

BP Energy Outlook

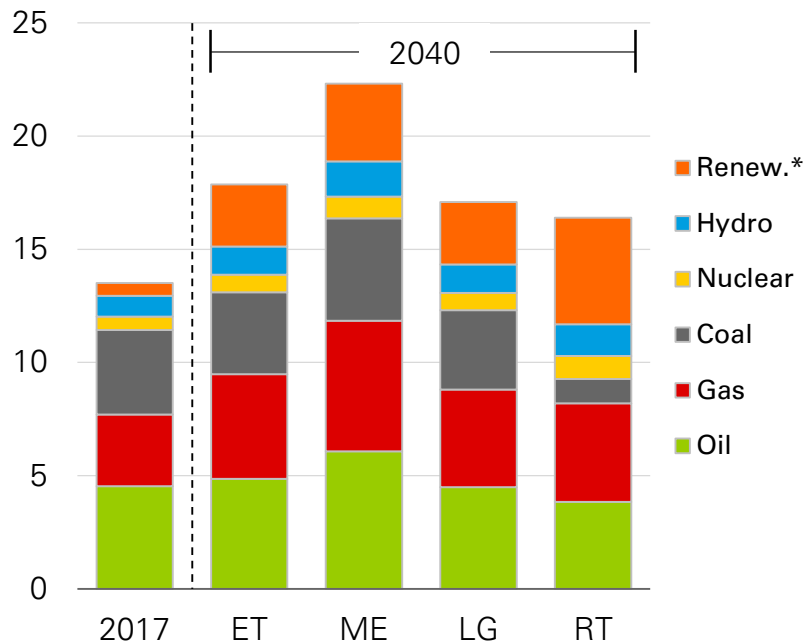
2019 edition

Spencer Dale
Group chief economist

Energy Outlook scenarios

Primary energy consumption by fuel

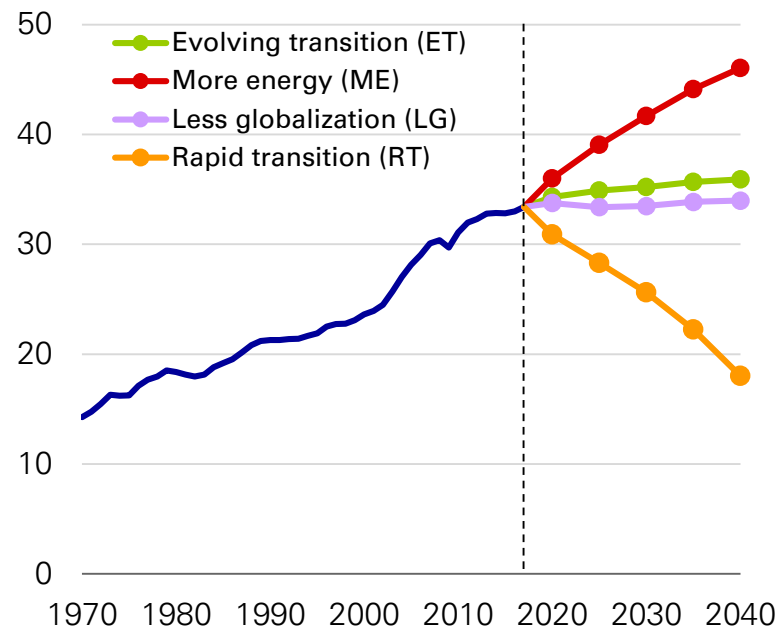
Billion toe



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

CO₂ emissions

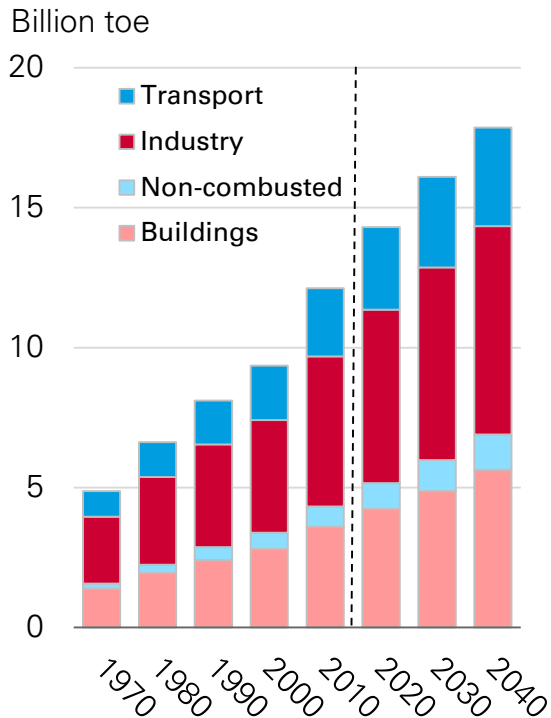
Gt of CO₂



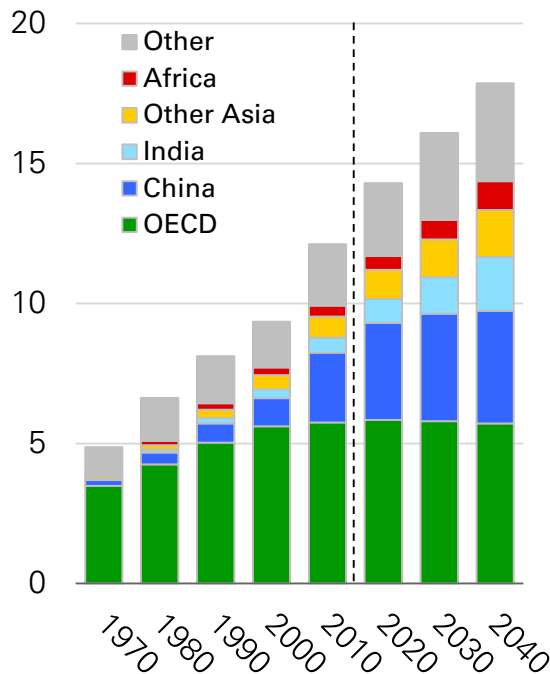
Three windows on the energy transition

Primary energy demand

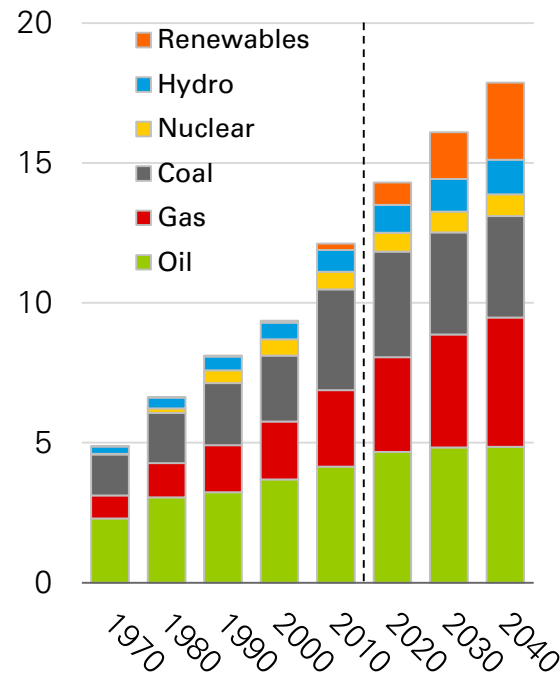
