

# Energy Transition Opportunities and Challenges

Stan Dempsey, Jr.

Colorado Mining Association

Club 20 Energy Committee

March 15, 2019

# Global Demand for Energy - 2040 or 2050

- ▶ Best Resources for Study
- ▶ Why Study?
- ▶ Basic Themes
- ▶ Population Growth and Prosperity
- ▶ Carbon
- ▶ State versus Federal Regulatory Landscape

# Mining Leader Cites Energy 'Inhibitions'

America's leaders have made little progress in becoming less dependent on foreign oil sources and the country now is "infinitely more" dependent on those sources, the chairman of the American Mining Congress said in Denver Sunday.

"If you think we were held up to hostage in 1973 during the (Arab) petroleum embargo," said Ian MacGregor, "it's nothing to what would happen to us if the same thing were repeated."

MacGregor, who is chairman and chief executive officer of AMAX, Inc., said an "ace-in-the-hole we thought we had—coal in plentiful quantities—is being quite severely inhibited by all types of restrictions on development of new mines and on procedures in mining. . . ."

"MANY OF THESE," he said, "originated from perfectly legitimate ideas to improve safety and working conditions. But they also have sharply reduced productivity."

MacGregor made his remarks in a press conference prior to the opening of the congress' national convention at the Brown Palace Hotel. The convention continues through Wednesday.

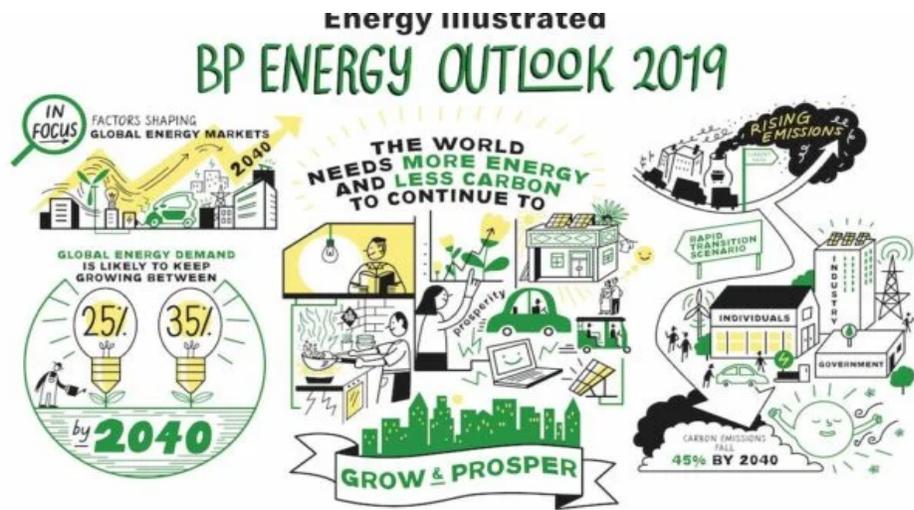
Referring to the energy inhibitions, the AMAX chief warned that if the nation's lawmakers don't reverse the trend, "this

continued, would have even a greater effect on Colorado, he said, "potentially" may be one of the country's "greatest sources of mineral wealth." That kind of taxing structure proposed in the amendment "is going to make it less interesting to investors (and) will slow (development) down very, very sharply."

MacGregor said the picture of the Old West miner gambling all on a mining venture hasn't changed very much.

"Actually, the gambles have become greater and greater," he said.

# Energy Outlooks



A significant energy transition is underway, and many factors will shape the world's energy future. These include government ambitions and policies that seek to promote prosperity while also addressing the risks of climate change.

The recent Paris Agreement<sup>1</sup> on climate change provided significant insights on governments' intentions to reduce greenhouse gas (GHG) emissions through the inclusion in the agreement of nationally determined contributions (NDCs).

Policies adopted to support NDCs will likely affect supply and use of energy across society.

- ▶ “The Outlook again brings into sharp focus just how fast the world's energy systems are changing, and how the dual challenge of more energy with fewer emissions is framing the future. Meeting this challenge will undoubtedly require many forms of energy to play a role,” said Bob Dudley.
- ▶ “Predicting how this energy transition will evolve is a vast, complex challenge. In BP, we know the outcome that's needed, but we don't know the exact path the transition will take. Our strategy offers us the flexibility and agility we need to meet this uncertainty head on.”

**ExxonMobil**

**SDG#1:  
No Poverty**

**3B**

Nearly 3 billion people still use biomass or animal dung for indoor cooking and heating. Roughly 1 billion people have no electricity. Our products can provide a cleaner solution.

**SDG#2:  
Zero Hunger**

**45%**

of the world's population would lack adequate food supplies without the use of nitrogen fertilizers, which are largely derived from natural gas.

**SDG#6:**

Clean Water and Sanitation

4.5B lack safely managed sanitation. Reliable energy is needed to meet this challenge.



# Annual Energy Outlook 2019

with projections to 2050



# The Value of the Outlook is not to predict the future, but to better understand the uncertainty we face

“The value of the Energy Outlook is in providing a **structure and discipline to our thinking and decision-making. It helps us gauge the range of uncertainties, judge how the risks can be managed, and determine how best to encourage change** that puts the world on a more positive and sustainable path.”

