

# BP Energy Outlook

## 2016 edition



Paul Appleby, head of energy economics

Australia, February 2016

Outlook  
to 2035

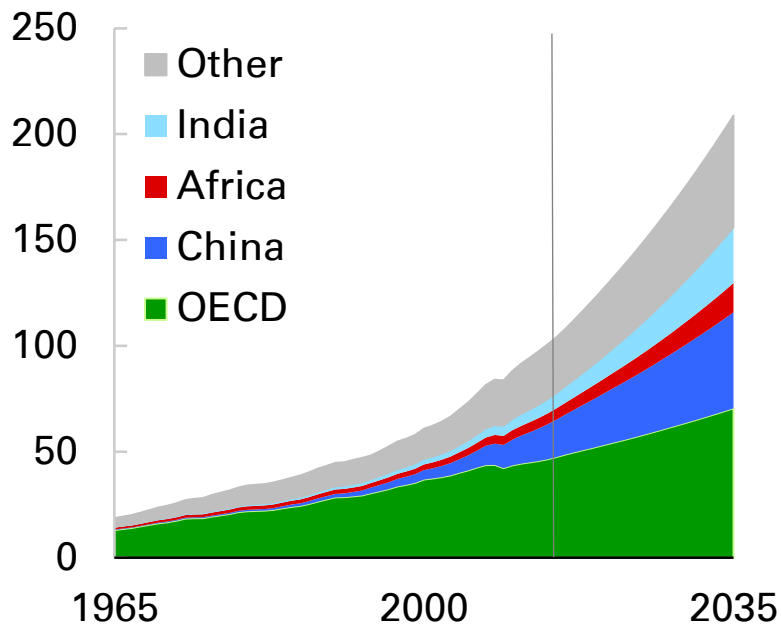
[bp.com/energyoutlook](http://bp.com/energyoutlook)  
#BPstats



# Economic backdrop

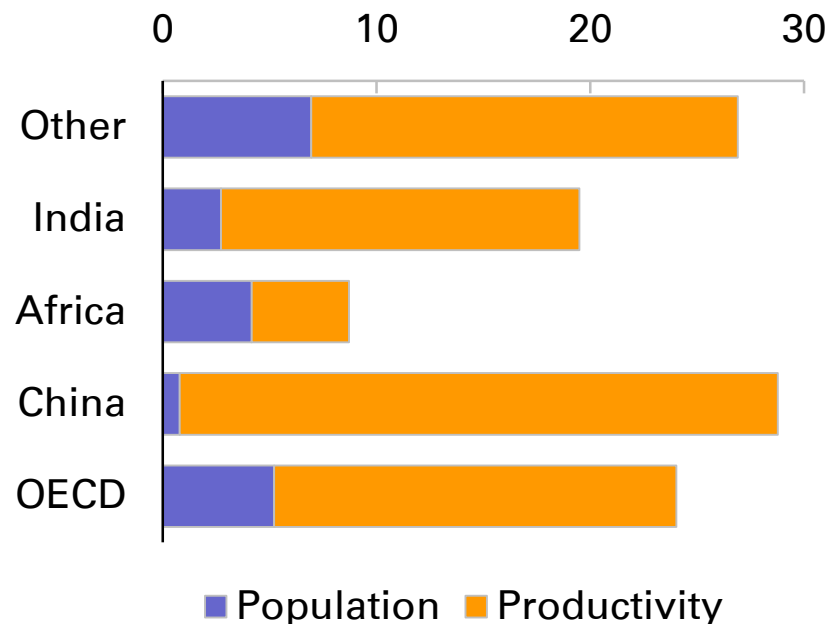
## GDP

Trillion, \$2010



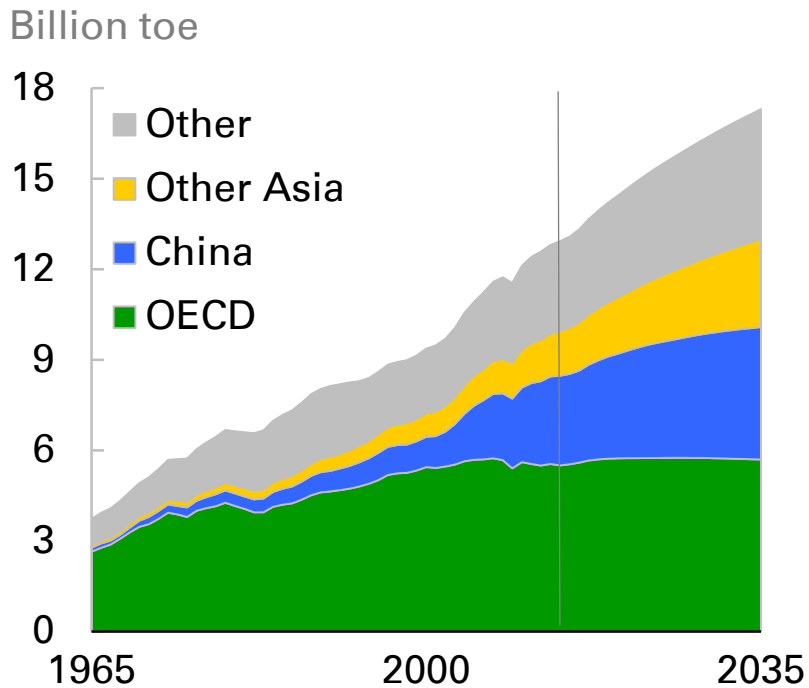
## Contribution to GDP growth 2014-35

Trillion, \$2010

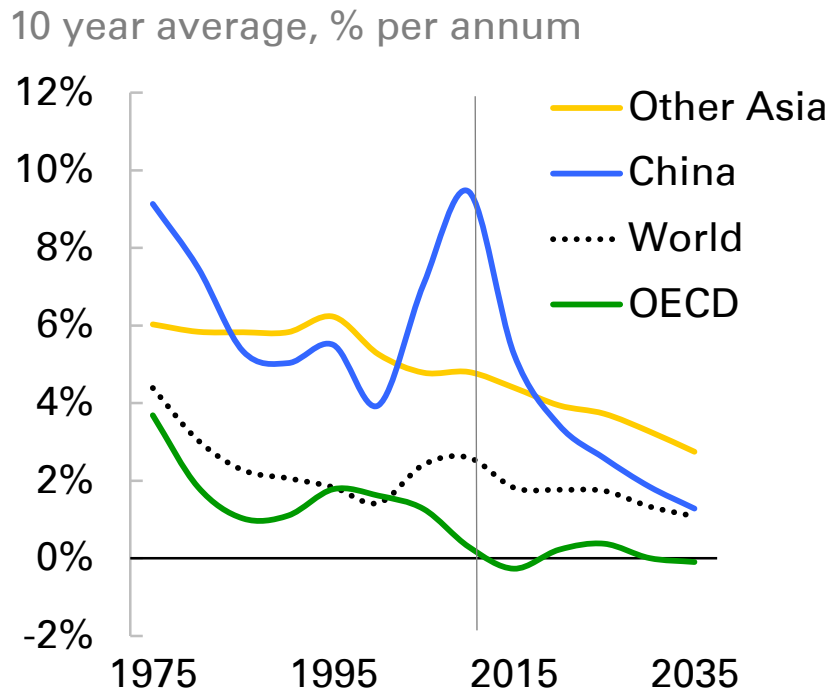


# Global energy demand

## Consumption by region



## Consumption growth by region

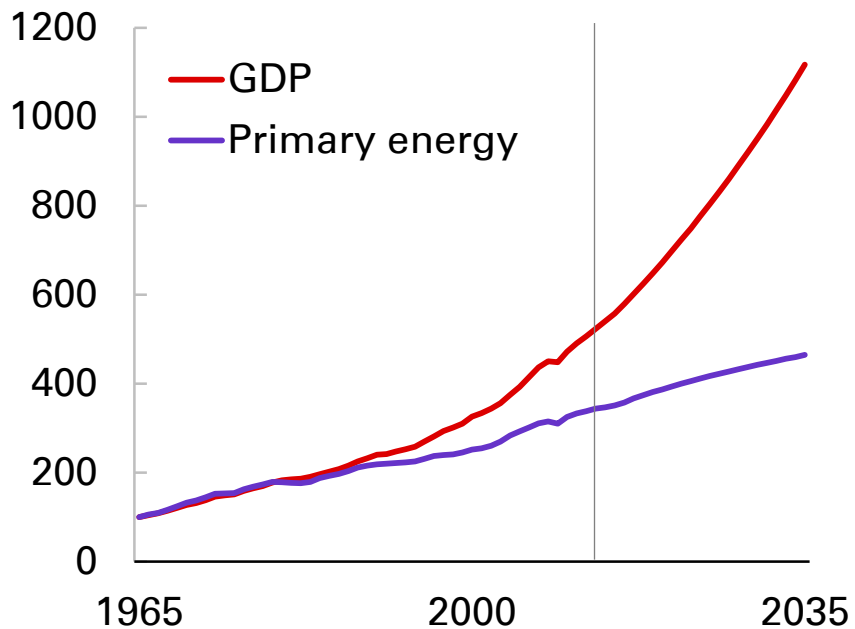


# What drives energy demand?

# Global GDP and energy

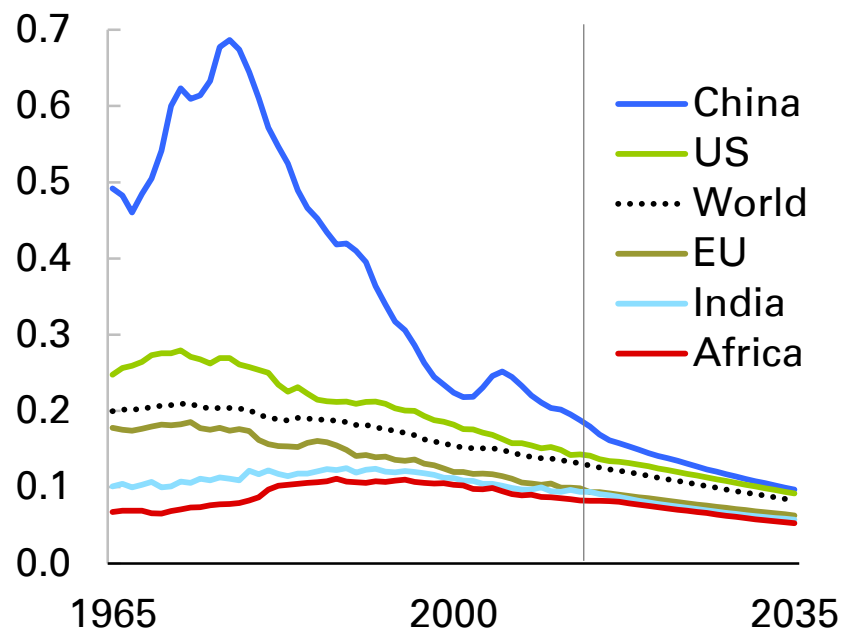
## World GDP and energy demand

Index (1965=100)



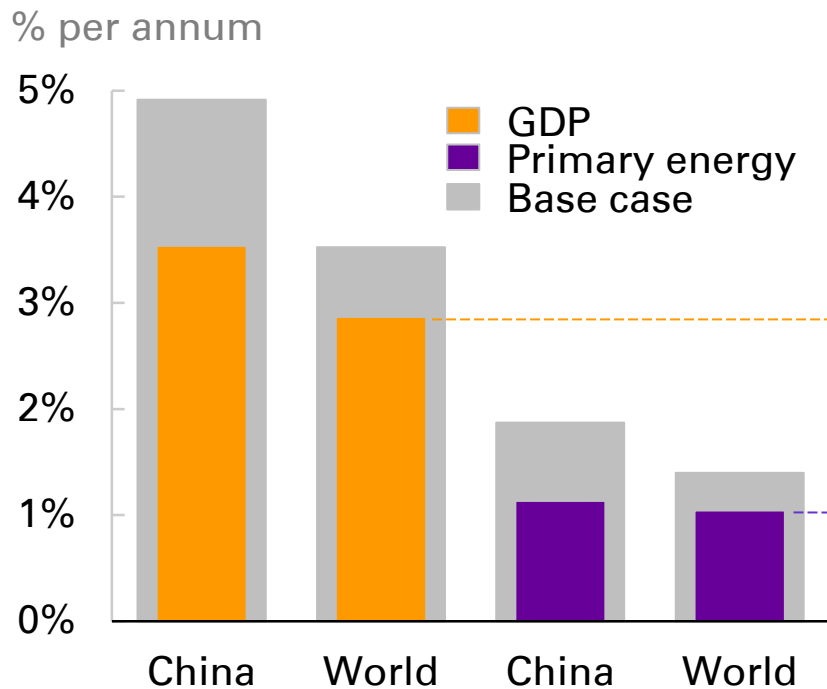
## Energy intensity by region

Toe per thousand \$2010 GDP

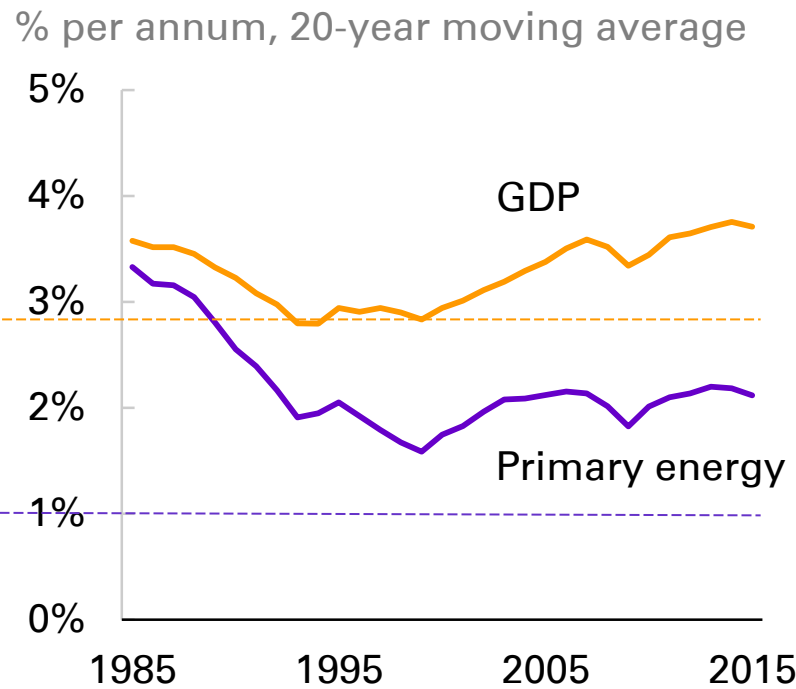


# Slower global GDP growth

## Annual growth rates 2014-35

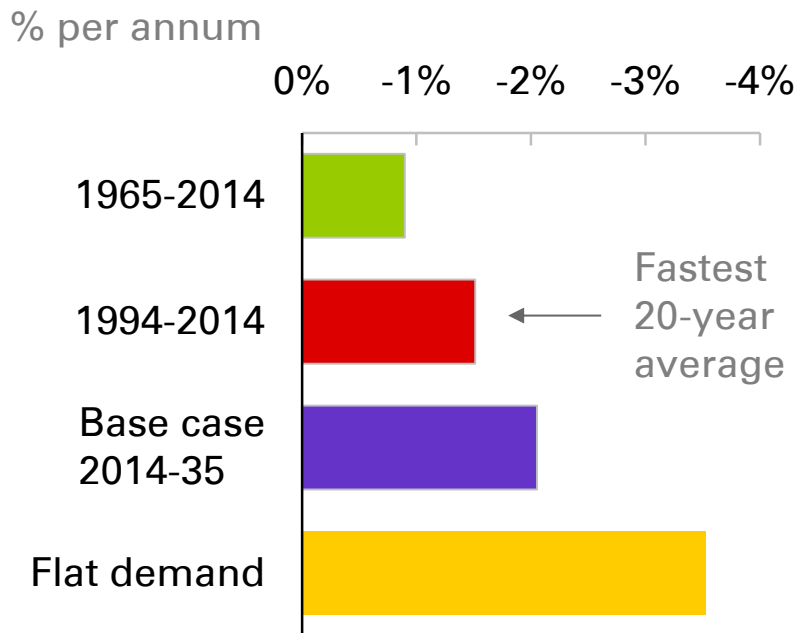


## Historical growth rates

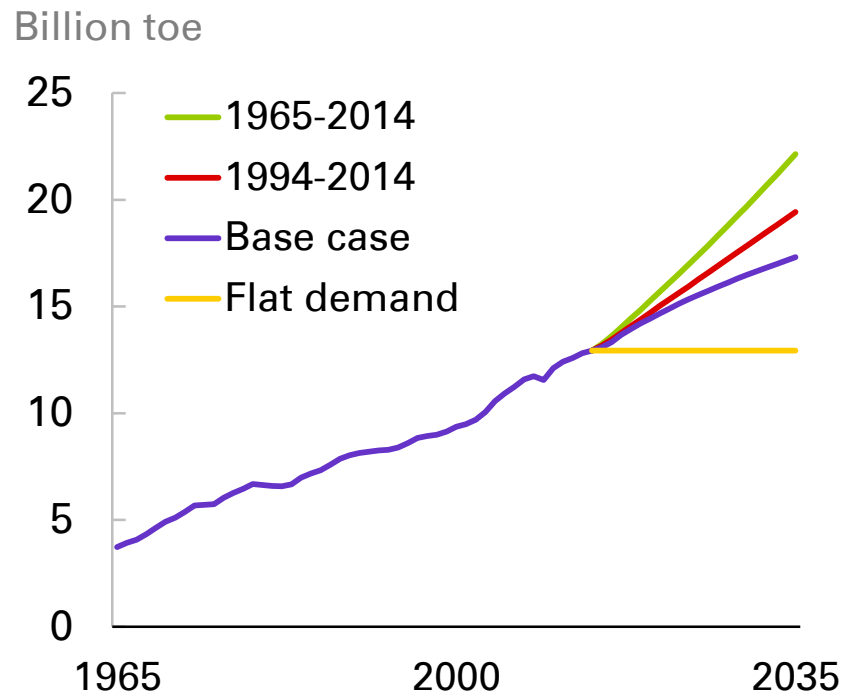


# Energy intensity and energy demand

## Decline in world energy intensity



## World energy demand



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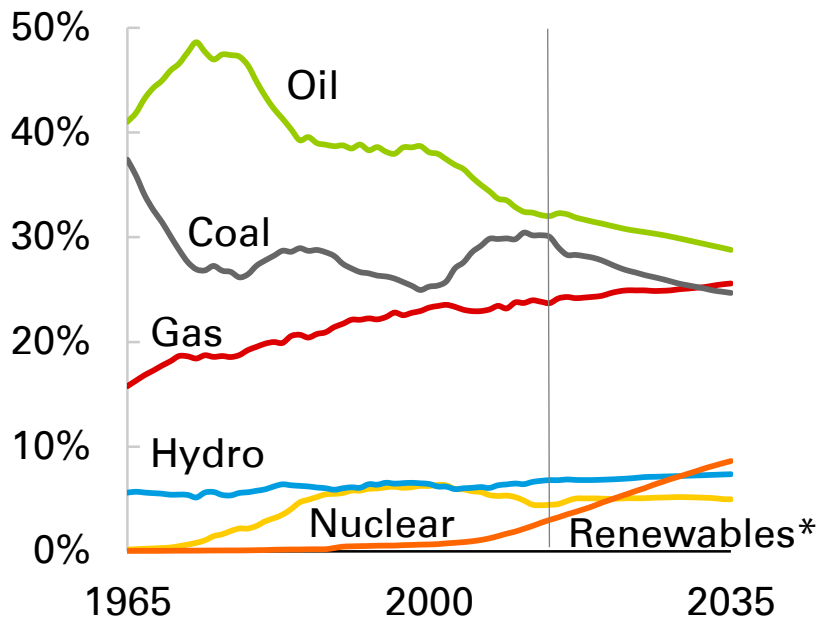
**Q: What drives energy demand?**

**A: Global economic growth**



# Fuel mix

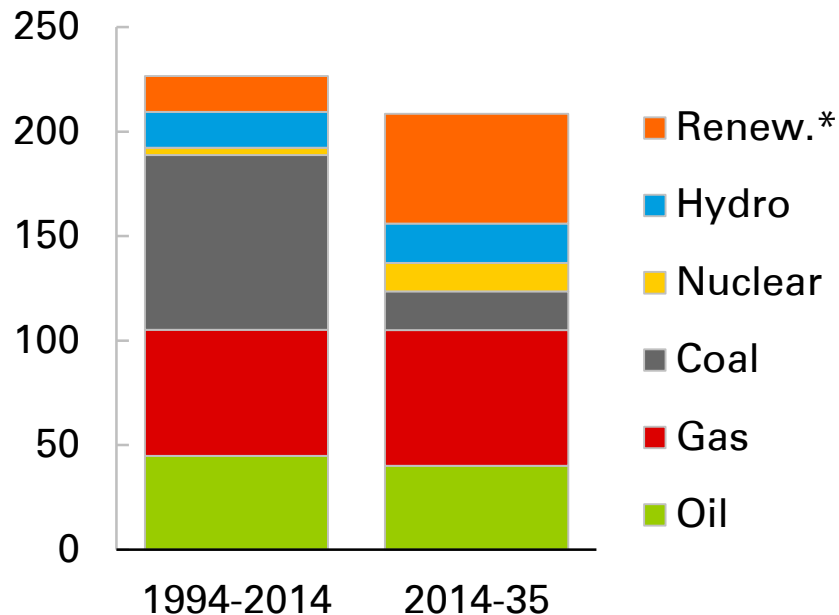
## Shares of primary energy



\*Includes biofuels

## Annual demand growth by fuel

Mtoe per annum



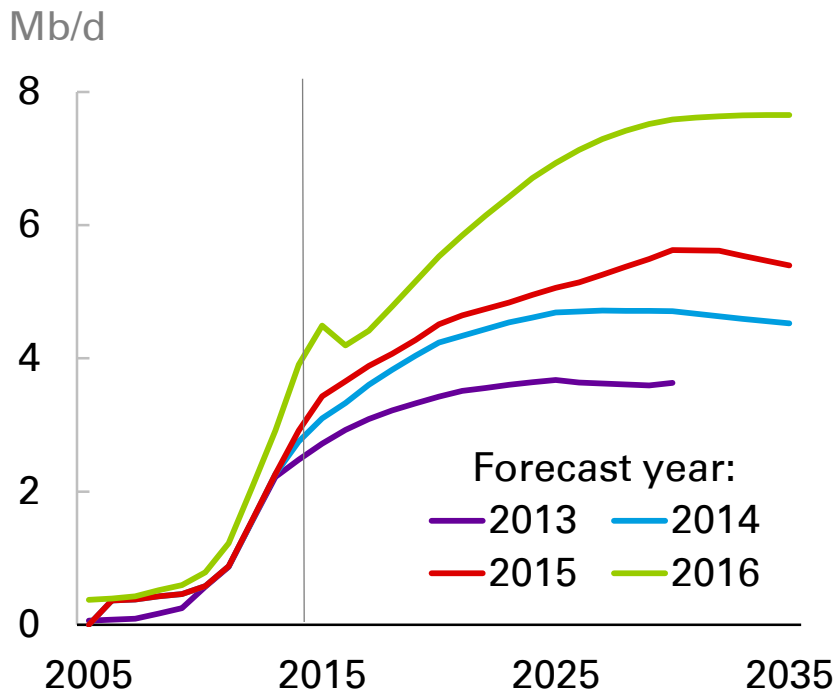
# Key factors shaping the fuel mix

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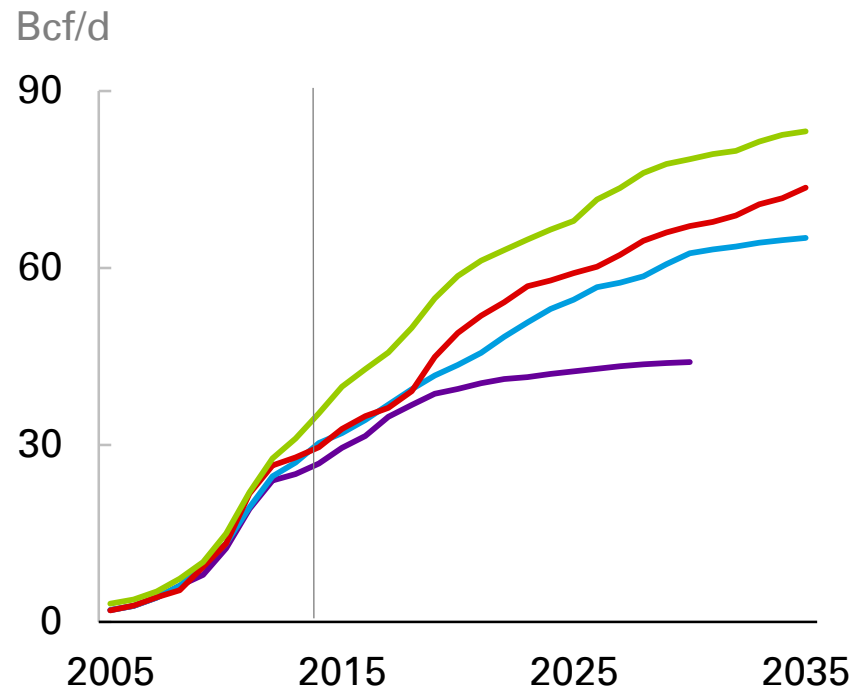
- What have we learned about US shale?
- China's changing energy needs
- Prospects for renewables and other non-fossil fuels

