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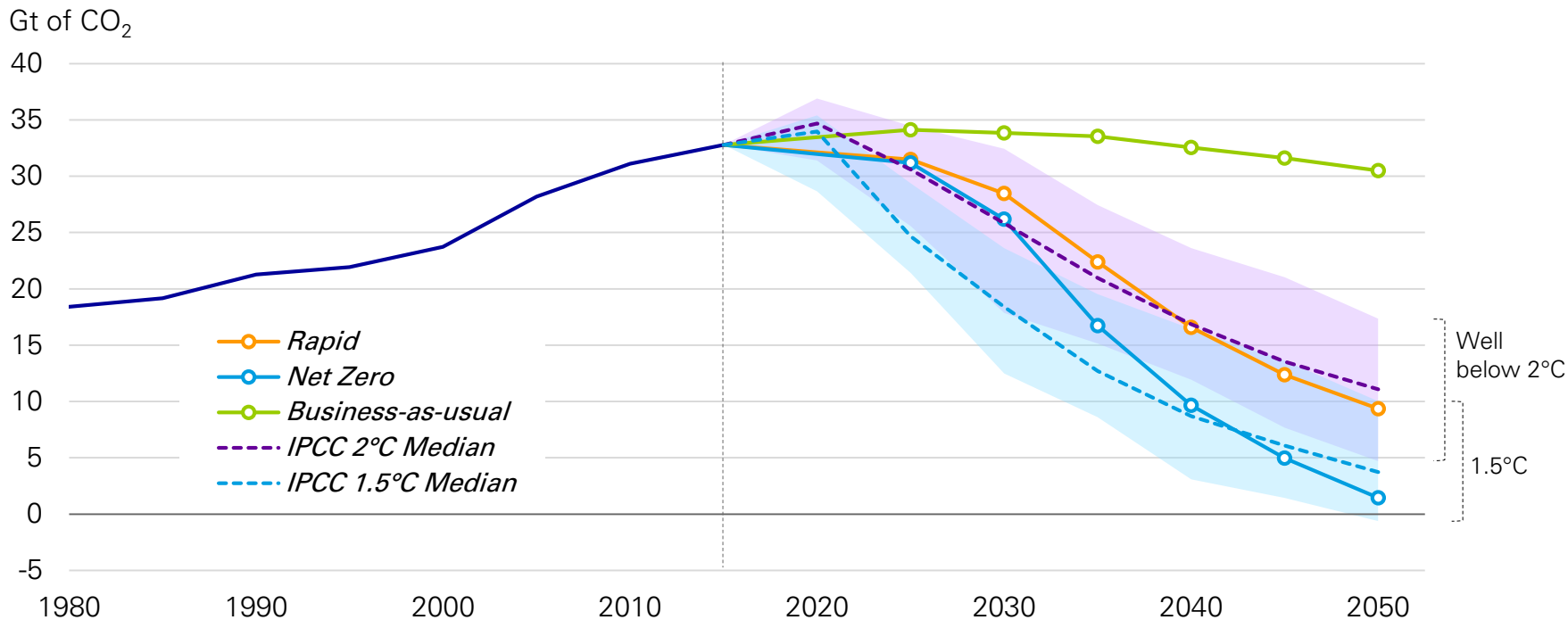
Energy Outlook  
2020 edition

**Spencer Dale**  
Group chief economist



# Three scenarios to explore the energy transition

## CO<sub>2</sub> emissions from energy use



Ranges show 10th and 90th percentiles of IPCC scenarios, see pp 150-151 of *Energy Outlook* for more details



# Key questions

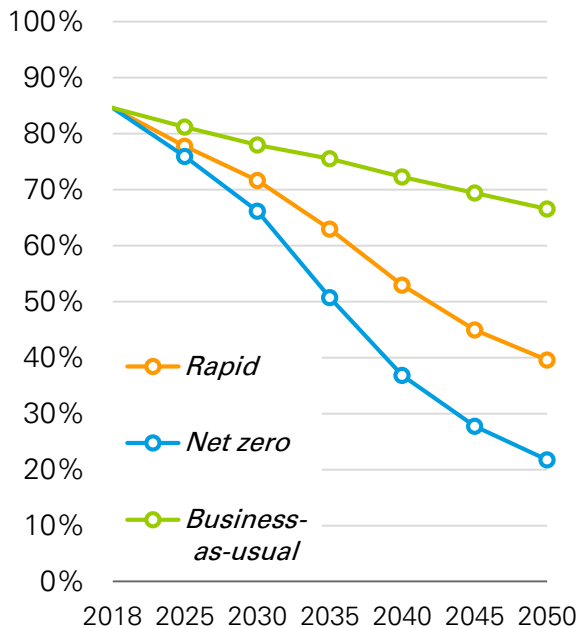
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# Changing structure of global energy demand

