BP Energy Outlook
2016 edition

Spencer Dale, group chief economist

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Unless noted otherwise, data definitions are based on the BP Statistical Review of World Energy, and historical energy data up to 2014 are consistent with the 2015 edition of the Review. Gross Domestic Product (GDP) is expressed in terms of real Purchasing Power Parity (PPP) at 2010 prices.
Economic backdrop

GDP

Contribution to GDP growth 2014-35

2016 Energy Outlook
Global energy demand

Consumption by region

Billion toe

- Other
- Other Asia
- China
- OECD

Consumption growth by region

10 year average, % per annum

- Other Asia
- China
- World
- OECD

2016 Energy Outlook
What drives energy demand?
Global GDP and energy

World GDP and energy demand

Energy intensity by region

Index (1965=100)

- GDP
- Primary energy

Toe per thousand $2010 GDP

- China
- US
- World
- EU
- India
- Africa

2016 Energy Outlook
Slower global GDP growth

Annual growth rates 2014-35

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<th>China</th>
<th>World</th>
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<td>% per annum</td>
<td>GDP</td>
<td>Primary energy</td>
<td>Base case</td>
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<tr>
<td>0%</td>
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<td>5%</td>
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Historical growth rates

% per annum, 20-year moving average

- GDP
- Primary energy

GDP

Primary energy
Energy intensity and energy demand

**Decline in world energy intensity**

% per annum

<table>
<thead>
<tr>
<th></th>
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**World energy demand**

Billion toe

- 1965-2014
- 1994-2014
- Base case
- Flat demand

2016 Energy Outlook
Q: What drives energy demand?

A: Global economic growth
Fuel mix

Shares of primary energy

Annual demand growth by fuel

Mtoe per annum

*Includes biofuels

2016 Energy Outlook
Key factors shaping the fuel mix

- 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

Forecast year:
- 2013
- 2014
- 2015
- 2016

2016 Energy Outlook
Global tight oil and shale gas

Ten year supply increments:

Tight oil

Shale gas

- S & C America
- Middle East
- Europe & Eurasia
- Africa
- Asia Pacific
- North America

2016 Energy Outlook
Market shares of tight oil and shale gas

Shares of total oil/gas production

- Shale gas
- Tight oil

2015  2020  2025  2030  2035

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Market shares of tight oil and shale gas

Shares of total oil/gas production

- Shale gas
- Tight oil

Stronger shale case

2016 Energy Outlook
Key factors shaping the fuel mix

- 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

- GDP
- Primary energy

Shares of primary energy

- Coal
- Oil
- Non-fossils
- Gas

2016 Energy Outlook
Key factors shaping the fuel mix

- 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

Mtoe

Forecast year:
- 2016
- 2015
- 2014
- 2013
- 2012
- 2011

2010 2015 2020 2025 2030 2035

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2016 Energy Outlook
Renewables and other non-fossil fuels

Renewables in power forecasts

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Revisions to non-fossil fuels vs 2011 Outlook

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2016 Energy Outlook
Oil demand and supply

Demand

- 2014: OECD decline
- 2014: Non-OECD growth
- 2035 level

Supply

- 2014: Non-OPEC growth
- 2014: OPEC growth

- 2016 Energy Outlook

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Oil demand

Liquids fuel demand by sector

- Transport
- Industry
- Other
- Power

Vehicle fleet

- Billion vehicles
  - Non-OECD
  - OECD

2016 Energy Outlook
Changing outlook for carbon emissions
Carbon emissions

% per annum

1994-2014

Decline in energy intensity

2014-35

Decline in carbon intensity

GDP

CO₂

2016 Energy Outlook
Outlook for carbon emissions

Carbon emissions

Billion tonnes CO₂

- Base case
- IEA 450

2016 Energy Outlook
Outlook for carbon emissions

Carbon emissions

Billion tonnes CO₂

- Base case
- IEA 450

Changes in intensity

Energy intensity

% per annum

- 0%
- 1%
- 2%
- 3%

Carbon intensity

- 0%
- 1%
- 2%
- 3%

1994-2014

Base case

IEA 450

2016 Energy Outlook
Outlook for carbon emissions

Carbon emissions

Billion tonnes CO₂

- Base case
- Faster transition
- IEA 450

Changes in intensity

% per annum

Energy intensity

1994-2014

Base case

Faster transition

IEA 450

2016 Energy Outlook
Impact of faster transition case

Consumption by fuel

Billion toe

Oil
Coal
Gas
Hydro & Nuclear
Renewables*

Annual demand growth by fuel

Mtoe per annum

1994-2014
Base case
Faster transition

2014-35

*Includes biofuels

2016 Energy Outlook
Conclusions

- 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