

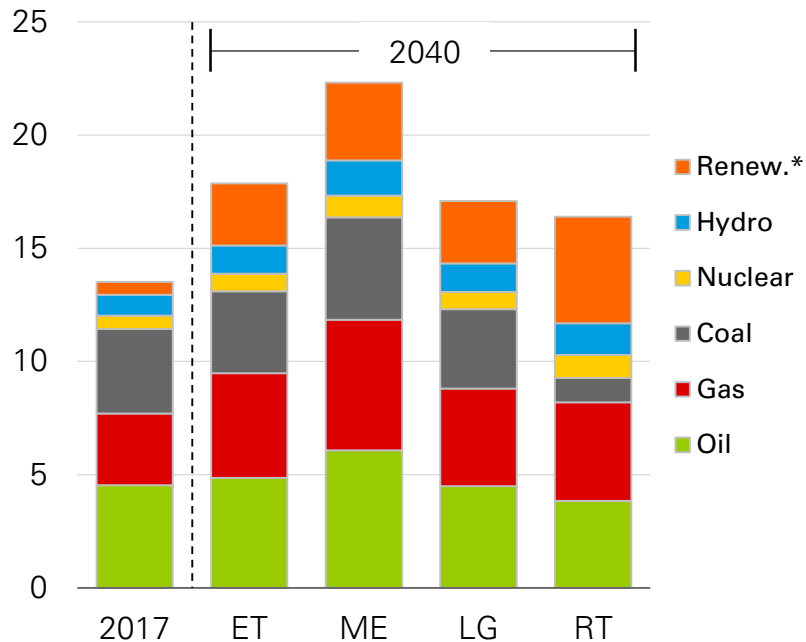
BP Energy Outlook  
2019 edition

**Spencer Dale**  
Group chief economist

# Energy Outlook scenarios

## Primary energy consumption by fuel

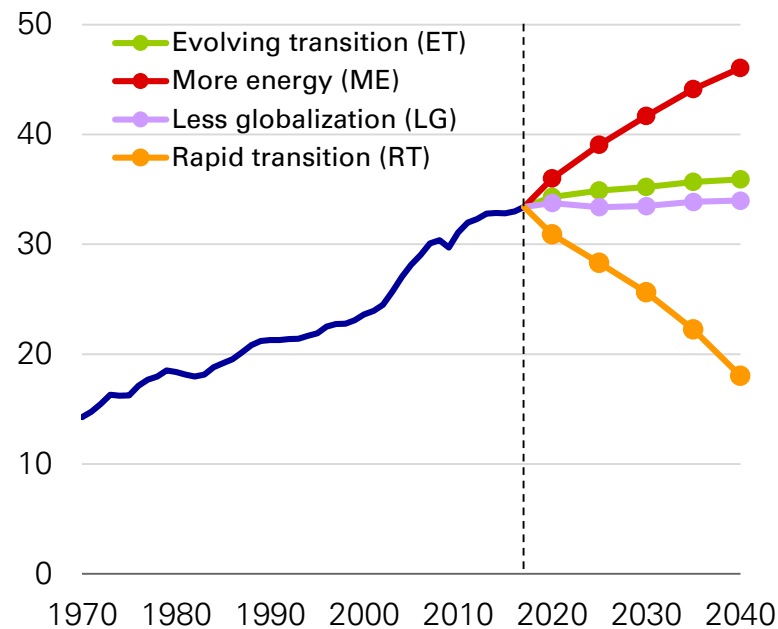
Billion toe



\*Renewables includes wind, solar, geothermal, biomass and biofuels

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

Gt of CO<sub>2</sub>

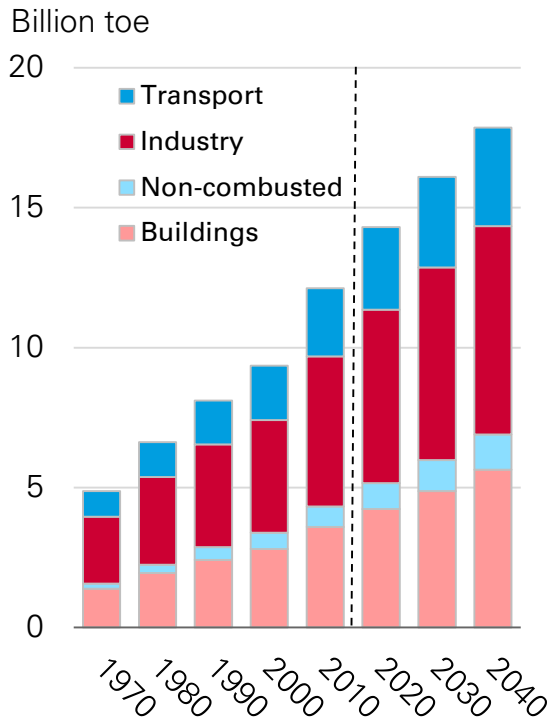




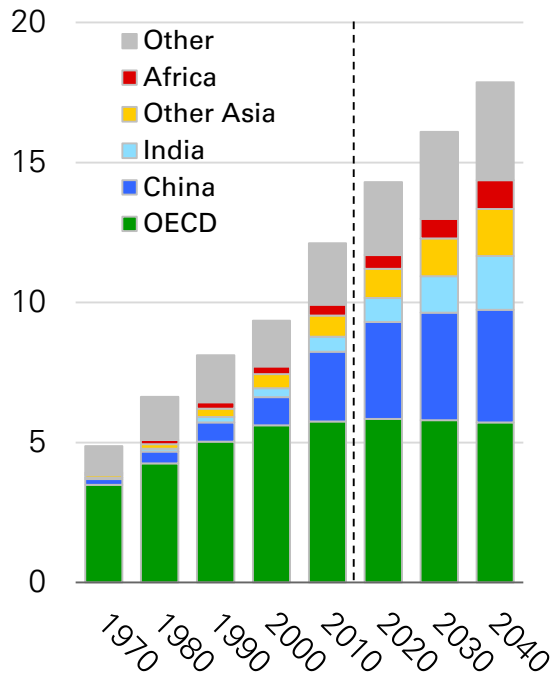
# Three windows on the energy transition