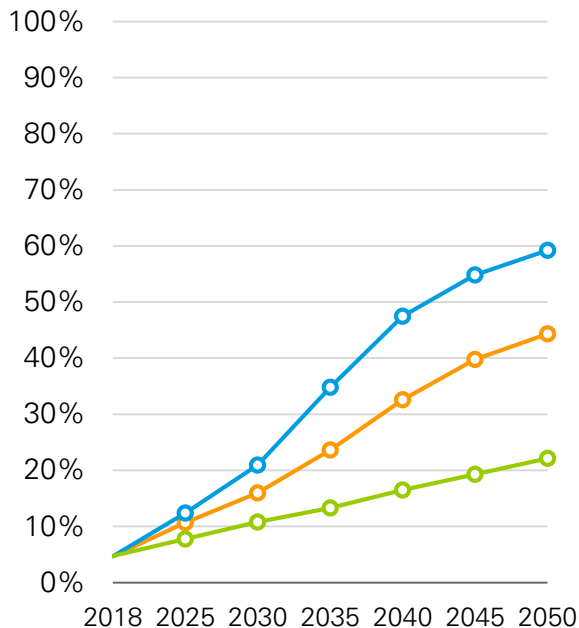
## Fossil fuels

Shares of primary energy



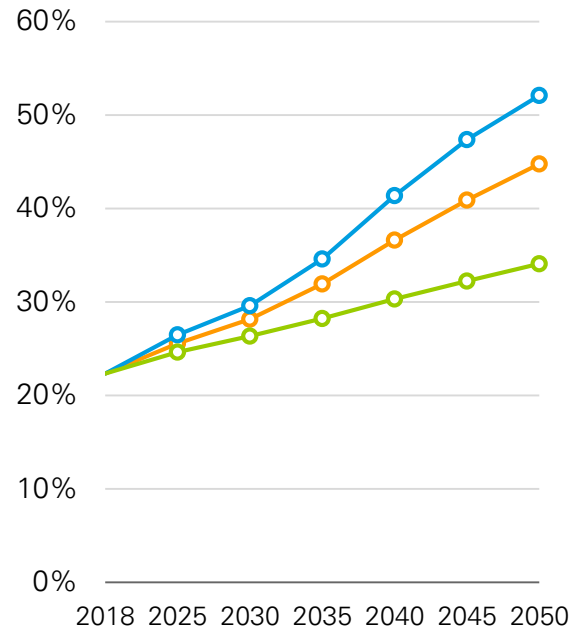
## Renewables\*

Shares of primary energy



## Electricity

Share of total final consumption

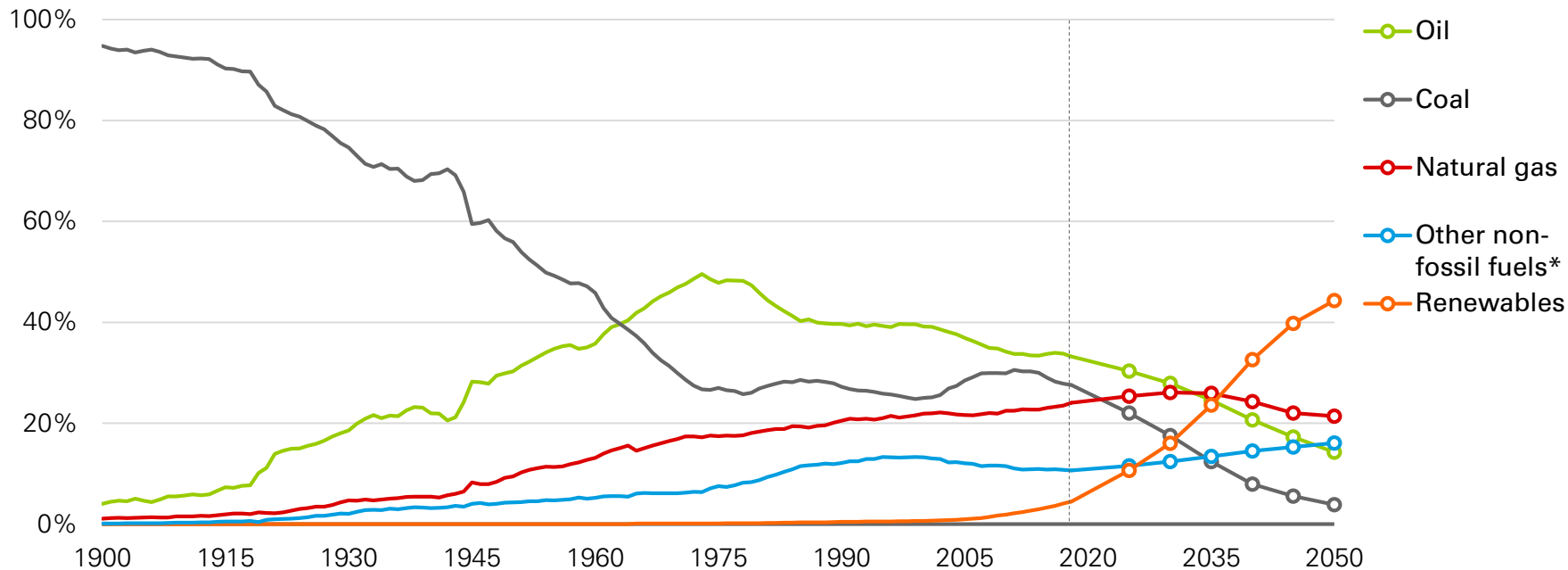


\*Renewables includes wind, solar, geothermal, biomass, biomethane and biofuels and excludes large-scale hydro



# Changing structure of global energy system

Shares of primary energy in *Rapid*



\*Nuclear and hydroelectricity



# Key questions

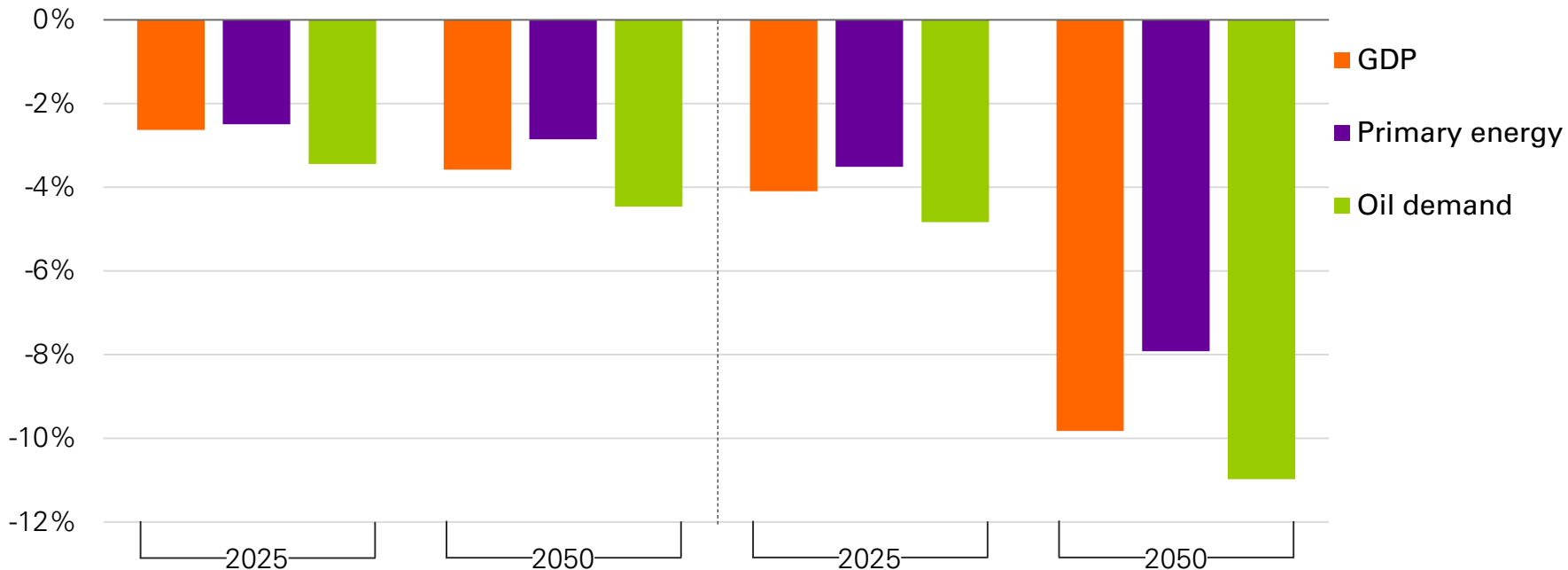
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# Impact of Covid-19 in *Rapid*



Alt case\*: Greater impact from Covid-19

% change as a result of Covid-19



\*Alternative case showing the impact if Covid-19 leads to higher economic losses



# Key questions

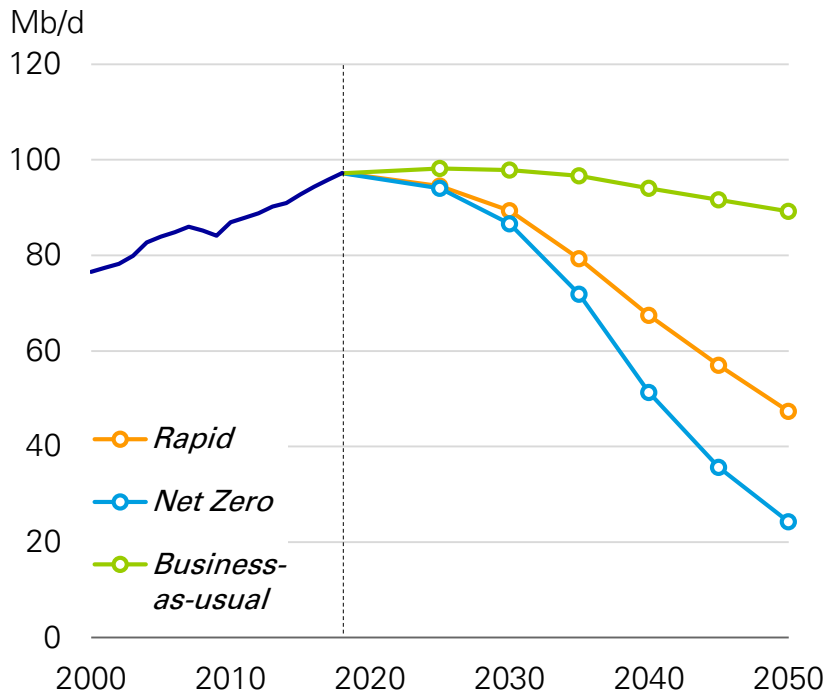
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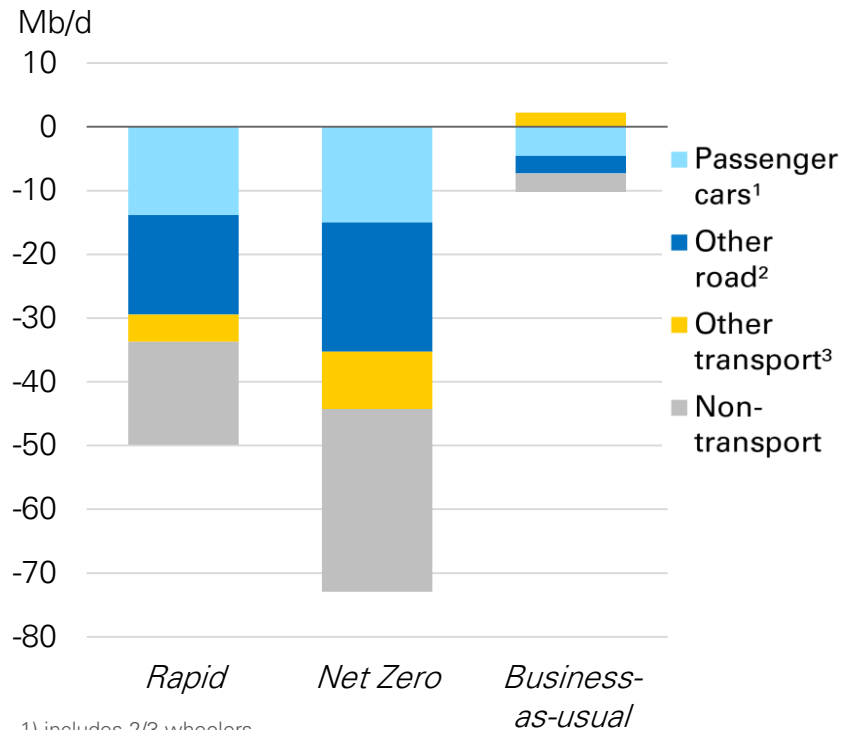


