U.S. Energy Independence

The Real Facts, and How to Actually Get There

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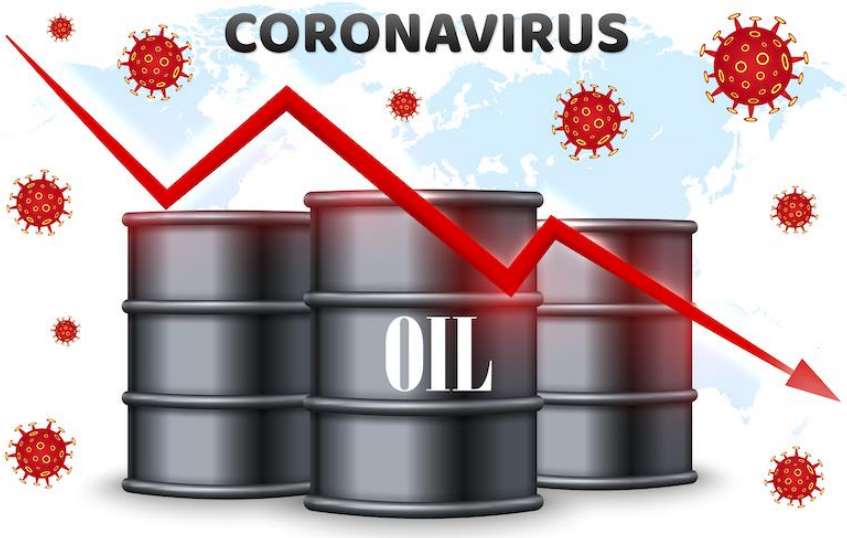
We Live in Interesting Times

- Because of the COVID 19 virus, world oil demand is down 30% or more
- Trading anomalies pushed WTI oil prices to negative
- Some of our oil basins are completely shut down

A Note: This presentation is based on pre COVID-19 data and post 2020 assumptions, when things will (hopefully) return to normal.



Is the U.S. Energy Independent?

"The United States is energy independent"

– *Not true*

"The U.S. is a net exporter of energy"

– *Largely not true*

"The U.S. is the world's largest producer of oil"

– *Depends on how you define oil*

Is the U.S. Energy Independent?

"The United States is energy independent"

- *In 2019 our net oil Imports (imports minus exports) were $192 billion*

"The U.S. is a net exporter of energy"

- *Maybe in molecules of oil, gas, corn, coal, etc. Just maybe… Not in dollars*

"The U.S. is the world's largest producer of oil"

- *In 2019 the U.S. produced 9.45 MBD of refinable oil, Russia – 10.87*

What is Energy Independence? History

- In the 70's, most U.S. energy consumption came from **oil/petroleum** (electricity, transportation, chemical industry, etc.)
- OPEC price hikes in 1973 and the 1979 post Iranian revolution oil shortages shocked the nation and the U.S. set a target to be Energy (oil) Independent from the influence of oil

- Target for "energy independence" was 20 years

Fighting our Oil Dependence - Successes

- Eliminated petroleum use in electricity production
- Reduced reliance on petroleum in the chemical sector
- Improved car/truck fuel efficiency
- Converted the heavy truck fleet to diesel
- Diversified import sources
- Reversed the decline in U.S. oil production (the shale revolution) – reaching top 3 producer status

Fighting our Oil Dependence - Failures

- **92%** of our transportation is oil dependent (2019)
- We are still dependent on global oil prices (both for the economy and for U.S. oil production)
- Oil Imports still represent over 31% of our trade deficit
- Protecting the oil flow consumes 30% of our defense budget (*source: Rand Institute*)
- Our foreign policy (e.g. in the middle east) is still captive to foreign oil interests

What is Energy?

- When the term **Energy Independence** was created in the 70's, it referred to **oil/petroleum**
- Today, the term "Energy" is used interchangeably for all types of energy, causing confusion. Examples:
  - "Energy prices are rising" – does it mean coal prices are rising? Natural gas? No – it means oil. Oil prices can rise while coal and natural gas prices are going down (which actually happened)
  - "The U.S. is a net exporter of Energy" – most people think that we are now a net exporter of oil, but the truth is that we export coal, natural gas, ethanol, largely non-refinable oil, gasoline and diesel
  - When we count "energy molecules" we may be a net exporter, but we import a large portion of our oil. In terms of dollars – we are a net importer!

