# APEC Energy Demand and Supply Outlook 9th Edition: APEC region

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# Outline

Introduction
1 Energy Demand
2 Energy Transformation
3 Energy Supply
4 Transition Costs
5 $CO_2$ Emissions
6 APEC Energy Goals
7 Four Key Takeaways

# Asia-Pacific Economic Cooperation (APEC)

- **A regional economic forum established in 1989**
- **21 Member Economies**

| year | economy |
|---|---|
| 1989 | Australia; Brunei Darussalam; Canada; Indonesia; Japan; Korea; Malaysia; New Zealand; The Philippine; Singapore; Thailand; The United States |
| 1991 | China; Hong Kong, China; Chinese Taipei |
| 1993 | Mexico; Papua New Guinea |
| 1994 | Chile |
| 1998 | Peru; Russia; Viet Nam |

- **Consensus based decision-making**
- **No binding commitments or treaty obligations**
- **Voluntary based commitments**

ttps://www.apec.org/

# Asia Pacific Energy Research Centre (APERC)

- **APERC is an energy research arm of APEC**
- **Established in 1996 by initiative of Japanese Government**
- **Located in Tokyo, Japan**
- **Four pillars of activities**
  - Research
  - Statistics
  - Training
  - Policy Cooperation
- **Two flagship publications**
  - APEC Energy Demand & Supply Outlook
  - APEC Energy Overview

https://aperc.or.jp

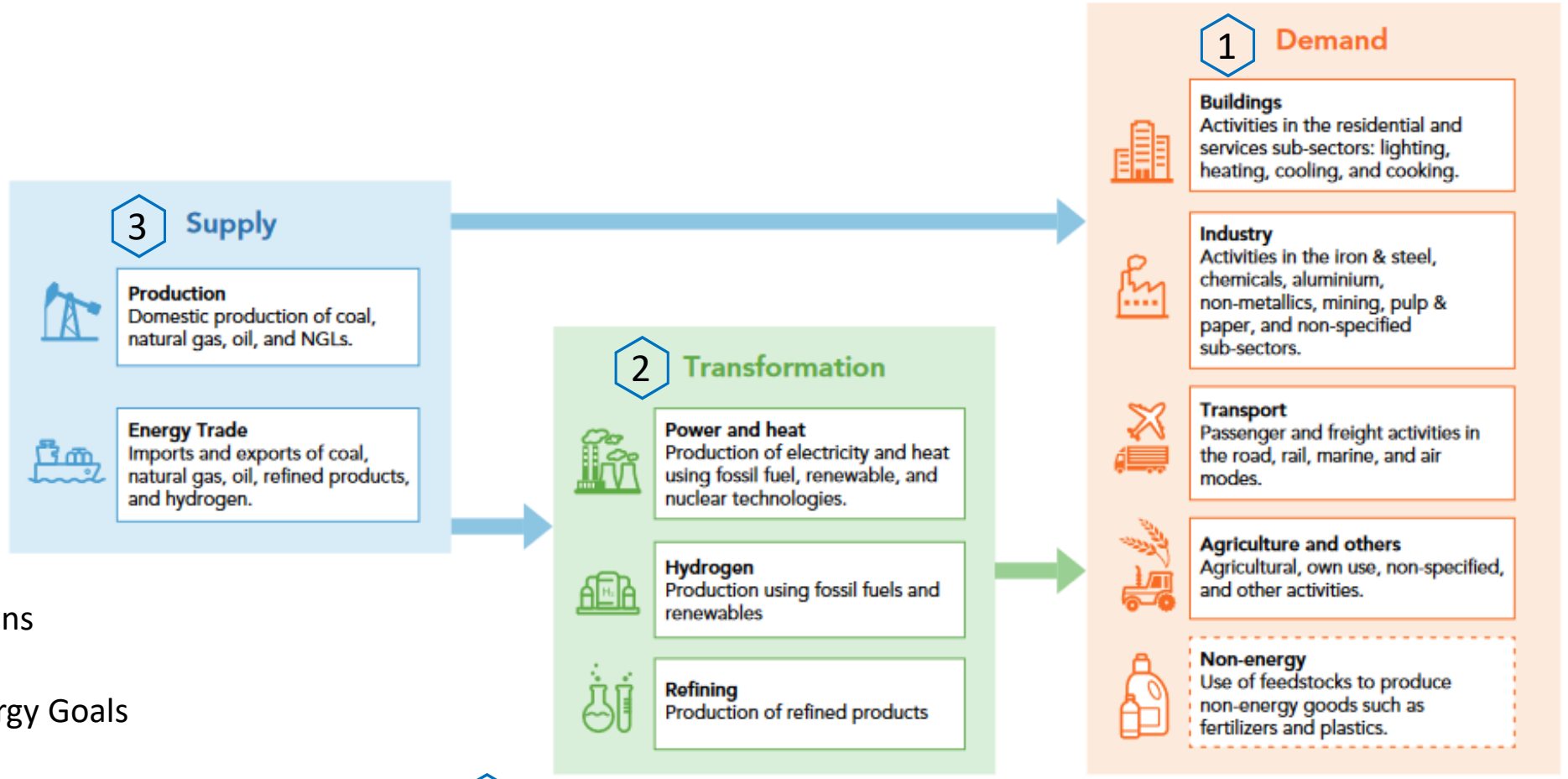
# Outline of the Outlook

- **Provide analyses and policy insights on future energy demand and supply in APEC economies**
- **Published every 3 years**
- **9th Edition was published in December 2025**
- **Provides coverage on projected energy demand & supply trends**
  - APEC-wide trends (Volume 1)
  - 21 Economy-specific trends (Volume 2)
- **The 9th edition**
  - Projections: 2022-2060
  - 2 scenarios: The Reference(REF) & The Target(TGT)
  - $CO_2$ Emissions
  - Transition Costs

