

2024  
NORTH  
AMERICAN  
ENERGY  
INVENTORY

2024

# NORTH AMERICAN ENERGY INVENTORY

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# TABLE OF CONTENTS

Letter from the President .....	4
Executive Summary.....	7
Introduction .....	11
The 2011 North American Energy Inventory: Shattering the Myth of Energy Scarcity .....	11
The Prevailing Narrative at the time of the 2011 North American Energy Inventory .....	12
Reaction to the 2011 Inventory .....	13
The American Energy Boom .....	14
North American Energy Resources .....	18
Will We Ever Run Out of Oil and Natural Gas?.....	20
U.S. Oil Resources .....	21
U.S. Natural Gas Resources .....	22
U.S. Coal Resources .....	24
Canada Oil Resources .....	25
Canada Natural Gas Resources .....	27
Canada Coal Resources .....	28
Mexico Oil Resources .....	28
Mexico Natural Gas Resources .....	29
Mexico Coal Resources .....	30
The Benefits of the United States	
Leading the World in Oil and Gas Production.....	31
Economic and Environmental Benefits .....	31
Lower Energy Prices from U.S. Energy Production Benefit Lower Income Earners the Most .....	33
Jobs from Domestic Energy Production .....	33
Germany: The Flip Side of the Coin .....	33
The European Union .....	34
The U.S. Model of Production of Resources Yields Enormous Benefits .....	34
Environmental Excellence .....	36
Benefits of Domestic Oil, Natural Gas, and Coal Production—Improved Energy Security.....	39
Crude Oil Prices and Key Geopolitical and Economic Events .....	40
What are the Impediments to Domestic Oil, Natural Gas, and Coal Production?.....	43
Regulatory Impediments to Energy Production .....	43
Other Impediments .....	45
Trading the Benefits of North American Energy	
Production with a Dependence on China .....	46
Conclusion .....	48



**Thomas J. Pyle is  
President of the  
Institute for Energy  
Research**

## LETTER FROM THE PRESIDENT

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In 2011, IER released the first edition of the *North American Energy Inventory*. This groundbreaking report shattered the myth of energy scarcity by using the government's own data to show the vast oil, coal, and natural gas resources that North America is blessed with underneath our lands and waters. Before the report, there was a widespread belief that we were running out of oil, natural gas, and, to some extent, coal.

In my letter from the 2011 *Inventory*, I stated:

"Thanks to new and continuing innovations in exploration and production technology, there's every reason to believe that today's estimates of reserves are only a fraction of what will be produced and delivered tomorrow."

Fast forward to today, where the United States is the world's largest producer of oil and natural gas and, most recently, the number one exporter of liquified natural gas (LNG). This happened because we have vast natural resources, a unique system of property rights (the landowner also owns the subsurface), the best technology, and a knowledgeable workforce. As a result, more wells have been drilled in the United States than in the rest of the world combined.

Since our 2011 report, oil production in the United States has increased by 117 percent and the estimate of oil that is technically recoverable increased by 15 percent. Domestic production of natural gas has increased by 62 percent and the estimate for technically recoverable natural gas increased by 47 percent. In other words, as production has increased, we have found even more.

During this time, the politicians and activists who claimed we needed to move on from oil and natural gas because we were running out have changed their tune. Faced with the formidable numbers above, they shifted their narrative, arguing that while we may indeed have vast energy resources, we have no choice but to "keep it in the ground" to combat climate change. Their allies in the government were all too happy to oblige, advancing policies that restrict our ability to access these resources or—at the very least—make it more expensive to do so. But that, too, has proved somewhat elusive.

As it became clear that there was no way the continued production of oil and gas resources (particularly on private and state lands) could be prevented, they again shifted their attention. This time the focus was on the infrastructure—specifically pipelines—that are necessary to move the energy safely and affordably from where it is being produced to where it can be transformed into the products that have consistently bettered human lives. In other words, the energy renaissance in North America happened despite sustained activist pressure and attempts by the government to slow or stop it.

The boom in oil and natural gas production in the United States has led to greater energy security for the United States and the world. The world is now less reliant on the Middle East

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to supply oil and natural gas. Oil and natural gas prices will continue to fluctuate, but events like Russia's invasion of Ukraine and the Israel-Hamas war have far less of an impact on oil prices than they would have if the United States were not the world's top producer.

The attempt by the current administration to transition away from a hydrocarbon-based energy system towards a new energy system reliant on minerals and materials like lithium and cobalt is truly baffling from an energy and national security perspective. The U.S. is now the leader in the production of hydrocarbon-based energy resources while China is the dominant producer and processor of the minerals and materials that make up the components of batteries, windmills, and solar panels. In other words, it is the policy of this administration to trade our hard won energy independence with a dependence on Communist China to meet our energy needs.

As I said in 2011, access to affordable and reliable energy is fundamentally a means for freedom. For those seeking to direct the way we live, work, and act, affordable, reliable abundant domestic energy is a threat. There are clear examples of this in today's debate, as activists and government agents now seek to dictate the types of stoves we can cook on or even the types of cars we can drive.

The data in this updated inventory shows, for at least many decades to come, that there are no meaningful physical limitations on the production and use of oil, natural gas, and coal resources in North America. The only limitations are political and ideological.

I would like to thank the entire IER team for their tireless efforts in putting together this latest *North American Energy Inventory*. It shows the reader that even with the explosion of energy production in the last fifteen years, North America is even richer in energy resources today than it was in 2011 and that the benefits of these bountiful resources are real and meaningful.

Sincerely,

A handwritten signature in black ink, appearing to read 'Thomas Pyle', written in a cursive style.

Thomas Pyle

# THE UNITED STATES VAST ENERGY RESOURCES



## OIL

**Total Technically Recoverable Resources: 1.66 trillion barrels**

- At our current rates of consumption that's enough oil for 227 years
- If the oil is devoted exclusively to gasoline production, it is enough gasoline to fuel the transportation sector for 539 years at 2023 usage levels
- 1.66 trillion barrels is 15 percent higher than the estimate of technically recoverable oil from IER's 2011 report
- 1.66 trillion barrels of technically recoverable oil in the U.S. is more than 5.6 times the proved reserves of Saudi Arabia



## NATURAL GAS

**Total Technically Recoverable Resources: 4.03 quadrillion cubic feet**

- At the current consumption rate, that's enough natural gas for the next 130 years from technically recoverable resources
- 4.03 quadrillion cubic feet is a 47 percent increase in the estimate of technically recoverable natural gas since the 2011 report
- The United States has over 65 quadrillion cubic feet of in place natural gas resources in the United States. If just half of that amount becomes recoverable, the U.S. has over 1,000 years of natural gas supply at 2022 consumption rates



## COAL

**Total Recoverable Resources: 470 billion short tons**

- The United States has 485 years of coal supply from proved reserves and 912 years from technically recoverable coal at 2022 consumption rates
- The United States has more coal than any other country in the world
- The United States has 53 percent more proved coal reserves than Russia, the country with the next largest coal reserves

# EXECUTIVE SUMMARY

In 2011, IER released the first edition of the *North American Energy Inventory*. At the time, the U.S. energy situation looked far different than it does today. In 2011, the United States was the third largest oil producer behind Russia and Saudi Arabia and conventional wisdom held that we were running out of oil, natural gas, and even coal.

At the time, then President Obama echoed this sentiment in numerous speeches when he claimed that because the United States only had 2 or 3 percent of the world's oil reserves we couldn't "simply drill our way out of our energy problems."<sup>1</sup> President Obama, it seems, did not understand what is really meant by the term "oil reserves." In reality, "oil reserves" represent only a fraction of the total oil resources available. Consequently, we successfully addressed many of our energy challenges by tapping into this broader pool of resources. Put another way, we did drill our way to energy security and more stable prices.

The first edition of the *Inventory* successfully challenged the myth of energy scarcity. We demonstrated that North America has vast energy resources—far more energy resources than people thought or believed at the time.

The *Inventory* was released when the shale revolution was beginning to pick up steam. Since 2005, oil production in the U.S. has increased by 149 percent<sup>2</sup> and natural gas production has more than doubled.<sup>3</sup> These massive increases, which have catapulted the U.S. to the world's top producer of both oil and natural gas, were the result of a combination of hydraulic fracturing, precision drilling, and private ownership of the subsurface in key parts of the United States. The hydraulic fracturing revolution has spread to some federal lands, but due to more onerous federal regulations, the benefits of increased production have occurred largely on private lands.

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1 President Barack Obama, Remarks by the President On America's Energy Security at Georgetown University, Mar. 30, 2011, <https://obamawhitehouse.archives.gov/the-press-office/2011/03/30/remarks-president-americas-energy-security>.

2 See Energy Information Administration, U.S. Field Production of Crude Oil, <https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=p&t=mcrf&f=m>.

