

# World Energy Outlook 2018



**The role of electricity in clean  
energy transitions**

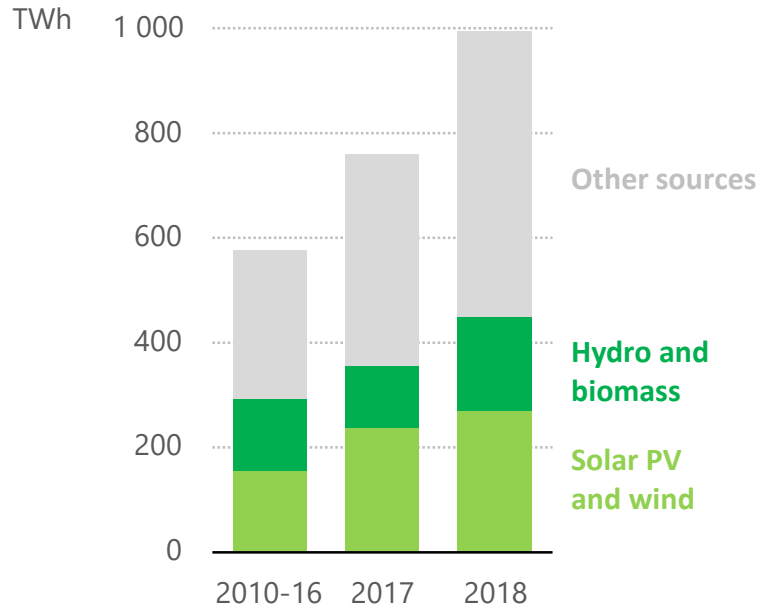
**Brent Wanner**

**Paris, 4 September 2019**

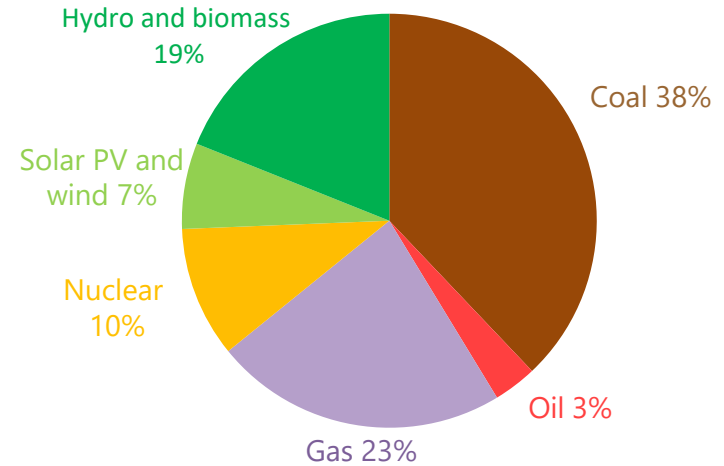
- Electricity is increasingly important in the modern world, to date:
  - **Electricity demand** has been growing twice as fast as total energy demand
  - **Investment** in the power sector is larger than that in the oil and gas sector
  - The rise of **solar PV and wind** power is transforming electricity supply
  - For the first time, the global **population without access to electricity fell below 1 billion**
- Policy makers need well-grounded insights about different possible futures & how they come about. The *WEO* provides two key scenarios:
  - New Policies Scenario
  - Sustainable Development Scenario
- The Future is Electric Scenario was introduced to explore the implications of more rapid electrification of end uses and the digitalization of the economy

# Electricity growth outpaces renewables acceleration

Average annual change in electricity generation, 2010-18



Electricity generation mix in 2018

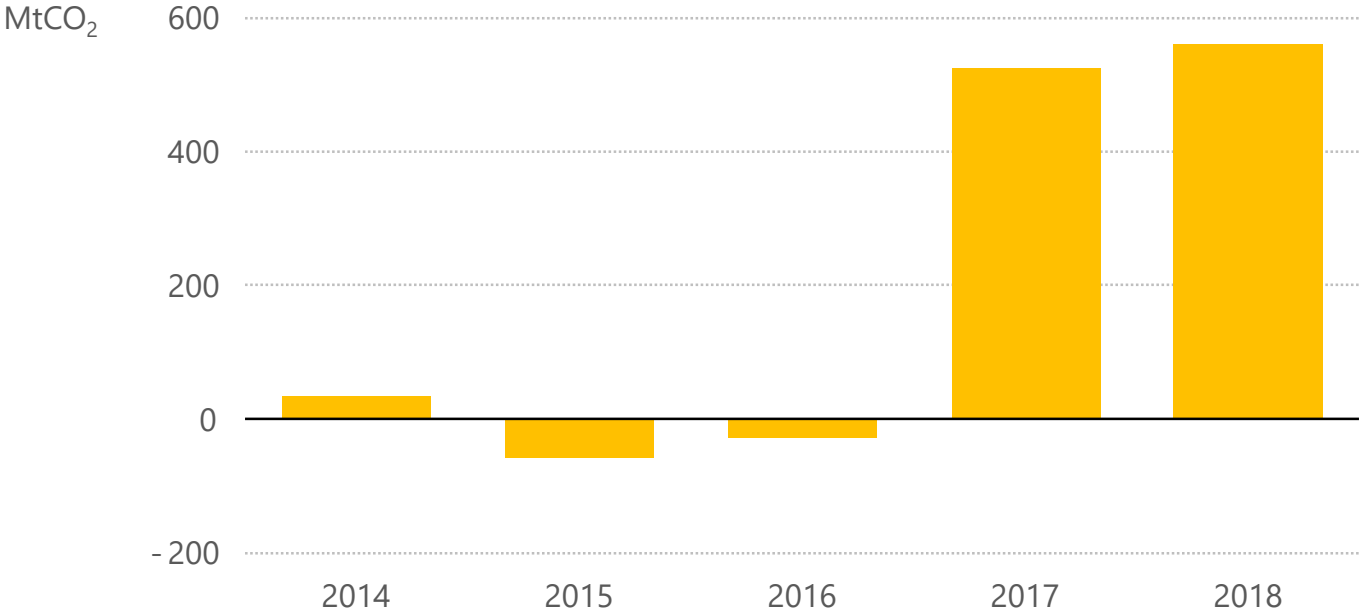


**Renewables accounted for the largest growth in electricity demand, led by growth in solar, wind and hydro. However, this growth was not fast enough to bend power sector emissions.**

