Energy markets – the short and the long term

Christof Rühl, Chief Economist, BP
Outline

- The economy
- A year of disruptions
- Long term implications
- Conclusion
Global growth: slow and on life support

2013 GDP and the good old days

<table>
<thead>
<tr>
<th>Region</th>
<th>Annual change, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eurozone</td>
<td>2%</td>
</tr>
<tr>
<td>Japan</td>
<td>3%</td>
</tr>
<tr>
<td>US</td>
<td>4%</td>
</tr>
<tr>
<td>Brazil</td>
<td>6%</td>
</tr>
<tr>
<td>China</td>
<td>8%</td>
</tr>
<tr>
<td>India</td>
<td>10%</td>
</tr>
<tr>
<td>Non-OECD</td>
<td>12%</td>
</tr>
<tr>
<td>World</td>
<td>10%</td>
</tr>
<tr>
<td>OECD</td>
<td>8%</td>
</tr>
</tbody>
</table>

Avg 2002-07

Central Bank liquidity

<table>
<thead>
<tr>
<th>Year</th>
<th>ECB</th>
<th>Fed</th>
<th>BoJ</th>
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</thead>
<tbody>
<tr>
<td>2007</td>
<td>1.5</td>
<td>2.0</td>
<td>1.0</td>
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<tr>
<td>2008</td>
<td>1.8</td>
<td>2.2</td>
<td>1.2</td>
</tr>
<tr>
<td>2009</td>
<td>2.1</td>
<td>2.4</td>
<td>1.4</td>
</tr>
<tr>
<td>2010</td>
<td>2.4</td>
<td>2.6</td>
<td>1.6</td>
</tr>
<tr>
<td>2011</td>
<td>2.7</td>
<td>2.8</td>
<td>1.8</td>
</tr>
<tr>
<td>2012</td>
<td>3.0</td>
<td>3.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Trillion $US* % of world GDP

*At constant 2011 exchange rates

Source: Includes data from Thomson Reuters Datastream
Europe struggles into recession

Eurozone indicators

<table>
<thead>
<tr>
<th>Volume index</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Apr-07</td>
<td>110</td>
</tr>
<tr>
<td>Jan-09</td>
<td>100</td>
</tr>
<tr>
<td>Oct-10</td>
<td>90</td>
</tr>
<tr>
<td>Jul-12</td>
<td>80</td>
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</table>

10-year benchmark bond yields

<table>
<thead>
<tr>
<th>% per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

Source: Includes data from Thomson Reuters Datastream
The US grows slowly

Components of domestic demand

Index: 1Q 2007=100

Government
Households
GDP

Investment

“Fiscal cliff”

Budget deficit, % of GDP

Lower revenues (extending current tax brakes)
Additional debt service
Higher spending

Deficit target (current legislation)

Source: Includes data from CBO August 2012 forecast and Thomson Reuters Datastream
The Chinese economy slows

Exports

% y-o-y, 3m ma.

Commercial bank loans

Change y-o-y, trillions of CNY

% y-o-y

Source: Includes data from Thomson Reuters Datastream
Energy in 2011 – disruptions and continuity

Supply disruptions

Mtoe

"Arab Spring" "Fukushima"

Coal Nuclear Gas Oil

0 -20 -40 -60 -80

Libya Syria/Yemen Japan Germany

GDP and energy growth

Annual change, %

GDP Energy

4% 3% 2% 1% 0%

2001-11 2011

Source: Includes data from Oxford Economics
Energy prices

Energy prices

2011 price changes

$/boe

- Oil Brent
- Gas Henry Hub
- Coal basket

Annual change, %

- Oil Brent
- Gas HH
- Coal basket

Source: Includes data from Platts and McCloskey
The Fukushima Adjustment
Natural gas markets in 2011

Production and consumption growth

Annual change, Bcm

Production

Consumption

Regional gas prices

$/Mmbtu

Source: Includes data from Platts
Global gas trade

Gas exports

<table>
<thead>
<tr>
<th>Year</th>
<th>Pipeline</th>
<th>LNG</th>
<th>Bcm</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>2003</td>
<td></td>
<td></td>
<td>200</td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td></td>
<td>400</td>
</tr>
<tr>
<td>2007</td>
<td></td>
<td></td>
<td>600</td>
</tr>
<tr>
<td>2009</td>
<td></td>
<td></td>
<td>800</td>
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<tr>
<td>2011</td>
<td></td>
<td></td>
<td>1000</td>
</tr>
</tbody>
</table>

Share of global consumption (RHS)

LNG import growth in 2011

<table>
<thead>
<tr>
<th>Source</th>
<th>Annual change, Bcm</th>
</tr>
</thead>
<tbody>
<tr>
<td>From Qatar</td>
<td>30</td>
</tr>
<tr>
<td>From Atlantic Basin</td>
<td>20</td>
</tr>
<tr>
<td>To Asia</td>
<td>10</td>
</tr>
<tr>
<td>To Europe</td>
<td>-10</td>
</tr>
</tbody>
</table>