3 See Energy Information Administration, U.S. Dry Natural Gas Production, <https://www.eia.gov/dnav/ng/hist/n9070us2A.htm>.

As the numbers below indicate, the United States and North America as a whole, has vast energy resources to continue producing the affordable and reliable energy that the world needs. Here are some highlights:

#### **U.S. Oil Resources:**

- The U.S. has **1,657.5 billion barrels of technically recoverable oil**, which is **15 percent higher** than estimated in IER's 2011 *Inventory*.
- The Energy Information Administration (EIA) reports **proved oil reserves of 44.4 billion barrels** at the end of 2021, representing a **16 percent increase** compared to the previous year's estimate of 38.2 billion barrels.
- At our current rate of consumption, **the United States has 227 years of oil supply** from technically recoverable oil resources.
- Additionally, the U.S. has **5,388 billion barrels of in place oil, resulting in 369 years of supply at a 50 percent recovery rate and at our current rate of consumption**. These resources include oil shale (kerogen) found primarily in the Green River Formation in parts of Colorado, Utah, and Wyoming.

#### **U.S. Natural Gas Resources:**

- The U.S. has **4,032 trillion cubic feet of technically recoverable natural gas**, which is a **47 percent increase** from IER's 2011 *Inventory*.
- The EIA reports proved gas reserves of 625 trillion cubic feet at the end of 2021, representing a **32 percent increase** compared to the previous year's estimate of 473 trillion cubic feet.
- At the current consumption rate, **the United States has 20 years of natural gas supply from proved reserves and over 130 years from technically recoverable resources**.
- Additionally, there are over **65 quadrillion cubic feet of in place natural gas resources in the United States**. If just half of that amount becomes recoverable, the U.S. has **over 1,000 years** of natural gas supply at 2022 consumption rates.

#### **U.S. Coal Resources:**

- The U.S. possesses abundant coal resources, with 10.3 trillion short tons in place.
- Technically recoverable coal resources amount to 470 billion short tons, while proved coal reserves stand at 250 billion short tons (slightly lower than 2011 estimates).
- Despite having the largest coal reserves globally, the U.S. faces challenges due to federal and state regulations that limit coal usage.
- In 2022, the U.S. consumed 515.5 million short tons of coal, a significant decrease from the 1,126 million short tons consumed in 2005.
- The U.S. has **485 years of coal supply from proved reserves and 912 years from technically recoverable coal at 2022 consumption rates**.



### **Canada's Energy Resources:**

While the United States has vast oil, natural gas, and coal resources, it also benefits from neighboring Canada where U.S. refiners get their largest quantity of oil imports. Canada has four times as much proved oil reserves as the United States, mostly composed of oil sands, and has the fourth-largest global quantity of oil reserves after Venezuela, Saudi Arabia, and Iran. U.S. refiners retooled their facilities years before the shale revolution, relying upon the heavier oil that Canada provides. The Keystone XL pipeline would have provided a critical infrastructure link between the Canadian oil supplies and Midwest refiners. In one of the first acts of his presidency, however, President Biden revoked the permit for the completion of the pipeline, threatening these imports to the U.S. as Canada finds other avenues for their oil exports.

Due to technological advances, estimates of Canada's technically recoverable natural gas resources have increased by 80 percent since 2011 and proved natural gas reserves are 40 percent higher. Canada's natural gas market is heavily integrated with the United States largely because of the location of supply basins, demand centers, availability of transportation infrastructure, and existing Canada-U.S. trade agreements. These factors allow for consumers and distributors on either side of the border to freely access natural gas from the lowest cost supplier.

### **Mexico's Energy Resources:**

A review of Mexico's energy resources is a reminder of how government decisions can impact a nation's energy potential. In IER's 2011 *Inventory*, Mexico was estimated to possess 10.5 billion barrels in proved oil reserves. Today, that figure has dwindled to 6.0 billion barrels. Additionally, Mexico's recoverable natural gas reserves have declined from 12 trillion cubic feet in 2011 to the current 11 trillion cubic feet.

While the United States and Canada have been able to grow their proved reserves and increase production, Mexico has experienced decreasing production and decreasing reserves. Mexico's energy sector has stagnated primarily due to policies of the López Obrador administration to roll back the 2013 reforms of the Enrique Peña Nieto administration and restore the near monopoly of Pemex, Mexico's state-owned oil company.

### **Benefits of Domestic Oil Production:**

**Abundant and reliable energy:** The U.S. is now the world's largest producer of oil and natural gas, which provides a secure and reliable supply of energy for the country. This has allowed families and businesses to plan with less worry about disruptions in energy supply.

**Lower energy prices:** Oil prices are lower and more stable today than they would be without the increase in domestic energy production.

**Job creation:** The oil and gas industry supports millions of jobs in the U.S., both directly and indirectly, that are often well-paying and provide good benefits.

**Environmental benefits:** The U.S. has made significant progress in reducing air pollution in recent years, even as energy production has increased.

**Better geopolitical situation:** Over the past 15 years, the growth in U.S. oil and natural gas production has significantly reshaped the nation's geopolitical priorities. The historical reliance on Middle East-sourced oil has been supplanted by domestic production, largely driven by the shale revolution and expanded natural gas output. This shift allows the United States to exercise greater discretion in foreign interventions. For decades, U.S. foreign policy was shaped by concerns about oil scarcity and conflicts, leading to price volatility. However, the U.S. now faces fewer vulnerabilities due to the large scale production of its own energy resources.

### **Impediments to U.S. Energy Production:**

The Biden administration has taken hundreds of actions to make it harder in the future to produce oil, natural gas, and coal in the United States. These actions include failing to hold lease sales, imposing a moratorium on new oil and gas leases, and issuing strict regulations on natural gas and coal production. As a result, coal production has fallen by 45 percent since 2009.

In addition to regulatory impediments, there are other challenges facing the oil, natural gas, and coal industries in the United States. These include difficulty raising capital due to the Environmental, Social, and Governance (ESG) investing movement, anti-fossil fuel activism, and competition from more heavily subsidized renewable energy sources.

### **One Last Note About the Future:**

If someone had asked us in 2011, "what would it take for the United States to become the largest oil and natural gas producer in the world," we would probably have guessed it would be a combination of a dramatic increase in offshore drilling, opening more of Alaska's onshore and offshore resources, and technological advancements with methane hydrates and oil shale (kerogen). None of these things happened. Instead, we got an energy revolution largely from technological advances—specifically hydraulic fracturing, directional drilling, and associated technologies—combined with our unique system of private property rights.

In the 2011 *Inventory*, we noted that hydraulic fracturing and direction drilling were responsible for huge increases in estimates of recoverable oil and natural gas, but we did not necessarily see the even bigger increases to come. The point we would make today is that we do not know what our energy future holds. However, we know it can be bright if people have access to our energy resources without excessive government intervention. We have enough affordable, reliable energy to last for generations so long as we have continued access to these energy resources.

# INTRODUCTION

## The 2011 North American Energy Inventory: Shattering the Myth of Energy Scarcity

In 2011, IER released the first edition of the *North American Energy Inventory*. At the time, the U.S. energy situation looked far different than it does today. In 2011, the United States was the third largest oil producer behind both Russia and Saudi Arabia. Russia had surpassed U.S. oil production in 2002 and by 2007, Russia's oil production was 47 percent larger than U.S. production.<sup>4</sup> Saudi oil production had surpassed U.S. production in 1992 and, like Russia, was nearly doubling U.S. production in 2007. Between 2007 and 2011, U.S. oil production had started to increase due to technological advances and while the production gap was decreasing, we were still dealing with both the rhetoric and the policies of scarcity.

In 2011, conventional wisdom held that the United States, and by extension North America, had limited energy resources. IER wrote the *Inventory* to counter this myth of energy scarcity. The numbers then (and the numbers now) speak for themselves. We showed,

with government data, that the United States possessed far more energy resources than many people realized. The data showed that North America had 1.79 trillion recoverable barrels of oil—enough oil to fuel every passenger car in the United States for the next 430 years. North America also had 4.24 quadrillion cubic feet of recoverable natural gas—enough to provide the United States with electricity for 575 years at then-current generation levels. Finally, in 2011, North America contained 497 billion short tons of coal—enough to provide electricity for approximately 500 years at then-current levels of electricity generation.

We also explained that despite increased population, longer lifespans, and greater economic activity over the past century, the U.S. had more recoverable oil, natural gas, and coal in 2011 than ever before. We made the case that North America had a very bright energy future ahead of itself, but opponents of increased energy production attempted to create a crisis mindset to manipulate energy policy and limit access to energy resources.