**Bob Dudley**, group chief executive



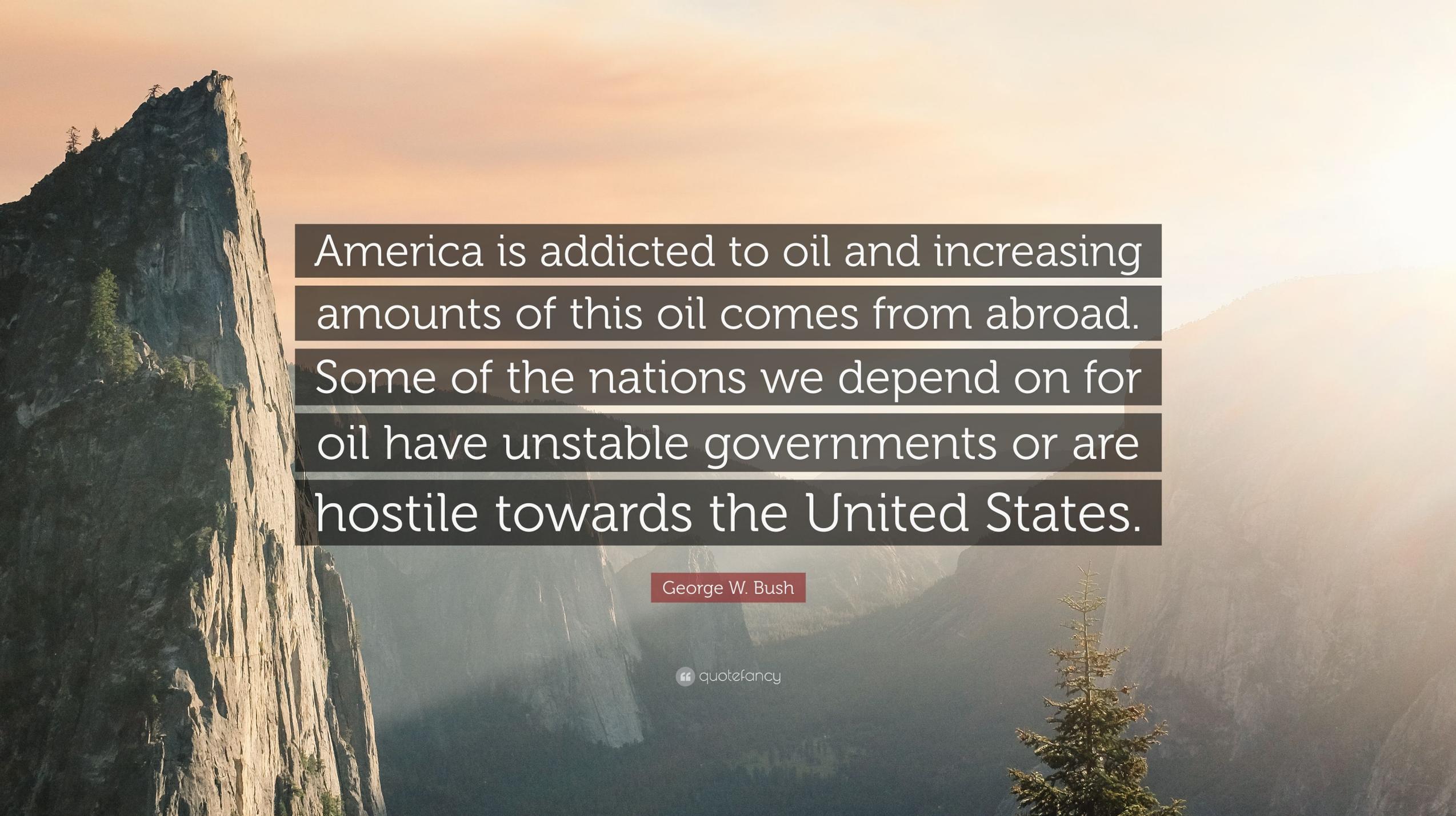
# A View to 2040

The *Outlook for Energy* is ExxonMobil's view of energy demand and supply through 2040. We use the *Outlook* to help inform our long-term strategies and investments.

To support economic progress and make substantial progress on the climate goals identified in the Paris Agreement, well-designed and transparent policy approaches that carefully weigh costs and benefits are needed. Such policies are likely to help manage the risks of climate change while also enabling societies to pursue other high-priority goals – including clean air and water, access to reliable, affordable energy and economic progress for all people.

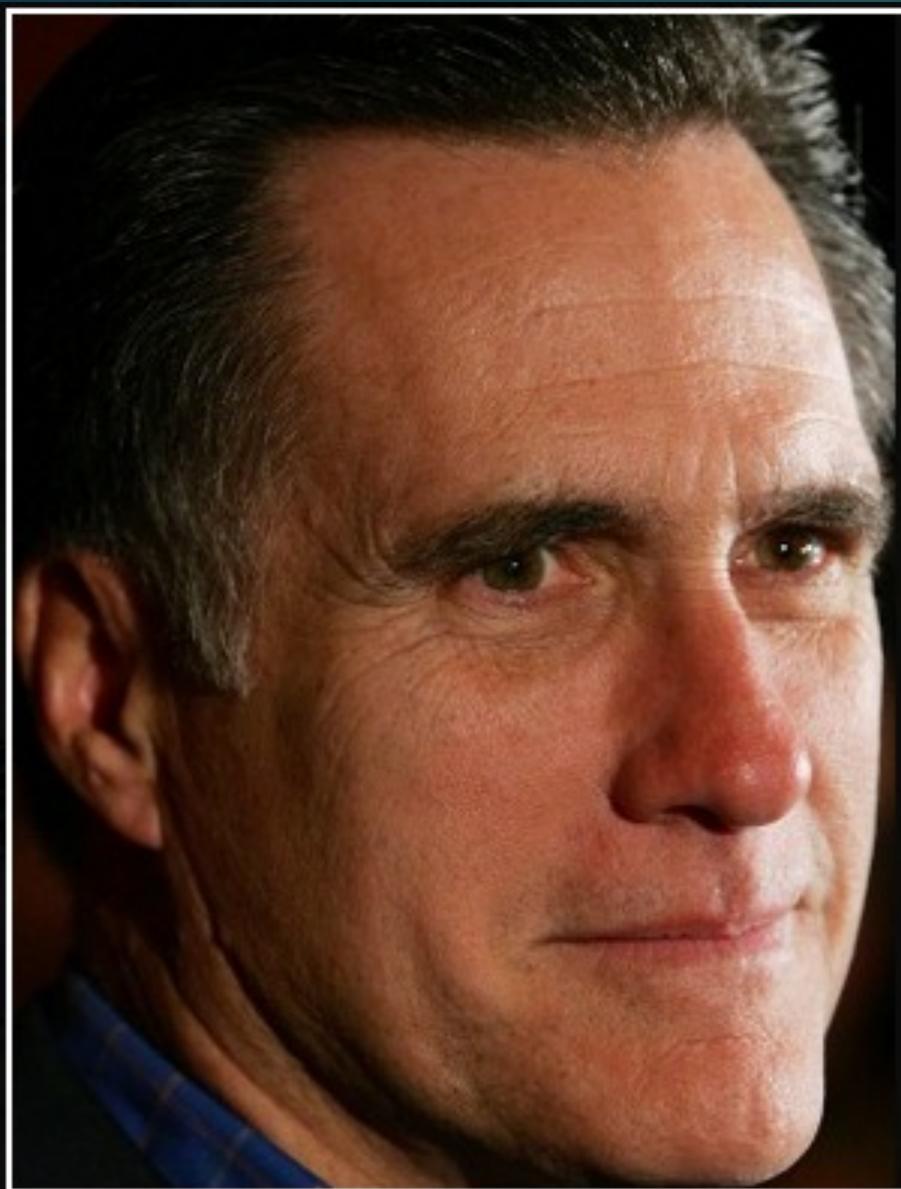
Technology will also be vital to improve living standards while addressing climate risks. Advances continue to reshape the energy playing field. **Many technologies not prevalent five to 10 years ago have a more significant role today, and their impacts will continue to expand.** Examples include wind and solar power, unconventional oil and gas development, and electric cars. Meeting the dual challenge of mitigating the risks of climate change while boosting standards of living will require additional technology advances.

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America is addicted to oil and increasing amounts of this oil comes from abroad. Some of the nations we depend on for oil have unstable governments or are hostile towards the United States.

