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Implications
Introduction

Global energy trends

Outlook 2030: Fuel by fuel

Implications
Population, income and energy growth

### Population
- **Billion**
- **1990**: OECD - 1.0, Non-OECD - 1.5
- **2010**: OECD - 4.0, Non-OECD - 6.0
- **2030**: OECD - 8.0, Non-OECD - 12.0

### GDP
- **Trillion $2011 PPP**
- **1990**: OECD - 1, Non-OECD - 1
- **2010**: OECD - 25, Non-OECD - 20
- **2030**: OECD - 75, Non-OECD - 100

### Primary energy
- **Billion toe**
- **1990**: OECD - 0.5, Non-OECD - 1.0
- **2010**: OECD - 5.0, Non-OECD - 8.0
- **2030**: OECD - 10.0, Non-OECD - 12.0

**Energy Outlook 2030**
Industrialisation drives energy growth

By region

By primary use

By fuel

*Includes biofuels
The power sector leads primary energy growth

Growth by sector and region, 2011–2030

Final energy use

Transport

Industry

Other

Power

Inputs to power

Transport

Industry

Other

Power

Billion toe

Range: -1 to 3

Growth by sector and fuel, 2011–2030

Final energy use

Transport

Industry

Other

Power

Inputs to power

Hydro

Nuclear

Renew.

Electricity

Gas

Biofuels

Oil

Coal

Billion toe

Range: -1 to 3

Energy Outlook 2030
Emerging economies dominate energy production

Energy Outlook 2030

OECD
Non-OECD

FSU
S&C America
N. America
Middle East
Europe
India
Asia P. ex India
Africa

Billion toe

1990 2000 2010 2020 2030

0 3 6 9 12 15 18

Billion toe

1990 2000 2010 2020 2030

0 3 6 9 12 15 18
Fuel shares and energy prices

Shares of world primary energy

Energy prices

*Includes biofuels
Energy efficiency improvements

Energy intensity by region

Toe per thousand $2011 GDP (PPP)

Energy and GDP

Billion toe
Trillion $2011 (PPP)

*Euro4 (France, Italy, Germany, UK) pre-1970

Energy Outlook 2030

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Energy efficiency improvements

Energy intensity by region

Toe per thousand $2011 GDP (PPP)

Energy and GDP

Billion toe

Trillion $2011 (PPP)

*Euro4 (France, Italy, Germany, UK) pre-1970

Energy Outlook 2030

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Shale gas and tight oil: resources and production

Current resources

Production in 2030

Billion toe

Resources data © OECD/IEA 2012

Energy Outlook 2030
US tight oil and shale gas: infrastructure requirements

Onshore oil & gas rigs 2011

Thousands

Oil wells drilled and output

Thousands

Mb/d

0.0
0.5
1.0
1.5
2.0
2012*

Canada

2010

Output

(RHS)

Bakken

Canada

Colombia

*Annualised from 1Q–3Q data

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Energy Outlook 2030
Introduction

Global energy trends

Outlook 2030: Fuel by fuel

Implications
High oil prices are reducing oil’s share of primary energy

**Oil share of energy and GDP**

- % of energy
- % of GDP

**Oil share in sector**

- Power
- Other
- Industry
- Transport

*Energy Outlook 2030*
Global transport demand

Transport demand by fuel

- Electricity
- Gas
- Coal
- Biofuels
- Oil - road
- Oil - non-road

Fuel economy of new cars

- EU
- US light vehicles
- China

Energy Outlook 2030
Global transport demand (2)

Transport demand by fuel

- Electricity
- Gas
- Coal
- Biofuels
- Oil - road
- Oil - non-road

Fuel economy of new cars

- EU
- US light vehicles
- China
- India

Billion toe

Litres per 100 km

Energy Outlook 2030
Global supply growth and tight oil

Liquids supply by type

- OPEC share (RHS)
- 45%
- 30%
- Mb/d

Tight oil output

- China
- Russia
- S. America
- N. America
- % of total (RHS)
- Mb/d
- Mb/d
- 0, 2, 4, 6, 8, 10

Energy Outlook 2030

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Global liquids balance

Demand

- China
- India
- Mid East
- S&C Am.
- Other

2011 OECD declines Non-OECD growth

Supply

2030 level

- Iraq
- OPEC-11
- NGLs

2011 Non-OPEC declines Non-OPEC growth OPEC growth

Tight oil
Biofuels
Oil sands

Energy Outlook 2030
Unconventional oil and the call on OPEC

Unconventionals share of net global supply growth

- Biofuels
- Oil sands
- Tight oil

Call on OPEC & spare capacity

 Mb/d

2000 2010 2020 2030

Spare capacity
Call on OPEC (RHS)

Energy Outlook 2030
Shale gas and global supply growth

Gas production by type and region

- Non-OECD other
- Non-OECD shale
- OECD shale
- OECD other

Shale gas production

- RoW
- China
- Europe & Eurasia
- Canada & Mexico
- US

% of total (RHS)
Shale gas: regional growth

Sources of gas supply, by region

Bcf/d

N. America

Bcf/d

EU

Bcf/d

China

- Net pipeline imports
- Net LNG imports
- Shale gas production
- Other domestic production
Shale gas: regional growth (2)