# Outlook for oil demand

## Oil consumption



## Change in oil demand, 2018-2050

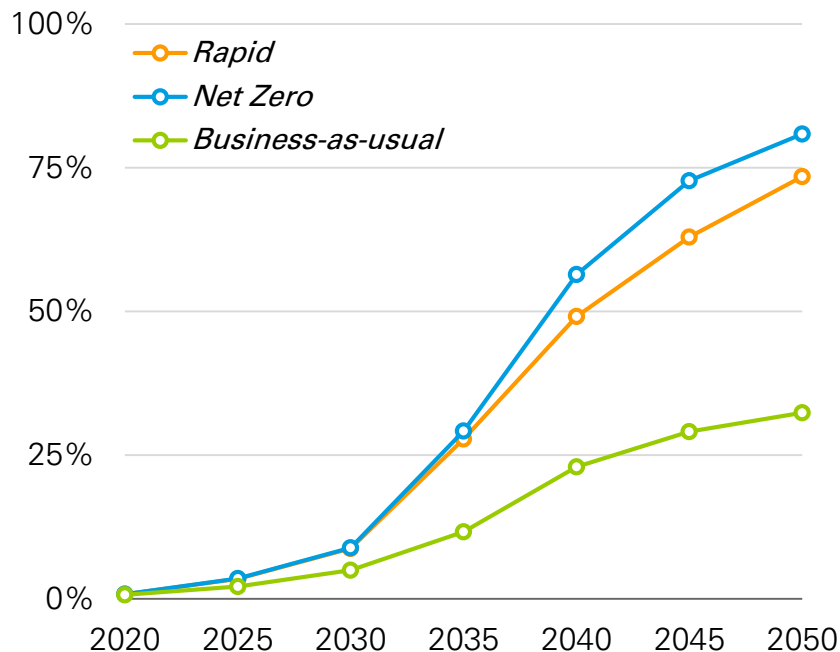


1) includes 2/3 wheelers  
2) trucks and buses  
3) aviation, marine and rail

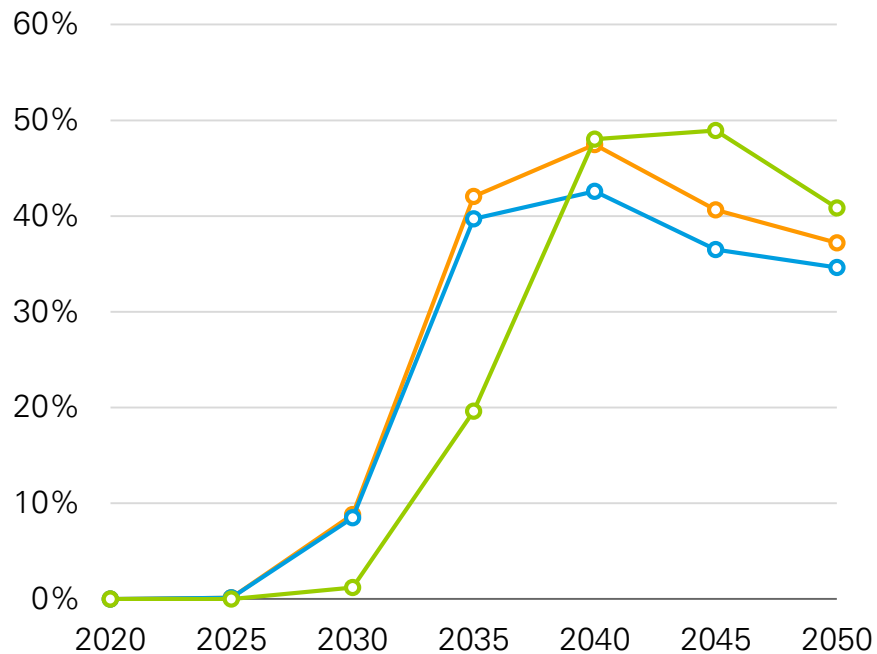
# Mobility revolution: electrification, shared-mobility and autonomy



## Share of car and truck VKM<sup>1</sup> electrified<sup>2</sup>



## Robotaxi share of passenger car VKM<sup>1</sup> powered by electricity



1) vehicle kilometres

2) includes buses



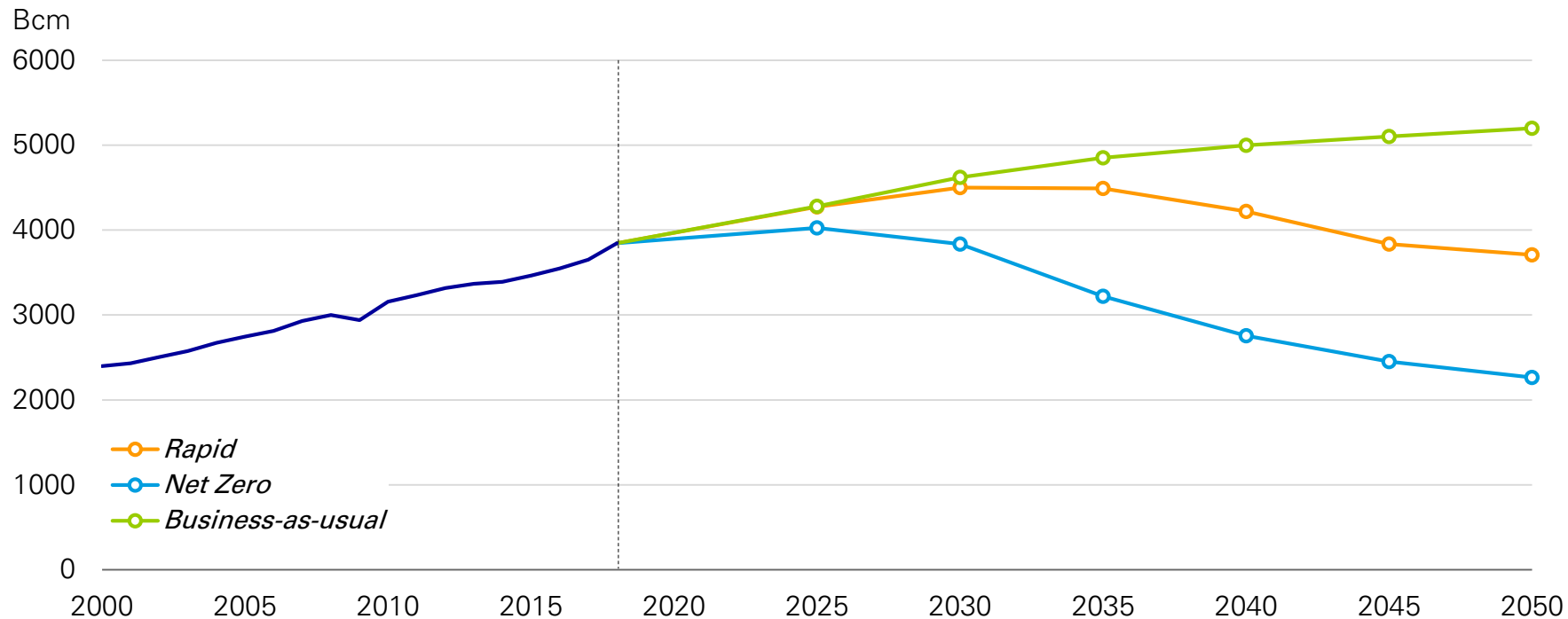
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# Outlook for natural gas