Volume 1

Volume 2

# Components of the Outlook



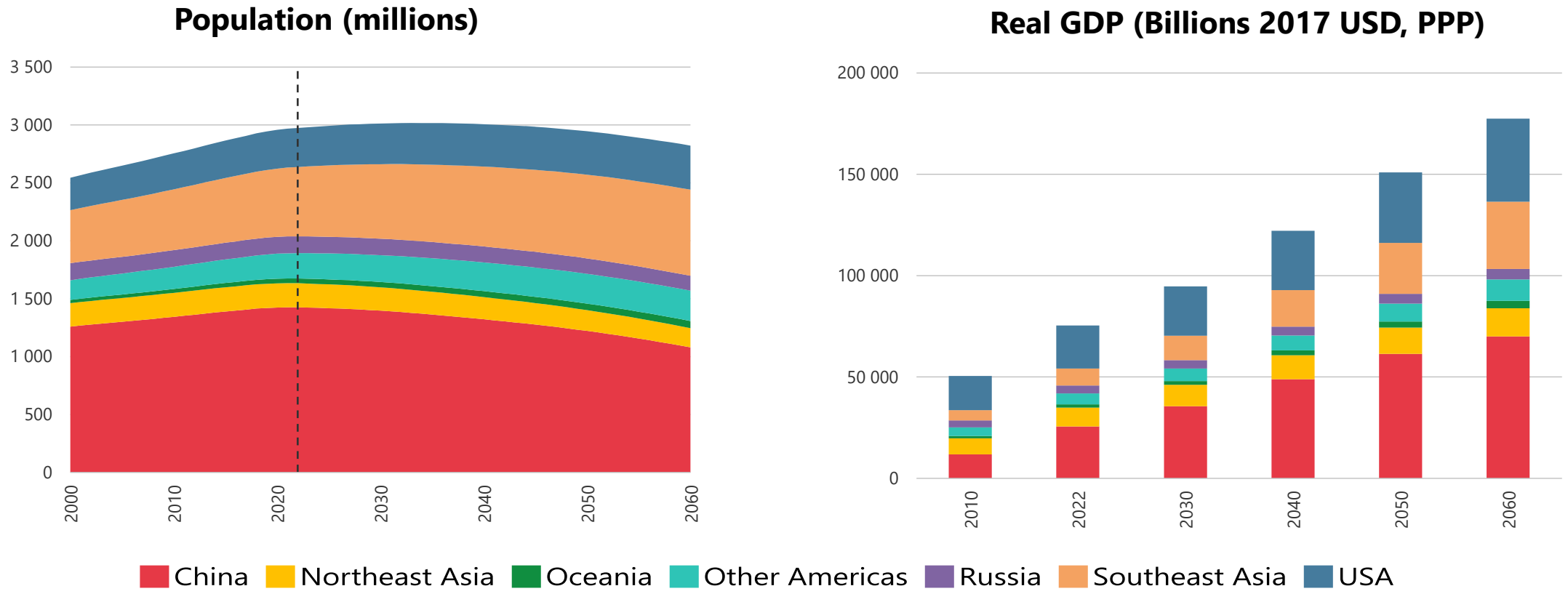

5 $CO_2$ Emissions

6 APEC Energy Goals

7 Four Takeaways

4 Transition Costs in Power Systems & Hydrogen

# Demographic & Macro Economic Assumptions




- Population & GDP projections are primarily derived from **United Nations** and **IMF** data; however alternative sources were utilized where necessary
- Population: **2,977mil in 2022**, peak is projected **3,021mil in 2035**, and then slowly decrease to **2,831mil in 2060**.

# Two Scenarios

## The Reference Scenario (REF)

Economy-specific pathways based on **historical trends**, recent developments, and APERC's assumptions about the evolution of the energy system within each APEC economy. REF offers a **baseline to compare with TGT projections**.

## The Target Scenario (TGT)

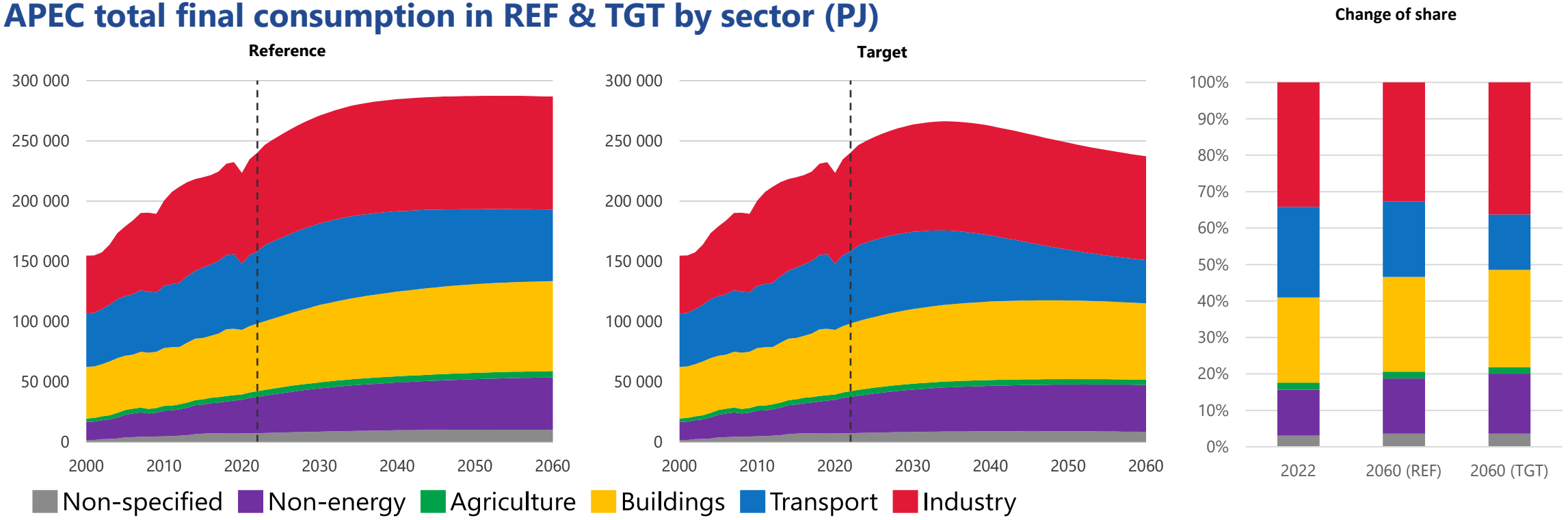
A **hypothetical pathway** where each economy **achieves its energy-related policy targets** regardless of cost-effectiveness. When implementation details are lacking, assumptions are inferred from the targets themselves or emissions-related goals.


# Energy Demand

# 1 APEC total final consumption by sector

----- Industry grows modestly, Buildings (incl. data center) rise, Transport falls

## APEC total final consumption in REF & TGT by sector (PJ)

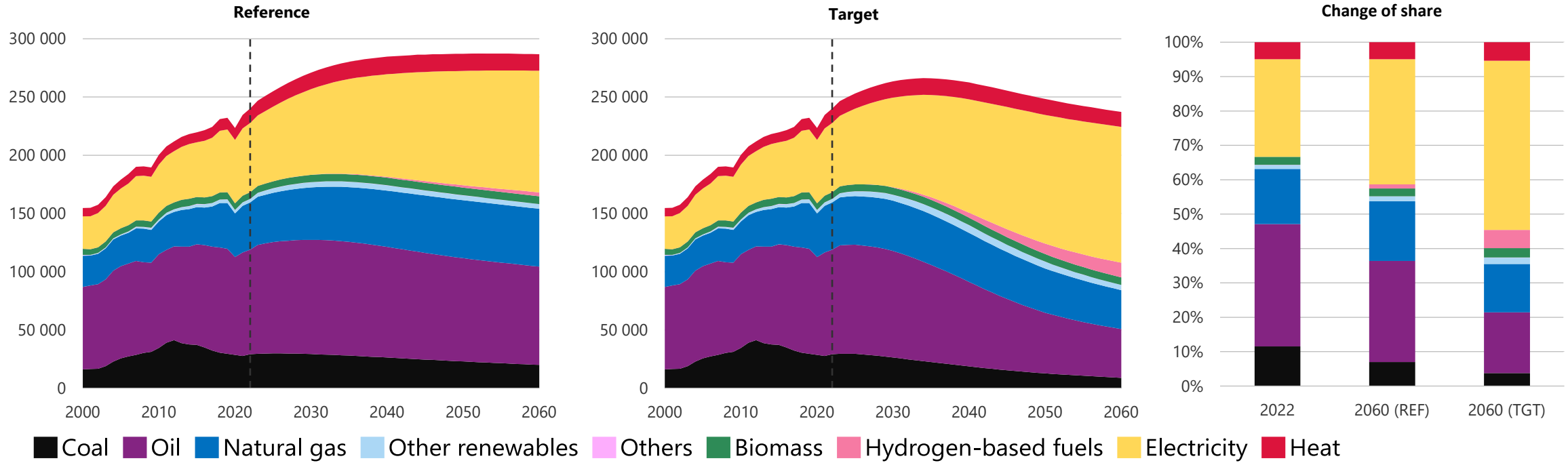



- **Total end-use energy consumption:** peak in 2052 at 20% increase and 19% increase in 2060 in REF / peak in 2034 at 11% increase and 1% decrease in 2060 in TGT
- **Industry:** peak in 2054 and 14.2% increase in 2060 in REF / peak in 2038 and 4.2% increase in 2060 in TGT
- **Building:** plateaus in mid-2050 with 32.3% increase in REF/ peak in 2044 at 16.6% increase against 2022 in TGT
- **Transport:** returns to around 2022 levels in REF / declines by approximately 40% by 2060 in TGT.