George W. Bush

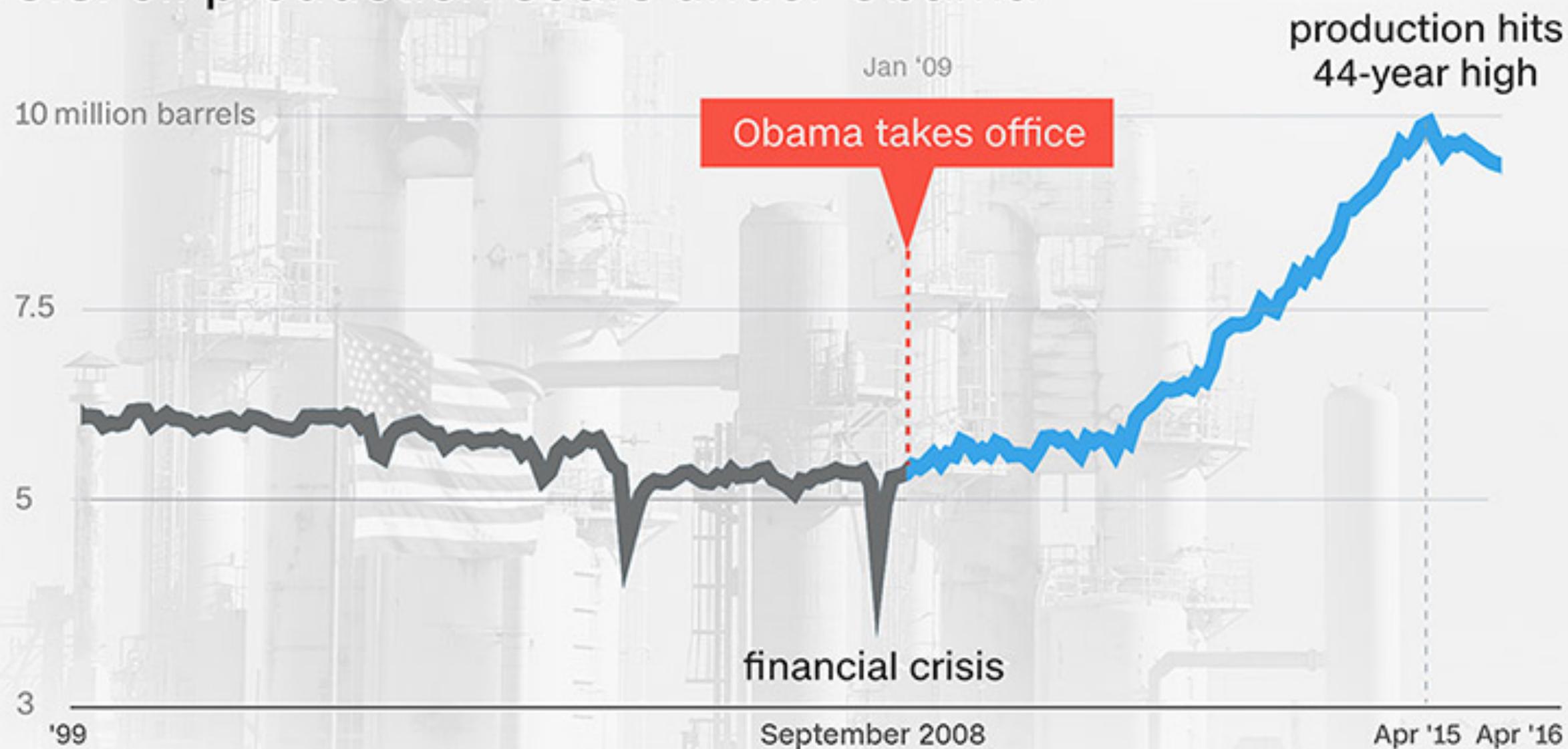


First, by 2020, North America will be energy independent by taking full advantage of our oil and coal and gas and nuclear and renewables.

— *Mitt Romney* —

AZ QUOTES

# U.S. oil production soars under Obama





"Our energy future will not be found in the dark of a mine but in the light of the sun," said Sen. Ed Markey, D-Mass., as he announced the legislation on Capitol Hill.

"When the planet has been in peril in the past, who came forward to save Earth from the scourge of Nazism and totalitarian regimes? We came forward! Who came forward to save the planet, or continents, from financial ruin? We came forward with the Marshall Plan. Our history is standing up and saying, look, humanity is in crisis, America is going to be the light and the hope," Booker said.



Despite Few Details And Much Doubt, The Green New Deal Generates Enthusiasm



By the end of the Green New Deal resolution (and accompanying fact sheet) I was laughing so hard I nearly cried. If a bunch of GOPers plotted to forge a fake Democratic bill showing how bonkers the party is, they could not have done a better job. It is beautiful.

[#GreenNewDeal](#)

# Why Georgetown's green energy gamble didn't pay off



Statesman

Smithsonian magazine called Mayor Dale Ross, a Republican, the “unlikeliest hero of the green revolution.” Journalists poured in to write about the cultural and energy significance of Georgetown’s move.

Now the hosannas have ceased, as Georgetown finds itself struggling with a revolt among its 25,000 ratepayers. Even as city officials acknowledge they had **misjudged their residents’ power demands, they are pointing fingers at the state’s grid for what they say were incorrect projections about the nature of a volatile energy market.**

Georgetown has lost \$8.3 million on its renewable energy contracts from 2016 to 2018 due to depressed energy prices, and it is in the middle of trying to renegotiate the contracts, city officials have said.

But renegotiating those contracts will be nearly impossible, and Georgetown ratepayers are likely to bear the burden, according to utility experts interviewed by the American-Statesman.

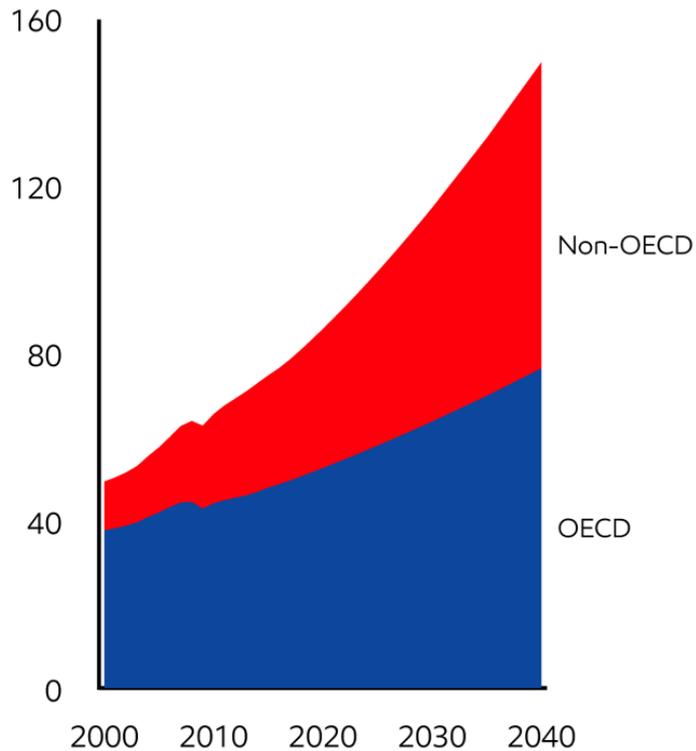
# World Population

- Global population grows from **7.4 billion today to 9.2 billion people in 2040**
- Africa's population increases at the fastest rate across major regions; it also has the largest working-age population across regions by 2040
- India likely to replace China as the most populous nation by 2025, with a significant increase in working-age population
- China's population will gradually trend down post 2030; its working-age population has already peaked, and its share of population age 65+ increases rapidly
- OECD working-age population flattens while the 65+ group continues to grow

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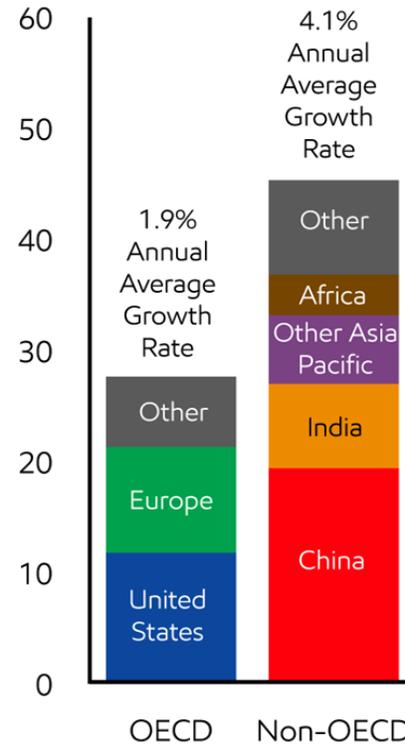
## World GDP doubles