End-use sector



Region



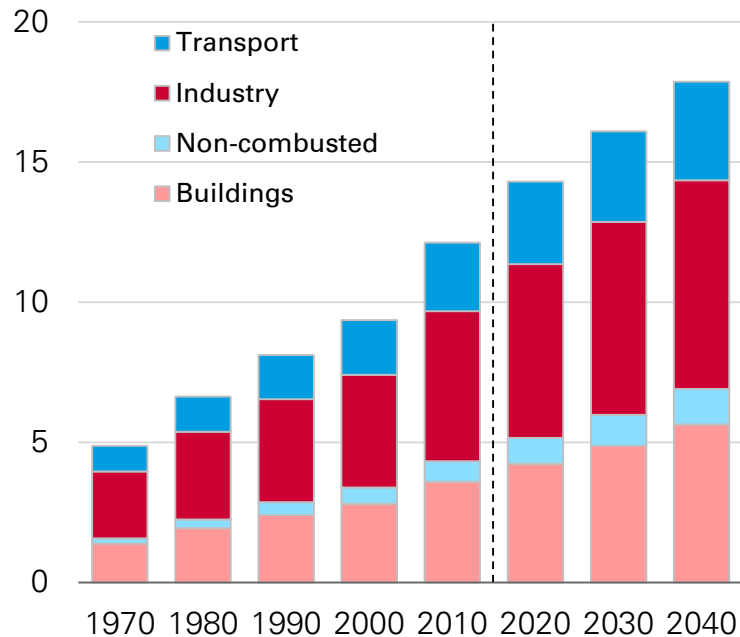
Fuel



Energy demand by sector

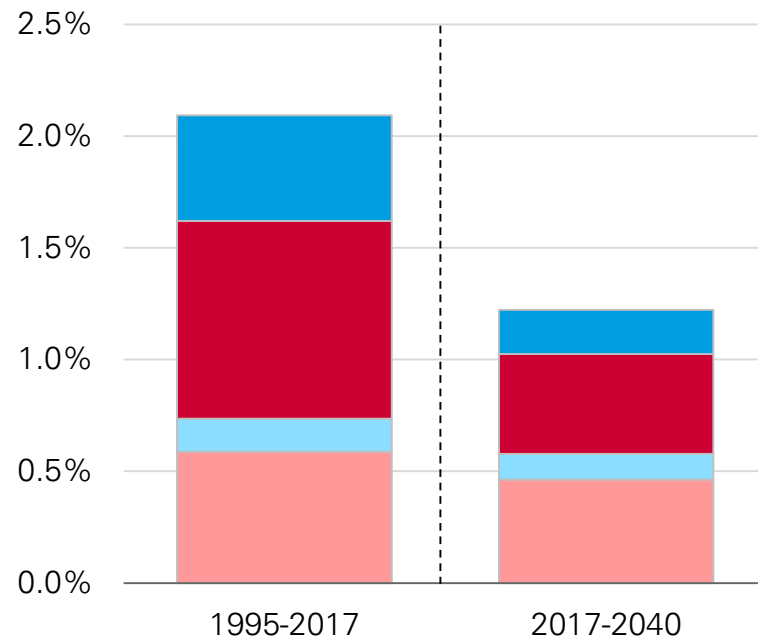
Primary energy consumption by end-use sector

Billion toe



Annual demand growth and sector contributions

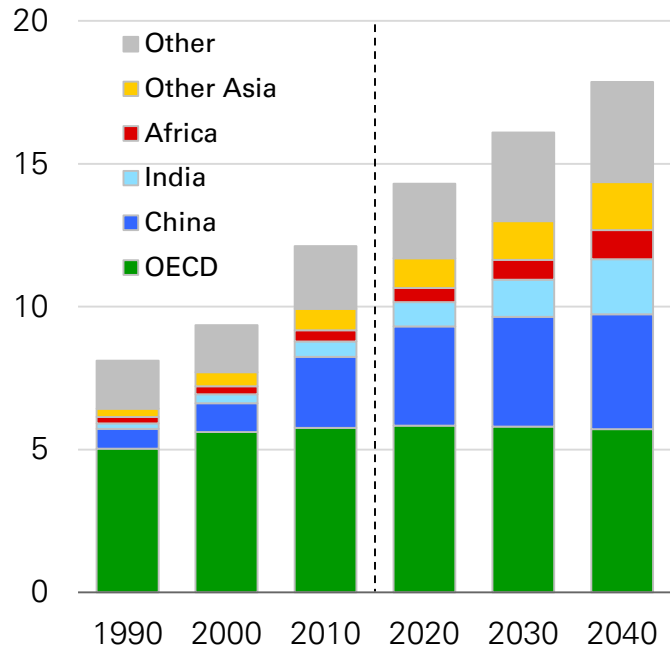
% per annum



Regional energy demand

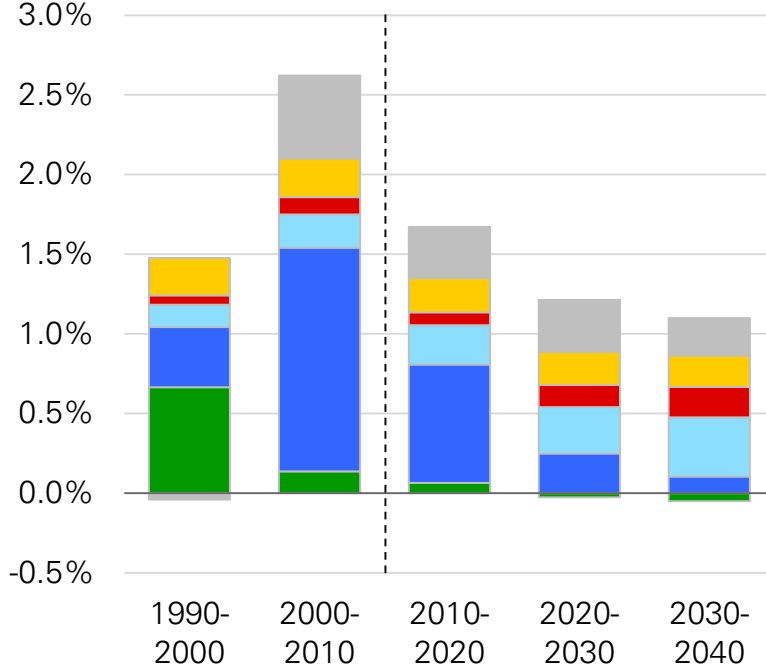
Primary energy consumption by region

Billion toe



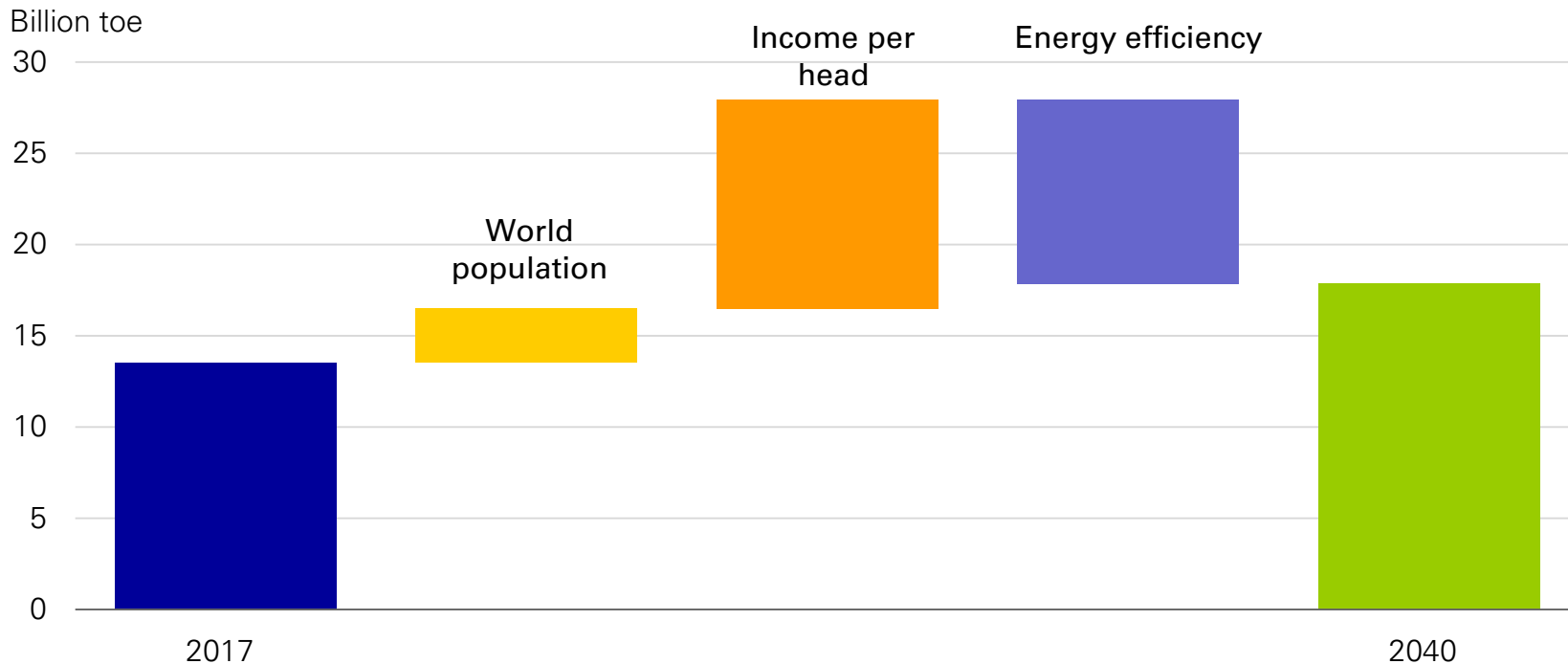
Primary energy growth and regional contributions