# Energy-related CO<sub>2</sub> emissions hit a record high...



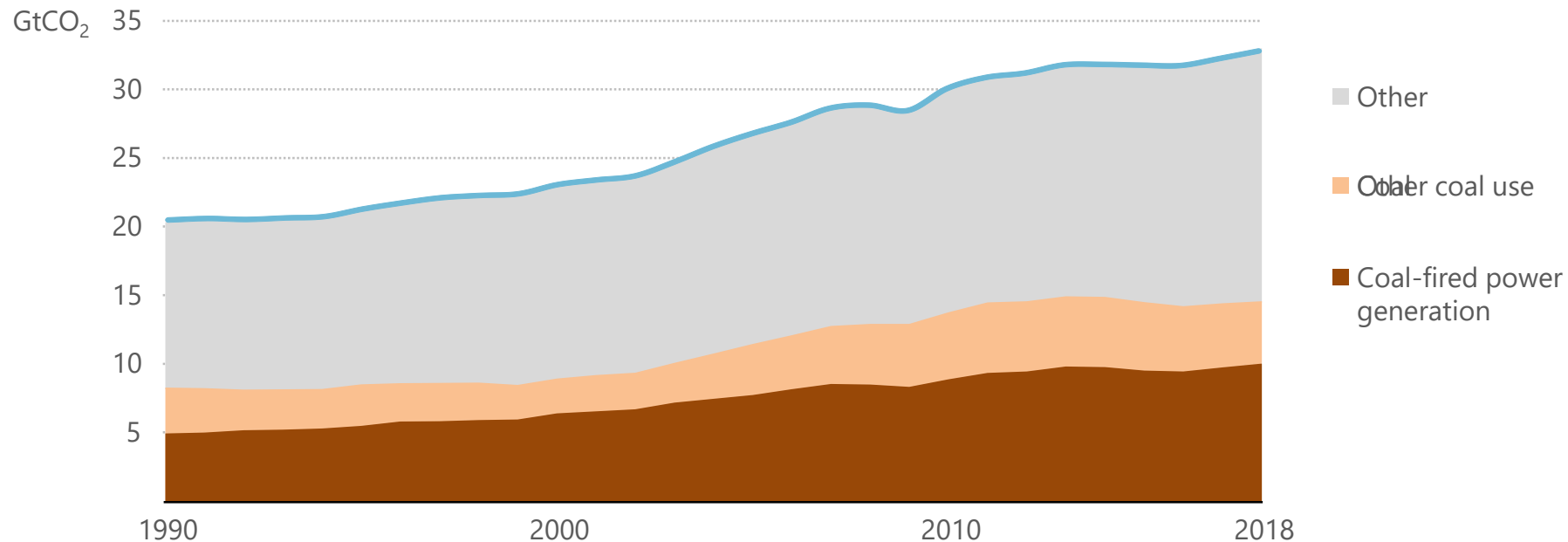
Annual change in global energy-related CO<sub>2</sub> emissions, 2014-2018



**Higher demand for fossil fuels drove up global CO<sub>2</sub> emissions for a second year after a brief hiatus. Increases in efficiency, renewables, coal-to-gas switching and nuclear avoided 640 Mt of CO<sub>2</sub> emissions.**

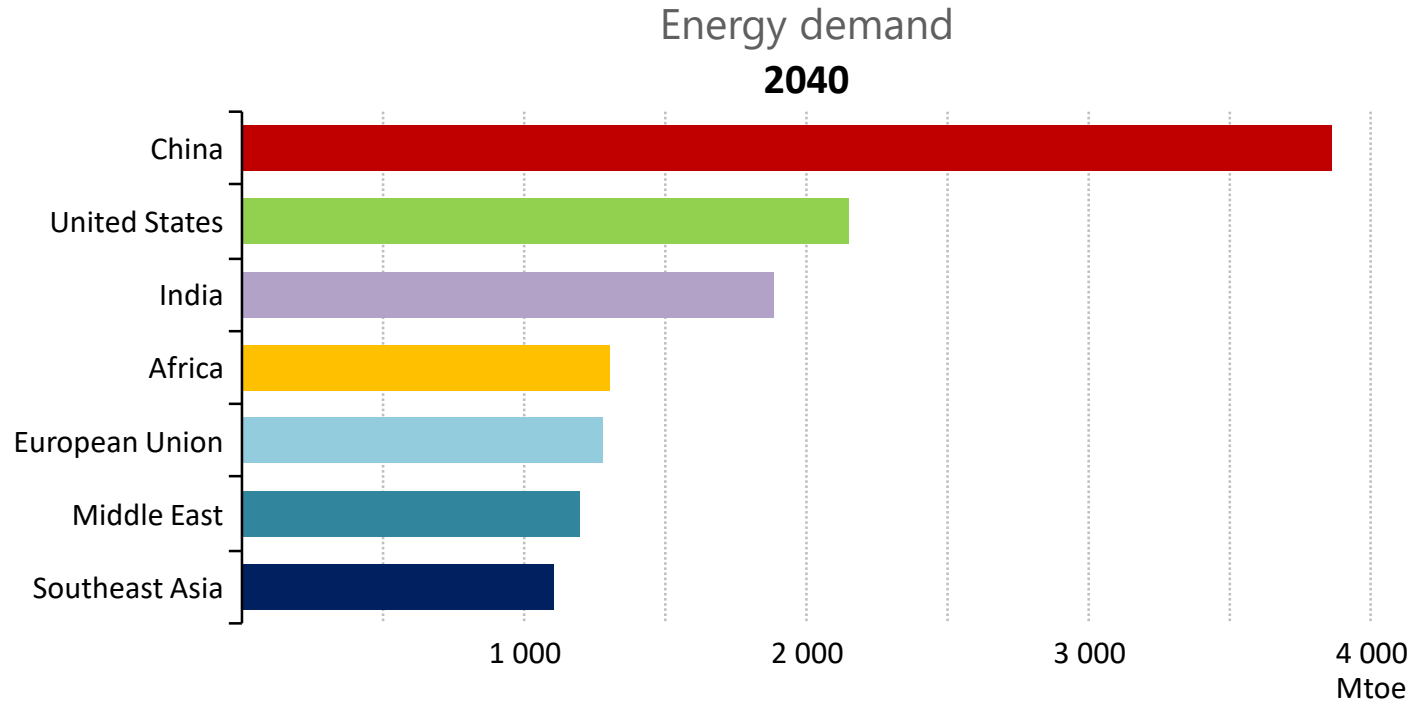
# ..led by coal in power generation in Asia