## Primary energy demand

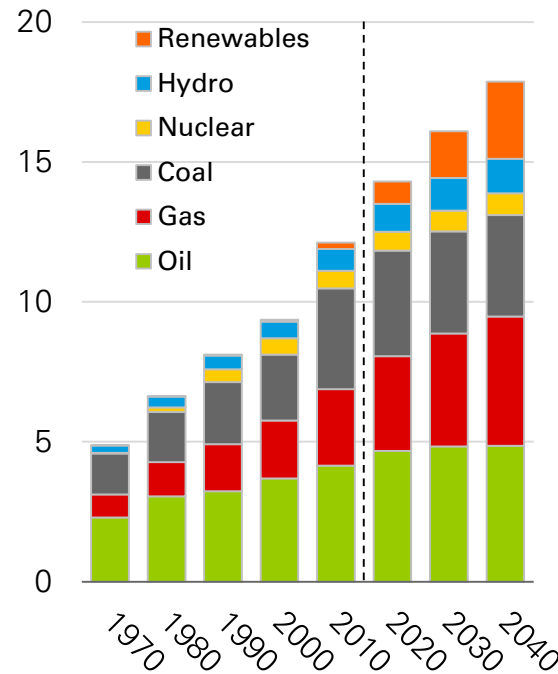
End-use sector



Region

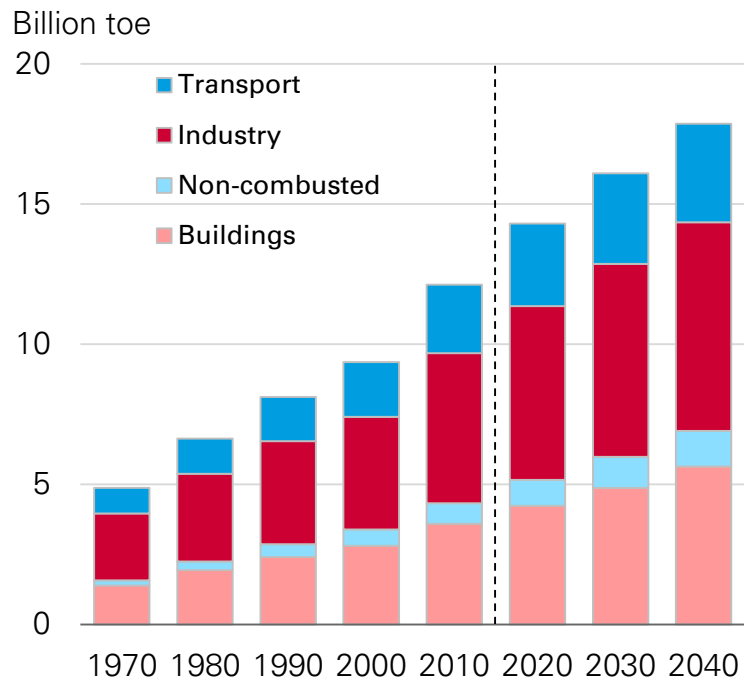


Fuel

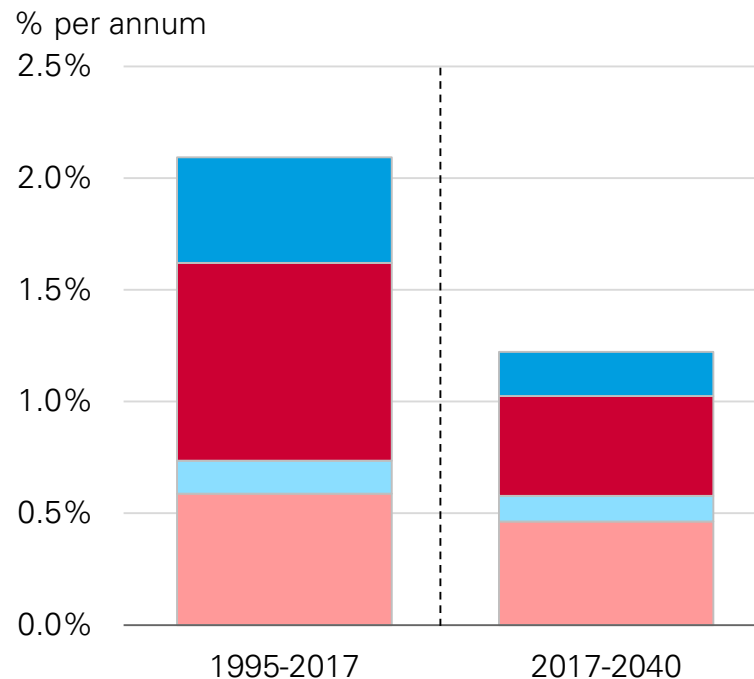


# Energy demand by sector

## Primary energy consumption by end-use sector



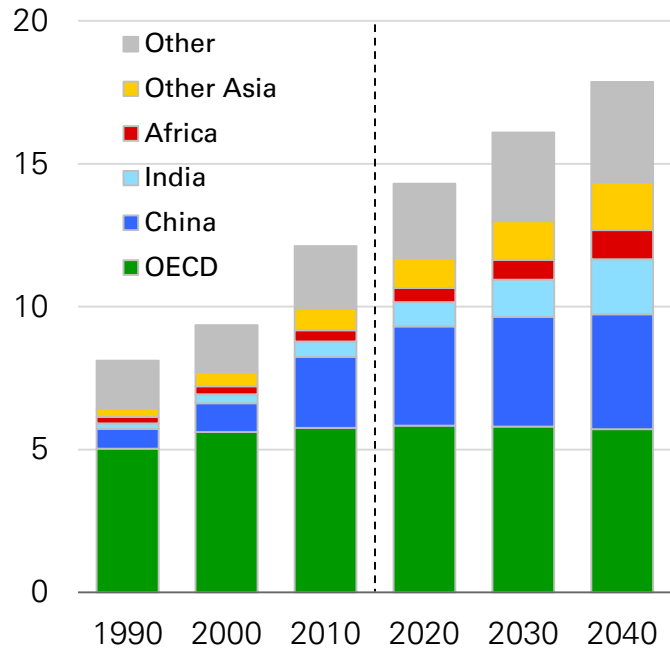
## Annual demand growth and sector contributions



# Regional energy demand

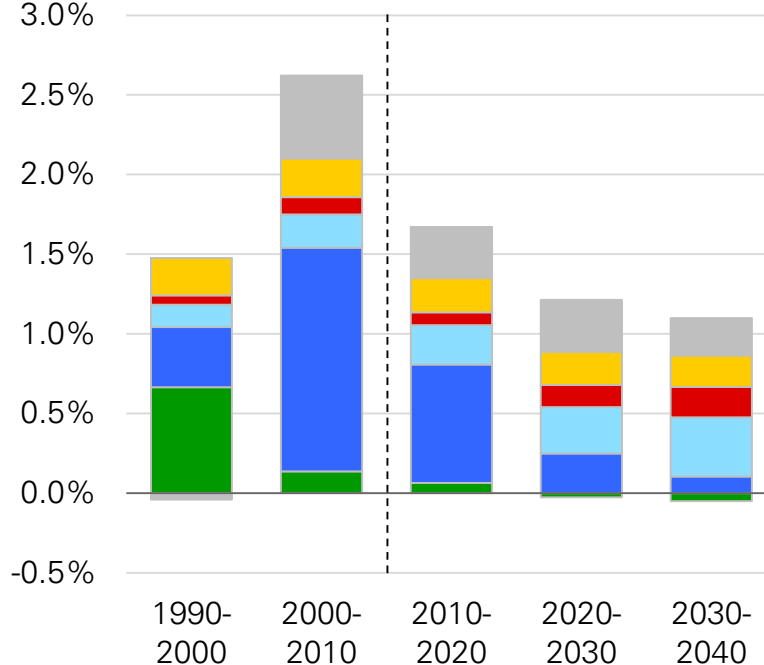
## Primary energy consumption by region

Billion toe



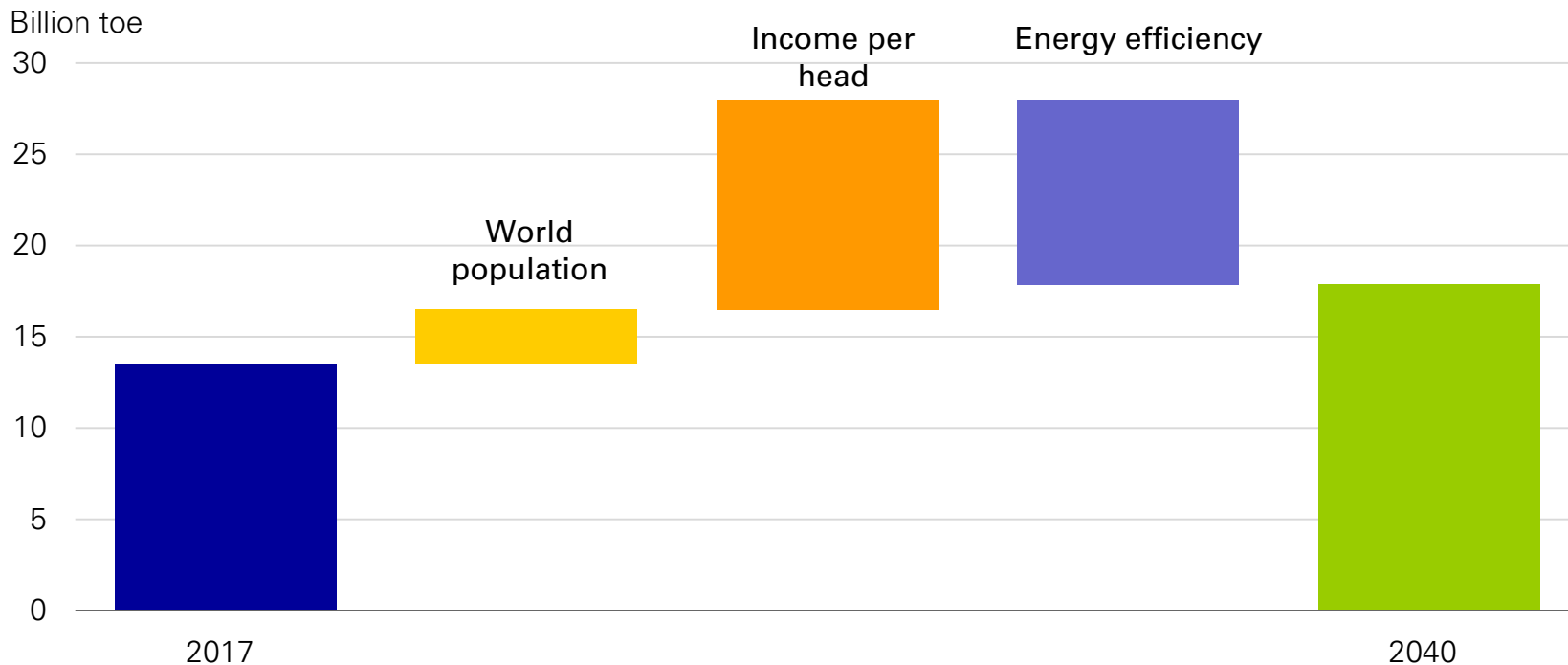
## Primary energy growth and regional contributions