% per annum



Increase in primary energy demand

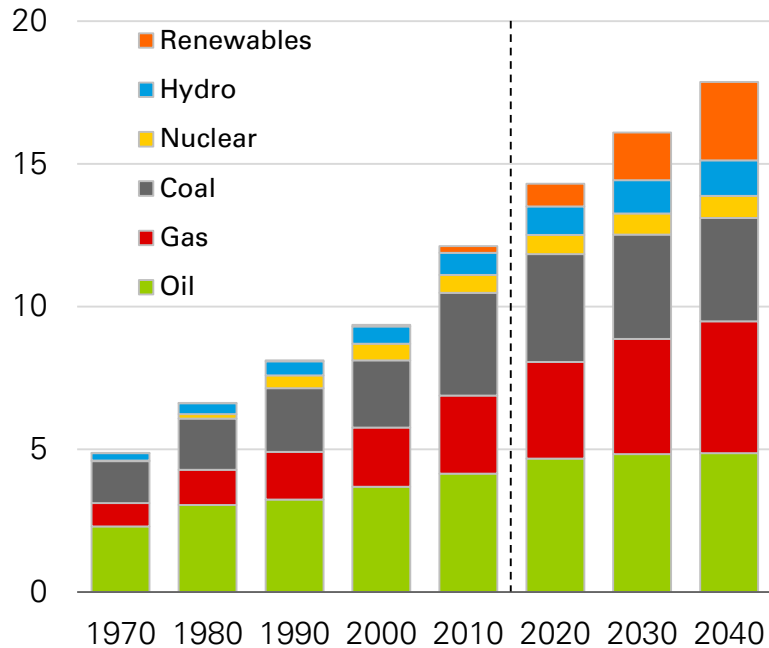
Increase in primary energy demand, 2017-2040



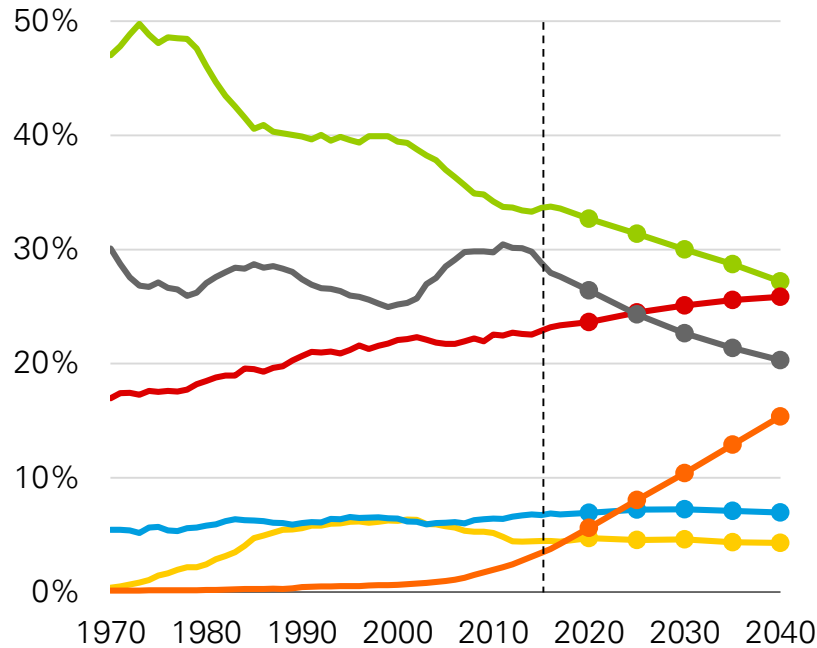
Global energy by fuel type

Primary energy consumption by fuel

Billion toe



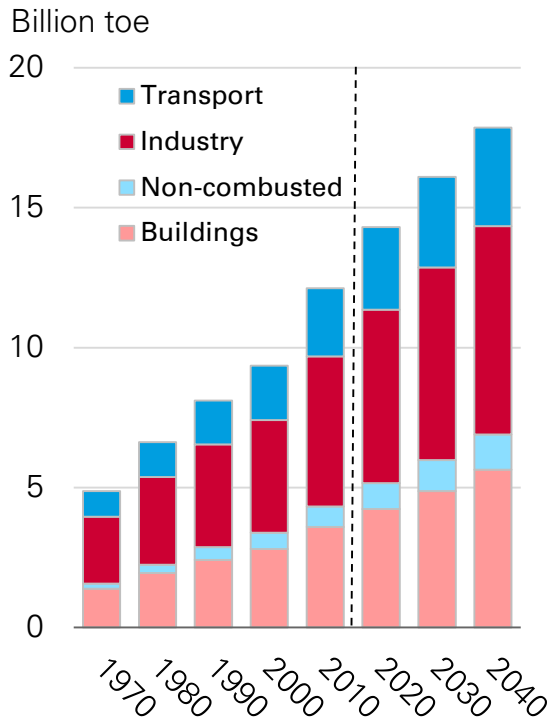
Shares of primary energy



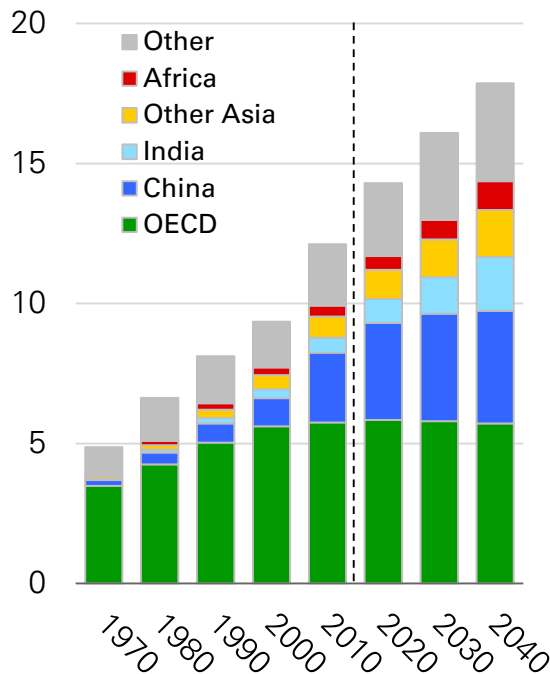
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Primary energy demand