Global energy-related CO<sub>2</sub> emissions, 1990-2018



**Emissions from coal continue to rise, driven by increasing coal use mostly for power generation in Asia. Coal is the largest source of emissions, and associated with around one-third of the warming to date.**

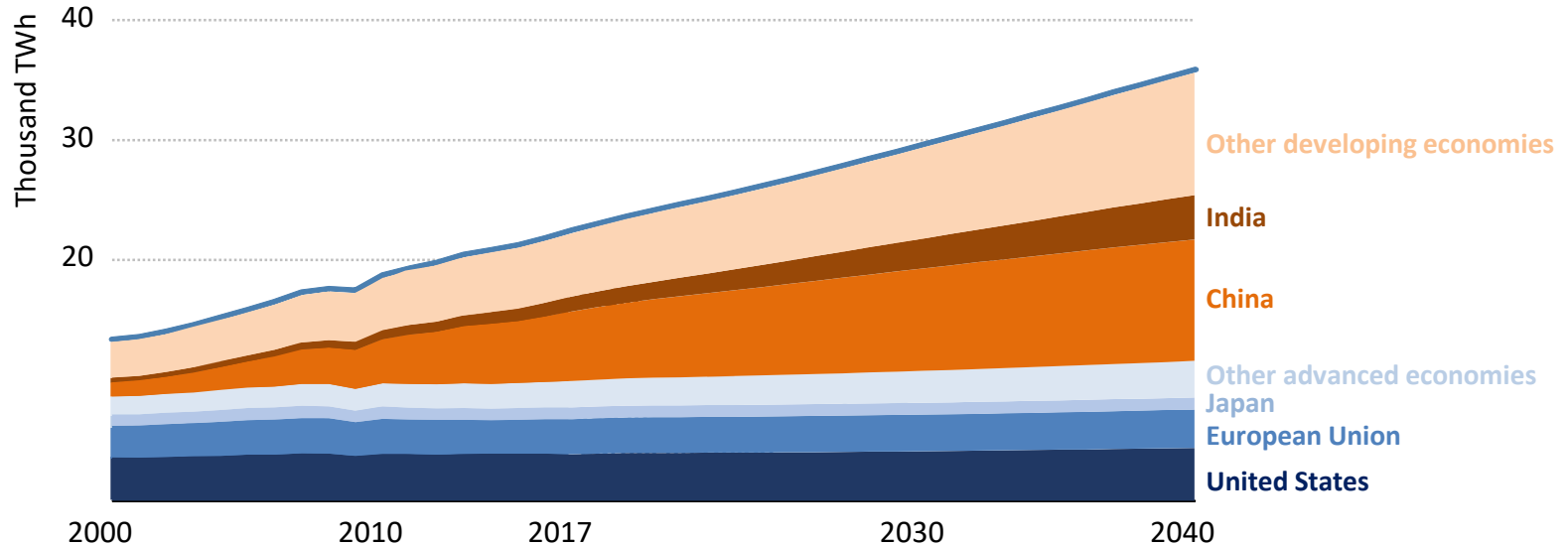
# The new geography of energy



*In 2000, more than 40% of global demand was in Europe & North America and some 20% in developing economies in Asia. By 2040, this situation is completely reversed.*

# Electricity, the fastest growing “fuel”

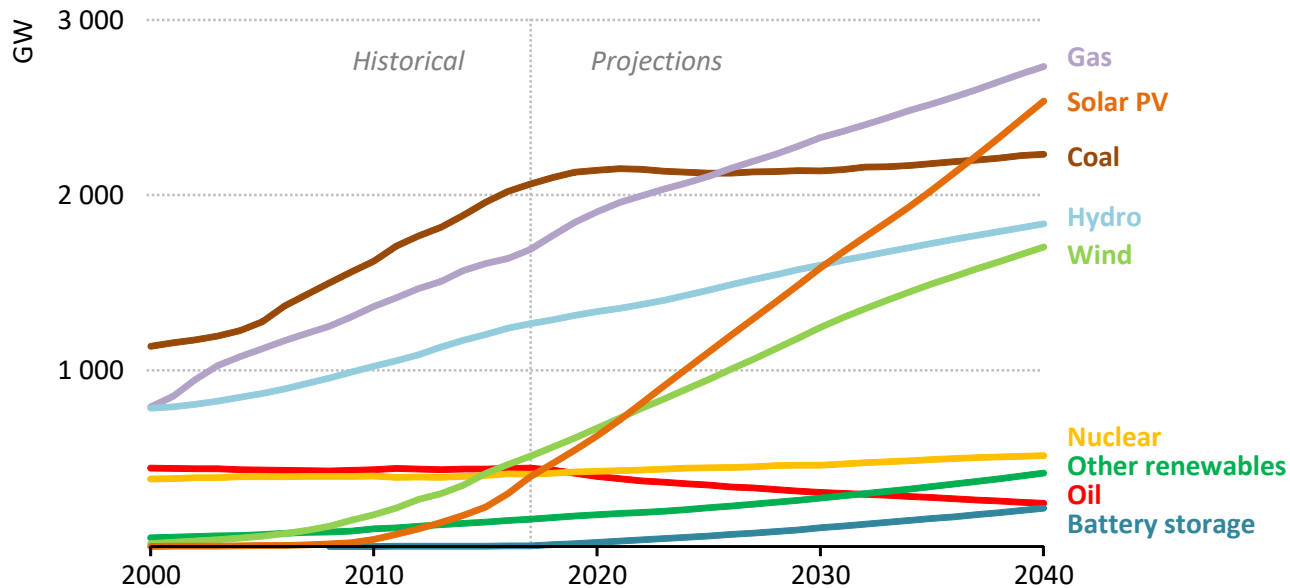
Global electricity demand by region



*In 2000, developing economies accounted for one-third of electricity demand, by 2040, their share doubles as they account for most of the electricity growth*