Trillions of 2010 dollars



## World GDP growth

Trillions of 2010 dollars



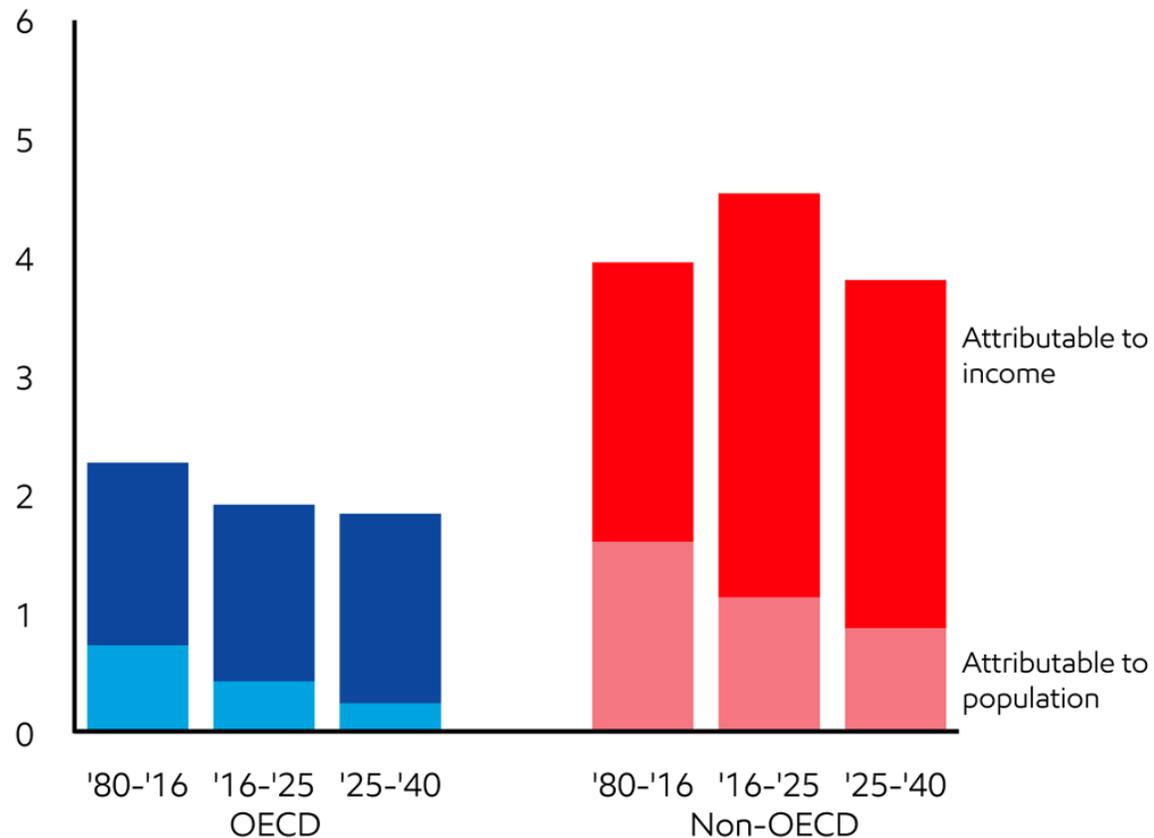
- Energy plays a critical role in supporting rising modern living standards around the world
- Electricity use per capita is one important measure of energy consumption
- A country's electricity use per capita is well-aligned with its income level
- About half of the global population resides in countries where average electricity demand per person is less than the annual consumption of basic household appliances
- About 1 billion people still lack access to electricity

**ExxonMobil**

## Non-OECD leads economic expansion

GDP growth

Year-over-year average percent (%)



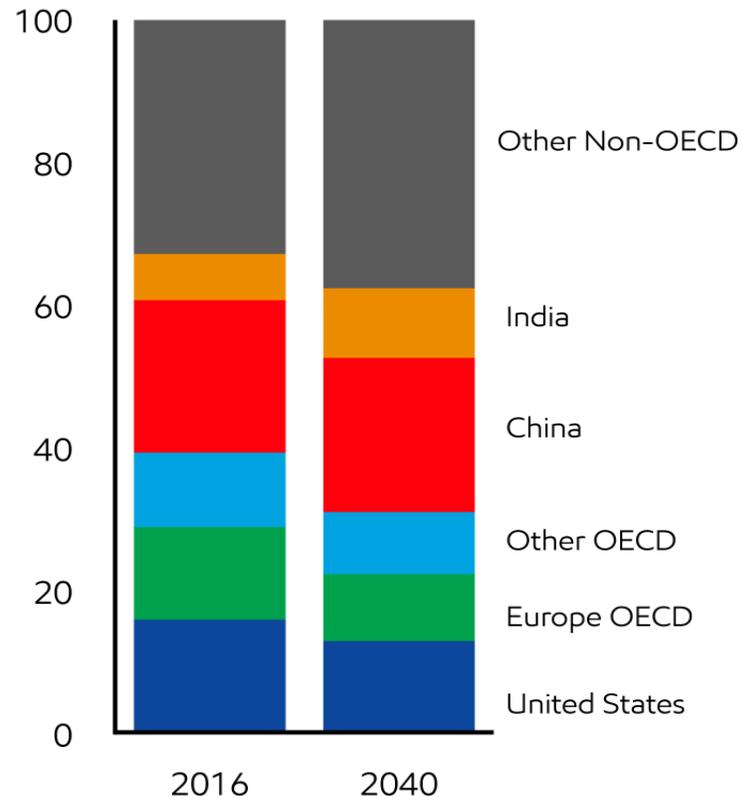
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# Global Energy Demand

- Despite growing population, global energy demand is expected to increase about 25 percent from 2016 to 2040, reflecting large savings due to efficiency improvements
- Without energy savings enabled by gains in energy efficiency of the world's economy, global energy demand could nearly double by 2040
- Demand growth will come from non-OECD nations, led by China and India, where energy use is expected to rise about 40 percent
- Demand in other Asia Pacific nations, Africa/Middle East and Latin America is similarly projected to grow strongly

## Energy demand shifts toward non-OECD

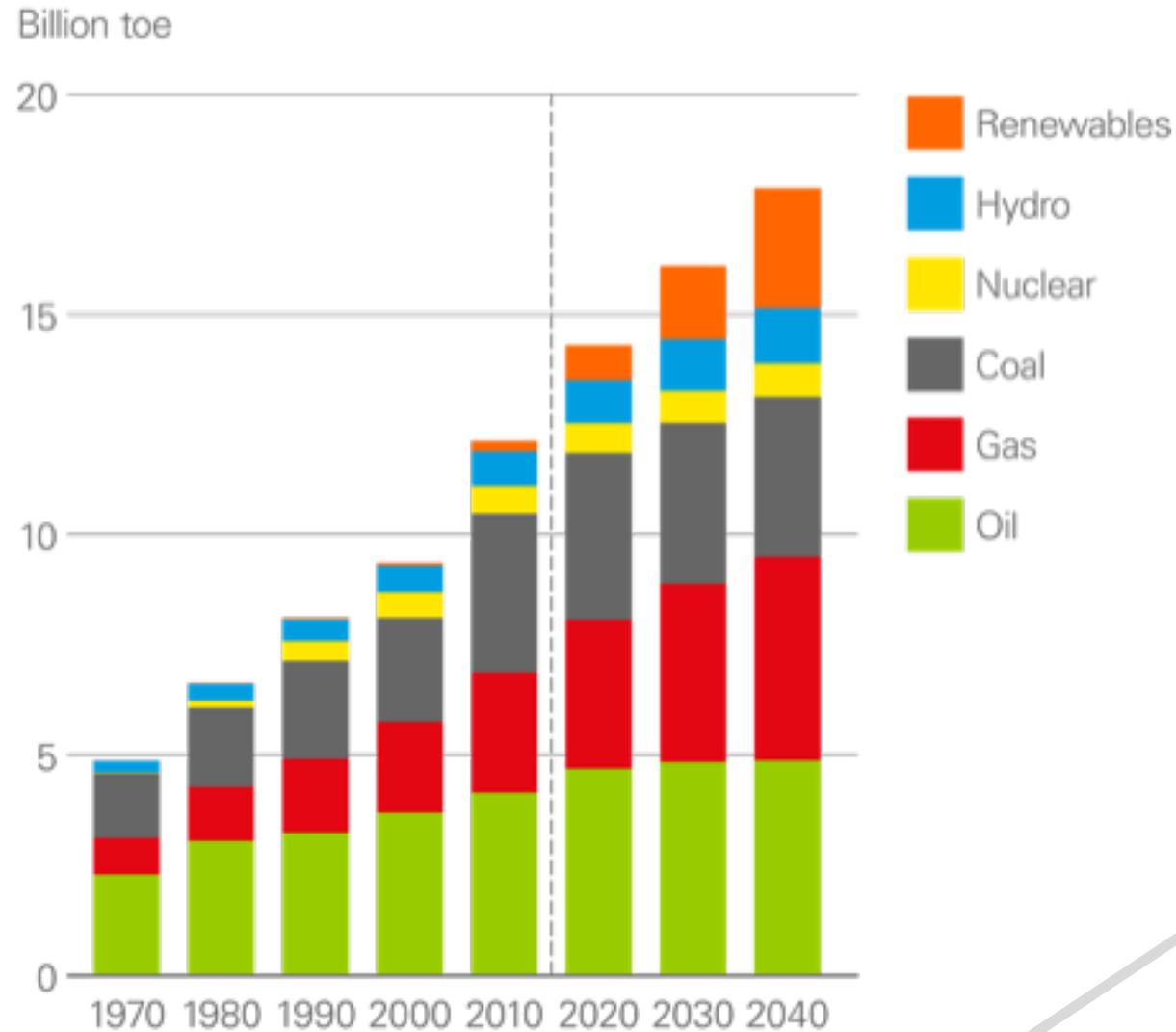
Percent of primary energy (%)