# US tight oil and shale gas

## US tight oil forecasts

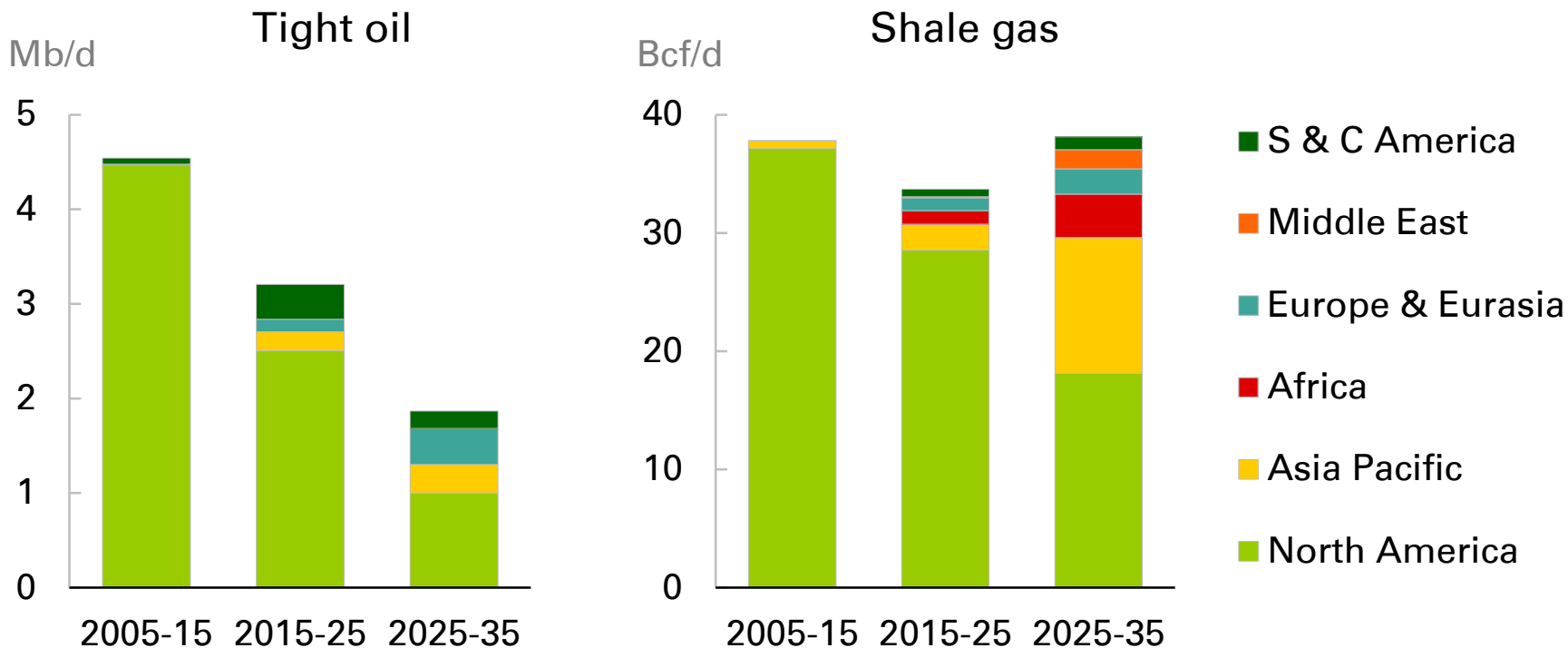


## US shale gas forecasts



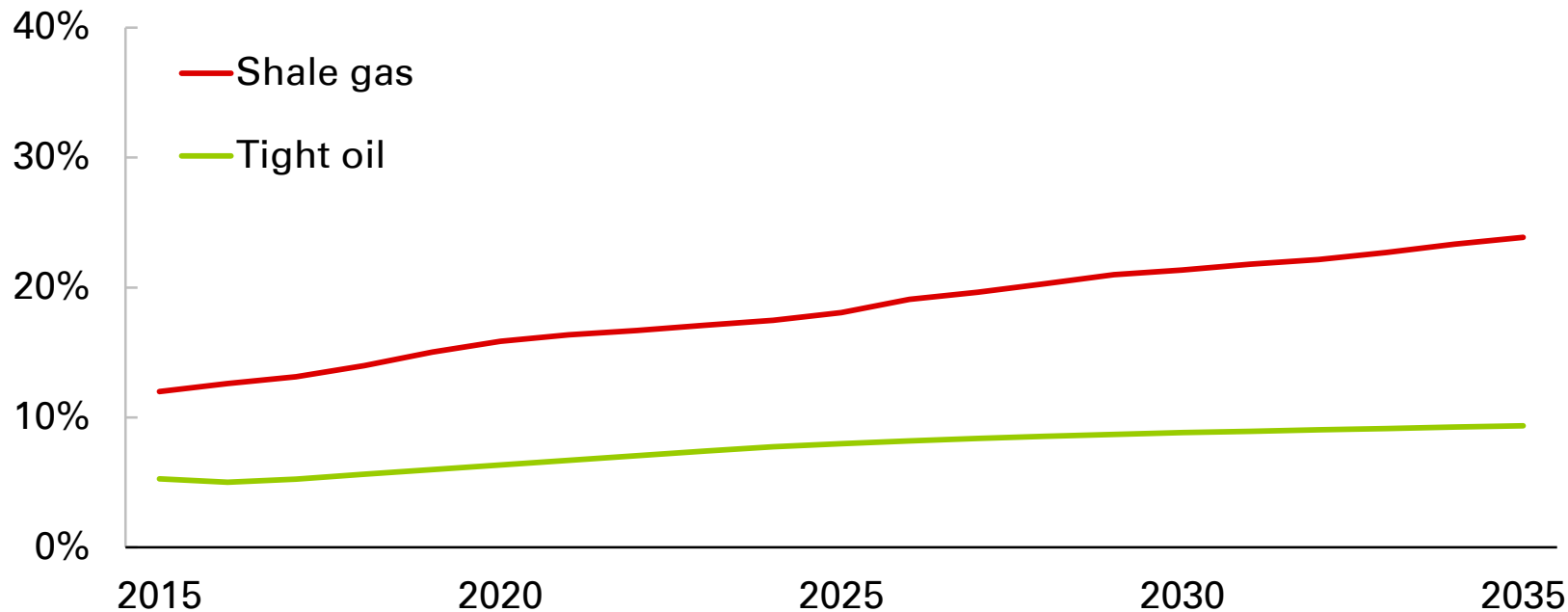
# Global tight oil and shale gas

Ten year supply increments:



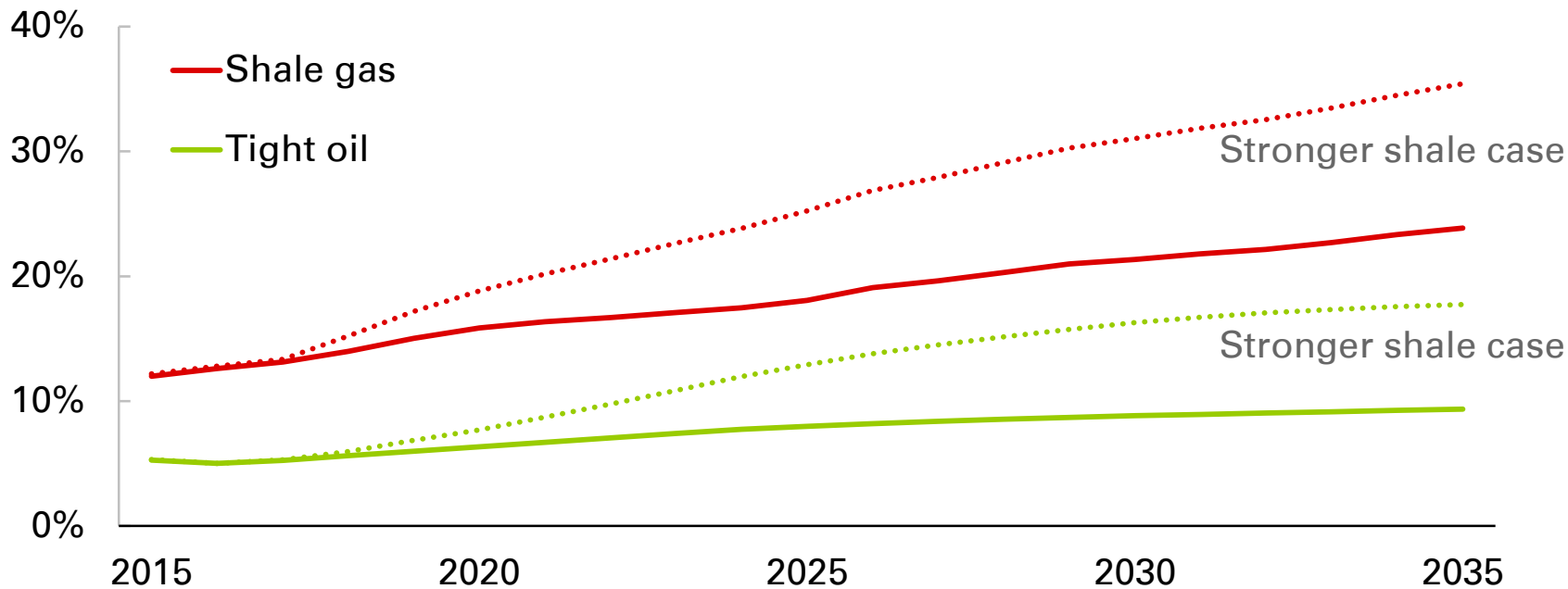
# Market shares of tight oil and shale gas

Shares of total oil/gas production



# Market shares of tight oil and shale gas

Shares of total oil/gas production



# Key factors shaping the fuel mix

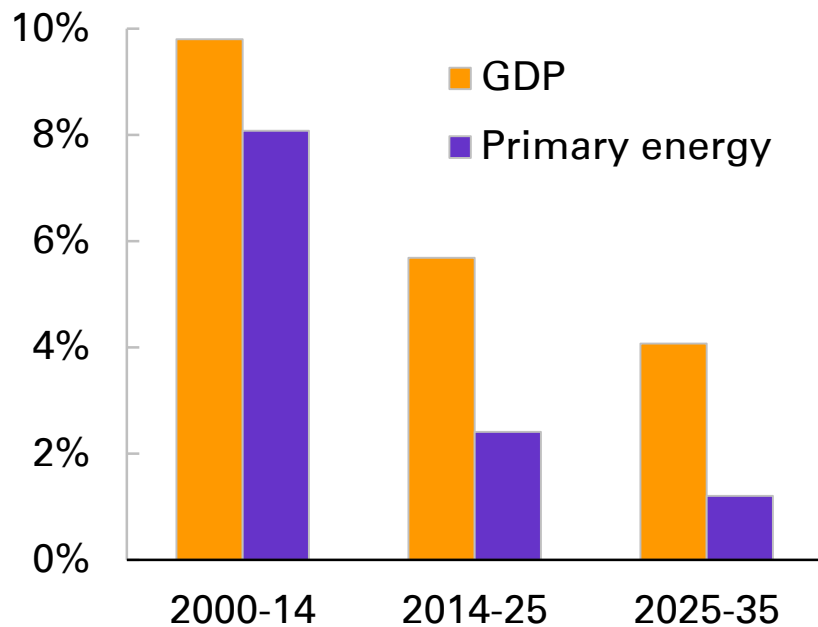
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- What have we learned about US shale?
- **China's changing energy needs**
- Prospects for renewables and other non-fossil fuels

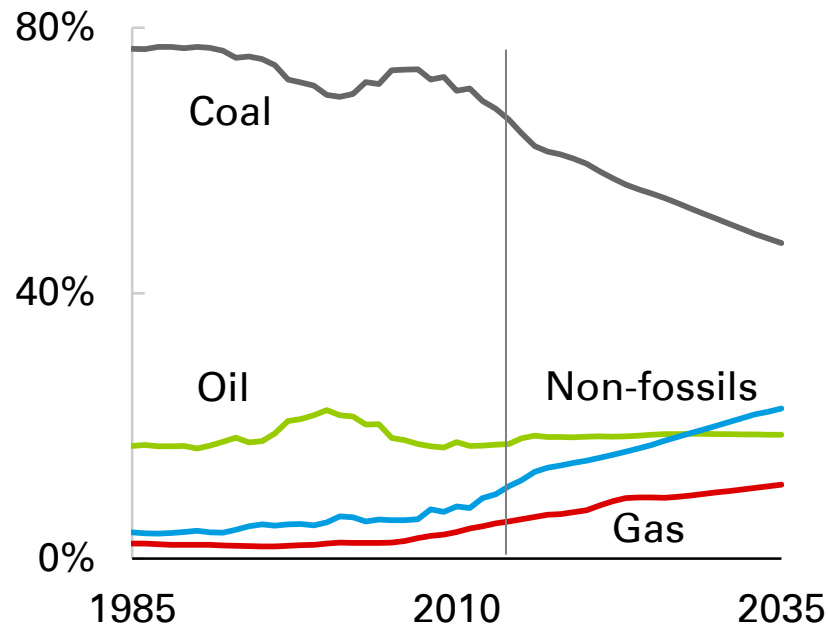
# China's changing energy needs

## GDP and primary energy growth

% per annum



## Shares of primary energy





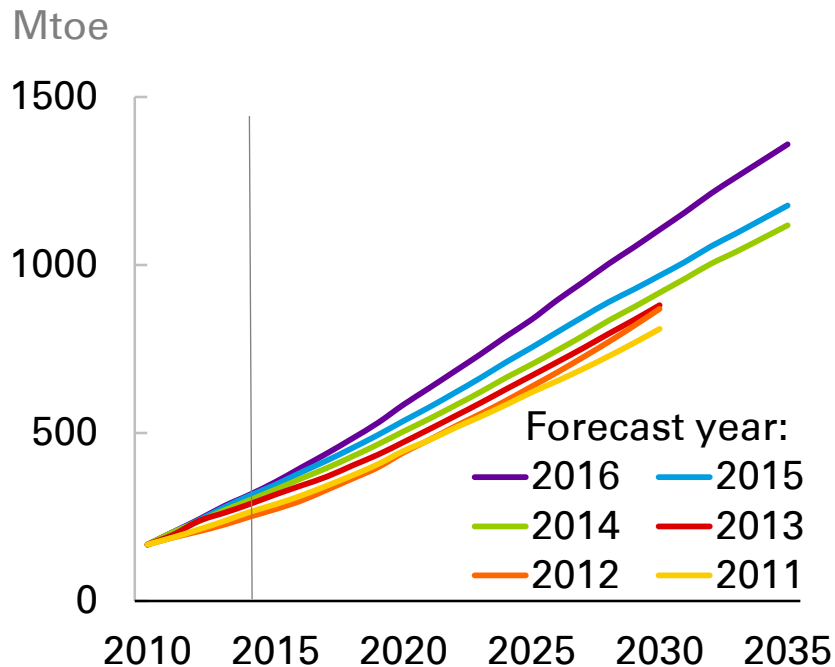
# Key factors shaping the fuel mix

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- What have we learned about US shale?
- China's changing energy needs
- Prospects for renewables and other non-fossil fuels

