



**Asia-Pacific  
Economic Cooperation**



## 2-5. APEC Goals and CO<sub>2</sub> Emissions (revised)

### APERC Workshop

The 63rd Meeting of APEC Energy Working Group (EWG)

13 June 2022 (GMT+8)

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# APEC goals

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APEC has two energy goals:

**1. Reducing APEC's aggregate energy intensity by 45% by 2035 relative to 2005**

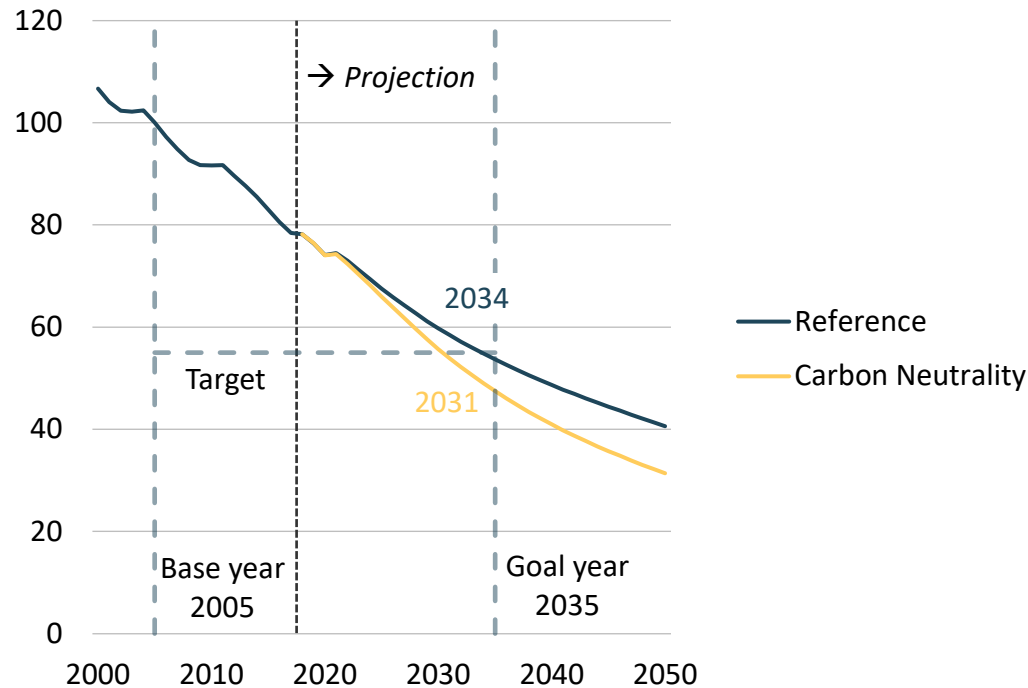
- Since 2011, APERC has tracked progress on the target. The target is expressed in final energy demand (excluding non-energy) relative to GDP expressed in terms of Purchasing Power Parity (PPP).

**2. Doubling the share of modern renewable energy by 2030 relative to 2010 levels**

- Modern renewables are defined as the demand of renewables in end-use sectors (excluding non-energy and traditional biomass) and includes the proportion of electricity and heat demand that is attributable to renewable sources.
- The modern renewables share is calculated using total final energy demand.

# APEC Goal: Final energy intensity

Final energy intensity in REF and CN (2005=100).

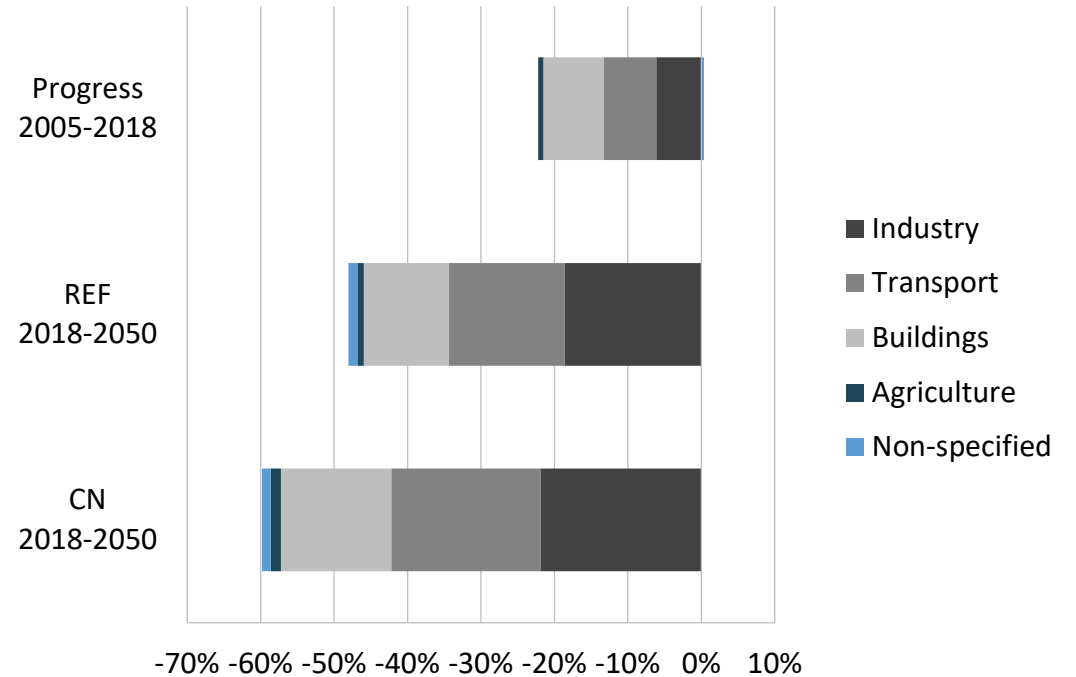


Note: Final energy intensity = final energy demand (excluding non-energy) divided by GDP

Sources: EGEDA, APERC analysis. Excludes non-energy.

