Transforming Oil/Gas Companies to Energy Companies: The New Narrative
Payne Institute, Colorado School of Mines

6 October, 2020

Atul Arya, Chief Energy Strategist, IHS Markit
atul.arya@ihsmarkit.com
Copyright notice and disclaimer

© 2020 IHS Markit. All rights reserved. For private use by recipients only.

These slides are subject to IHS Markit copyright. You are not permitted to reproduce, reuse, or otherwise redistribute the slides or any portion of this presentation to anyone without prior written consent of IHS Markit.

This presentation is not to be construed as legal or financial advice, use of or reliance on any content is entirely at your own risk, and to the extent permitted by law, IHS Markit shall not be liable for any errors or omissions or any loss, damage, or expense incurred by you.
Outline

▪ Recap of 2020
▪ Energy Transition
▪ Future Scenarios
▪ Company Strategies
▪ Conclusions
Recap of 2020
The global economy is in recession in 2020

Global real GDP, industrial production, and real exports

Source: IHS Markit

© 2020 IHS Markit
The world of oil and gas has been radically altered in the 2020

- Greatest demand decline in world oil history: -22 MMb/d in second quarter 2020
- Greatest volume of production cuts in world oil history: -14 MMb/d in second quarter 2020
- President Trump orchestrates global oil supply management deal: Overturns decades of US policy
- Negative crude oil price: -$37/bbl WTI on 20 April
- Halt to international travel: Vast majority of international passenger flights cancelled
- Global economy projected to shrink around 5.5% in 2020: Most severe outcome since World War II

April was the bottom of the oil demand decline but the oil/gas industry is still deeply distressed.
While US truck miles traveled have recovered to the pre-pandemic level, US passenger car miles traveled remain below the 2019 level.

**US weekly vehicle miles traveled compared with last year**

Note: Vehicle miles traveled by all vehicles on all interstate highways. Data are based on permanently installed traffic monitoring roadway sensors and other passive data observations.

Source: IHS Markit, US Department of Transportation © 2020 IHS Markit

**Change from a year earlier in US weekly gasoline retail sales in 2020, OPIS by IHS Markit survey**

Note: Each week, OPIS conducts an exclusive weekly survey of 15,000 US gasoline stations that account for 20% of total US gasoline sales.

Source: OPIS by IHS Markit © 2020 IHS Markit
The market balance has moved to slight deficits compared with record surpluses in first half 2020, while risks to demand are on the downside.
Global upstream capex will take five years to be back to 2019 levels
Energy Transition
It takes decades to change global energy mix
More recently, energy addition not transition

<table>
<thead>
<tr>
<th>Fuel Mix Energy</th>
<th>2000</th>
<th>2018</th>
<th>Fuel Mix Electricity</th>
<th>2000</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>23%</td>
<td>26%</td>
<td>Coal</td>
<td>39%</td>
<td>38%</td>
</tr>
<tr>
<td>Oil</td>
<td>36%</td>
<td>31%</td>
<td>Oil</td>
<td>8%</td>
<td>2%</td>
</tr>
<tr>
<td>Gas</td>
<td>21%</td>
<td>23%</td>
<td>Gas</td>
<td>18%</td>
<td>23%</td>
</tr>
<tr>
<td>Nuclear</td>
<td>7%</td>
<td>5%</td>
<td>Nuclear</td>
<td>17%</td>
<td>10%</td>
</tr>
<tr>
<td>Hydro</td>
<td>2%</td>
<td>3%</td>
<td>Hydro</td>
<td>17%</td>
<td>16%</td>
</tr>
<tr>
<td>Biomass</td>
<td>10%</td>
<td>10%</td>
<td>Biomass</td>
<td>1%</td>
<td>3%</td>
</tr>
<tr>
<td>Renewables</td>
<td>1%</td>
<td>2%</td>
<td>Renewables</td>
<td>0%</td>
<td>8%</td>
</tr>
</tbody>
</table>
Recent Emissions History

