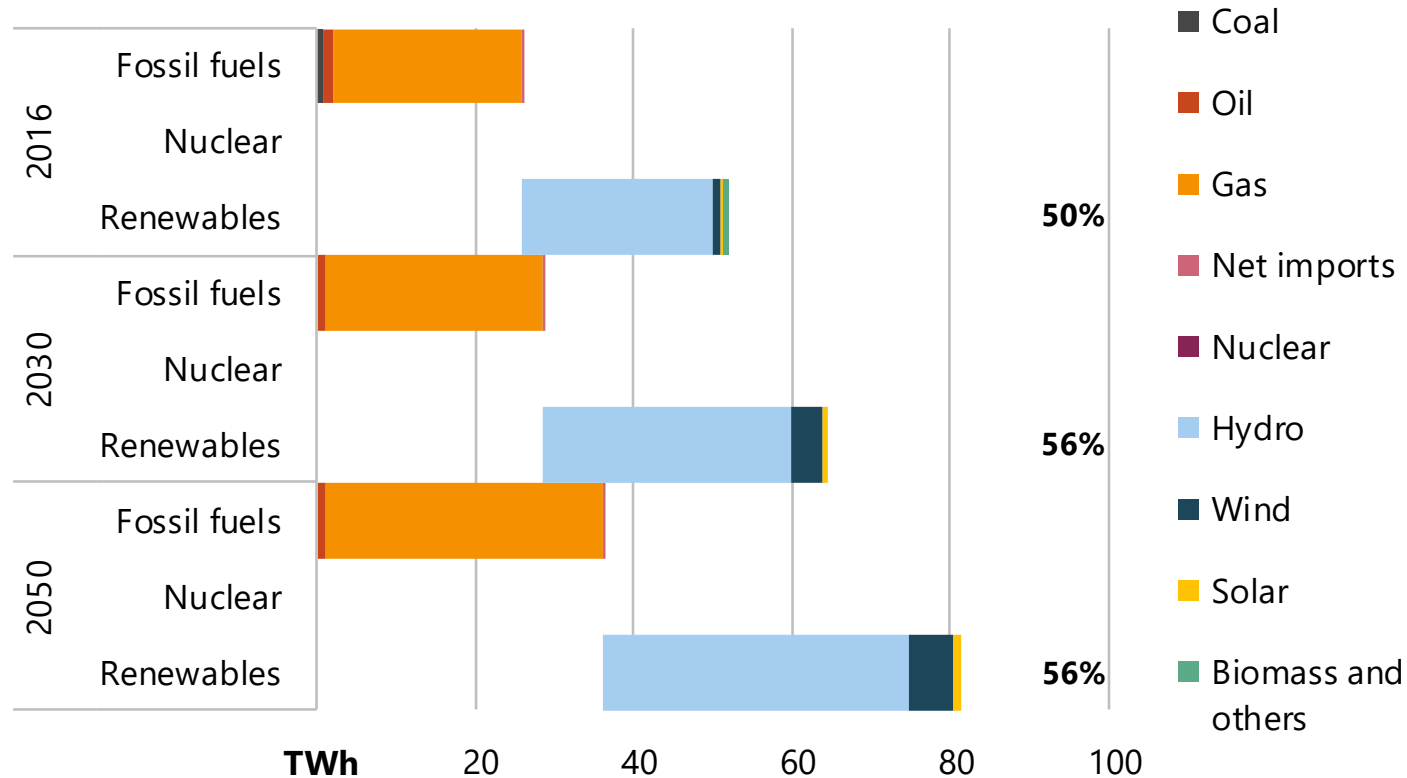


Sources: APERC Analysis and IEA (2018).

Transport (mostly oil) demand flattens. Energy efficiency measures slow-down growth while electricity and gas replace a significant amount of oil use.

