International Oil and Gas Markets: Energy Security
Session IV G20 Energy Transitions Working Group

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Summary

I. Global Trends and Projections Compared

- Trilateral work programme with the IEA and OPEC
- Collaboration with the IGU, GECF, and other Agencies

II. 3 Key Energy Security Themes

- Volatility
- Change
- Investment

III. IEF producer-consumer dialogue achievements

- Orderly and inclusive transitions
- Enhanced data transparency
- Efficient and sustainable markets
Dialogue on varied producer and consumer outlooks is better informed and more collegial. This enhances predictability and policy cohesion through cooperation on historical baseline data, classifications and methods underlying outlook scenarios.
Complex physical and financial energy market interactions are made more transparent. This tempers volatility, reinforces confidence in price mechanisms, evolving financial market regulations, and improves risk management.
Dialogue focused on sustainable demand and supply balances for coal and for natural gas. Building consensus on new technologies and renewables to sustainable development goals and achieve climate change mitigation targets.
Dialogue on the mutual reinforcing role of hydrocarbon, renewables and clean technologies. Enabling reliable and realistic transformations all can afford, with rational responses to global challenges. Focusing on energy poverty alleviation and more sustainable and competitive supply.
Dialogue enabling gas market stakeholders to unite behind a clear vision to stimulate inclusive growth and create sustainable energy futures faster together. Focus on new gas technologies from Hydrogen and CCUS to Green Gas and synergies with other sectors and sources.
Implementing the 5-Year Action Plan to 2020 and dialogue on scope of work to 2025. Enhancing energy data transparency visibility on new platforms with new members and on sources such as better data on LNG trade flows and non-OCED inventories.
Enhancing data transparency on Non-OECD inventories
Becomes more important as East - East flows rise to 80% of global

Accumulative OECD and Non-OECD* Crude + Product Builds Since End-2014

Data Sources: JODI, IEA, Rapidan
Additions of New JODI-Oil Participating Countries During JODI 5 Year Action Plan Period toward 2020

Armenia
Belarus
Bangladesh
Gambia
Niger
Tajikistan
the FYR of Macedonia
Mauritius
Moldova
Bermuda

2018
114
Additions of New JODI-Gas Participating Countries During JODI 5 Year Action Plan Period toward 2020

- Angola
- Algeria
- Iraq
- the FYR of Macedonia
- Nigeria
- Kazakhstan

2018

85
Improved JODI visibility
The media increasingly features JODI as a unique data source

Source: JODIdata.org
IEA, OPEC and most recent U.S. EIA Outlooks
Small changes in fuel shares over the years also compared to historical data

<table>
<thead>
<tr>
<th>Percent</th>
<th>Comparison of 2016-2017-2018 IEA, OPEC and most recent EIA Outlooks Fuel Shares in World Primary Energy Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>13%</td>
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<tr>
<td>90%</td>
<td>13%</td>
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<td>80%</td>
<td>16%</td>
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<td>70%</td>
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<td>60%</td>
<td>26%</td>
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<td>50%</td>
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<td>10%</td>
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<td>0%</td>
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Data Sources: U.S. EIA, IEA, OPEC 2016-2018

GLOBAL ENERGY SECURITY THROUGH DIALOGUE

KNOWLEDGE GENERATION THROUGH DIALOGUE
More Scenarios Show Alternate Futures
Fossil shares range from 69% to 60% in 2040, and 48% to 38% in 2040/50

Comparison of 2016-2017-2018 IEA, OPEC and EIA Outlooks on World Energy Demand and IRENA-IEA Long Term Perspectives on 2050

<table>
<thead>
<tr>
<th>Year</th>
<th>1971</th>
<th>2016</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>IEA</td>
<td>OPEC</td>
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<td>IRENA</td>
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Data Sources IEA OPEC 2016-2018

GLOBAL ENERGY SECURITY THROUGH DIALOGUE

KNOWLEDGE GENERATION THROUGH DIALOGUE
Though fossil shares decrease volume grows
Renewables, gas, and oil show strongest growth