# Solar PV outpaces all other technologies

Installed power generation capacity by source in the New Policies Scenario

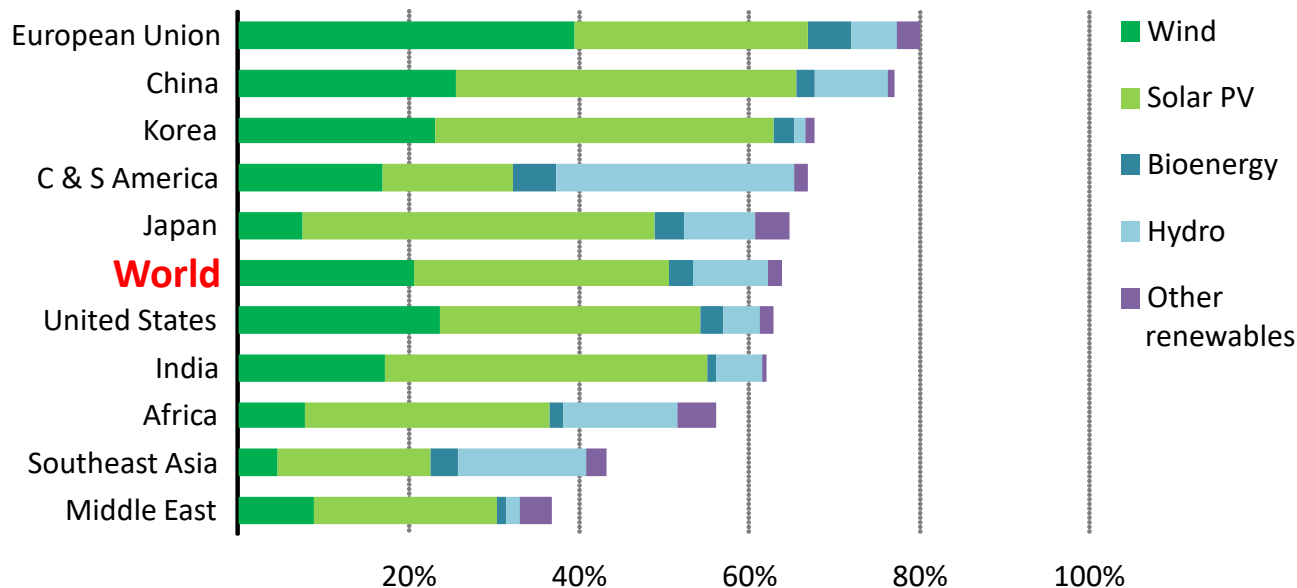


*Renewables make up two-thirds of all capacity additions worldwide to 2040, capturing 70% of power plant investment*



# Wind and solar are poised for growth everywhere

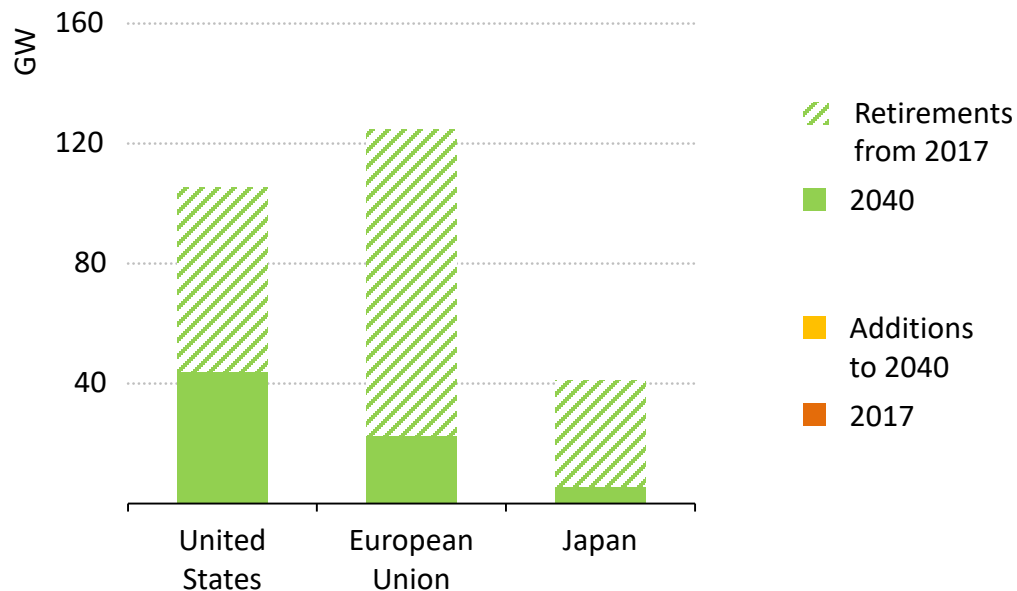
Renewable energy share in capacity additions in the New Policies Scenario, 2018-2040



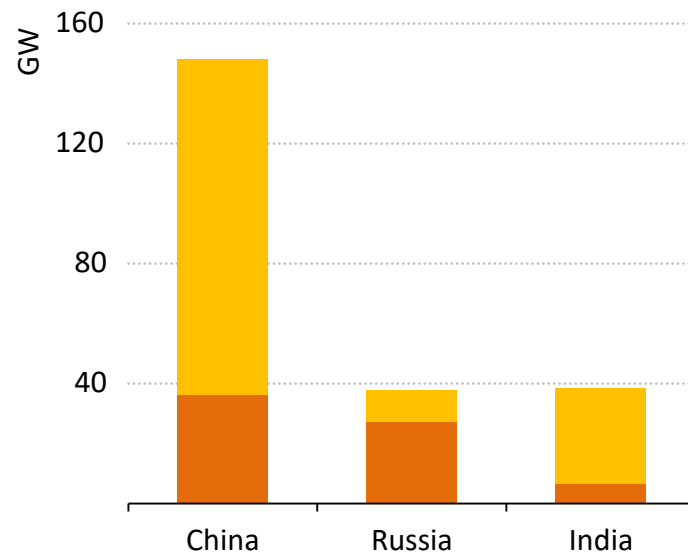
*Renewables make up two-thirds of all capacity additions worldwide to 2040, capturing 70% of power plant investment*

