Oil and Gas: Short & Medium Term Outlook and Long Term Uncertainty

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IEEJ, 30 May 2014
The new oil paradox: High supply, high prices

- Non-OPEC Supply remains exceptionally high
  - Annual growth of 1.8 mb/d in 1Q14 and April
  - Forecast growth of 1.5 mb/d for 2014 as a whole
  - US crude supply to exceed 8 mb/d in 2014 reaching 8.6 mb/d in 4Q14
  - US NGL supply to exceed 2.8 mb/d in 4Q14
  - Total US liquids (exc. biofuels & processing gains) 11.3 mb/d April 2014
  - Total US liquids >11 mb/d for the first time since at least the 1980s
- Yet oil prices also remain exceptionally elevated
Global demand inches upwards...

Global oil demand grows as the economic recovery gains momentum

But inter-fuel competition rises, including in the transport sector
... and rebalances across regions

US resilience offsets China slowdown

- Chinese economic slowdown dampens demand
- Fuel switching out of oil
- But from a high base
- Chinese demand up 2% y-o-y to 10.2 mb/d in March

- OECD demand swung back into growth in 2013
- US demand grew by 1.3% y-o-y to 19 mb/d in February
- Demand also rising in other non-OECD economies
OPEC faces production hurdles...

- OPEC’s real production challenges are internal not external (shale)
- Production back near 30 mb/d in April, up 405 kb/d
- But supply down nearly 1 mb/d on the year
- Libyan production still at 220 kb/d in April
... but must ramp up production to meet demand

<table>
<thead>
<tr>
<th></th>
<th>1Q12</th>
<th>2Q12</th>
<th>3Q12</th>
<th>4Q12</th>
<th>1Q13</th>
<th>2Q13</th>
<th>3Q13</th>
<th>4Q13</th>
<th>1Q14</th>
<th>2Q14</th>
<th>3Q14</th>
<th>4Q14</th>
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<tbody>
<tr>
<td>World Demand</td>
<td>89.3</td>
<td>89.5</td>
<td>90.7</td>
<td>91.3</td>
<td>90.4</td>
<td>90.8</td>
<td>92.1</td>
<td>92.4</td>
<td>91.3</td>
<td>92.1</td>
<td>93.6</td>
<td>94</td>
</tr>
<tr>
<td>Non-OPEC Supply</td>
<td>53.5</td>
<td>52.9</td>
<td>53</td>
<td>54.2</td>
<td>53.9</td>
<td>54.2</td>
<td>55</td>
<td>55.8</td>
<td>55.7</td>
<td>56.1</td>
<td>56.3</td>
<td>56.8</td>
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<tr>
<td>OPEC NGLs</td>
<td>6.1</td>
<td>6.1</td>
<td>6.2</td>
<td>6.2</td>
<td>6.3</td>
<td>6.3</td>
<td>6.4</td>
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<td>6.4</td>
<td>6.4</td>
<td>6.6</td>
<td>6.6</td>
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<tr>
<td>OPEC Crude</td>
<td>31.3</td>
<td>31.7</td>
<td>31.5</td>
<td>30.7</td>
<td>30.5</td>
<td>30.9</td>
<td>30.6</td>
<td>29.8</td>
<td>30</td>
<td></td>
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<tr>
<td>Stock Ch. &amp; Misc.</td>
<td>1.6</td>
<td>1.2</td>
<td>0</td>
<td>-0.2</td>
<td>0.3</td>
<td>0.6</td>
<td>-0.2</td>
<td>-0.4</td>
<td>0.8</td>
<td>0</td>
<td></td>
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<tr>
<td>Call on OPEC + Stock Ch.</td>
<td><strong>29.7</strong></td>
<td><strong>30.5</strong></td>
<td><strong>31.4</strong></td>
<td><strong>30.9</strong></td>
<td><strong>30.2</strong></td>
<td><strong>30.3</strong></td>
<td><strong>30.8</strong></td>
<td><strong>30.2</strong></td>
<td><strong>29.2</strong></td>
<td><strong>29.6</strong></td>
<td><strong>30.7</strong></td>
<td><strong>30.7</strong></td>
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</tbody>
</table>
Ukraine gas transit still vital – Nord Stream only alternative with excess capacity

Major physical flows in 2013 in bcm

Russian gas exports to Europe

- Southern reroute: via BlueStream
- Northern reroute: via Belarus, via NordStream
- Transit through Ukraine: to Poland, to Slovak Republic, to Hungary, to Romania, Ukrainian imports
The engine of energy demand growth moves to South Asia

Primary energy demand, 2035 (Mtoe)

- China: 4,060
- India: 1,050
- Southeast Asia: 4,060
- China: 1,030
- Africa: 1,710
- United States: 2,240
- Brazil: 480
- Europe: 1,370
- Middle East: 1,030
- Japan: 440
- Asia: 65%
- Non-OECD Asia: 10%
- Middle East: 8%
- Latin America: 5%
- OECD: 4%
- Eurasia: 8%

China is the main driver of increasing energy demand in the current decade, but India takes over in the 2020s as the principal source of growth
A mix that is slow to change