<sup>4</sup> The Energy Institute, *Statistical Review of World Energy*, 72<sup>nd</sup> Edition, 2023, p. 15, <https://www.energyinst.org/statistical-review>.

## The Prevailing Narrative at the time of the 2011 North American Energy Inventory

In 2024, with the United States being the largest oil and gas producer in the world, it is difficult to imagine that 10 to 15 years ago many prominent experts and politicians strongly argued that the best days of oil and gas were behind us. To illustrate this, we included the following quotes in the first edition of the *Inventory*:

*“Unless profound changes are made to lower oil consumption, we now believe that early in the 1980’s the world will be demanding more oil than it can produce.”*

— **President Jimmy Carter,**  
**Address to the Nation, April 18, 1977**

*“The U.S. is running out of natural gas—production is declining and demand growing—so the expectation is that the import levels will go from 3 percent today to about 24 percent in 2020.”*

— **Paul Hanrahan,**  
**CEO of AES power, January 6, 2007**

*“[P]eak coal looks like it’s occurred in the lower 48 (US States).”*

— **David Hughes,**  
**Geologist for The Geological Survey of Canada, 2007**

*“The math is simple: America has just 3 percent of the world’s oil reserves, but Americans use a quarter of its oil.”*

— **Senator Harry Reid, October 27, 2009**

*“Peak Coal Is The Next Energy Crisis You Need to Start Paying Attention To”*

— **Business Insider, November 29, 2010**

*“Study: World’s ‘Peak Coal’ Moment Has Arrived”*

— **New York Times, September 29, 2010**

*“The problem is we only have about 2 to 3 percent of the World’s oil reserves.”*

— **President Barack Obama, April 19, 2011**

These quotes above exemplify 40 years of prevailing sentiment about energy in the United States. The “peak oil” crowd insisted that the easy oil, natural gas, and coal deposits had been found and exploited and that Americans faced a future of higher prices, less domestic production, and increasing energy imports.

That “wisdom” went back to the early 1970s. In 1970, the United States became a net oil importer. In 1971, the chairman of the Texas Railroad Commission (the oil and gas regulatory agency in Texas) said, “Texas oil fields have been like a reliable old warrior that could rise to the task when needed.” He continued, “That old warrior can’t rise anymore.” In 1972, U.S. Commerce Secretary Peter G. Peterson said, “The era of low-cost energy is almost dead.” He continued, “Popeye is running out of spinach.”<sup>5</sup>

By 1994, the United States was importing more oil than it produced. Deputy Energy Secretary Bill White described the situation as “the biggest trade problem we have.”<sup>6</sup> The situation became more dire in 2008 when oil prices hit \$148 a barrel (though rapidly fell after the peak).

<sup>5</sup> Chris Homans, *Energy Independence: A Short History*, Foreign Policy, Jan. 3, 2012, <https://foreignpolicy.com/2012/01/03/energy-independence-a-short-history/>

<sup>6</sup> *Id.*

By 2011, as IER was working on the *Inventory*, there was a general misunderstanding of the relationship between proved reserves, production, and the potential for future production. These misunderstandings were exemplified by President Obama's claims that "we can't simply drill our way out of our energy problems."<sup>7</sup> He stated:

America holds about 2 percent of the world's proven oil reserves. What that means is, is that even if we drilled every drop of oil out of every single one of the reserves that we possess—offshore and onshore—it still wouldn't be enough to meet our long-term needs. We consume about 25 percent of the world's oil. We only have 2 percent of the reserves. Even if we doubled U.S. oil production, we're still really short.<sup>8</sup>

Obama's statement was nonsensical and reflected a lack of understanding about oil reserves and production. But it also reflected the general belief, though incorrect, that the United States was lacking oil and natural gas resources.

That is why IER's first edition of the *Inventory* was so important, as it highlighted the vast energy potential within North America, particularly the United States, and debunked the myth that drilling for oil and gas could not alleviate energy concerns.

The 2011 *Inventory* concluded:

The question Americans therefore need to ask is whether government officials throughout North America will embrace this enormous opportunity or scorn it. Armed only with pessimistic assumptions about technology and an incomplete and misleading understanding of our energy wealth here at home, we should not be surprised that our energy situation has gotten worse the more they intervened.

This is precisely where this assessment can play a vital role in educating the public. The era of perceived energy shortages must end, and informed judgments about North America's energy potential must finally be made. Millions of new jobs, untold economic growth, and unprecedented wealth creation for North America and the world await a productive and conducive environment for energy production.

Facing a future of plentiful and affordable energy supplies, Americans can once again reclaim the optimism that has characterized our history, replacing the pessimism of scarcity and government rationing that has placed limits on the growth of our economy and perhaps more importantly, our way of looking at the world.

## Reaction to the 2011 Inventory

The report's initial reception was mixed. Skepticism arose from two camps: those strongly opposed to oil, natural gas, and coal, and those supportive of these fuels who were still tethered to the myth of energy scarcity. Even to some prominent supporters of oil, natural gas, and coal production it didn't seem possible that the United States, along with Canada and Mexico, was blessed with such massive sums of conventional energy resources.

After the report was released, subsequent events, including the advancements in hydraulic fracturing, directional drilling, and associated technologies have validated both the data and the message found in the 2011 *Inventory*. The United States, along with Canada and Mexico, have massive amounts of oil, natural gas, and coal, but what matters most is access to these resources.

<sup>7</sup> President Barack Obama, *Remarks by the President On America's Energy Security at Georgetown University*, Mar. 30, 2011, <https://obamawhitehouse.archives.gov/the-press-office/2011/03/30/remarks-president-americas-energy-security>.

<sup>8</sup> *Id.*

# THE AMERICAN ENERGY BOOM



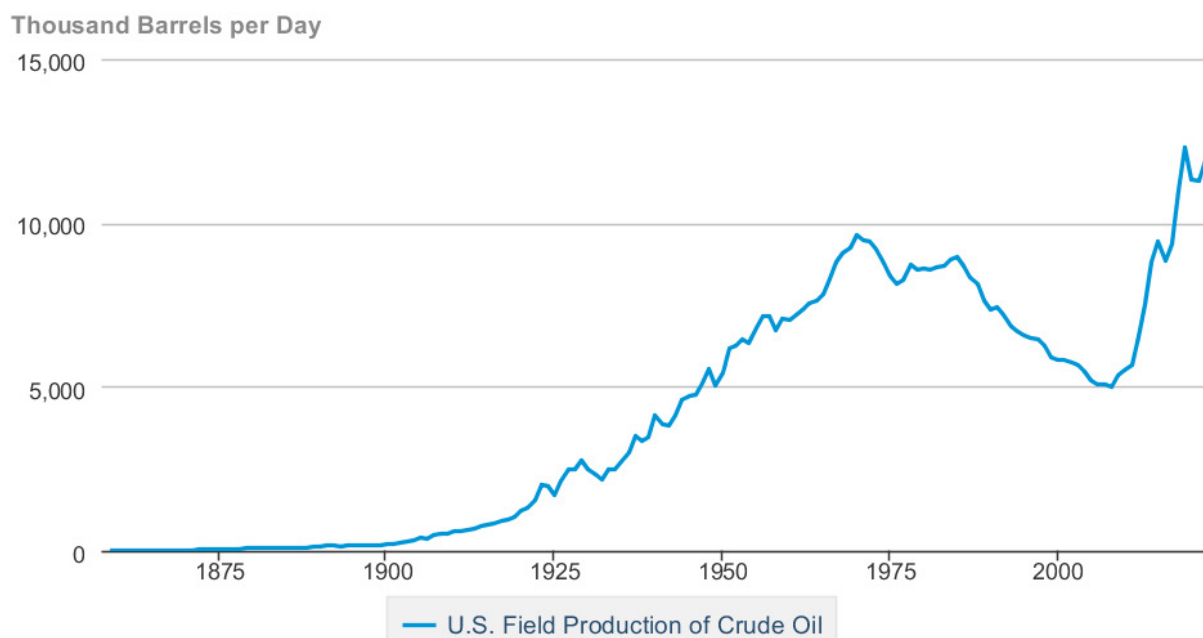
Since 2011, American energy producers have delivered remarkable technological breakthroughs that hardly anyone believed to be possible at the time.<sup>9</sup> The shale revolution has been a transformative force for American energy production. The combination of hydraulic fracturing, precision drilling, along with private ownership of the subsurface in key parts of the United States has catapulted it into a position of energy preeminence.<sup>10</sup> Along the way, this surge in U.S. oil production has promoted national security and limited

the ability of OPEC+ to dictate global oil prices.<sup>11</sup>

Over the past 15 years, oil production has nearly tripled in the United States, reaching 13.2 million barrels per day (bpd) as of January 5, 2024.<sup>12</sup> In the Permian Basin, average lateral lengths, defined as the horizontal sections of a well, grew by over 250 percent to over 10,000 feet from 2010 to 2022, while average oil production per rig grew from 126 bpd in 2010 to 1,211 bpd in 2022.<sup>13</sup>