# 1 APEC total final consumption by fuel

----- Strong growth in electricity demand in both REF and TGT

## APEC total final consumption in REF & TGT by fuel (PJ)

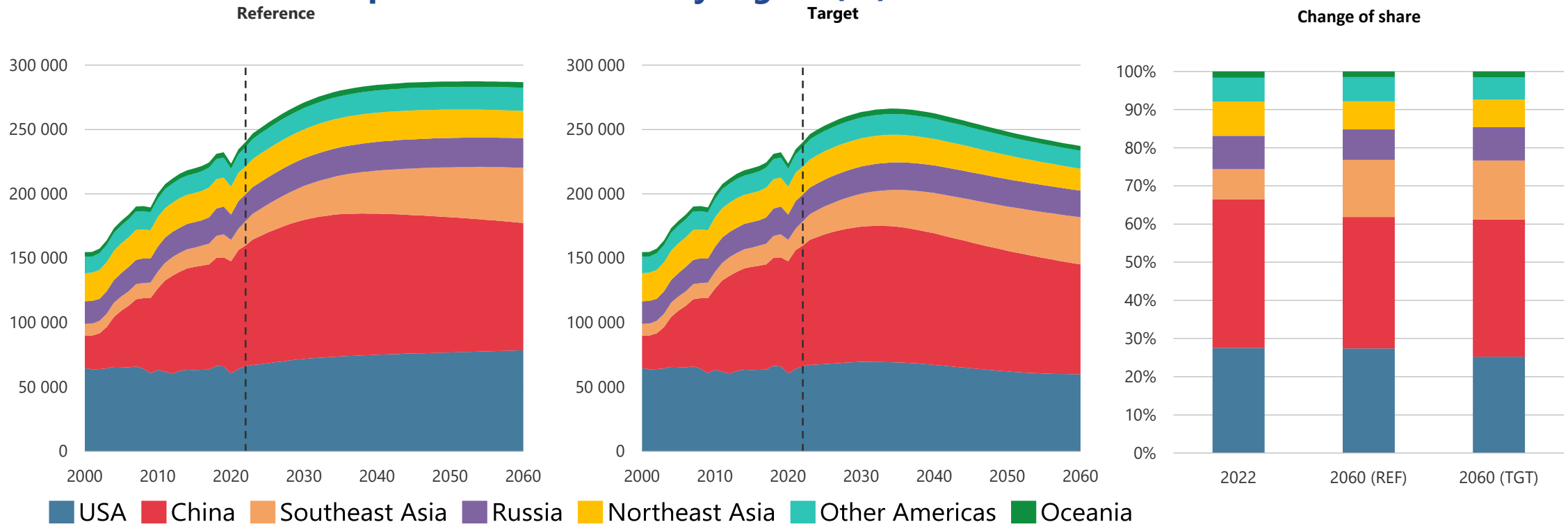



- **Coal:** demand declines from 12% in 2022 to 3.8% in TGT
- **Oil & oil products:** peak by 2030
- **Natural gas:** rises until mid-2030s; slight TGT decline from 16.9% to 14%
- **Electricity:** demand driven by EVs, electric cooking, space conditioning, and data centres

# 1 APEC total final consumption by region

----- China & US remains large, while Southeast Asia continues to grow

## APEC total final consumption in REF & TGT by region (PJ)

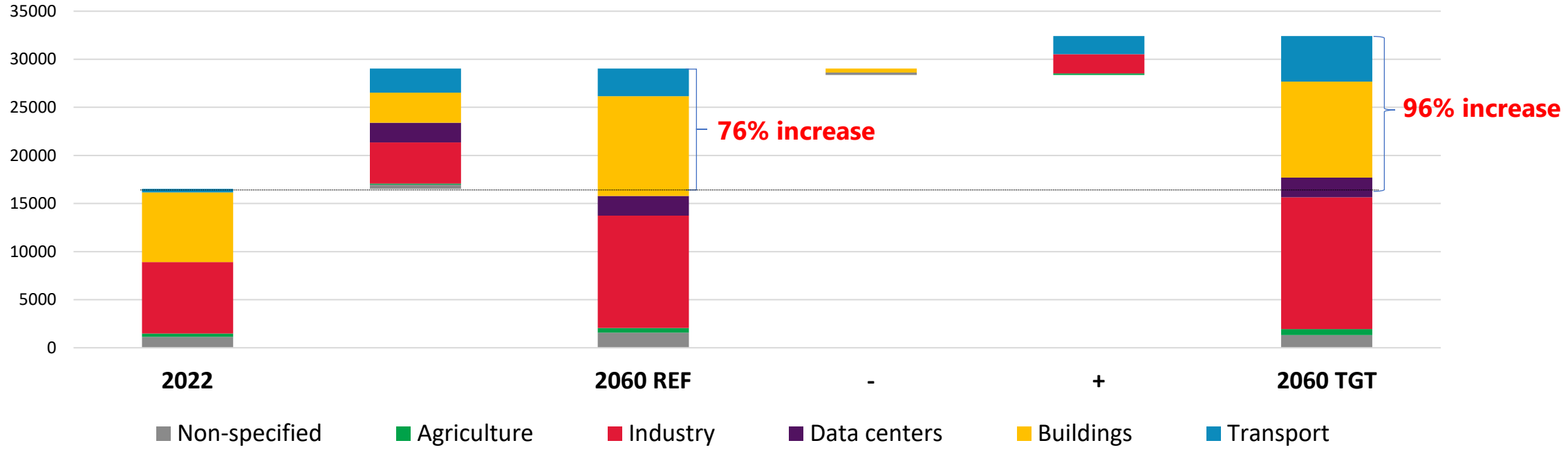



- **China:** Share declines in both scenario, but still 35% in REF, and 36% in TGT. Demand remains the highest in APEC.
- **US:** Share unchanged in REF, but decline to 25% in TGT. Transportation have impact to demand decline in TGT.
- **Southeast Asia:** Share to nearly double in both REF and TGT. In REF, demand climbs 127% by 2060, in TGT it still grows 94%

# 1 Strong electricity demand pulled by most of sectors

----- Data center will be a emerging player of strong electricity demand

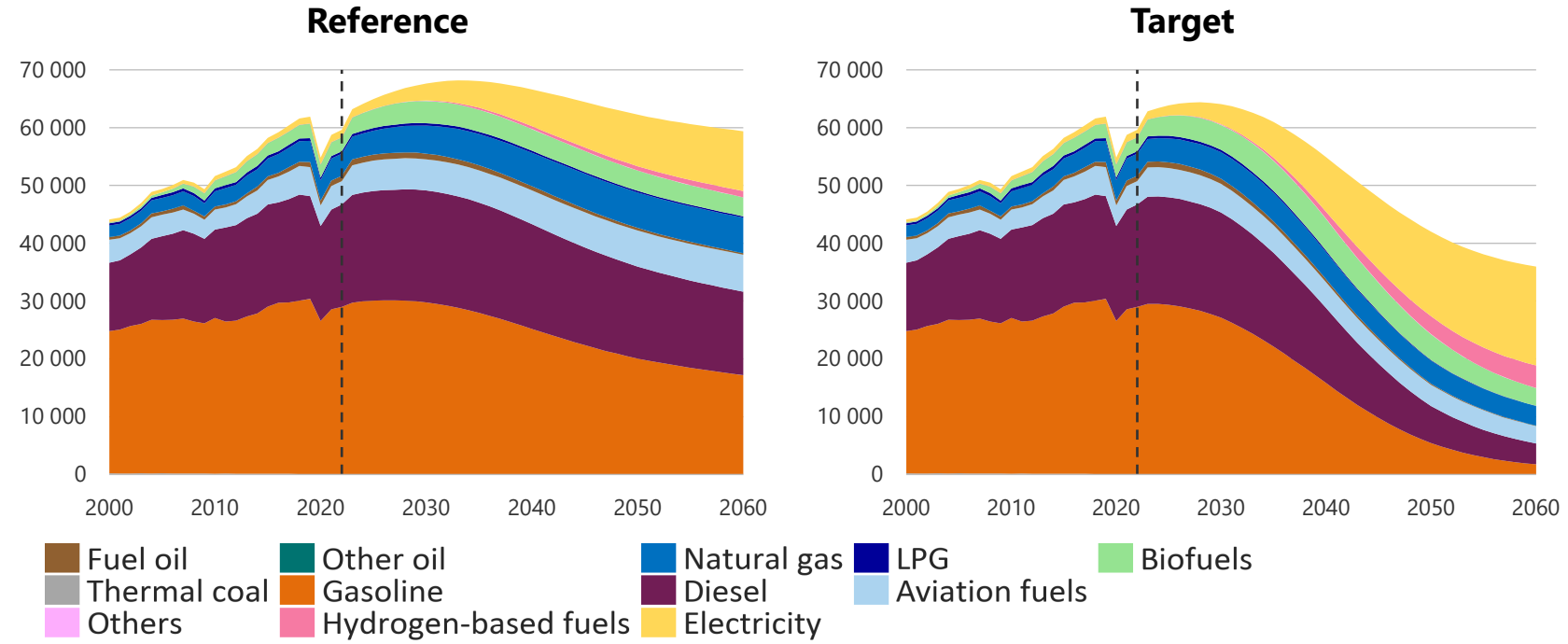
## APEC electricity consumption by end-use sectors (TWh)