World energy demand 2017-2040 according to 2018 NPS

<table>
<thead>
<tr>
<th>Year</th>
<th>Oil</th>
<th>Gas</th>
<th>Coal</th>
<th>Nuclear</th>
<th>Renewables¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>13,972</td>
<td>4,435</td>
<td>3,107</td>
<td>3,750</td>
<td>1,991</td>
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<tr>
<td>2025</td>
<td>15,388</td>
<td>4,754</td>
<td>3,539</td>
<td>3,768</td>
<td>2,521</td>
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<tr>
<td>2030</td>
<td>16,167</td>
<td>4,830</td>
<td>3,820</td>
<td>3,783</td>
<td>2,885</td>
</tr>
<tr>
<td>2035</td>
<td>16,926</td>
<td>4,842</td>
<td>4,132</td>
<td>3,793</td>
<td>3,240</td>
</tr>
<tr>
<td>2040</td>
<td>17,715</td>
<td>4,894</td>
<td>4,436</td>
<td>3,809</td>
<td>3,605</td>
</tr>
</tbody>
</table>

Growth 2017-2040
- Oil: +459
- Gas: +1,329
- Coal: +59
- Nuclear: +283
- Renewables¹: +1,614

¹. Hydropower, Bioenergy, Geothermal, PV, CSP, Wind and Marine

Down-turn leaves oil market without clear direction
Between unconventional production surges and OPEC+ agreements

Brent and WTI Oil Prices

~ $101.23/bbl
Average Market Price 2011-2015

~ $53.58/bbl
Average Market Price 2015 - to date

Data Source: CBOE 2019
Volatility set to increase
On shifting market fundamentals, transitions, and geopolitics

$/bbl

Oil Prices (LHS) vs United States Volatility Index (RHS)

Data Source: CBOE 2019
Oil demand outlooks vary more sharply overtime

Growing uncertainty impacts upstream investment

IEF-RFF Based on IEA and OPEC 2018 data
Focus on change must factor in decline rates

Enhanced producer-consumer dialogue is needed to manage transitions

IEF-KAPSARC Based on IEA, OPEC, IEEJ, EIA, BP, Shell, and Rystad data
3 Key Questions

1. How can countries and regions achieve more secure sustainable and inclusive energy futures?

2. What policy and market initiatives must be leveraged to respond to the challenges that population growth, urbanization and climate change impose?

3. Where can different energy policy and technology pathways reinforce each other to optimise synergies and enhance cohesion?
2019/20 Key Dialogue Meetings

1. 3rd IEF-EU Energy Day on Renewable Deployment in GCC and beyond
   26 February 2019 | Riyadh

2. 9th IEA-IEF-OPEC Symposium on Energy Outlooks
   27 February 2019 | Riyadh

3. 5th IEF-KAPSARC Thought Leaders’ on Competitive and Sustainable Energy Supply
   28 February 2019 | Riyadh

   28 March 2019 | Vienna

5. 4th IEF – OFID Symposium on Energy Poverty (in the JODI Framework)
   7-8 May 2019 | South Africa

6. 8th Asian Ministerial Energy Roundtable
   9-10 September 2019 | Abu Dhabi

7. 17th International Energy Forum Ministerial
   3rd Quarter 2020 | China

8. 7th IEF-IGU Gas Ministerial Forum
   4th Quarter 2020
2019/20 Key JODI Meetings

1. JODI Capacity Building Workshop
   7-8 May | South Africa, 1Q19

2. JODI Information Seminar and Workshop for the Asia Region
   11-13 June 2019 | Tokyo

3. JODI Workshop for the Latin American Region
   3rd Quarter 2019

4. 14th JODI International Conference
   4th Quarter 2019 | Egypt

5. JODI Information Seminar as part of the GECF Summit
   4th Quarter 2019

6. 7th JODI Head of Organisations Meeting and JODI Seminar
   3rd Quarter 2020 | China