- 9 Institute for Energy Research, *175 Ways the Biden Administration and Democrats Have Made it Harder to Produce Oil & Gas*, Sept. 19, 2023, <https://www.instituteforenergyresearch.org/fossil-fuels/gas-and-oil/175-ways-the-biden-administration-and-democrats-have-made-it-harder-to-produce-oil-gas/>.
- 10 IER, *Oil and Gas Booms on Private and State Lands*, Institute for Energy Research Apr. 14, 2015, <https://www.instituteforenergyresearch.org/fossil-fuels/gas-and-oil/oil-and-natural-gas-production-booms-on-private-and-state-lands-plummets-on-federal-lands/>.
- 11 John Kemp, *Rising U.S. oil production frustrates OPEC+ cuts*, Reuters, Feb. 1, 2023, <https://www.reuters.com/markets/commodities/rising-us-oil-production-frustrates-opec-cuts-kemp-2024-02-01/>.
- 12 U.S. Energy Information Administration, *U.S. Field Production of Crude Oil*, Jan. 31<sup>st</sup>, 2024, <https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MCRFPUS2&f=M>
- 13 U.S. Energy Information Administration, *Advances in technology led to record new well productivity in the Permian Basin in 2021*, Sept. 30, 2022, <https://www.eia.gov/todayinenergy/detail.php?id=54079>

## U.S. FIELD PRODUCTION OF CRUDE OIL



Data source: U.S. Energy Information Administration

Source: <https://www.eia.gov/todayinenergy/detail.php?id=54079>

Furthermore, the United States witnessed a twofold increase in natural gas production from 2005 to 2022, reclaiming its position as the leading global natural gas producer.<sup>14</sup>

The record is clear: the shale revolution has produced considerable benefits including lower energy prices, reduced carbon dioxide emissions, increased royalty payments, and more jobs.<sup>15</sup> The National Bureau of Economic Research found in a 2015 report titled *Welfare and Distributional Implications of Shale Gas* that

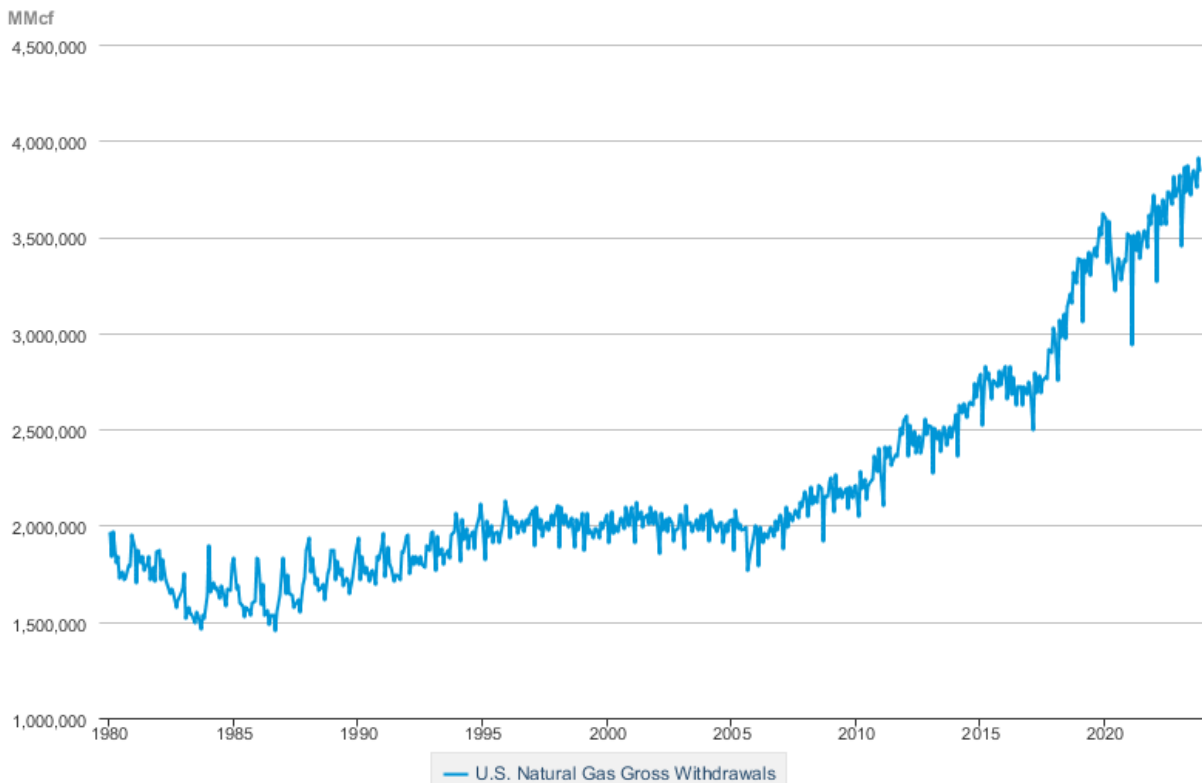
the U.S. shale boom reduced prices for natural gas and that the total welfare gain from 2007 to 2013 was \$48 billion annually, which is sizable given retail spending on natural gas was around \$160 billion in 2013. For the economy the change was about one-third of one percent of gross domestic product, or about \$150 per capita.

Those low natural gas prices contributed to the displacement of coal for natural gas in the U.S. energy mix. In 2023, carbon dioxide emissions fell by 3

<sup>14</sup> U.S. Energy Information Administration, *Natural Gas Gross Withdrawals and Production*, Jan. 31st, 2024, [https://www.eia.gov/dnav/ng/ng\\_prod\\_sum\\_a\\_EPG0\\_FGW\\_mmcfc\\_m.htm](https://www.eia.gov/dnav/ng/ng_prod_sum_a_EPG0_FGW_mmcfc_m.htm)

<sup>15</sup> Ilia Murtazashvili & Ennio E. Piano, *More Boon Than Bane: How the U.S. Reaped the Rewards and Avoided the Costs of the Shale Boom*, 24 *The Independent Review* 1086, (2019), [https://www.independent.org/pdf/tir/tir\\_24\\_2\\_05\\_murtazashvili.pdf](https://www.independent.org/pdf/tir/tir_24_2_05_murtazashvili.pdf).

## NATURAL GAS CROSS WITHDRAWALS AND PRODUCTION



eia Data source: U.S. Energy Information Administration

Source: [https://www.eia.gov/dnav/ng/ng\\_prod\\_sum\\_a\\_EPGO\\_FGW\\_mmc\\_f\\_m.htm](https://www.eia.gov/dnav/ng/ng_prod_sum_a_EPGO_FGW_mmc_f_m.htm)

percent continuing a steady decline in U.S. emissions that has taken place over the past 15 years.<sup>16</sup>

Additionally, the advantages of the shale boom extend to royalty payments for individuals and families and significant benefits for local and regional economies. According to the American Economic Association, for every million dollars of new oil and gas extraction there

is an associated \$80,000 increase in wage income, \$132,000 in royalty payments and business incomes, and the creation of 0.85 jobs within the local economy. These economic impacts are three times larger when considered within the broader region.<sup>17</sup>

A recent report from the American Petroleum Institute highlights the oil and natural gas industry sustains

<sup>16</sup> Institute for Energy Research citing the BP Statistical Review of World Energy, <https://www.instituteforenergyresearch.org/international-issues/since-2005-u-s-has-had-largest-decline-in-carbon-dioxide-emissions-globally/> & Catherine Hausman & Ryan Kellogg, *Welfare and Distributional Implications of Shale Gas*, Brookings Papers on Economic Activity 50, no. 1: 71–125 (2015).

<sup>17</sup> James Feyrer, Erin T. Mansur, & Bruce Sacerdote, *Geographic Dispersion of Economic Shocks: Evidence from the Fracking Revolution*, *American Economic Review* 107, no. 4: 1313–34 (2017).



10.8 million full-time and part-time positions across all 50 states. This workforce constitutes 5.4 percent of the nation's total employment, and the industry contributes nearly \$1.8 trillion annually to the U.S. economy.<sup>18</sup>

However, in light of these significant advancements, new challenges to American energy production have emerged. The current discourse no longer revolves around the adequacy of oil, natural gas, and coal reserves. Those who want to restrict our ability to make productive use of our natural resources now fear that we have too much of them.<sup>19</sup>

*Regrettably, some policymakers fail to recognize the American oil and gas sector as a thriving tale of innovation.*

But this American energy revolution is far from over. The U.S. energy industry continues to be a leader in implementing new technology across the production process to improve production and ensure safety.<sup>20</sup> New companies are making use of advanced analytics to provide producers with information and new ways to visualize data. The industry has also been a leader in developing artificial intelligence platforms that help upstream companies develop resources as efficiently as possible. New technologies have been developed to help recover our energy resources in a safe and more efficient way. Oilfield services companies are constantly innovating to find safer and more cost-efficient methods of exploration and production. Blockchain is increasingly playing a larger role in oil and gas production as various companies have moved to using smart contracts for added security and transparency. Field staff in upstream operations have begun adopting augmented reality technology and wearable computers that help with worker safety and decrease downtime issues. Today, everywhere you look you see innovation in the oil and natural gas industry.