% per annum



# Increase in primary energy demand

Increase in primary energy demand, 2017-2040

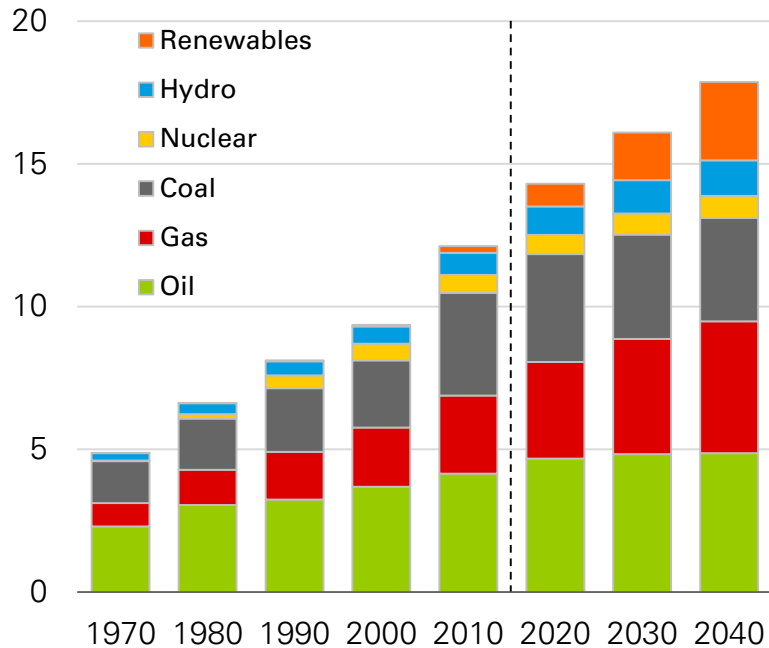




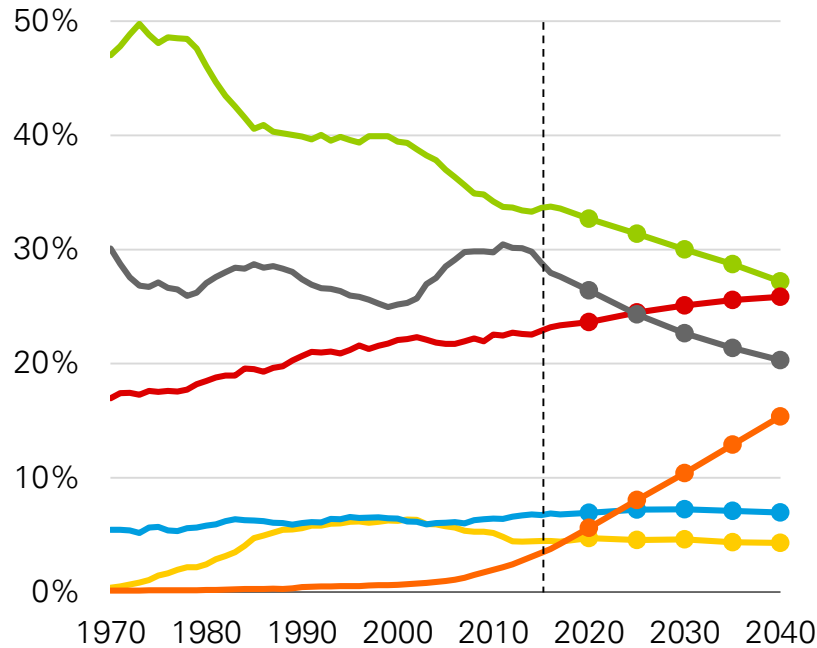
# Global energy by fuel type

## Primary energy consumption by fuel

Billion toe



## Shares of primary energy

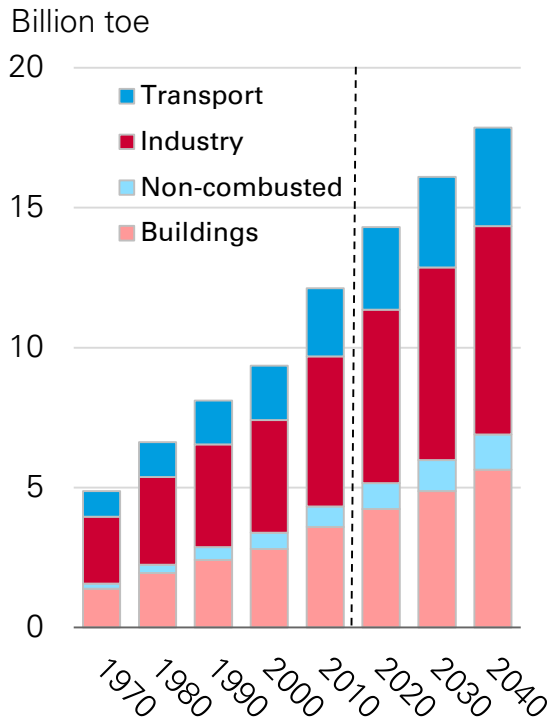




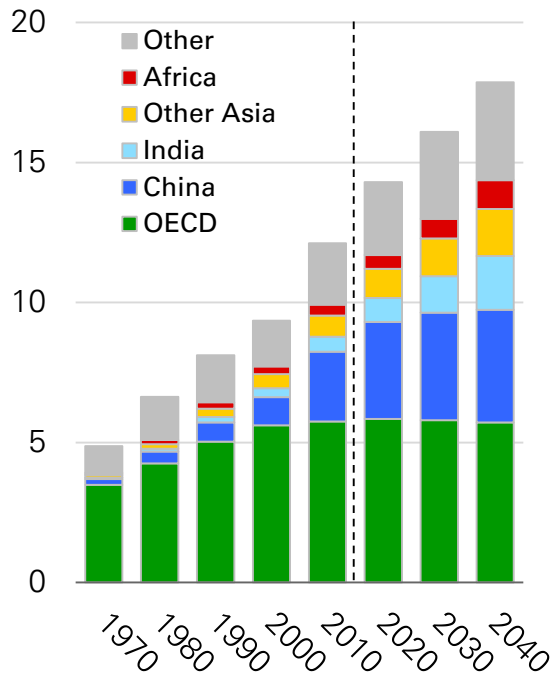
# Three windows on the energy transition

## Primary energy demand

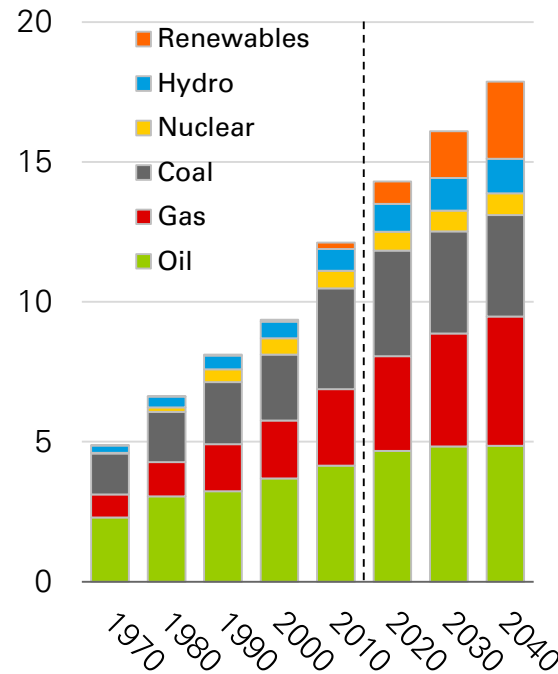
End-use sector



Region



Fuel







## Five key questions and uncertainties

- ▶ How much 'more energy' does the world need?
- ▶ How important are plastics for the future of oil demand?
- ▶ What might happen if the trade disputes escalate?
- ▶ How quickly could renewables grow?
- ▶ A low-carbon energy system: what more needs to be done?