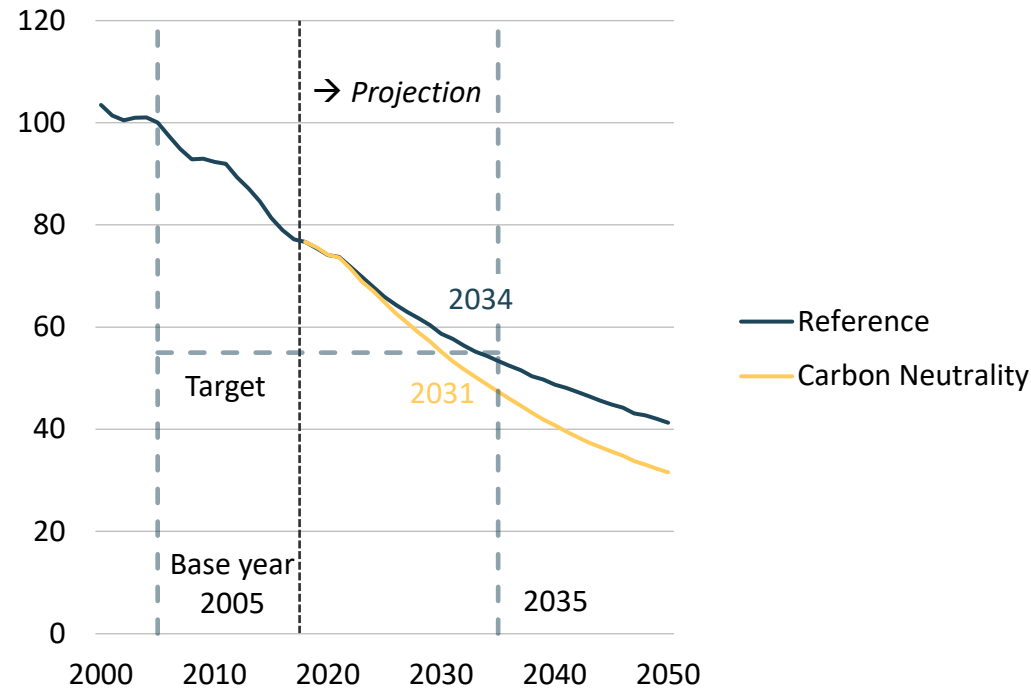
- In 2035, final energy intensity improves by 46.3% (REF) and 52.5% (CN).
- The goal is achieved before the target year 2035 in both scenarios (REF: 2034, CN: 2031).
- By 2050 in REF, APEC's final energy intensity is estimated to have improved by almost 60% below 2005 levels.
- By 2050 in CN, APEC's final energy intensity is estimated to have improved by almost 70% below 2005 levels.

Contribution to change in final energy intensity.



# Energy supply intensity

Energy supply intensity in REF and CN (2005=100).

