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Why the US exports *and imports* crude oil

A presentation by
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for PATACS First Wednesday
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Agenda

- How much crude oil does the US export and import?
- The two crude oil types involved
- The imbalance of oil type produced and the US refineries that can refine that type.
- Locations of oil fields and refineries in the US
- Seasonal refinery adjustment
- Markets and tariffs
- Some possible mitigations

This is not one of my usual how-to-do-it presentations

- This presentation does have a lot to do with gasoline refinery tech at the stratospheric level.
- This presentation also describes how supply and demand is affected by an imbalance of that refinery tech relative to the US supply of crude oil.
- This presentation will help you understand the economic issues affecting gasoline prices. Increasing US gasoline supply to drive down prices is a complex challenge.

The US exports about 13 million barrels of crude oil per day

- This exceeds even the exports of Saudi Arabia and any other producing country in the world.
- This is a welcome change for those who remember the OPEC shutoffs of the late 1970s when the US gasoline supply was exhausted in some city regions.

The US also *imports* about 4 million barrels of crude oil per day

- Why does the US both export and import crude oil?
- The answer is that there are **two types of crude oil produced by US oil fields.**
- Most US refineries are tailored to refine one type or the other, but not both.
- **IMBALANCE:** The US has too many refineries for one crude oil type found in the US, and not enough refineries for the other crude oil type found in the US.

What are the two crude oil types?

- **Heavy crude oil** contains many very long heavy organic molecules and a lot of sulfur.
- US large-scale heavy crude oil field production began in 1950, and many refineries were built to refine that type. In recent decades, heavy crude production has fallen.
- **Light sweet crude** has almost no sulfur and fewer heavy molecules.
- US light sweet crude production is growing.

Oil types, Imports and Exports

- **Heavy crude:** US production is declining. Current production is no longer sufficient to keep US heavy crude refineries fully productive. Result: ***heavy crude oil imports*** keep those refineries fully productive.
- US gasoline supply would decrease if those heavy crude refineries are not fully productive.
- **Light sweet crude:** US production is increasing and is already more than US light sweet crude refineries can process. Result: ***Excess light sweet crude is sold to foreign refineries***.

How big is an oil refinery?

- The average size of a US refinery is 1,111 acres, almost 2 square miles. A square miles equals 640 acres.
- As of January 1, 2025, 131 refineries were operating in the US. The peak number was 254 in 1982.
- Many refineries were built near oil fields, to minimize the cost of delivery of crude oil to refineries.
- Those retired after 1982 were mostly small, and were built before World War II for light sweet crude. They could not compete with large modern refineries with more recent chemical engineering tech. Some were supplied by small oil fields where production levels have declined.

A Google Map image of a refinery

- Big Spring Refinery in Big Spring TX, east of Midland on I-20.
- This is a small refinery, maybe 750 acres.

Where is crude oil extracted in the US?

- Texas, New Mexico and North Dakota are the three leading extraction states in the US in terms of volume.
- All three produce only light sweet crude oil.
- Others include Alaska, California, Pennsylvania, and Louisiana.

Where is crude oil refined in the US?

- Texas: 47 refineries
- Louisiana: 19 refineries
- California: 18 refineries
- Illinois: 8 refineries
- Pennsylvania: 7 refineries
- That is 97 of the 131 US refineries.
- Sixteen other US states have at least one refinery.
- One new refinery is being built in Texas. The last new one was built in 1977.

US production mix of the two crude oil types has changed over time

- Refineries were relatively small in the US before World War II because gasoline demand was low.
- Demand increased during and after the War. Veterans came home and bought cars, many for the first time.
- Massive US heavy crude oil fields were discovered starting in 1950. Refineries were built for that type to keep up with growing US demand for gasoline.
- Decades later, the US fields of heavy crude were producing fewer barrels per day.

US production mix of the two crude oil types has changed over time

- The main incentive to build a refinery is demand for gasoline. Refineries also produce aircraft fuel, naval fuel, armored cavalry fuel, heating oil, kerosene, and some medical hydrocarbons.
- Ultimately, many US heavy crude refineries were built, enough to consume peak US heavy crude production. Then the annual production of heavy crude oil began declining.
- Many heavy crude refineries cannot buy enough US heavy crude to keep the refinery fully productive.