And renewable penetration grows strongly

Peru • Electricity generation by fuel in the TGT, 2016, 2030 and 2050

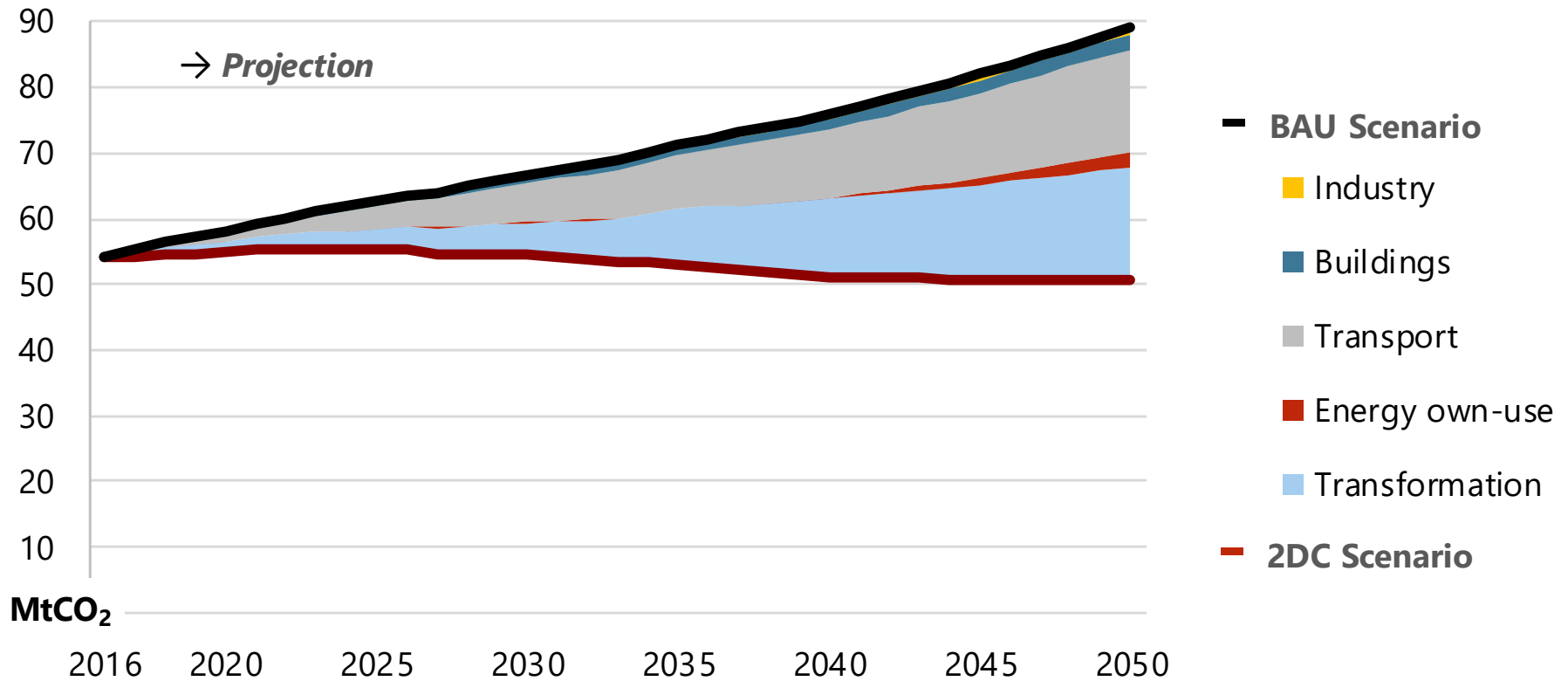


Sources: APERC Analysis and IEA (2018).

Electricity demand increases more slowly than in the BAU, but the share of renewables reaches 56% (compared with 50% under the BAU).

Fundamental changes in transport and further electrification required.

Peru • Energy related CO₂ emissions reductions by sector, 2016-50



Sources: APERC Analysis and IEA (2018).

Reducing emissions in Industry and buildings is harder. Transportation emissions reduction requires more attention (efficiency, electrification, rail, etc.).