1. Where did yesterday’s experts say we were going?
2. Where do today’s experts say we are going?
3. Where are we now?
1. Yesterday’s Experts

- From 1975 - 2011
The End of Oil

Jimmy Carter in 1976:

- “We have about 35 years of oil left in the whole world …”
- “We are going to run out of oil.” [35 + 1976 = 2011]
- “We need to concentrate our R&D effort on coal burning and extraction . . . it is clean burning.”
The End of Cheap Oil

Global production of conventional oil will begin to decline sooner than most people think, probably within 10 years

by Colin J. Campbell and Jean H. Laherrère

In 1973 and 1979 a pair of sudden price increases radically awakened the industrial world to its dependence on cheap crude oil. Prices first tripled in response to an Arab embargo and then nearly doubled again when Iran deposed its Shah, sending the major economies spiraling into recession. Many analysts warned that these crises proved that the world would soon run out of oil. Yet they were wrong.

Their dire predictions were emotional and political reactions, even at the time, oil experts knew that they had no scientific basis. Just a few years earlier oil explorers had discovered enormous new oil provinces on the north slope of Alaska and below the North Sea off the coast of Europe. By 1973 the world had consumed, according to many experts’ best estimates, only about one eighth of its endowment of readily accessible crude oil (so-called conventional oil). The five Middle Eastern members of the Organization of Petroleum Exporting Countries (OPEC) were able to hike prices not because oil was growing scarce but because they had managed to corner 36 percent of the market. Later, when demand sagged, and the flow of fresh Alaskan and North Sea oil weakened OPEC’s economic stranglehold, prices collapsed.

The next oil crunch will not be so temporary. Our analysis of the discovery and production of oil fields around the world suggests that within the next decade, the supply of conventional oil will be unable to keep up with demand. This conclusion contradicts the picture one gets from oil industry reports, which boasted of 1.020 billion barrels of oil (Gbo) in “Proved” reserves at the start of 1998. Dividing this figure by the current production rate of about 23.6 Gbo a year might suggest that crude oil could remain plentiful and cheap for 43 more years—probably longer, because official charts show reserves growing.

Unfortunately, this appraisal makes three critical errors. First, it relies on inflated estimates of reserves. A mistake is to pretend that production remain constant. Third and most important, conventional wisdom erases the fact that the last bucket of oil is pumped from the ground just as the barrels of oil gushing through today. In fact, the rate at which any one country—can produce increases to a maximum and then, when half the oil is gone, begins falling back to zero.

From an economic perspective, the world runs completely out of oil not directly relevant: what matters is that production begins to taper off. At that point, prices will rise unless declines are commensurate.

HISTORY OF OIL PRODUCTION, from the first commercial American oil well in Titusville, Pa. (left), to derricks bristling above the Los Angeles basin (below) with steady growth in the U.S. (red line). But domestic production began to fall after 1970, and restrictions in the flow of Middle Eastern oil in 1973 and to inflation and shortages (near and center right). More recently, the Persian Gulf War, with its burning oil fields (far right), reminded the industrial world of its dependence on Middle Eastern oil production (gray line).
Oil Scarce

2004 prediction:

• Oil demand will rise faster than supply
2005 prediction:

- World oil production will peak in 5 - 10 years

Global Crude Oil Had Peak In May 2005

This record (EIA data) 74.3 MMB/D is now almost 3 years old.

32 added monthly supply estimates have failed to breach this record.

Climbing to 75 – 77 MMB/D quickly becoming far-fetched dream.

The gap to supply 88 MMB/D is spread thin and not sustainable:
- NGL’s
- Refinery processing gains
- Sliver of biofuels
Plateau Oil

2011 prediction:

• World oil production will not decline until ~ 2050

• At least 5 previous “peak oil” periods

• Price matters
2. Today’s Experts

• Since about 2016
Today’s World

![Image of Tesla charging station](image1)

![Diagram of unconventional and conventional drilling methods](image2)
Today’s World

DIRECT MEASUREMENTS: 2005-PRESENT

Data source: Monthly measurements (average seasonal cycle removed). Credit: NOAA

![Graph showing CO2 levels from 2005 to 2020](image-url)
Is peak oil demand in sight?

