Energy Perspectives
2021
Long-term macro and market outlook
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Senior Vice President and Chief Economist
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COVID-19: A shock with profound impact

On human beings, societies, economies, and markets

Global GDP, oil and gas demand
Indexed, 2019 = 100

Countries in recession in 2020
Real GDP growth, annual percent change

Source: Equinor

Source: International Monetary Fund
Signs of recovery
Recessions receding, trade levels back, signs of bottlenecks in markets

GDP growth 2020/21
Real % change y/y

Global goods trade
Indexed, July 2008 and December 2019 = 100

Global commodity prices
Index 2019 = 100 (lhs) and USD/bbl (rhs)

Source: Equinor
Source: CP8 Netherlands Bureau for Economic Policy Analysis, Refinitiv Datastream
Source: OECD
Energy use is increasing

$CO_2$ emissions in China have rebounded, with others likely to follow; still potential for further increases

**Change in $CO_2$ emissions 2019-20**

<table>
<thead>
<tr>
<th>Country</th>
<th>2019 (Mt)</th>
<th>2020 (Mt)</th>
<th>Change (Mt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>-500</td>
<td>-400</td>
<td>-100</td>
</tr>
<tr>
<td>European Union</td>
<td>-300</td>
<td>-200</td>
<td>-100</td>
</tr>
<tr>
<td>India</td>
<td>-200</td>
<td>-100</td>
<td>-100</td>
</tr>
<tr>
<td>Japan</td>
<td>-400</td>
<td>-300</td>
<td>-100</td>
</tr>
<tr>
<td>Russia</td>
<td>-100</td>
<td>-0</td>
<td>-100</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>-200</td>
<td>-100</td>
<td>-100</td>
</tr>
<tr>
<td>Brazil</td>
<td>-200</td>
<td>-100</td>
<td>-100</td>
</tr>
<tr>
<td>China</td>
<td>-500</td>
<td>-400</td>
<td>-100</td>
</tr>
</tbody>
</table>

Source: IEA

**Community movement**

% difference from pre-crisis. Average of retail, workspace and transit related movement of people

Source: Our world in data
An unbalanced world...

15% of the world’s population have nearly 2/3 of the income and use more than 1/3 of the energy

Source: United Nations, IEA, Equinor
An unbalanced world...

Industrialised countries emitting far more CO₂ per capita than those in the emerging economies; resource use too high

CO₂ emissions per capita in 2018

Living within the Earth’s resource limits

Source: United Nations

Source: Global Footprint Network
The limits to economic growth and well-being

Economic growth brings enormous benefits, but beyond a certain point the improvements in well-being are marginal

Happiness and average annual income

GDP per capita and GPI per capita
2005 thousand USD, measured for 17 countries

Source: Worldwatch Institute

Source: Beyond GDP, Measuring and achieving global genuine progress
In which direction is the energy world moving?

Recent signposts show diverging paths, in terms of:

- Economic growth
- Energy efficiency
- Technology development
- Climate ambitions
- Market regulations
- Geopolitics

- Vaccine nationalism
- Weakening of international institutions
- Uneven recovery between rich and poor economies

- Traditional economic stimulus taking priority in policy
- Solar capacity growth slowing
- Volatility in commodity prices

- Net zero ambitions by governments and companies
- Growing support for CCS and Hydrogen
- USA taking leadership on climate issues
Two scenarios that capture where the world could be heading...

**Reform**
- Economic growth prioritised
- Market and technology driven
- Current policy momentum

**Rivalry**
- Focus on energy security
- Geopolitical uncertainty and volatility
- Trade tensions and isolationism
... and a path to a sustainable future

Rebalance

- Immediate and coordinated international action
- Consistent with well below 2°C Paris agreement target
- UN sustainable development goals met
Growing economies, massive improvement in energy efficiency

Only Rebalance delivers a sufficient energy transition and avoids energy addition

Global GDP
Indexed to 100 in 2018, constant USD

World energy intensity development
Index, 2000=100

Total primary energy demand
Billion toe

Source: Equinor
Several pathways for energy-related CO₂ emissions

Reaching net zero in 30-50 years is a massive challenge and requires policies, behavioural changes, technology and investments.

Source: Equinor
What does it take to get to net zero by 2050?

