Volatility and Structural Change

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General Manager, Global Energy Markets
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Outline

• Introduction
• Volatility and Structural Change
• Fuel by Fuel
• Conclusion
The Economy

Growth in global GDP and trade

- GDP growth (lhs)
- World trade growth (rhs)

Source: Includes data from IMF World Economic Outlook and Oxford Economics

US real policy rates and GDP growth

- Real Fed Funds rate
- GDP (y-o-y)

Source: BP 2009

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Energy Prices

Index: Jan-07=100

- **Oil (Brent)**
- **Coal (NW Europe)**
- **Gas (Henry Hub)**

Source: Includes data from Platts and McCloskey

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OECD and Non-OECD Energy Consumption

**Primary energy**

- **1978**: OECD 4000 Mtoe, Non-OECD 2000 Mtoe
- **1988**: OECD 4500 Mtoe, Non-OECD 2500 Mtoe
- **1998**: OECD 5000 Mtoe, Non-OECD 3000 Mtoe
- **2008**: OECD 5500 Mtoe, Non-OECD 3500 Mtoe

**Gas**

- **1978**: OECD 1000 Mtoe, Non-OECD 500 Mtoe
- **1988**: OECD 1500 Mtoe, Non-OECD 750 Mtoe
- **1998**: OECD 2000 Mtoe, Non-OECD 1000 Mtoe
- **2008**: OECD 2500 Mtoe, Non-OECD 1500 Mtoe

**Oil**

- **1978**: OECD 2000 Mtoe, Non-OECD 1000 Mtoe
- **1988**: OECD 2500 Mtoe, Non-OECD 1500 Mtoe
- **1998**: OECD 3000 Mtoe, Non-OECD 2000 Mtoe
- **2008**: OECD 3500 Mtoe, Non-OECD 2500 Mtoe

**Coal**

- **1978**: OECD 800 Mtoe, Non-OECD 400 Mtoe
- **1988**: OECD 1200 Mtoe, Non-OECD 600 Mtoe
- **1998**: OECD 1600 Mtoe, Non-OECD 800 Mtoe
- **2008**: OECD 2000 Mtoe, Non-OECD 1000 Mtoe
GDP and Primary Energy Growth

OECD

Growth

2004 2005 2006 2007 2008

GDP

Non-OECD

Growth

2004 2005 2006 2007 2008

GDP

Primary energy

Source: Includes data from Oxford Economics

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Crude Prices: What Happened?

$/bbl

- Dated Brent
- Annual averages

Source: Includes data from Platts

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Oil Consumption Growth

Source: Includes data from IEA
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Oil Consumption Growth in 2008

- Oil exporters
- Non-OECD oil importers
- OECD oil importers ex US
- US

Tax and subsidy regimes

- Subsidizers
- Taxers
OPEC Adjusts to Falling Consumption

OPEC-12 crude oil production

Global consumption and production

y-o-y, Mb/d

Source: Includes data from US DOE

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Main Oil Production Changes

Mb/d Decrease Increase

-0.4 -0.3 -0.2 -0.1 0.0 0.1 0.2 0.3 0.4

Mexico
Nigeria
US
Norway
UK
Russia
Canada

Brazil
Kazakhstan
Kuwait
Angola
Qatar
Iraq

Non-OPEC
FSU
OPEC
Changes in Production and Inventories

Global oil production changes

<table>
<thead>
<tr>
<th>Mb/d</th>
<th>2007</th>
<th>2008</th>
</tr>
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<tbody>
<tr>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-1.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Non-OPEC | OPEC | OPEC | Non-OPEC
-12 crude

OECD commercial inventories

<table>
<thead>
<tr>
<th>Million barrels</th>
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</thead>
<tbody>
<tr>
<td>2800</td>
</tr>
<tr>
<td>2700</td>
</tr>
<tr>
<td>2600</td>
</tr>
<tr>
<td>2500</td>
</tr>
<tr>
<td>2400</td>
</tr>
<tr>
<td>2300</td>
</tr>
</tbody>
</table>

2003-2007 range

Source: Includes data from IEA

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Reserves-to-Production Ratios

Note: Showing R/P ratios of over 20 years and reserves over 2 billion barrels.
Refining Margins and Spare Capacity

Refining margins

- BP GIM
- 10-year average

Spare capacity growth

- From new investment
- From lower crude runs

Source: Includes data from Parpinelli and Energy Security Analysis Inc.