## Natural gas consumption

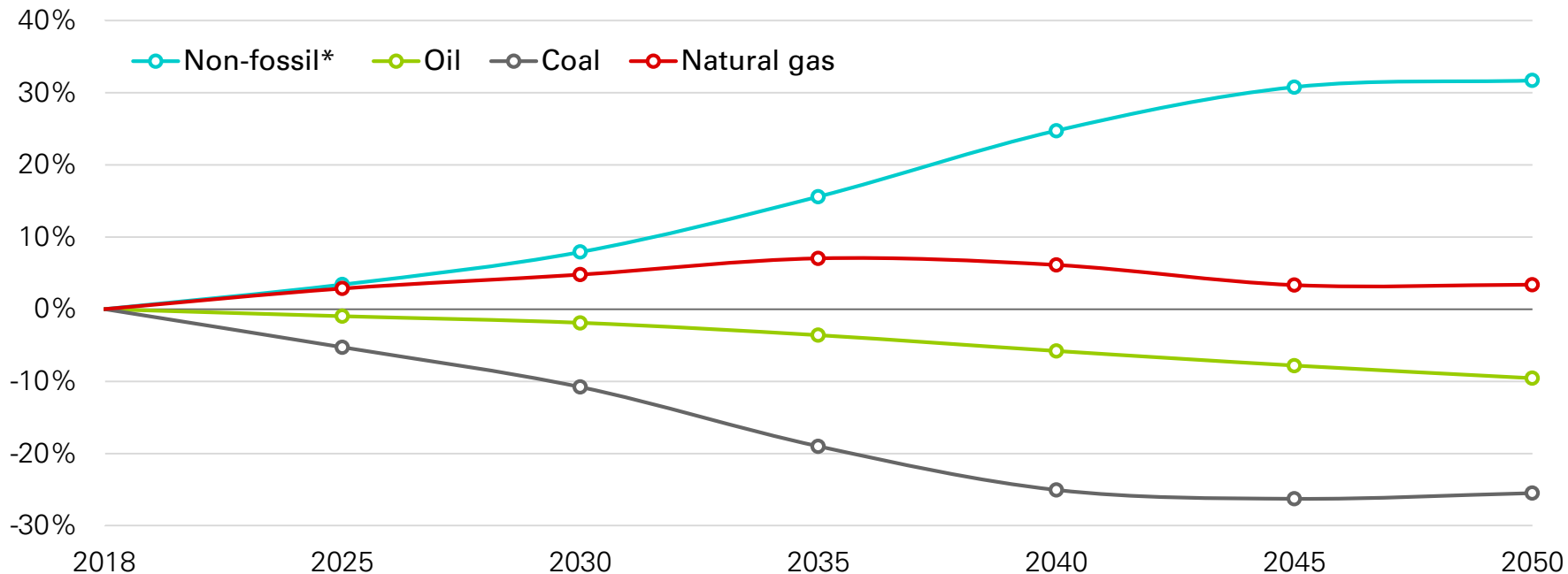


# Supporting role of natural gas



## *Rapid vs. Business-as-usual: India and Other Asia*

Differences in shares of primary energy

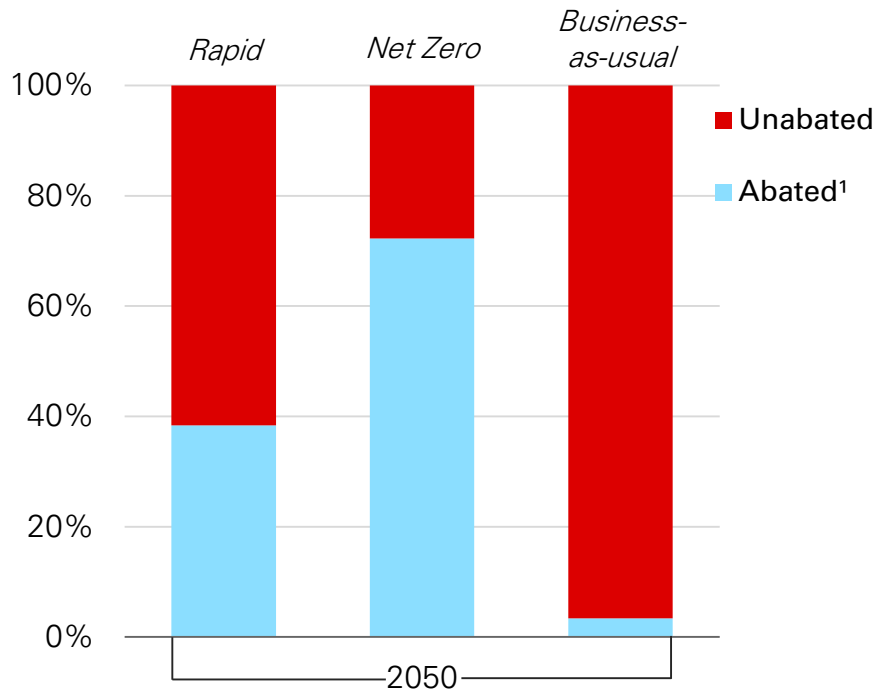


\*Renewables, nuclear and hydroelectricity



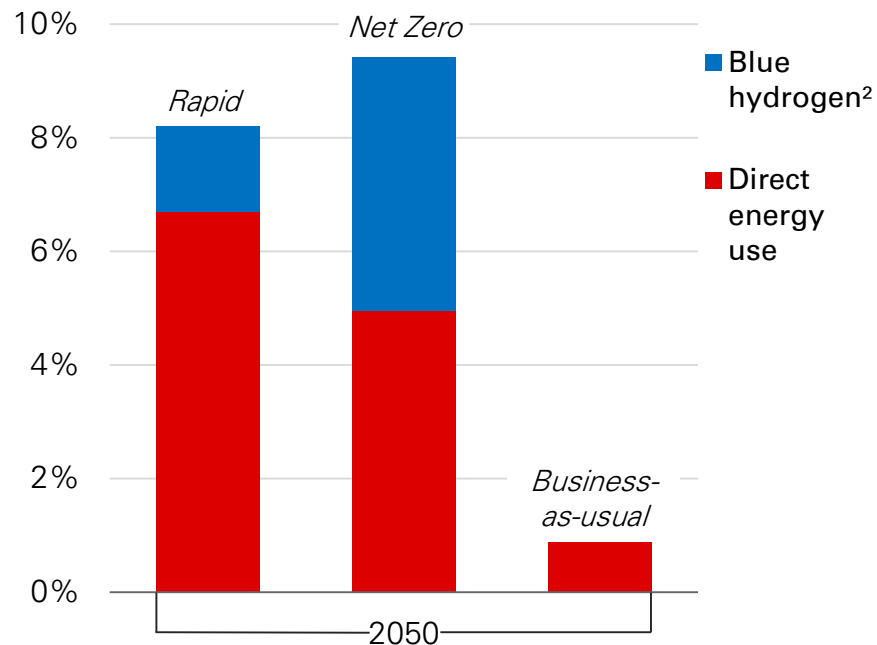
# Natural gas as a source of near-zero carbon energy

## Share of natural gas abated<sup>1</sup> and unabated



1) Direct use of natural gas with CCUS plus natural gas as input to blue hydrogen

## Natural gas with CCUS as a share of primary energy



2) Blue hydrogen is extracted from natural gas (or coal), with the carbon dioxide by-product being captured via CCUS.