Regrettably, some policymakers fail to recognize the American oil and gas sector as a thriving tale of innovation, having been influenced by a coordinated and well funded movement. But American producers persist in their tradition of discovering inventive new methods to generate energy.

<sup>18</sup> American Petroleum Institute, *America's Natural Gas and Oil: Securing Our Nation and Powering Progress*, American Petroleum Institute, <https://www.api.org/-/media/files/policy/american-energy/pwc/2023/api-pwc-national-2023>.

<sup>19</sup> Samantha Gross, *Reducing US oil demand, not production, is the way forward for the climate*, Brookings, Sept. 2023, <https://www.brookings.edu/articles/reducing-us-oil-demand-not-production-is-the-way-forward-for-the-climate/>

<sup>20</sup> Alex Stevens, *The Oil and Gas Industry isn't Done Innovating*, ShaleMag.com, Nov. 4, 2022, <https://shalemag.com/the-oil-and-gas-industry-isnt-done-innovating/>

# NORTH AMERICAN ENERGY RESOURCES



Oil and natural gas resources are the estimated oil and natural gas volumes that might be produced at some time in the future. Resource estimates change as extraction technologies improve, as markets evolve, and as oil and natural gas are produced. Oil and natural gas resources can be classified into four categories:

- In place resources
- Technically recoverable resources
- Economically recoverable resources
- Proved reserves

The oil and natural gas volumes reported for each resource category are estimates based on the geophysical characteristics of the rocks, the fluids trapped within those rocks, the capability of extraction

technologies, and the prices received and costs paid to produce oil and natural gas. The uncertainty in estimated volumes declines across the resource categories, with proved reserves being the most certain and in place resources being the least certain and largest category as depicted below.

Nonetheless, the oil and gas industry continues exploring and finding more resources as can be seen through the growth in U.S. reserves. For example, the EIA estimates proved oil reserves of 44.4 billion barrels<sup>21</sup> at the end of 2021 (the latest data on its website), 16 percent higher than the proved oil reserves at the end of 2020 (38.2 billion barrels), despite consuming over 7 billion barrels in 2021.<sup>22</sup> Thus, almost twice as much new oil was “proved up” as was consumed in 2021.

<sup>21</sup> U.S. Energy Information Administration, *Crude Oil Plus Lease Condensate Proved Reserves, Reserves Changes, and Production*, Dec. 29<sup>th</sup>, 2023, [https://www.eia.gov/dnav/pet/pet\\_crd\\_cplc\\_dcu\\_NUS\\_a.htm](https://www.eia.gov/dnav/pet/pet_crd_cplc_dcu_NUS_a.htm)

<sup>22</sup> U.S. Energy Information Administration, *Monthly Energy Review*, Jan. 2024, [https://www.eia.gov/totalenergy/data/monthly/pdf/sec3\\_3.pdf](https://www.eia.gov/totalenergy/data/monthly/pdf/sec3_3.pdf)

## NORTH AMERICA'S MASSIVE RESOURCE POTENTIAL

	Oil	Natural Gas	Coal
<b>United States</b>	<b>In Place</b> 5.388 trillion barrels	<b>In Place</b> 65 quadrillion cubic feet	<b>In Place</b> 10.3 trillion short tons
	<b>Technically Recoverable</b> 1.658 trillion barrels	<b>Technically Recoverable</b> 4.032 quadrillion cubic feet	<b>Technically Recoverable</b> 470 billion short tons
	<b>Proved Reserves</b> 44.4 billion barrels	<b>Proved Reserves</b> 625 trillion cubic feet	<b>Proved Reserves</b> 250.4 billion short tons
<b>Canada</b>	<b>In Place</b> 2.678 trillion barrels	<b>In Place</b> 33.3 quadrillion cubic feet	<b>In Place</b> 222 billion short tons
	<b>Technically Recoverable</b> 324 billion barrels	<b>Technically Recoverable</b> 1.368 quadrillion cubic feet	<b>Technically Recoverable</b> 9.6 billion short tons
	<b>Proved Reserves</b> 163 billion barrels	<b>Proved Reserves</b> 87 trillion cubic feet	<b>Proved Reserves</b> 7.3 billion short tons
<b>Mexico</b>	<b>In Place</b> 418 billion barrels	<b>In Place</b> 2.266 quadrillion cubic feet	<b>In Place</b> 3.31 billion short tons
	<b>Technically Recoverable</b> 30.6 billion barrels	<b>Technically Recoverable</b> 577 trillion cubic feet	<b>Technically Recoverable</b> 1.33 billion short tons
	<b>Proved Reserves</b> 6 billion barrels	<b>Proved Reserves</b> 11 trillion cubic feet	<b>Proved Reserves</b> 1.33 billion short tons

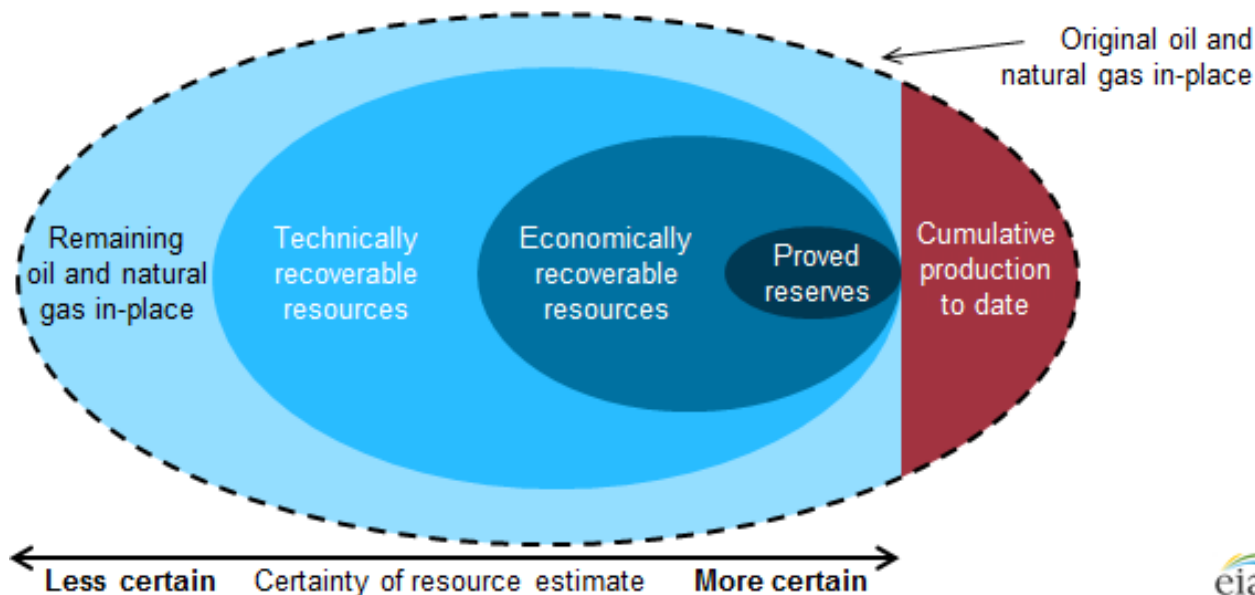
**Oil and natural gas in place resource** is the volume of oil and natural gas within a formation before the start of production. As oil and natural gas are produced, the volumes that remain are the remaining oil and gas in place, which has the largest volume and is the most uncertain of the four resource categories.

**Technically recoverable resource** is the oil and gas that can be produced based on current technology. As technology develops; as industry improves its processes, optimizes resources, and effectuates standardization and efficiencies; and as the geologists' understanding increases, the estimated volumes of

technically recoverable resources also increases. Typically, industry is unable to produce 100 percent of the original oil and gas in place because of the geophysical characteristics of the rock (e.g., resistance to fluid flow) and the physical properties of the hydrocarbons (e.g., viscosity). But as technology improves, more and more of the oil and gas resources are recoverable. For example, hydraulic fracturing and directional drilling have made the United States the number one oil and gas producer in the world and have increased U.S. oil production from 5 million bpd in 2008 to over 11.9 million barrels per day in 2022<sup>23</sup>—an increase of 138 percent.