- ▶ Global demand reaches 680 quadrillion British thermal units in 2040, up nearly 25 percent
- ▶ Non-OECD share of global energy demand reaches about 70 percent in 2040, as efficiency gains and slowing economic growth in the United States and OECD nations help keep energy demand relatively flat
- ▶ China and India contribute about 45 percent of world energy demand growth
- ▶ The combined share of energy used in the United States and in European OECD nations will decline from about 30 percent in 2016 to close to 20 percent in 2040, similar to China's share of world energy demand

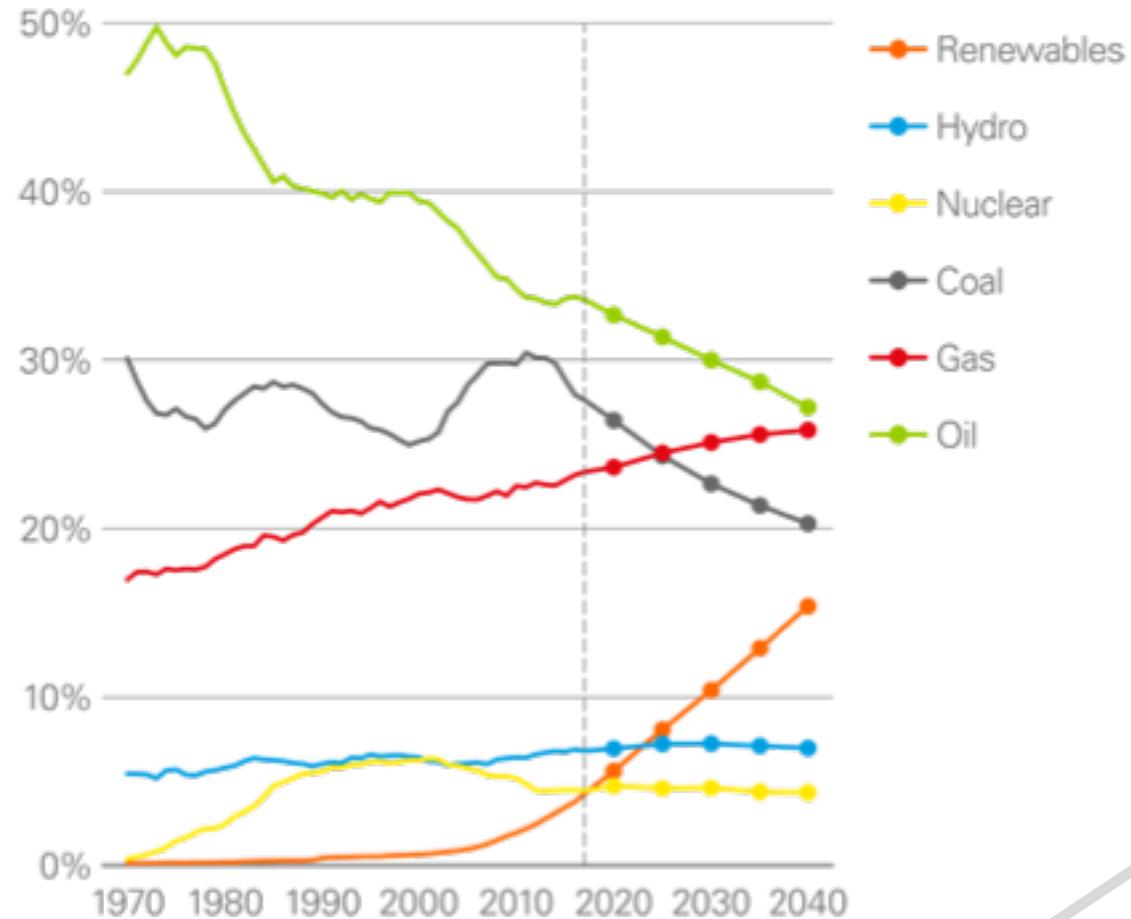
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# Primary Energy Consumption by Fuel