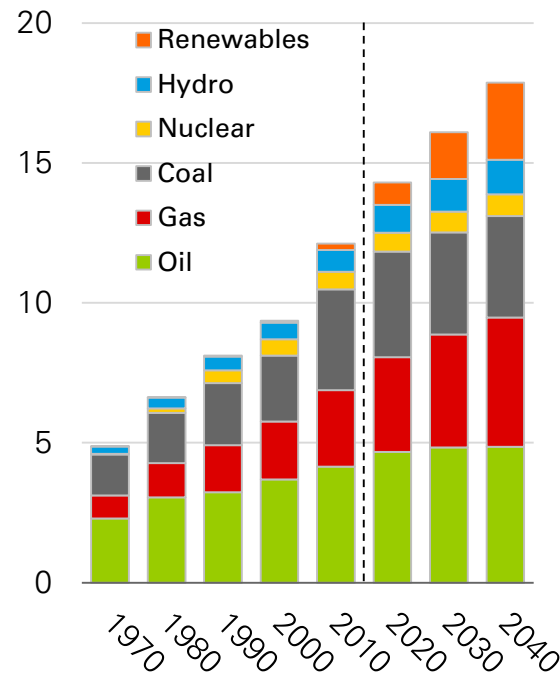
End-use sector



Region



Fuel



Five key questions and uncertainties

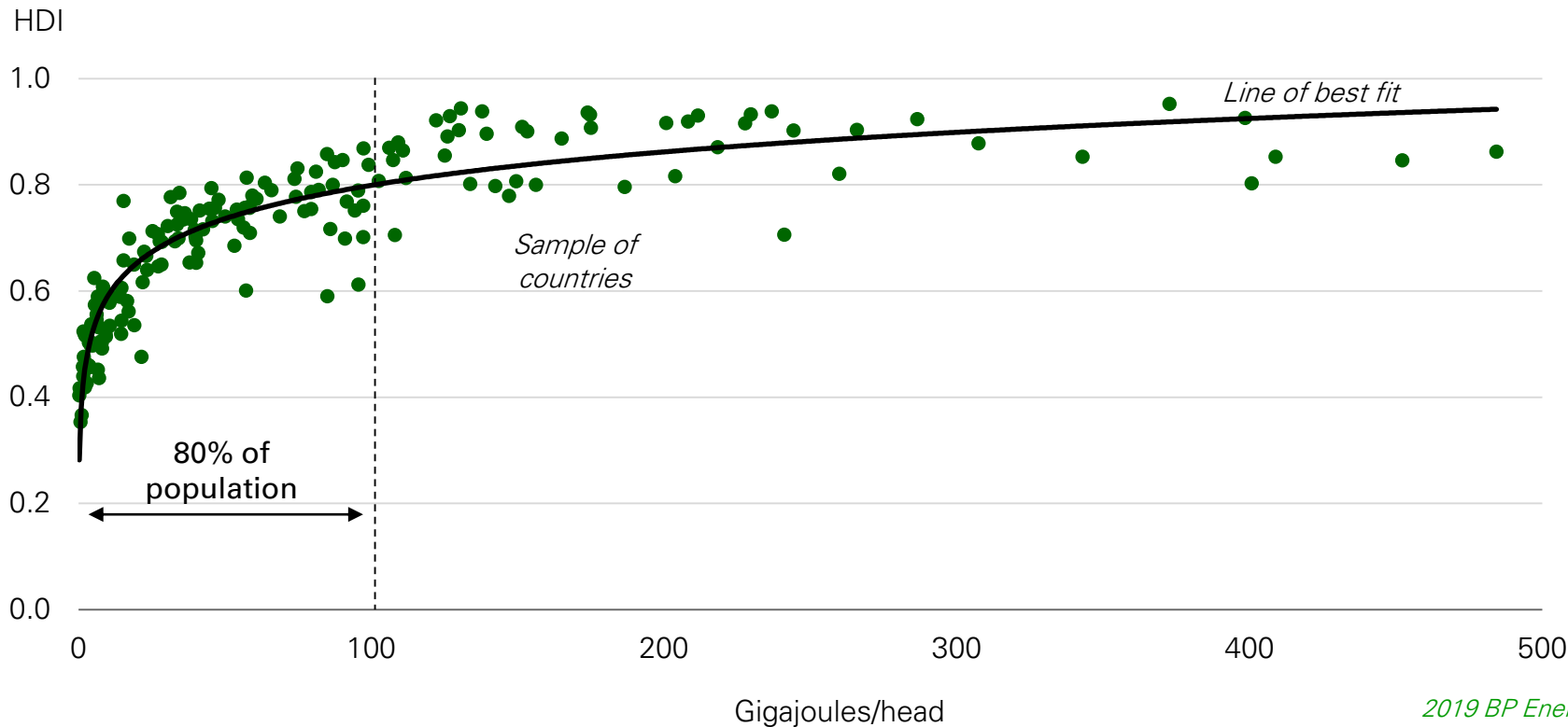
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- ▶ How important are plastics for the future of oil demand?
- ▶ What might happen if the trade disputes escalate?
- ▶ How quickly could renewables grow?
- ▶ A low-carbon energy system: what more needs to be done?

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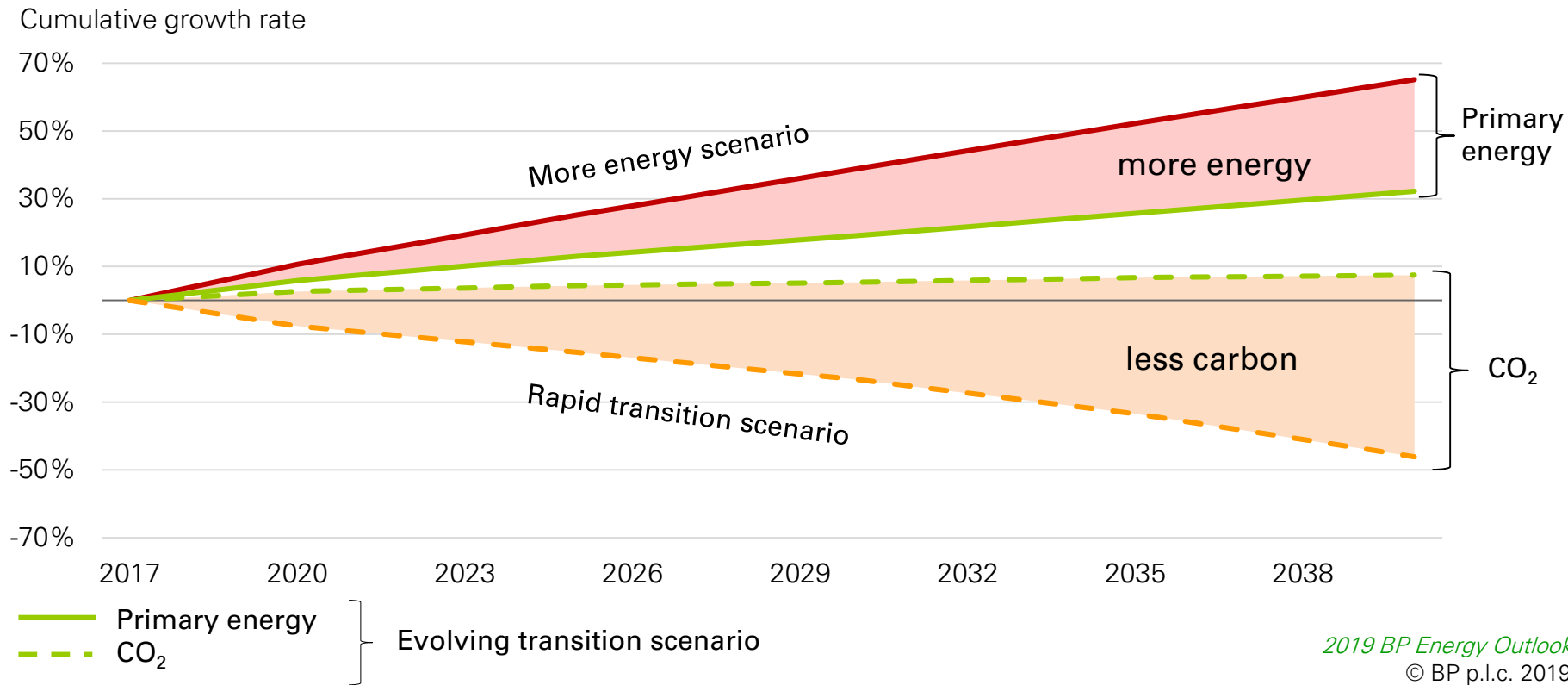
Human development and energy consumption