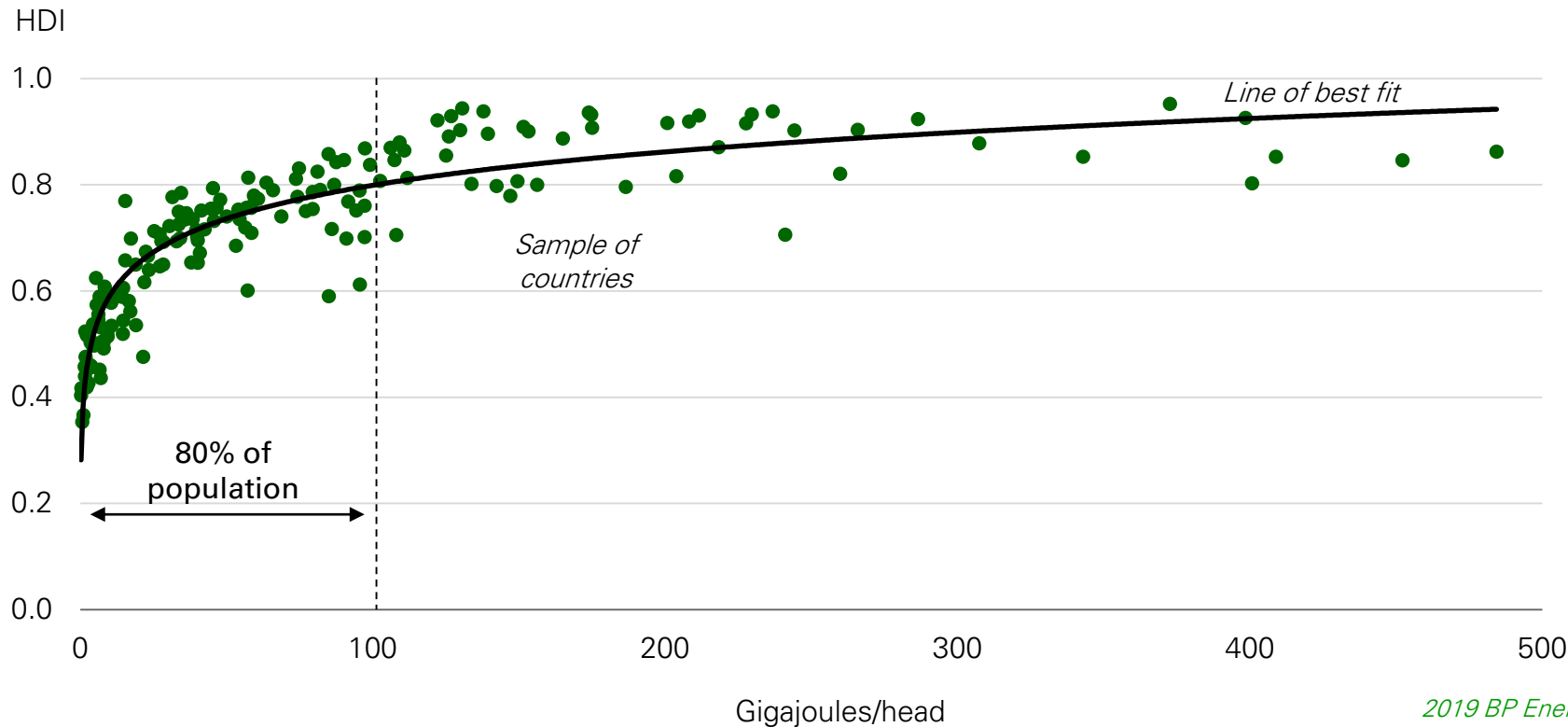
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# Human development and energy consumption

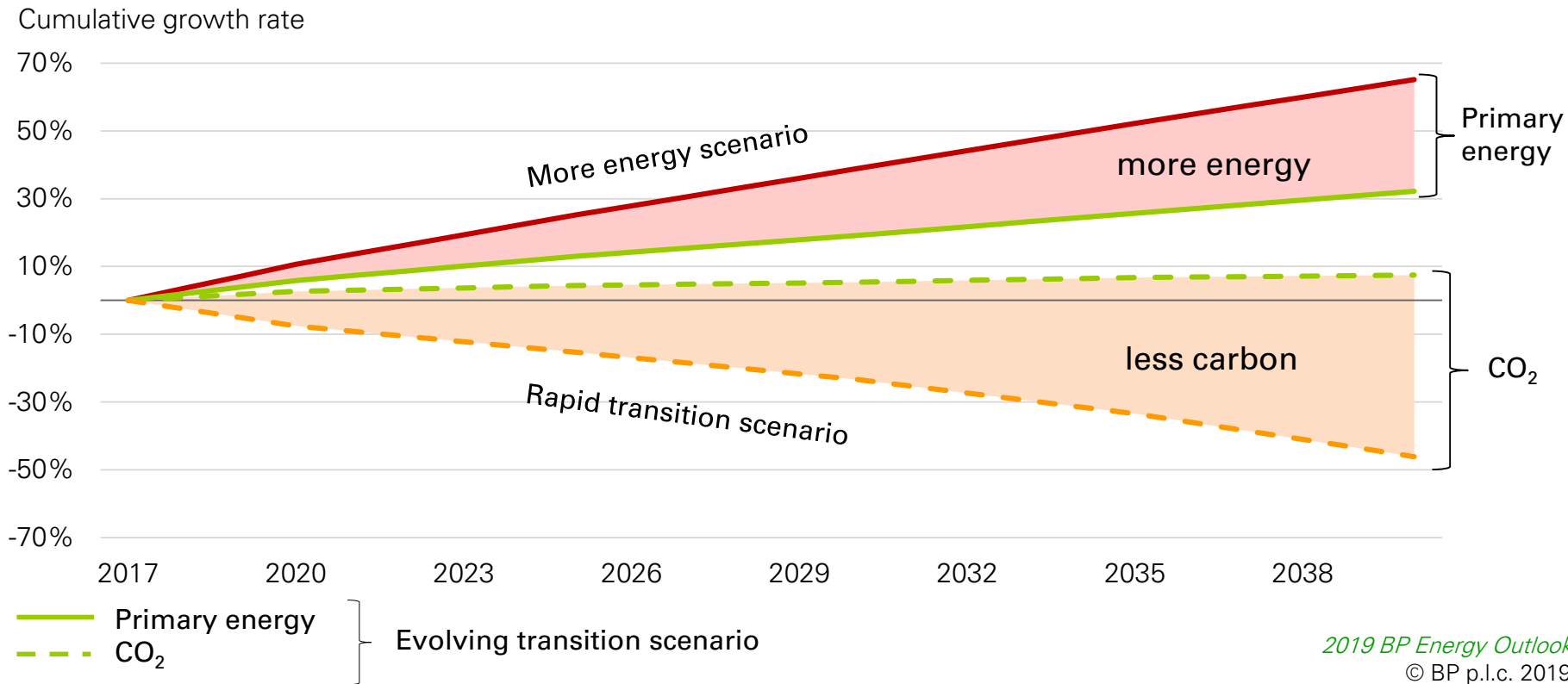
UN Human Development Index and energy consumption, 2017