<sup>23</sup> *Id.*

## STYLIZED REPRESENTATION OF OIL AND NATURAL GAS RESOURCE CATEGORIZATIONS (NOT TO SCALE)



Source: <https://www.eia.gov/todayinenergy/detail.php?id=17151#:~:text=The%20volume%20of%20oil%20and%20natural%20gas%20within,the%20most%20uncertain%20of%20the%20four%20resource%20categories>

**Economically recoverable resources** are the portion of technically recoverable resources that can be profitably produced. The volume of economically recoverable resources is determined by both oil and natural gas prices and by the capital and operating costs that would be incurred during production. As oil and gas prices increase, the volume of the economically recoverable resources increases. This report does not include economically recoverable resources because their estimates are tied to a specific set of prices and costs that can quickly become obsolete as prices and costs change.

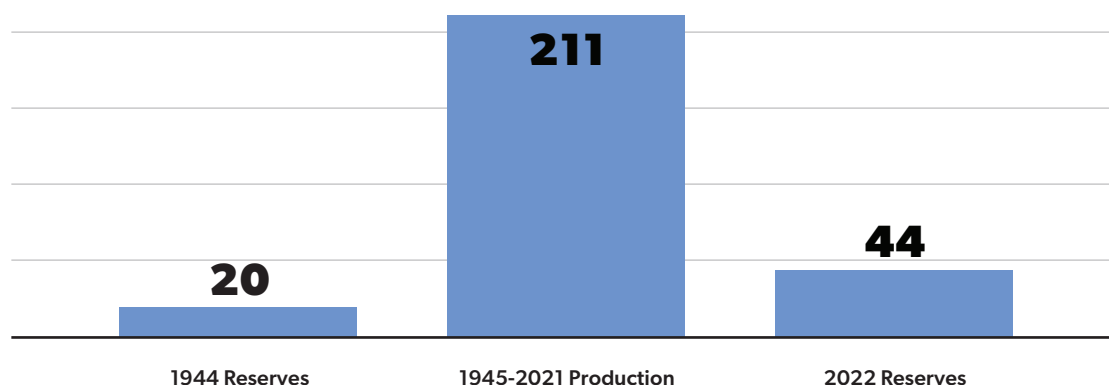
**Proved reserves** are the most certain oil and gas resource category and the smallest volume. Proved reserves are volumes of oil and natural gas that geologic and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions. The U.S. Securities and Exchange

Commission regulates the reporting of company financial assets, including proved oil and gas reserve assets reported by public oil and gas companies. The U.S. employs the most rigorous standards in the world for valuations of proved reserves. Often, making comparisons among nations is difficult because of the use of different standards.

### Will We Ever Run Out of Oil and Natural Gas?

Over time, oil and natural gas resource volumes are reclassified, going from one resource category into another category, as production technology develops and markets evolve. For example, proved reserves are continually replenished as oil and gas companies are allowed to develop new fields and basins. The chart below shows U.S. proved oil reserves in 1944, total U.S. oil production from 1945 through 2021, and proved

## U.S. OIL RESERVES VS. PRODUCTION, 1944-2021 (BILLION BARRELS)



Source: IER produced from EIA Data <https://www.instituteforenergyresearch.org/fossil-fuels/gas-and-oil/global-oil-and-gas-proved-reserves-increase-in-2021/>

reserves as of January 1, 2022. The 2022 proved reserve number is more than twice the proved reserve number in 1944, while oil companies produced 211 billion barrels of oil between 1945 and 2021, over 10 times as much. This clearly points out that the United States is not running out of oil, and indeed, much of the federal government's 2.46 billion acres of mineral estate remains unexplored owing mostly to restrictive government policies.<sup>24</sup>

Likewise, the chart below shows U.S. proved natural gas reserves in 1944, total U.S. natural gas production from 1945 through 2021, and proved reserves of natural gas as of January 1, 2022. The 2022 proved reserve number is more than four times the proved reserve number in 1944, while oil and gas companies produced

1,357 trillion cubic feet of natural gas between 1945 and 2021, over nine times as much as proved gas reserves in 1944.

### U.S. Oil Resources

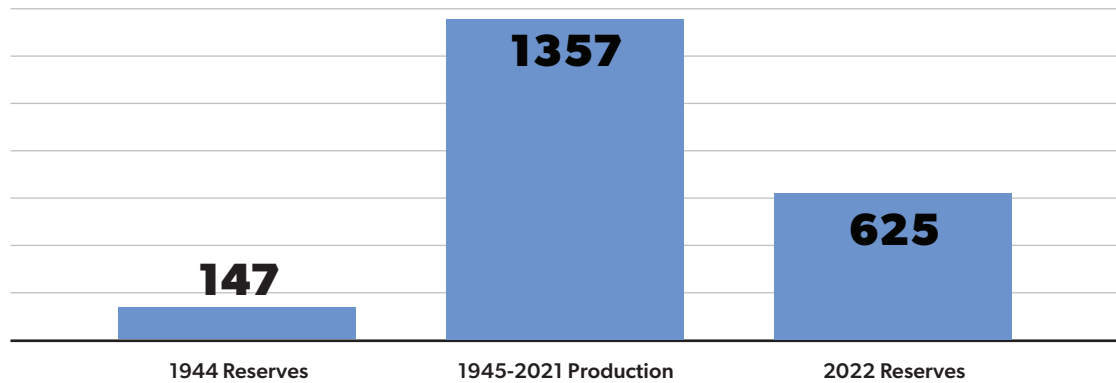
IER estimates technically recoverable U.S. oil resources at 1,657.5 billion barrels—15 percent higher than IER's *Inventory* report published in 2011.<sup>25</sup> The EIA estimated proved oil reserves of 44.4 billion barrels at the end of 2021—16 percent higher than the previous year when oil proved reserves were estimated at 38.2 billion barrels<sup>26</sup> and 116 percent higher than IER's previous report. The U.S. oil industry added to oil reserves despite Americans consuming 7.3 billion barrels of oil

<sup>24</sup> Institute for Energy Research, *175 Ways the Biden Administration and Democrats Have Made it Harder to Produce Oil & Gas*, September 19, 2023, <https://www.instituteforenergyresearch.org/fossil-fuels/gas-and-oil/175-ways-the-biden-administration-and-democrats-have-made-it-harder-to-produce-oil-gas/>

<sup>25</sup> The Institute for Energy Research, *North American Energy Inventory*, December 2011, <https://www.instituteforenergyresearch.org/wp-content/uploads/2013/01/Energy-Inventory.pdf>

<sup>26</sup> U.S. Energy Information Administration, *Crude Oil Plus Lease Condensate Proved Reserves, Reserves Changes, and Production*, Dec. 29<sup>th</sup>, 2023, [https://www.eia.gov/dnav/pet/pet\\_crd\\_cplc\\_dcu\\_NUS\\_a.htm](https://www.eia.gov/dnav/pet/pet_crd_cplc_dcu_NUS_a.htm)

## U.S. NATURAL GAS RESERVES VS. PRODUCTION, 1944-2021 (TRILLION CUBIC FEET)



Source: IER produced from EIA Data <https://www.instituteforenergyresearch.org/fossil-fuels/gas-and-oil/global-oil-and-gas-proved-reserves-increase-in-2021/>

in 2021.<sup>27</sup> At that consumption rate, the United States has 227 years of oil supply from technically recoverable oil resources. As the oil industry drills more wells, technically recoverable resources will increase. It is estimated that the United States has 5,388 billion barrels of in place oil resulting in 369 years of supply at 50 percent recovery rates.