What is Energy? (cont.)

- The two dominant uses of energy in the U.S. are power generation (electricity) and transportation
- In most cases, their energy sources are very different*
  - Power is generated from a mix of natural gas, coal, nuclear, hydro, and renewables such as solar and wind. Virtually all are domestically produced.
  - Transportation is almost exclusively powered by petroleum (gasoline, diesel and jet fuel)
- So energy in general is not the problem. *The problem is energy used for our transportation.*
- However, energy is often conflated in people's minds

* Electric and natural gas vehicles are exceptions (but the volume is low)

How Do You Know if Someone is a Republican or a Democrat?

Ask them what is the best way to replace oil as our driving fuel –

- If they say nuclear – he/she is likely a Republican
- If they say solar and wind – he/she is likely a Democrat

They are both wrong!

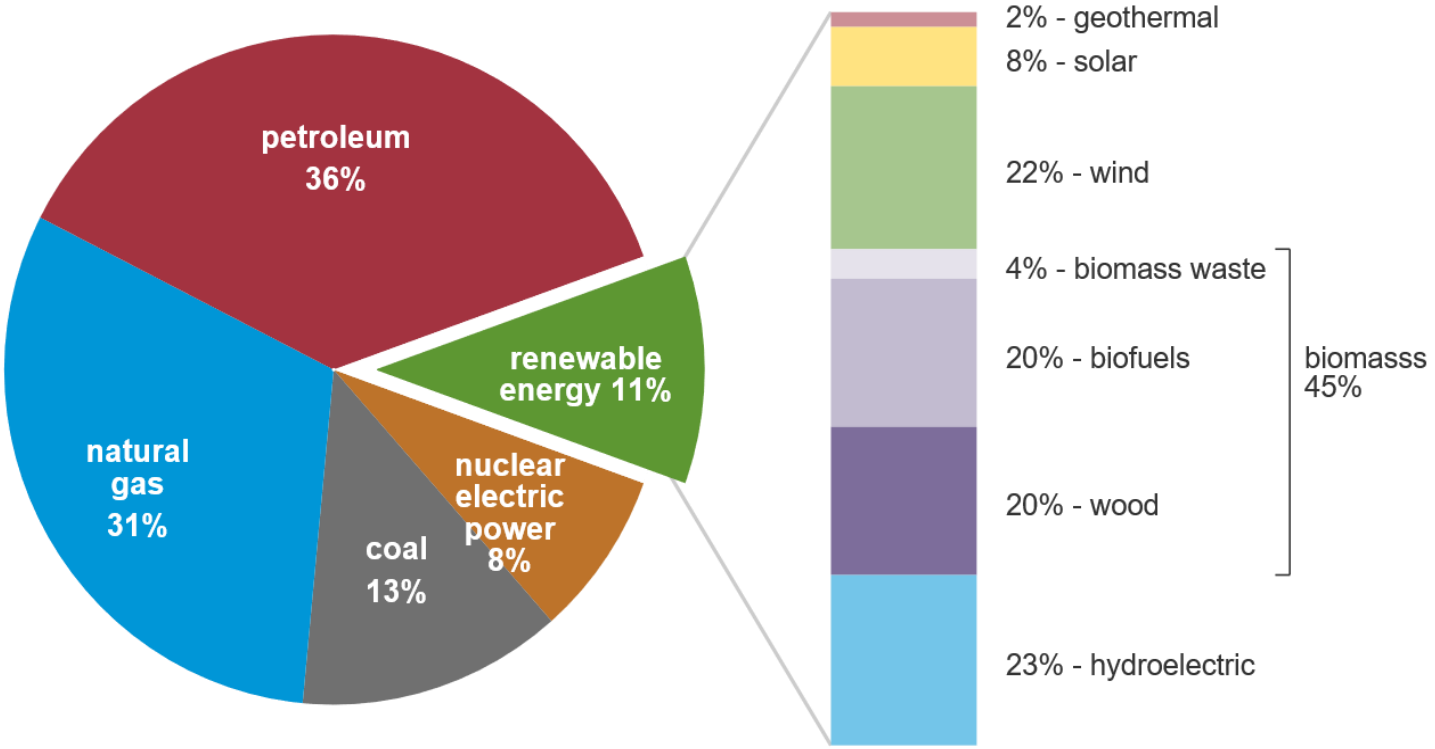
We do not use oil to produce electricity, and of course we cannot use wind, solar and nuclear to power our cars. Even if our entire electricity grid was powered by nuclear, solar and wind power, it could not replace a single gallon of oil.