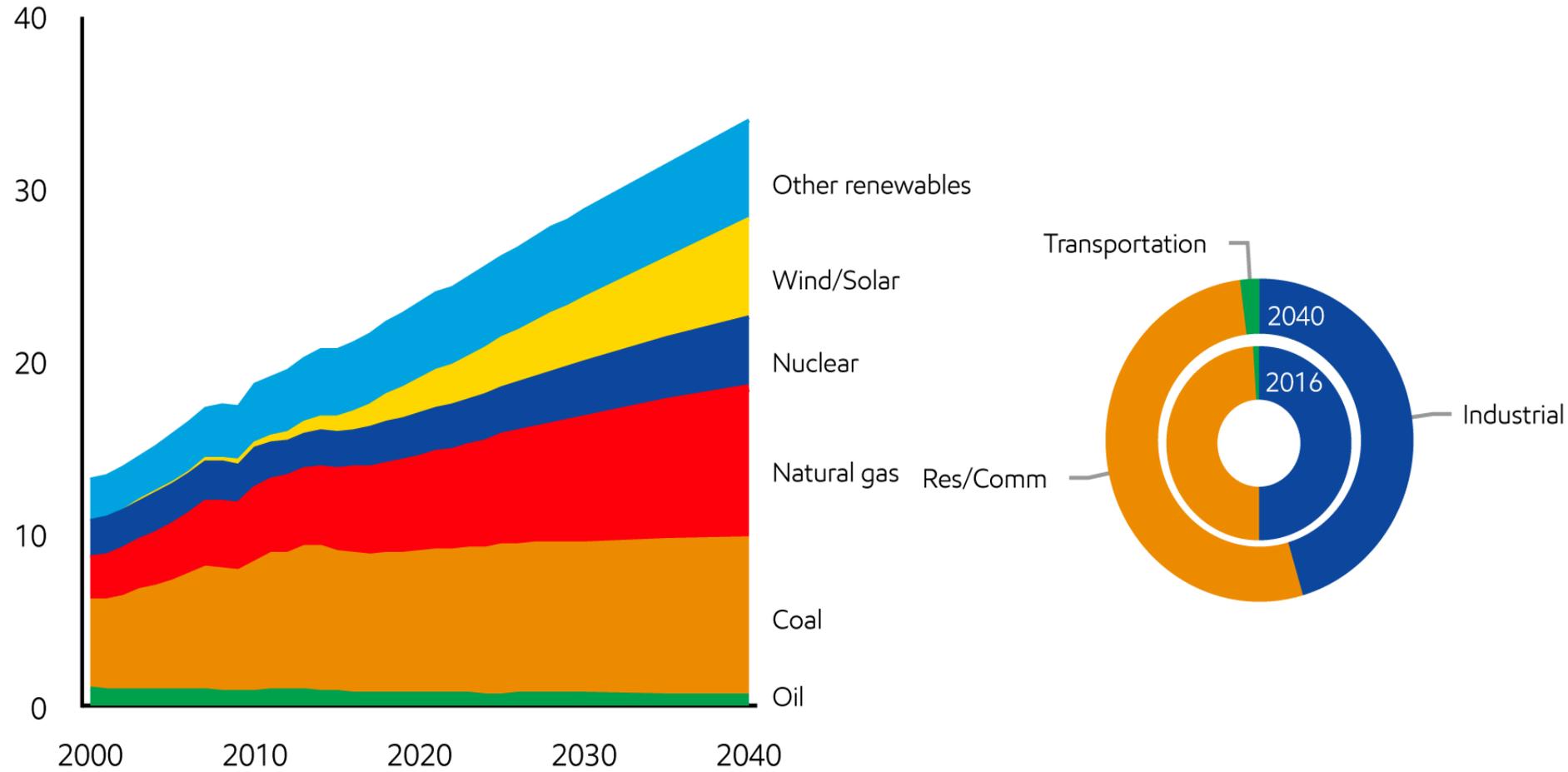
# Shares of Primary Energy

Renewables and natural gas account for 85% of energy growth

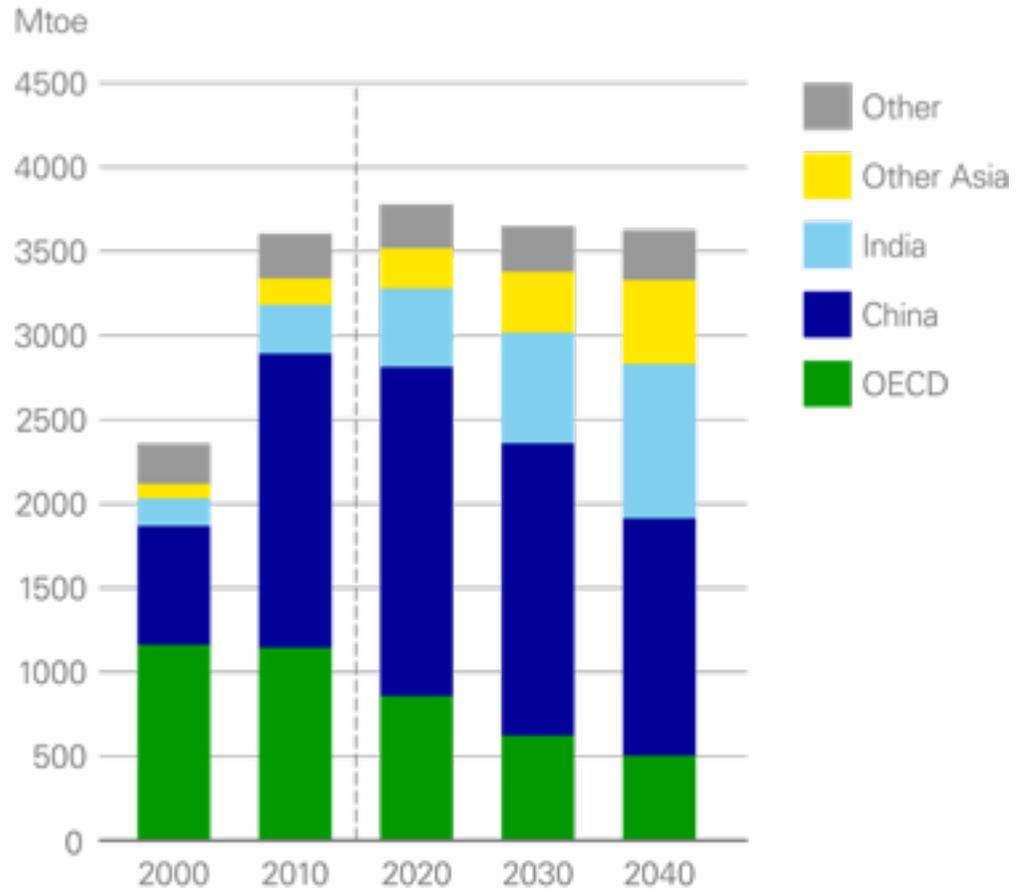


# Electricity sources shift

World – thousand TWh (net delivered)



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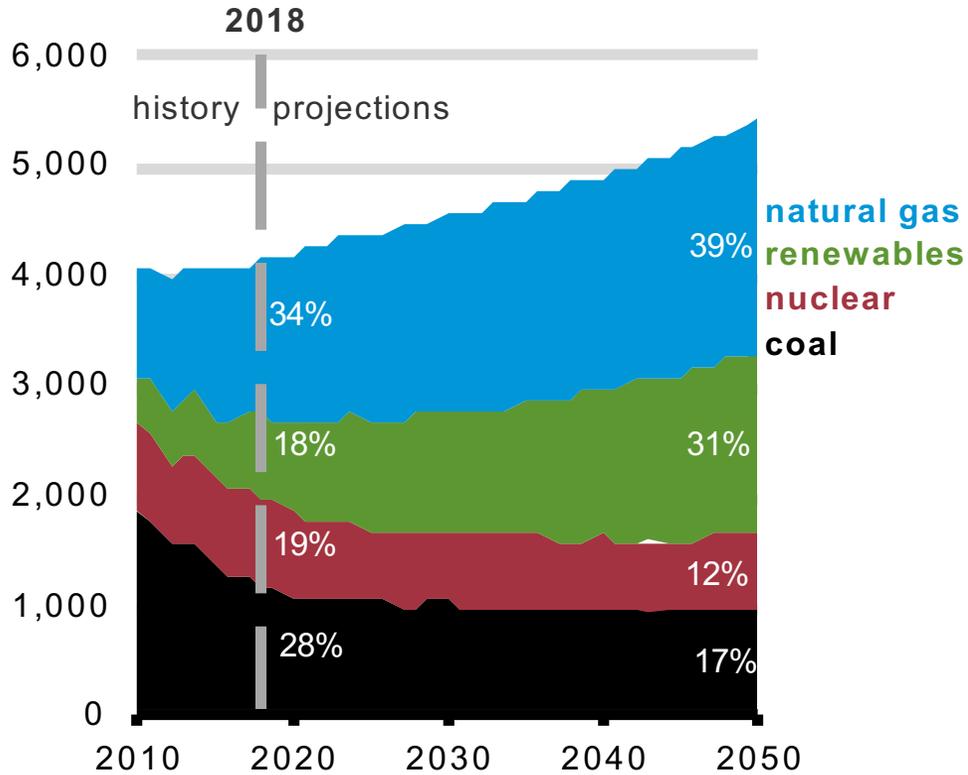
- Global coal demand flat-lines, with falls in China and OECD offset by gains in India and other emerging Asian countries
- Growth in coal consumption slows sharply relative to the past, although this masks contrasting patterns across countries and regions.



# Electricity generation from natural gas and renewables increases, and the shares of nuclear and coal generation decrease—

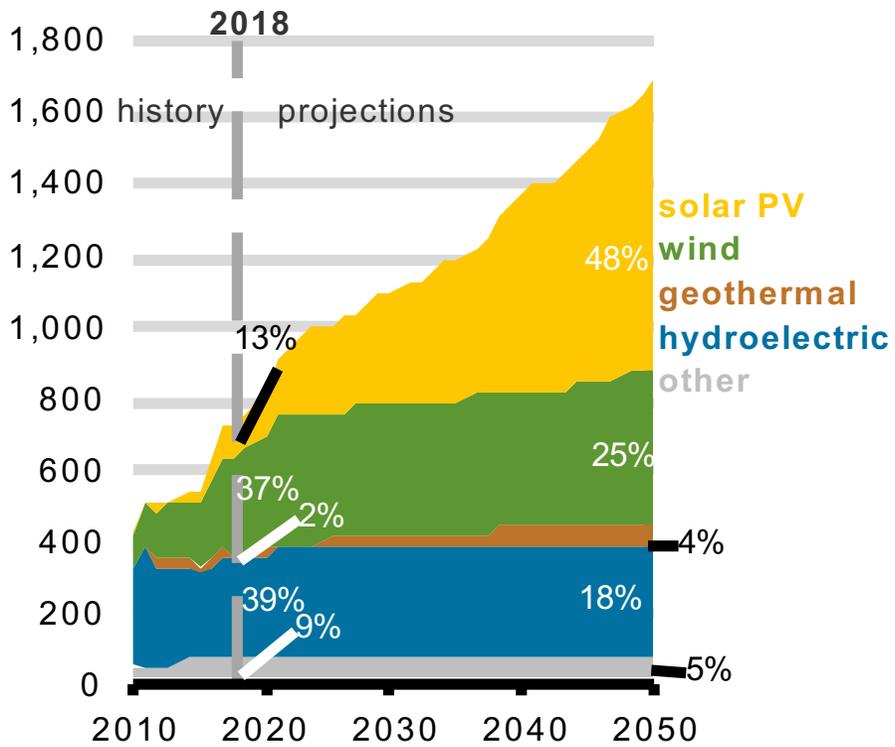
**Electricity generation from selected fuels (Reference case)**