**Top greenhouse gas emitters**

**Absolute Basis**
Gigatonnes of CO2 Emissions

**Per Capita Basis**
Territorial CO2 Emissions Per Capita

**SOURCE:** UN Environment Programme. Excluding land-use change emissions due to lack of reliable country-level data.
Notwithstanding drop in emissions due to the pandemic, CO2 concentrations continue to increase …
Focus on emission reductions from power generation
Little progress in all other sectors

Greenhouse gas emissions by sector

- Agriculture: 24%
- Electricity Generation: 25%
- Manufacturing: 21%
- Buildings: 10%
- Other Sources: 6%
- Transportation: 14%

Source: IPCC (2014)
Future Scenarios
“Autonomy” Scenario: Gas demand plateaus in 2030s
Oil and gas account for 44% of energy demand in 2050, renewables share to grow to 20%

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Share in 2019</th>
<th>Share in 2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil</td>
<td>32%</td>
<td>24%</td>
</tr>
<tr>
<td>Gas</td>
<td>26%</td>
<td>21%</td>
</tr>
<tr>
<td>Coal</td>
<td>23%</td>
<td>20%</td>
</tr>
<tr>
<td>Renewables*</td>
<td>5%</td>
<td>9%</td>
</tr>
<tr>
<td>Modern biomass**</td>
<td>2%</td>
<td>7-8%</td>
</tr>
<tr>
<td>Other***</td>
<td>4%</td>
<td>4%</td>
</tr>
</tbody>
</table>

Note: *Includes solar, wind, geothermal, and ocean energy. **Includes biofuels and biomass (industry, electricity, district heat, and refining). ***Includes solid waste, traditional biomass, ambient heat, net trade of electricity, or heat.

Source: IHS Markit

Autonomy: Primary energy demand by fuel, 1990–2050

<table>
<thead>
<tr>
<th>Year</th>
<th>Oil (MMtoe)</th>
<th>Natural gas (MMtoe)</th>
<th>Coal (MMtoe)</th>
<th>Hydro (MMtoe)</th>
<th>Nuclear (MMtoe)</th>
<th>Renewables* (MMtoe)</th>
<th>Modern biomass** (MMtoe)</th>
<th>Other*** (MMtoe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>1,000</td>
<td>2,000</td>
<td>3,000</td>
<td>4,000</td>
<td>5,000</td>
<td>6,000</td>
<td>7,000</td>
<td>8,000</td>
</tr>
<tr>
<td>2000</td>
<td>1,000</td>
<td>2,000</td>
<td>3,000</td>
<td>4,000</td>
<td>5,000</td>
<td>6,000</td>
<td>7,000</td>
<td>8,000</td>
</tr>
<tr>
<td>2010</td>
<td>1,000</td>
<td>2,000</td>
<td>3,000</td>
<td>4,000</td>
<td>5,000</td>
<td>6,000</td>
<td>7,000</td>
<td>8,000</td>
</tr>
<tr>
<td>2020</td>
<td>1,000</td>
<td>2,000</td>
<td>3,000</td>
<td>4,000</td>
<td>5,000</td>
<td>6,000</td>
<td>7,000</td>
<td>8,000</td>
</tr>
<tr>
<td>2030</td>
<td>1,000</td>
<td>2,000</td>
<td>3,000</td>
<td>4,000</td>
<td>5,000</td>
<td>6,000</td>
<td>7,000</td>
<td>8,000</td>
</tr>
<tr>
<td>2040</td>
<td>1,000</td>
<td>2,000</td>
<td>3,000</td>
<td>4,000</td>
<td>5,000</td>
<td>6,000</td>
<td>7,000</td>
<td>8,000</td>
</tr>
<tr>
<td>2050</td>
<td>1,000</td>
<td>2,000</td>
<td>3,000</td>
<td>4,000</td>
<td>5,000</td>
<td>6,000</td>
<td>7,000</td>
<td>8,000</td>
</tr>
</tbody>
</table>
The future of oil demand faces epic uncertainty