IER's in place and technically recoverable resource categories include oil shale—an organic-rich fine-grained sedimentary rock containing kerogen from which oil can be produced found primarily in the Green River Formation in parts of Colorado, Utah, and Wyoming.<sup>28</sup> While the technology for mining and producing oil shale

from kerogen is known, it is not yet economic. The U.S. Geologic Survey (USGS) estimates that there are 4.3 trillion barrels of in place oil shale resources<sup>29</sup> with 1.3 trillion barrels estimated by IER to be technically recoverable. The Rand Corporation, a nonprofit research organization, estimates that 30 to 60 percent of the oil shale in the Green River Formation can be recovered.<sup>30</sup>

### U.S. Natural Gas Resources

IER estimates U.S. technically recoverable natural gas resources at 4,032 trillion cubic feet—a 47 percent

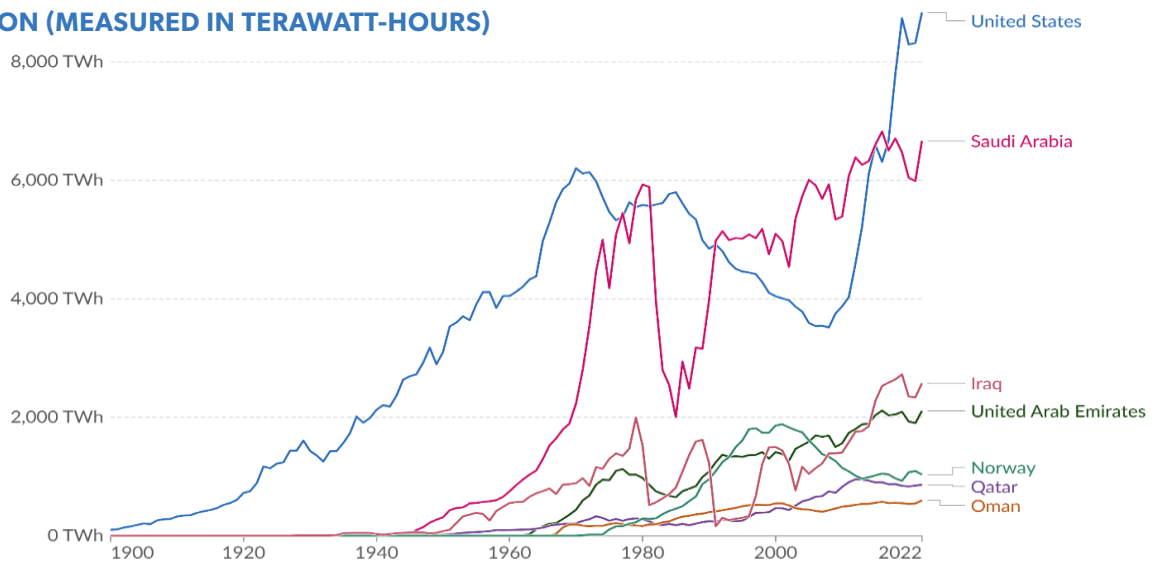
<sup>27</sup> U.S. Energy Information Administration, *Monthly Energy Review*, Jan. 2024, [https://www.eia.gov/totalenergy/data/monthly/pdf/sec3\\_3.pdf](https://www.eia.gov/totalenergy/data/monthly/pdf/sec3_3.pdf)

<sup>28</sup> Wikipedia, *Oil Shale*, Feb. 13th, 2024, [https://en.wikipedia.org/wiki/Oil\\_shale](https://en.wikipedia.org/wiki/Oil_shale)

<sup>29</sup> USGS, *Assessment of In-Place Oil Shale Resources of the Green River Formation, Greater Green River Basin in Wyoming, Colorado, and Utah*, June 2011, <https://pubs.usgs.gov/fs/2011/3063/pdf/FS11-3063.pdf>

<sup>30</sup> The New American, *The Green River Formation: World's Largest Oil Shale Deposits*, May 15, 2012, <https://thenewamerican.com/us/tech/energy/the-green-river-formation-worlds-largest-oil-shale-deposits/>

## OIL PRODUCTION (MEASURED IN TERAWATT-HOURS)



Data source: Energy Institute - Statistical Review of World Energy (2023); The Shift Data Portal (2019)  
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Source: <https://ourworldindata.org/fossil-fuels>

increase from IER's 2011 *Inventory*.<sup>31</sup> The EIA estimates proved gas reserves of 625 trillion cubic feet at the end of 2021<sup>32</sup>—32 percent higher than the previous year when natural gas proved reserves were 473 trillion cubic feet and an increase of 130 percent from IER's last report. In 2021, the U.S. consumed 30.6 trillion cubic feet of natural gas<sup>33</sup>—consuming only 20 percent of the increase in proved reserves that year. At that consumption rate, the U.S. has 20 years of natural gas supply from proved reserves and over 130 years from technically recoverable resources. But, as the oil and gas industry drills more, it adds to both these

categories ensuring Americans of many, many years of supply. There are over 65 quadrillion cubic feet of in place natural gas resources in the U.S. If just half of that amount becomes recoverable, the U.S. has over 1000 years of natural gas supply at 2022 consumption rates.

The in place and technically recoverable natural gas categories include gas hydrates—solid structures that are composed of rigid cages of water molecules that trap molecules of gas. According to federal government agencies, the USGS<sup>34</sup> and the Bureau of Ocean Energy Management,<sup>35</sup> there are 5.2 quadrillion cubic feet of in place gas hydrates and 53.8 trillion

31 The Institute for Energy Research, *North American Energy Inventory*, December 2011, <https://www.instituteforenergyresearch.org/wp-content/uploads/2013/01/Energy-Inventory.pdf>

32 U.S. Energy Information Administration, *Natural Gas Reserves Summary as of Dec. 31*, Dec. 31st, 2023 [https://www.eia.gov/dnav/ng/ng\\_enr\\_sum\\_a\\_EPG0\\_r21\\_BCF\\_a.htm](https://www.eia.gov/dnav/ng/ng_enr_sum_a_EPG0_r21_BCF_a.htm)

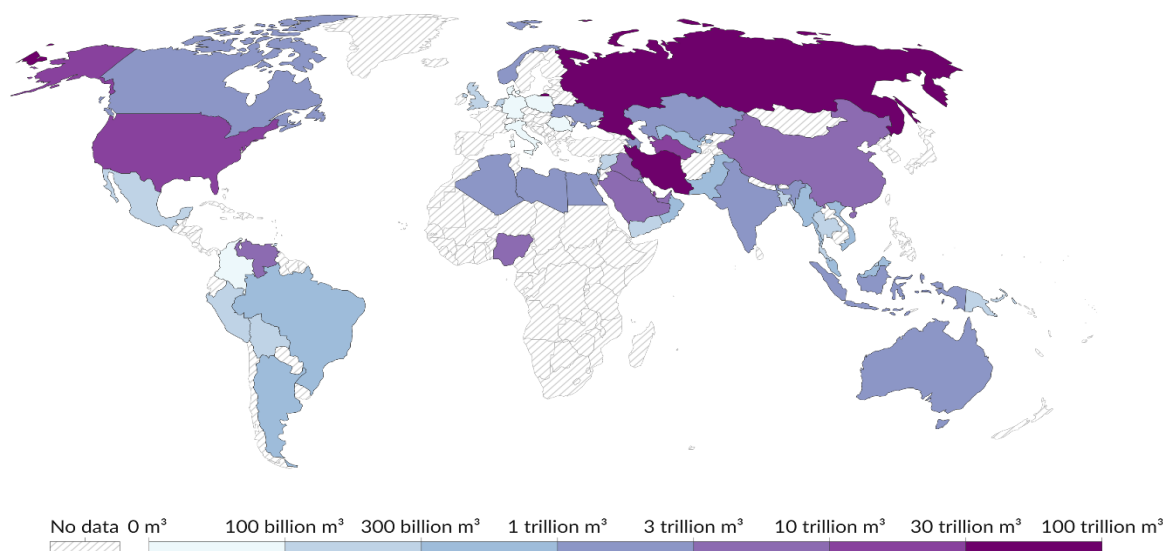
33 U.S. Energy Information Administration, *Monthly Energy Review*, Jan. 2024, [https://www.eia.gov/totalenergy/data/monthly/pdf/sec3\\_3.pdf](https://www.eia.gov/totalenergy/data/monthly/pdf/sec3_3.pdf)

34 Timothy S. Collett USGS, *Gas Hydrate Resources of Northern Alaska*, Bulletin of Canadian Petroleum Geology, 1997, <https://pubs.usgs.gov/publication/70019143#:~:text=The%20mean%20in-place%20hydrate%20resource%20estimate%20for%20northern,of%20gas%20%28590%20trillion%20cubic%20feet%20of%20gas%29>

35 Bureau of Ocean Energy Management, *Assessment of In-Place Gas Hydrate Resources of the Lower 48 United States Outer Continental Shelf*, 2012, [https://www.boem.gov/sites/default/files/documents/oil-gas-energy/resource-evaluation/gas-hydrates/BOEM-FactSheetRED\\_2012-01.pdf](https://www.boem.gov/sites/default/files/documents/oil-gas-energy/resource-evaluation/gas-hydrates/BOEM-FactSheetRED_2012-01.pdf)

## GAS RESERVES, 2020

Proved reserves, measured in cubic meters, are generally those quantities that can be recovered in the future from known reservoirs under existing economic and operating conditions, according to geological and engineering information.



Data source: Energy Institute - Statistical Review of World Energy (2023)

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Source: <https://ourworldindata.org/fossil-fuels>

cubic feet of technically recoverable gas hydrates.<sup>36</sup>

The Potential Gas Committee (PGC) has estimated future gas supply at 3,978 trillion cubic feet—an all-time high.<sup>37</sup> The PGC estimates future gas supplies every two years, as the graph below depicts. It clearly shows the effect that the combination of hydraulic fracturing and directional drilling had on natural gas supplies, which has not only enabled Americans to enjoy more energy at lower carbon dioxide rates, but Asians and Europeans as well.