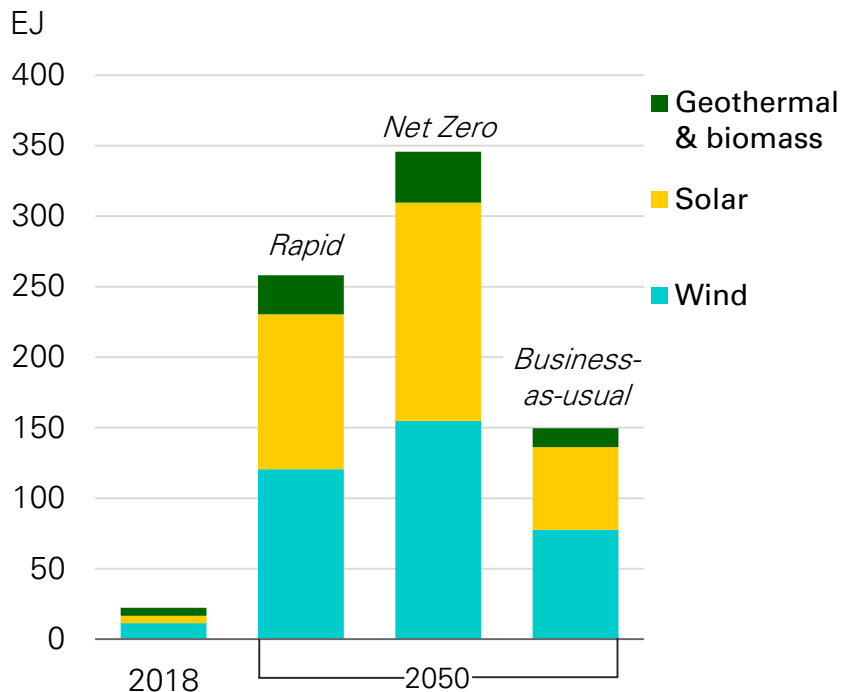


# Key questions

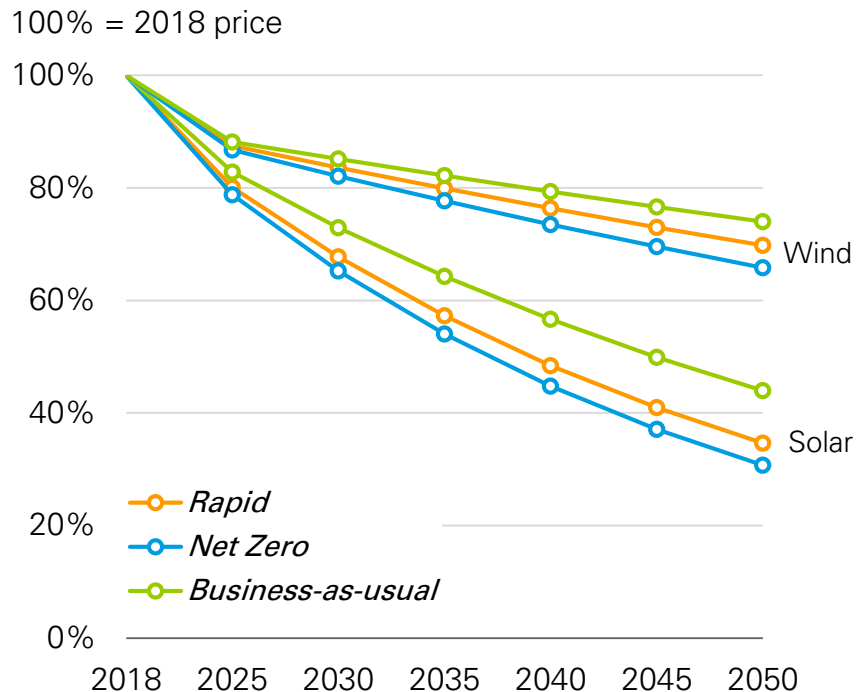
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# Renewable energy in power

## Renewable energy used in power sector\*



## Cost of wind and solar energy



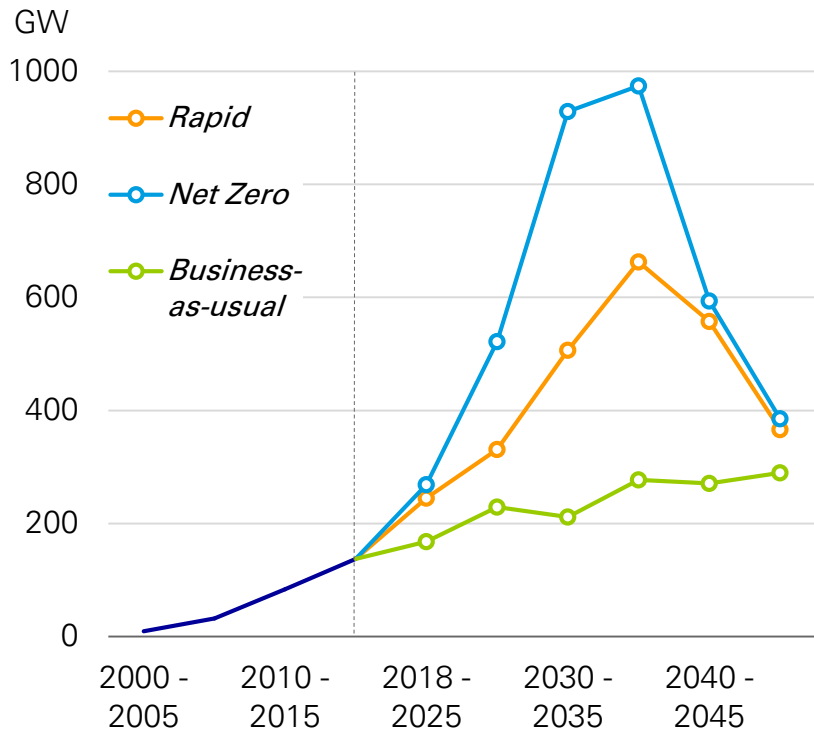
\*On a primary energy basis (see *Energy Outlook* p154 for more details)