Global oil (liquids) demand scenario

- History
- Rivalry
- Autonomy

Notes: includes biofuels and LPGs

© 2020 IHS Markit
Outlook for oil demand

Oil consumption

Change in oil demand, 2018-2050

1) includes 2/3 wheelers
2) trucks and buses
3) aviation, marine and rail
Natural gas demand expected to be more resilient than oil demand

**Primary liquids demand**

- **Base case**
- **Autonomy**

**Primary natural gas demand**

- **Base case**
- **Autonomy**

Note: Excludes biofuels, coal to liquids/gas to liquids, and refinery

Source: IHS Markit

© 2020 IHS Markit
Renewables expected to make 75% of future growth in power generation

Operating capacity, by fuel source, 2019

- **China**
- **Europe and CIS**
- **North America**
- **Asia Pacific**
- **Latin America**
- **India**
- **Middle East**
- **Africa**

Note: Other conventional includes large hydro, nuclear, and oil.
Source: IHS Markit © 2020 IHS Markit

Net capacity additions, 2019–50

- **China**
- **Europe and CIS**
- **North America**
- **Asia Pacific**
- **Latin America**
- **India**
- **Middle East**
- **Africa**

Source: IHS Markit © 2020 IHS Markit
Company Strategies
Investors continue to retreat from energy sector

S&P 500 sector weighting

Source: Bloomberg LP

© 2020 IHS Markit
While oil/gas sector returns have been in single digits for nearly a decade…

Global Integrated Oil Companies: Corporate return on average capital employed

Note: Includes data for BP, Chevron, Eni, Equinor, ExxonMobil, Shell, and Total.
Source: IHS Markit

© 2020 IHS Markit
...Low carbon returns are becoming competitive to oil and gas and less volatile

### Median annual operating return on invested capital since 2010

<table>
<thead>
<tr>
<th>Segment</th>
<th>Return (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ren fuels</td>
<td>-9.0%</td>
</tr>
<tr>
<td>Oil &amp; gas</td>
<td>8.5%</td>
</tr>
<tr>
<td>Efficiency</td>
<td>8.2%</td>
</tr>
<tr>
<td>Wind mfg</td>
<td>7.5%</td>
</tr>
<tr>
<td>Utilities</td>
<td>6.8%</td>
</tr>
<tr>
<td>Storage</td>
<td>6.1%</td>
</tr>
<tr>
<td>LowC power</td>
<td>5.3%</td>
</tr>
<tr>
<td>Solar mfg</td>
<td>4.2%</td>
</tr>
<tr>
<td>Elec vehicles</td>
<td>-2.7%</td>
</tr>
</tbody>
</table>

Source: IHS Markit © 2019 IHS Markit

### SD of median annual operating return

<table>
<thead>
<tr>
<th>Segment</th>
<th>SD (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil &amp; gas</td>
<td>7.8%</td>
</tr>
<tr>
<td>Solar mfg</td>
<td>7.5%</td>
</tr>
<tr>
<td>Wind mfg</td>
<td>6.0%</td>
</tr>
<tr>
<td>Ren fuels</td>
<td>4.4%</td>
</tr>
<tr>
<td>Elec vehicles</td>
<td>3.2%</td>
</tr>
<tr>
<td>Storage</td>
<td>2.9%</td>
</tr>
<tr>
<td>Efficiency</td>
<td>1.4%</td>
</tr>
<tr>
<td>Utilities</td>
<td>0.7%</td>
</tr>
<tr>
<td>LowC power</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

Source: IHS Markit © 2019 IHS Markit

*Excludes hydrogen/fuel cells sector due to values that are not meaningful.