UN Human Development Index and energy consumption, 2017



Dual challenge: more energy, less carbon

Primary energy demand and carbon emissions

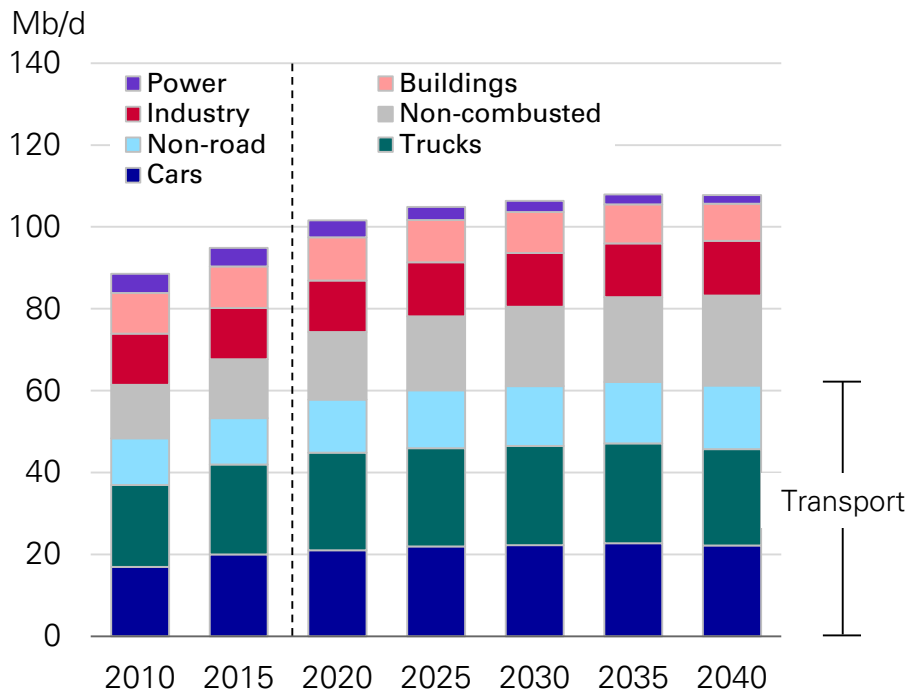


Five key questions and uncertainties

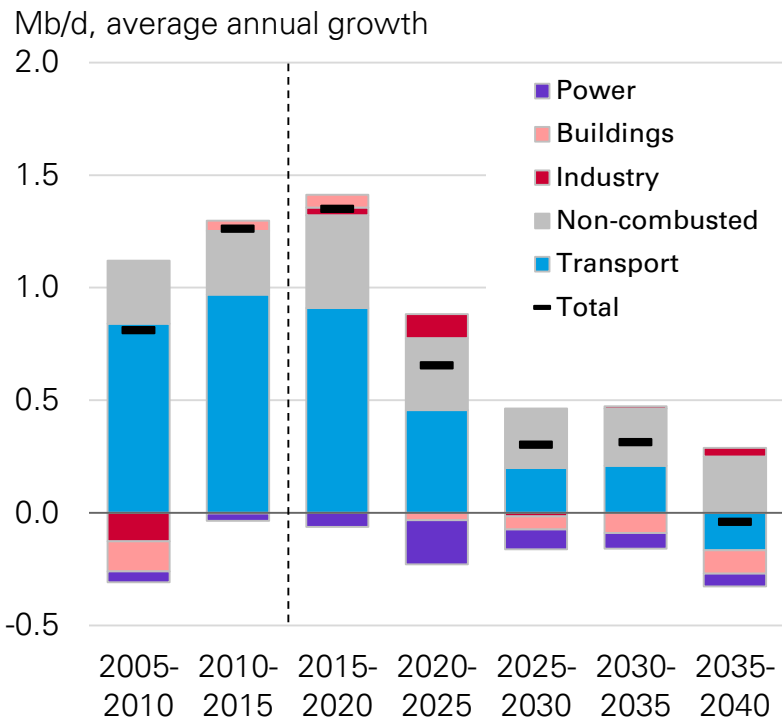
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Demand for oil and other liquid fuels