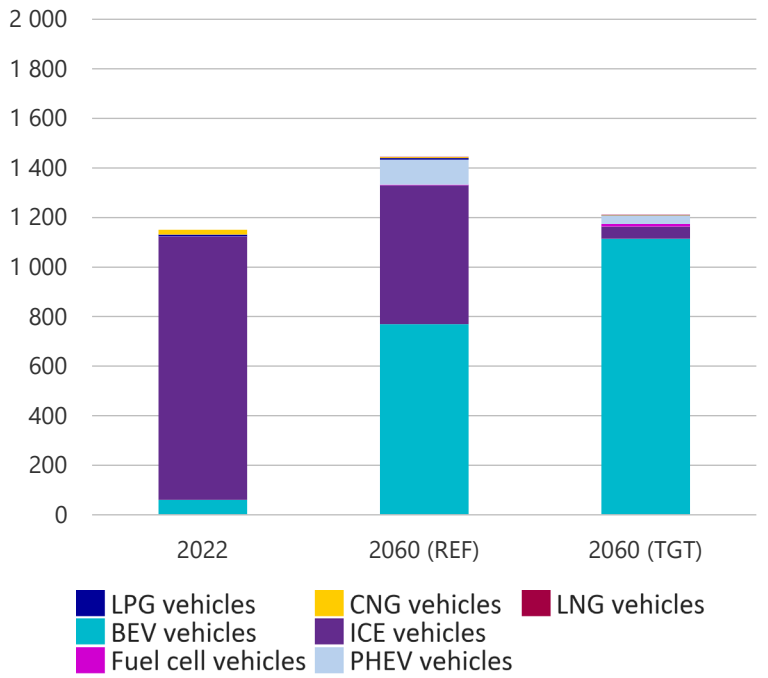

- By 2060, **APEC electricity demand** is projected to grow by 76% in REF and by 96% in TGT
- The development of **data centres** is expected to be the strong driver of increased demand.
- Sector share in 2060: **industry** 40% and **buildings** 36% in REF / **industry** 42% and **buildings** 31% in TGT
- Additional TGT consumption is equally divided between industry and transport

# 1 Widespread EV adoption reshapes transport energy outlook

## APEC transport energy consumption by fuel (PJ)




## Transport stocks (millions)

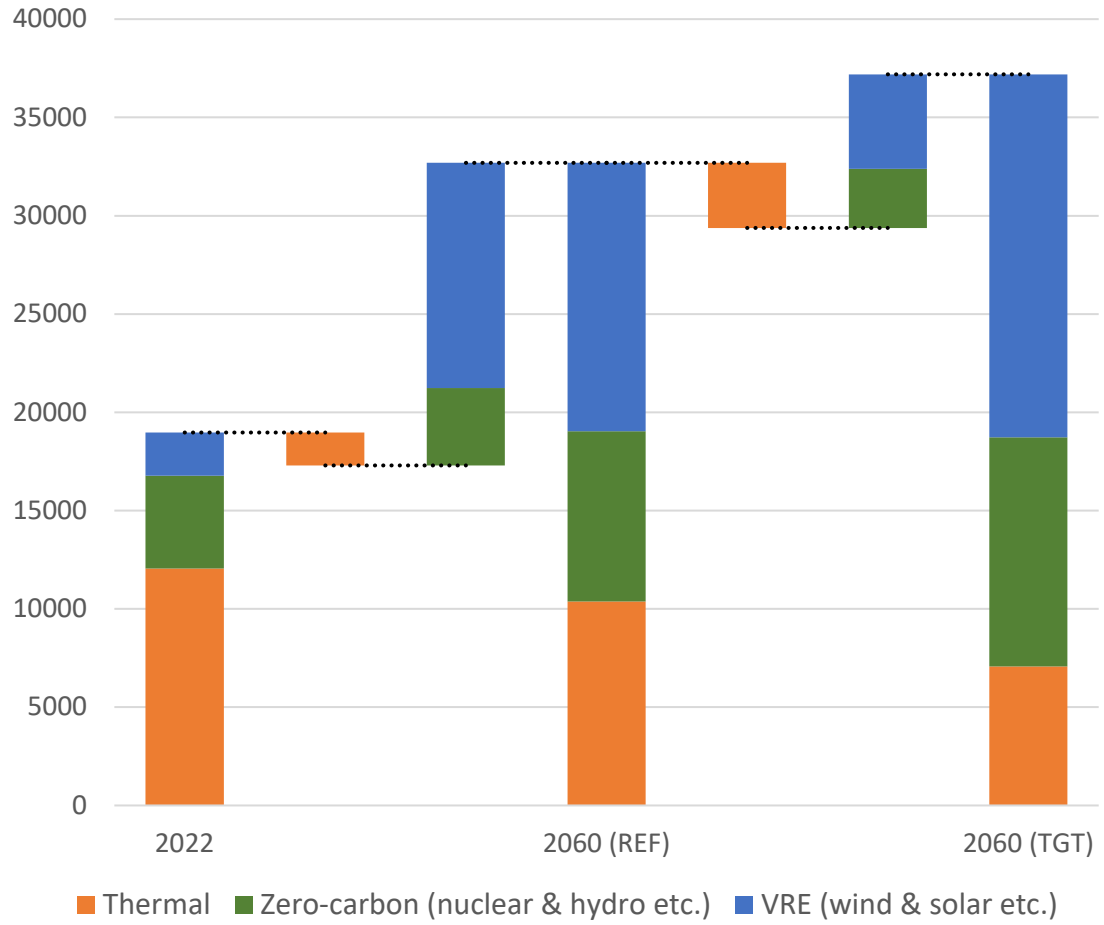



- Transport transformation **driven by EV** adoption
- Electricity share by 2060: 17% REF / 47% TGT
- **Vehicle stock**: 770M BEVs + 110M PHEVs (60%) in REF / 1,114M BEVs + 34M PHEVs (**95%**) in TGT
- Low-carbon **hydrogen**: 2% in REF / 10% in TGT, mainly in heavy-duty transport