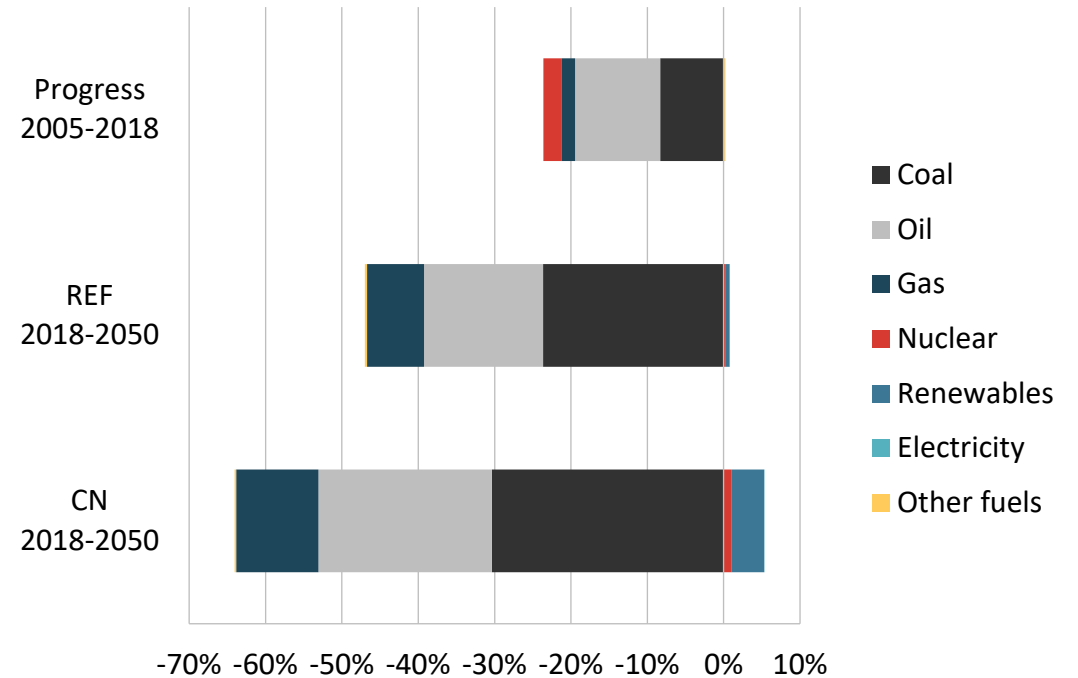


Notes: Energy supply intensity = total primary energy supply divided by GDP

Sources: EGEDA, APERC analysis.

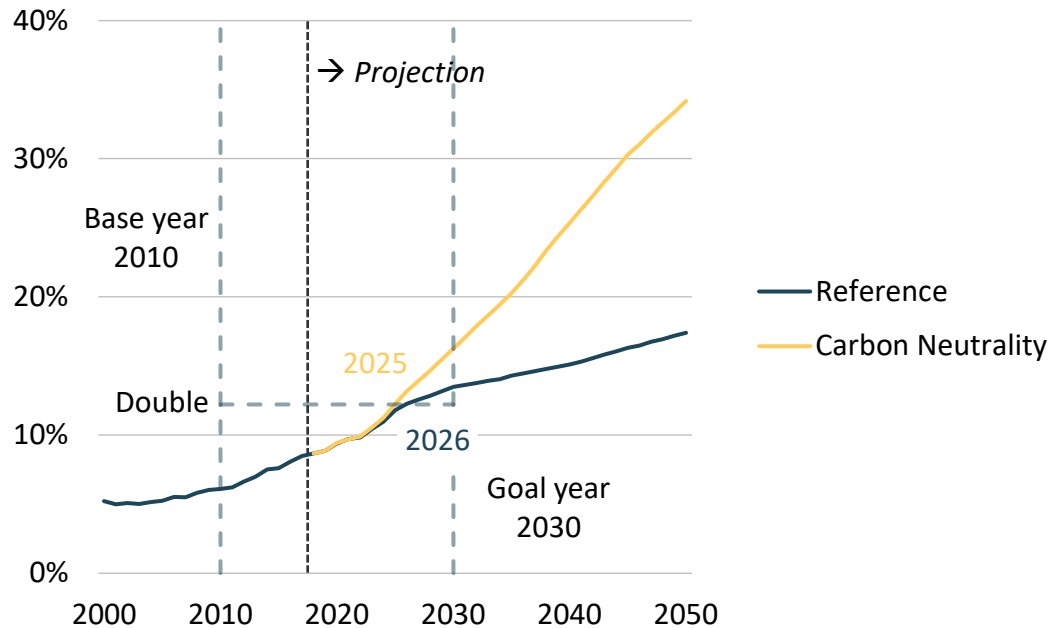
- At EWG 62, APERC was asked to also show energy supply intensity.
- In 2035, energy supply intensity improves by 46.7% (REF) and 52.7% (CN).
- 45% energy supply intensity improvement relative to 2005 can be achieved before 2035 (REF: 2034, CN: 2031).
- Historically, oil and coal use were the most important factors. In CN and REF, coal, oil, and gas are all significant.

Energy supply intensity factors.

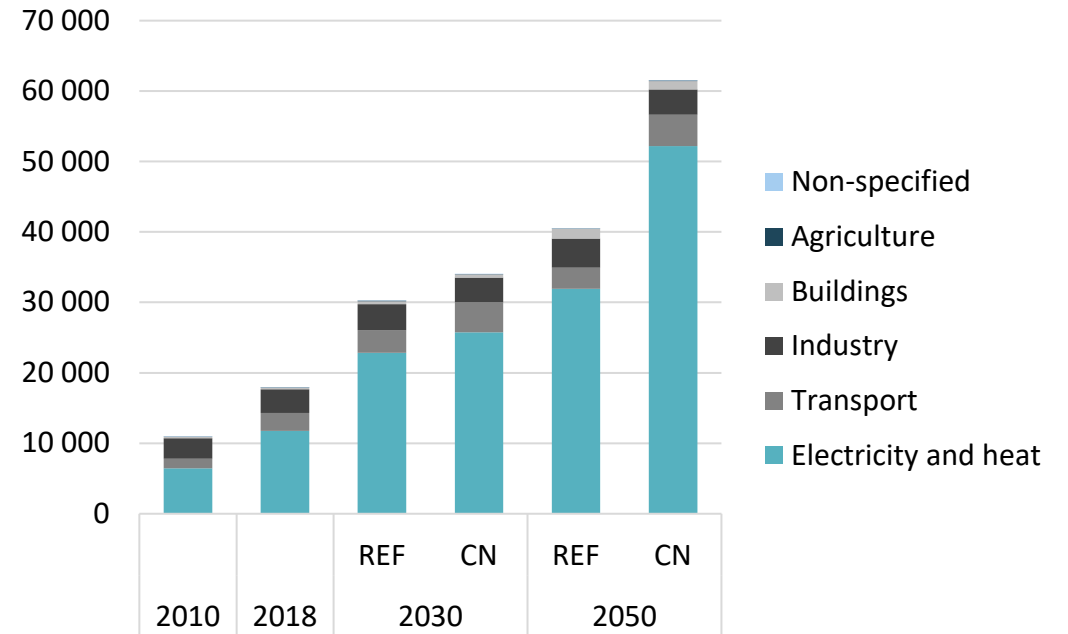


# APEC Goals: Doubling modern renewable energy share

Modern renewable energy share in REF and CN, 2000-2050.