billion kilowatthours



**Renewable electricity generation, including end-use (Reference case)**

billion kilowatthours



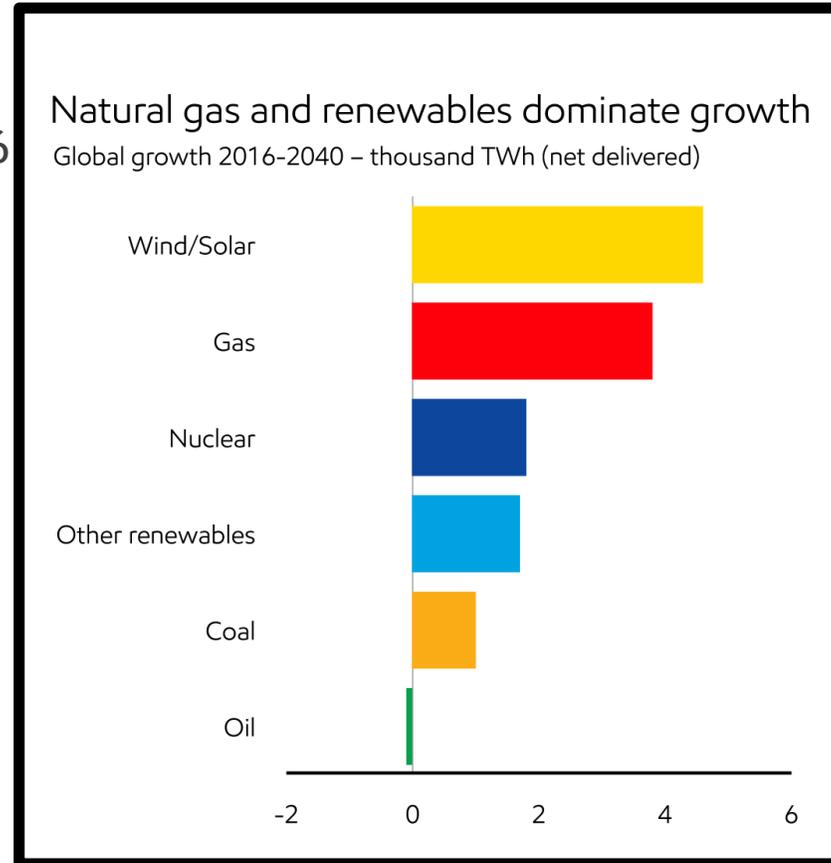
# Electricity Demand

- Global electricity demand grows by 60 percent from 2016 to 2040, driven by demand in the residential and commercial, industrial and transportation sectors
- Industrial share of demand reduces as China's economy shifts from heavy industry to services and lighter manufacturing; transportation's share doubles to 2 percent in 2040
- The world shifts to lower carbon sources for electricity generation, led by natural gas, renewables such as wind and solar, and nuclear
- Coal provides less than 30 percent of the world's electricity in 2040, down from about 40 percent in 2016

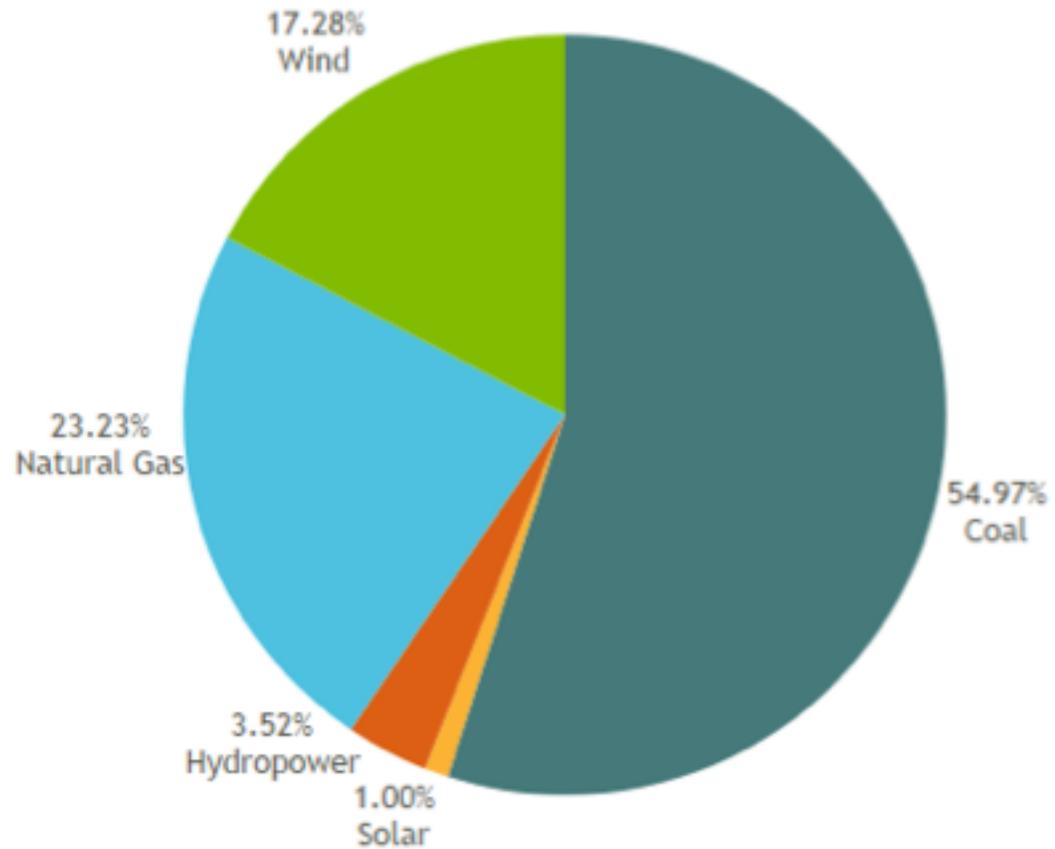
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# Natural gas and renewables dominate growth