# Energy Transformation
(& Grid Reliability)

# 2 Electricity generation transitions to increased reliance on solar, wind, nuclear, and hydro

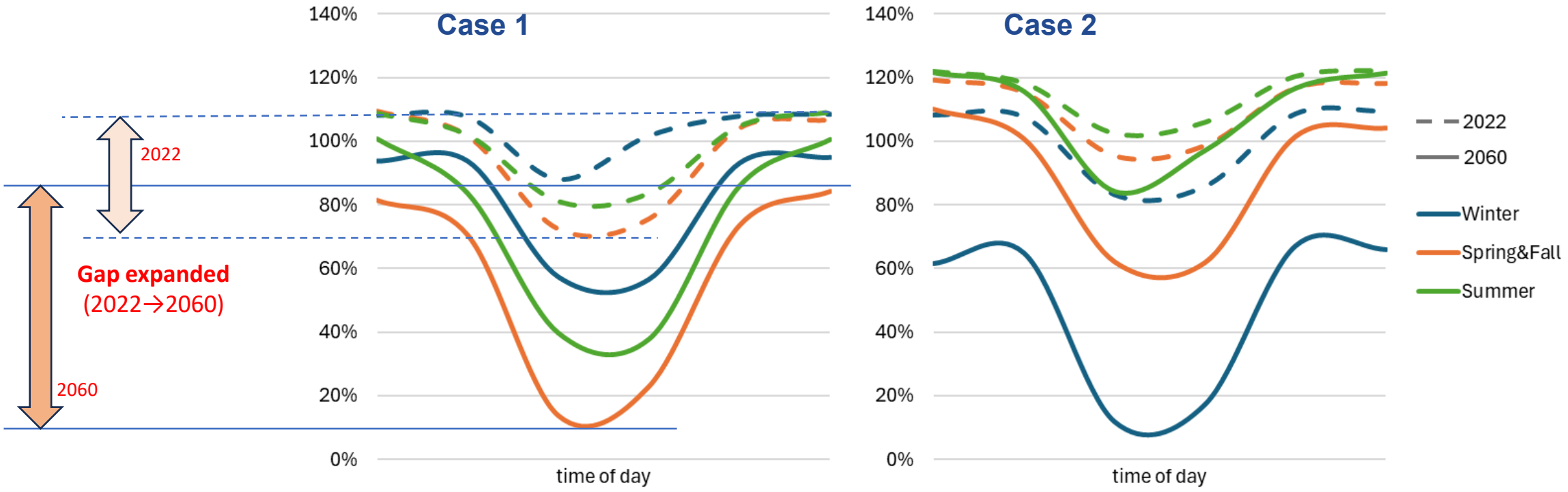
## Electricity generation (TWh)




- **Wind and solar** generation increase sixfold, raising their share from 12% in 2022 to 42% in REF and 50% in TGT by 2060, and are projected to meet all additional electricity demand after 2040.
- The share of **dispatchable thermal and zero-carbon generation** declines from 88% in 2022 to 58% in REF and 50% in TGT by 2060, reflecting the rapid growth of variable renewable energy (VRE) sources.
- In absolute terms, dispatchable generation will grow slightly, but shifts toward zero-carbon sources, such as nuclear and hydro.

# 2 Dispatchable power remains essential in a high-renewables grid

## Power from dispatchable sources vs load (%)

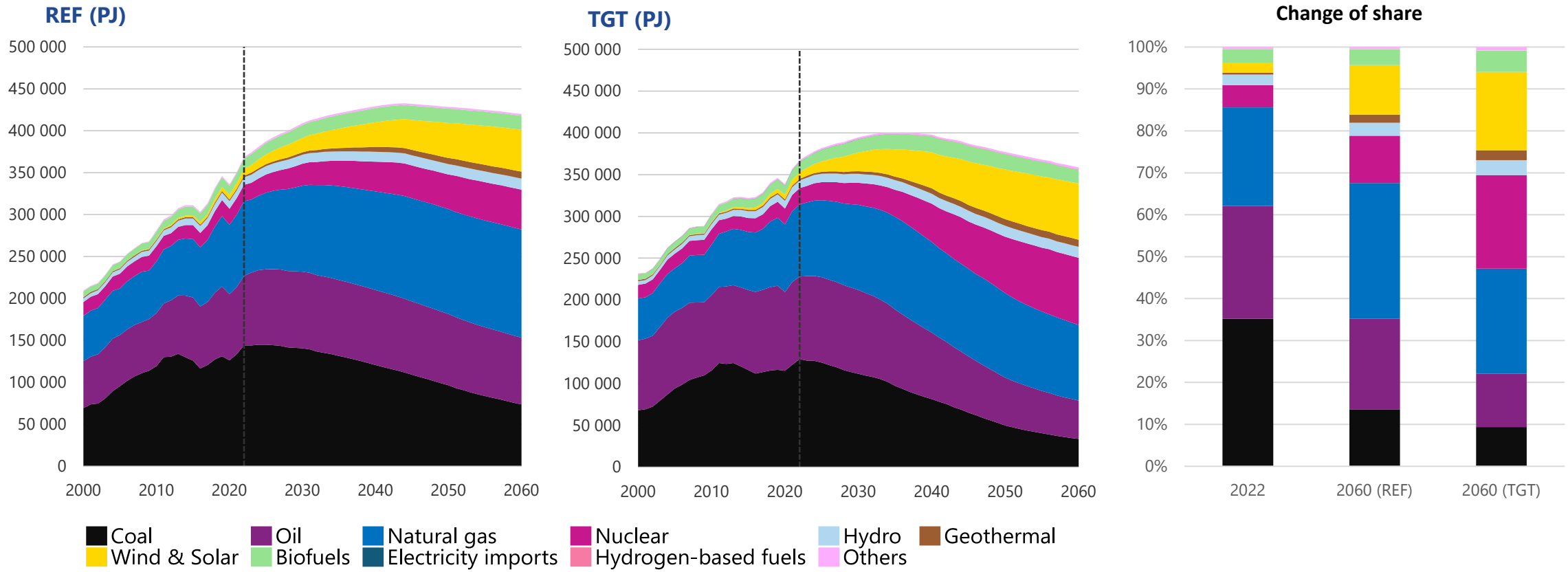



- **VRE variability** rises from 20-30% (2022) to 50-70% (2060) of daily maximum
- **Dispatchable sources** supply 80-100% of load in low VRE seasons


# Energy Supply

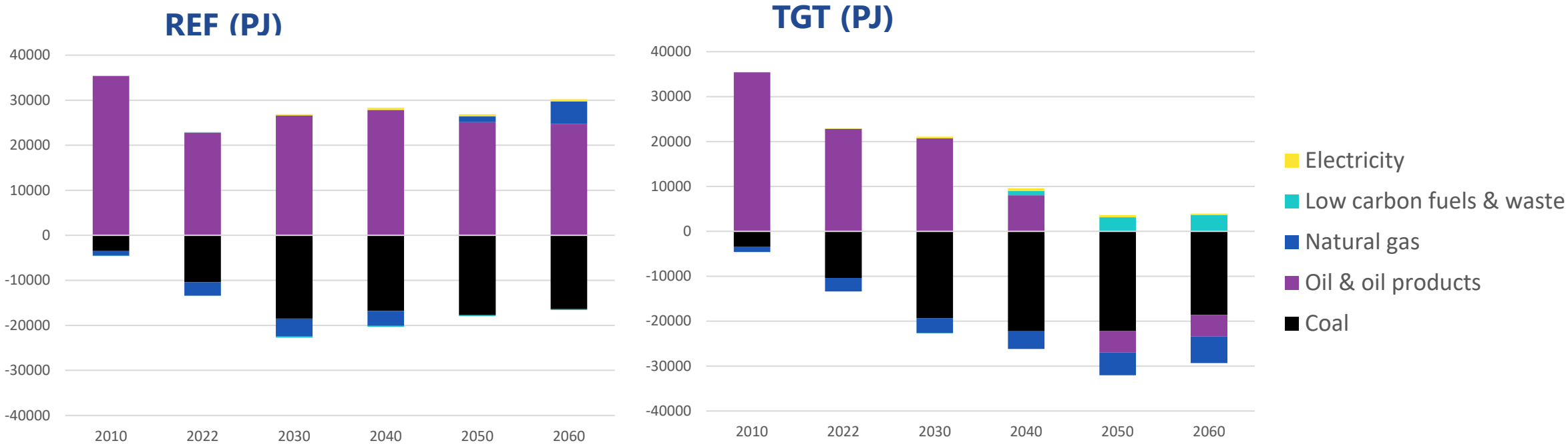
# 3 APEC total primary energy supply by fuel

----- In TGT, renewable rise significantly, yet fossil fuels remain large




- The **total APEC primary energy supply** is projected to increase by 15% in REF and to decrease by 2% in TGT by 2060.
- The **share of renewable energy** increases in both scenarios, but
- **Fossil fuels remain the dominant** energy source at 85% in 2022, though declining to 68% in REF and to 47% in TGT by 2060.