Modern renewable energy demand by sector in REF and CN, 2010-2050 (PJ).

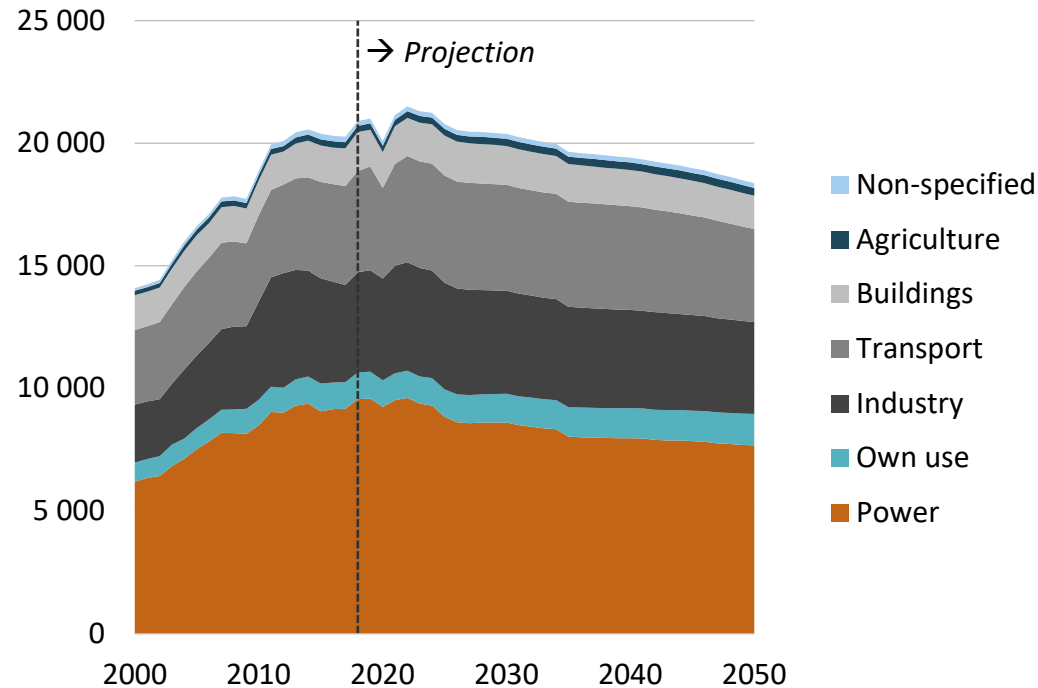


Sources: EGEDA, APERC analysis. Notes: Modern renewables: the demand of renewables in end-use sectors (excluding non-energy and traditional biomass) and includes the proportion of electricity and heat demand that is attributable to renewable sources.

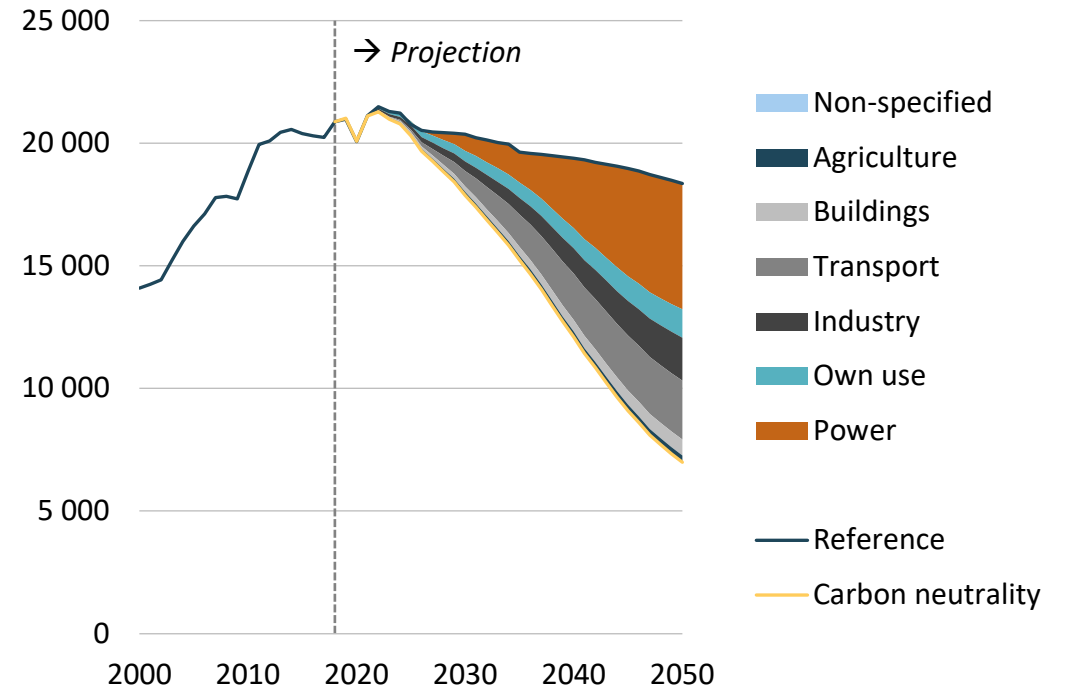
- In 2030, the share of modern renewables is 13.5% (REF) and 16.3% (CN).
- The goal can be achieved before the target year 2030 in both scenarios (REF: 2026, CN: 2025).
- Renewable electricity and heat are expected to account for even more of the share of modern renewables than is currently the case.
- Direct use of modern renewables in the transport and industry sectors grow as well; greater adoption of biofuels in the transport sector and increased demand for biomass in the industry sector.