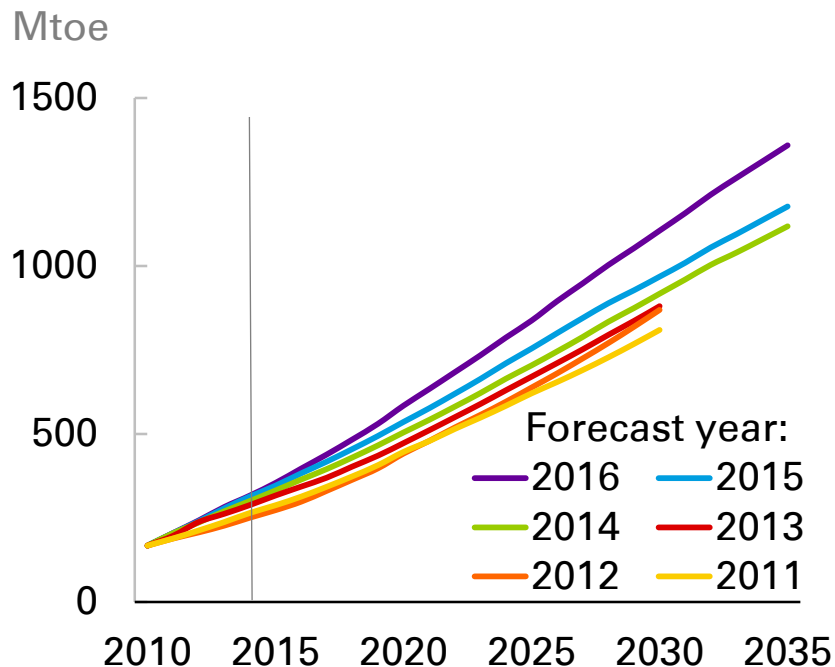
# Renewables and other non-fossil fuels

## Renewables in power forecasts

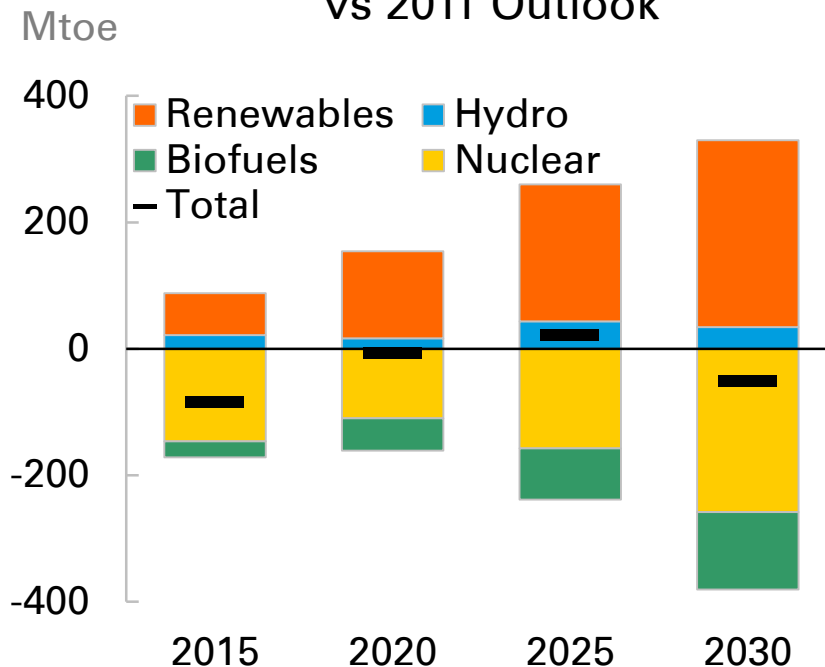


# Renewables and other non-fossil fuels

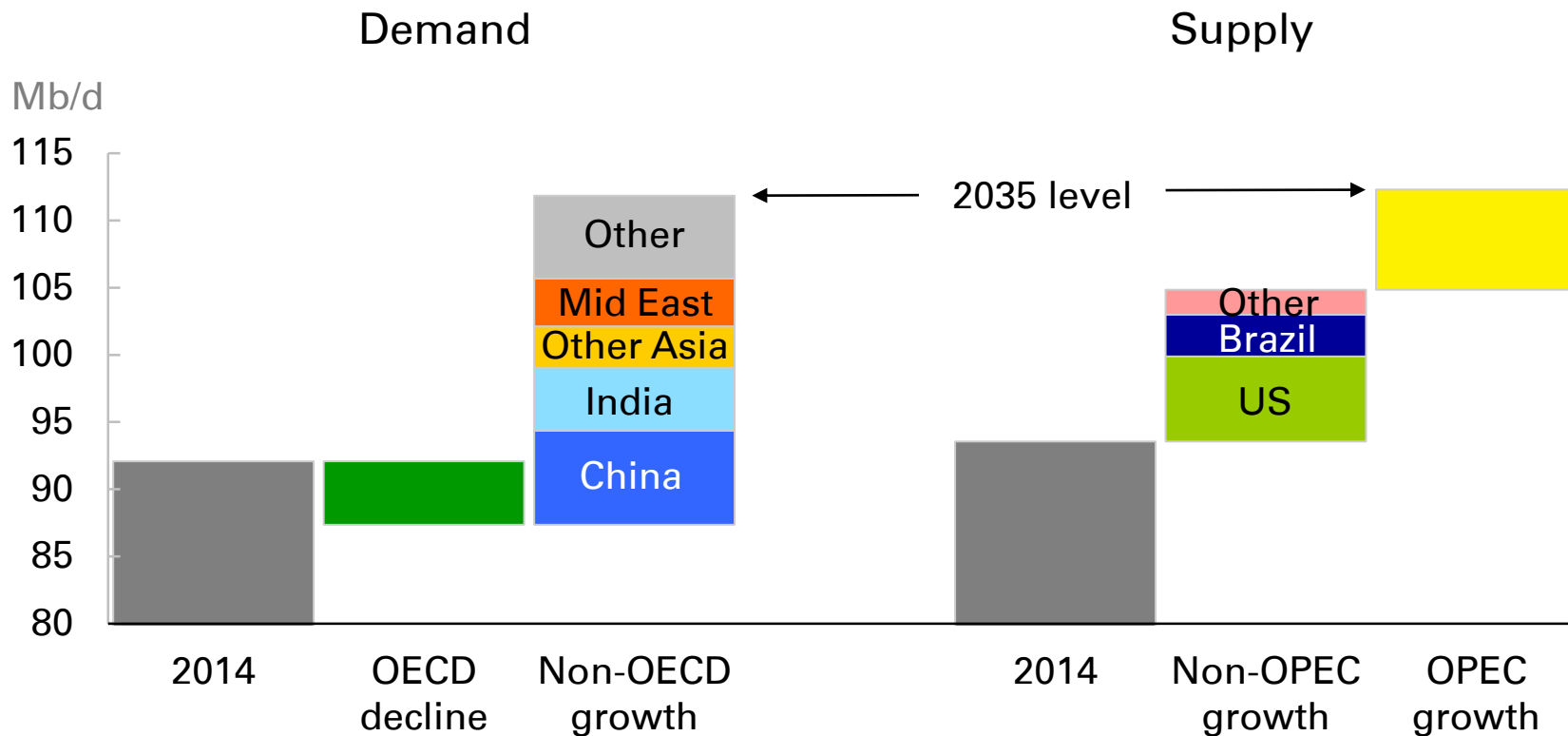
## Renewables in power forecasts



## Revisions to non-fossil fuels vs 2011 Outlook

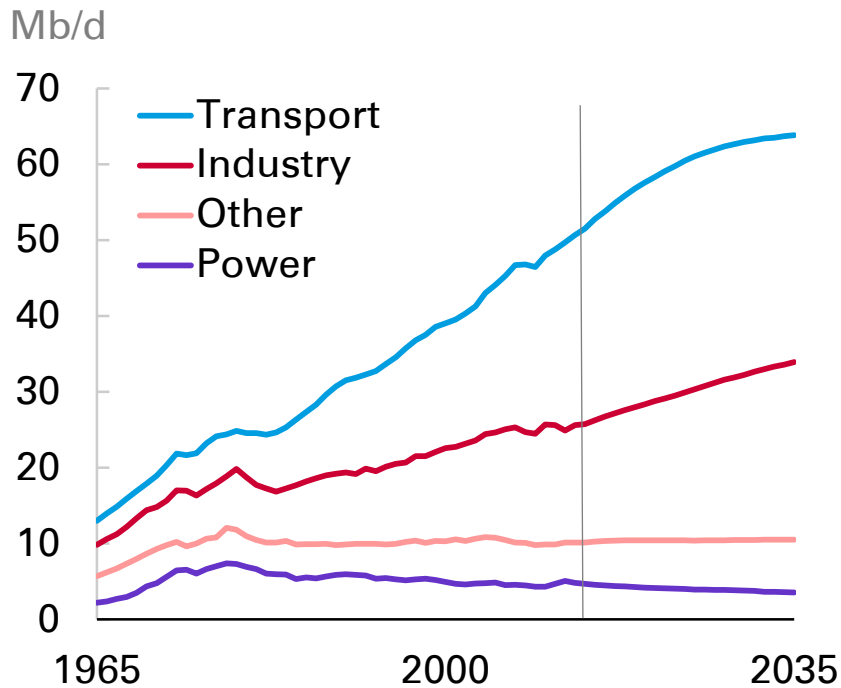


# Oil demand and supply

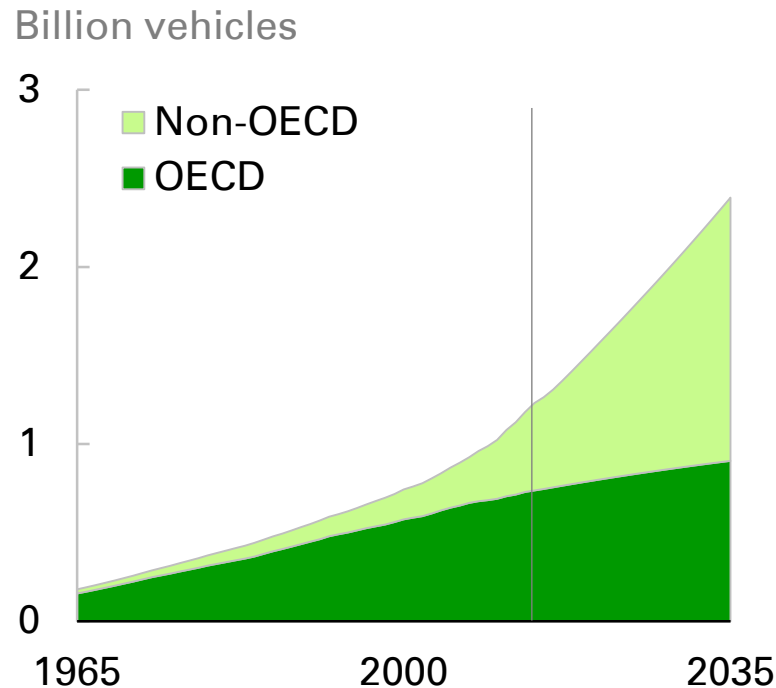


# Oil demand

## Liquids fuel demand by sector

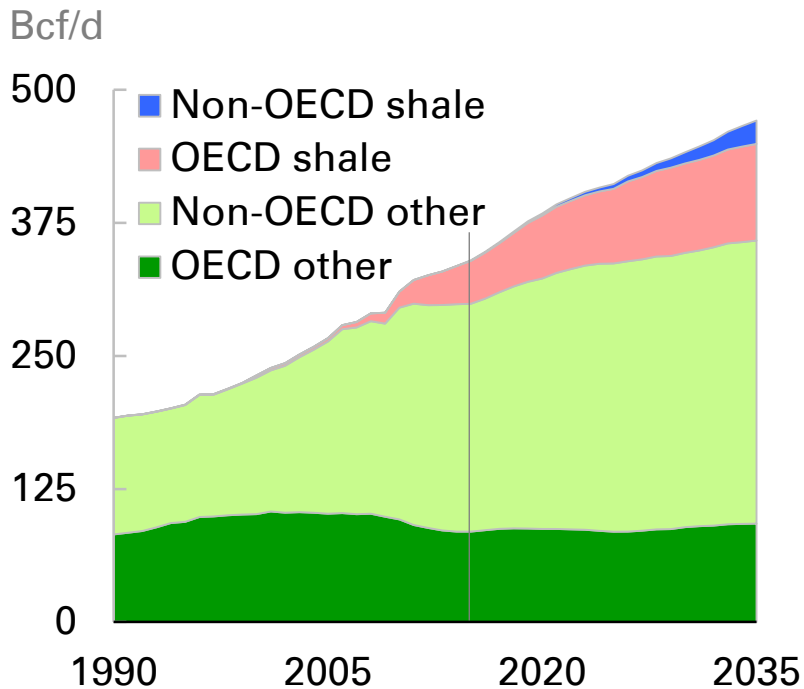


## Vehicle fleet

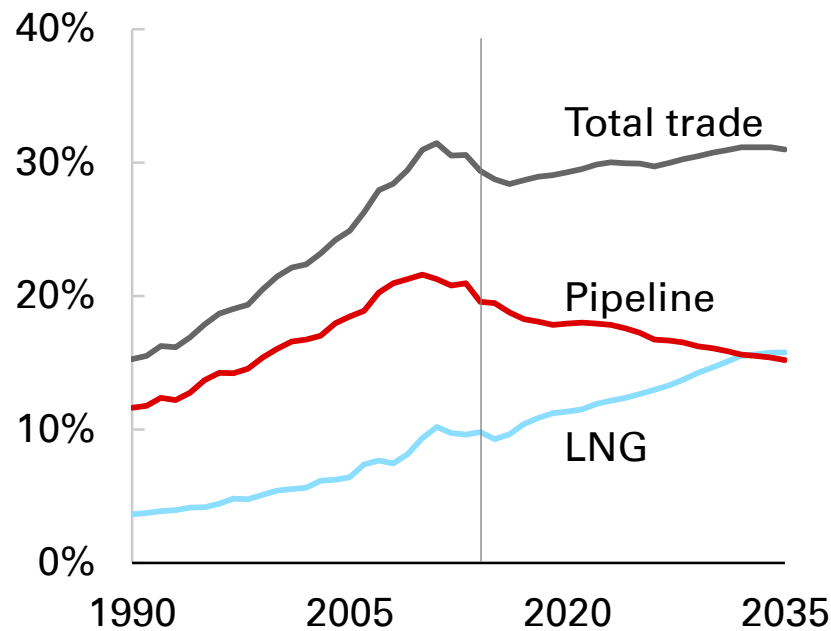


# Natural gas

## Gas production by type and region

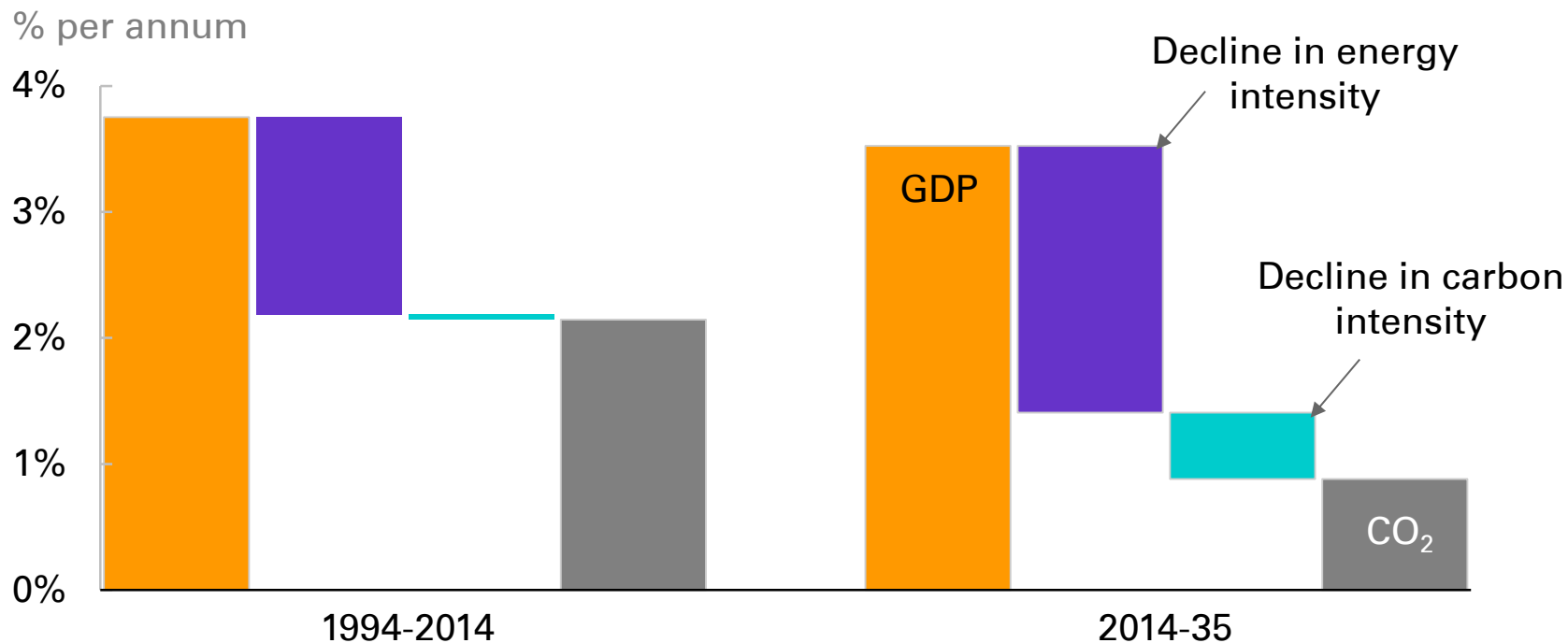


## Shares of global gas consumption



# Changing outlook for carbon emissions

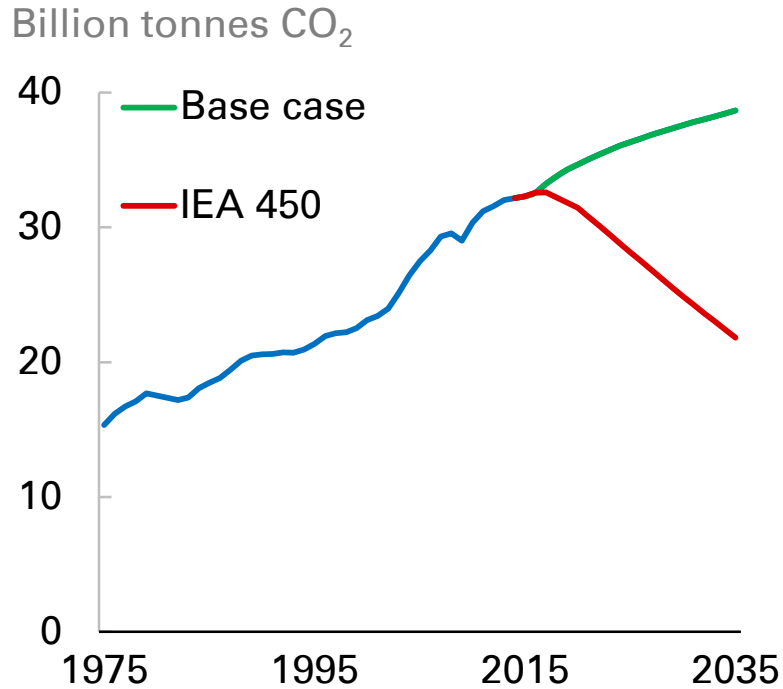
# Carbon emissions





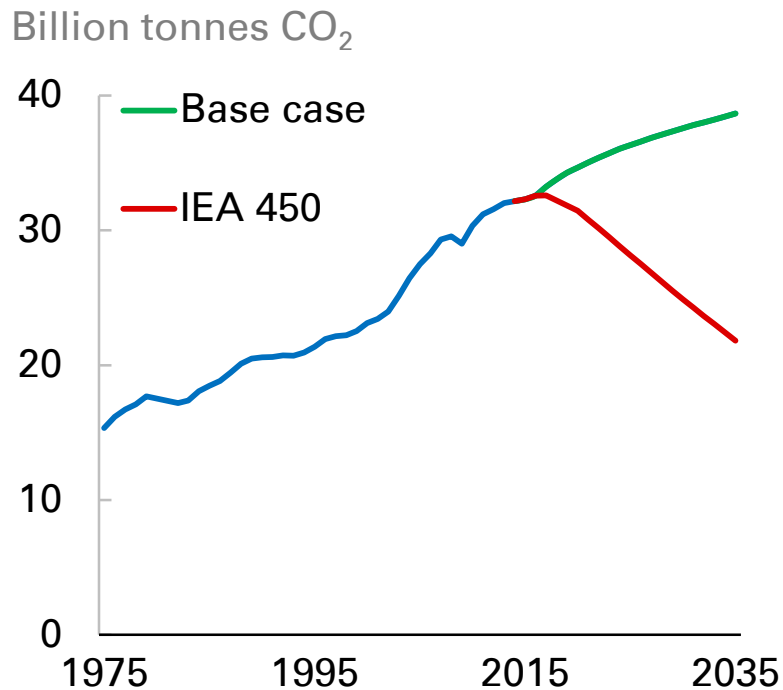
# Outlook for carbon emissions

## Carbon emissions

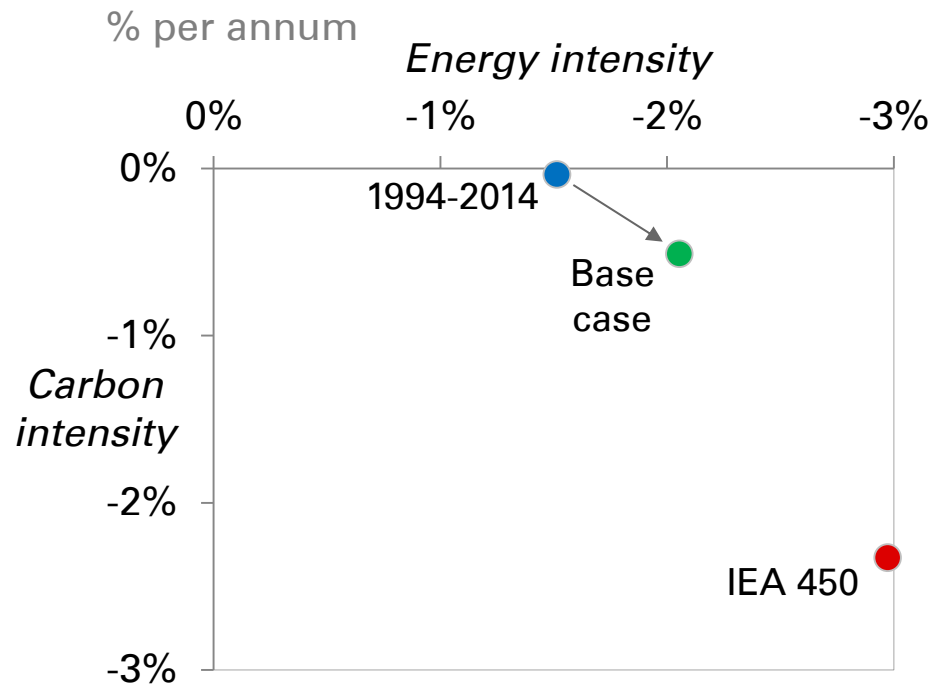


# Outlook for carbon emissions

## Carbon emissions

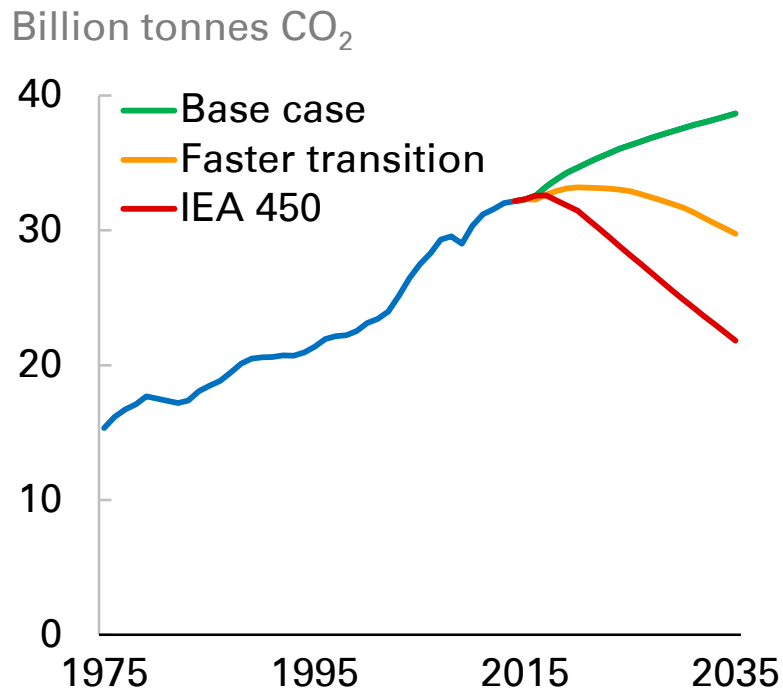


## Changes in intensity

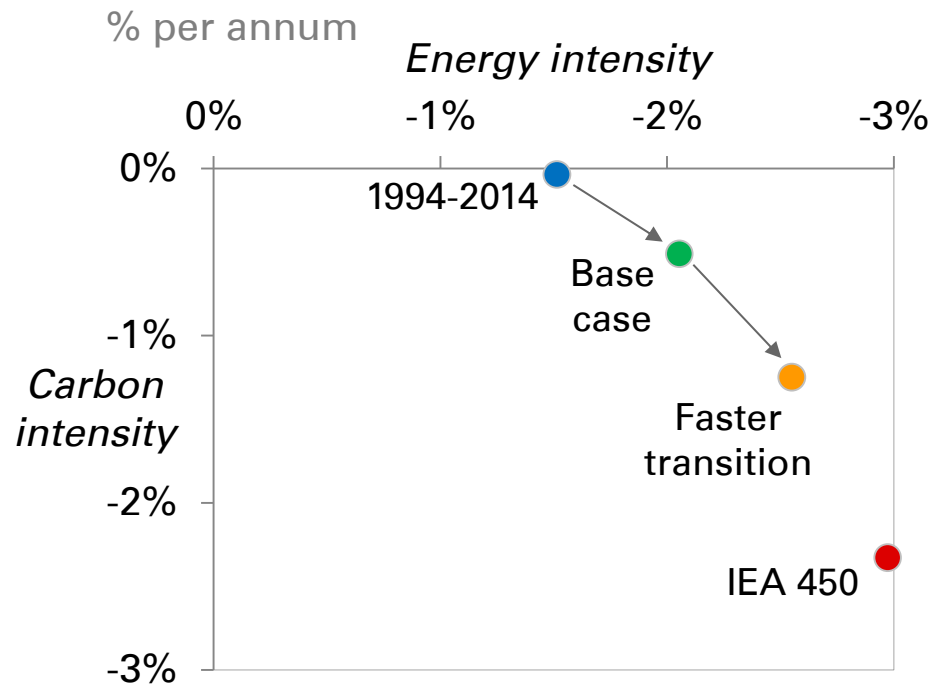


# Outlook for carbon emissions

## Carbon emissions



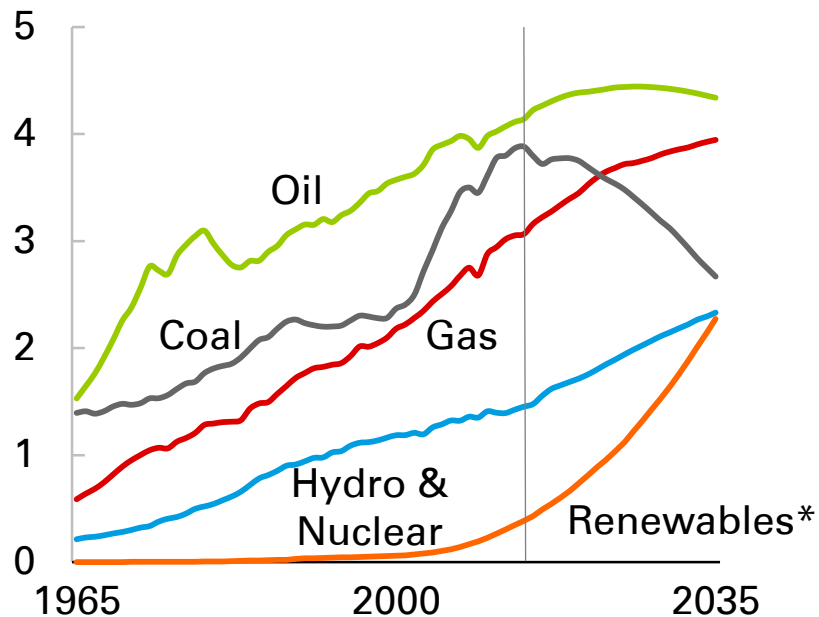
## Changes in intensity



# Impact of faster transition case

## Consumption by fuel

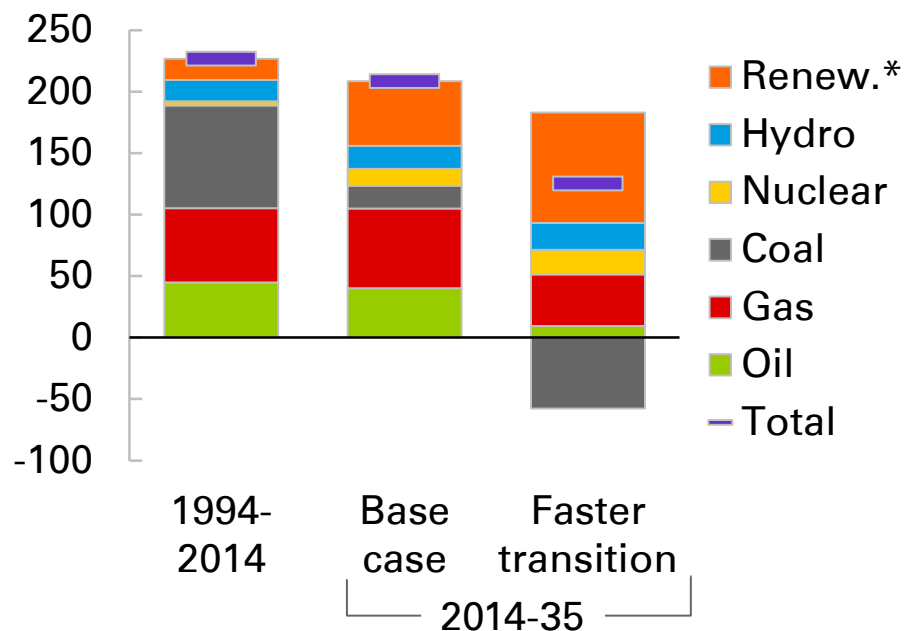
Billion toe



\*Includes biofuels

## Annual demand growth by fuel

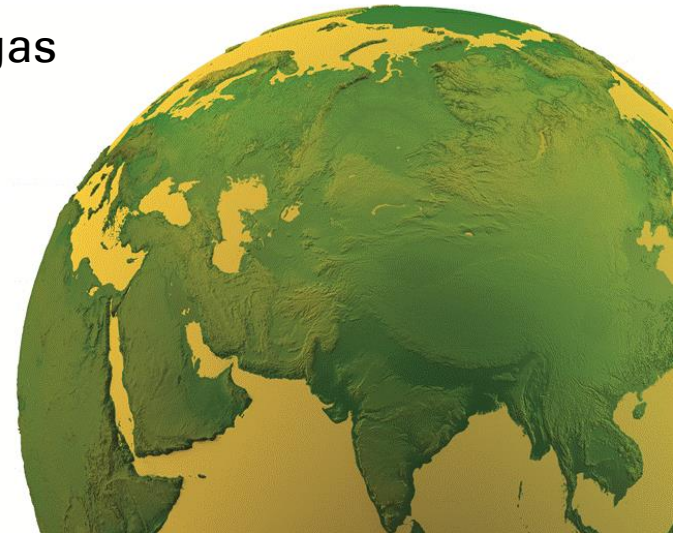
Mtoe per annum



# Conclusions

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- Global demand for energy continues to rise
  - to power increased levels of activity as the world economy continues to grow
- Fuel mix changes significantly
  - coal losing, renewables gaining, and oil and gas combined holding steady
- Growth rate of carbon emissions slows sharply
  - but further policy changes are needed