# 3 APEC energy imports(+) & exports(-) by fuel




- **Oil imports** decline **30%** from **2010** to 2060
- **Gas trade** shifts from 1,000 PJ exports to 5,000 PJ imports
- **Coal exports** from APEC increase by **58%** from 2022 to 2060

- **Oil trade** shifts from 35,000 PJ imports to 5,000 PJ exports by 2060
- **Gas exports** rise **96%** from 2022 to 2060
- **Coal exports** increase **79%** by 2060 from their level in 2022

**Note:** **For importing economies,** import dependency rises in REF, while it is more contained in TGT, with a lower oil reliance and a flatter gas trajectory reducing, but **not elimination import risks**.

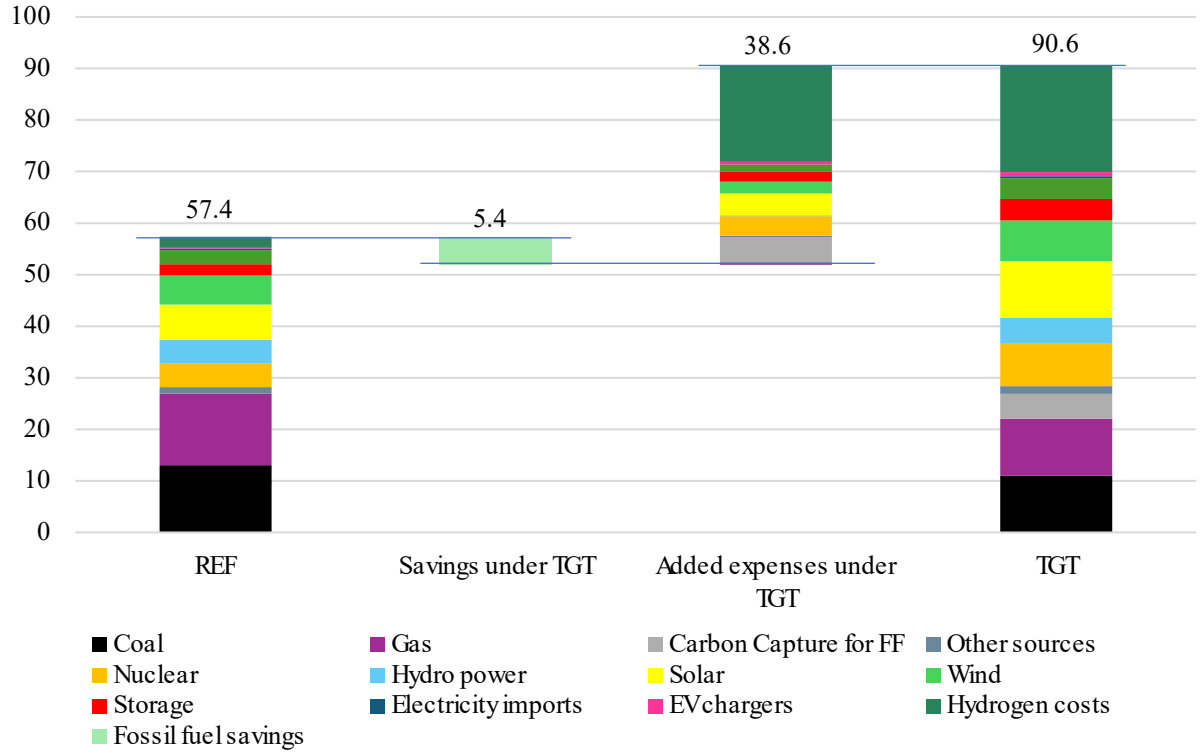

# Transition Costs

## for power systems and hydrogen

# 4 Costs for power systems and hydrogen in the energy transition

- Total costs are **57 trillion USD (share of GDP 1.23%) in REF**, and rise to **91 trillion USD (share of GDP 1.94%) in TGT**.*
- In TGT, there are **5.4 trillion USD in savings** from reduced operational costs as economies consume less fossil fuel.
- These savings are more than **offset by the added costs** of renewable and low carbon technology investment.
- **Costs related to low-carbon hydrogen** are a large component of TGT costs due to inefficiencies inherent in electrolysis and hydrogen/ammonia conversion and transport.

**Costs for power systems and hydrogen in the energy transition, 2025 to 2060 (trillion USD, undiscounted)**

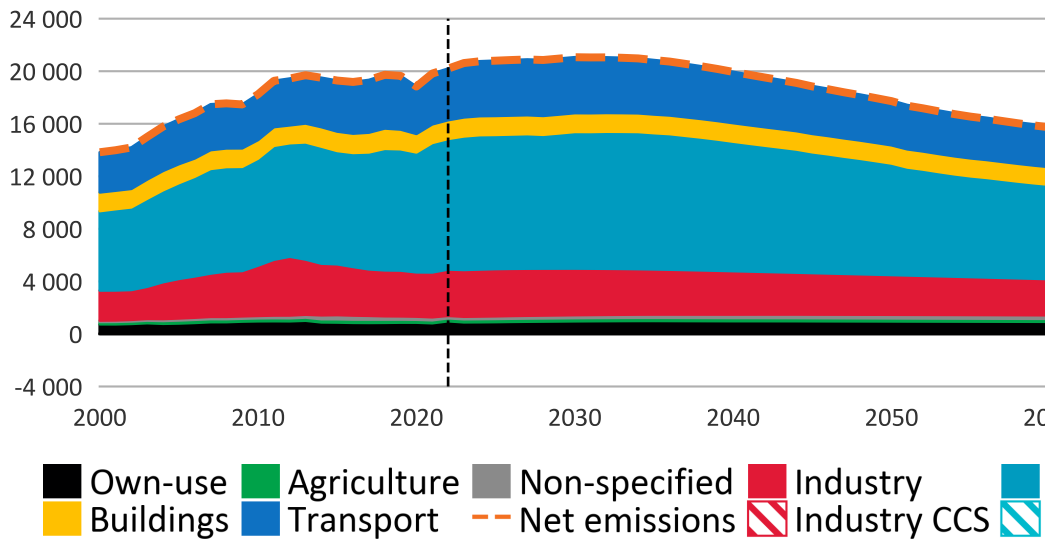



Note: The USA costs estimates in TGT are based on policies in place as of January 1, 2025.