# Dual challenge: more energy, less carbon

## Primary energy demand and carbon emissions



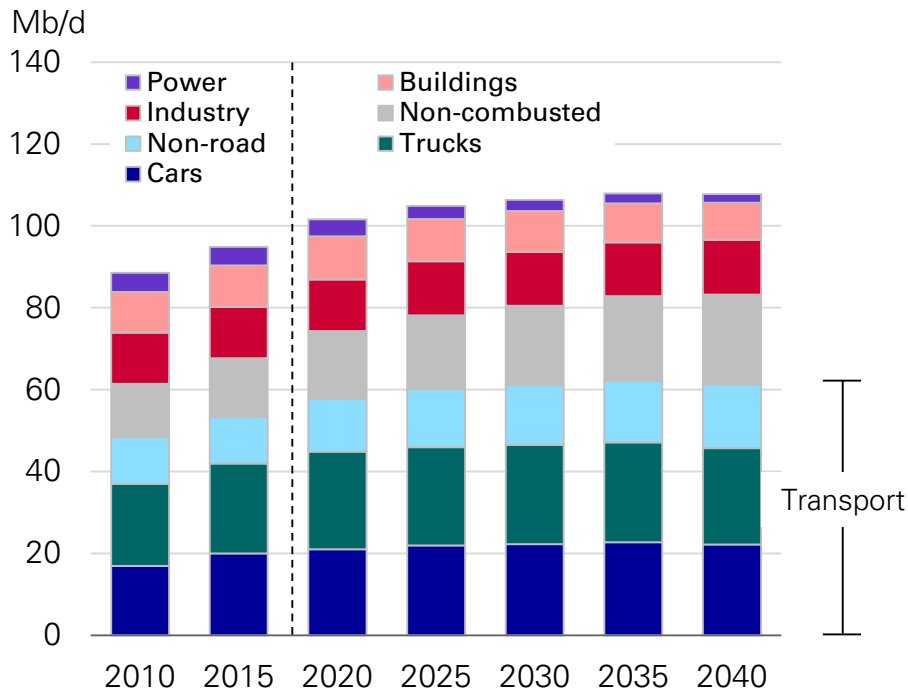


## Five key questions and uncertainties

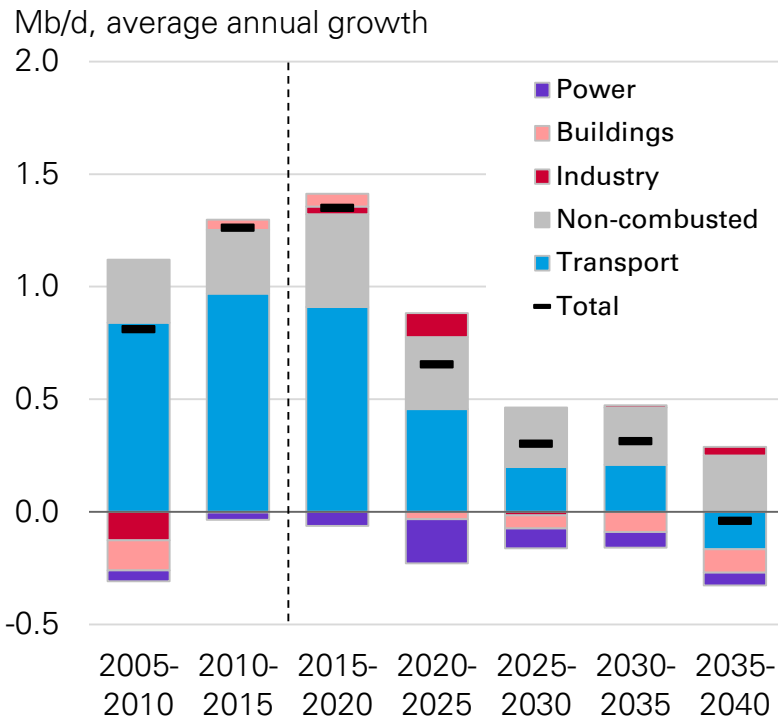
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# Demand for oil and other liquid fuels

## Liquids demand

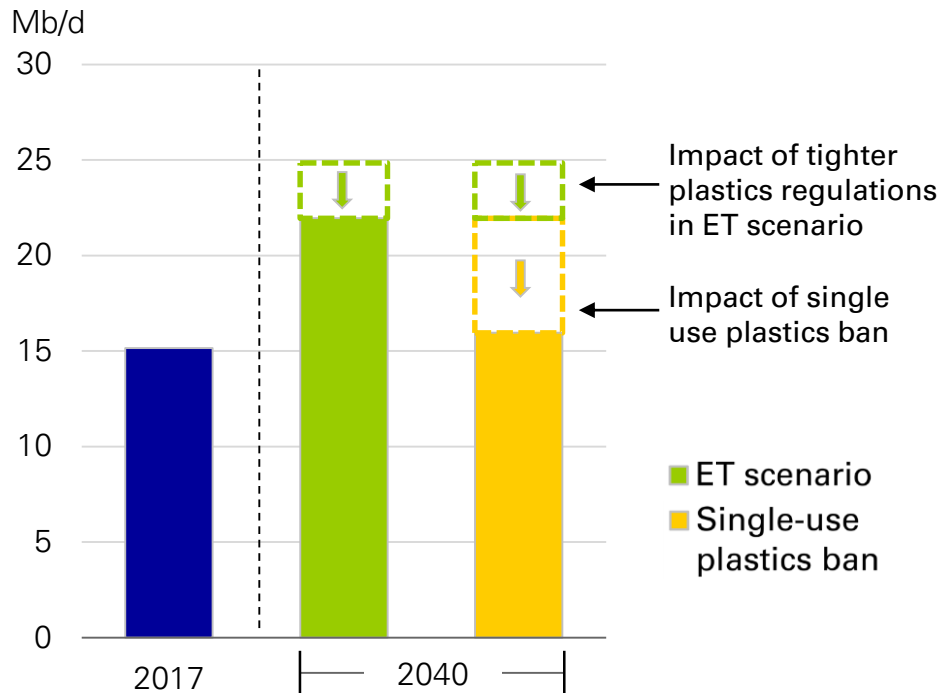


## Liquids demand growth

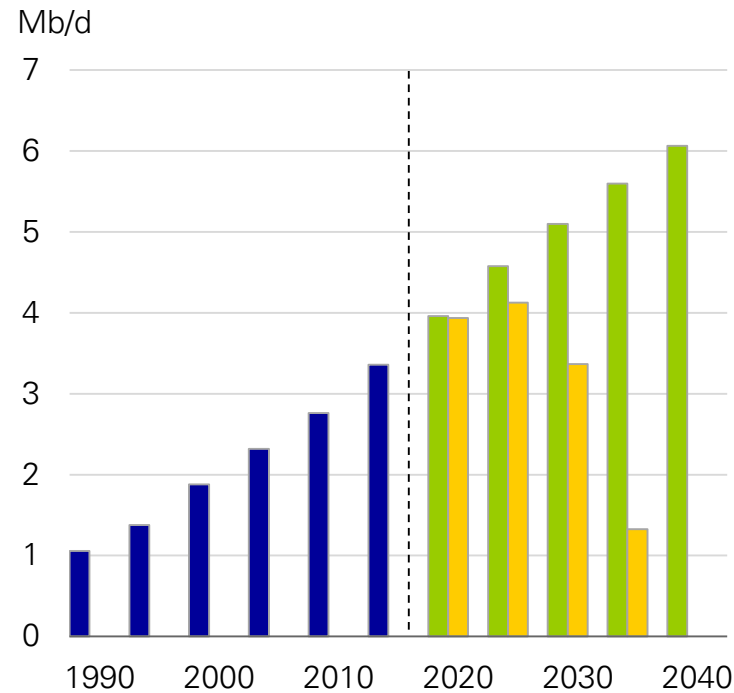


# Demand for liquid fuels and plastics

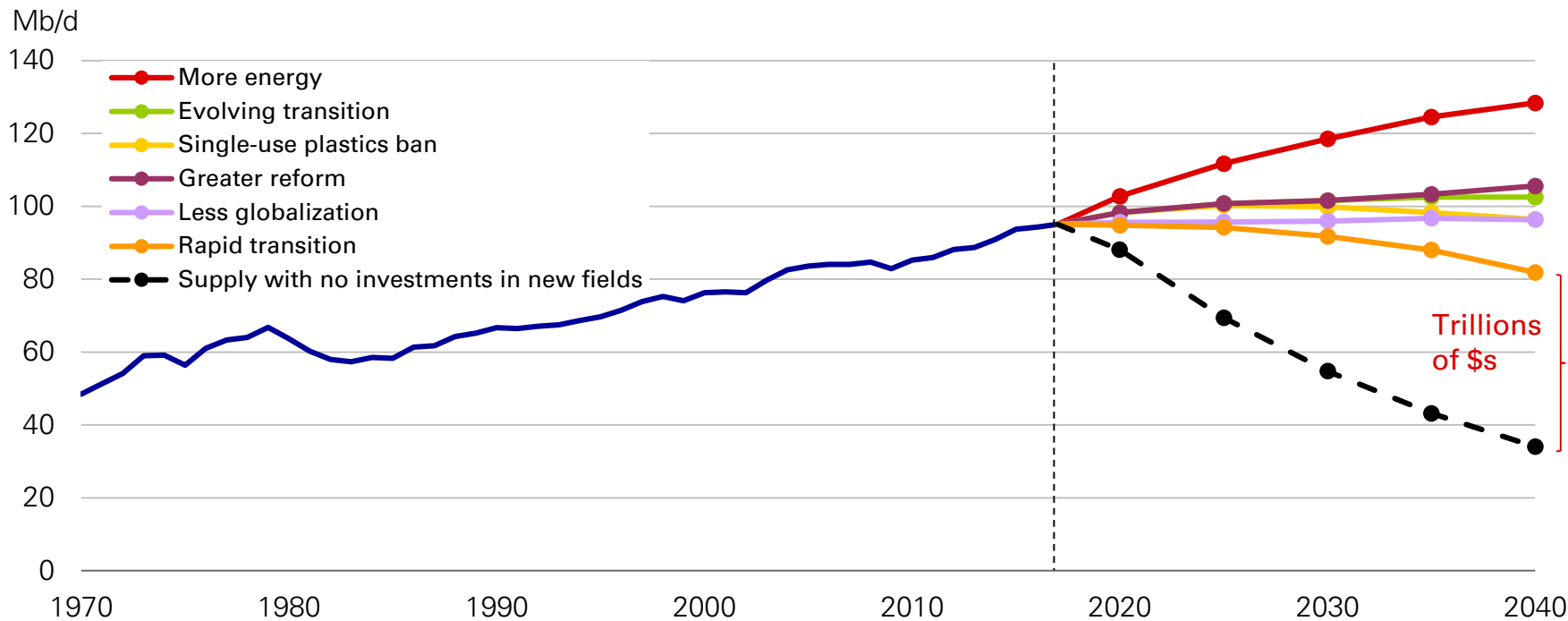
## Demand for non-combusted liquid fuels