Oil & Gas June 2016

Our latest research suggests lower long-term growth in demand for oil than previously forecast. This warrants a fresh, critical look at energy investments.

Energy outlook: Key insights
Our business-as-usual case integrates the latest McKinsey view on economic-growth fundamentals and granular sector and regional insights. Six key points have emerged:

1. Growth in global energy demand will decelerate to 0.7 percent per year through 2050, a rate 30 percent slower than we had previously forecast.

2. Emerging and developing countries will drive all growth in energy demand, while European and North American demand will decline.

3. Chemicals will grow at more than double the rate of total energy demand, while light-vehicle demand will peak around 2023.

4. Demand for electricity will outpace demand for other energy sources by more than two to one. Solar and wind will represent almost 80 percent of net added capacity and 34 percent of generation by 2050.

5. Fossil fuels will dominate the total energy mix through 2050, but their share of total energy will decline to 74 percent from 82 percent. While gas is a relative winner (growing at almost twice the rate of total energy demand), coal will peak by 2025, and oil demand growth will flatten to 0.4 percent.

2016 prediction:

- OECD energy demand slowing
- Non-OECD country demand dominates energy growth
2019 prediction:

- EVs and renewables will cause demand to decline by 2020 in OECD countries
- But growth outside OECD increases oil demand

The rise and fall of black gold

When will peak oil demand strike?

The market used to worry about peak oil supply. With the world now considering a structural decline, sectors will feel the greatest impact.
The outlook for oil demand is uncertain but looks set to play a major role in global energy out to 2040.

**BP 2019 prediction:**
- World oil demand/supply could go either way.
Oil and Gas Expected to Grow

Comparing the ET scenario with other outlooks...

Contributions to growth of energy consumption, 2016-2040

BP’s and others’ predictions:
• World oil demand/supply grows through 2040
US EIA 2019 prediction:

- US a net oil and gas exporter for ~ 15 years
US Oil Supply to Expand

US leads the way in global supply growth

Change in total oil supply 2018-24

mb/d

US

Guyana
UAE
Norway
Iraq
Brazil

Iran
Venezuela

US expansion is 70% of global growth. Gains in Brazil, Iraq, Norway, the UAE and Guyana. Main declines in Iran and Venezuela.

IEA 3/2019
US Gas Supply to Climb

The United States continues to produce large volumes of natural gas from oil formations, even with relatively low oil prices—

Dry natural gas production from oil formations
trillion cubic feet

- Southwest
- Gulf Coast
- Other

US EIA 2019
Saudi, US, Russia to Lead

US gross exports overtake Russia, catch up with Saudi Arabia

US is net oil exporter in 2021 after 75 years of import dependency. US exports add to market flexibility.

IEA 3/2019
US Shale to Lead Oil Growth

In higher price environment production could be even greater.

IEA 3/2019
Permian to Lead US Oil Increase

The Southwest region leads tight oil production growth in the United States in the Reference case—

**Lower 48 onshore crude oil production by region (Reference case)**

<table>
<thead>
<tr>
<th>Region</th>
<th>2018 Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southwest</td>
<td>6 million bpd</td>
</tr>
<tr>
<td>Gulf Coast</td>
<td>5 million bpd</td>
</tr>
<tr>
<td>Northern Great Plains</td>
<td>4 million bpd</td>
</tr>
<tr>
<td>Rocky Mountains</td>
<td>3 million bpd</td>
</tr>
<tr>
<td>Midcontinent</td>
<td>2 million bpd</td>
</tr>
<tr>
<td>East</td>
<td>1 million bpd</td>
</tr>
<tr>
<td>West Coast</td>
<td>0.5 million bpd</td>
</tr>
</tbody>
</table>

US EIA 2019
3. Where We Are Now

- Oil and Gas Prices
- World Oil Production
- The Eagle Ford Shale
- Texas Energy
Oil and Gas Prices

Price History of Oil & Gas Benchmarks in U.S. Dollars

WTI @ Cushing Spot
Europe Brent Crude F.O.B.
Henry Hub SPOT
AECO - $US

Ryder Scott
World Oil and Gas Production

WORLD Petroleum Produced & Consumed
(Includes crude oil, lease cond. NGLs, & Other Liquids [biodiesel, ethanol, liquids from coal, gas, & oil shales etc.])

