Introduction

Outlook 2035: Global energy trends

Liquid fuels
Natural gas
Coal and non-fossil fuels
Carbon emissions and the fuel mix
Conclusion
Primary energy consumption growth slows

Consumption by region

Ten year increments by region

Billion toe

Energy Outlook 2035

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The strong impetus from industrialization starts to fade

Consumption by sector

Ten year increments by sector

Billion toe

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The slowdown in China and industry is reflected in coal

Consumption by fuel

Ten year increments by fuel

Billion toe

*Includes biofuels

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New sources help to supply sufficient energy

Primary energy production

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

Billion toe

1990 2005 2020 2035

New energy forms

- Renewables in power
- Shale gas
- Tight oil, oil sands, biofuels

% of total (RHS)

Billion toe

1990 2005 2020 2035

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Energy decouples from GDP and fuel mix evolves

GDP and energy

- GDP
- Energy (RHS)

Shares of primary energy

- Oil
- Coal
- Gas
- Hydro
- Nuclear
- Renewables*

*Includes biofuels

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The power sector takes an increasing share of energy

Inputs to power as a share of total primary energy

Primary inputs to power

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Energy security and sustainability pose challenges

Primary energy net balances

- FSU
- Africa
- S&C America
- Middle East
- N America
- Asia
- Europe

Energy and CO₂ emissions

Index: 1965 = 100

Energy Outlook 2035
Introduction
Outlook 2035: Global energy trends
Liquid fuels
Natural gas
Coal and non-fossil fuels
Carbon emissions and the fuel mix
Conclusion
The global liquids balance

Demand

2012

OECD decline
Non-OECD growth

110
105
100
95
90
85
80

Supply

2012

Non-OPEC growth
OPEC growth

2035 level

Crude
NGLs

Mid East
Other Asia
India
China
Other
North America
Other

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Liquids demand growth is largest in non-OECD transport

Demand by sector

Five year increments

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Supply growth is supported initially by unconventionals

Liquids supply by type

Mb/d

120

100

80

60

40

20

0

1990 2005 2020 2035

- OPEC NGLs
- OPEC crude
- Biofuels
- Oil sands
- Tight oil
- Other non-OPEC

Tight oil supply

Mb/d

12

8

4

0

2005 2020 2035

- Russia
- China
- South America
- Canada & Mexico
- US

% of total (RHS)

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Oil balances suggest OPEC will be challenged

OPEC spare capacity

OPEC share of global supply

Energy Outlook 2035
Supply disruptions reduce the immediate impact on OPEC

Recent disruptions and US growth

<table>
<thead>
<tr>
<th>Change since 4Q10, Mb/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sudans</td>
</tr>
<tr>
<td>Syria</td>
</tr>
<tr>
<td>Iran</td>
</tr>
<tr>
<td>US</td>
</tr>
<tr>
<td>Libya</td>
</tr>
<tr>
<td>Net</td>
</tr>
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</table>

Historical disruptions

<table>
<thead>
<tr>
<th>Change from pre-disruption level*, Mb/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iran (1979)</td>
</tr>
<tr>
<td>Libya (1970)</td>
</tr>
<tr>
<td>Iraq (1990)</td>
</tr>
<tr>
<td>Russia (1991)</td>
</tr>
</tbody>
</table>

*Event occurs in year 1

Energy Outlook 2035
OPEC countries face pressure from rising populations

**Population**

Index: 1975 = 100

- OPEC
- Other non-OECD
- OECD

**GDP per capita**

Index: 1975 = 100

**OPEC exports**

Mb/d and Bcf/d

---

*Energy Outlook 2035*
Oil trade continues to shift from West to East
Vehicle numbers are set to grow rapidly in the non-OECD
Policy and technology enable efficiency improvements

Fuel economy of new cars

Vehicle sales by type

Litres per 100 km*

*New European Driving Cycle

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Global transport demand growth slows

Transport demand by fuel

Five year increments by fuel

Energy Outlook 2035
Introduction
Outlook 2035: Global energy trends
Liquid fuels
Natural gas
Coal and non-fossil fuels
Carbon emissions and the fuel mix
Conclusion
Natural gas demand grows in all regions and sectors