## Liquid feedstocks for single-use plastics



# Demand and supply of oil







## Five key questions and uncertainties

- ▶ How much 'more energy' does the world need?
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- ▶ **What might happen if the trade disputes escalate?**
- ▶ How quickly could renewables grow?
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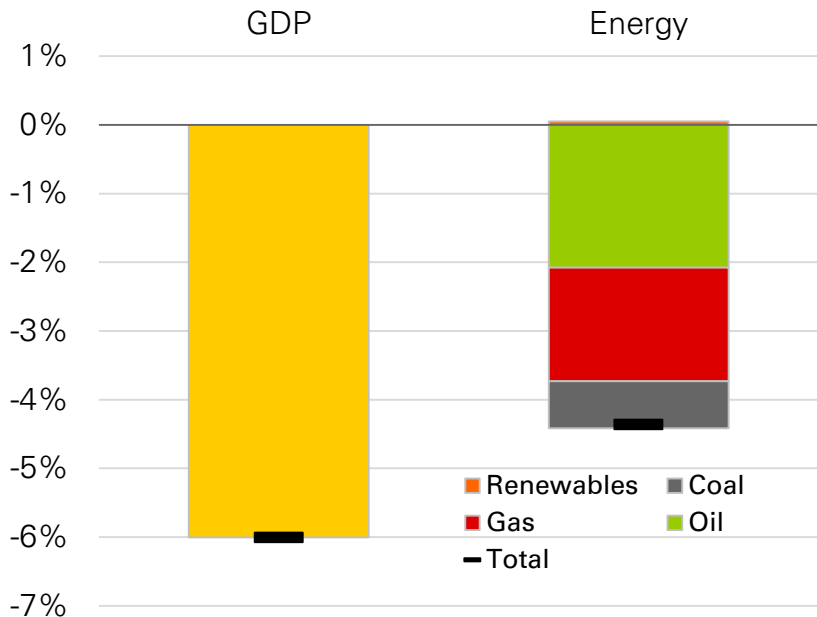


## Less globalization scenario

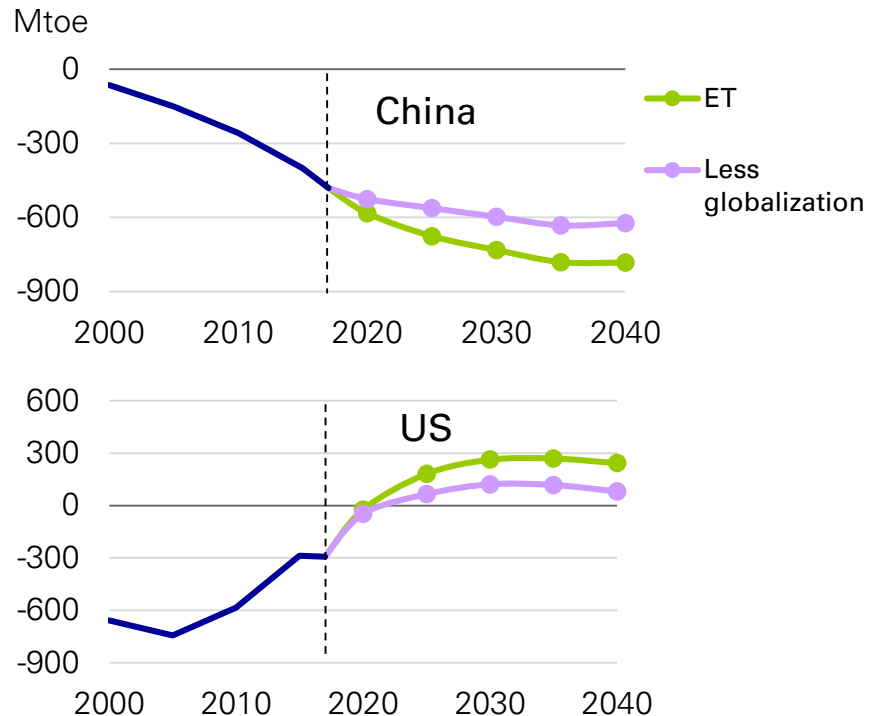
- ▶ Reduced openness and trade leads to slight reduction in trend global GDP growth
- ▶ Concerns about energy security adds a small risk premium (10%) to imported energy

# Alternative scenario: Less globalization

Difference relative to ET scenario in 2040:  
Global GDP and energy



Net exports (oil & gas)





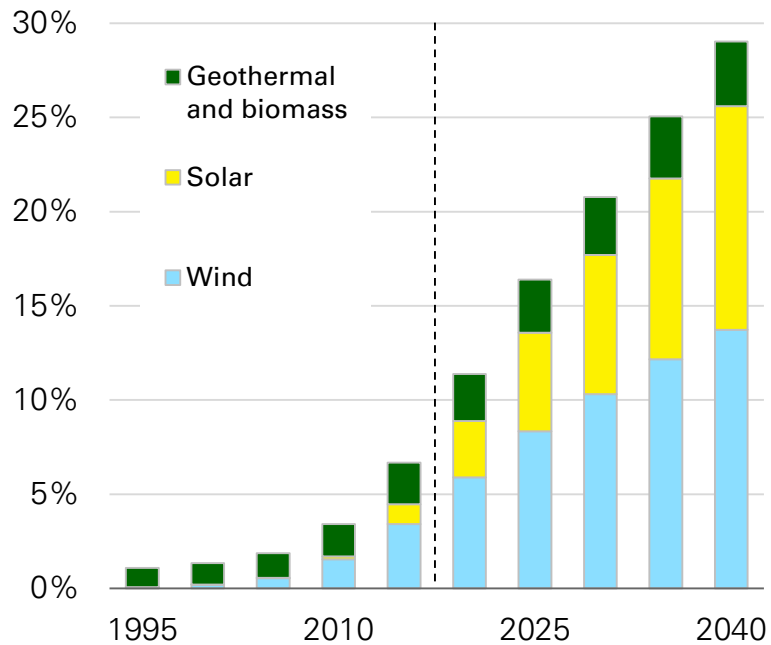
# Five key questions and uncertainties

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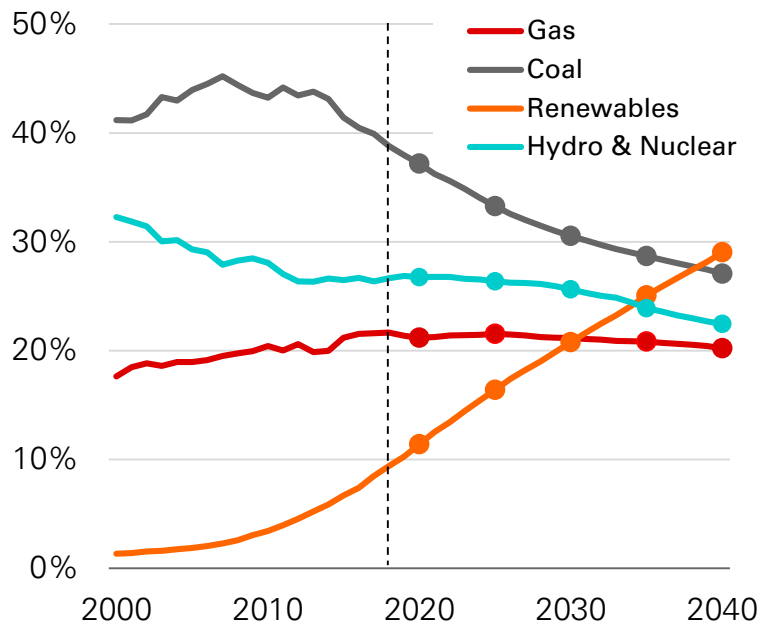
# Renewable energy