# BP Energy Outlook

## 2016 edition



Outlook  
to 2035

# BP Energy Outlook

## 2016 edition



Charts from the booklet

Outlook  
to 2035

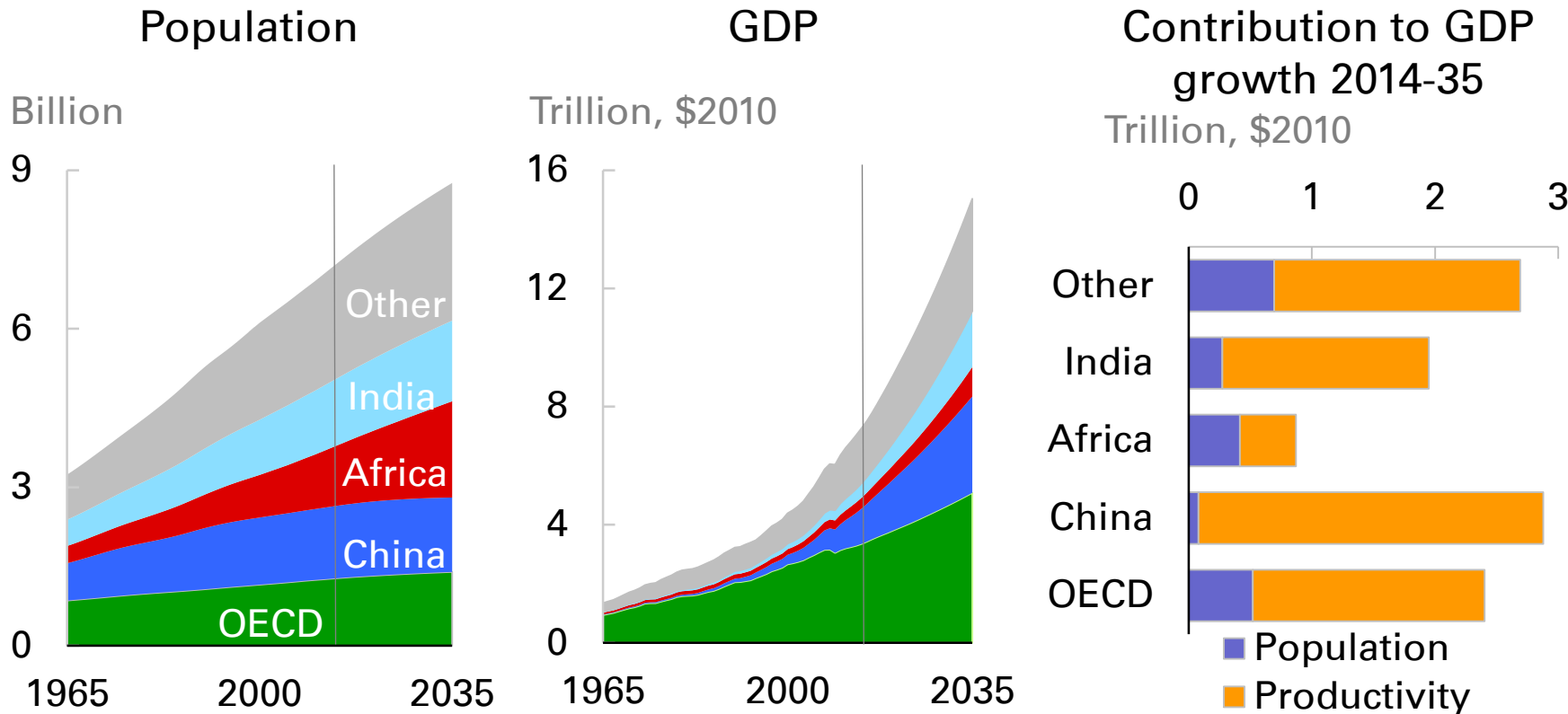


# **Base case**

## Primary energy

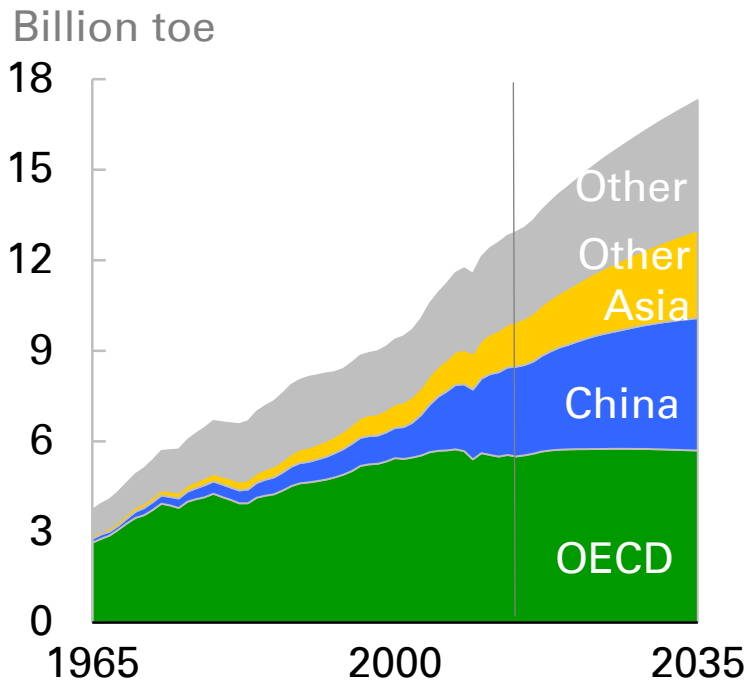


# Global GDP is expected to more than double...

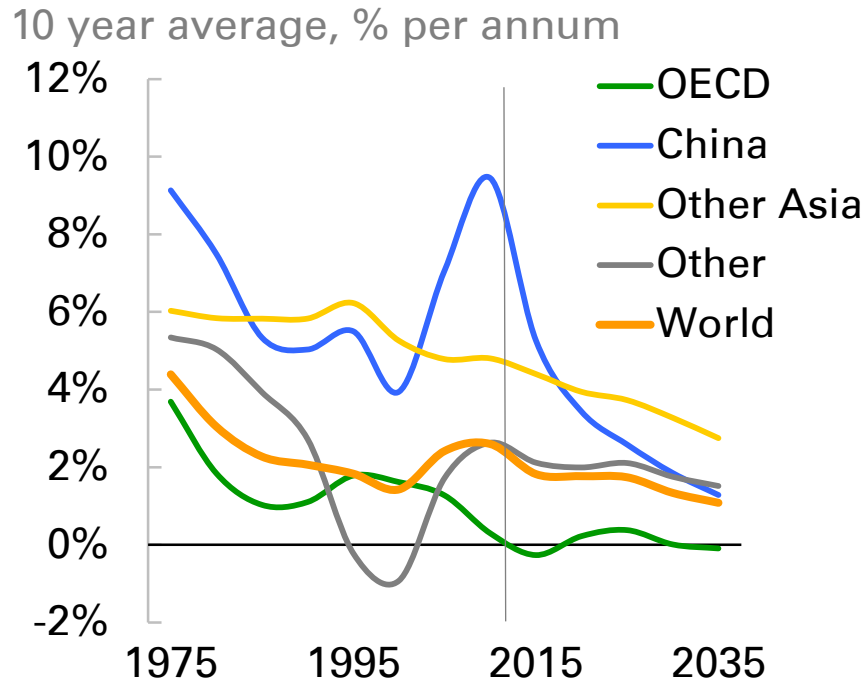


# Growth in the world economy requires more energy...

## Consumption by region

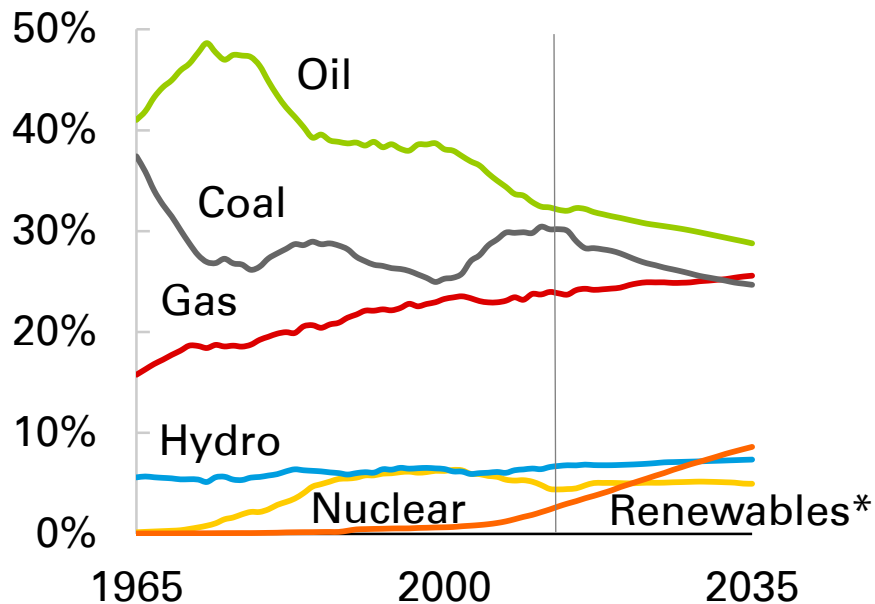


## Consumption growth by region



# The fuel mix is set to change significantly...

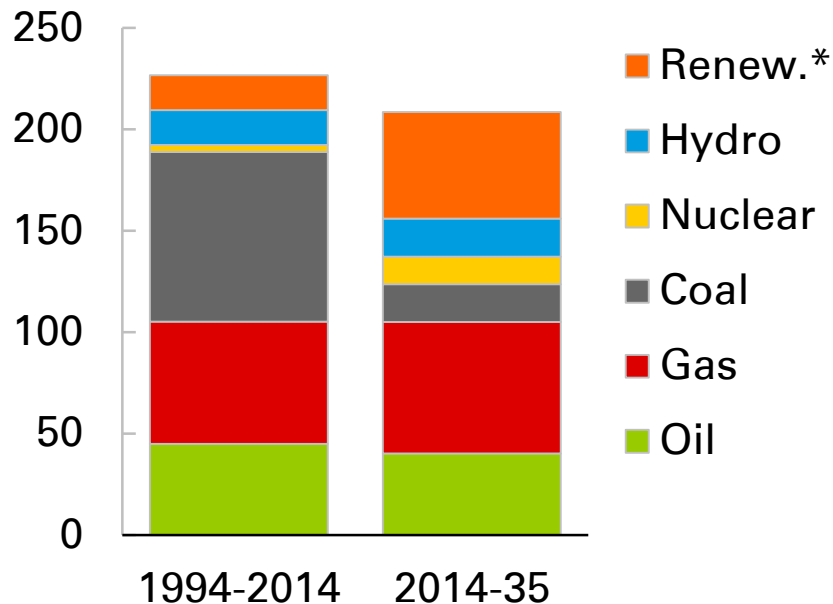
## Shares of primary energy



\*Includes biofuels

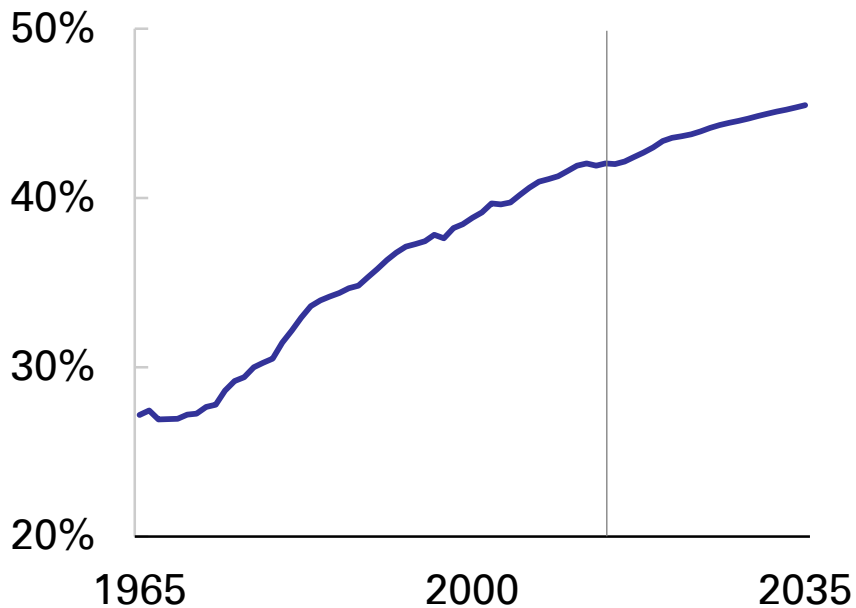
## Annual demand growth by fuel

Mtoe per annum

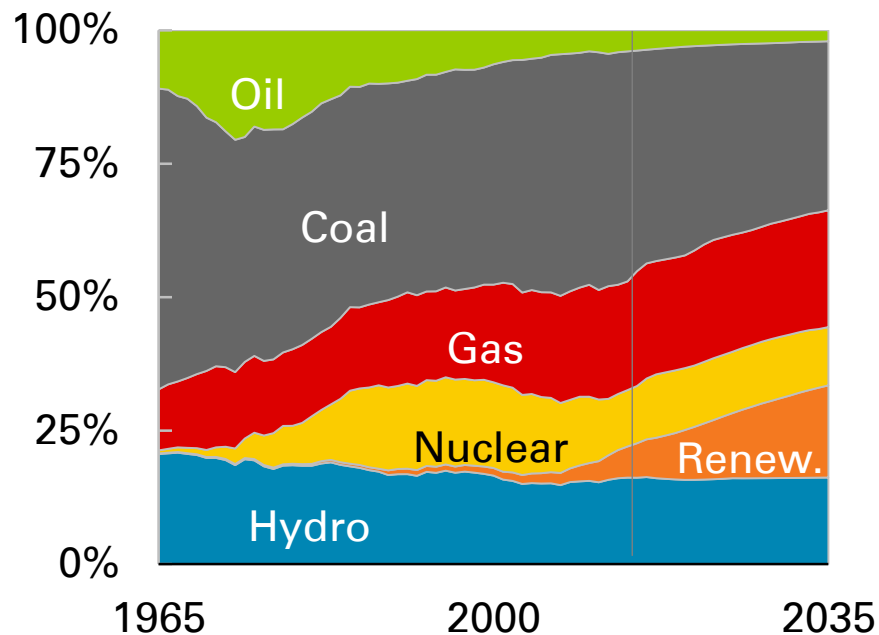


# Much of the growth in energy is used for power generation...

### Inputs to power as a share of total primary energy



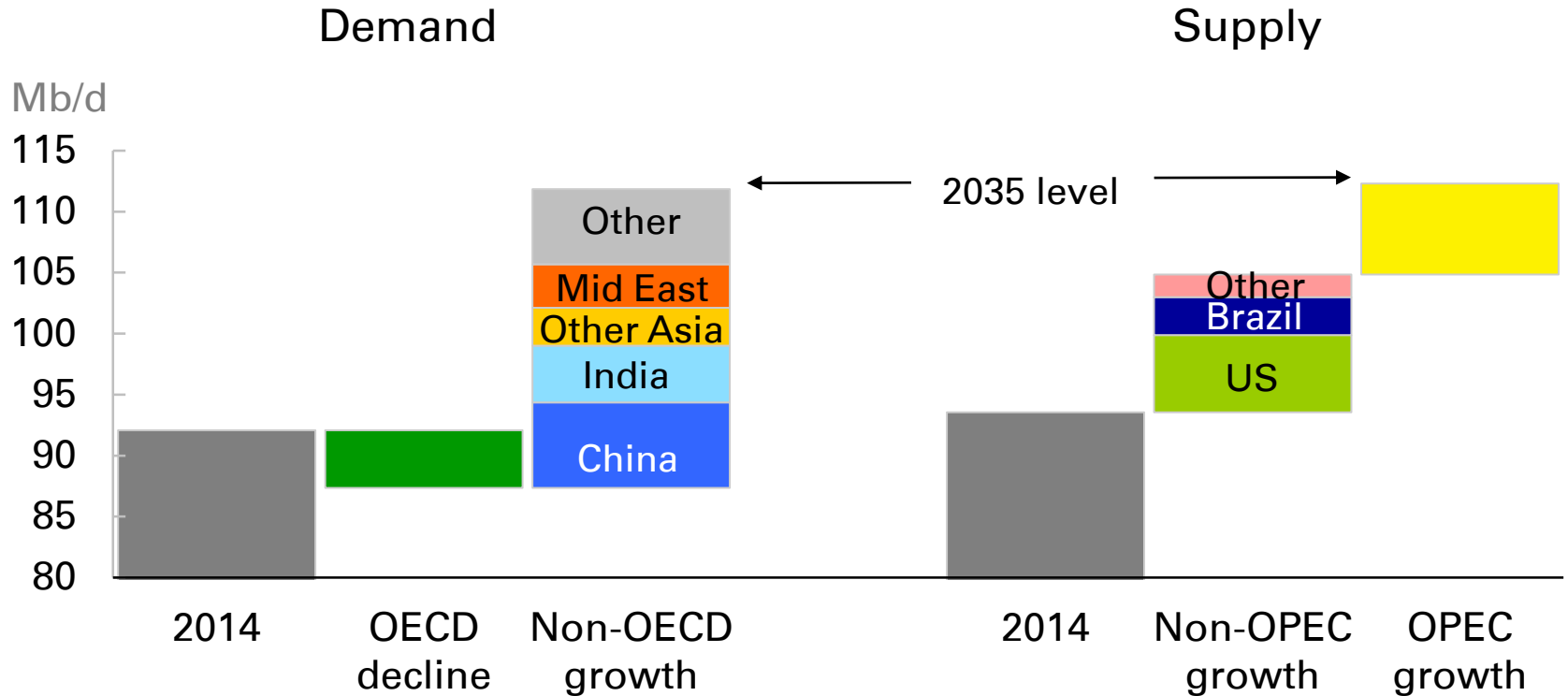
### Primary inputs to power



# **Base case**

## Fuel by fuel detail

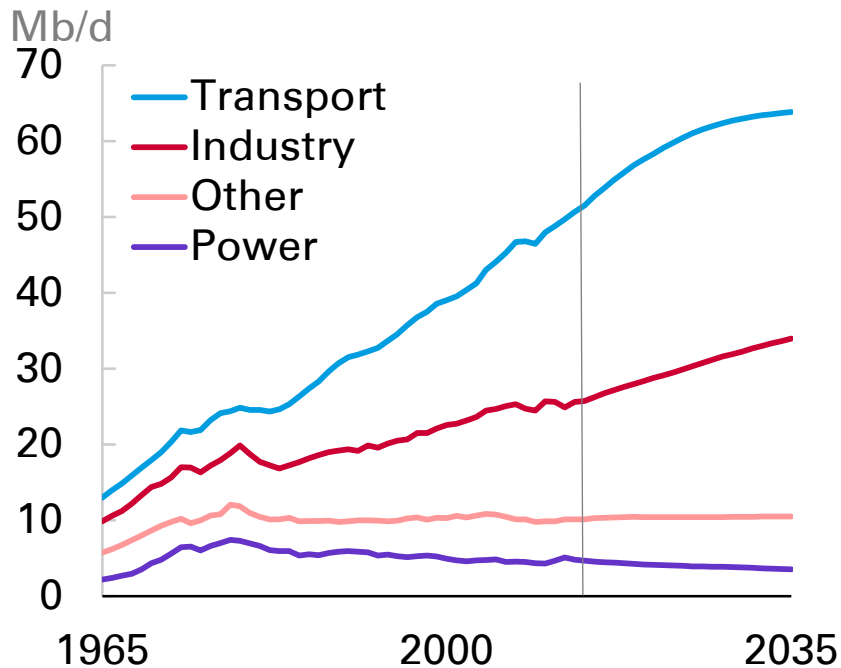
# Strong growth in Asia drives increases in oil demand...



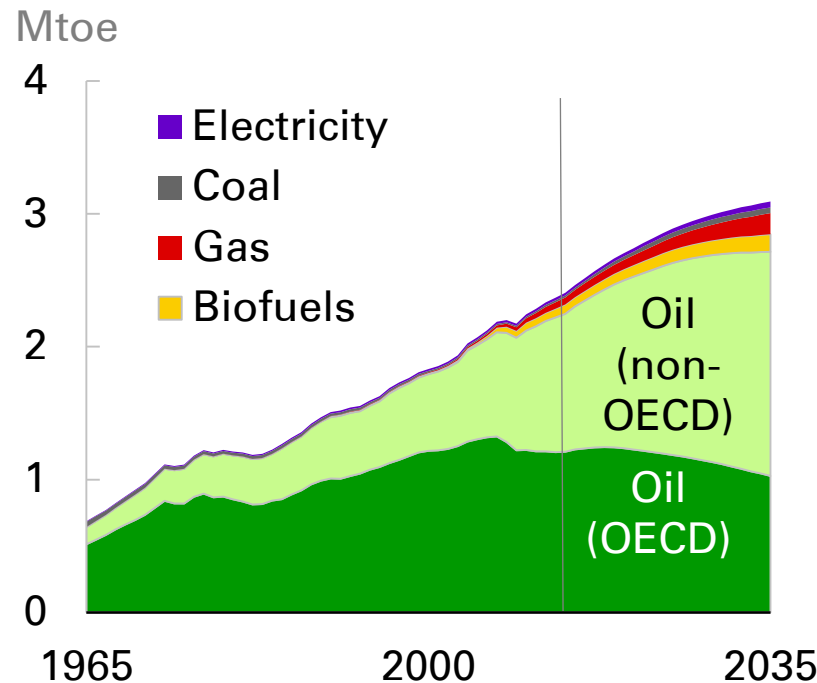


# Growth in liquids demand is driven by transport and industry...

## Liquids demand by sector



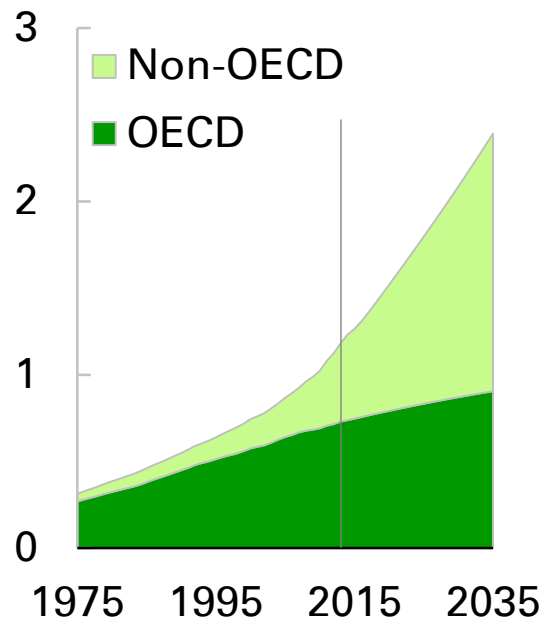
## Transport demand by fuel



# The global vehicle fleet more than doubles...

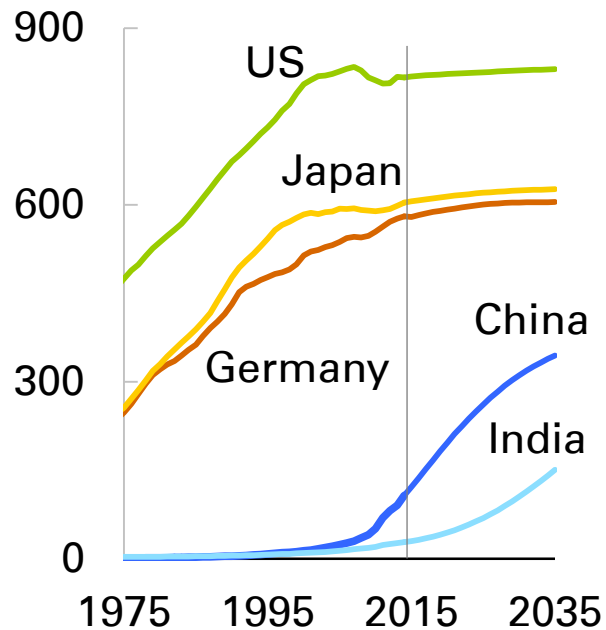
## Vehicle fleet

Billion vehicles



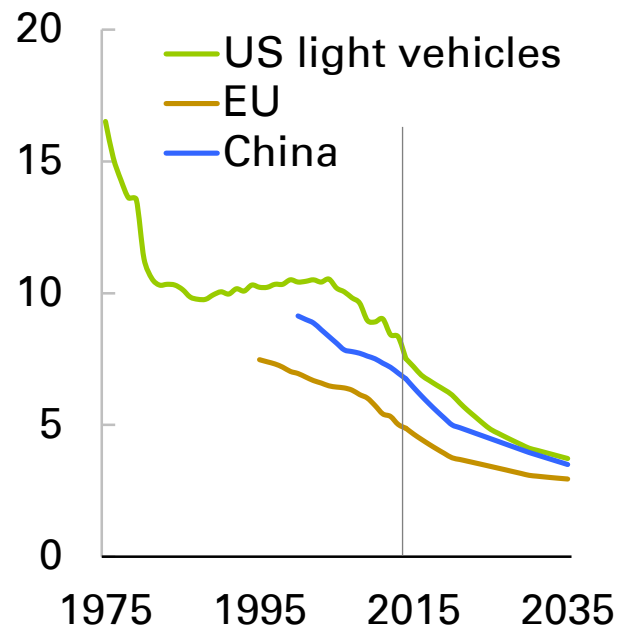
## Vehicle ownership

Vehicles per 1000 people



## Fuel economy of new cars

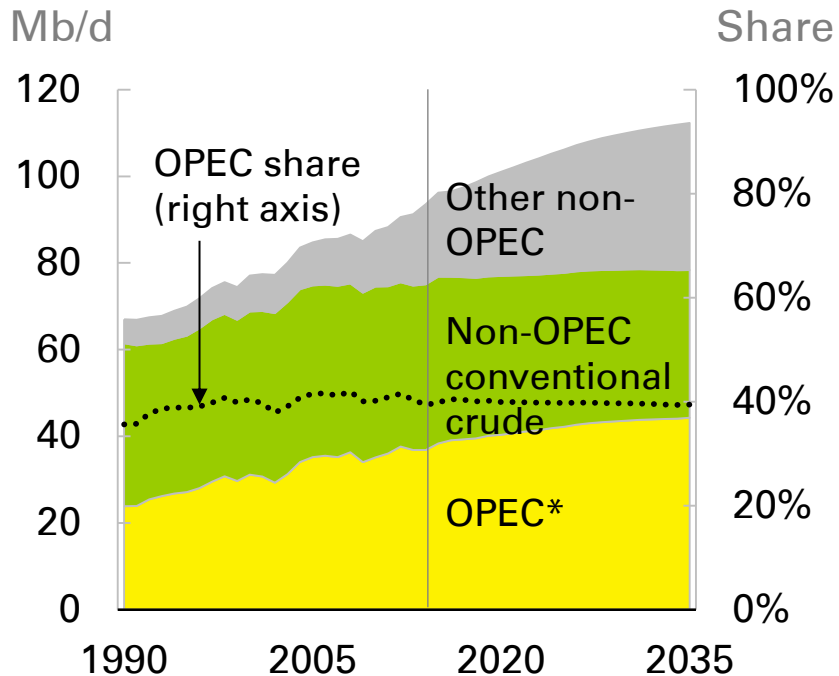
Litres per 100 km



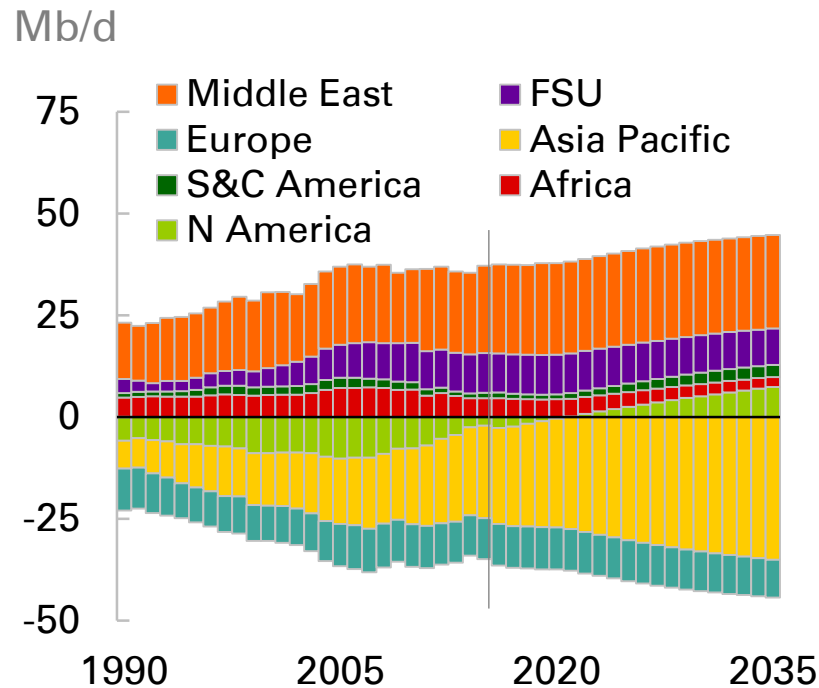


# Non-OPEC is the largest source of supply growth...

### Liquids supply by type



### Regional net balances



\*Includes crude and natural gas liquids (NGLs)