Liquids demand

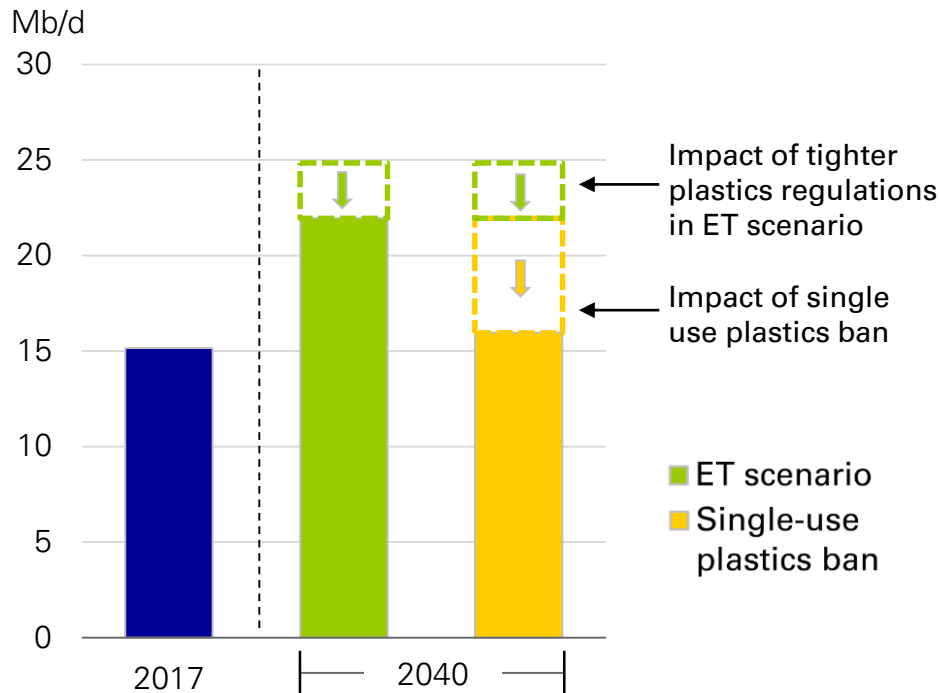


Liquids demand growth

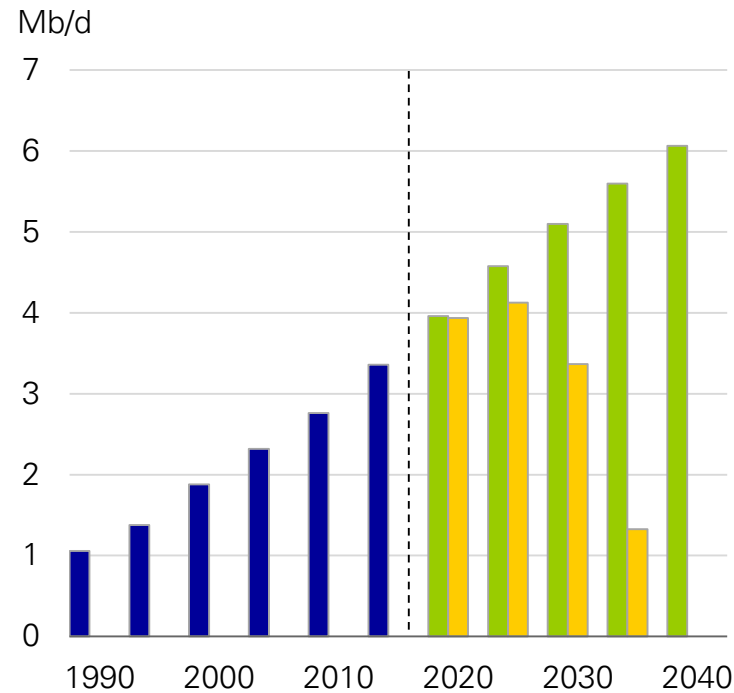


Demand for liquid fuels and plastics

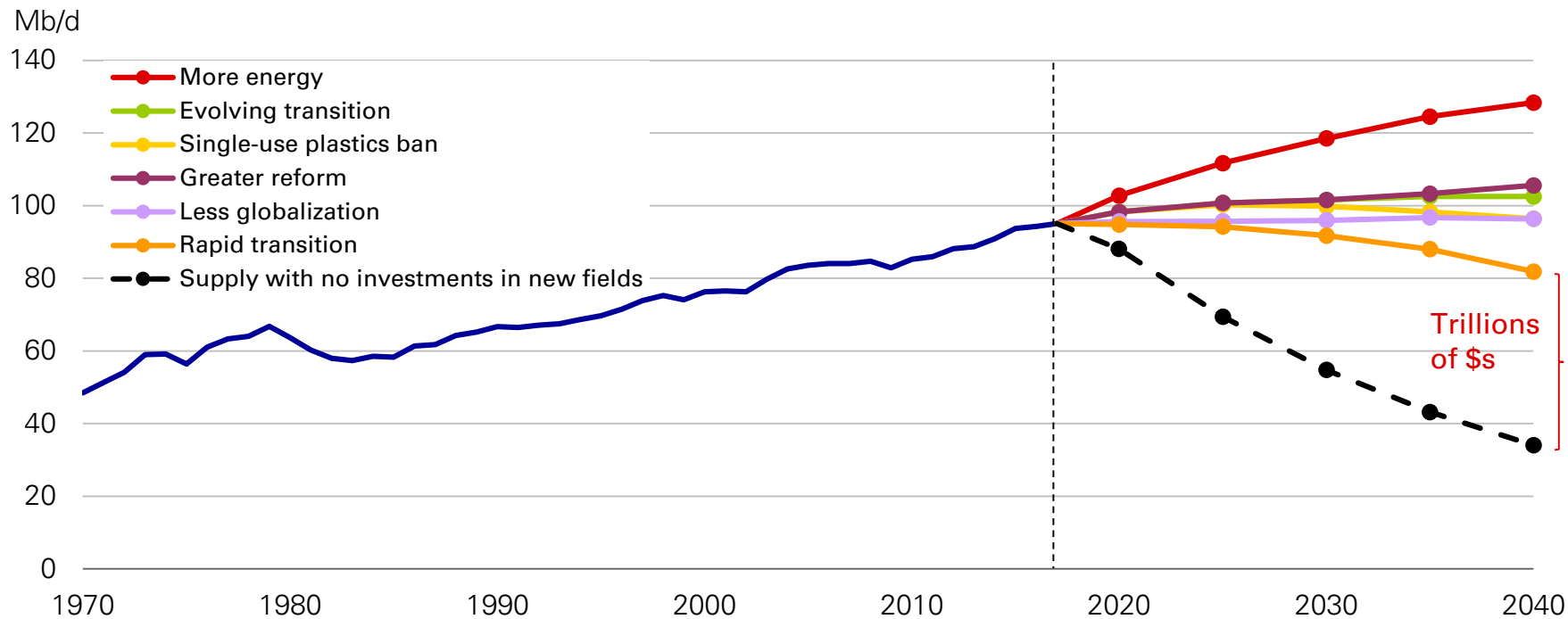
Demand for non-combusted liquid fuels



Liquid feedstocks for single-use plastics



Demand and supply of oil



Five key questions and uncertainties

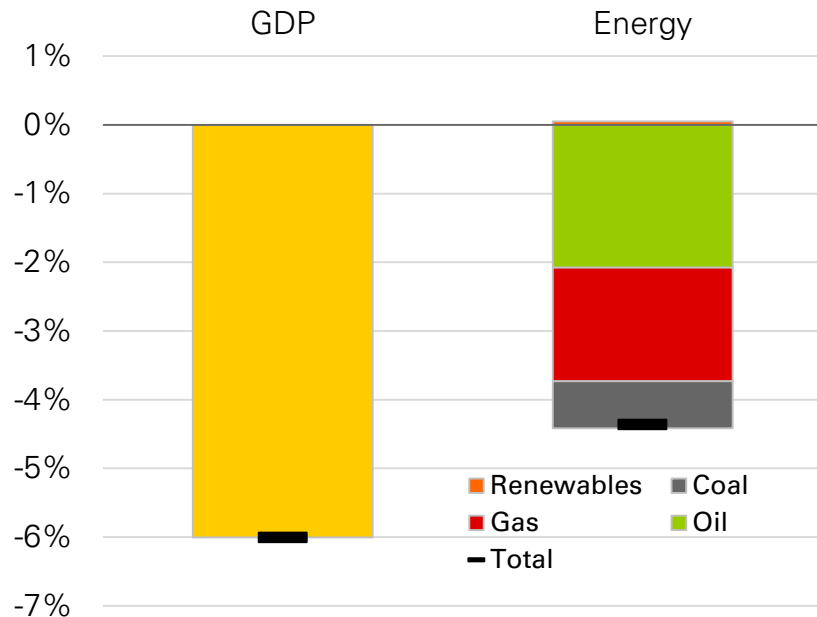
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Less globalization scenario

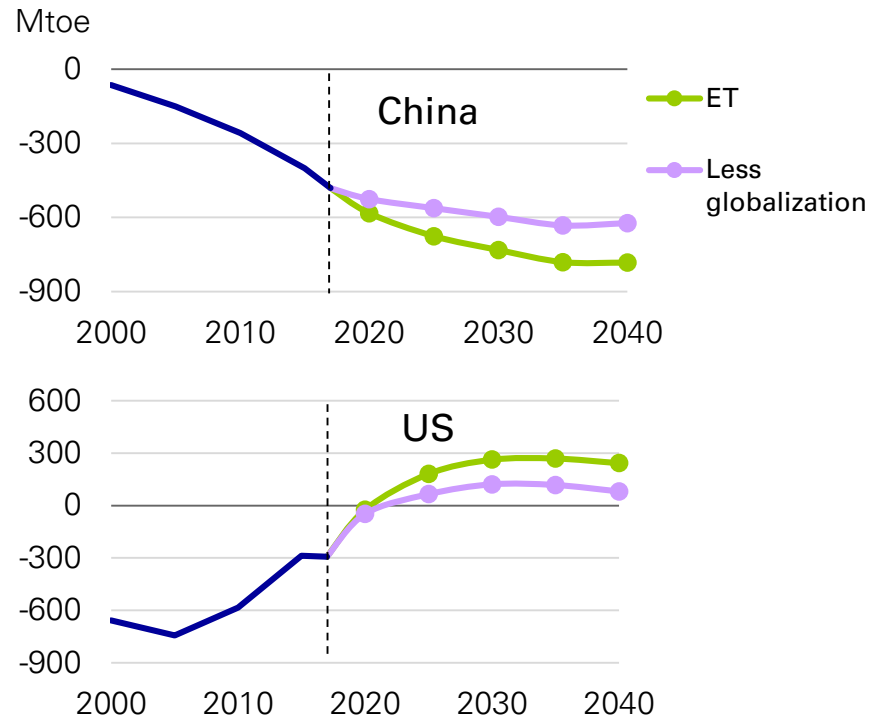
- ▶ Reduced openness and trade leads to slight reduction in trend global GDP growth
- ▶ Concerns about energy security adds a small risk premium (10%) to imported energy

Alternative scenario: Less globalization

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



Net exports (oil & gas)



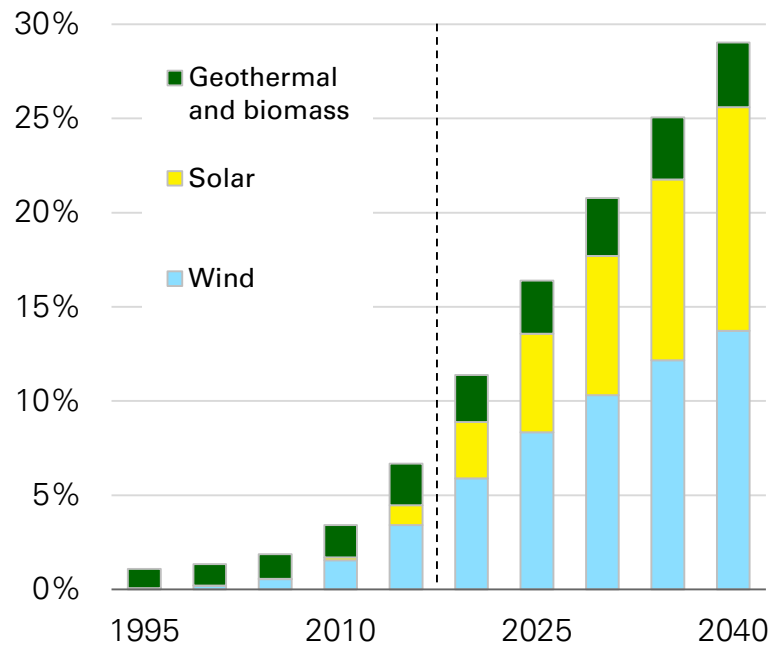
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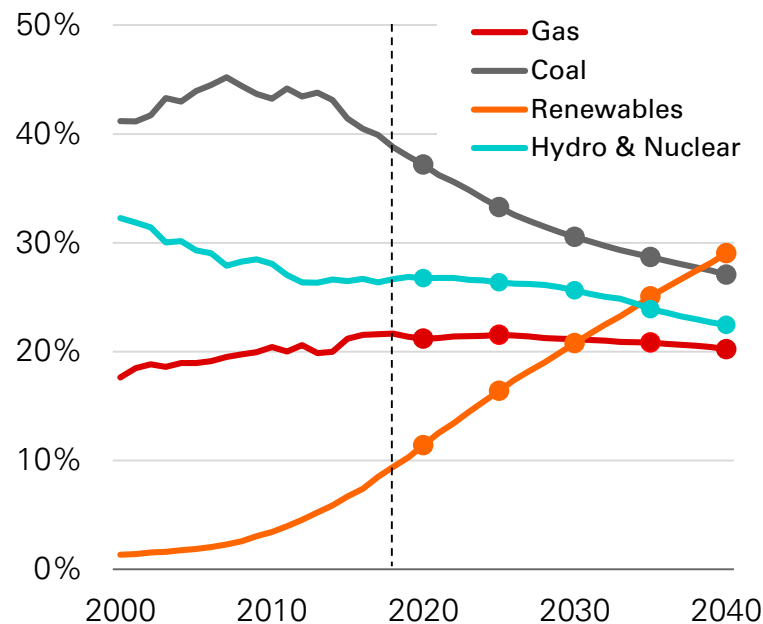
Renewable energy