EIA Table 3a  http://www.eia.gov/forecasts/steo/report/us_oil.cfm

March 2019
Major Oil and Gas Producers

Crude Oil & Lease Condensate Production by Country

EIA Tables 11.1a & 11.1b  http://www.eia.gov/forecasts/steo/report/us_oil.cfm

- United States
- Canada
- China
- Iran
- Iraq
- Libya
- Mexico
- Nigeria
- Russia
- Saudi Arabia
- United Kingdom (Offshore)
- Venezuela

March 2019
U.S. crude oil production grew 17% in 2018, surpassing the previous record in 1970.

U.S. crude oil production (1940-2018)

- 1970: 9.64 million b/d
- 2018: 10.96 million b/d
- 2017: 9.35 million b/d

Source: EIA
Record Texas Oil Production

U.S. crude oil production by state or region, 1970-2018
million barrels per day (record production year)

Texas (2018)
Offshore GOM (2018)
North Dakota (2018)
New Mexico (2018)
Oklahoma (1967)

Alaska (1988)
California (1985)
Colorado (2018)
Louisiana (1970)
rest of U.S.
## Largest US Oil Producers

<table>
<thead>
<tr>
<th>2018 Top 10 Oil Producing State</th>
<th>Oil Production (BBL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Texas</td>
<td>1,540,953,349</td>
</tr>
<tr>
<td>North Dakota</td>
<td>442,926,383</td>
</tr>
<tr>
<td>New Mexico</td>
<td>226,158,117</td>
</tr>
<tr>
<td>Oklahoma</td>
<td>186,542,241</td>
</tr>
<tr>
<td>Alaska</td>
<td>174,830,591</td>
</tr>
<tr>
<td>California</td>
<td>170,904,184</td>
</tr>
<tr>
<td>Colorado</td>
<td>152,471,637</td>
</tr>
<tr>
<td>Wyoming</td>
<td>83,276,742</td>
</tr>
<tr>
<td>Louisiana</td>
<td>48,017,828</td>
</tr>
<tr>
<td>Utah</td>
<td>35,738,124</td>
</tr>
</tbody>
</table>
Texas World No. 3 Oil Producer

Texas to pump more oil than Iraq, Iran in 2019

- Russia
- Saudi Arabia
- Texas
- Iraq
- Iran

12 million

Source: HSBC estimates of daily barrels of oil production
Eagle Ford Shale from Space
Texas - Largest US Wind Energy Capacity

2018 Installed Wind Power Capacity (MW)

Total Installed Wind Capacity: 96,487 MW
Thank You

Locations

McGinnis Lochridge is a Texas-based firm with offices in Austin, Houston, Dallas and Decatur, where we represent clients throughout Texas, the United States and the world.
The Trouble with Forecasts

• Intuitive Linear View
  – Bias toward the recent past
• Technological Change is Exponential
  – E.g., Moore’s Law
U.S. petroleum consumption by sector and share of total in 2017

- Transportation—14.02 million barrels per day (b/d)—71%
- Industrial—4.76 million b/d—24%
- Residential—0.52 million b/d—3%
- Commercial—0.47 million b/d—2%
- Electric power—0.10 million b/d—1%
Petroleum Produced & Consumed by Country/Region

Includes crude oil, lease cond, NGLs, & Other liquids (biodiesel, ethanol, liquids from coal, gas, & oil shales etc)

EIA Tables 3a, 3b & 3d  http://www.eia.gov/forecasts/steo/report/us_oil.cfm

March 2019