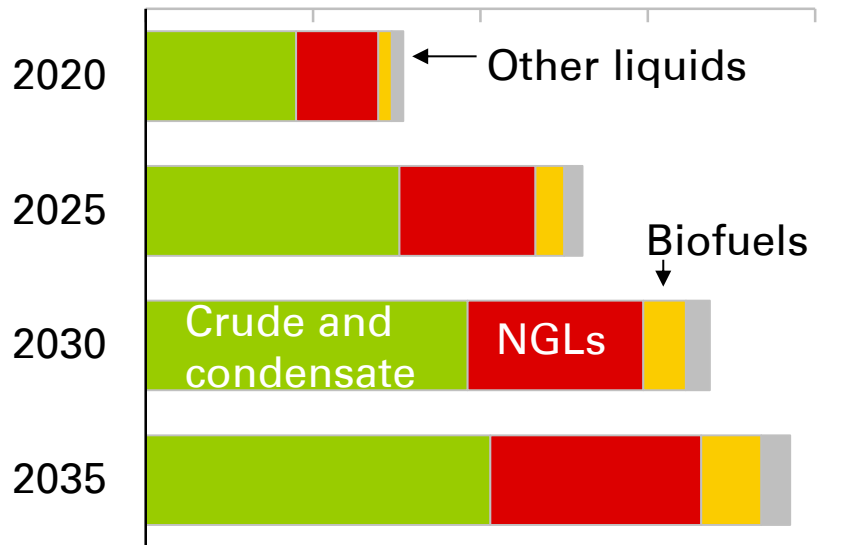


# Refiners are challenged by spare capacity...

## Global liquids supply growth

Mb/d, cumulative from 2014

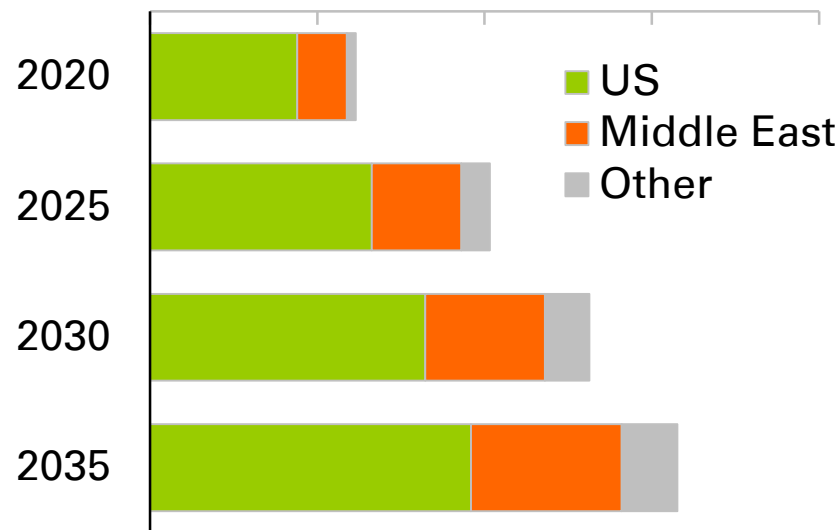
0 5 10 15 20



## NGLs production growth

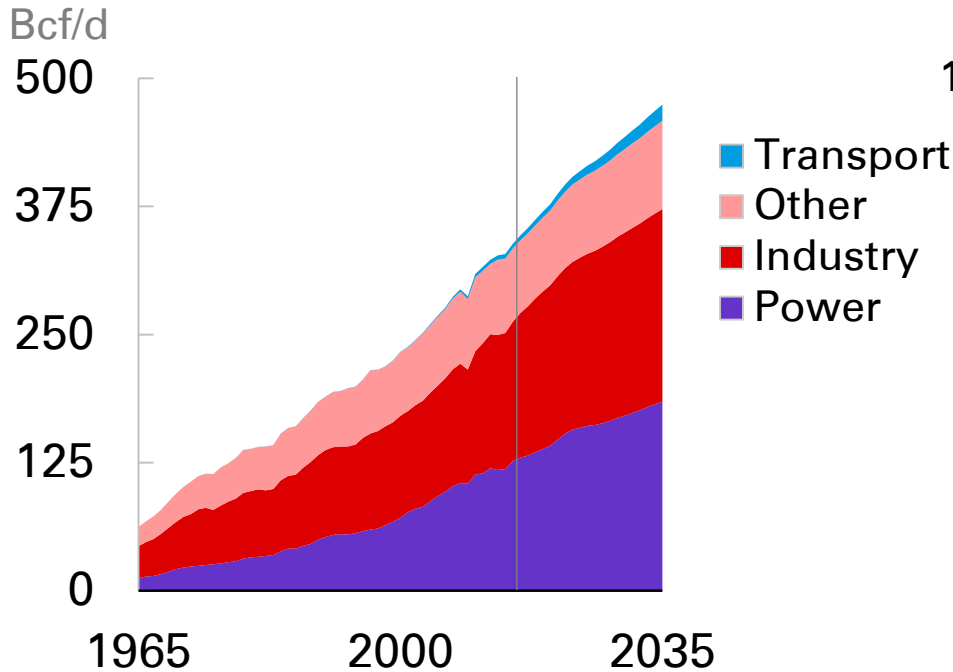
Mb/d, cumulative from 2014

0 2 4 6 8

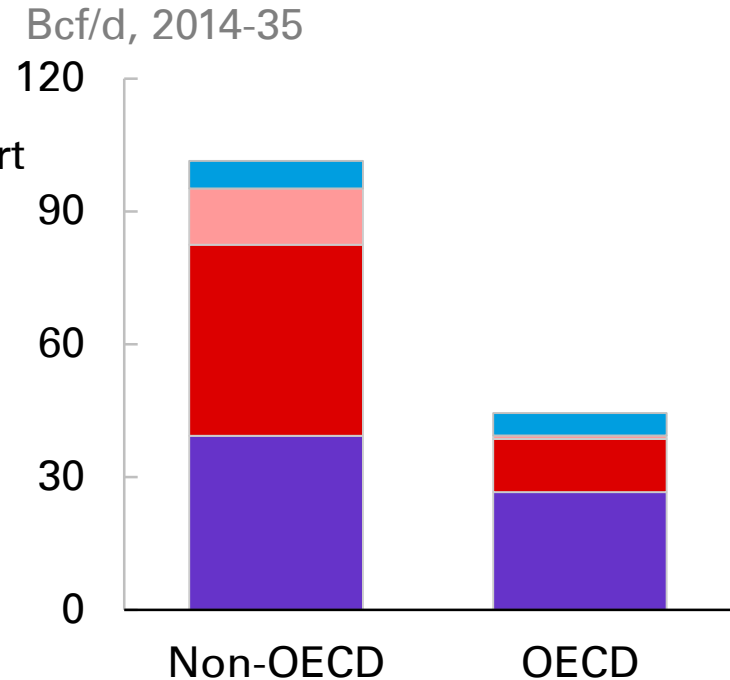


# Demand for natural gas grows strongly...

### Demand by sector



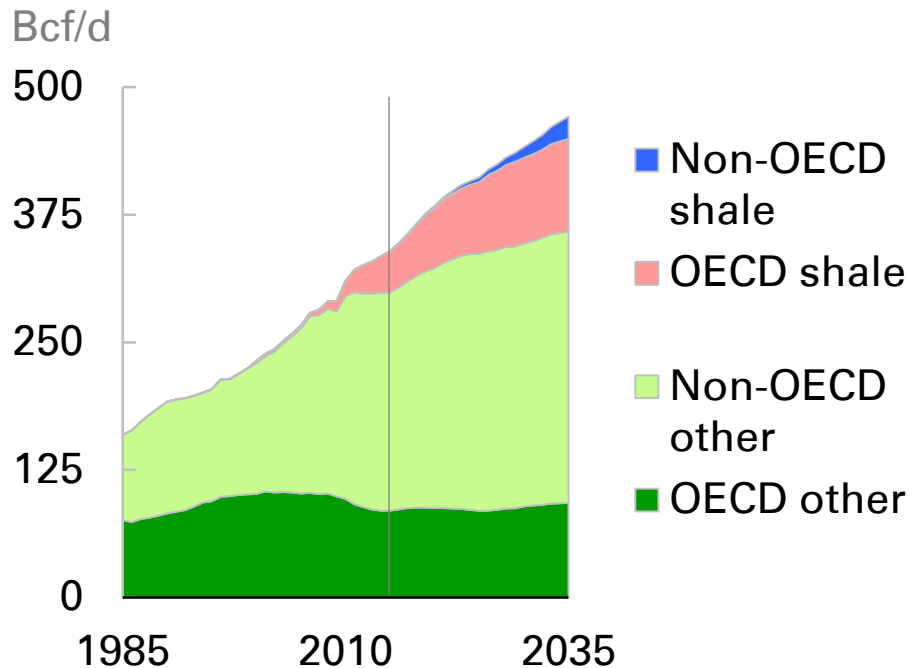
### Demand growth by region



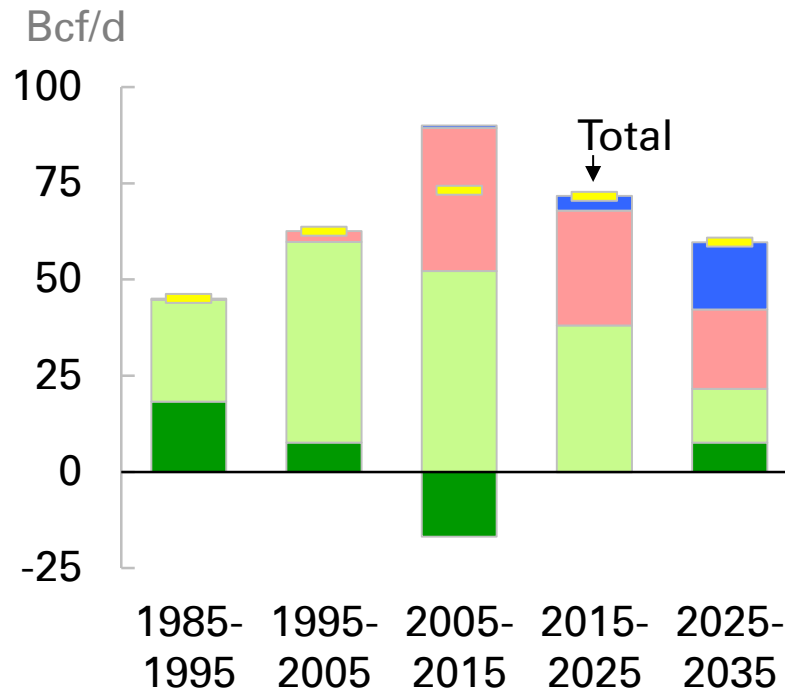


# Global supplies of natural gas grow robustly...

## Gas production by type and region



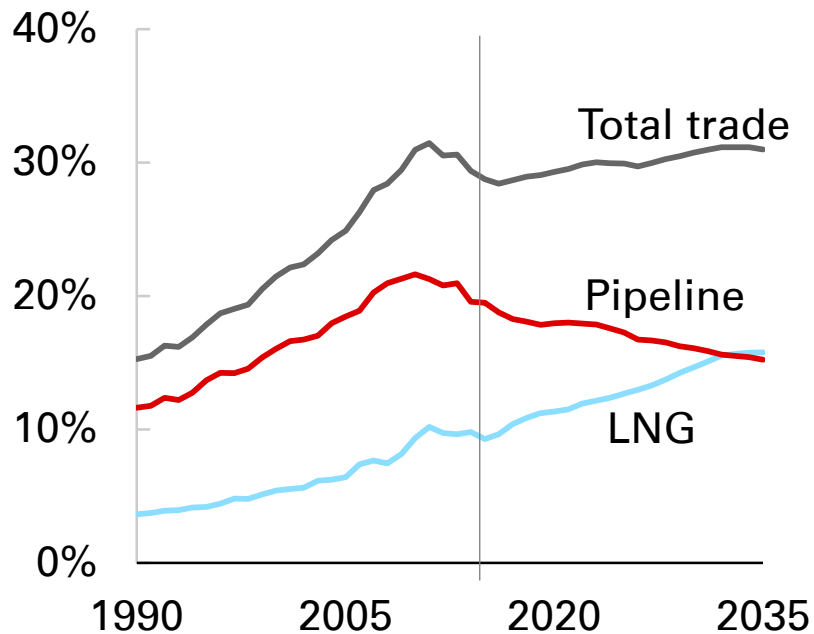
## Ten year increments



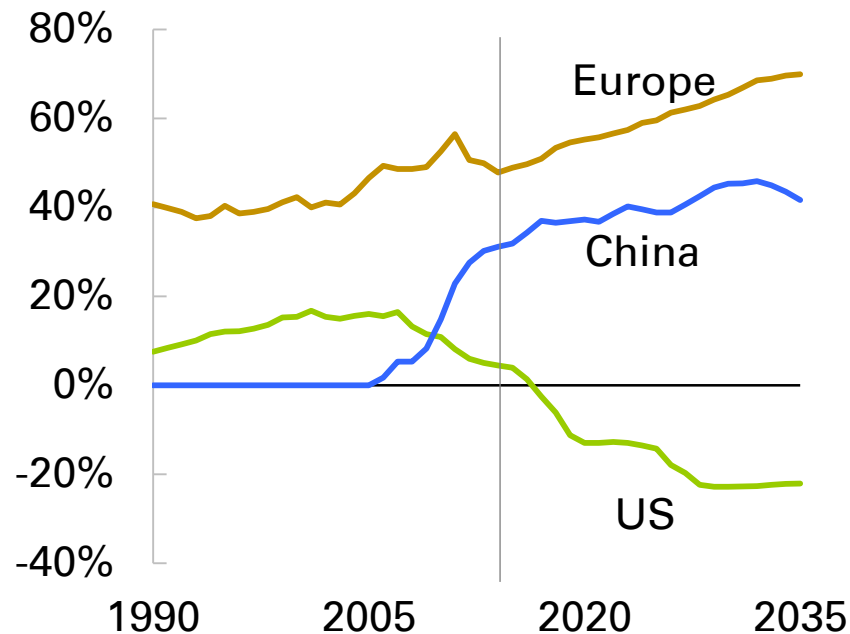


# Trade in gas grows broadly in line with global consumption...

## Trade as share of global consumption

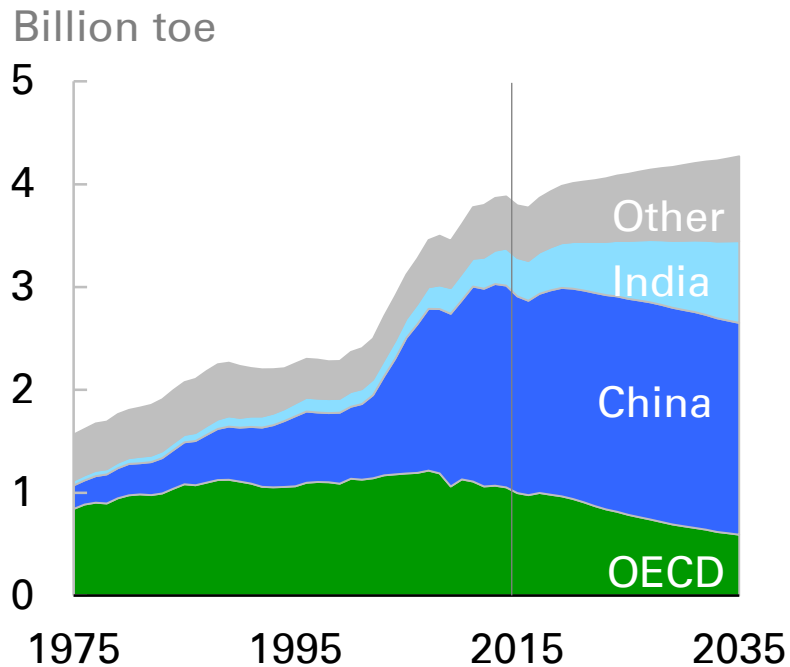


## Imports as share of consumption

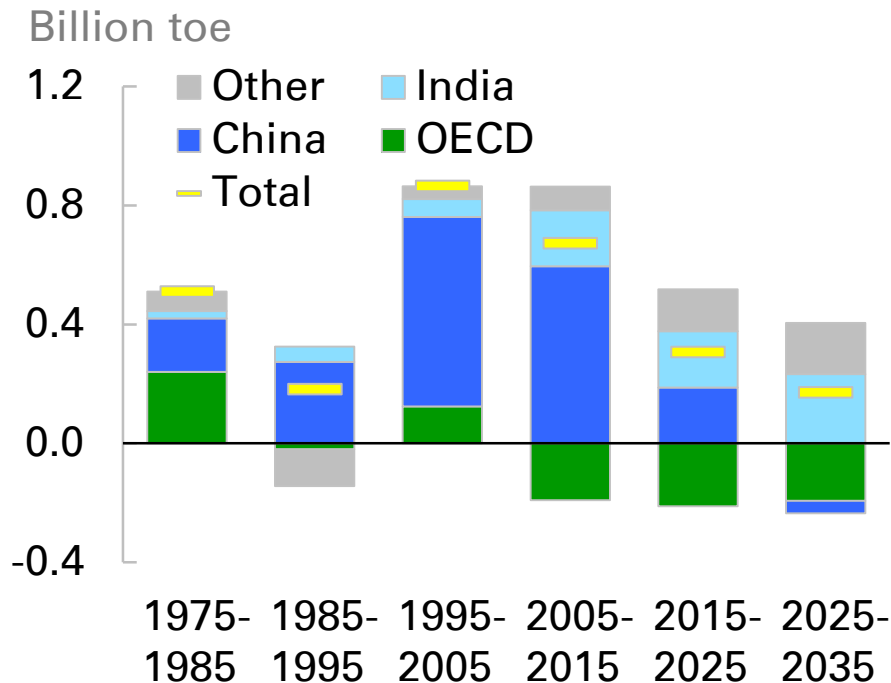


# Growth in global coal demand slows sharply...

## Coal consumption by region

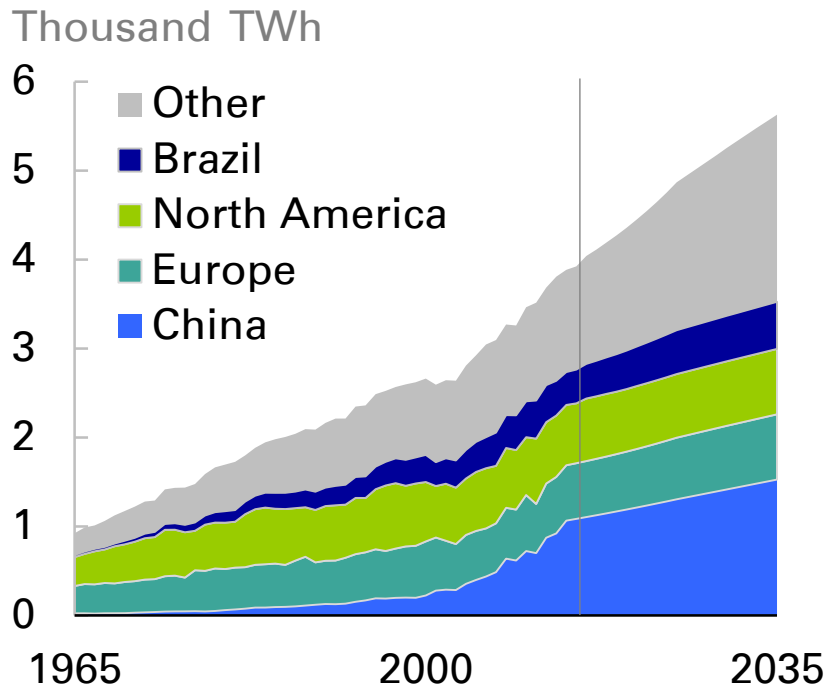


## Ten year increments by region

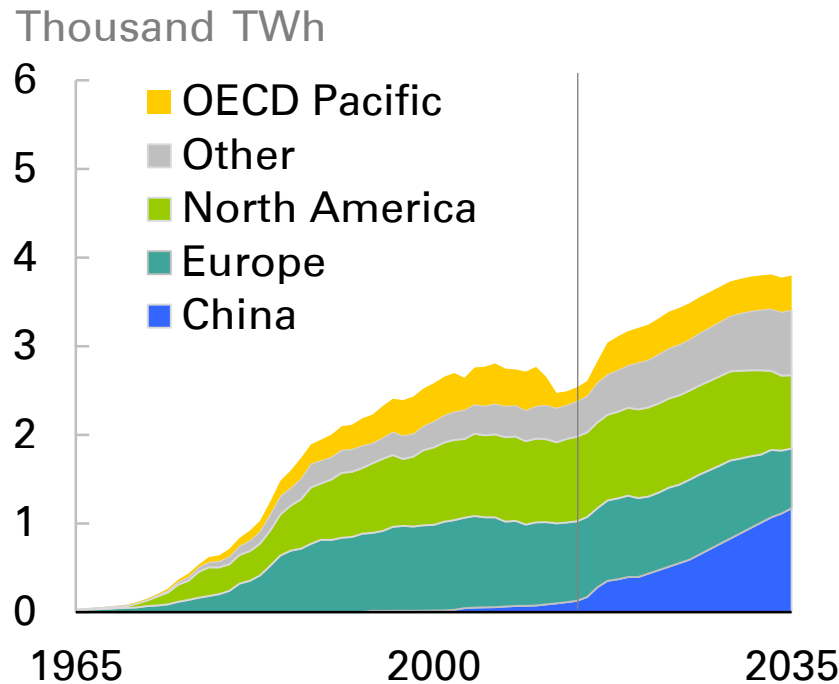