US Energy Consumption

U.S. primary energy consumption by energy source, 2018

total = 101.3 quadrillion British thermal units (Btu)

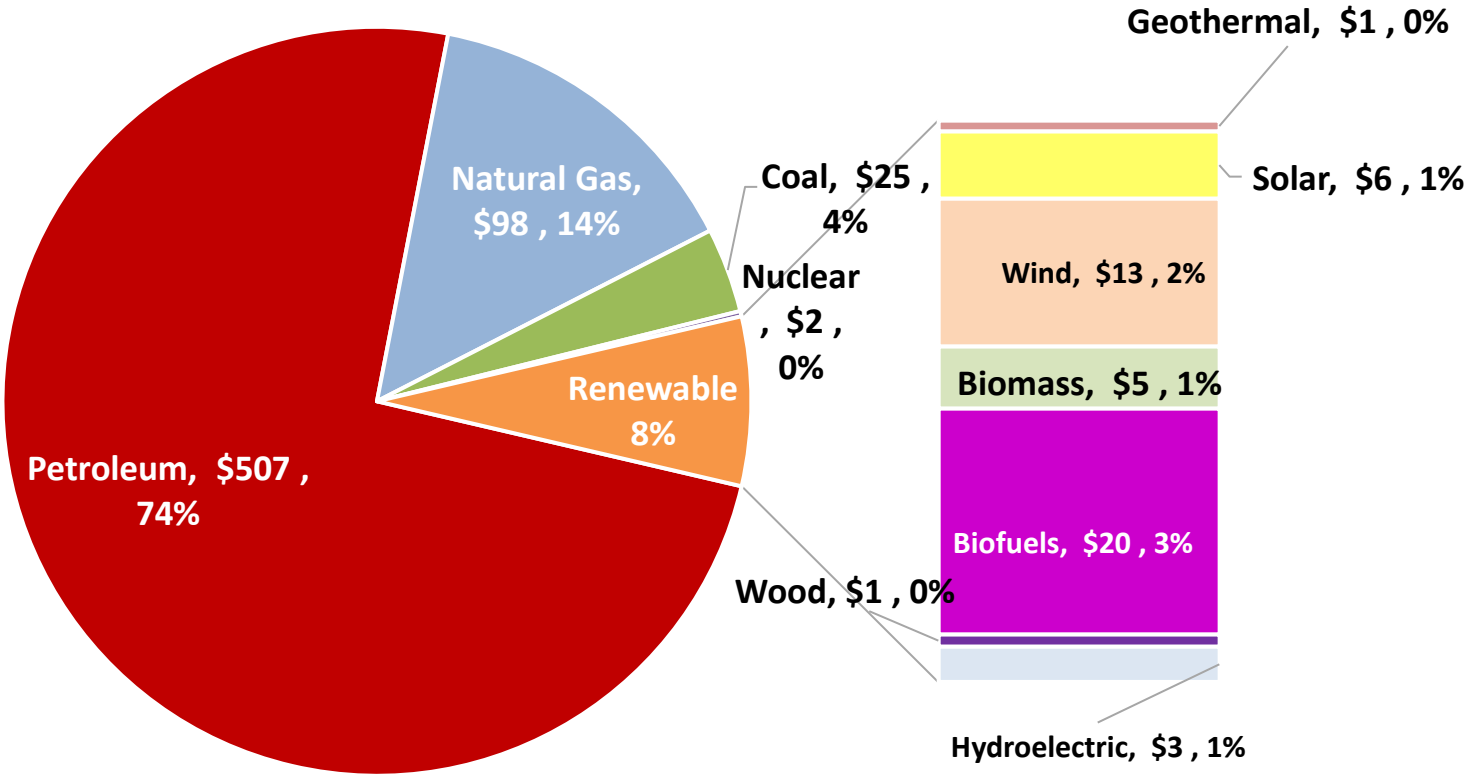
total = 11.5 quadrillion Btu



Note: Sum of components may not equal 100% because of independent rounding.
Source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 1.3 and 10.1, April 2019, preliminary data

Follow the Money – Not the BTUs

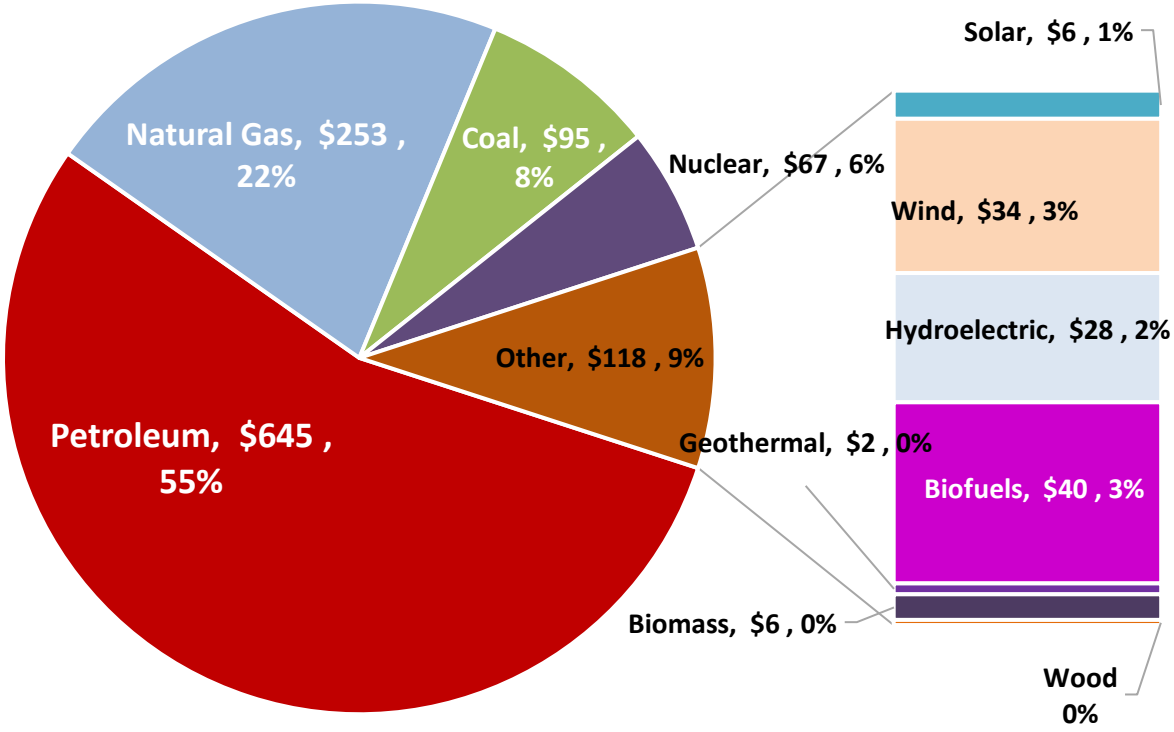
Wholesale (Pre-Tax) Energy Expenditures By Source -2018



Source: U.S. EIA

Follow the Money – What You Actually Pay

Retail Energy Expenditures by Source - 2018
Billion $



What is Oil?

- U.S. oil production in 2019 was 12.23 MBD - #1 in the world
- U.S. **refinable oil** production in 2019 was 9.45 MBD
- What is the difference?
  - 2.78 MBD of condensate (lower energy value molecules that cannot be converted to gasoline or diesel at a reasonable price)
- Historically, we did not count condensate as oil. Ten years ago, the EIA changed the definition of oil to include condensate. At the time, the net result was that politicians could declare that we produce more than 50% of our oil

The U.S. Shale Revolution

It is a true revolution!