# Two directions for nuclear power

## Without policy changes



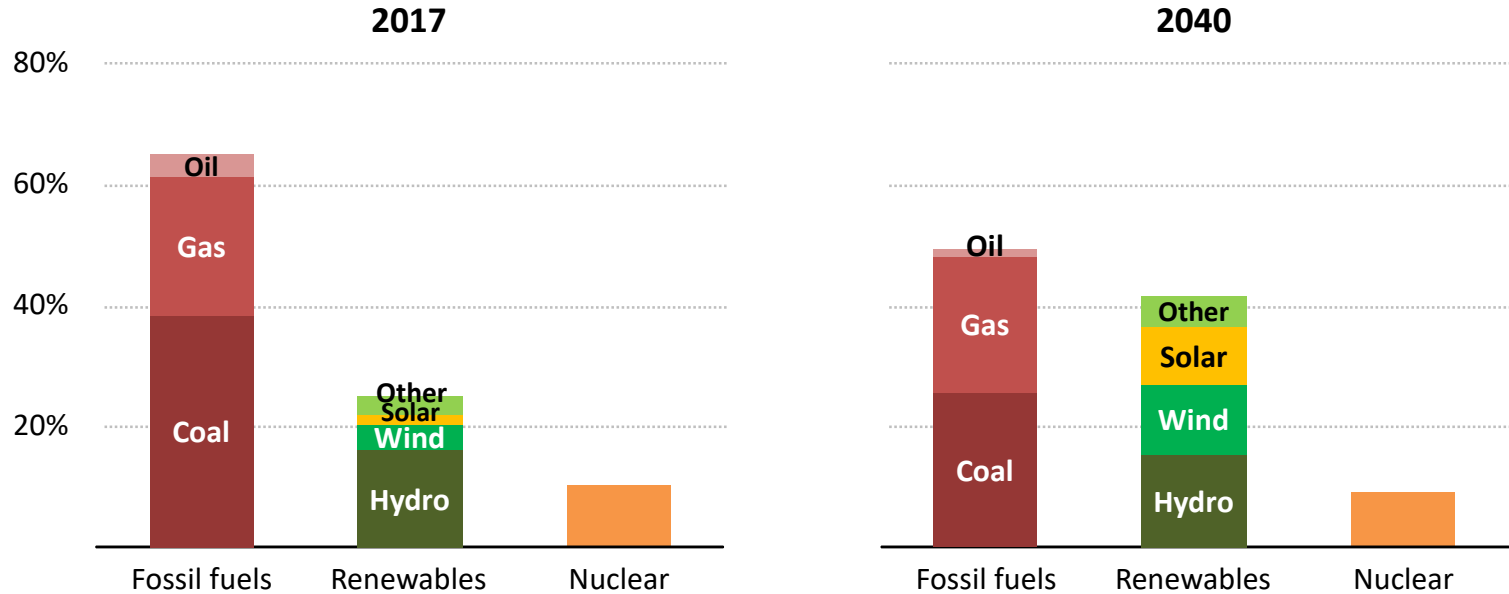
## Growth markets



*The contribution of nuclear power could decline substantially in leading markets, while large growth is coming, as China takes first position within a decade*

# The electricity landscape is transforming

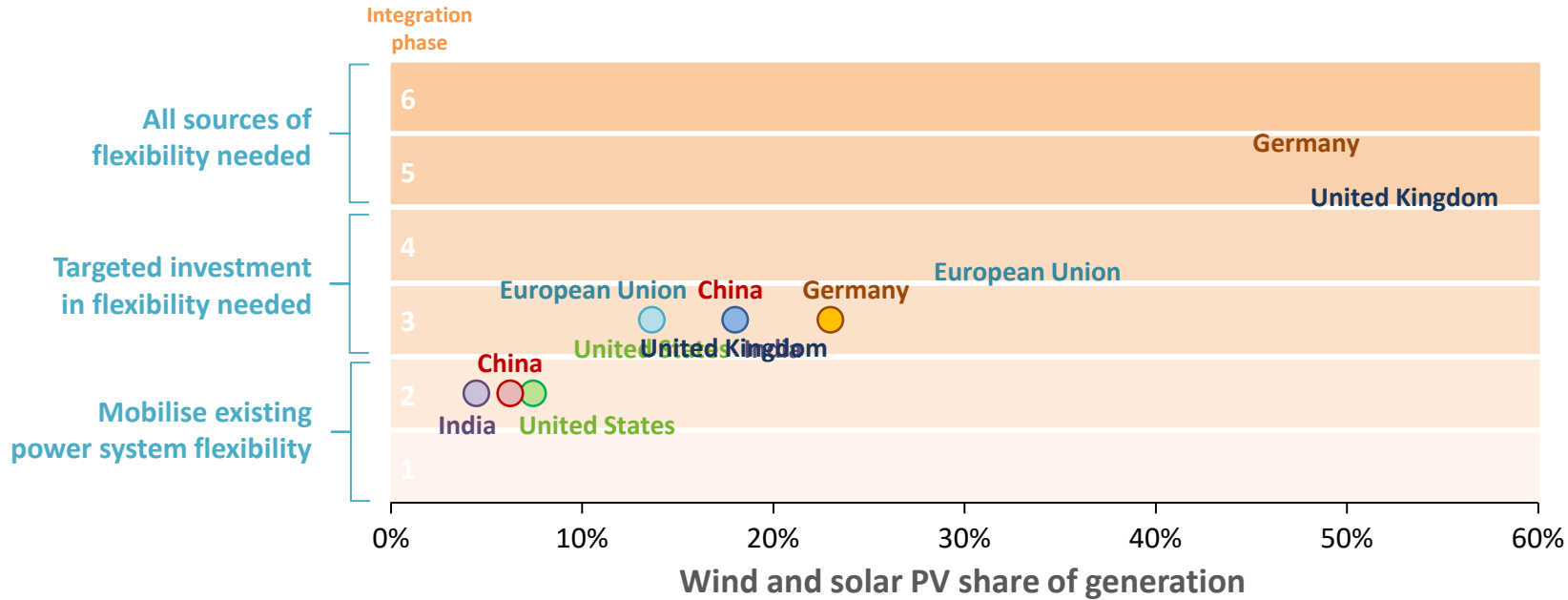
World electricity generation mix by source in the New Policies Scenario



*Coal and renewables switch roles by 2040, mainly driven by policy support and accelerated by the improving competitiveness of renewables*