Today's share of fossil fuels in the global mix, at 82%, is the same as it was 25 years ago; the strong rise of renewables only reduces this to around 75% in 2035.
Demand increases for all forms of energy, with gas growing the most; the share of fossil fuels in the world’s energy mix falls from 82% to 76% in 2035.
There are striking differences in demand for fossil fuels across scenarios, while global demand for renewable energy increases strongly in all cases.
Emissions off track in the run-up to the 2015 climate summit in France

Cumulative energy-related CO$_2$ emissions

Non-OECD countries account for a rising share of emissions, although 2035 per capita levels are only half of OECD
China becomes the largest consumer of oil by 2030, as OECD oil use drops; demand is concentrated in transport, where diesel use surges by 5.5 mb/d, & petrochemicals.
**Two chapters to the oil production story**

Contributions to global oil production growth

<table>
<thead>
<tr>
<th>Region</th>
<th>2013-2025</th>
<th>2025-2035</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle East</td>
<td></td>
<td>1.8 mb/d</td>
</tr>
<tr>
<td>Brazil</td>
<td>2.9 mb/d</td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>2.0 mb/d</td>
<td></td>
</tr>
<tr>
<td>Rest of the world</td>
<td>0.8 mb/d</td>
<td></td>
</tr>
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</table>

The United States (light tight oil) & Brazil (deepwater) step up until the mid-2020s, but the Middle East is critical to the longer-term oil outlook.
Ever-growing crude trade between the Middle East & Asia

2035 Middle East crude oil exports by destination

N. America’s imports diminish as it becomes more self-sufficient, Europe’s decrease with falling demand, and Middle East exports are drawn increasingly to Asia
More oil bypassing the refining system and new capacity in growing non-OECD markets pile pressure on existing refiners, especially in Europe.
Non-OECD oil demand increasing

Growing importance of consuming countries outside IEA

**World Oil Demand in 1973**
- Non-OECD Total: 26%
- OECD Total: 74%
- 57.2 million barrels per day

**World Oil Demand 2013**
- NON-OECD: 49.5%
- OCDE: 50.5%
- 91.3 million barrels per day

**World Oil Demand 2035**
- nonOECD: 64%
- OECD: 36%
- 101.4 million barrels per day
Gas growth strongest in emerging markets

Natural gas demand

The biggest absolute increases in demand are in China & the Middle East, where gas use overtakes that of the European Union before 2020
Natural gas production increases in every region of the world between 2011 and 2035, with the exception of Europe.
Regional Gas Price Disparity

USD/MBtu

Jan 03, Jan 04, Jan 05, Jan 06, Jan 07, Jan 08, Jan 09, Jan 10, Jan 11, Jan 12, Jan 13

Henry Hub, Japan LNG (Monthly Average), German border price
Electricity generation in non-OECD countries has only begun to rise

Electricity generation by source

<table>
<thead>
<tr>
<th>Year</th>
<th>OECD</th>
<th>Non-OECD</th>
</tr>
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<tbody>
<tr>
<td>1990</td>
<td>2000</td>
<td>10000</td>
</tr>
<tr>
<td>2011</td>
<td>4000</td>
<td>8000</td>
</tr>
<tr>
<td>2035</td>
<td>6000</td>
<td>10000</td>
</tr>
</tbody>
</table>

- Coal
- Renewables
- Gas
- Nuclear
- Oil
Impact of gas prices increase on the merit order (Europe)

Merit order curve: coal cheaper than gas (illustrative)
Impact of gas prices increase on the merit order (US)

Merit order curve: gas and coal mixed (illustrative)
Displacing coal in Asia will not be that easy

COAL AND GAS PRICES. IMPLIED CO2 PRICE TO TRIGGER FUEL SWITCHING

USD/mbtu

USD/t CO2

Jan-09 Apr-09 Jul-09 Oct-09 Jan-10 Apr-10 Jul-10 Oct-10 Jan-11 Apr-11 Jul-11 Oct-11 Jan-12 Apr-12 Jul-12 Oct-12 Jan-13 Apr-13

CO2 price triggering fuel switch
Coal marker price Asia
LNG Asia average
The power sector is fundamental to the energy outlook of Southeast Asia

ASEAN incremental electricity generation by fuel, 2011-2035

- Coal
- Renewables
- Gas
- Nuclear
- Oil

TWh
Over the long term, the power generation mix is set to change.

Global electricity generation by source, 2010-2035

Source: IEA World Energy Outlook 2012
Wind and solar compensated for the decline of domestic gas upstream.

Incremental production in OECD Europe since 2005

- gas with 50% efficiency
- wind
- solar
Large-scale integration accomplished today, but more to come

Case studies

Note: ERCOT = Electricity Reliability Council of Texas, United States
Interaction is key

Properties of variable renewable energy (VRE)

- Variable
- Uncertain
- Non-synchronous
- Location constrained
- Modularity
- Low short-run cost

Flexibility of other power system components

- Grids
- Generation
- Storage
- Demand Side
The political will to make meaningful progress at a global scale has yet to be demonstrated.
Total primary energy supply
Investment in our future pays off...

...and it is cost effective to make the transition
A sustainable electricity system is a smarter, multidirectional and integrated energy system that requires long-term planning for services delivery.
Thank you

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