## Renewables share of power generation



## Fuel shares in power

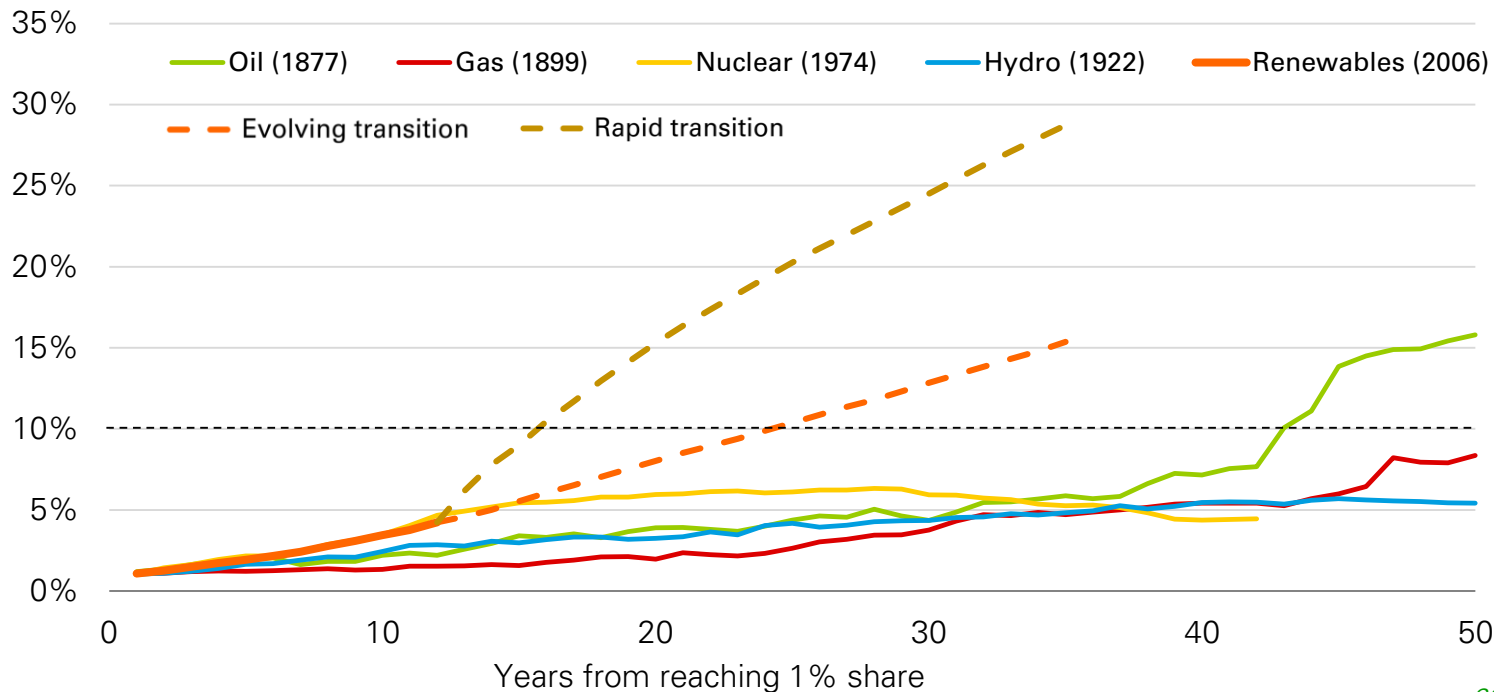


# Speed of energy transition



## Speed of penetration of new fuels in global energy system

Share of world energy





## Five key questions and uncertainties

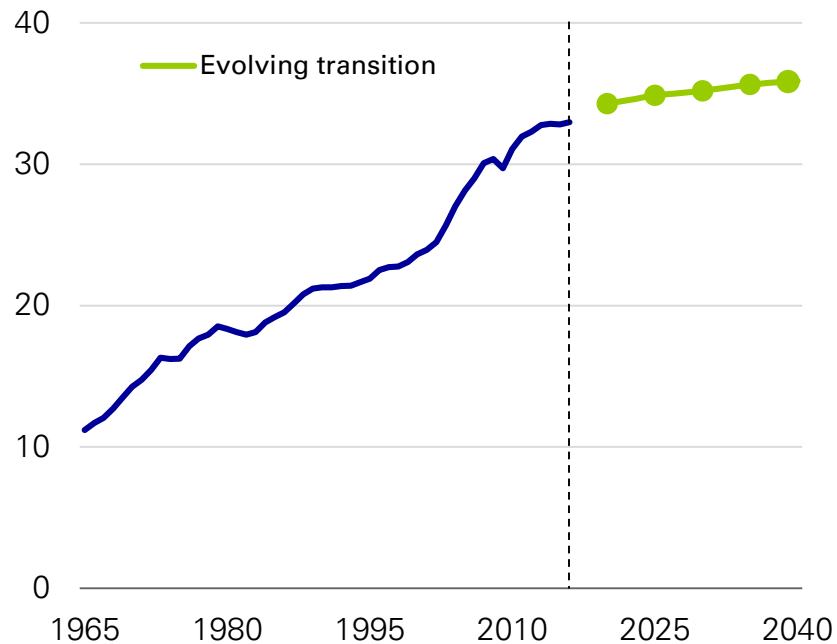
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# CO<sub>2</sub> emissions in ET scenario