# Gross CO<sub>2</sub> emissions by sector

Gross CO<sub>2</sub> emissions in REF, 2000-2050 (million tonnes).



Emissions changes from REF to CN by sector, 2000-2050 (million tonnes).

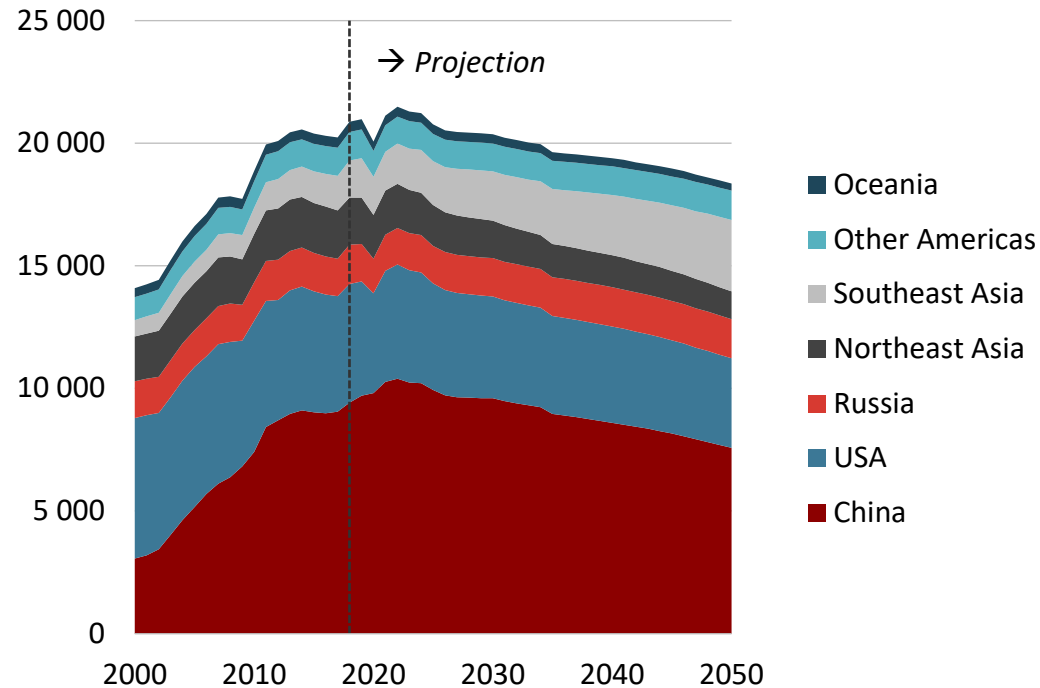


Sources: UNFCCC, EGEDA, APERC analysis. Notes: excludes non-energy, land-use, and methane emissions.

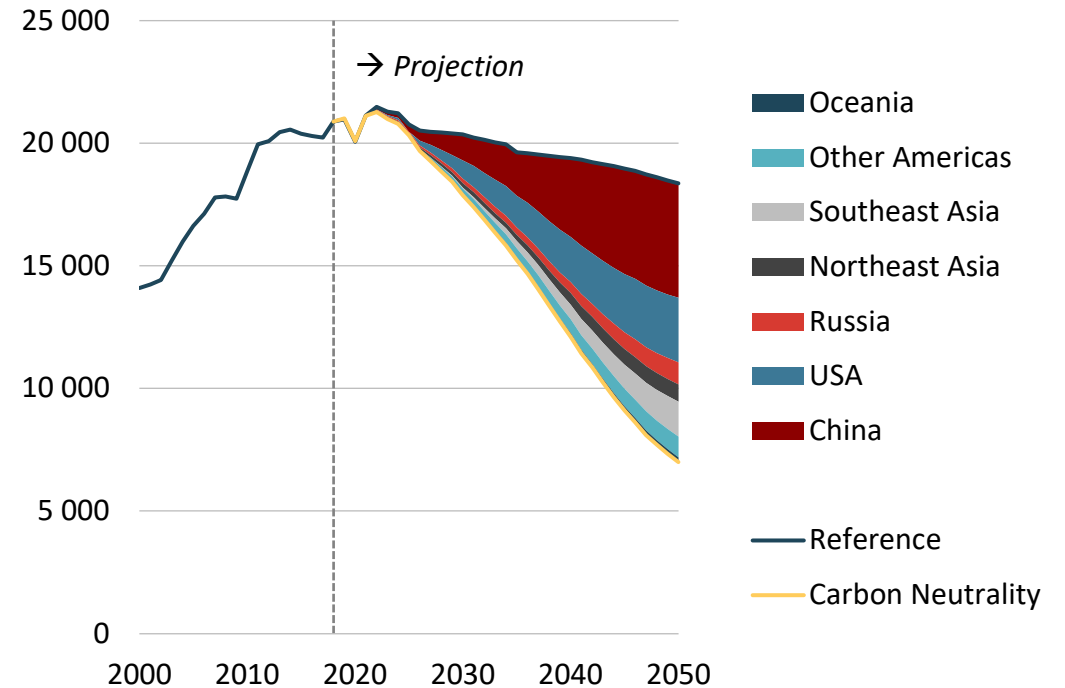
- In REF, APEC is expected to reduce its overall CO<sub>2</sub> emissions from 21 000 million tonnes in 2018 to 18 000 million tonnes in 2050. The largest CO<sub>2</sub> emissions reduction is in the power sector, due mostly to a reduction in coal-fired generation.
- In CN, all sectors make significant reductions in emissions. Key drivers include a phase-out of coal in the power sector, widespread electrification, successful development of hydrogen, and extensive CCS deployment.