IEA NZE scenario compared with Rebalance

**Oil demand**

<table>
<thead>
<tr>
<th>Year</th>
<th>History</th>
<th>Rebalance</th>
<th>IEA Net Zero</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>90</td>
<td>4,500</td>
<td>4,000</td>
</tr>
<tr>
<td>2030</td>
<td>80</td>
<td>4,000</td>
<td>3,500</td>
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<tr>
<td>2040</td>
<td>70</td>
<td>3,500</td>
<td>3,000</td>
</tr>
<tr>
<td>2050</td>
<td>60</td>
<td>3,000</td>
<td>2,500</td>
</tr>
</tbody>
</table>

**Gas demand**

<table>
<thead>
<tr>
<th>Year</th>
<th>History</th>
<th>Rebalance</th>
<th>IEA Net Zero</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>5,000</td>
<td>5,000</td>
<td>4,500</td>
</tr>
<tr>
<td>2030</td>
<td>4,500</td>
<td>4,500</td>
<td>4,000</td>
</tr>
<tr>
<td>2040</td>
<td>4,000</td>
<td>4,000</td>
<td>3,500</td>
</tr>
<tr>
<td>2050</td>
<td>3,500</td>
<td>3,500</td>
<td>3,000</td>
</tr>
</tbody>
</table>

**Electricity generation mix**

<table>
<thead>
<tr>
<th>Year</th>
<th>Hydrogen</th>
<th>Wind</th>
<th>Nuclear</th>
<th>Solar</th>
<th>Biomass</th>
<th>Gas</th>
<th>Reb</th>
<th>NZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>5</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
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<tr>
<td>2050</td>
<td>15</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>

Reb NZE: +167% +89%
Where are energy markets moving?

Electrification is the key element of the energy transition, and a major factor in efficiency improvements.
Transition moving too slowly in some sectors

No silver bullet; efficiency and electrification are the primary measures

**Industrial demand**
Billion toe

<table>
<thead>
<tr>
<th>Year</th>
<th>Reb</th>
<th>Ref</th>
<th>Riv</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>2</td>
<td>1.5</td>
<td>0.5</td>
</tr>
<tr>
<td>2050</td>
<td>2.2</td>
<td>1.6</td>
<td>0.8</td>
</tr>
</tbody>
</table>

- Reb: Red
- Ref: Gray
- Riv: Red

**Buildings demand**
Billion toe

<table>
<thead>
<tr>
<th>Year</th>
<th>Reb</th>
<th>Ref</th>
<th>Riv</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>3</td>
<td>2.5</td>
<td>1</td>
</tr>
<tr>
<td>2050</td>
<td>3.3</td>
<td>2.7</td>
<td>1.2</td>
</tr>
</tbody>
</table>

- Reb: Red
- Ref: Gray
- Riv: Red

**Non-Energy demand**
Billion toe

<table>
<thead>
<tr>
<th>Year</th>
<th>Reb</th>
<th>Ref</th>
<th>Riv</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>1.5</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>2050</td>
<td>2.2</td>
<td>1.6</td>
<td>0.8</td>
</tr>
</tbody>
</table>

- Reb: Red
- Ref: Gray
- Riv: Red

Source: IEA, Equinor
The impact of adding hydrogen to Rebalance

H₂ could be an important part of the transition to a net zero economy

**Demand by sector**

<table>
<thead>
<tr>
<th>Mt</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
<th>2040</th>
<th>2045</th>
<th>2050</th>
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</thead>
<tbody>
<tr>
<td>Power and heat</td>
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<tr>
<td>Industry</td>
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<tr>
<td>Transport</td>
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<tr>
<td>Buildings</td>
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</tr>
</tbody>
</table>

**Supply of Hydrogen**

<table>
<thead>
<tr>
<th>Mt</th>
<th>2025</th>
<th>2030</th>
<th>2031</th>
<th>2035</th>
<th>2040</th>
<th>2045</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (from natural gas and CCS)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Green (from electrolysis with renewable electricity)</td>
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<td></td>
</tr>
</tbody>
</table>

**Global CO₂ emissions and CCS**

<table>
<thead>
<tr>
<th>Gt</th>
<th>2020</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
<th>CCS</th>
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</thead>
<tbody>
<tr>
<td>Rebalance</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Hydrogen sensitivity study</td>
<td></td>
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</tr>
</tbody>
</table>

Source: Equinor
Wide outcome space for oil and gas demand

Large oil and gas investments in all scenarios, although significantly less in Rebalance

**Oil demand and supply from existing fields**

- **Mbd**
- **Demand range**
- Cumulative supply gap >283 bn bbls
- Supply without new fields

**Gas demand and supply from existing fields**

- **Bcm**
- Demand range
- Cumulative supply gap >60 Tcm
- Supply without new fields

Source: IEA, Equinor
Investments in the IEA’s Net Zero scenario

Gradually less investments in fossil fuels, massive growth elsewhere, with opportunities for incumbent players in oil and gas

Global average annual investments
Trillion USD (2019)

Average annual investment needs
Billion USD (2019)

Source: International Energy Agency (2021), Net Zero by 2050, IEA
What does the energy transition hold?
Continued growth and little change in fuel mix over preceding 30 years, then rapid change in Rebalance

Source: IEA, Equinor