The majority of newer US oil fields produce light sweet crude oil

- So far, the US light sweet crude oil supply has grown faster than the build-out of US light sweet crude refineries.
- The light sweet crude oil fields must sell their crude oil or else they cannot drill new wells. US refineries tailored to light sweet crude are working at full capacity and cannot buy all the US light sweet crude.
- The light sweet crude oil fields sell also to foreign refineries, including many in western Europe who formerly bought crude oil from price gouging countries. Those prefer to purchase from the US.

Heavy crude oil is found in Canada, Mexico, and some other locales

- US heavy crude supplies are dwindling. The US supply is not enough to keep US heavy crude oil refineries operating at max capacity.
- Those refineries import heavy crude oil from Canada and Mexico, two closest sources, to stay busy and help satisfy US demand for gasoline.
- US heavy crude oil refineries once also bought heavy crude from Venezuela, until that country became a pariah.

Seasonal refinery production of gasoline

- Refineries produce gasoline in the summertime with ethanol mixed in to provide extra oxygen to completely burn gasoline in cars.
- That ethanol is not added during winters.
- It takes a refinery roughly a week to switch between the two modes of production.
- There were 131 refineries in the US as of January 1, 2025.
- A schedule exists for the switch in the spring and fall, so that only 10% of the refineries are offline in a given week.

Markets and Tariffs

- An important lesson here is that there are multiple markets between crude oil pumps and gasoline consumers.
- Crude oil producers sell crude oil and refineries buy.
- Refineries sell gasoline and gasoline retailers buy.
- Gasoline Retailers sell gasoline and consumers buy.
- Every one of those markets involves some profit for the seller.
- A tariff on foreign heavy crude oil purchased by US refineries drives up refinery costs. Refineries increase gasoline prices sold to gasoline retailers.

Markets and Tariffs

- As we know from recent experience, many countries respond to US tariffs on their products entering the US by imposing tariffs on US products imported to their countries.
- A US tariff on goods from countries in which refineries buy US light sweet crude may cause the countries to place a counter-tariff on US light sweet crude sold to their refineries. That action increases the crude oil price for refineries in those countries.
- That reduces US incentives to develop new US light sweet crude oil sources.

Markets and Tariffs

- Another important point is that gasoline not affected by a tariff is almost certain to rise in price because gasoline affected by a tariff does.
- When heavy crude refineries pay tariffs and pass through that cost to gasoline retailers, light sweet crude refineries might choose to charge the same high price for gasoline.

US announces lease auctions for offshore oil fields

- This recent headline was clearly intended to suggest that the US can increase its domestic gasoline supply.
- Will the new offshore leases reduce imports of heavy crude for US heavy crude refineries?
- My Google search revealed that **both types, heavy crude and light sweet crude, are found offshore**. The mix actually discovered might not eliminate that 4 millions heavy crude barrels imported every day.
- Drilling exploratory holes under the seabed and building wells and platforms takes years.

How many refineries would be needed to consume the exported light sweet crude?

- Current exports: 13 million barrels per day
- The largest refineries buy and intake 400,000 barrels of light sweet crude per day.
- 13 million / 400,000 equals 32.5
- That could be a mix of new construction and heavy crude refinery conversions.
- It will take a very long time to build and convert.

How many heavy crude refineries can be converted or retired to eliminate imports?

- Conversions and retirements should not be done on a whim.
- Assume the max purchase and ingestion rate: 400,000 barrels per day per refinery.
- 4 million / 400,000 equals 10.
- Refineries with a lower purchase and intake rate will increase the number to be converted or retired.

Vertical Integration

- A few companies own or lease oil fields, own refineries and gasoline retailers.
- Exxon Mobil, formerly known as Standard Oil of Ohio and later Esso and then Exxon, owns four US refineries.
- Chevron, formerly known as Standard Oil of California and later as Chevron-Texaco, owns five, including two in California.
- Marathon Oil and Valero Energy each own 13 US refineries, the most owned by one company. Both sell gasoline to many other station brands.

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Are there any quick fixes?

- For the current US product mix of oil types, we need more light sweet crude refineries. Building a light sweet crude refinery takes years, land and capital.
- The US cannot “build baby build” light sweet crude refineries quickly enough to consume all the excess US light sweet crude within, say the next three years.
- Heavy crude refinery owners might conclude that tariffs on imported heavy crude will be removed soon, and almost certainly will be by 2029.
- The only quick fix is to remove the US tariff on imported heavy crude oil.

Are there any quick fixes?