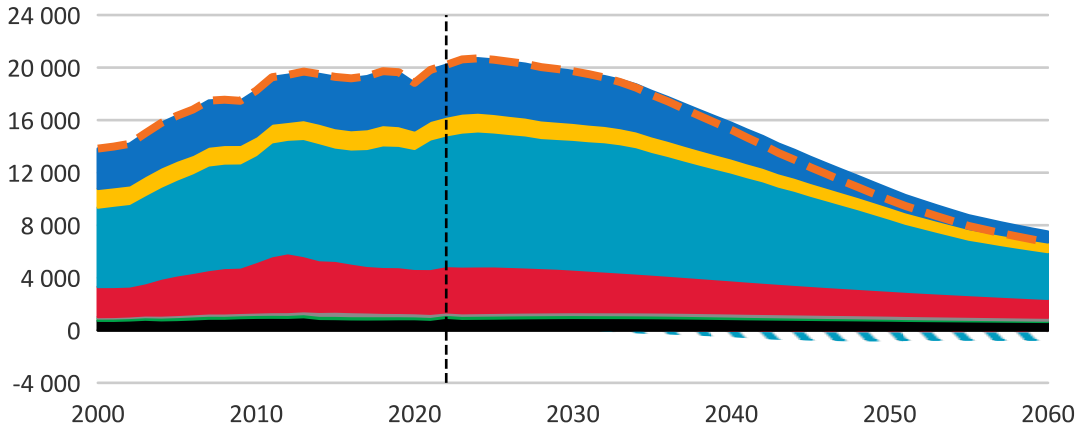

# $CO_2$ Emissions

# 5 $CO_2$ Emissions by sector

## REF (million tonnes)



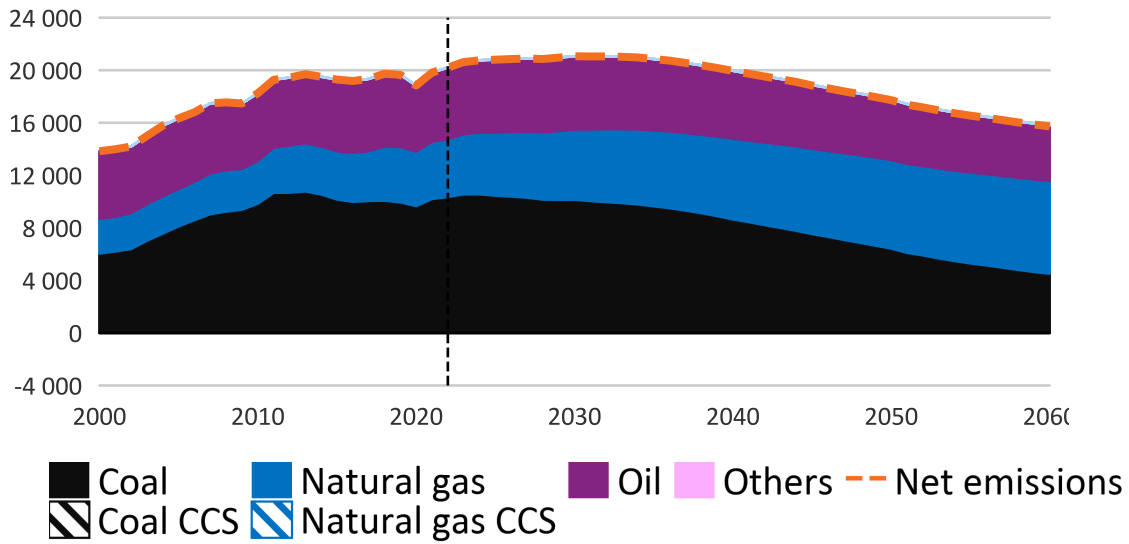

## TGT (million tonnes)



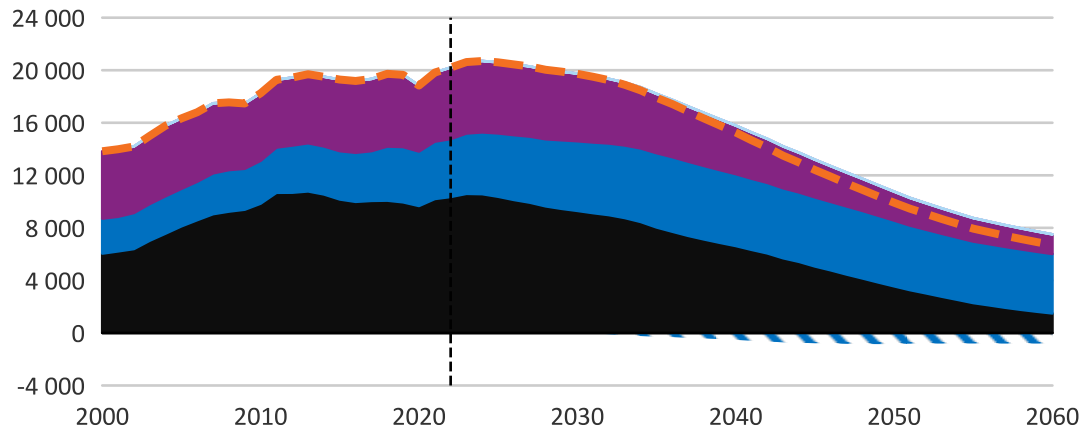

- **APEC's $CO_2$ emissions fall** from 2022 to 2060 by 22% only in REF and to 67% even in TGT.
- **Power and transport** drive most reductions through renewables and electrification.
- **Industry** declines slower, limited by high-temperature processes.
- **CCS** removes around 0.8 Gt by 2060, mainly in power and industry.
- Residual emissions remain requiring further carbon removal.

# 5 $CO_2$ Emissions by fuel

## REF (million tones)




## TGT (million tones)




- **Coal** emissions drop the most, driving overall reductions.
- **Natural gas** emissions stay moderate, partly offset by CCS deployment.
- **Oil** emissions falls largely from transport electrification.


# APEC Energy Goals

# 6 APEC Energy Goals

- **Two APEC Energy Goals**
  - to double the share of modern renewables in the APEC energy mix by 2030, relative to the numbers from 2010
  - to reduce energy intensity of total final energy consumption (TFEC) by 45% in 2035 relative to a 2005 baseline

$$(\textit{Kaya Identity})$$

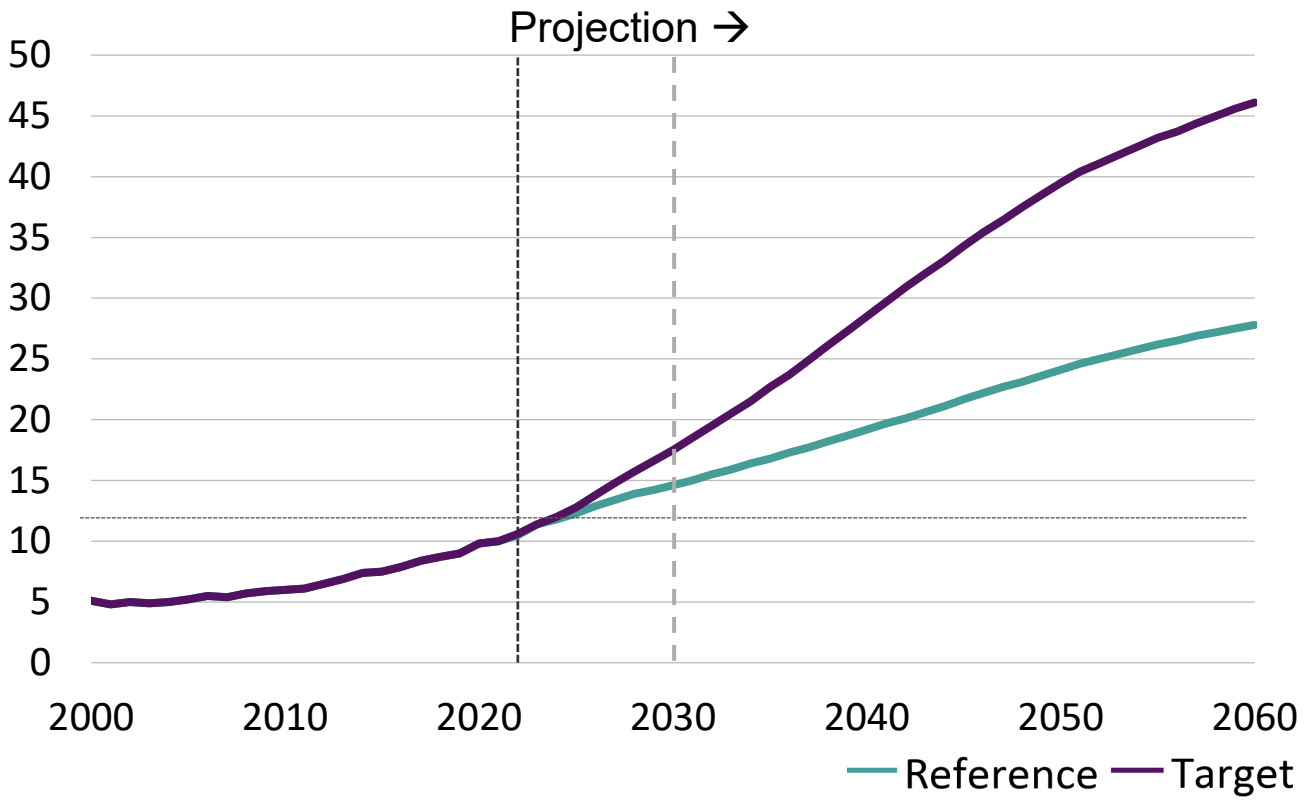
$$CO_2\ emissions = Population * \underbrace{\frac{GDP}{Population}}_{(GDP\ per\ capita)} * \underbrace{\frac{Energy\ supply}{GDP}}_{(Energy\ Intensity)} * \underbrace{\frac{CO_2\ emissions}{Energy\ supply}}_{(Emissions\ intensity)}$$

# Goal: The share of modern renewables:

----- Likely has already doubled

to double the share of modern renewables in the APEC energy mix from 2010 by 2030.