# Gross CO<sub>2</sub> emissions by region

Gross CO<sub>2</sub> emissions in REF, 2000-2050 (million tonnes).



Emissions changes from REF to CN by sector, 2000-2050 (million tonnes).



Sources: UNFCCC, EGEDA, APERC analysis. Notes: excludes non-energy, land-use, and methane emissions.

- In REF, CO<sub>2</sub> emissions are expected to decline for all regions except southeast Asia and other Americas between 2018 and 2050. Many of the economies will see an increase in the use of natural gas, but this increase is more than offset by a decline in coal and oil (including refined products).
- In CN, every region achieves substantial emissions reductions. These emissions reductions occur in the context of significant growth in GDP, indicating APEC can achieve substantial emissions reduction while maintaining strong economic growth.

# Kaya identity

- Kaya identity: breaks down CO<sub>2</sub> emissions into four factors
- Defined as below:

$$CO_2 \text{ emissions} = Population * \frac{GDP}{Population} * \frac{Energy \text{ supply}}{GDP} * \frac{CO_2 \text{ emissions}}{Energy \text{ supply}}$$

(GDP per capita)      (Energy Intensity)      (Emissions intensity)

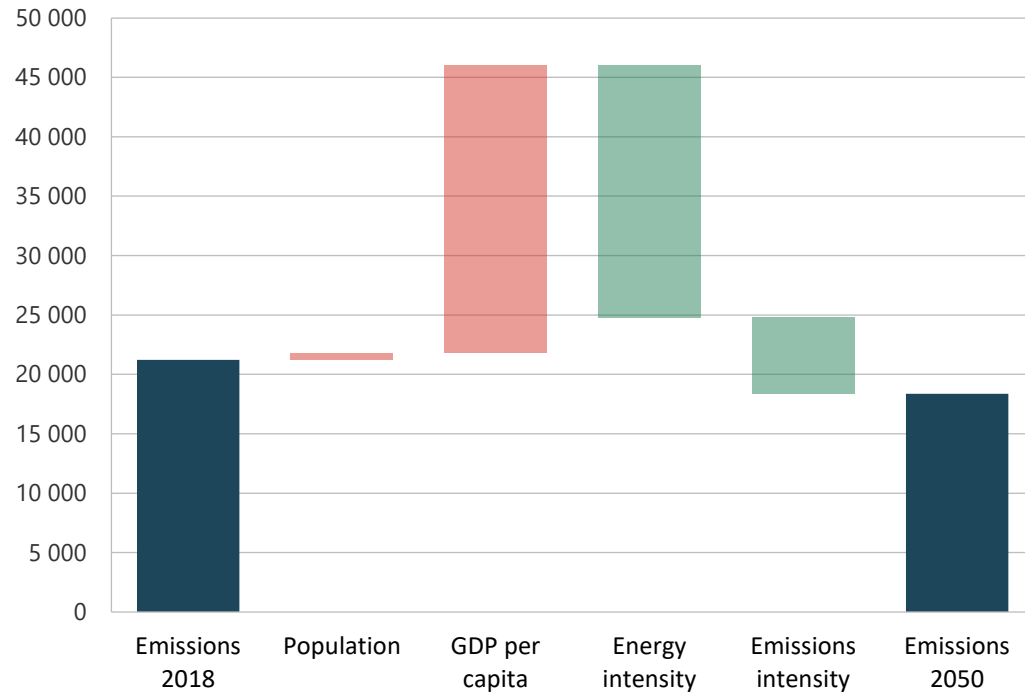
Technologies and Policies

*Notes: energy intensity here means energy supply intensity*

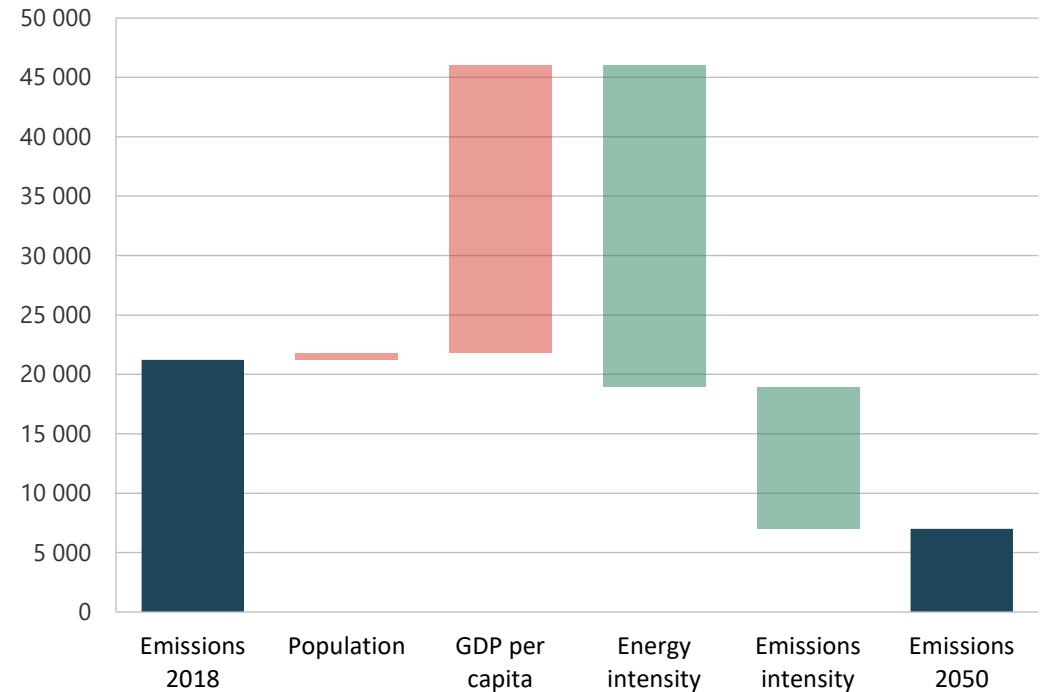


# Components of CO<sub>2</sub> emissions

CO<sub>2</sub> emissions components in REF, 2018 and 2050 (million tonnes).



CO<sub>2</sub> emissions components in CN, 2018 and 2050 (million tonnes).

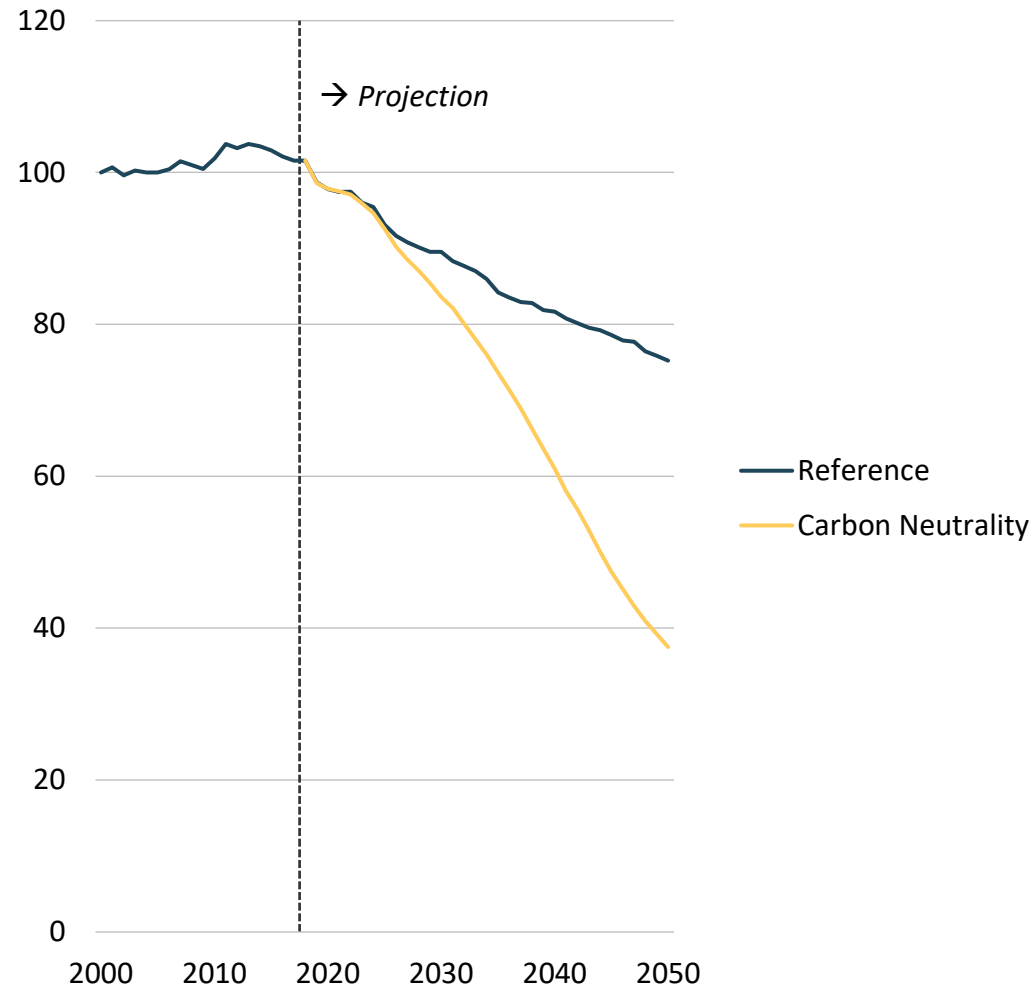


Note: the above charts are a representation of the Kaya identity. Sources: UNFCCC, EGEDA, APERC analysis. Notes: excludes non-energy, land-use, and methane emissions.