# Flexibility: the cornerstone of tomorrow's power systems

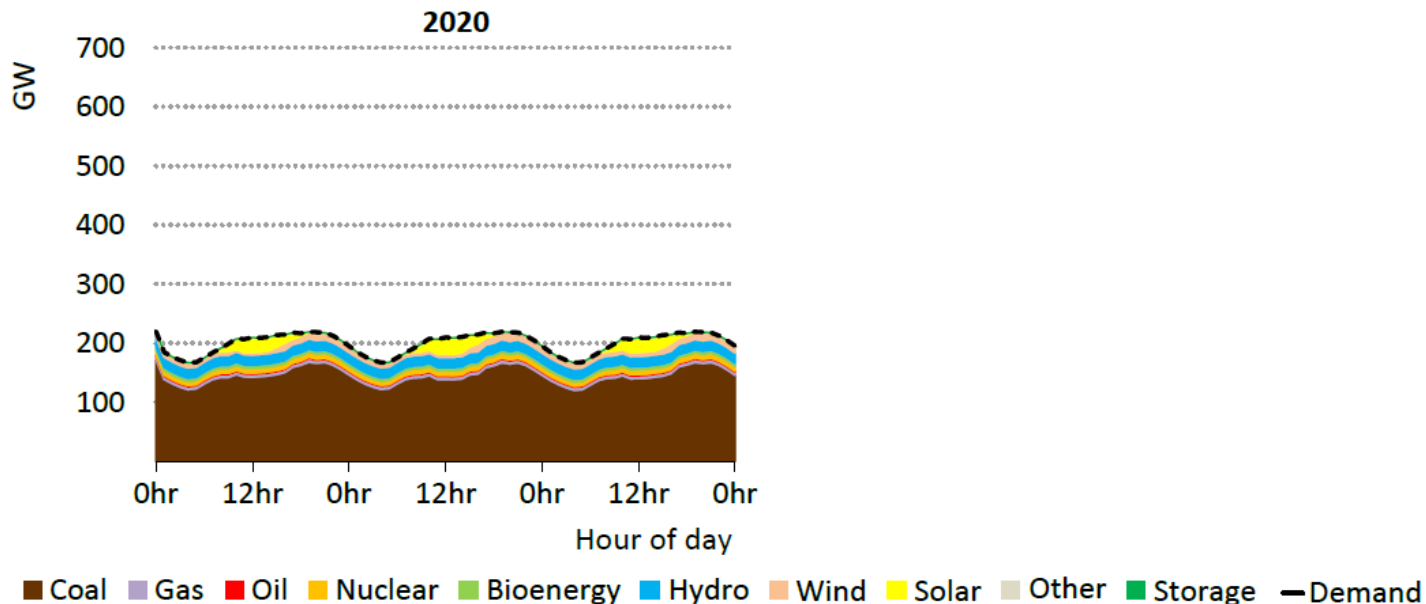
Phases of integration with variable renewables share, 2030



*Higher shares of variable renewables raise flexibility needs and call for reforms to deliver investment in power plants, grids & energy storage, and unlock demand-side response*

# Electricity demand and supply is re-shaped

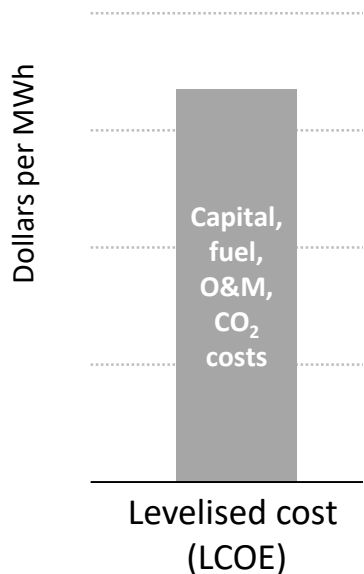
Sample days from hourly generation mix in India in the New Policies Scenario



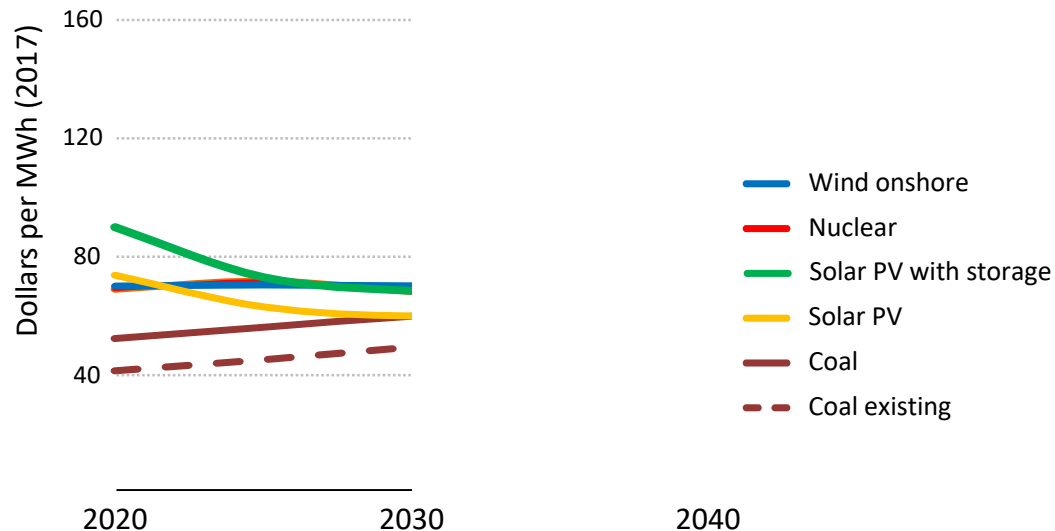
*More variability in the demand profile plus rising shares of generation from variable renewables raise system flexibility needs*

# Looking beyond the levelised cost of electricity

## Technology costs and value



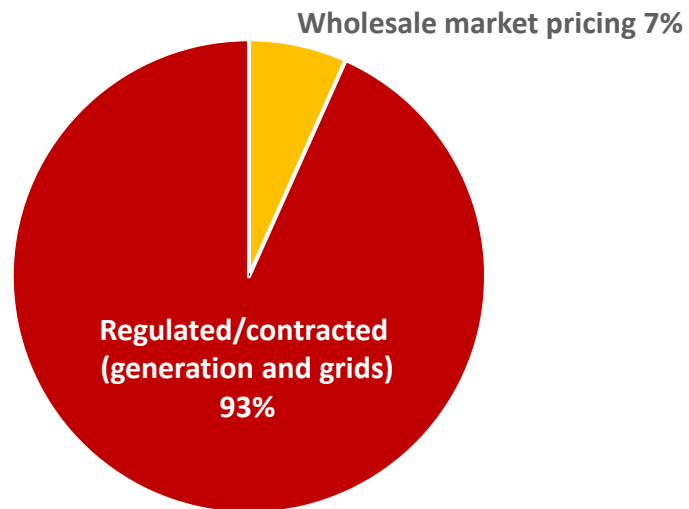
## Value-adjusted LCOEs (VALCOEs) in China



*Costs remain an important indicator of competitiveness, but better metrics are needed to reflect the changing nature and needs of power systems*