## APEC Modern renewables % of TFEC



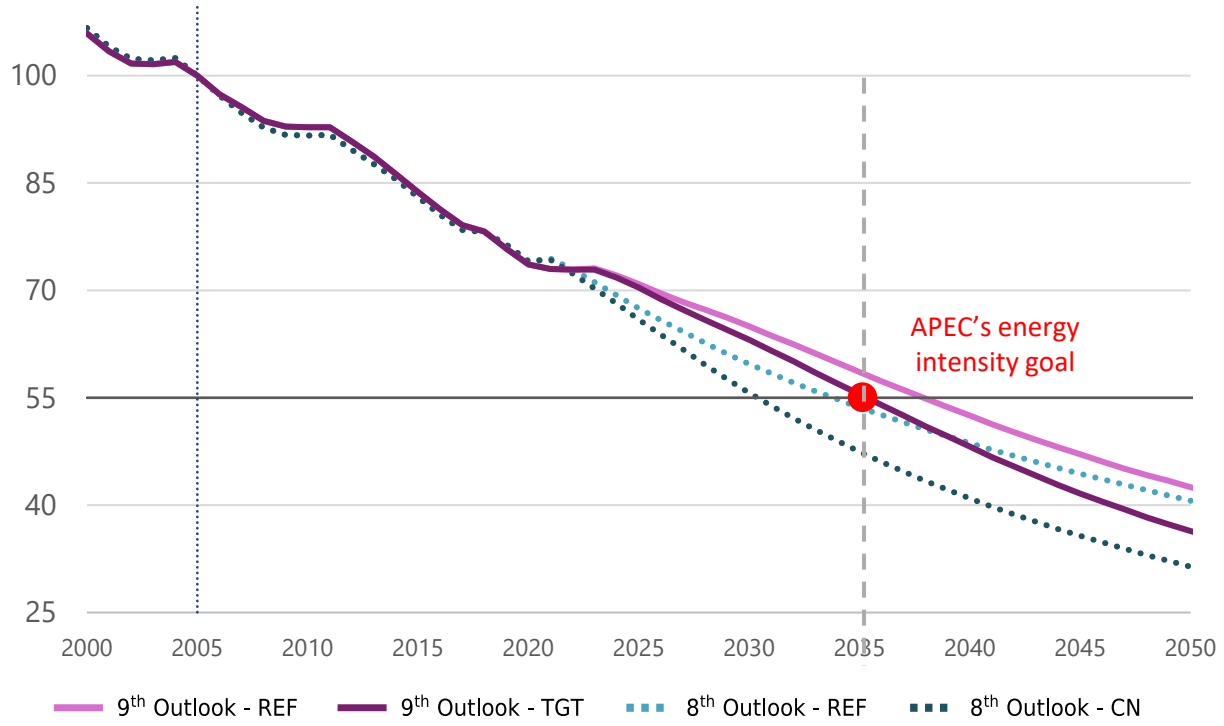

| | 2010 | 2022 | 2060 (REF) | 2060 (TGT) |
|---|---|---|---|---|
| Modern RE Share of TFEC | 6.2% | 10.7% | 28.0% | 38.7% |

# Goal: Energy intensity:

## ----- Achievable, but growing more challenging

to reduce energy intensity of total final energy consumption (TFEC) by 45% in 2035 relative to a 2005 baseline.

**Comparison of 8th and 9th energy intensity trajectories (PJ/GDP, billion USD) indexed to 100 at 2005**



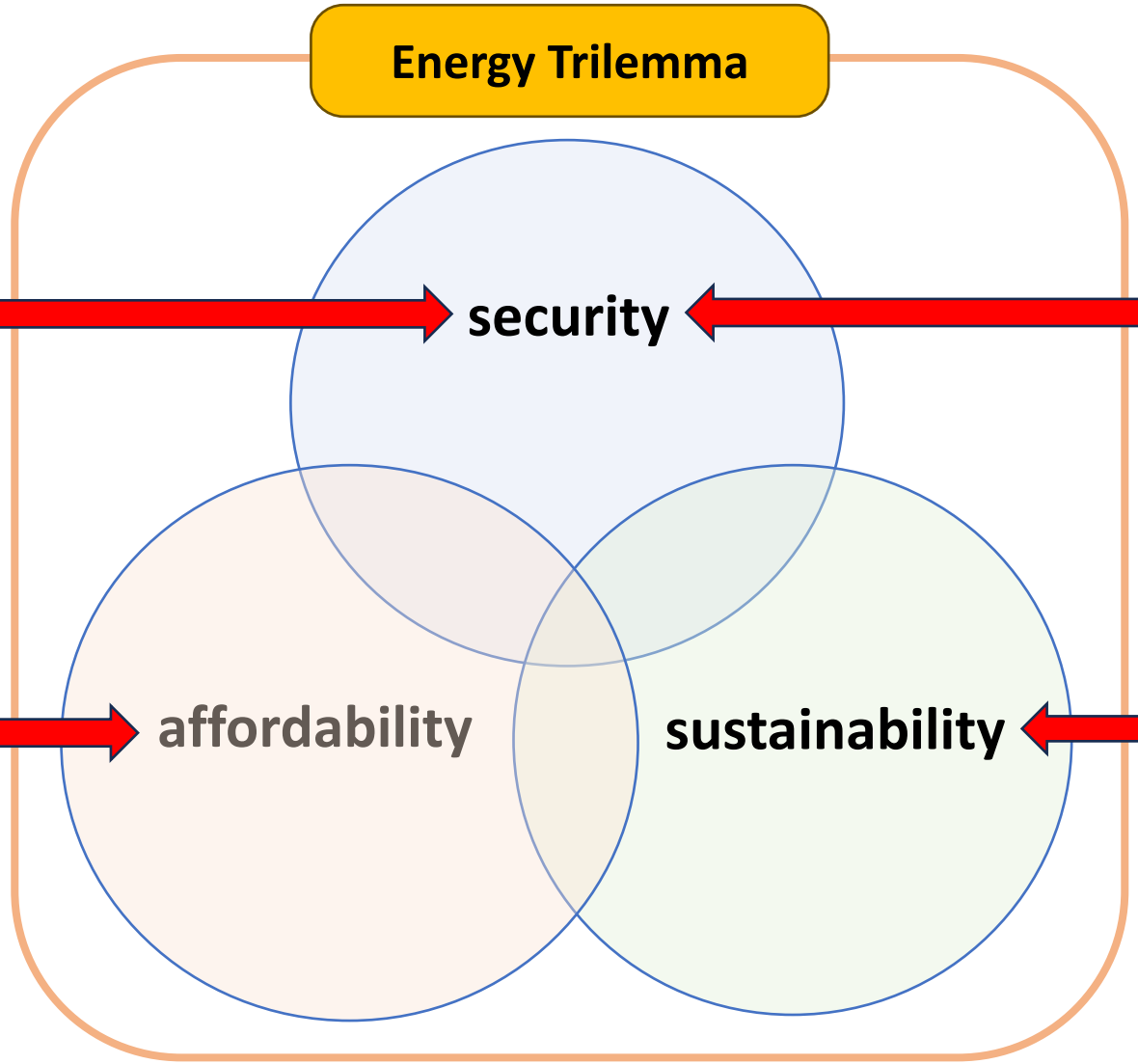

The energy intensity trend was disrupted after 2020 by global events, including the COVID-19 pandemic; however, the long-term decline continues.

APEC is unlikely to meet its 2035 energy intensity reduction goal in REF, whereas the goal is reached in TGT.


# Four Key Takeaways

# 7 Four Takeaways:

## $CO_2$ Emissions / Energy import dependance / Electric Grid Reliability / Costs




**Grid Reliability**
Increased reliance on VRE makes dispatchable power as essential factor.

**Costs**
Costs for power systems & Hydrogen in the energy transition are substantial.

**Import Dependence**
In REF Oil & Gas import dependence remains for some economies.

**$CO_2$ Emissions**
Emissions fall both in REF & TGT. Power & Transport sectors drive the reduction.

# Thank you.

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Volume 1

Volume 2