Source: Includes data from Cedigaz, GilNL, CiiStats, Poten, Waterborne
US natural gas market

Production

Gas share in power generation

Source: Includes data from Energy Information Administration
Coal prices and trade

Steam coal prices

$/tonne

- China Qinhuangdao (fob)
- Japan Index (cif)
- NW Europe (cif)
- US CAPP (fob)

Jan-10  Jul-10  Jan-11  Jul-11  Jan-12

Import growth in 2011

Annual change, Mtoe

- From Indonesia
- From US
- From Russia
- From Colombia
- From other

To Asia*

To Europe

*China, India, Japan, South Korea, Hong Kong, Taiwan

Source: Includes data from McCloskey, Eurostat, IHS CERA
Oil markets and trends
Crude oil prices

Dated Brent

$/bbl

150

100

50

0

2007 2008 2009 2010 2011 2012

Dated Brent

Annual averages

Source: Includes data from Platts

Dated Brent and WTI

$/bbl

130

115

100

85

70

Jun-10 Dec-10 Jun-11 Dec-11 Jun-12

Dated Brent

WTI
Oil production growth in 2011

Decline

Libya

Non-OPEC

OPEC

UK

Angola

Azerbaijan

Norway

Increase

US

Iraq

Kuwait

UAE

Saudi Arabia
Oil consumption growth in 2011

Largest changes

<table>
<thead>
<tr>
<th>Kb/d</th>
<th>-400</th>
<th>-200</th>
<th>0</th>
<th>200</th>
<th>400</th>
<th>600</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
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<td>Russia</td>
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<td>India</td>
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<td>Saudi Arabia</td>
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<tr>
<td>Iran</td>
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<tr>
<td>Taiwan</td>
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<tr>
<td>Germany</td>
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<tr>
<td>US</td>
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</tbody>
</table>

Regional growth by fuel type

Kb/d

<table>
<thead>
<tr>
<th>Kb/d</th>
<th>900</th>
<th>600</th>
<th>300</th>
<th>0</th>
<th>-300</th>
<th>-600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light distillate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle distillate</td>
<td></td>
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</tbody>
</table>

Non-OECD     OECD
Oil consumption and production

World liquids demand and supply

OECD commercial oil stocks

Source: Includes data from Energy Information Administration and Monthly Oil Data Services © OECD/International Energy Agency June 2012
US supply

US supply

Annual change, Kb/d

<table>
<thead>
<tr>
<th>Year</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>1Q12</th>
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<tbody>
<tr>
<td>Other</td>
<td>250</td>
<td>500</td>
<td>750</td>
<td>1000</td>
<td>1250</td>
</tr>
<tr>
<td>NGLs</td>
<td>500</td>
<td>750</td>
<td>1000</td>
<td>1250</td>
<td>1500</td>
</tr>
<tr>
<td>GoM</td>
<td>250</td>
<td>500</td>
<td>750</td>
<td>1000</td>
<td>1250</td>
</tr>
<tr>
<td>TX/ND*</td>
<td>0</td>
<td>250</td>
<td>500</td>
<td>750</td>
<td>1000</td>
</tr>
<tr>
<td>Net</td>
<td>0</td>
<td>250</td>
<td>500</td>
<td>750</td>
<td>1000</td>
</tr>
</tbody>
</table>

*Texas and North Dakota

Source: Includes data from Energy Information Administration and Baker Hughes
Limits to oil consumption growth

Subsidised consumption

% of global demand

$/bbl

Oil price (RHS)

Vehicle fuel economy

Litres/100km for new sales

US*
EU
China
Japan

* Includes light trucks

Source: Includes data from the International Council for Clean Transportation and the US Environmental Protection Agency
The long term: energy security
Impact of oil prices on the economy

2011 net oil import bill

% GDP

- Oil import bill
- Exports to oil producers
- Net cost

Net oil imports

Mb/d

Source: Includes data from the International Monetary Fund
Import dependency rises in Asia and Europe

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</thead>
<tbody>
<tr>
<td>India</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>47%</td>
<td>91%</td>
<td>40%</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>China</td>
<td></td>
<td></td>
<td></td>
<td>42%</td>
<td>80%</td>
<td>6%</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>EU27</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>80%</td>
<td>57%</td>
<td>94%</td>
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<td>US</td>
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<td></td>
<td></td>
<td></td>
<td>32%</td>
</tr>
</tbody>
</table>

Import share of respective fuel

- Gas
- Oil
- Coal

Billion toe
Long-term trends

Shares of world primary energy

- Oil
- Coal
- Gas
- Hydro
- Nuclear
- Renew.

1970 1990 2010 2030

Oil and gas reserves

- Trillion bbls
- Tcm

- Other
- North America
- FSU
- OPEC

Conclusion

• Key to the 2011 response: flexible markets

• Medium term: supply response, inter-fuel substitution and trade optimisation

• Long term: Global integration and its perils
Energy markets – the short and the long term