# Hydro and nuclear generation are set to grow steadily...

## Hydro generation by region

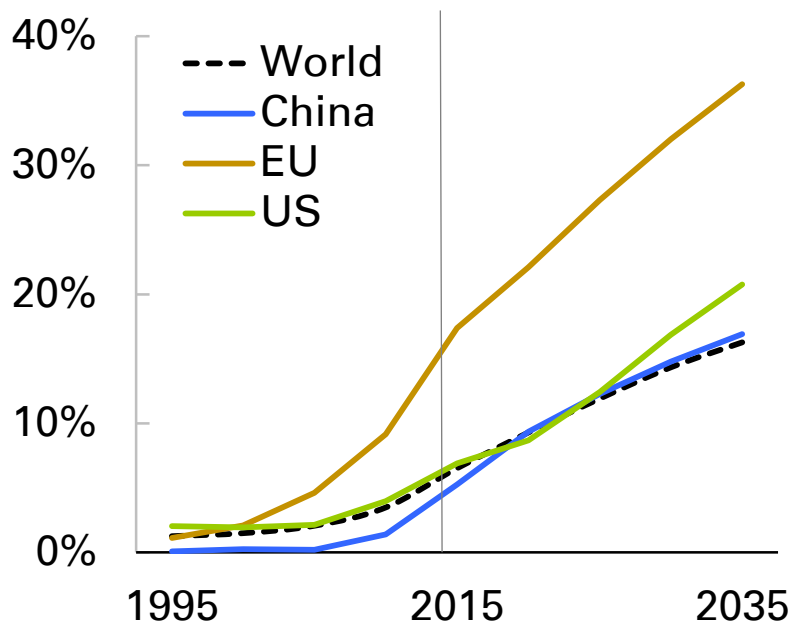


## Nuclear generation by region

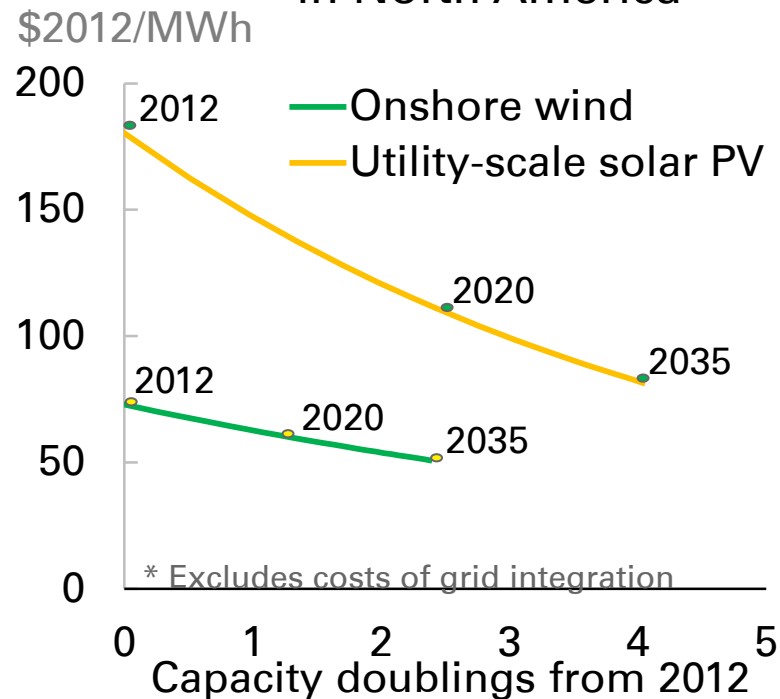


## Renewables continue to grow rapidly...

### Renewables share of power generation



### Levelized cost\* of electricity in North America





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# **Base case**

## **Key issues**

*What drives energy demand?*

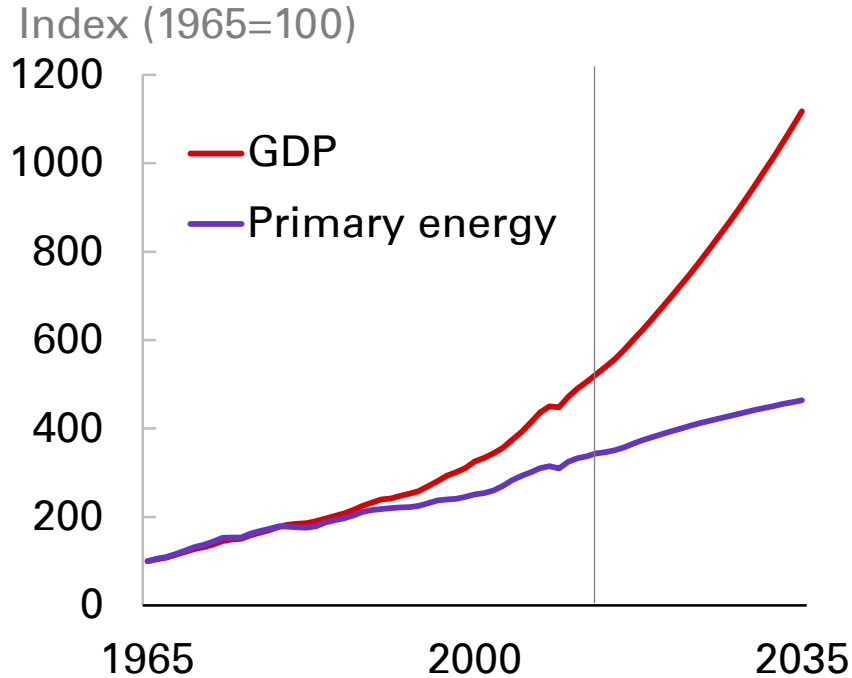
*The changing outlook for carbon emissions*

*What have we learned about US shale?*

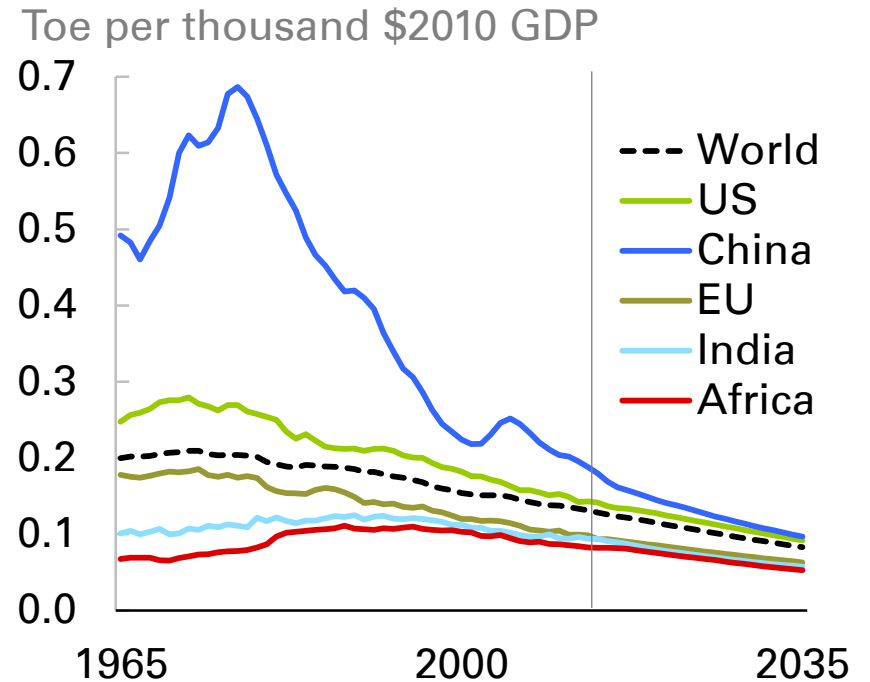
*China's changing energy needs*

# Increases in energy demand are driven by economic growth...

## World GDP and energy demand

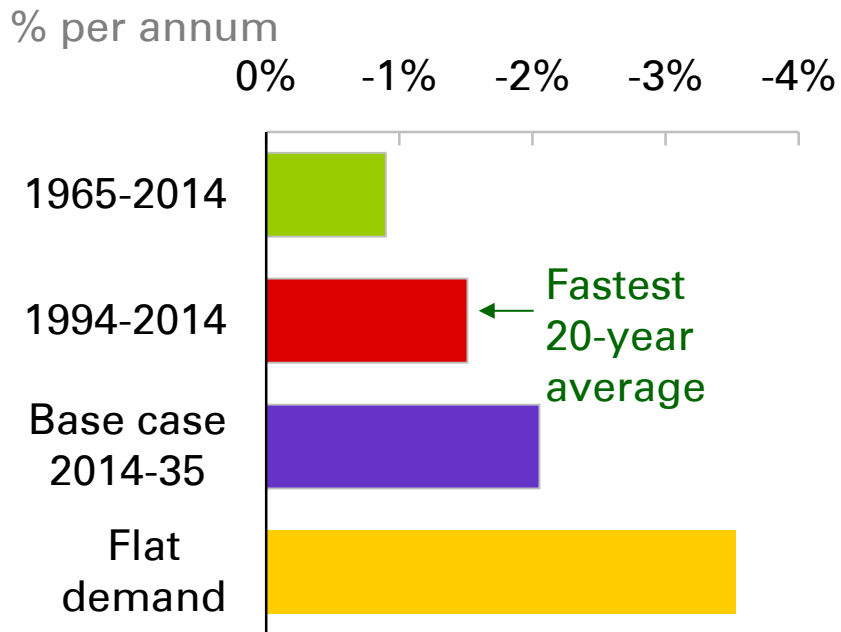


## Energy intensity by region

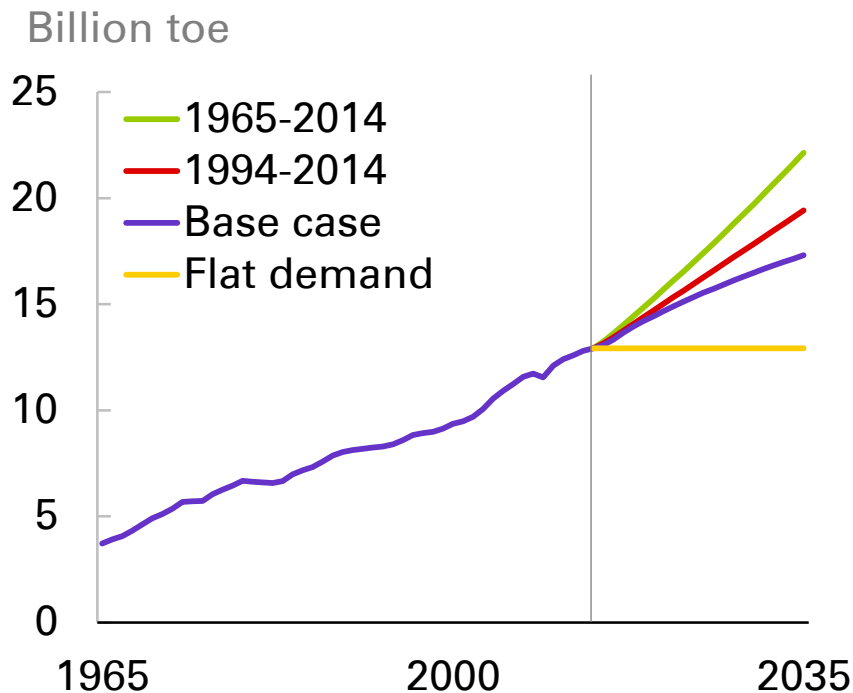


# Alternative assumptions about energy intensity...

### Decline in world energy intensity

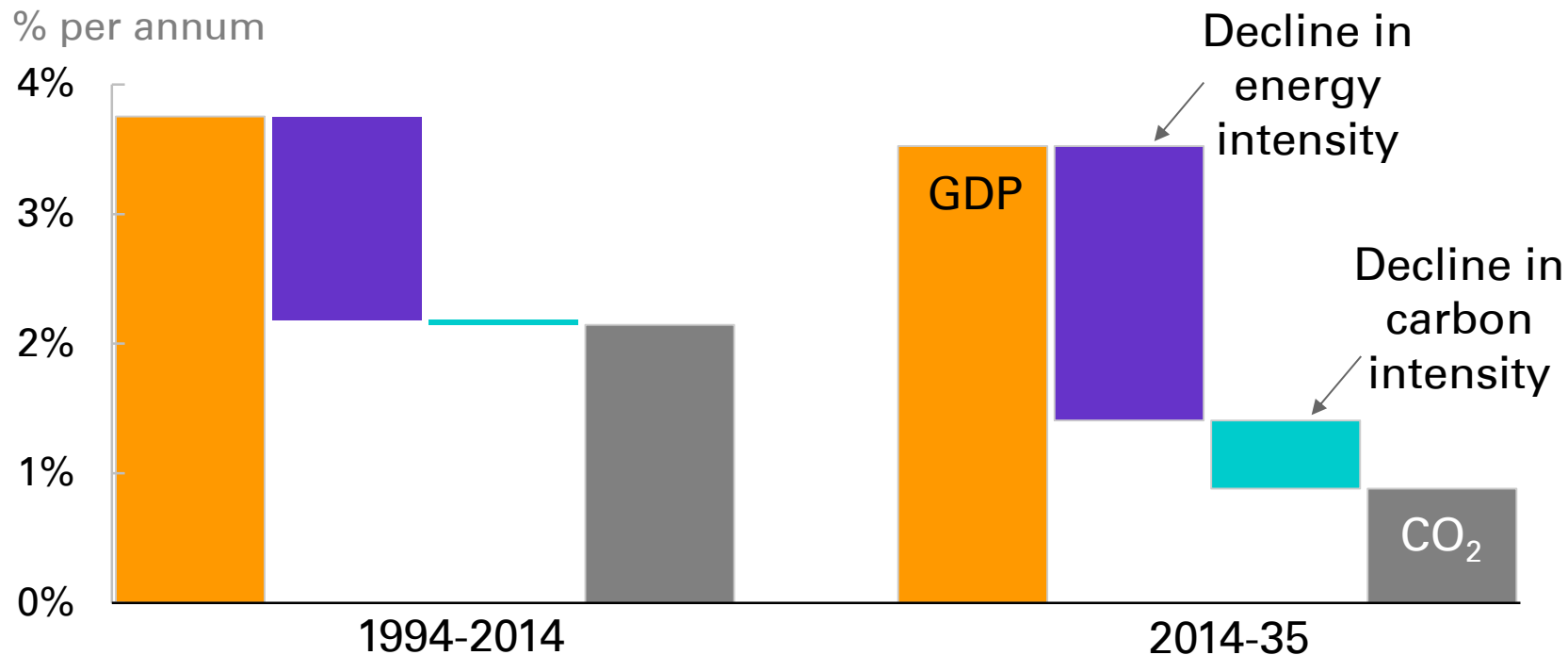


### World energy demand



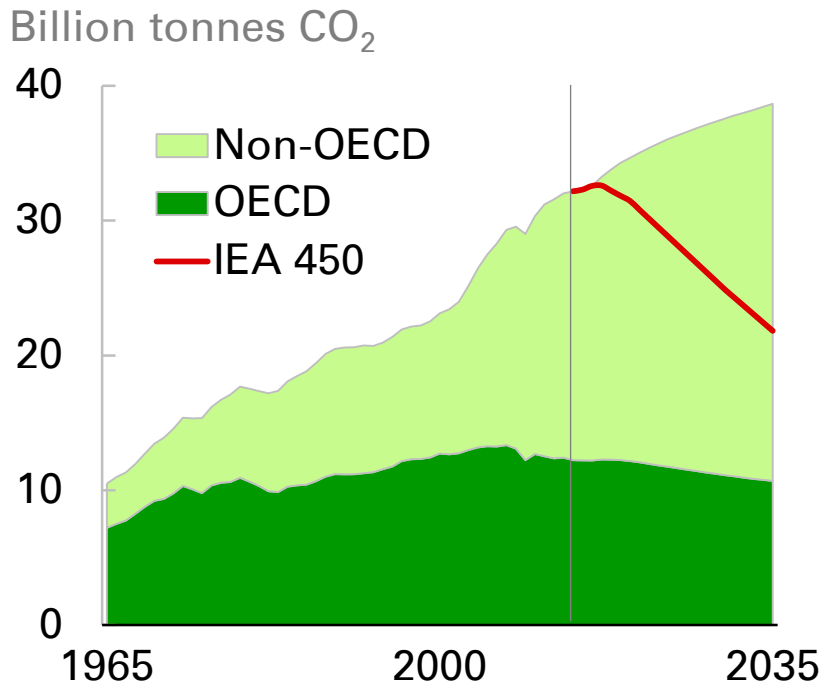
# The growth rate of carbon emissions more than halves...