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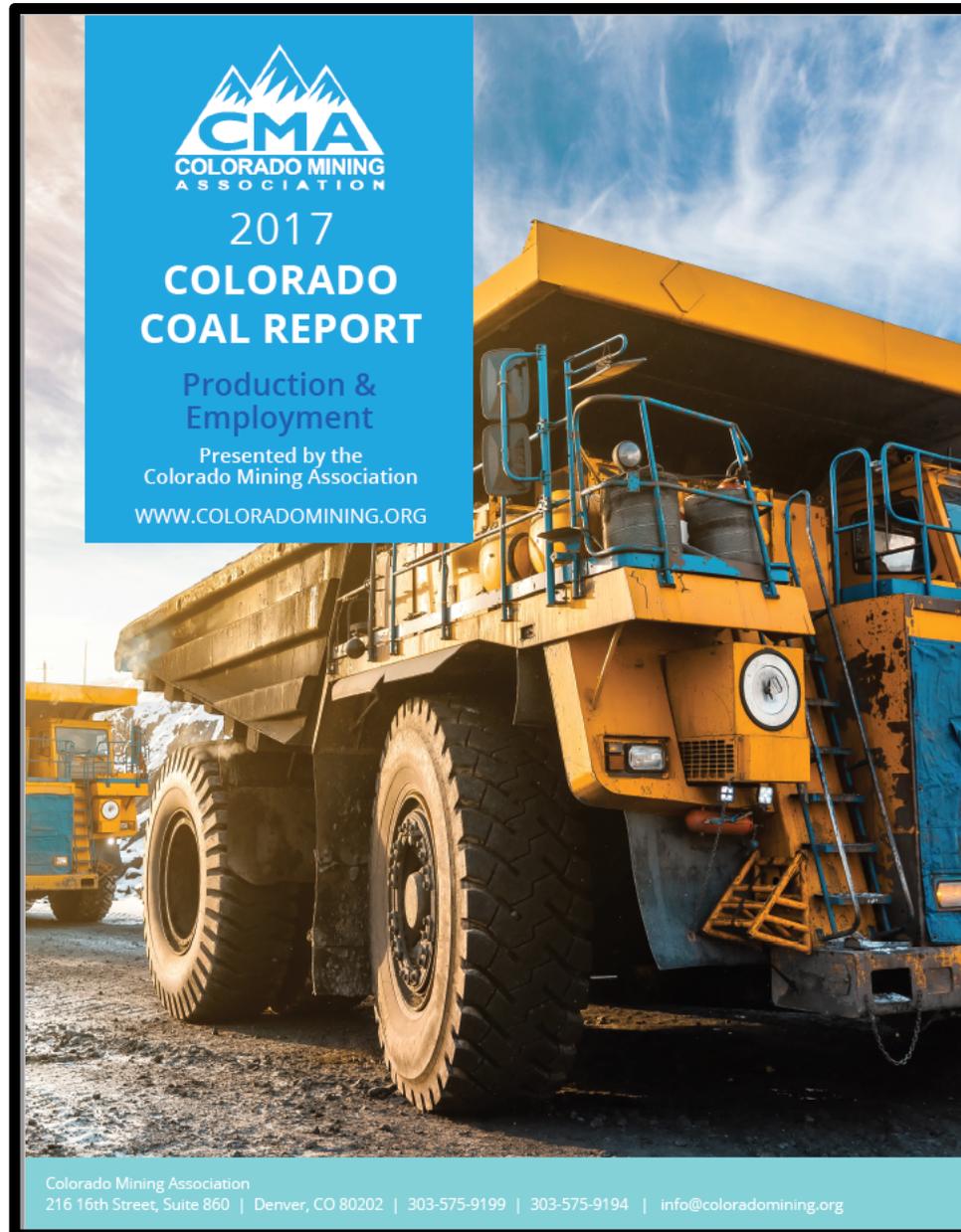


# CO Electricity Generation (2016, Thousand MWh)



Source: Energy Information Administration

# 2017 Coal Report



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# 2017 Coal Report

## COLORADO COAL

Colorado Coal: Supports Rural Economies



Colorado ranks 10th  
in coal production



54% of Colorado's  
electricity comes from coal



Coal is the largest fuel source  
that provides the highest  
percent of electric power to  
Colorado

2%  
solar

23%  
natural  
gas

18%  
wind

Total Coal Produced	14,715,000 Tons
Total Coal Sold In State	5,951,000 Tons
Total Coal Sold Out of State (domestic US sales)	5,893,000 Tons
Total Coal Sold Outside of U.S.	2,727,000 Tons
Number of Mine Employees in Colorado	1,200
Total Payroll & Benefits	\$158,268,000
Average per Employee	\$132,000
Property Taxes	\$7,117,000
Severance Tax	\$3,781,000
Sales Tax	\$3,004,000
Black Lung Tax	\$10,842,000
Abandoned Mine Tax	\$2,247,000
Federal Royalties	\$31,685,000
State Royalties	\$7,417,000
Private Royalties	\$3,431,000
Total Sales Value of Production	\$519,216,000
Equipment Services and Supplies	\$200,337,000

# Colorado Energy Policy Drivers

- ▶ Renewable Energy Portfolio - Increases?
- ▶ Clean Air Clean Jobs - Fully Implemented
- ▶ Governor's Executive Order
- ▶ Air Quality Control Commission Rulemakings (Talk to Will Toor!)
- ▶ Potential Climate Legislation
- ▶ Clean Air Act Settlement Agreement and Enforcement Actions
- ▶ Comprehensive Oil and Gas Legislation - Senate Bill 181-Rulemakings
- ▶ PUC Efficiency Measures and Carbon Pricing

# Colorado Opportunities and Challenges

- ▶ Jordon Cove
- ▶ Colorado Coal Exports - 5,893,000 Tons (US) and 2,727,000 (Foreign)
- ▶ Crude Oil Exports
- ▶ Recovery of Vanadium - Used by wide variety of industries
- ▶ Ouray Silver Mines - Ouray County - Reopening of Reunion Mine
- ▶ Increased Pipeline Takeaway Capacity - Eastern Slope Crude
- ▶ Northern Front Range Ozone - Background Designation?
- ▶ Potential Fuel Spec Changes - Access to Supply

# Reactions to Colorado Energy Plan

- ▶ Wendy Mosher - PUC Commissioner “The customers of Xcel Energy will pay for the retirement of these plants and it will show up in rates,” she said. “So don’t think that this is free and that it’s going to be borne by somebody else.”
- ▶ “Rural Colorado has fallen behind in key economic areas and it is affecting our local communities,” the [letter](#) said. “Serving as a leader in renewable energy production is not only a source of pride in our counties but it is a key economic factor that will help us grow and strengthen our local communities.”- Letter from Eastern Colorado County Commissioners
- ▶ Today’s PUC support of [@XcelEnergyCO](#)’s Clean Energy Plan is good for our future, **retires coal plants**, advances renewables and costs less. Perfect alignment with our EO to reduce greenhouse gas emissions. Coloradans leading the way. Nice work!
- ▶ Governor Jared Polis in a Tweet

# Colorado's Energy Policy

## What's the Future?



 American Petroleum Institute @APIenergy · 1h  
Colorado Petroleum Council Executive Director Tracee Bentley Expresses Concern Over Lack Of Stakeholder Process In Upcoming Energy Legislation. [bit.ly/2U98Cge](https://bit.ly/2U98Cge)

In my over 15 years of working with the Colorado state government, not having a thorough stakeholder process is unprecedented, especially for a bill that targets one industry but impacts every Coloradan. We are deeply disappointed that House and Senate leadership do not appear to value the stakeholder process nor the importance of having all stakeholders at the table on one of the most consequential proposals in Colorado history.  
—Tracee Bentley, Colorado Petroleum Council Executive Director



News flash

[@Tracee\\_Bentley](#), [@APIenergy](#), [@COPetroCouncil](#), special interests don't write bills, legislators do. I understand it might be difficult for the industry to no longer be able to write their own laws. But that's not how things work in Colorado anymore. [#conolitics](#) [#coleg](#)



"COLORADO'S ELECTRIC UTILITIES WILL CONTINUE TO FACE THE NEED TO RETIRE EXISTING ELECTRIC GENERATING FACILITIES TO REDUCE ELECTRICITY RATES FOR CUSTOMERS AND ENSURE THE HEALTH AND WELL-BEING OF COLORADO'S NATURAL ENVIRONMENT AND RESIDENTS"



" I love the concept of providing a mechanism to get the coal producers out of our environment and get our air a little cleaner". - Representative Emily Sirota (D-Denver)

# Oxbow Mining LLC, Vessels Coal Gas, Gunnison Energy Corporation, Aspen Skiing Company and Holy Cross Energy Announce First Waste Mine Methane to Energy Facility in Colorado

- ▶ North Fork Methane Coal Mine Working Group