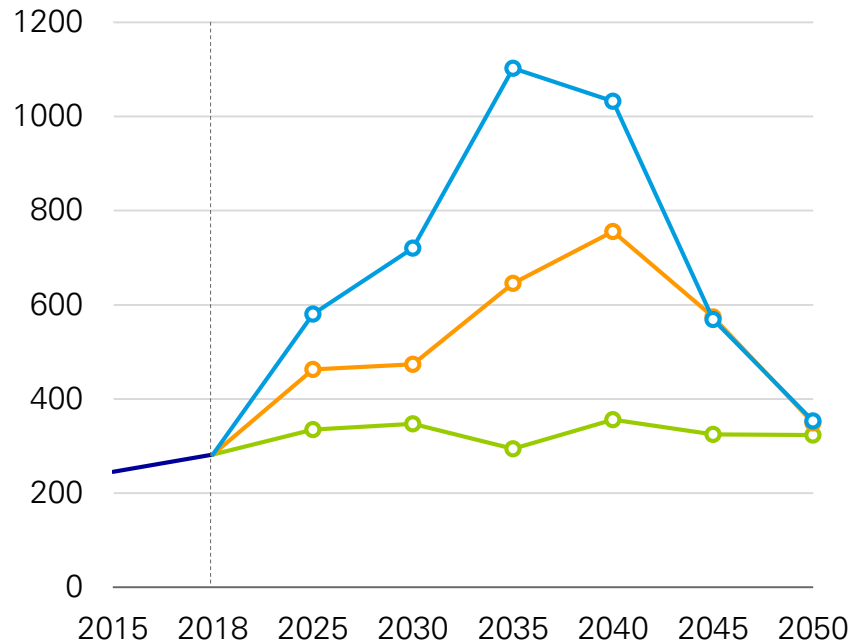
# Wind and solar capacity

## Average annual increase in wind and solar capacity



## Average annual investment in wind and solar

Five-year rolling average, 2018 US\$ Billion





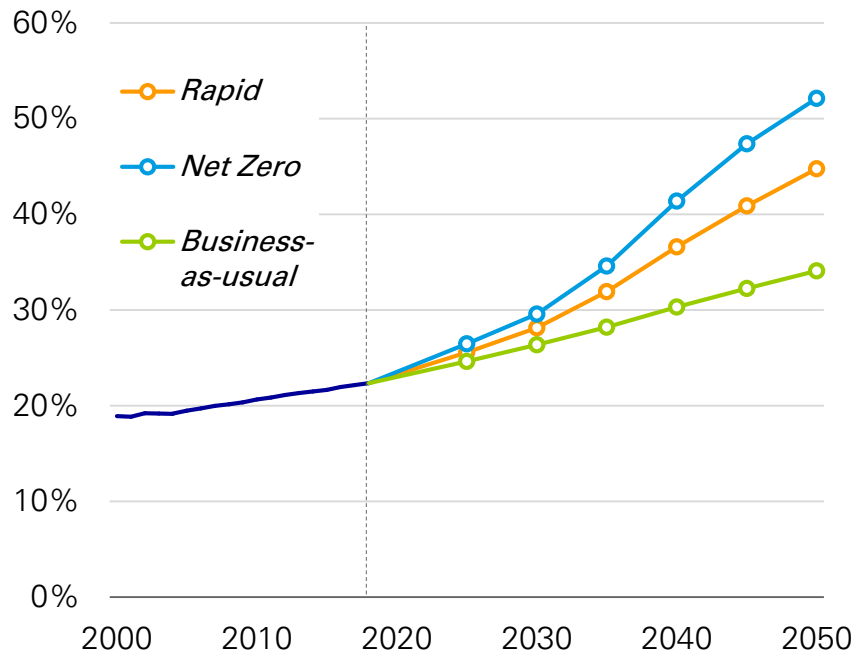
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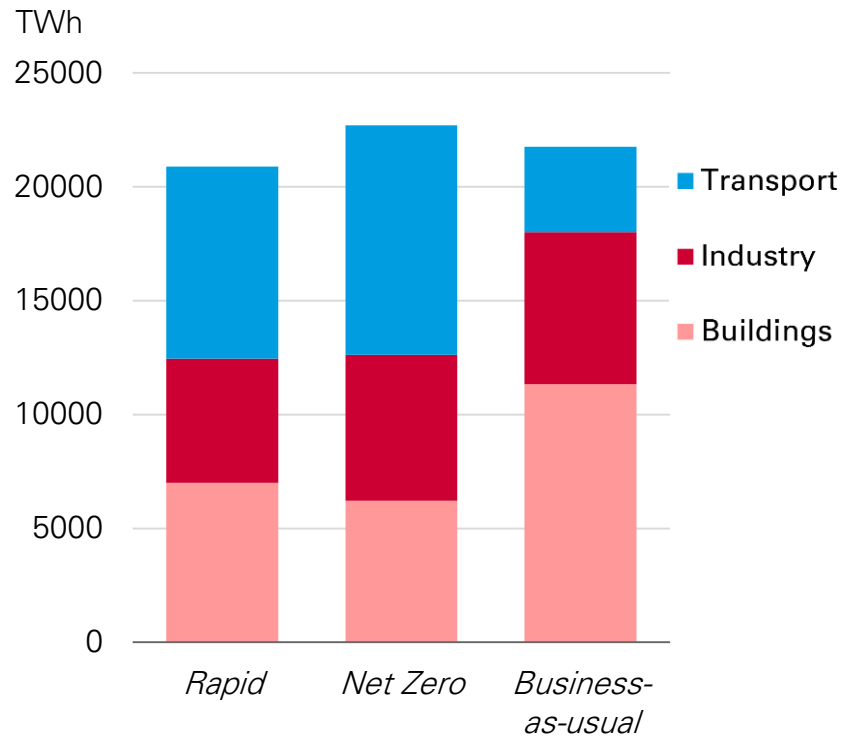


# Electricity demand

## Share of electricity in total final consumption



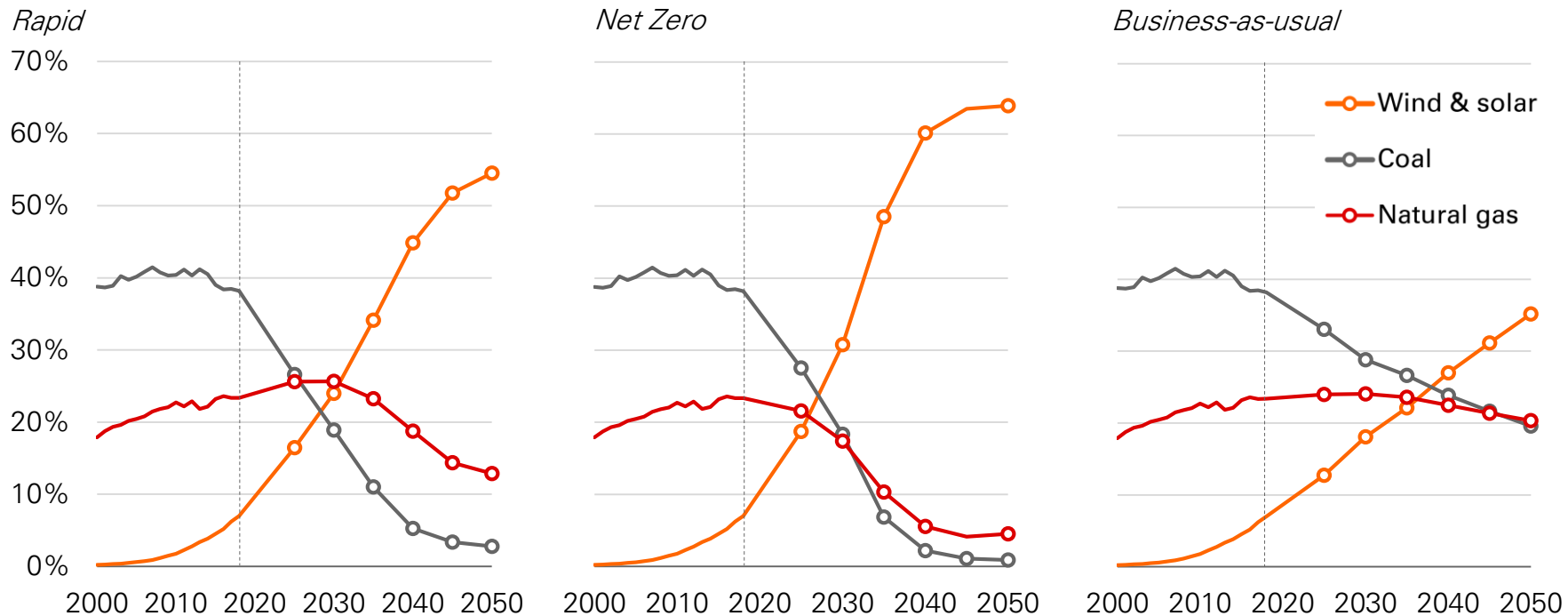
## Change in electricity demand by sector, 2018-2050