Notes: Low-carbon segments based on companies included in the WilderHill New Energy Global Innovation Index; Utilities companies include those in the iShares Global Utilities ETF; Oil & gas companies include 29 multijurisdiction upstream-focused IOCs covered as part of IHS Markit's Upstream Company Strategies team.
Companies are making different climate-related choices

- Diversify into growth areas
- Integrate vertically in the energy value chain
- Create technology breakthroughs
- Cut costs and cut emissions drastically
- Shift business mix and narrow focus
- Divest/downsize hydrocarbon investments
- Return more to shareholders and less back to the business
- Be the last man standing
- All of the above
E&P organizations are taking multiple approaches to reduce the carbon intensity of their operations and portfolios

Upstream industry drivers and responses of GHG reduction

Energy transition
- Greater electrification of the global economy
- Long transition period where fossil and renewable energy sources coexist

Technology
- New low-cost technologies to precisely locate and accurately measure greenhouse gas (GHG) emissions
- Use of digital technologies to manage complexity of more diverse energy supply mix

Climate concerns from multiple stakeholders
- Regulatory: Carbon tax
- Environmental: Paris Agreement (2016)
- Financial: Task Force on Climate-related Financial Disclosure (TFCD)

Reduce carbon intensity of core E&P operations
- Increase operational efficiency, identify and mitigate GHG emissions
- Life-cycle approach to carbon reduction (e.g., wells to wheels analysis, reduce end-use carbon produced)
- Change composition of resource portfolio

Expand into clean energy value chain
- Seek new business lines that build on existing capabilities including carbon capture, use and storage (CCUS)
- Reenter clean tech at more mature technology stages

Source: IHS Markit
“There is no single solution to tackling climate change. A transformation of the global energy system is needed, from electricity generation to industry and transport”, said Ben van Beurden, Shell's CEO.

<table>
<thead>
<tr>
<th>Global Integrateds: Current activities in the low-carbon segment</th>
<th>BP</th>
<th>Chevron</th>
<th>Eni</th>
<th>Equinor</th>
<th>ExxonMobil</th>
<th>Repsol</th>
<th>Shell</th>
<th>Total S.A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce direct operational emissions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promote natural gas and LNG</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solar</td>
<td></td>
<td>⬤</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind</td>
<td></td>
<td>⬤</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biofuels</td>
<td></td>
<td>⬤</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geothermal</td>
<td></td>
<td>⬤</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydropower</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power transmission/distribution</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EVs/charging infrastructure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>⬤</td>
<td></td>
</tr>
<tr>
<td>Batteries/storage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>⬤</td>
<td></td>
</tr>
<tr>
<td>Fuel cells</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>⬤</td>
<td></td>
</tr>
<tr>
<td>Carbon capture, utilization, and storage</td>
<td></td>
<td>⬤</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>⬤</td>
<td></td>
</tr>
<tr>
<td>Nature-based solutions (carbon sinks)</td>
<td></td>
<td>⬤</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>⬤</td>
<td></td>
</tr>
</tbody>
</table>

- **Green**: Current development focus and/or stated part of current strategy
- **Yellow**: Existing area of research and/or discussed as potential investment area

Source: IHS Markit

Note: Includes only direct investments and R&D; excludes venture capital investments.
Companies setting and revising emission targets – Europeans IOCs leading

Dates when oil and gas companies’ have set and updated their emission reduction targets, including Scope 3


* These assessments are made on a provisional basis by TPI
** TPI currently includes volumes from BP’s Crude Oil sales business in its assessment, which BP indicates exclusively comprises financial trading.
...will create a very different company in 2030

<table>
<thead>
<tr>
<th>2019</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5GW / 250TWh</td>
<td>Developed renewables and traded electricity¹</td>
</tr>
<tr>
<td>22Kbd</td>
<td>Bioenergy</td>
</tr>
<tr>
<td>0.6 Mte in our operations</td>
<td>Hydrogen</td>
</tr>
<tr>
<td>10m</td>
<td>Customer touchpoints per day</td>
</tr>
<tr>
<td>&gt;7,500</td>
<td>EV charging points</td>
</tr>
<tr>
<td>~2.6mmboed</td>
<td>Oil and gas production</td>
</tr>
<tr>
<td>~360Mte</td>
<td>Aim 2 emissions</td>
</tr>
<tr>
<td>0</td>
<td>Partnerships with cities and industry</td>
</tr>
<tr>
<td>8.9%</td>
<td>ROACE²</td>
</tr>
</tbody>
</table>