# Our energy destiny lies with governments

Power sector investment to 2040  
**\$20 trillion**

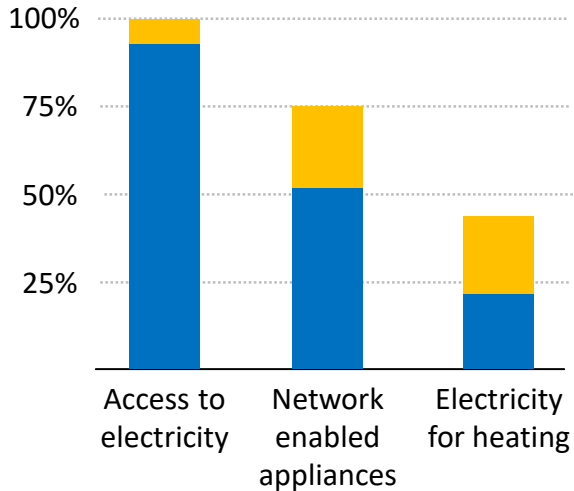


*Power sector investment continues to be driven by regulated market frameworks*

# What if the future is electric?

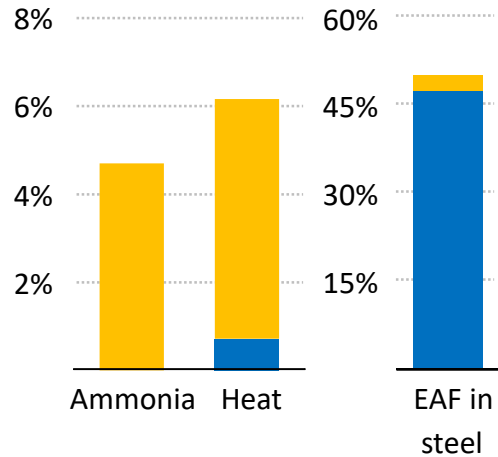
## Buildings

Level of household uptake



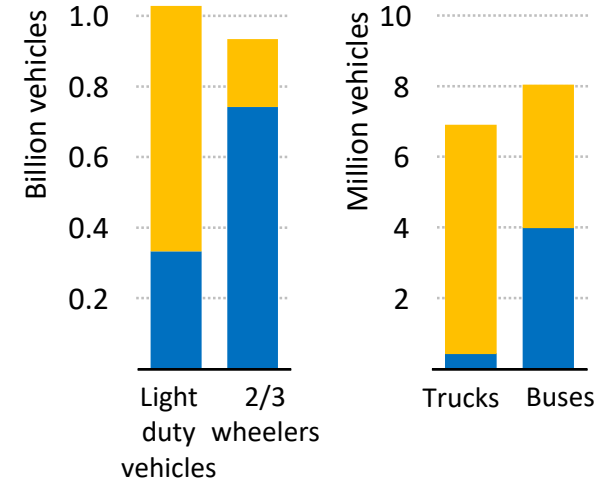
## Industry

Electrification of end-uses



## Transport

Electric vehicle fleet



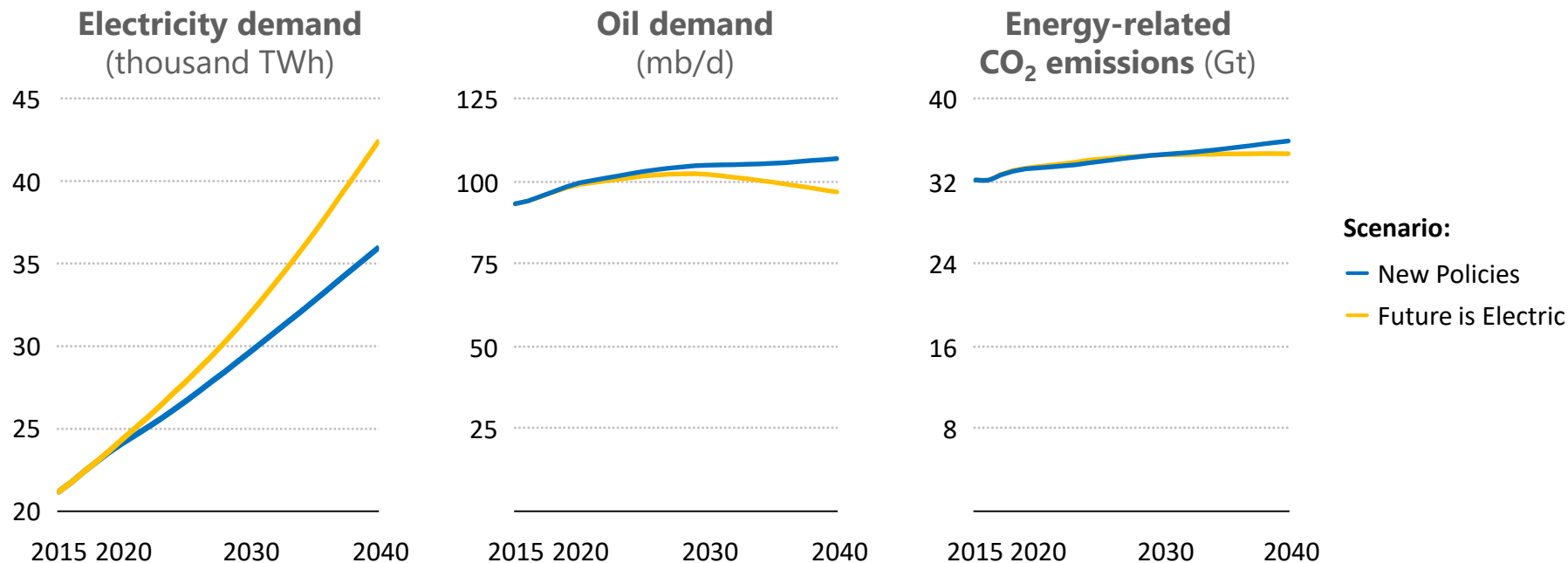
■ New Policies Scenario

■ Future is Electric Scenario

*Electrification makes inroads in all end-uses in parallel with global access to electricity and greater digitalisation*