- Using new technologies, we can access oil (and other hydrocarbons) that would otherwise stay in the ground
- Within 10 years we were able to increase our production of “oil” from 5 MBD to 12 MBD
- Producing 9.45 MBD of refinable oil is way better than 5MBD. It does bring us closer to “energy Independence”

Let’s look under the hood

U.S. Shale Revolution – Under the Hood

A shale well is different from a “traditional” oil well. Traditional oil wells produce largely oil. Shale oil produces:

- Refinable – light oil – priced at the low end of the refinable oil range
- Natural gas – very cheap – we have too much
- Condensates – very cheap – industry feedstock
- Other light carbohydrates (HGLs) – extremely cheap – industry feedstock

Gas to oil ratio matters – the more oil, the more profitable the well

U.S. Oil Flow by the Numbers (2019)

U.S. Production	MMBD	Annual Cost ($Bil)
US Refinable Oil Production	**9.45**	**$196.54**
US Condensate Production	2.78	$55.92
Total US Oil Production	**12.23**	**$252.46**
US Ethanol Production	1.03	$20.82
US bio-diesel and other Production	0.08	$5.09
US Other Liquids Production (incl HGL)	5.48	$51.68
Total all US Production		**$330.05**

U.S. Oil Flow by the Numbers (2019)

U.S. Imports	MMBD	Annual Cost ($Bil)
US Refinable Oil Imports	6.58	$203.39
US Condensate Imports	0.21	$4.93
Total US Oil Imports	**6.79**	**$208.32**
US Ethanol Imports	0.01	$0.56
US bio-diesel and other Imports	0.03	$1.26
US Other Liquids Imports	1.34	$37.27
Total all US Imports		**$247.41**

U.S. Oil Flow by the Numbers (2019)

U.S. Exports	MMBD	Annual Cost ($Bil)
US Oil exports	2.98	$61.93
US Ethanol exports	0.1	$1.95
US Bio-diesel and other export	0.01	$0.34
US Other Liquids export	0.39	$13.78
US HGL exports	1.60	$18.23
Total Value of US Exports		**$96.23**

U.S. Shale Revolution – Financial Distress

- The Shale industry has not produced the returns investors were hoping for. Many lost money.
- Even before the current crisis, investors stopped refinancing many of the shale producers.
  - A case in point – Whiting Petroleum – from a market cap of $13B in 2014 to $60 million and bankruptcy.
- Despite tremendous technological breakthroughs, the cost of producing shale oil is still very high, making it very sensitive to oil price swings
- Surplus of natural gas has dropped in price dramatically. Large quantities are simply flared
- Surplus of NGLs has also dropped in price significantly, sometimes even going negative!

U.S. Shale Revolution – How to Make it Healthy?

- As long as the shale industry relies primarily on oil, it will not be financially viable long term
- The key to financial health is developing significantly larger markets for Natural Gas and NGLs that will raise both their prices and their volume

The prime candidate is the transportation market

- If we replaced our oil imports with natural gas-based fuels, we would increase the U.S. natural gas market from 40,700 tcf, by an additional 15,600 tcf !

Energy Independence – Back to Square One

- If the U.S. produced all of its oil – would we be energy independent?
  - NO. We will always be subject to the world price of oil
- When Russia and Saudi Arabia decide to flood the market with oil, prices will tank and our shale producers will go bankrupt

- When OPEC+ cuts production in a tight oil market, oil prices will rise and will cause a recession in the U.S. (and the rest of the world)

Energy Independence – The Solution

- Create a competitive transportation market for oil:
  - Ethanol from natural gas and NGLs
  - Ethanol from biomass
  - Other biofuels such as bio- or renewable diesel
  - Electric vehicles
  - Compressed Natural Gas (CNG)
- These are all competitive with gasoline/diesel.
- Whenever the government removed market barriers in the past, markets flourished

It is time to open the transportation market to true competition!

U.S. Energy Independence is within our reach

Thank you

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