Renewables share of power generation



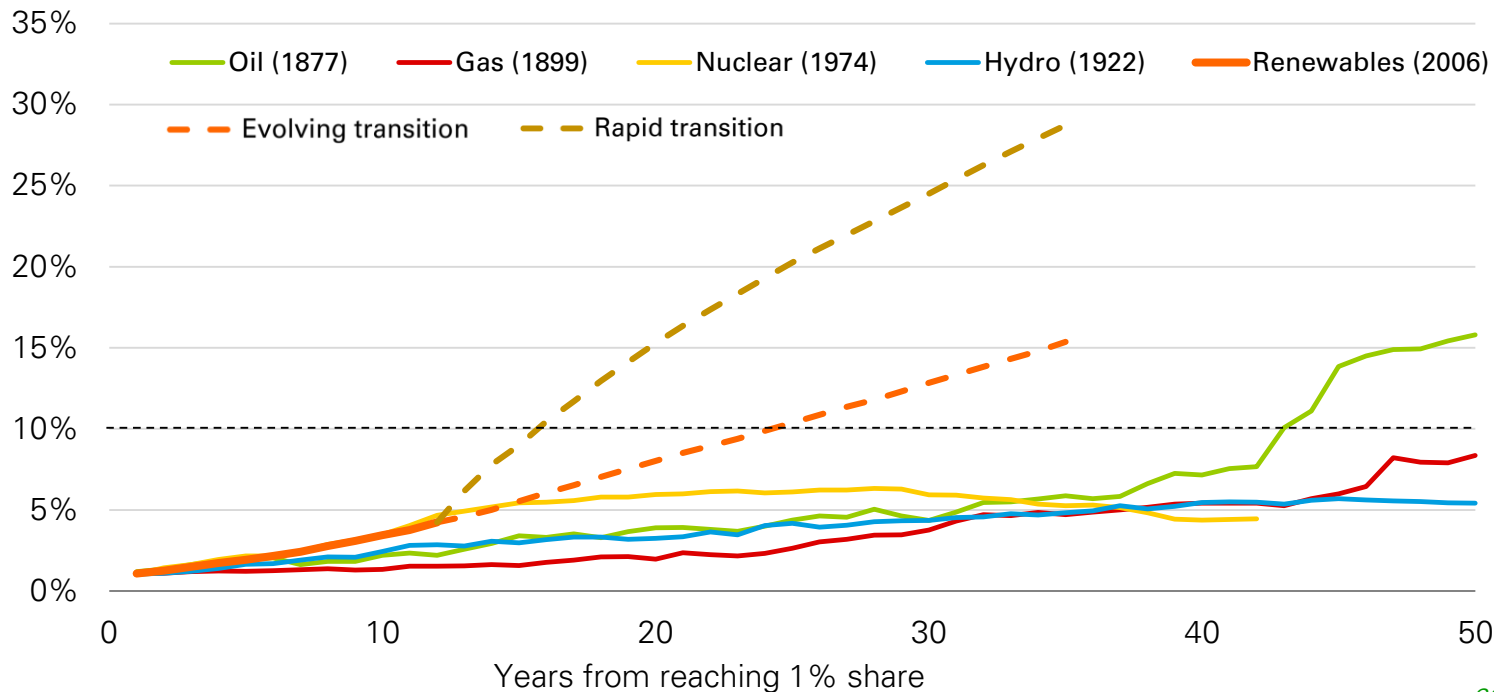
Fuel shares in power



Speed of energy transition

Speed of penetration of new fuels in global energy system

Share of world energy



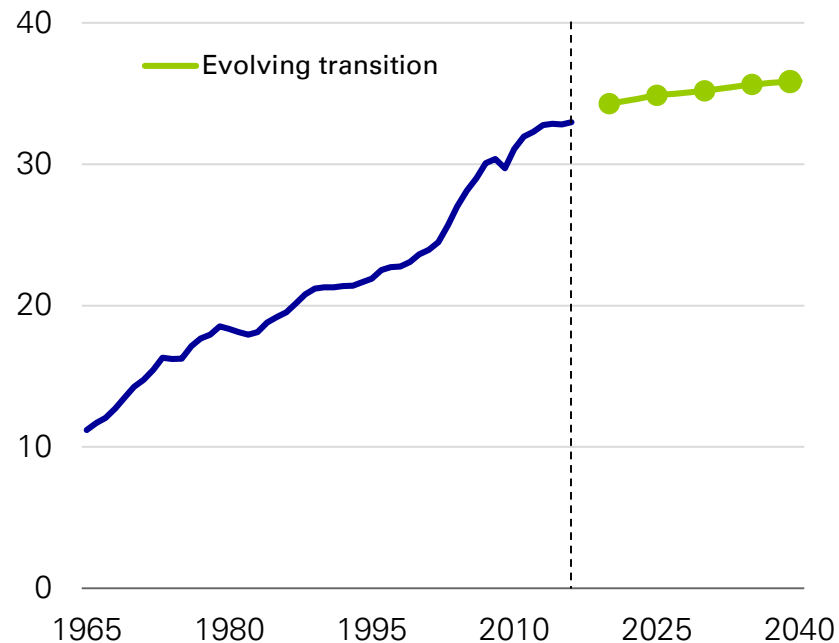
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CO₂ emissions in ET scenario