## Decoupling emissions growth from GDP growth

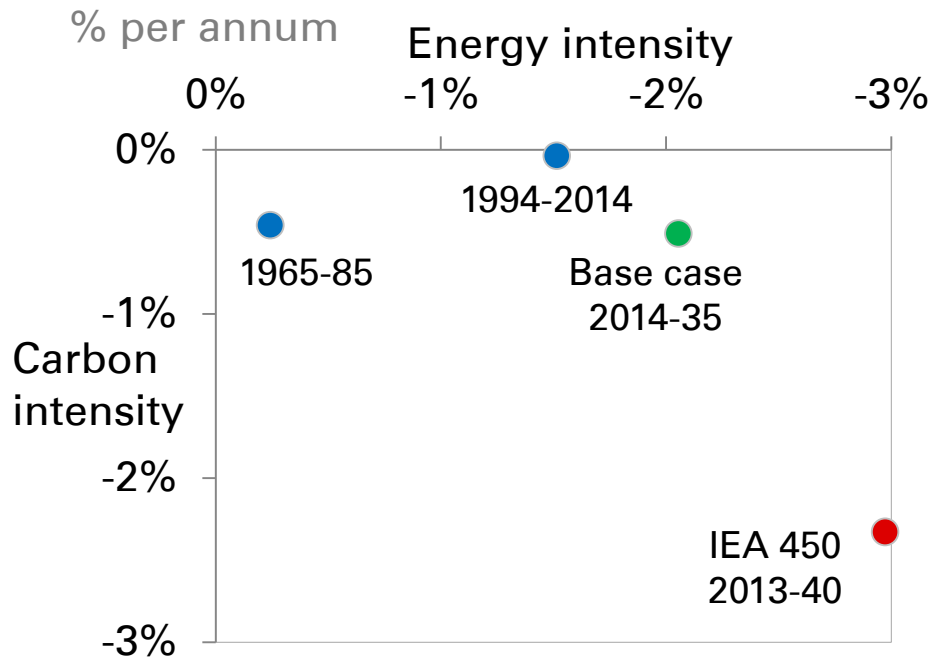


# But carbon emissions continue to rise...

## Carbon emissions



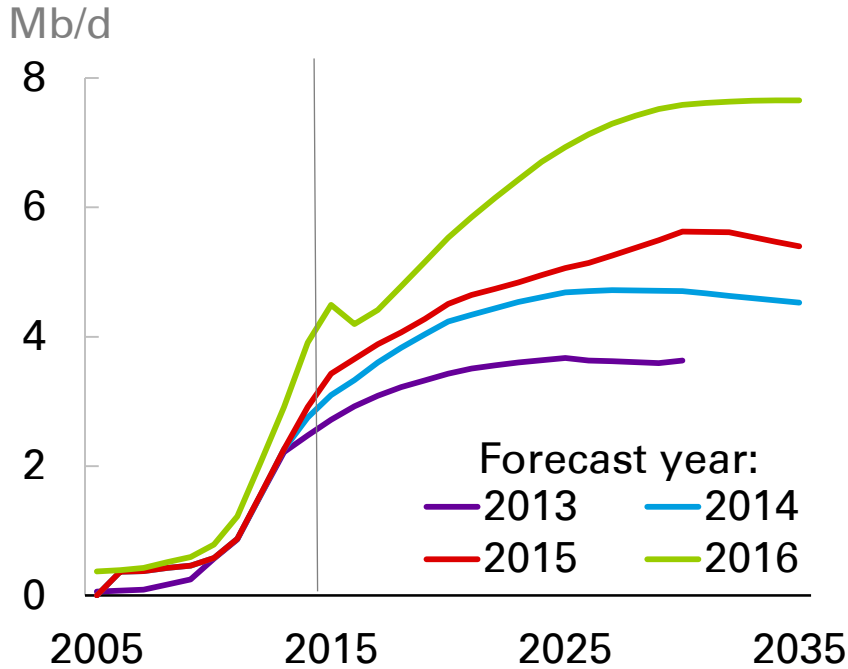
## Changes in intensity



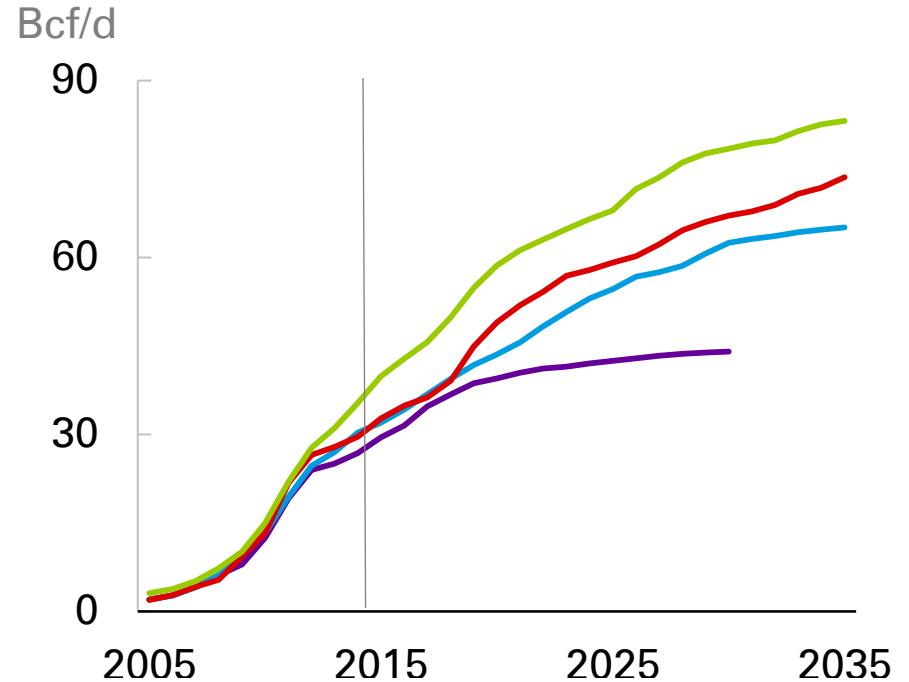


# The outlook for US shale has been revised up repeatedly...

## US tight oil forecasts

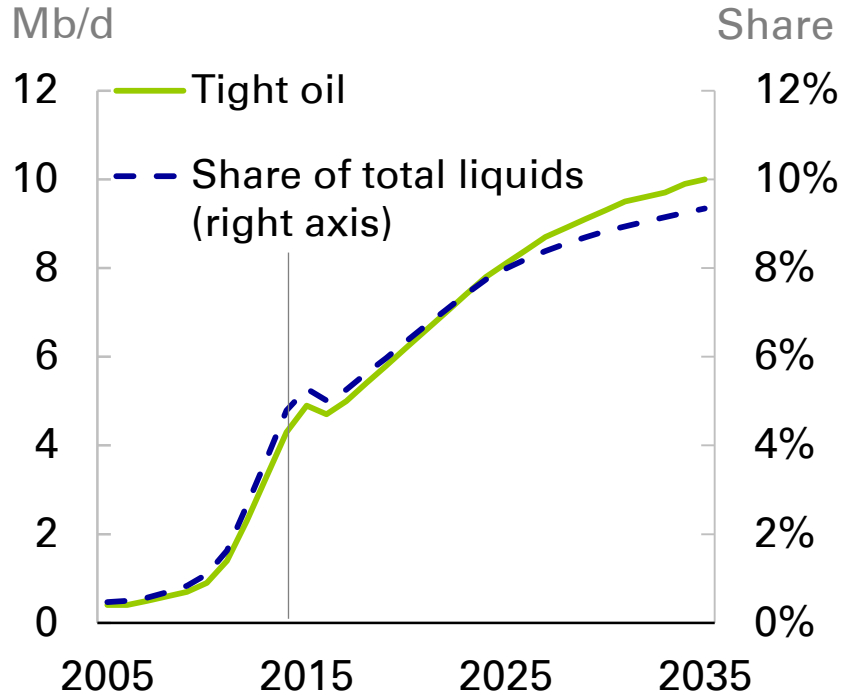


## US shale gas forecasts

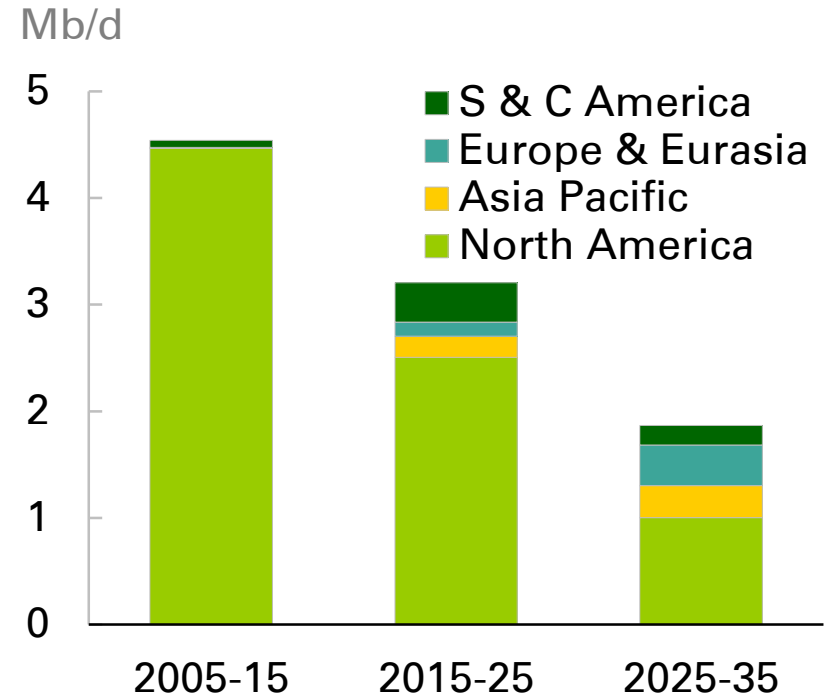


# The global growth in tight oil slows...

## Global tight oil production



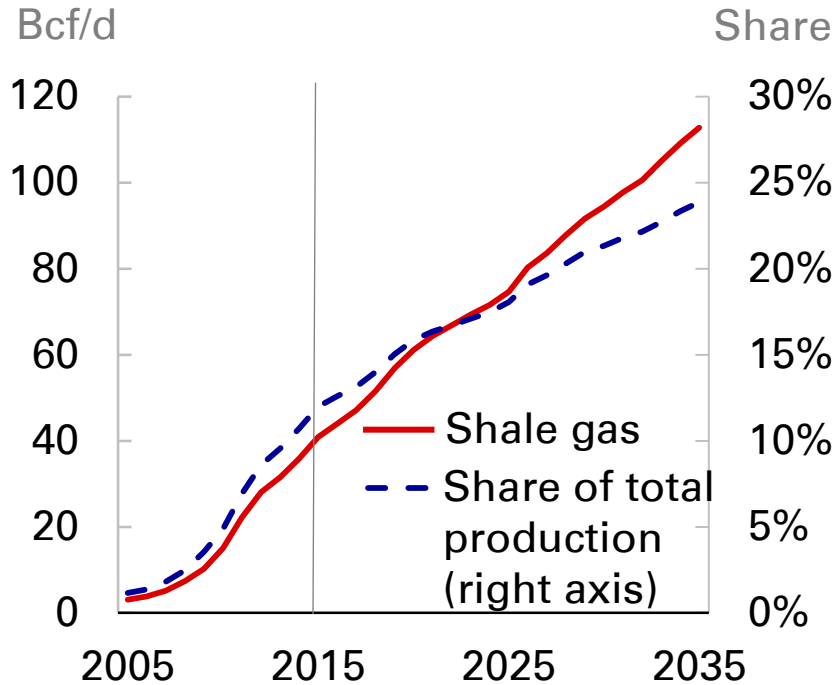
## Ten year increments by region



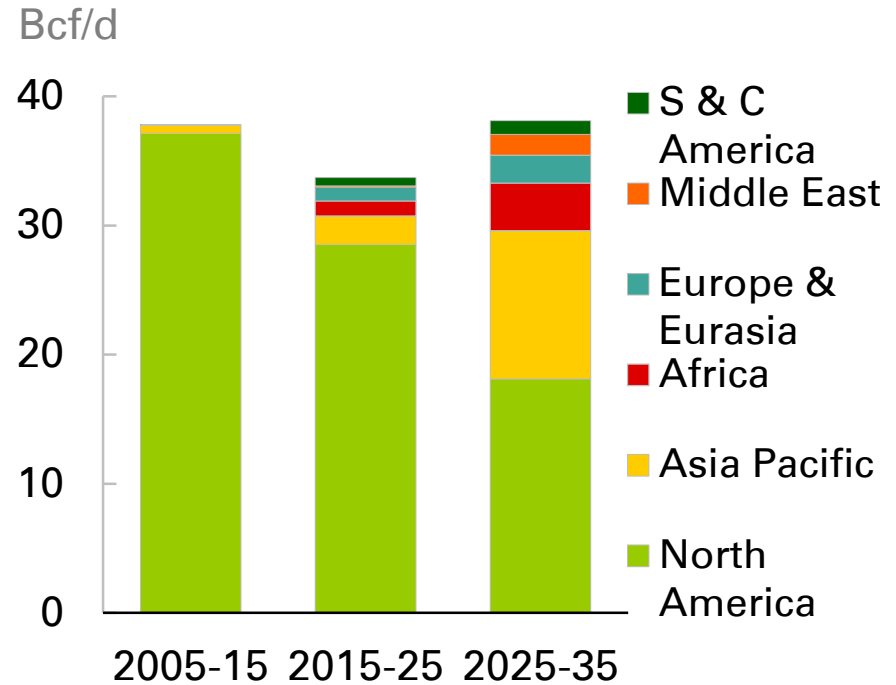


# Shale gas production continues to expand rapidly...

## Global shale gas production



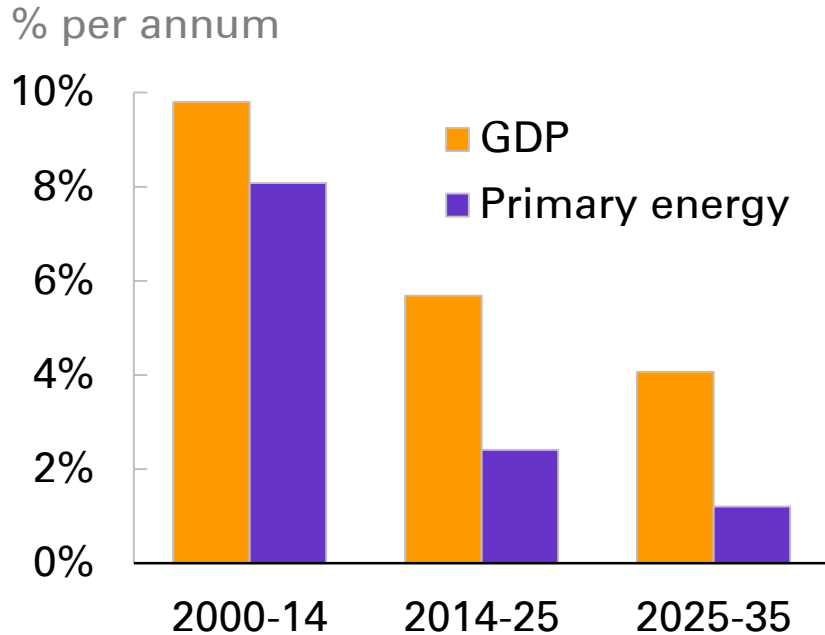
## Ten year increments by region



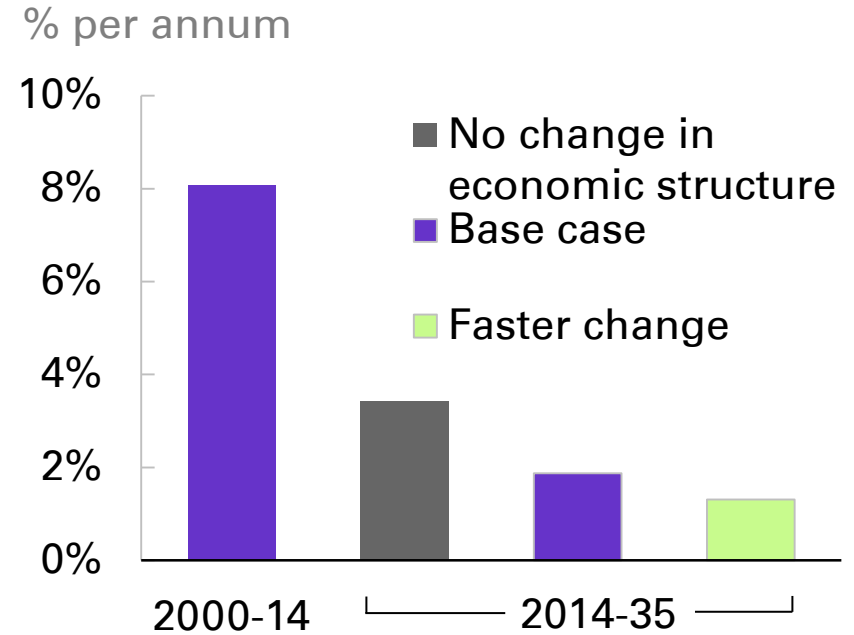


## China's energy needs are changing...

### GDP and primary energy growth

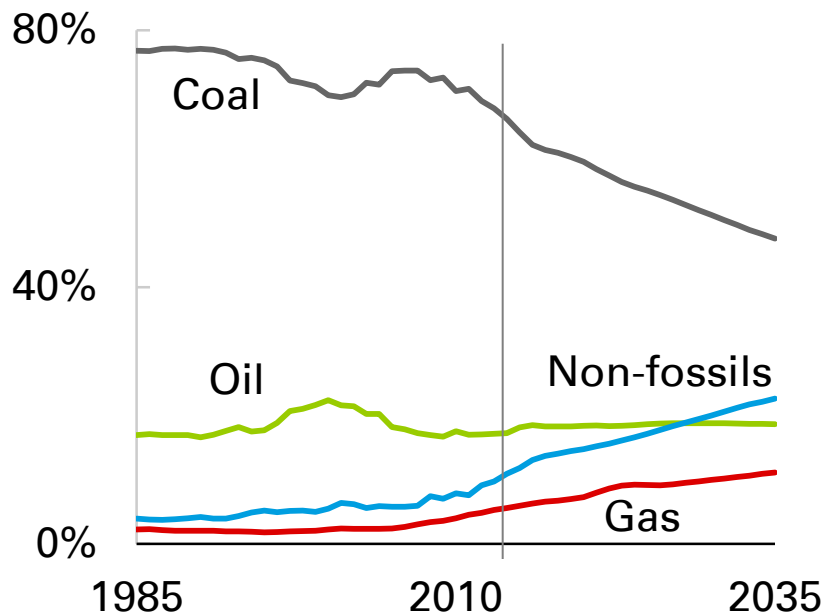


### Primary energy growth and changing economic structure



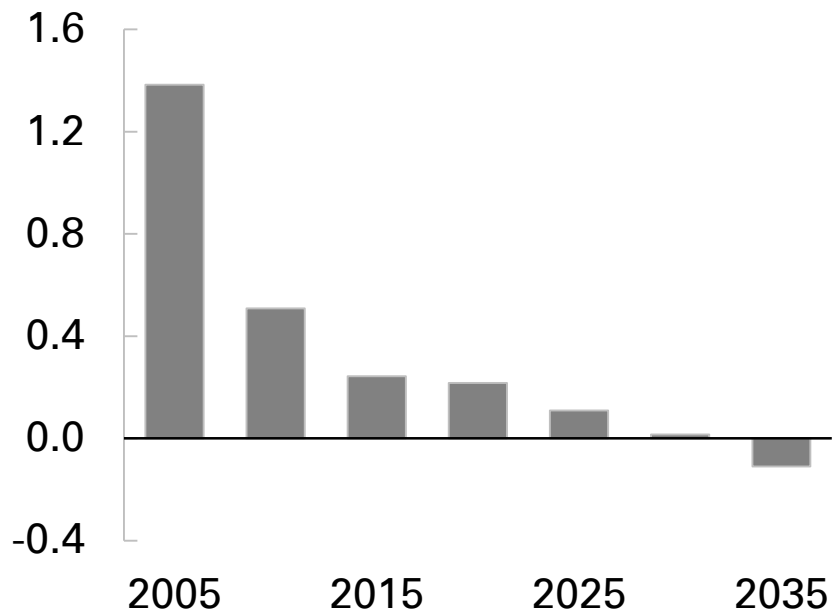
## China's fuel mix is also likely to change significantly...

### Shares of primary energy in China



### Ratio of coal demand growth to GDP growth

Average ratio during previous five years

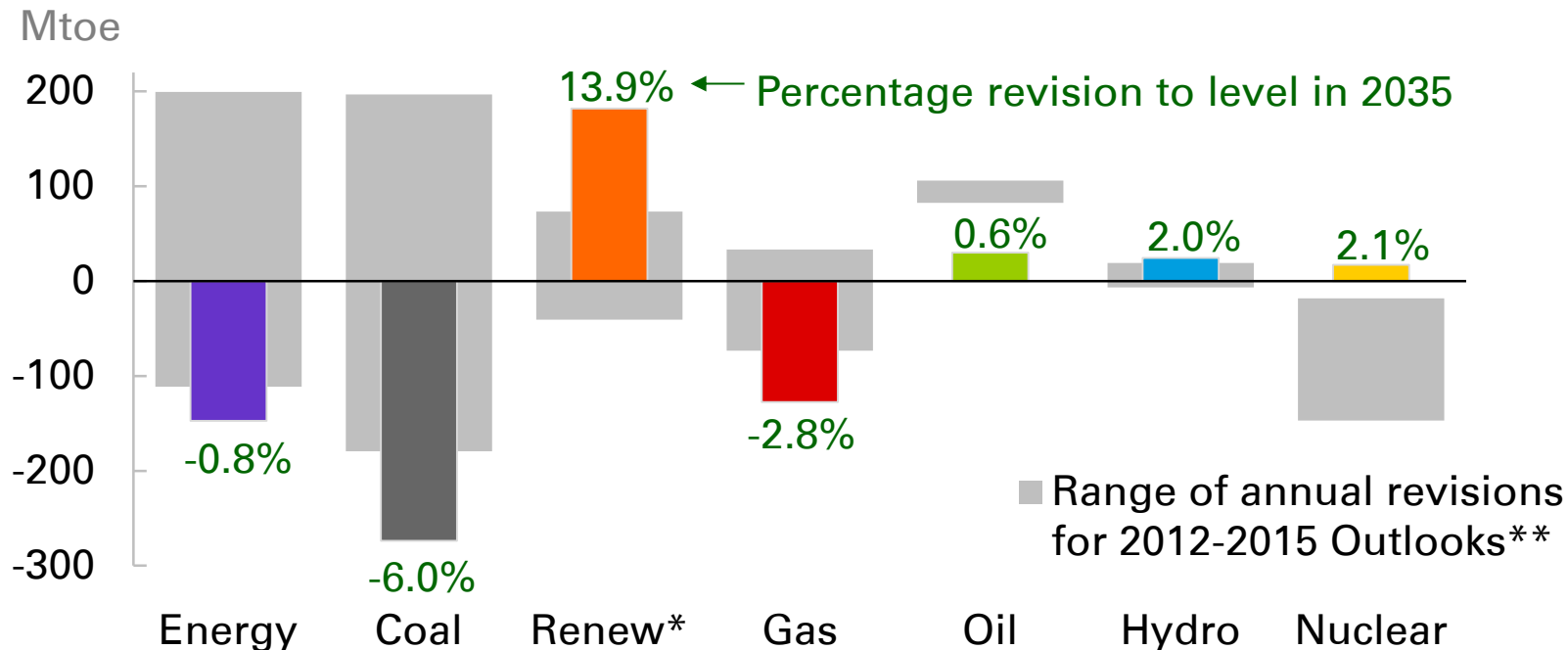


# **Base case**

## Main changes

# Energy demand in 2035 has been revised down...

## Changes to level in 2035 relative to previous Outlook



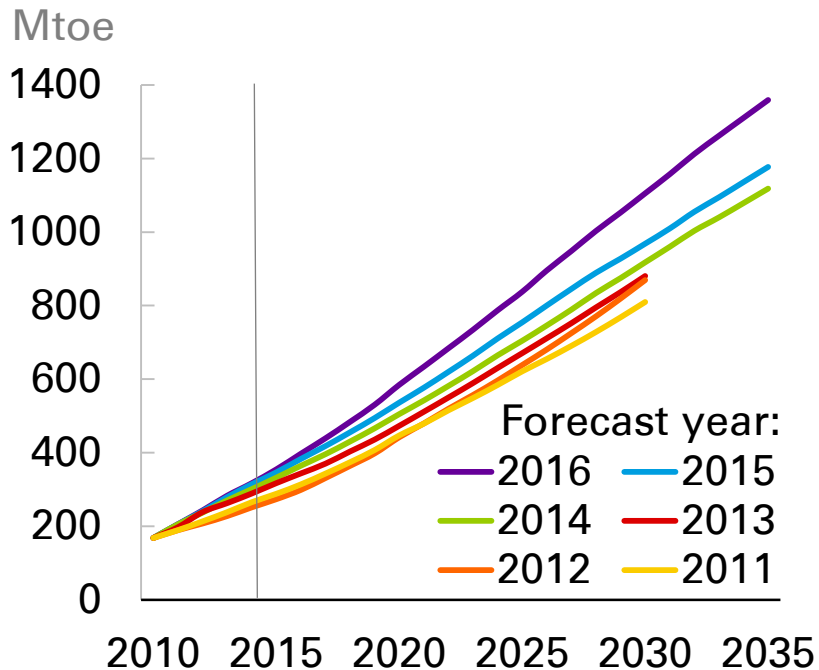
\* Renewables including biofuels

\*\* Revision in final year of Outlook

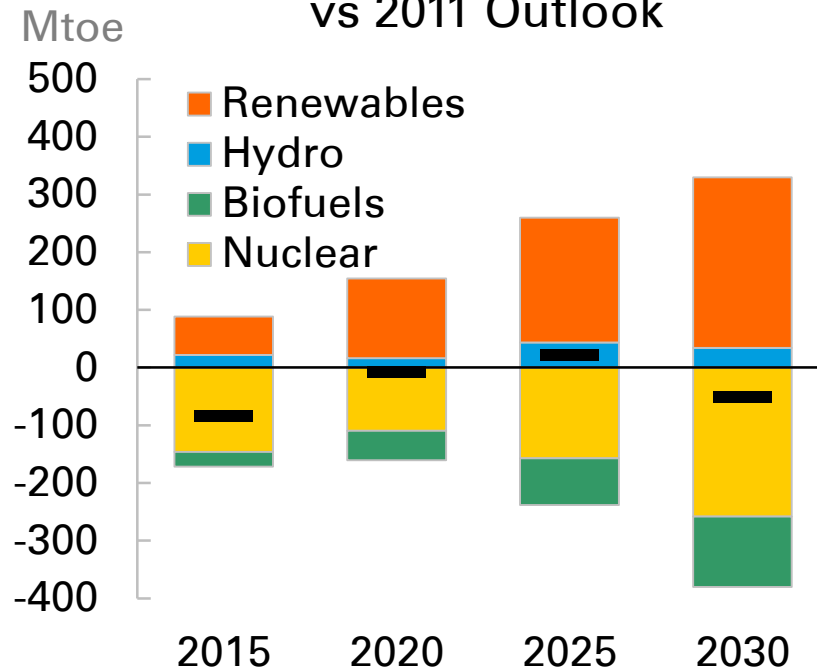


# Renewables have been revised up repeatedly...

## Renewable power forecasts



## Revisions to non-fossil fuels vs 2011 Outlook

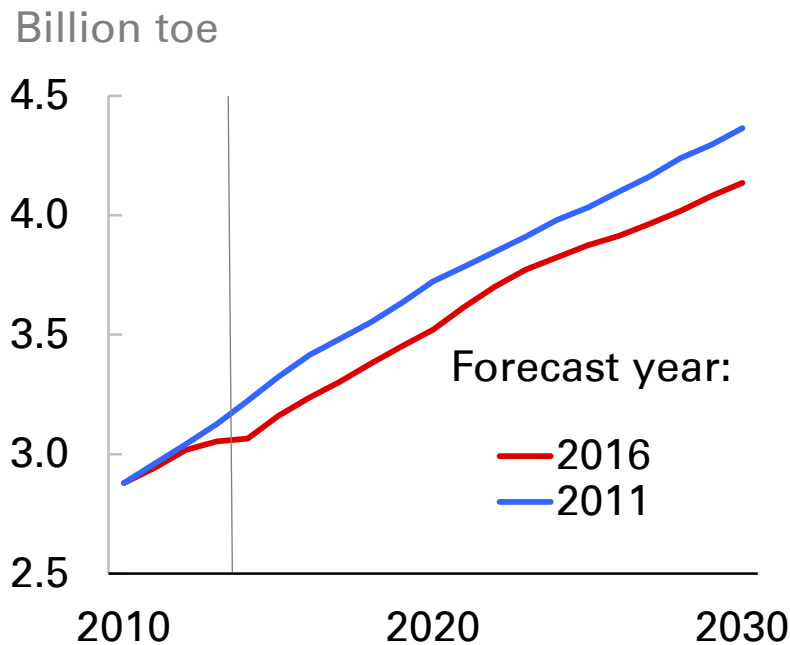


Note: Projected growth from each Outlook applied to latest 2010 data



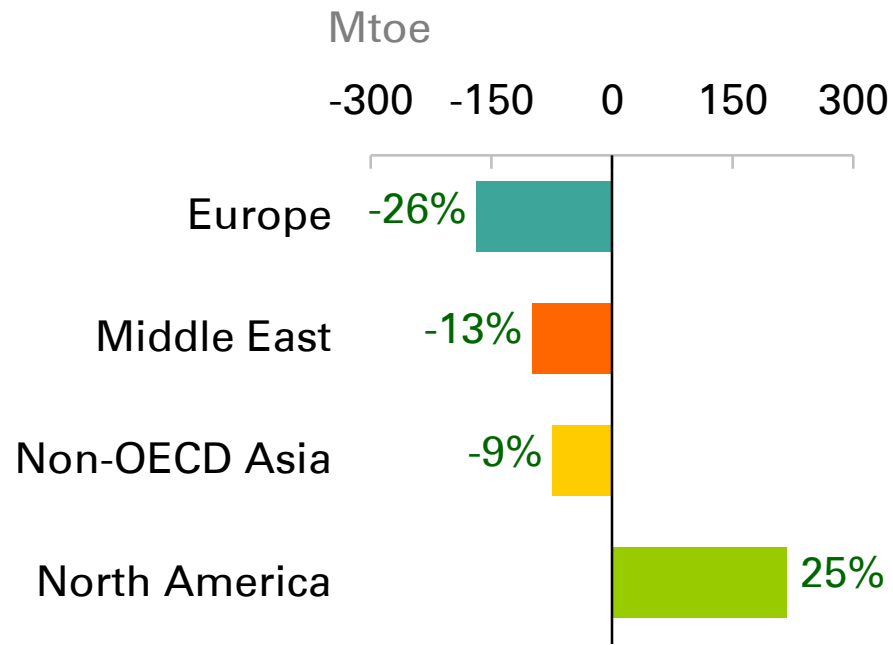
# Gas demand growth has been weaker than expected...