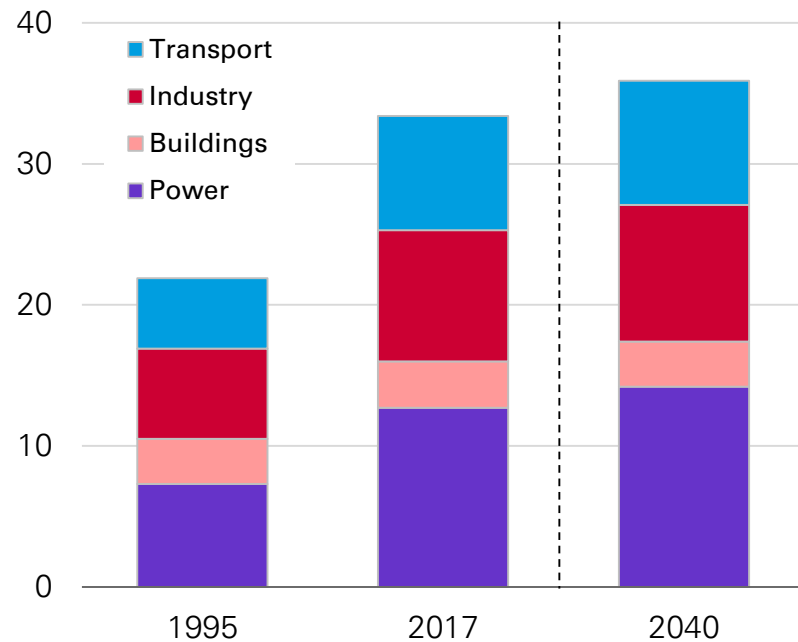
## CO<sub>2</sub> emissions

Gt of CO<sub>2</sub>



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

Gt of CO<sub>2</sub>





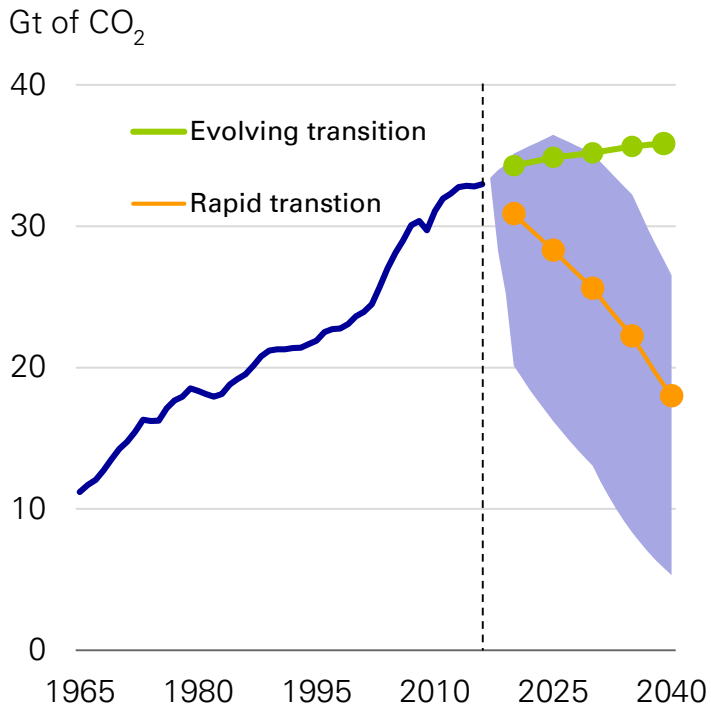


## Rapid transition scenario: policy measures

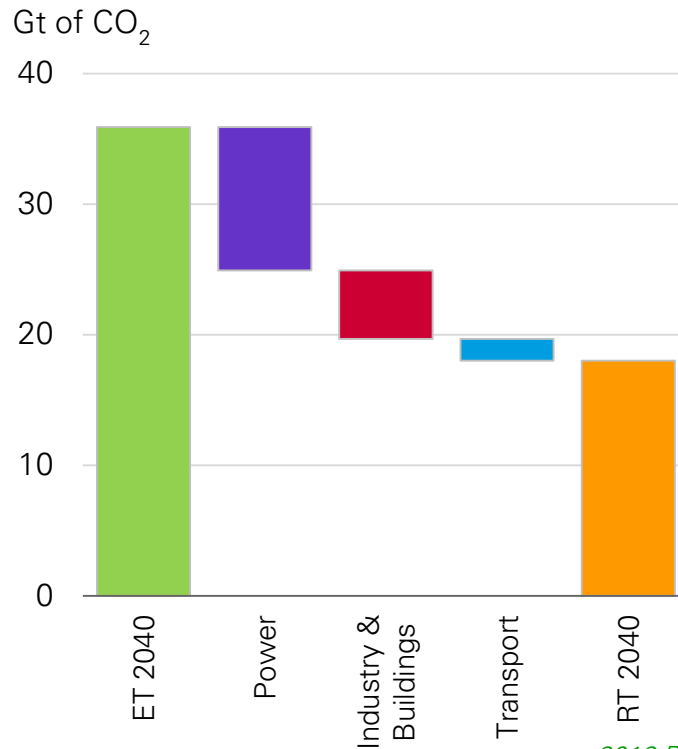
- ▶ Wide range of policy measures: broadly equivalent in terms of their implied costs and effort
- ▶ No silver bullet: a comprehensive set of policy measures is needed
- ▶ Carbon prices are key, especially in the power and industrial sectors
- ▶ Role for targeted regulatory measures, especially until carbon prices reach material levels

# CO<sub>2</sub> emissions

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

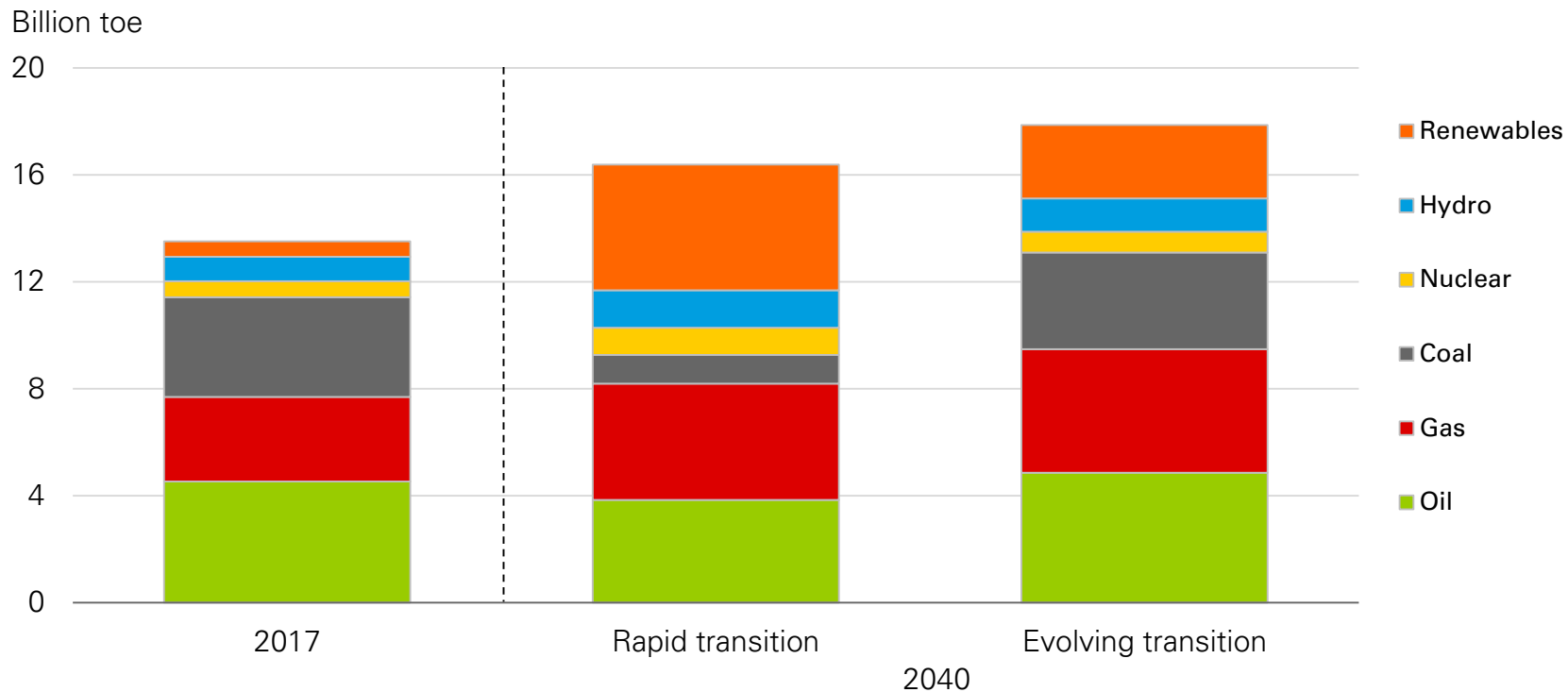


## CO<sub>2</sub> in 2040: ET vs RT scenario



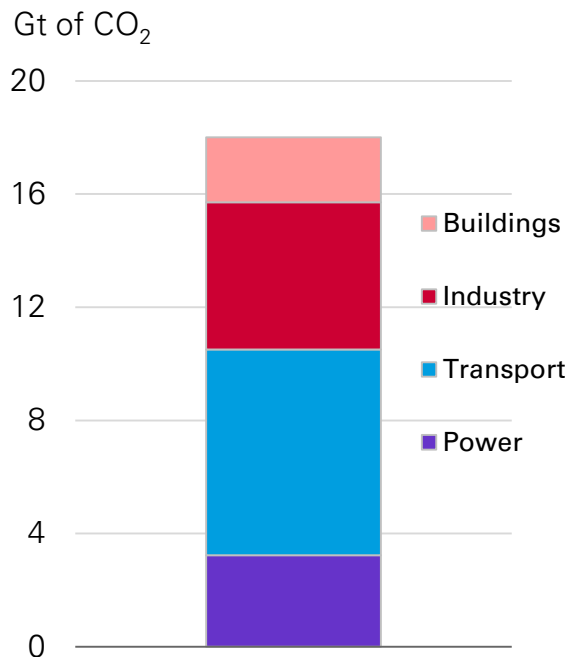
# Global energy demand and fuel mix

## Primary energy consumption by fuel



# Hard-to-abate carbon emissions

CO<sub>2</sub> emissions in RT scenario in 2040



## Decarbonise power sector

- Renewables
- Gas (and coal) plus CCUS
- Energy storage and demand-side-response

## Other low-carbon energy sources and carriers

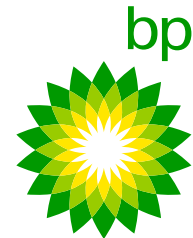
- Hydrogen
- Bioenergy

## Efficiency

- Circular economy
- Process efficiency

## Storage and removal of carbon

- CCUS
- Negative emission technologies, eg land carbon, bioenergy with CCS (BECCS)



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