1. Traded electricity may include electricity sourced from the grid
2. ROACE: return on average capital employed as defined in bp’s 2019 annual report
Approach to the energy transition

**Lower carbon intensity**
cost efficiently

- **2016 - 2023 Upstream targets**
  - Oil net GHG intensity 5 - 10% ↓
  - Gas net GHG intensity 2 - 5% ↓
  - Flaring intensity 25 - 30% ↓
  - Methane emissions intensity 20 - 25% ↓

**Increase renewables**
in support of our business

- Renewable natural gas
- Co-processing biofeed
- Renewable PPAs

**Invest in the future**
target breakthrough technologies

- Future energy fund
  - Trialing carbon capture technology
  - Contribution to OGCI's $1B+ fund
  - Gorgon CO₂ sequestration
# COLLABORATIONS ENABLE TECHNOLOGY SOLUTIONS

Collaborations expand technology development and deployment

<table>
<thead>
<tr>
<th>Energy center low-emission focus areas</th>
<th>MITeC</th>
<th>Princeton-Offices Partnership</th>
<th>University of Texas at Austin Energy Institute</th>
<th>Stanford Strategic Energy Alliance</th>
<th>Singapore Energy Centre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renewable power</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Carbon capture</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Grid-scale electron storage</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Long-distance battery storage</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Gas conversion</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>New products</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Liquids conversion</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

- External collaborations combine university science capabilities with ExxonMobil’s expertise in scaling technology
- Progressing joint research and development with academia, national laboratories, and industry partners

1 Covers active collaborations and proposals in progress
Ways to achieve the ambition

Energy efficiency
- Operational improvements
- Process optimisation
- Reducing flaring/venting/fugitives

Use of low-carbon energy
- Low- and zero-carbon electricity and steam
- Biofuels
- Hydrogen

Carbon sinks
- Carbon capture, utilisation & storage
- Nature based solutions

Governance
- Potential GHG costs associated with operational GHG emissions
- Greenhouse gas energy management plans
- Performance standards or industry benchmarks for projects

Aiming to be net-zero on all the emissions from the manufacture of all our products¹

¹Refers to the Scopes 1 and 2 emissions in absolute terms associated with operations under direct Shell control
Growing sales while adapting to demand

Energy sold to our customers
PJ/y

2019

2030

12,000

5%

40%

55%

Electrons
Biogas, H₂
Natural Gas
Biofuels
Oil products

% in sales

15%

50%

35%

Confidential. © 2019 IHS Markit®. All rights reserved.
Conclusions
The current turmoil in the global economy and energy markets will impact the Energy Transition – but how?

**SLOWER**

- Fossil fuels (re)gain price advantage over renewables
- Policy measures on emissions and sustainability take a back seat as governments recover from providing fiscal and monetary stimulus
- Energy companies cut spending on clean technologies to repair balance sheets
- Cash-strapped public less willing to pay for green energy
- Reduction in use of ‘unsafe’ public transport, increased use of private vehicles
- Renewable technology supply chains are rebuilt to reduce dependence on China, increasing costs and delaying capacity ramp up

**FASTER**

- Volatility, low returns and bankruptcies make oil & gas an increasingly unattractive investment; increased investor pressure on IOCs to accelerate portfolio migration
- Governments of hydrocarbon producing countries increase their efforts at economic diversification
- Real life demonstration that even a short term drop in emissions can bring significant climate and environmental benefits
- Increased stakeholder recognition that a post Covid-19 world cannot afford further economic damage from climate change (fires, floods…)
- Structural changes to work & social mobility models exacerbate already stagnating market for ICE vehicles