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Natural Gas Market

Gas prices

$/mmbtu

- Japan LNG
- EU contract
- UK NBP
- US Henry Hub

Growth in 2008

Bcm

- Non-OECD
- OECD

Source: Includes data from Platts

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US Gas Production

Gas production

Conventional gas

Non-conventional gas

Production vs. rig count outside Gulf of Mexico

Sources: Includes data from US DOE and Baker Hughes
Atlantic Basin LNG*

Sources: Includes annual data from Cedigaz and quarterly figures from Waterborne LNG

* LNG from Algeria, Belgium, Egypt, Nigeria, Norway, Trinidad and Equatorial Guinea

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Coal Prices and Consumption Growth

Prices

$/tonne

- NWE CIF
- US CAAP
- Japan Steam coal
- Qinhuangdao spot

Jan-07 Jan-08 Jul-08 Jan-09

Consumption growth

Mtoe

China 92.7
India 18.5
Russia 7.8
South Korea 6.4
South Africa 5.1
UK -2.8
Australia -4.5
Germany -4.8
Spain -5.6
US -8.3

Sources: Includes data from McCloskey and Platts

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Changes in Nuclear and Hydroelectric Output

Nuclear

y-o-y growth

-2% -1% 0% 1% 2% 3% 4% 5% 6%

2004 2005 2006 2007 2008

10-year average

Hydro

RoW  China

2004 2005 2006 2007 2008

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Renewable Energy

Wind capacity

Solar PV capacity

Sources: Includes data from BTM Consult, IEA, EPIA and EurObserver

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CO₂ Emissions and Prices

Global CO₂ emissions

Billion tonnes of CO₂

<table>
<thead>
<tr>
<th>Year</th>
<th>OECD</th>
<th>Non-OECD</th>
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<tbody>
<tr>
<td>2004</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>2005</td>
<td>14</td>
<td>14</td>
</tr>
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<td>2006</td>
<td>15</td>
<td>15</td>
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<td>2007</td>
<td>16</td>
<td>16</td>
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<tr>
<td>2008</td>
<td>17</td>
<td>17</td>
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</tbody>
</table>

EU Emissions Trading Scheme

€/tonne of CO₂ equivalent

Source: Includes prices from European Climate Exchange

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GDP, Population and Primary Energy Consumption

Source: Includes data from Oxford Economics and US DOE

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Conclusion

- 2008: Rapid market adjustment
- Non-OECD: The future is here
- Volatility: Unavoidable in our industry?
Volatility and Structural Change

Q & A

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Coal in the European Union

Gas and coal consumption growth

<table>
<thead>
<tr>
<th>Country</th>
<th>Coal Mtoe</th>
<th>Gas Mtoe</th>
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</thead>
<tbody>
<tr>
<td>Spain</td>
<td>-10</td>
<td>0</td>
</tr>
<tr>
<td>Germany</td>
<td>-5</td>
<td>0</td>
</tr>
<tr>
<td>UK</td>
<td>0</td>
<td>-10</td>
</tr>
<tr>
<td>France</td>
<td>-15</td>
<td>-5</td>
</tr>
<tr>
<td>EU</td>
<td>-20</td>
<td>-15</td>
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</table>

Changes in EU coal imports by source

<table>
<thead>
<tr>
<th>Source</th>
<th>Million tonnes</th>
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<tbody>
<tr>
<td>US</td>
<td>8.8</td>
</tr>
<tr>
<td>Russia</td>
<td>0.8</td>
</tr>
<tr>
<td>Indonesia</td>
<td>-1.1</td>
</tr>
<tr>
<td>Australia</td>
<td>-3.8</td>
</tr>
<tr>
<td>South Africa</td>
<td>-9.2</td>
</tr>
</tbody>
</table>

Sources: Includes data from Eurostat

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