Energy in 2012 – Adapting to a changing world

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General Manager, Global Energy Markets
Outline

• Introduction
• 2012 in long-term context
• Fuel by fuel
• Concluding remarks
Energy in 2012

Energy and GDP

Annual change, %

-2% -1% 0% 1% 2% 3% 4%

10 year average

GDP Energy Intensity

Energy growth by region

Annual change, %

-3% 0% 3% 6%

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

10 year average

Source: includes data from Oxford Economics

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Long-term energy trends

Primary energy demand

<table>
<thead>
<tr>
<th>Year</th>
<th>OECD</th>
<th>Non-OECD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>1996</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>2000</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>2004</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>2008</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>2012</td>
<td>13</td>
<td>14</td>
</tr>
</tbody>
</table>

Energy and GDP in 2012

Annual change, %

- **Non-OECD**:
  - GDP: 8%
  - Energy: 4%
- **OECD**:
  - GDP: 0%
  - Energy: -2%

10 year average

Source: includes data from Oxford Economics

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Reserves and production

Oil reserves
- Trillion bbls
- Other
- North America
- FSU
- OPEC

Gas reserves
- Tcm

Energy production growth in 2012
- Mtoe
- Other
- North America
- FSU
- OPEC

*Includes biofuels

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Energy prices

Inflation adjusted prices

$2012/boe, monthly

Annual change, %

2012 price changes

Oil (Brent)  | Gas  | Coal basket

Asia  | US  |

Source: includes data from ICIS Heren Energy and Energy Intelligence Group, McCloskey and Platts

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The evolving fuel mix

 Shares of global primary energy

 2012 energy consumption changes

 Annual change, Mtoe

Non-OECD  OECD

Renewables  Nuclear  Hydro  Coal  Gas  Oil

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The oil market in 2012

The price of oil

$/bbl

Production and consumption growth

Annual change, Mb/d

Source: includes data from Platts

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Oil production in 2012

Largest changes

<table>
<thead>
<tr>
<th>Country</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>1.0</td>
</tr>
<tr>
<td>Libya</td>
<td>0.5</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>0.0</td>
</tr>
<tr>
<td>Iraq</td>
<td>-0.5</td>
</tr>
<tr>
<td>Kuwait</td>
<td>-1.0</td>
</tr>
<tr>
<td>Norway</td>
<td></td>
</tr>
<tr>
<td>UK</td>
<td></td>
</tr>
<tr>
<td>Syria</td>
<td></td>
</tr>
<tr>
<td>Sudan</td>
<td></td>
</tr>
<tr>
<td>Iran</td>
<td></td>
</tr>
</tbody>
</table>

Supply disruptions

<table>
<thead>
<tr>
<th>Country</th>
<th>Loss (Mb/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yemen</td>
<td>1.0</td>
</tr>
<tr>
<td>Syria</td>
<td>0.5</td>
</tr>
<tr>
<td>Libya</td>
<td>1.0</td>
</tr>
<tr>
<td>Iran</td>
<td>1.5</td>
</tr>
<tr>
<td>Sudan</td>
<td>0.0</td>
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</tbody>
</table>

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US oil supply: cause and effect

North Dakota production

<table>
<thead>
<tr>
<th>Count</th>
<th>Kb/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td></td>
</tr>
<tr>
<td>225</td>
<td></td>
</tr>
<tr>
<td>150</td>
<td></td>
</tr>
<tr>
<td>75</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

- Wells started
- Rig count
- Production (RHS)

Jan-08 May-09 Sep-10 Jan-12

Net US oil imports

<table>
<thead>
<tr>
<th>Change since 2007, Mb/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>-1</td>
</tr>
<tr>
<td>-2</td>
</tr>
<tr>
<td>-3</td>
</tr>
<tr>
<td>-4</td>
</tr>
</tbody>
</table>

- S & C America
- Africa
- Europe & Eurasia
- RoW

Refined Products Crude Oil

Source: includes data from North Dakota Department of Mineral Resources and Energy Information Administration
Emerging oil trade patterns

**Net oil imports**

<table>
<thead>
<tr>
<th>Mb/d</th>
<th>US</th>
<th>EU</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Adjustment to 2012 disruptions**

<table>
<thead>
<tr>
<th>Change in trade, Kb/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>-200</td>
</tr>
<tr>
<td>-100</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>100</td>
</tr>
<tr>
<td>200</td>
</tr>
</tbody>
</table>

- **Spain**
- **Italy**
- **Germany**
- **Japan**
- **India**
- **China**

- **Iran**
- **Saudi Arabia**
- **Libya**

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Oil consumption in 2012

Largest changes

Kb/d

Non-OECD

OECD

China
Japan
India
S. Arabia
Iran
France
UK
Spain
Italy
US

Growth by product type

Kb/d

Non-OECD

OECD

Middle distillate
Gasoline

10 year average

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Oil consumption and mobility

Oil consumption trends

New registrations (millions)

Source: includes data from R. L. Polk & Co.
Oil inventories

OECD commercial inventories

Inventory increases in 2012

Source: Includes data from the International Energy Agency © OECD/IEA 2013
Refining margins and capacity

Upgrading margins

Unused refining capacity

$/bbl

Mb/d


USGC

NWE

Singapore

OECD

Non-OECD

Source: Includes data from Platts

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Crude run rebalancing and product stocks

Oil consumption and crude runs

Mb/d

US

Europe

- Refinery throughput

Consumption 2005
Consumption 2012

OECD product stocks

Mbbls

2007-11 range

2012

2013

Jan
Mar
May
Jul
Sep
Nov

Source: Includes data from the International Energy Agency © OECD/IEA 2013
Global natural gas balance