## Gas consumption forecasts



Note: Projected growth applied to latest 2010 data

## Key revisions in 2030 by region (relative to 2011 Outlook)



---

# Key uncertainties

*Slower global GDP growth*

*Faster transition to a lower-carbon world*

*Shale oil and gas have even greater potential*



## Exploring the impact of alternative assumptions...

Case 1: Slower global GDP growth

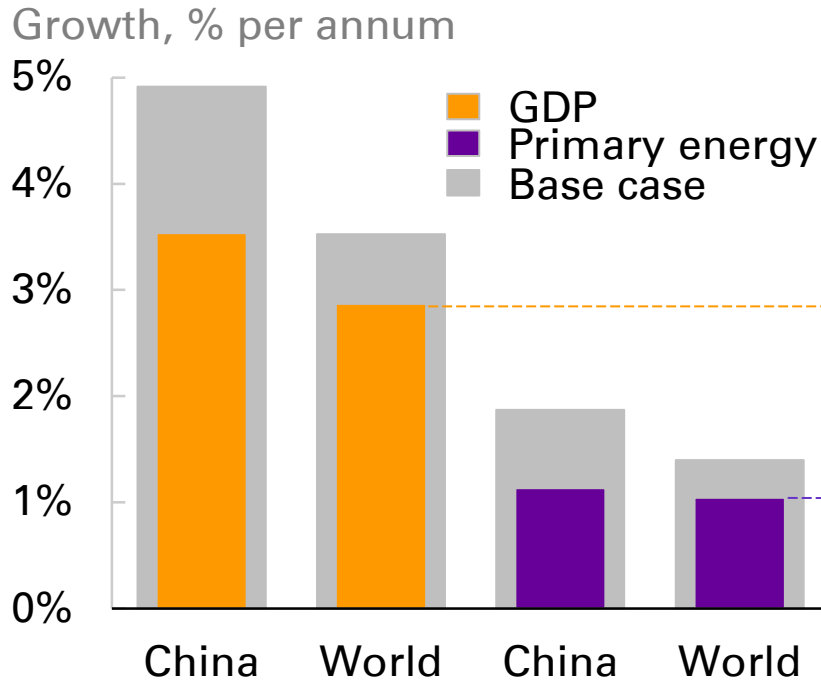
Case 2: Faster transition to a lower-carbon world

Case 3: Shale oil and gas have even greater potential

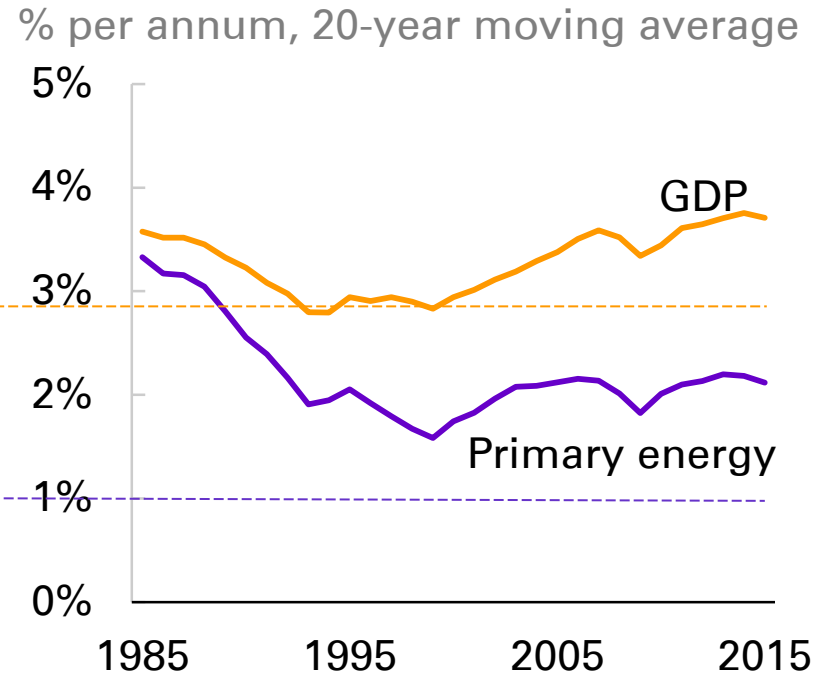


# Case 1: Slower global GDP growth...

## Slower GDP growth case 2014-35

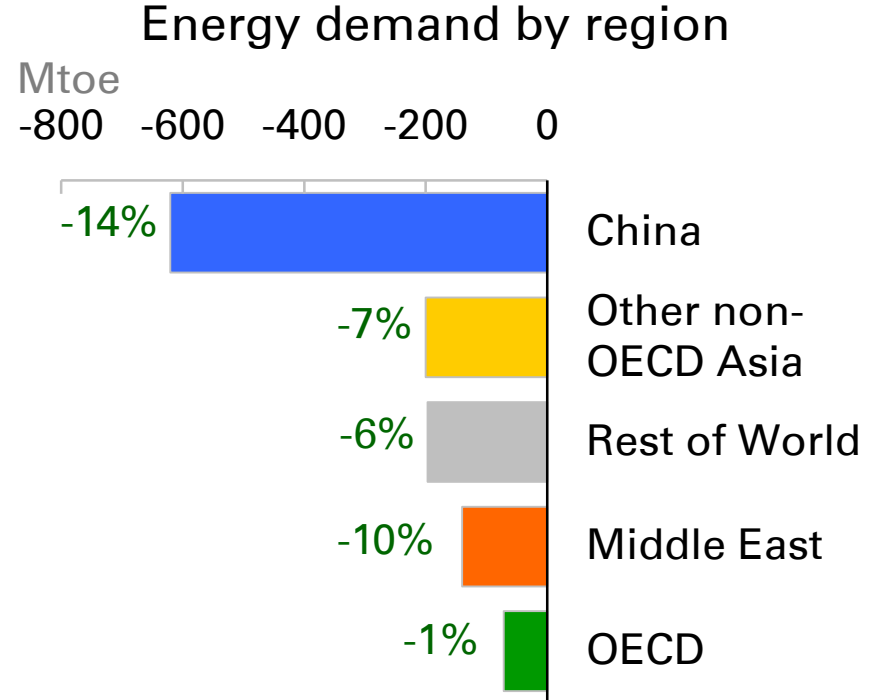
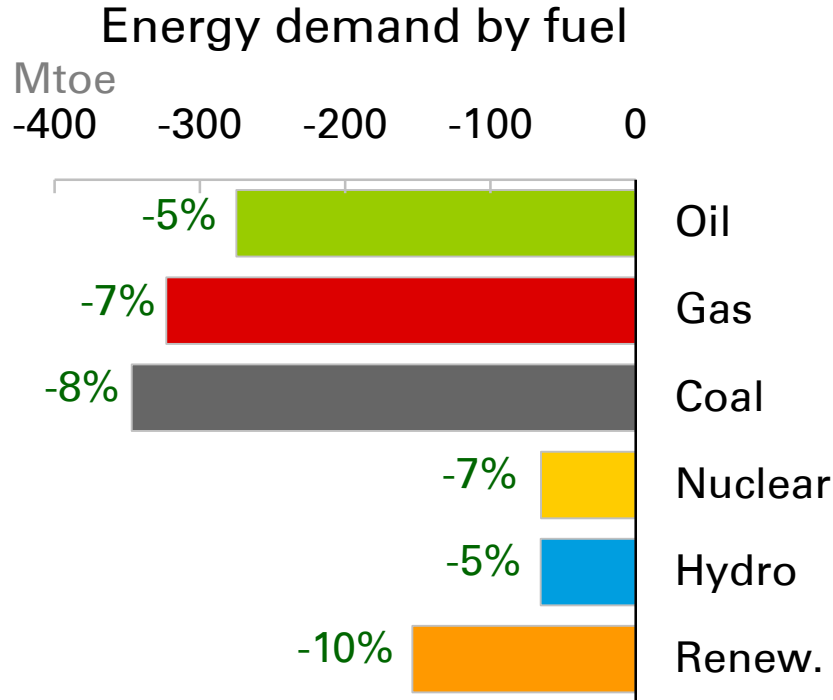


## Historical growth rates



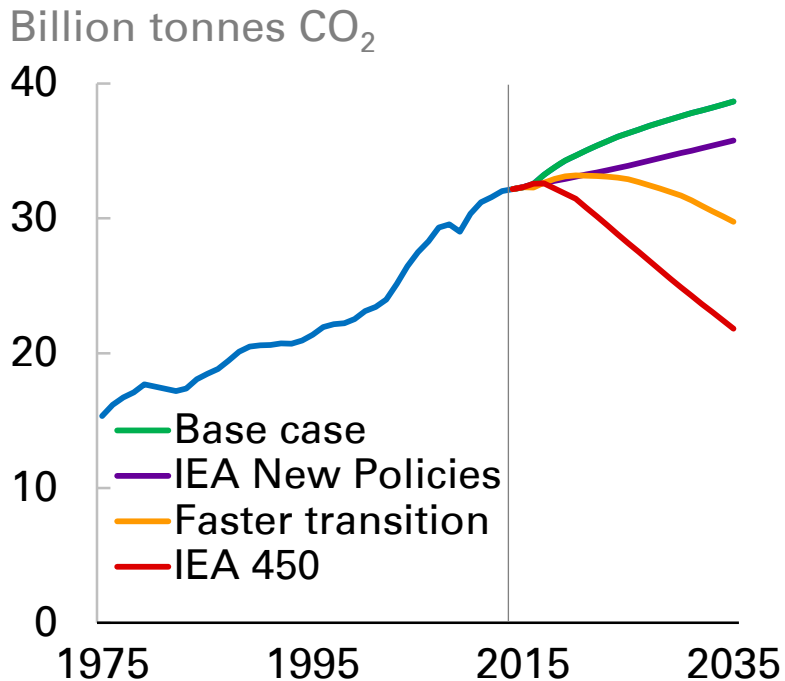
# Demand growth is slower across all fuels...

Differences from base case in 2035:

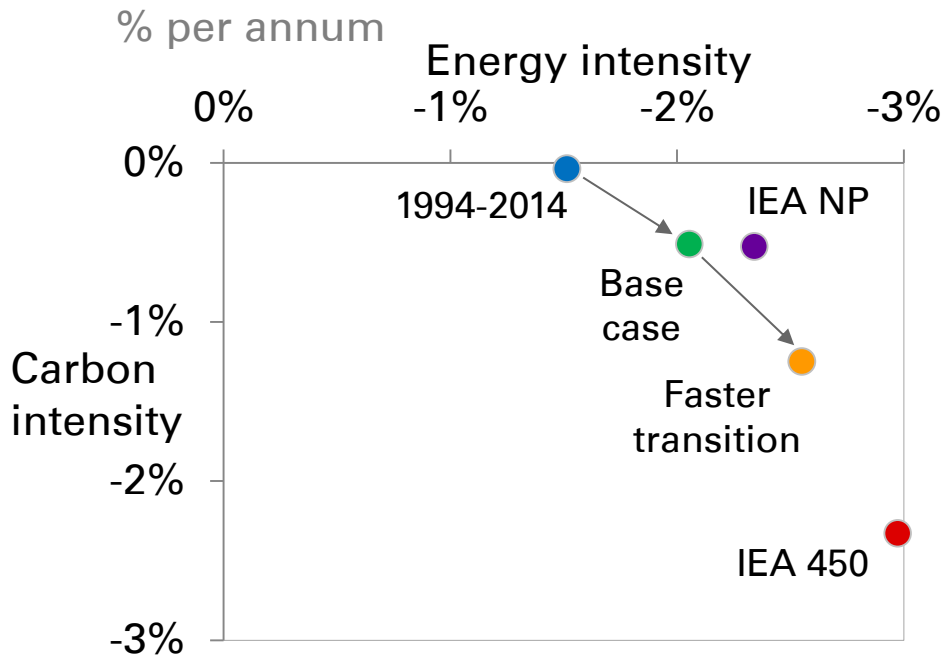


# The speed of transition to a lower-carbon energy system...

## Carbon emissions

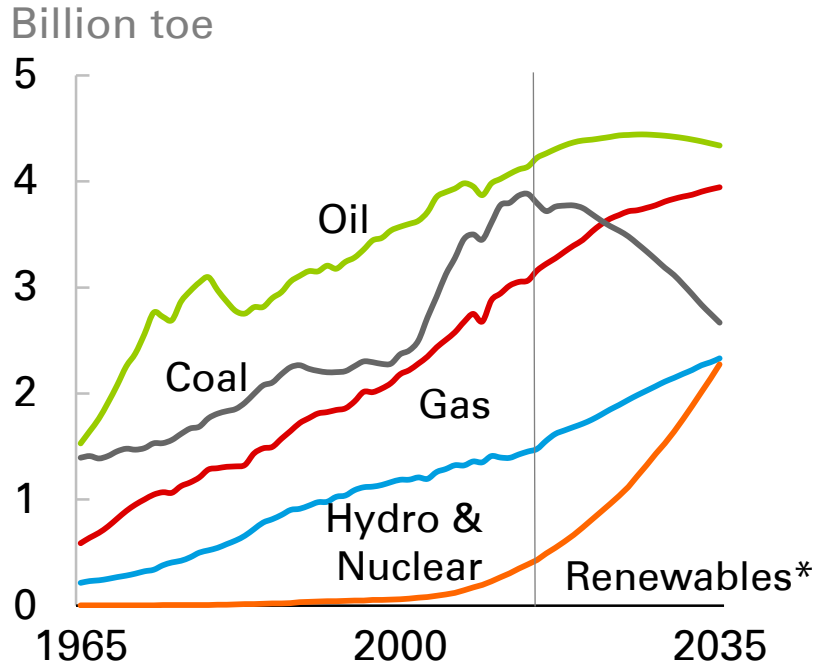


## Changes in intensity



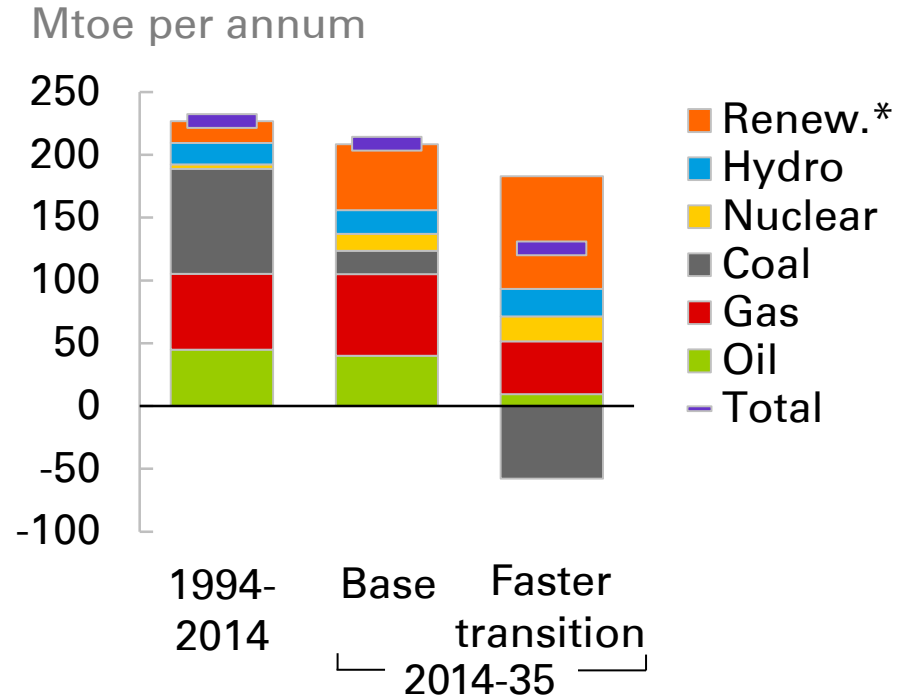
# The faster transition has a significant impact...

## Consumption by fuel



\*Includes biofuels

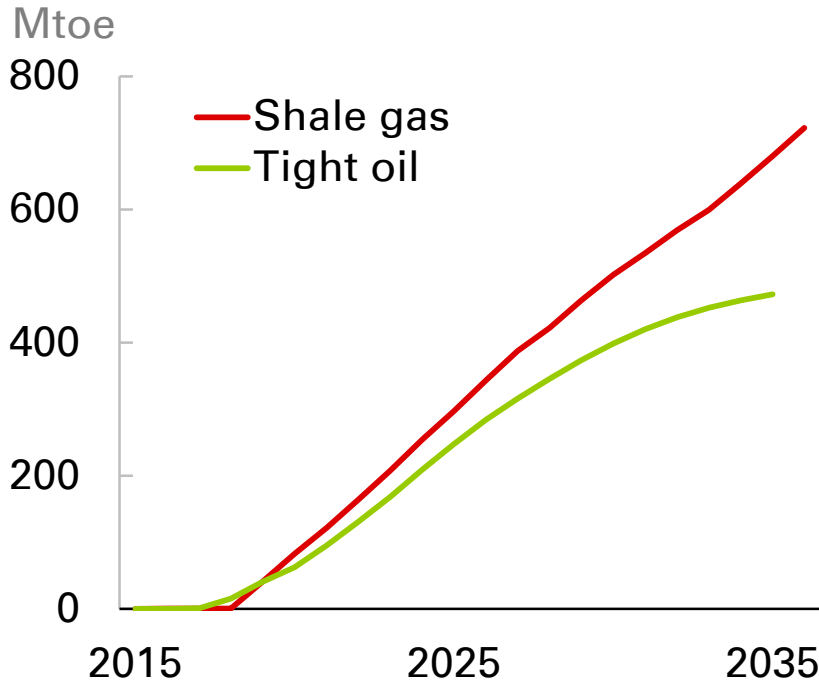
## Annual demand growth by fuel



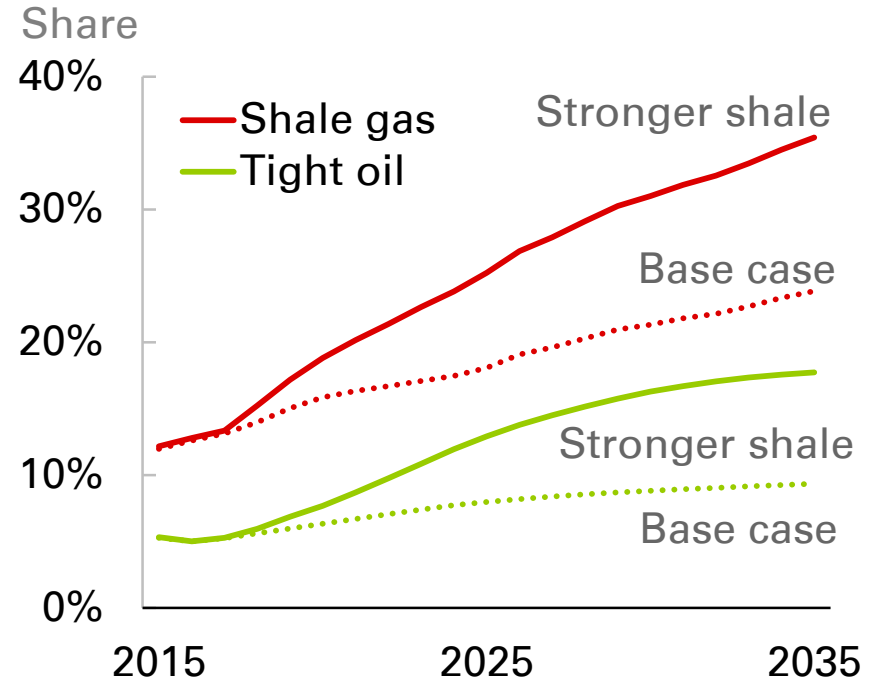


# Case 3: Tight oil and shale gas having even greater potential...

### Differences in supply from base case



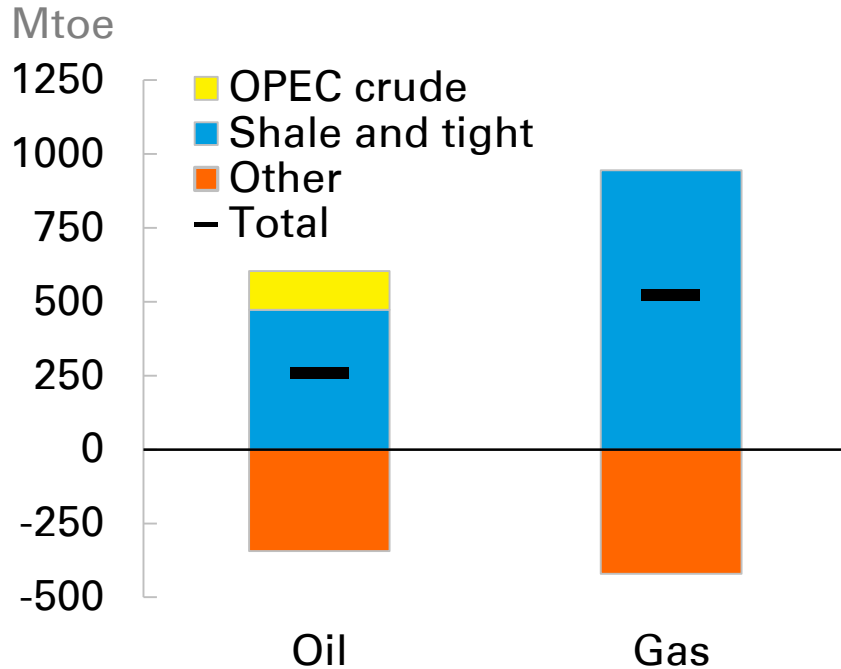
### Shares of total oil/gas production



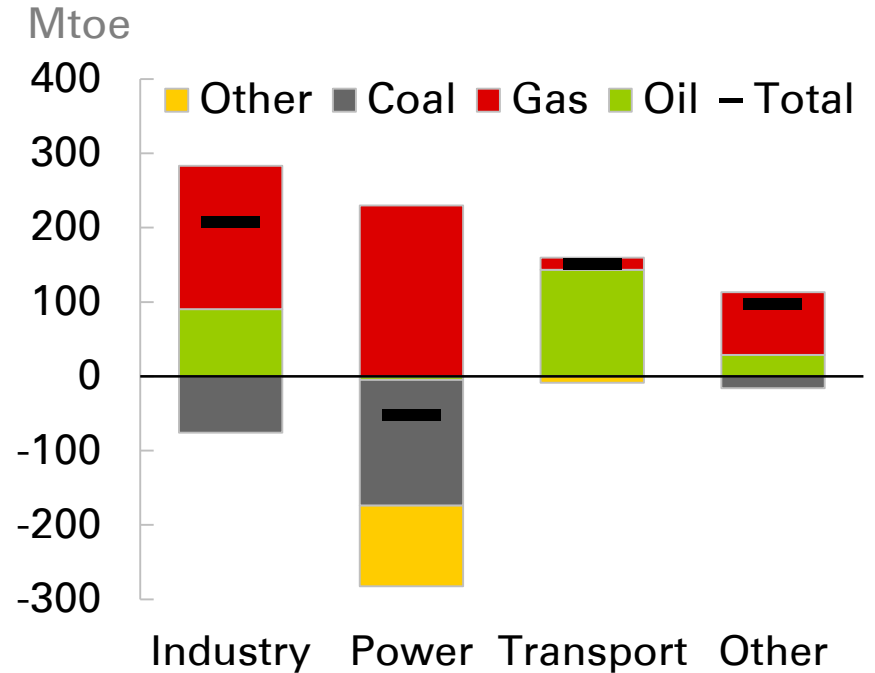
# Higher shale output crowds out conventional production...

Differences from base case in 2035:

Oil and gas production



Consumption by fuel



---

# **Annex**

*Annual revisions in detail*

*Fast facts and key figures*

*Comparison with other energy outlooks*

*Data sources*

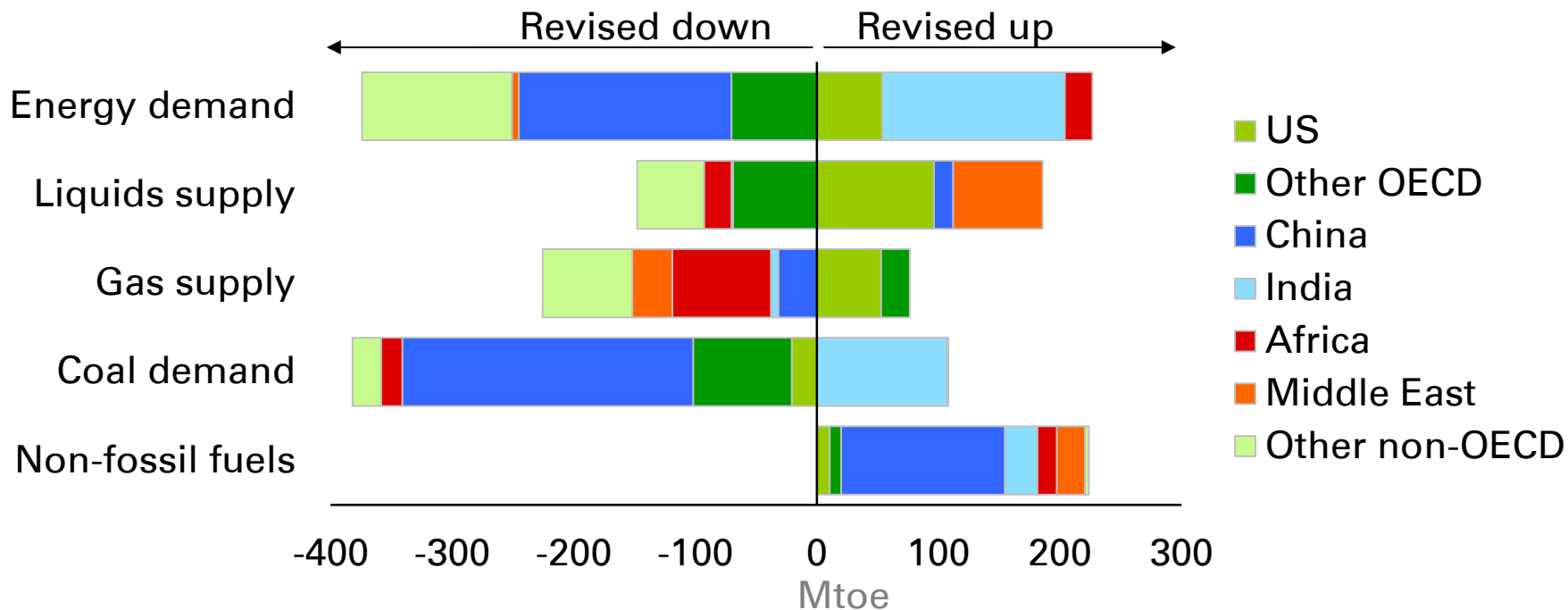
	Growth 2014-35 (p.a.)	Growth 2014-35 (cumulative)	2014 (share)	2035 (share)
Primary energy	1.4%	34%	100%	100%
Oil	0.9%	20%	32%	29%
Gas	1.8%	44%	24%	26%
Coal	0.5%	10%	30%	25%
Nuclear	1.9%	50%	4%	5%
Hydro	1.8%	45%	7%	7%
Renewables*	6.6%	285%	3%	9%
Population	0.9%	21%		
GDP (\$2010 PPP)	3.5%	107%		
Energy Intensity	-2.1%	-35%		
CO <sub>2</sub> emissions	0.9%	20%		

\* Includes biofuels



## Annual revisions in detail

### Changes in 2035 levels versus the February 2015 Outlook



## Comparison with other energy outlooks

### Growth of energy consumption, 2010-30