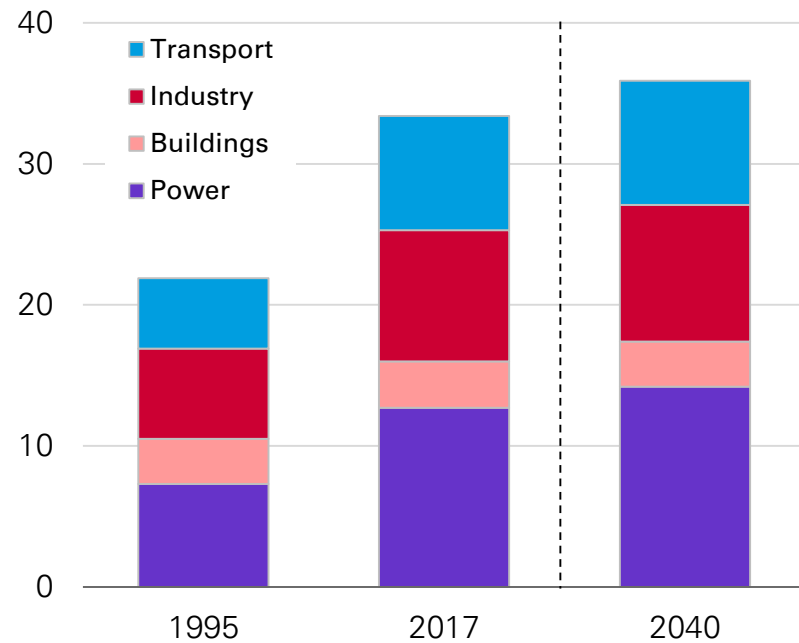
CO₂ emissions

Gt of CO₂



CO₂ emissions by sector

Gt of CO₂

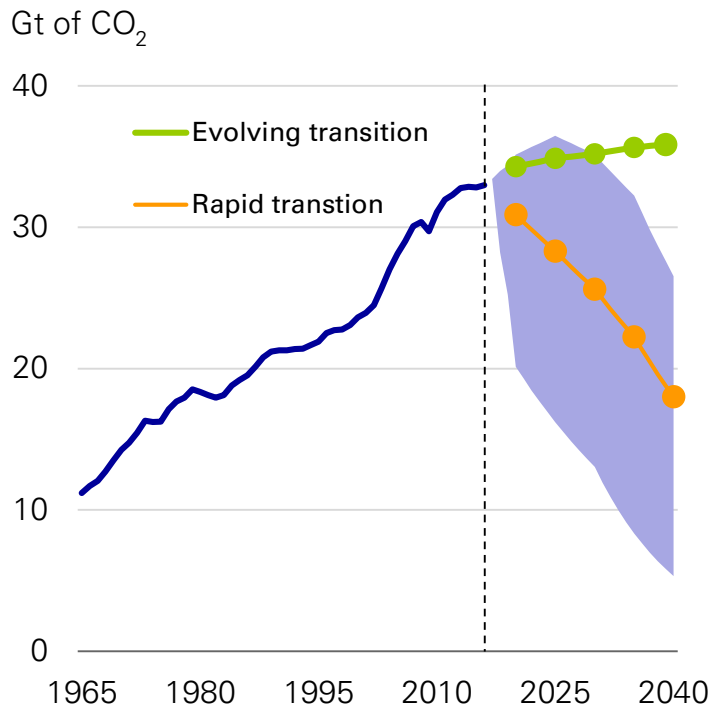


Rapid transition scenario: policy measures

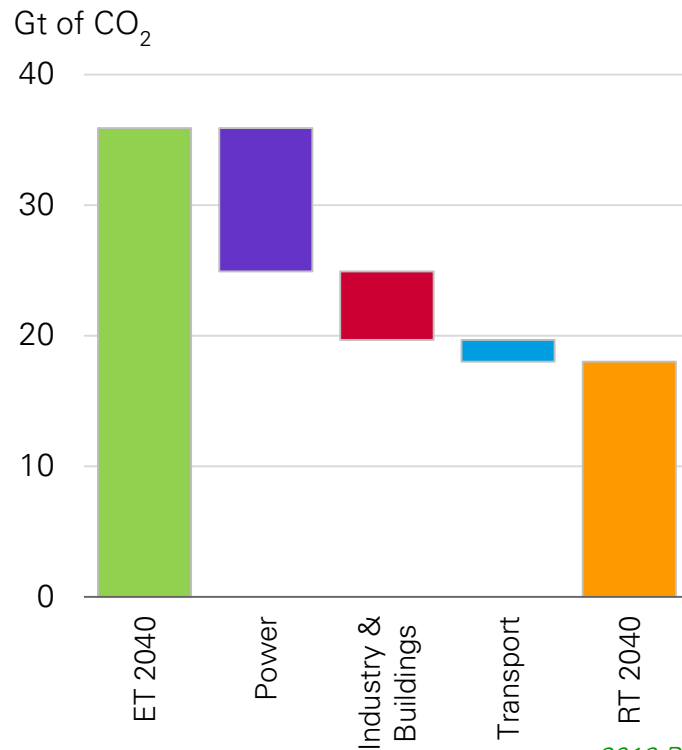
- ▶ Wide range of policy measures: broadly equivalent in terms of their implied costs and effort
- ▶ No silver bullet: a comprehensive set of policy measures is needed
- ▶ Carbon prices are key, especially in the power and industrial sectors
- ▶ Role for targeted regulatory measures, especially until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

CO₂ emissions

CO₂ emissions



CO₂ in 2040: ET vs RT scenario

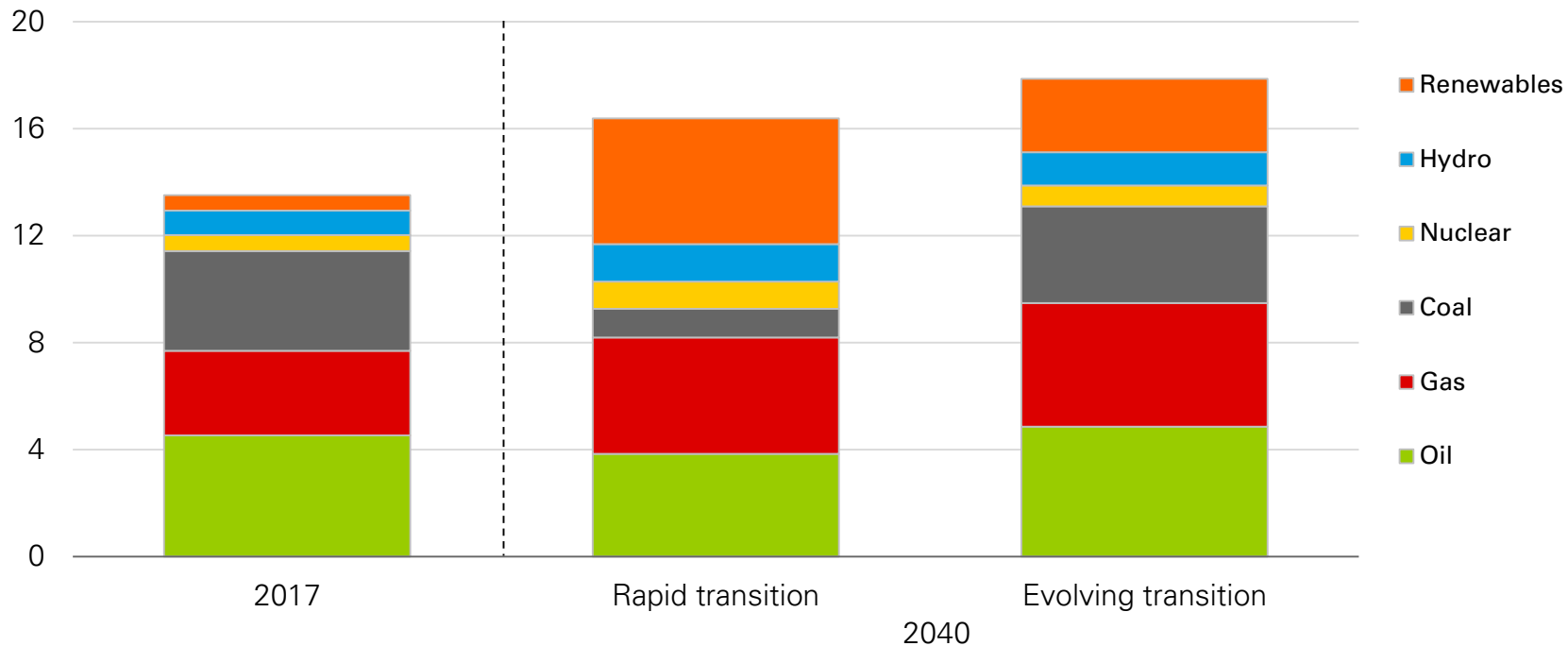


Global energy demand and fuel mix



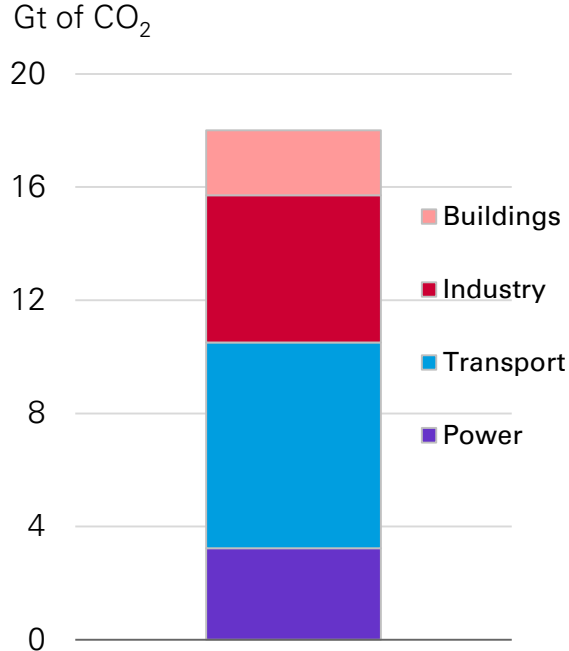
Primary energy consumption by fuel

Billion toe



Hard-to-abate carbon emissions

CO₂ 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

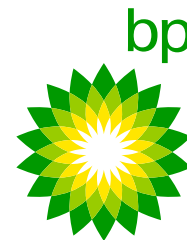
- Hydrogen
- Bioenergy

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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