- A few US refineries can refine both heavy crude and light sweet crude, but building them was especially expensive.
- Switching over from refining heavy crude to refining light sweet crude may take the refineries offline for weeks.
- Don’t expect more of those to be built soon.
- Building a refinery requires not just land but the consent of the neighbors, and lots of capital to buy the land, and building the chemical engineering facilities and the roads needed within the land. That takes years.

Economic incentives to build oil refineries for light sweet crude

- To encourage rapid startup of refinery construction, the federal government could offer construction loan guarantees or outright construction loans.
- Another possible incentive for the long run is federal tax incentives to reduce taxes on refinery profits for a limited time. I suggest offering this with a scale that reduces and eliminates the incentive over time, such as 5 years of refinery operation.
- The federal government offers some incentives now. Those clearly are not motivating a construction boom.

Refineries during armed conflicts

- Fuel for the military must take priority during wars involving the US.
- The US anticipates the possibility of armed conflicts involving the US in Venezuela and Taiwan, and maybe elsewhere.
- Already, the US military is short on Pacific munitions supplies and could not defend Taiwan for more than a few weeks.
- My guess is that the military fuel stock situation in the Pacific might be similar.

Refineries during armed conflicts

- Refineries may be forced to prioritize production of diesel and aircraft fuel during a conflict. Gasoline production may plummet.
- Gerald Ford class aircraft carriers can use a couple of their eight nuclear reactors to make naval and aircraft fuel, using water and air. Only the namesake carrier is in service at this time. Two more are being built.
- Germany used that technique, at ruinous cost, near the end of WWII as their foreign crude oil sources were seized by the Allies.

Coda: the name plights of Exxon

- Esso was a gas station brand in the US and abroad.
- In Japanese, the word for “flat tire” sounds like Esso.
- Esso decided to find a new company name that literally had no prior meaning in any language. They chose Exxon.
- James Exon was the governor of Nebraska, and owned a successful real estate firm named for him.
- The Nebraska state corporation name statute prohibited Exxon from doing business in Nebraska. Oops!
- Exxon paid big money to the governor to change the name of his business.

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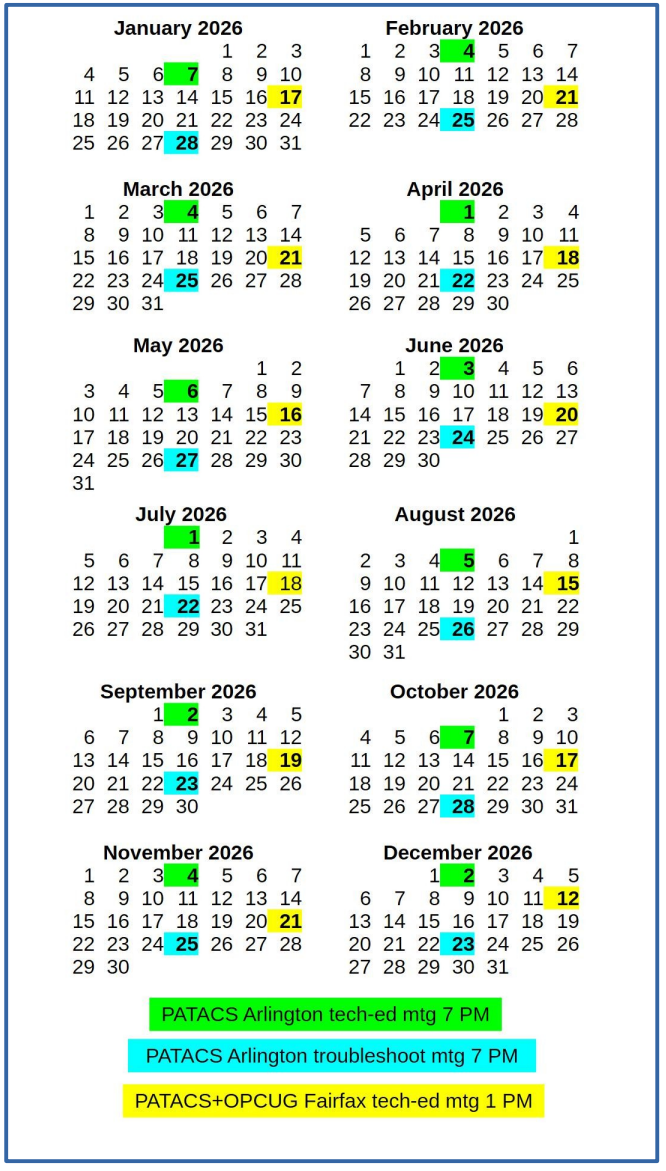

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