# Global power generation

## Share of global power generation by energy source





# Technologies to help balance the power sector

	Seconds	Minutes	Hours	Days	Weeks	Seasons
Batteries	Most advantaged	Most advantaged	Most advantaged	Not applicable / expensive	Not applicable / expensive	Not applicable / expensive
Pumped Hydro	Less advantaged	Most advantaged	Most advantaged	Not applicable / expensive	Not applicable / expensive	Not applicable / expensive
Demand response and rescheduling	Less advantaged	Most advantaged	Most advantaged	Less advantaged	Not applicable / expensive	Not applicable / expensive
Hydro with high-capacity reservoirs	Less advantaged	Most advantaged	Most advantaged	Most advantaged	Most advantaged	Most advantaged
Hydrogen	Less advantaged	Less advantaged	Less advantaged	Most advantaged	Most advantaged	Most advantaged
Gas (or coal) with CCUS	Not applicable / expensive	Less advantaged	Less advantaged	Most advantaged	Most advantaged	Most advantaged
Bioenergy with or without CCUS	Not applicable / expensive	Less advantaged	Less advantaged	Most advantaged	Most advantaged	Most advantaged

Not applicable / expensive

Less advantaged

Most advantaged

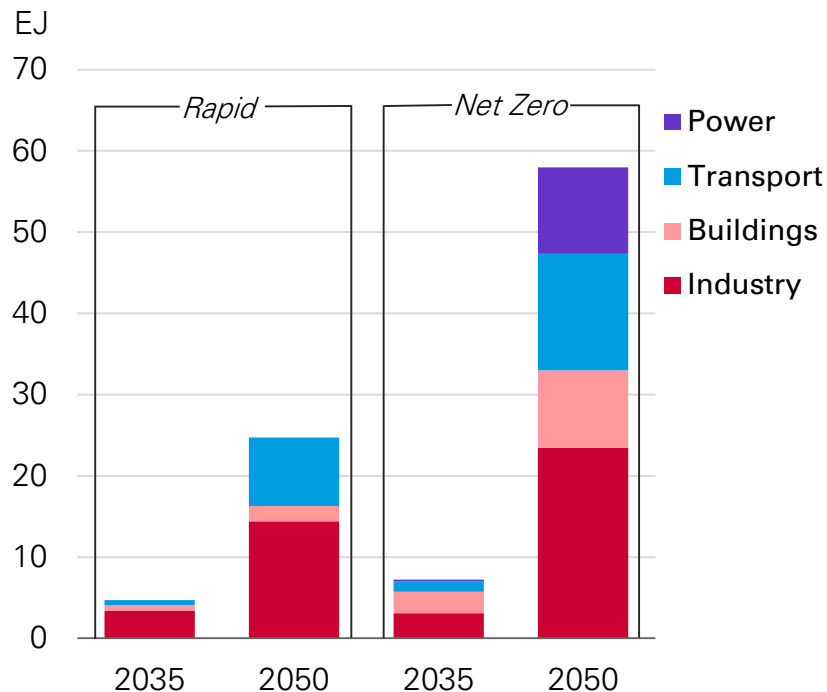


# Key questions

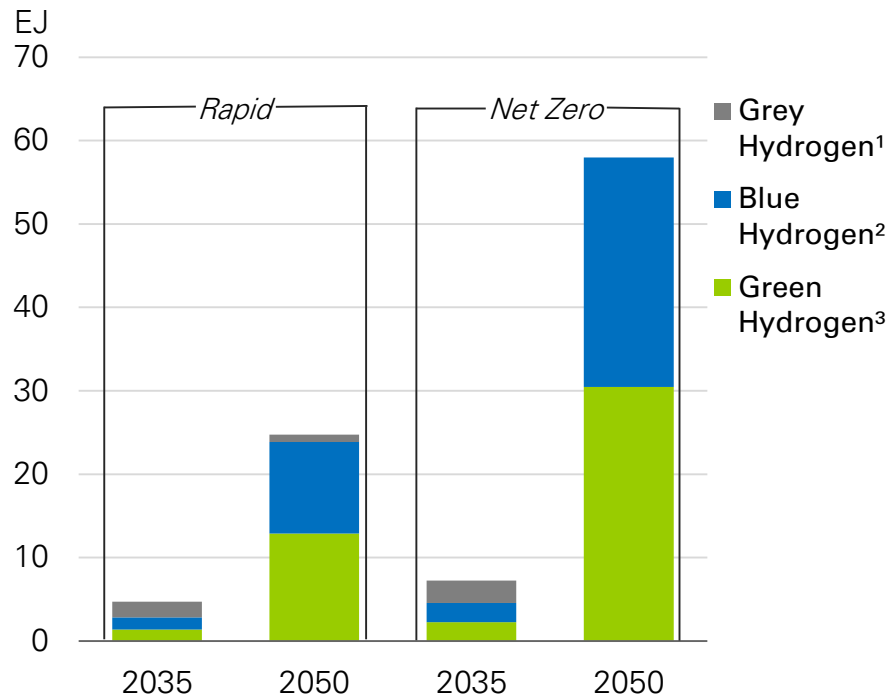
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# Consumption and production of hydrogen

## Hydrogen use by sector



## Hydrogen production by type



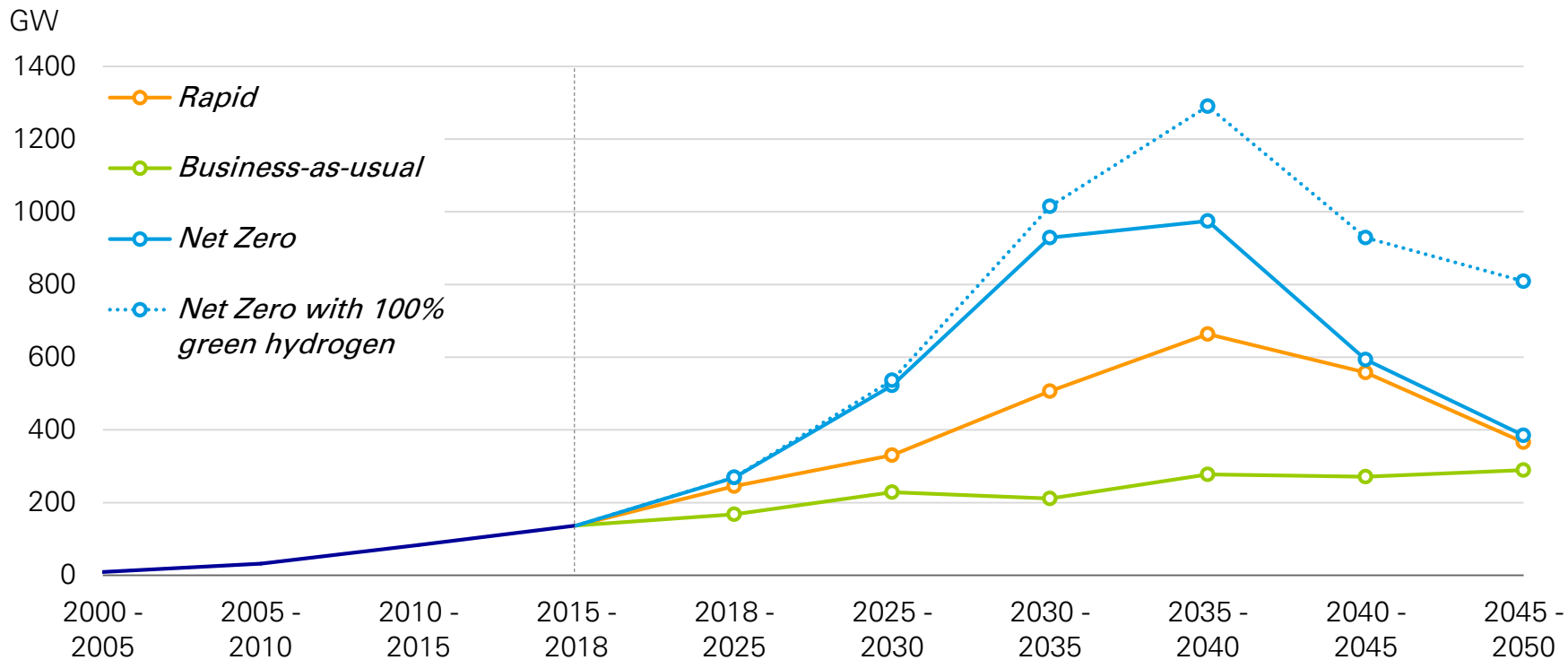
1) produced from natural gas (or coal), without CCUS.