Global growth in 2012

Annual change, Bcm

<table>
<thead>
<tr>
<th>Region</th>
<th>Consumption</th>
<th>Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>N. America</td>
<td>Orange Bar</td>
<td>Red Bar</td>
</tr>
<tr>
<td>Asia Pacific</td>
<td>Orange Bar</td>
<td>Red Bar</td>
</tr>
<tr>
<td>Middle East</td>
<td>Orange Bar</td>
<td>Red Bar</td>
</tr>
<tr>
<td>Other</td>
<td>Orange Bar</td>
<td>Red Bar</td>
</tr>
<tr>
<td>FSU</td>
<td>Orange Bar</td>
<td>Red Bar</td>
</tr>
<tr>
<td>EU</td>
<td>Orange Bar</td>
<td>Red Bar</td>
</tr>
</tbody>
</table>

International gas prices

$/mmBtu

- Average Japanese import price
- UK NBP
- US Henry Hub

Source: includes data from ICIS Heren Energy and Energy Intelligence Group

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US natural gas production

Production growth

Annual change, Bcm

2011

2012

Other

Shale gas

Associated

Rig count

Count

Jan-11

Jul-11

Jan-12

Jul-12

Jan-13

Oil

Gas

Source: includes data from Energy Information Administration and Baker Hughes

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US coal to gas switching

Natural gas consumption growth

<table>
<thead>
<tr>
<th>Annual change, Bcm</th>
<th>Power</th>
<th>Industrial</th>
<th>Residential</th>
<th>Commercial</th>
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<tbody>
<tr>
<td>0</td>
<td>45</td>
<td>30</td>
<td>-15</td>
<td>0</td>
</tr>
<tr>
<td>10 year average</td>
<td>30</td>
<td>15</td>
<td>-15</td>
<td>0</td>
</tr>
<tr>
<td>2012</td>
<td>60</td>
<td>45</td>
<td>30</td>
<td>15</td>
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Power generation

<table>
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<tr>
<th></th>
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<tbody>
<tr>
<td>0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Average gas price (RHS)

<table>
<thead>
<tr>
<th></th>
<th>$/mmBtu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>3</td>
</tr>
<tr>
<td>Gas</td>
<td>6</td>
</tr>
<tr>
<td>2012</td>
<td>9</td>
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</tbody>
</table>

Source: includes data from Energy Information Administration and Platts
Natural gas trade

LNG and pipeline trade

Annual change, Bcm

<table>
<thead>
<tr>
<th>10 year average</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade share of consumption (RHS)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LNG</th>
<th>Pipeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>35%</td>
<td>33%</td>
</tr>
<tr>
<td>31%</td>
<td>31%</td>
</tr>
<tr>
<td>29%</td>
<td>27%</td>
</tr>
</tbody>
</table>

-10 0 10 20 30 40

10 year average

LNG exports

Annual change, Bcm

<table>
<thead>
<tr>
<th>Indonesia</th>
<th>Malaysia</th>
<th>Egypt</th>
<th>Yemen</th>
<th>Nigeria</th>
</tr>
</thead>
<tbody>
<tr>
<td>35%</td>
<td>33%</td>
<td>31%</td>
<td>29%</td>
<td>27%</td>
</tr>
</tbody>
</table>

-5 0 5 10

10 year average

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European gas-coal competition

**EU power generation cost**

- **Gas**
- **Coal**

**2012 changes in EU imports**

- **Annual change, Mtoe**

Source: includes data from Platts, IHS McCloskey and IntercontinentalExchange

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The coal market in 2012

Coal consumption in China

Annual change, %

Largest changes outside China in 2012

Annual change, Mtoe

-10 0 10 20 30

India
EU
Japan
Indonesia
Russia
Australia
US

Share of world (RHS)
Growth

Consumption
Production

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Hydro, other renewables and nuclear

**Power generation**

<table>
<thead>
<tr>
<th>Year</th>
<th>Nuclear</th>
<th>Hydro</th>
<th>Renewables</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>1.5</td>
<td>1.8</td>
<td>0.5</td>
</tr>
<tr>
<td>1996</td>
<td>1.7</td>
<td>3.2</td>
<td>0.7</td>
</tr>
<tr>
<td>2000</td>
<td>2.1</td>
<td>3.6</td>
<td>1.0</td>
</tr>
<tr>
<td>2004</td>
<td>2.6</td>
<td>3.8</td>
<td>1.2</td>
</tr>
<tr>
<td>2008</td>
<td>3.0</td>
<td>4.2</td>
<td>1.4</td>
</tr>
<tr>
<td>2012</td>
<td>3.5</td>
<td>4.5</td>
<td>1.6</td>
</tr>
</tbody>
</table>

**Output changes in 2012**

- **Nuclear**: -0.5 TWh
- **Hydro**: 0.2 TWh
- **Renewables**: 0.4 TWh

Annual change, TWh

- **Japan**: -100 TWh
- **EU**: -50 TWh
- **US**: -10 TWh
- **Other**: 20 TWh
Renewables in power generation

Contributions to growth

Annual change, %

- Wind
- Solar
- Other

Renewables share of power

- World
- OECD
- Non-OECD
Carbon emissions

Global emissions from energy use

- OECD
- Non-OECD

Largest emission changes in 2012

- China
- India
- Japan
- EU
- US

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Carbon emissions by fuel: US and EU

2012 change, MtCO₂

Effect of:

Renewables
Hydro & Nuclear

-300 -200 -100 0 100

* The net effect of changes in non-fossil fuels in power on emissions, based on 2011 shares of fossil fuels in power generation

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Conclusion

Energy in 2012

• Fundamental adjustment
  – And short-term aberrations

• Market and price driven
  – Sometimes with surprises

• Policy matters