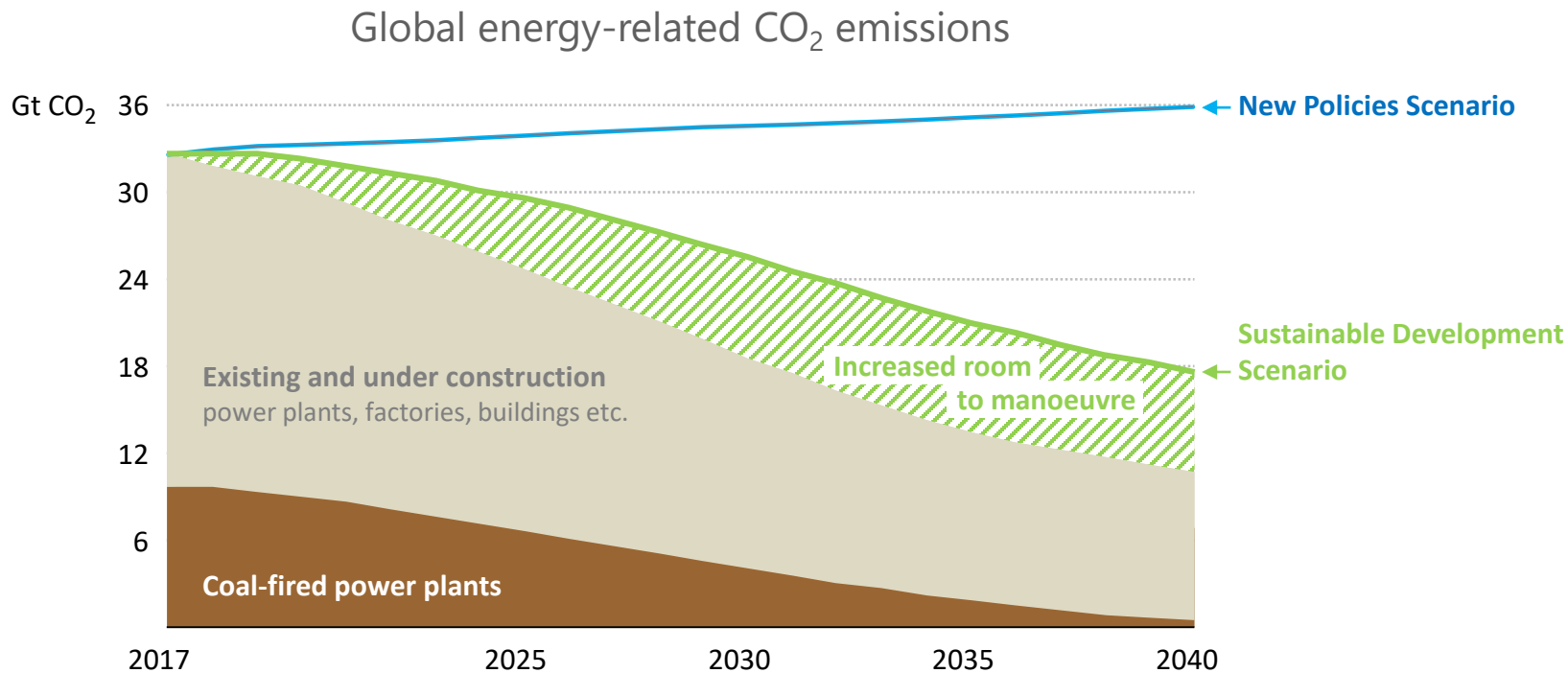


# Implications of greater electrification



*Increased electrification leads to a peak in oil demand, avoids 2 million air pollution-related premature deaths, but does not necessarily lead to large CO<sub>2</sub> emissions reductions*

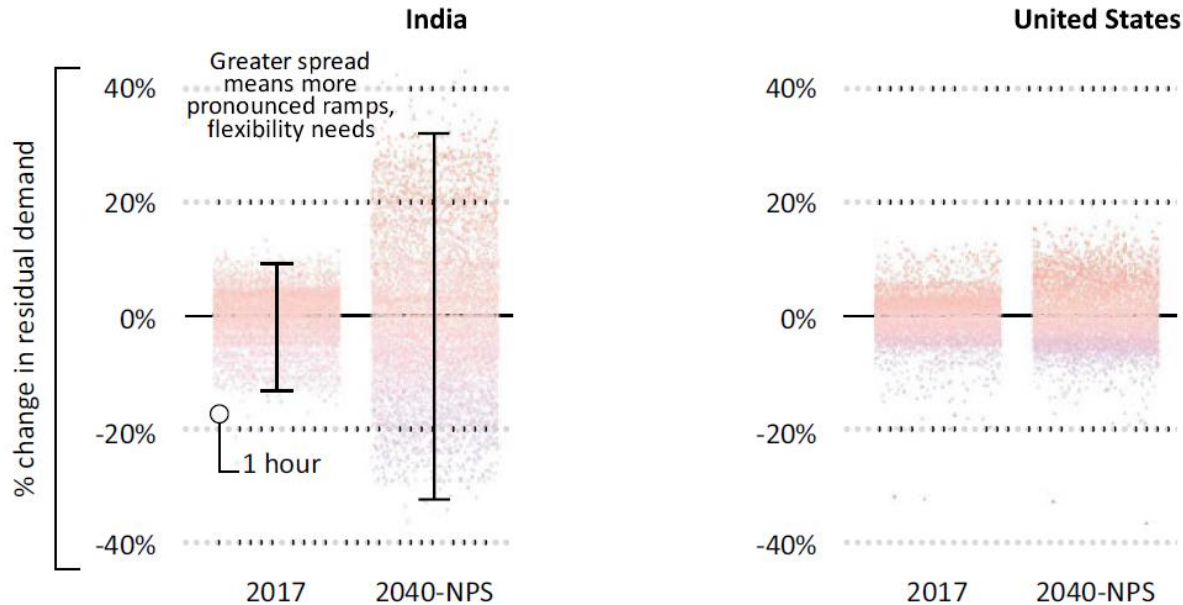
# Can we unlock a different energy future?



*Coal plants make up one-third of CO<sub>2</sub> emissions today and half are less than 15 years old; policies are needed to support CCUS, efficient operations and technology innovation*

# A sustainable pathway calls for accelerating efforts

Hourly ramping needs in the New Policies Scenario and Sustainable Development Scenario



*The Sustainable Development Scenario, consistent with the Paris Agreement, includes far higher shares of variable renewables and greater flexibility needs*

- The links between energy & geopolitics are strengthening & becoming more complex, a major factor in the outlook for energy security
- The rapid growth of electricity brings huge opportunities; but market designs need to deliver both electricity *and* flexibility to keep the lights on
- A comprehensive strategy to electrify end uses and decarbonise the power sector is needed to achieve environmental goals
- There is no single solution to turn emissions around: renewables, efficiency & a host of innovative technologies, including storage, CCUS & hydrogen, are all required
- The future pathway for energy is open: governments will determine where our energy destiny lies

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