2) produced from natural gas (or coal) with CCUS

3) made by electrolysis, using renewable power

# Wind and solar capacity

Annual average increase in wind and solar capacity

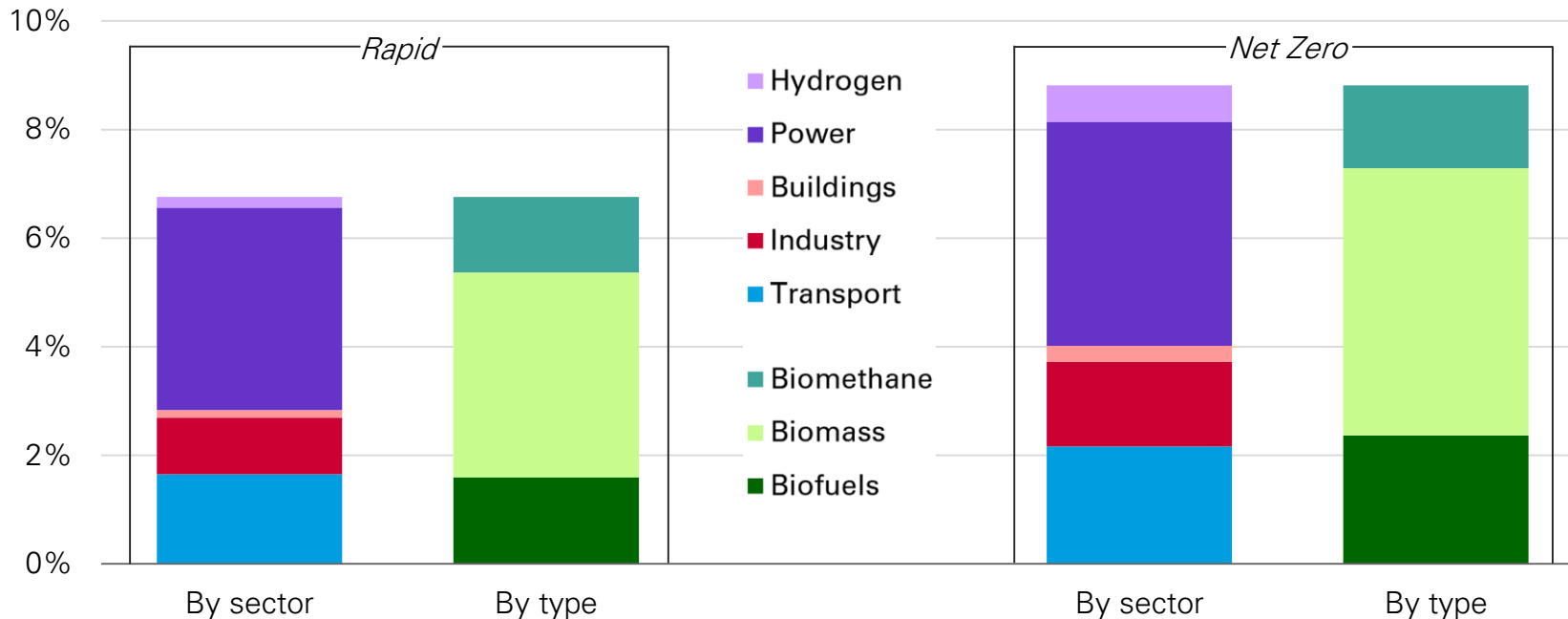




# Bioenergy in *Rapid* and *Net Zero*



Shares of primary energy



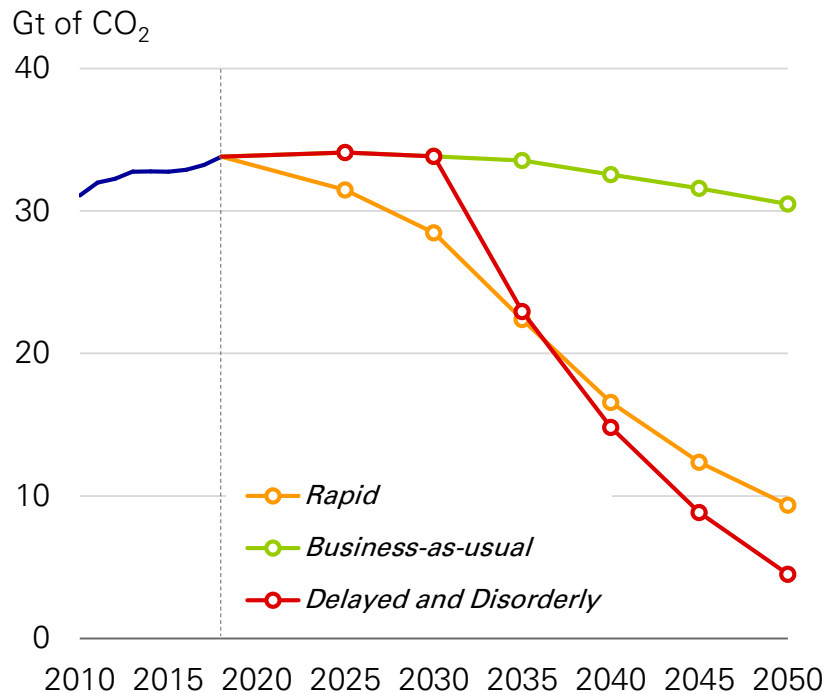


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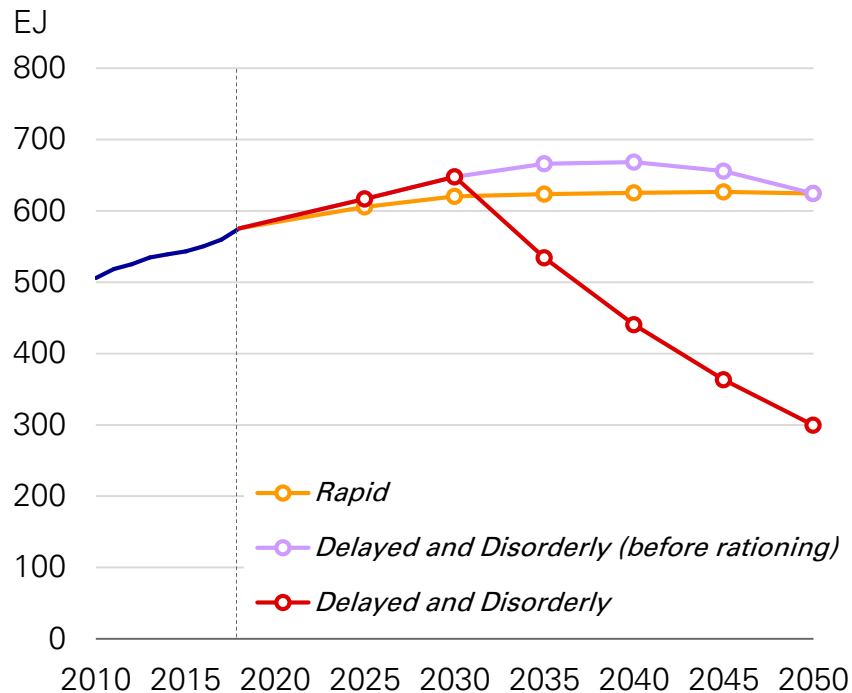
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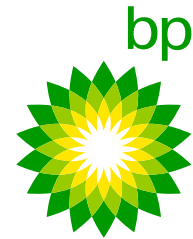
# Delayed and Disorderly scenario

## Carbon emissions



## Primary energy consumption



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