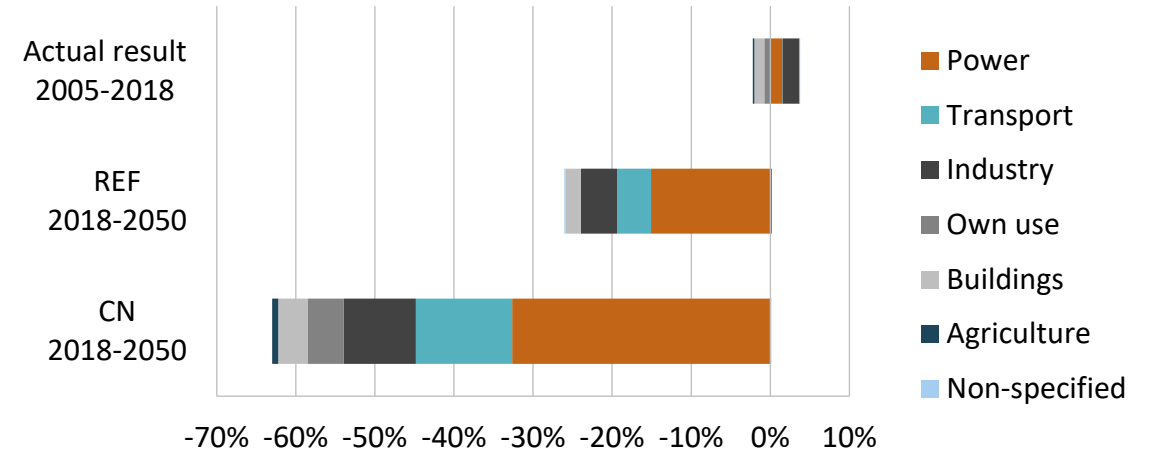
- Population is a small contributor to CO<sub>2</sub> emissions growth.
- Economic activity (GDP per capita) contributes to a doubling of CO<sub>2</sub> emissions.
- In REF, increases in population and economic output are more than offset by improvements in energy intensity and emissions intensity.
- In CN, energy intensity improvements fully offset emissions increases from population and economic activity. Emissions intensity improvements further reduce emissions to one-third of 2018 levels.

# Emissions intensity

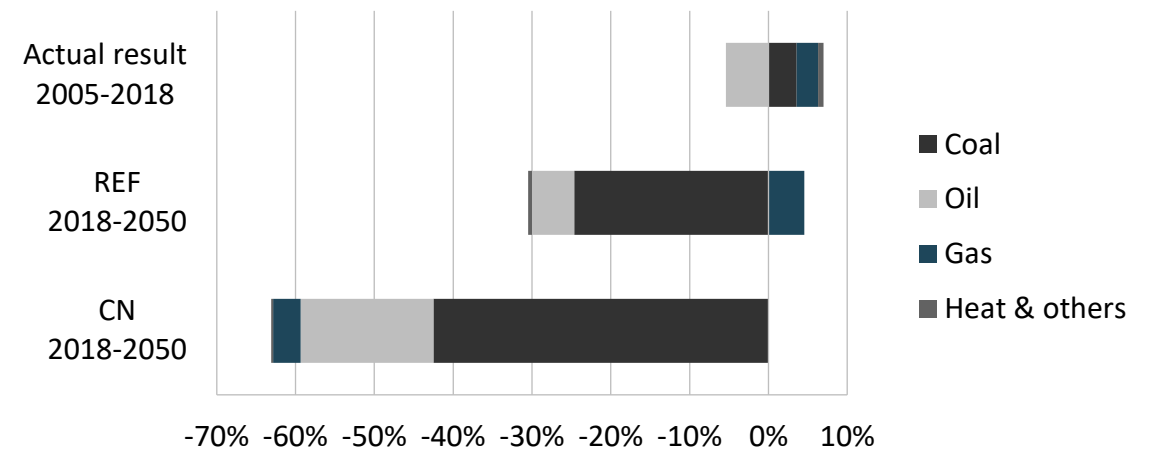
Emissions intensity, 2000-2050 (2005=100).



Contribution to change in emissions intensity by sector (2018 to 2050)



Contribution to change in emissions intensity by fuel (2018 to 2050)



Sources: UNFCCC, EGEDA, APERC analysis. Notes: excludes non-energy, land-use, and methane emissions.

# Summary

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- APEC is on track to achieve the two energy goals before the target years.
- Further final energy intensity reduction can be achieved with the contribution of all end use-sectors especially industry, buildings, and transport.
- Looking by fuel, coal and oil supply reductions contribute most to the energy supply intensity reduction.
- Power generation from wind and solar is the primary pathway for achieving APEC's renewable share doubling goal.
- In CN, substantial CO<sub>2</sub> emissions reductions are realised through both technology advancements and energy policies.



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**Thank you.**

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