Sources of gas supply, by region

Bcf/d

EU

Bcf/d

China

Bcf/d

India

- Net pipeline imports
- Net LNG imports
- Shale gas production
- Other domestic production

Shale gas: regional growth (2)
Gas trade and market integration

**LNG exports**

- % of total consumption (RHS)

**LNG diversification**

- Suppliers per importer
- Customers per exporter

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*Energy Outlook 2030*
Global gas balance

Demand

- N. America
- Other OECD
- Middle East
- China
- Non-OECD
- India

Supply

- Non-shale
- Shale
- Non-OECD
- OECD

2011

Energy Outlook 2030
Non-fossil fuels

Energy Outlook 2030
Growth of renewables in power

Share of power generation

Renewables
2000–2030

Nuclear
1970–2000

Renewable power

Growth 2011–30, and share of power

% share

% p.a.

OECD Europe Other OECD Non-OECD

Growth (RHS)
Share 2011 Share 2030

Energy Outlook 2030

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Power generation and electricity use

Electricity share of final consumption

Shares of power output

Energy Outlook 2030

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Introduction

Global energy trends

Outlook 2030: Fuel by fuel

Implications
Oil and gas: reserves and production

Key:

% share of global total

0%  50%

- **2011 reserves**
- **2030 output**

**Net importers 2011**

**Net exporters 2011**

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Energy Outlook 2030
Tight oil and shale gas uncertainties

Range of tight oil forecasts (excludes NGLs)

Share of global supply growth

Range of shale gas forecasts

 Mb/d

2010  2020  2030

0  2  4  6  8  10

BP

Shale gas

Tight oil

Bcf/d

2010  2020  2030

0  20  40  60  80  100  120

BP

Energy Outlook 2030

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Energy imbalances: import profiles

Energy imbalances

- Mtoe
- India, China, EU, US
- Oil, Gas, Coal

Energy imbalances to GDP ratio

- Toe per $Mln GDP PPP
- China, US, EU, India

Energy Outlook 2030
Energy imbalances: export profiles

Energy imbalances

<table>
<thead>
<tr>
<th>Year</th>
<th>Saudi Arabia</th>
<th>Africa</th>
<th>Russia</th>
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<tbody>
<tr>
<td>1990</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2010</td>
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</tr>
<tr>
<td>2030</td>
<td></td>
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</table>

Energy imbalances to GDP ratio

Toe per $Mln GDP PPP

1990 2000 2010 2020 2030
Energy and carbon emissions

CO₂ emissions and primary energy

Emissions from energy use

Primary energy (RHS)

Billion tonnes CO₂

Billion toe

% p.a.

Growth of CO₂ emissions

1970-1990

1990-2010

2010-2030

China

India

EU

US

Energy Outlook 2030

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Conclusion

- Economic growth needs energy
- Competition and innovation are the key to meeting this need
  - energy efficiency
  - new supplies
- Energy security and climate change remain challenges

% p.a.

Income per capita

Population

Economic growth
Efficiency gains
New supply

Energy Outlook 2030
Alternative for #4

Population

<table>
<thead>
<tr>
<th>Billion</th>
<th>1970</th>
<th>1990</th>
<th>2010</th>
<th>2030</th>
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<tbody>
<tr>
<td>OECD</td>
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<tr>
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<tr>
<td>Other non-OECD</td>
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<td>2.7</td>
<td>5.7</td>
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Energy

<table>
<thead>
<tr>
<th>Billion toe</th>
<th>1970</th>
<th>1990</th>
<th>2010</th>
<th>2030</th>
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<td>OECD</td>
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<td>5.0</td>
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<tr>
<td>Other non-OECD</td>
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</table>

GDP

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<tbody>
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<td>3.0</td>
<td>4.0</td>
<td>6.0</td>
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</tbody>
</table>
Global transport demand (with India forecast added, no history)

Transport demand by fuel

- Electricity
- Gas
- Coal
- Biofuels
- Oil - road
- Oil - non-road

Fuel economy of new cars

- EU
- US light vehicles
- China
- India

Energy Outlook 2030
Alternative or additional

Gas demand by sector

Russia

India

China

Transport
Other
Industry
Power

Bcf/d

1990 2000 2010 2020 2030

Energy Outlook 2030

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Sources of gas supply, by region

<table>
<thead>
<tr>
<th>Region</th>
<th>1990</th>
<th>2010</th>
<th>2030</th>
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<tbody>
<tr>
<td>EU</td>
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<td>China</td>
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<tr>
<td>India</td>
<td>5</td>
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<td>20</td>
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</table>

Net pipeline imports, Net LNG imports, Shale gas production, Other domestic production.
Sources of gas supply, by region

- Bcf/d

<table>
<thead>
<tr>
<th>Region</th>
<th>1990</th>
<th>2010</th>
<th>2030</th>
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<tbody>
<tr>
<td>N. America</td>
<td>60</td>
<td>80</td>
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</tr>
<tr>
<td>EU</td>
<td>40</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>India</td>
<td>10</td>
<td>15</td>
<td>20</td>
</tr>
</tbody>
</table>
High oil prices are reducing oil's share of primary energy

Oil share in sector

- Power
- Other
- Industry
- Transport

Fuel economy of new cars

- EU
- US light vehicles
- China

Litres per 100 km

Energy Outlook 2030