Demand by region

Demand by sector

Energy Outlook 2035
Shale gas shows the fastest production growth

Gas production by type and region

<table>
<thead>
<tr>
<th>Year</th>
<th>Non-OECD other</th>
<th>Non-OECD shale</th>
<th>OECD shale</th>
<th>OECD other</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td></td>
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<td></td>
<td></td>
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<td>1983</td>
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<td></td>
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<td>1996</td>
<td></td>
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</tr>
<tr>
<td>2009</td>
<td></td>
<td></td>
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<tr>
<td>2022</td>
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<tr>
<td>2035</td>
<td></td>
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</tbody>
</table>

Shale gas production

<table>
<thead>
<tr>
<th>Year</th>
<th>Rest of world</th>
<th>China</th>
<th>Europe &amp; Eurasia</th>
<th>Canada &amp; Mexico</th>
<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2005</td>
<td></td>
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<tr>
<td>2020</td>
<td></td>
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<tr>
<td>2035</td>
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</tbody>
</table>

% of total (RHS)
Gas trade continues to expand

Regional net exports

Bcf/d

Imports share of consumption

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Regional supply patterns differ

Sources of gas supply by region

North America

Europe

China

- Net pipeline import
- Net LNG import
- Shale gas
- Other unconventional
- Conventional

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The US shale revolution leads to market adjustments

US oil and gas supply

Gas share of US sector demand

Billion toe

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Shale gas changes the US and global gas trade picture

US natural gas exports

<table>
<thead>
<tr>
<th>Year</th>
<th>Net LNG</th>
<th>Net pipeline</th>
<th>Net total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>0</td>
<td>-10</td>
<td>-20</td>
</tr>
<tr>
<td>2015</td>
<td>10</td>
<td>-5</td>
<td>-15</td>
</tr>
<tr>
<td>2020</td>
<td>15</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>2025</td>
<td>5</td>
<td>0</td>
<td>5</td>
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<tr>
<td>2030</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2035</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Share of global LNG trade

- **US**
- **Australia**
- **Africa**
- **Qatar**

Energy Outlook 2035
Introduction
Outlook 2035: Global energy trends
Liquid fuels
Natural gas
Coal and non-fossil fuels
Carbon emissions and the fuel mix
Conclusion
Coal consumption growth slows in the non-OECD

Consumption by region

Ten year increments by region

Billion toe

1965  2000  2035

Other non-OECD
India
China
OECD

Billion toe


Other non-OECD
India
China
OECD

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Non-fossil fuels grow rapidly

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Renewables in power gain share most rapidly in Europe

Renewables share of power

Renewables growth 2012-35

Thousand TWh

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Introduction
Outlook 2035: Global energy trends
Liquid fuels
Natural gas
Coal and non-fossil fuels
Carbon emissions and the fuel mix
Conclusion
CO₂ emissions from energy use continue to rise

**Emissions by region**

<table>
<thead>
<tr>
<th>Billion tonnes CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>1965</td>
</tr>
<tr>
<td>Non-OECD</td>
</tr>
<tr>
<td>OECD</td>
</tr>
<tr>
<td>IEA 450 Scenario</td>
</tr>
</tbody>
</table>

**Emissions per capita**

<table>
<thead>
<tr>
<th>Country</th>
<th>1965</th>
<th>2000</th>
<th>2035</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EU</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>India</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>World</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Energy Outlook 2035*
Energy intensity and carbon intensity follow different patterns

Energy intensity

Toe per thousand $2012 GDP

- China
- US
- India
- EU
- World

Carbon intensity

Tonnes CO₂ per toe

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The fuel mix diversifies over time

Evolution of the fuel mix in 20 major countries

Share of dominant fuel

*France, Germany, Italy and United Kingdom pre-1965

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The power sector is the main driver of fuel mix changes

Share of power sector fuel consumption

North America

EU

China

Other non-OECD Asia
Energy efficiency and fuel mix restrain emissions growth

GDP, energy and emissions

Index: 1990 = 100

<table>
<thead>
<tr>
<th>Year</th>
<th>GDP</th>
<th>Energy</th>
<th>CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>2005</td>
<td>200</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>2020</td>
<td>300</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>2035</td>
<td>400</td>
<td>400</td>
<td>400</td>
</tr>
</tbody>
</table>

Emissions growth 2012 to 2035

Billion tonnes CO₂

Energy intensity
Fuel mix
Projected growth

Energy Outlook 2035
Conclusion

Meeting the global energy challenge

- Sufficient and available?
  - Yes – new energy sources and efficiency improvements

- Secure and reliable?
  - Mixed – improving for some, a concern for others

- Sustainable?
  - Room for improvement