## U.S. Coal Resources

The U.S. is well endowed in coal resources with 10.3 trillion short tons of in place resources. Technically recoverable coal resources total 470 billion short tons and proved coal reserves total 250 billion short tons<sup>38</sup>—slightly lower amounts than the last *Inventory* estimated. The U.S. has the most coal reserves of any country in the world. As a result, coal historically has been the predominant source of electricity generation

<sup>36</sup> Office of Communications and Publishing USGS, *USGS Estimates 53.8 Trillion Cubic Feet of Natural Gas Hydrate Resources in the Alaska North Slope*, September 10, 2019, <https://www.usgs.gov/news/national-news-release/usgs-estimates-538-trillion-cubic-feet-natural-gas-hydrate-resources>

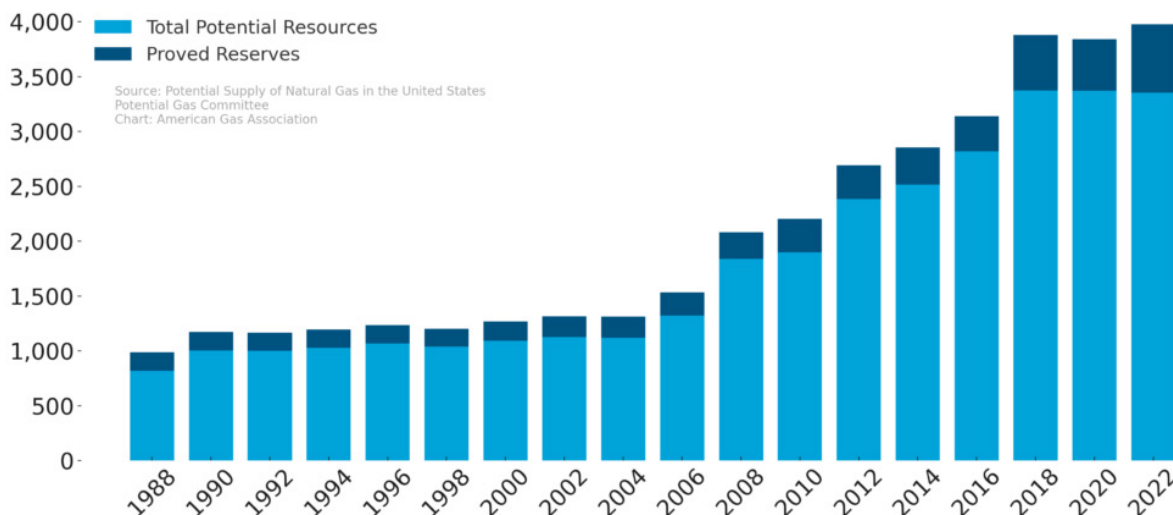
<sup>37</sup> Potential Gas Committee, *Potential Supply of Natural Gas in the United States*, Dec. 31st, 2022, <https://www.aga.org/wp-content/uploads/2023/09/PGC-2022-Report-Executive-Summary.pdf>

<sup>38</sup> U.S. Energy Information Administration, *Recoverable Coal Reserves at Producing Mines, Estimated Recoverable Reserves, and Demonstrated Reserve Base by Mining Method*, Annual Coal Report, 2022, <https://www.eia.gov/coal/annual/pdf/table15.pdf>



## U.S. FUTURE NATURAL GAS SUPPLY (POTENTIAL RESOURCES PLUS PROVED RESERVES)

(Trillion Cubic Feet)



Source: <https://www.aga.org/research-policy/resource-library/energy-insights-future-natural-gas-supplies-in-the-united-states-are-at-their-highest-reported-level-on-record/>

in the U.S.<sup>39</sup> However, since 2007, onerous federal regulations and the dramatic increase in the supply of natural gas have displaced the use of coal in the electric utility market. In 2022, the U.S. consumed 515.5 million short tons of coal, 54 percent lower than the 1,126 million short tons consumed in 2005.<sup>40</sup> Most U.S. coal is consumed in the electric utility sector, with some industrial uses. The U.S. has 485 years of coal supply from proved reserves and 912 years from technically recoverable coal at 2022 consumption rates. Despite the U.S. reducing its coal consumption drastically, other countries in the world are producing and consuming more and more coal each year. In 2022, China increased

its coal production by 10.5 percent, producing 8.5 times as much coal as the U.S. and still had to import coal to meet demand. India and Indonesia also produced more coal than the U.S., increasing their production by 12 percent each in 2022.<sup>41</sup>

### Canada Oil Resources

IER estimates Canada's technically recoverable oil resources at 324 billion barrels—about the same as the IER's 2011 report. Canada's proved oil reserves totaled 163 billion barrels at the end of 2021, 97 percent of

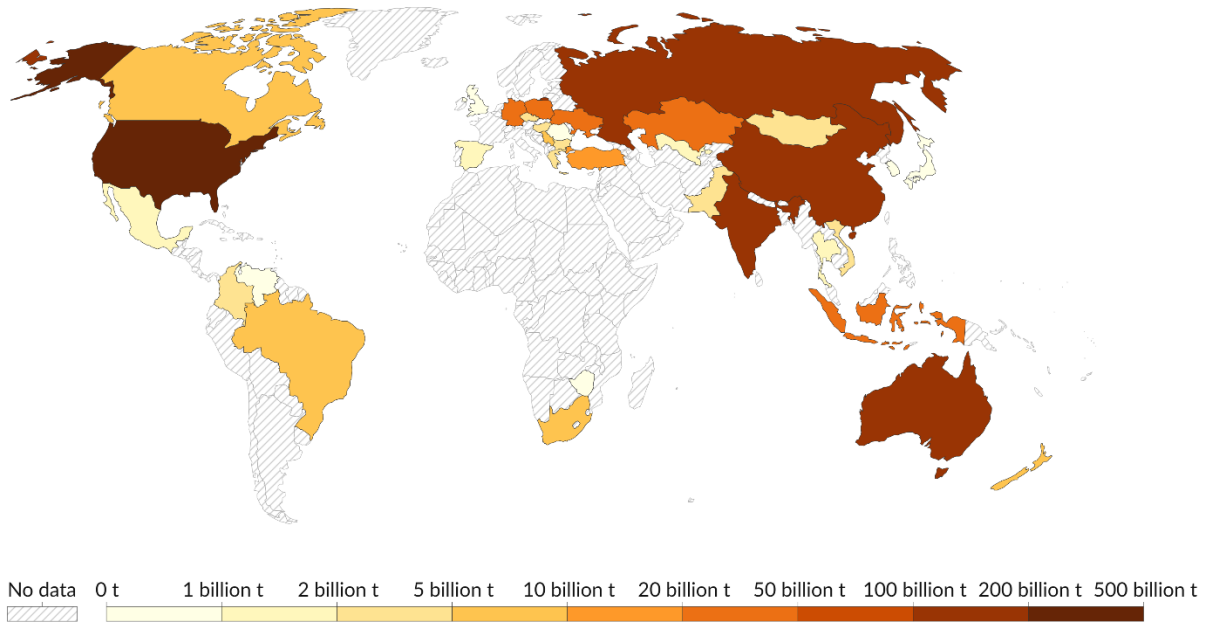
39 The Energy Institute, *Statistical Review of World Energy*, 72<sup>nd</sup> Edition, 2023, [https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.energyinst.org%2F\\_data%2Fassets%2Fexcel\\_doc%2F0007%2F1055545%2FEI-stats-review-all-data.xlsx&wdOrigin=BROWSELINK](https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.energyinst.org%2F_data%2Fassets%2Fexcel_doc%2F0007%2F1055545%2FEI-stats-review-all-data.xlsx&wdOrigin=BROWSELINK).

40 U.S. Energy Information Administration, *Monthly Energy Review*, Jan. 2024, [https://www.eia.gov/totalenergy/data/monthly/pdf/sec3\\_3.pdf](https://www.eia.gov/totalenergy/data/monthly/pdf/sec3_3.pdf)

41 The Energy Institute, *Statistical Review of World Energy*, 72<sup>nd</sup> Edition, 2023, [https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.energyinst.org%2F\\_data%2Fassets%2Fexcel\\_doc%2F0007%2F1055545%2FEI-stats-review-all-data.xlsx&wdOrigin=BROWSELINK](https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.energyinst.org%2F_data%2Fassets%2Fexcel_doc%2F0007%2F1055545%2FEI-stats-review-all-data.xlsx&wdOrigin=BROWSELINK).

## COAL RESERVES, 2020

Proved reserves, measured in tonnes, are generally those quantities that can be recovered in the future from known reservoirs under existing economic and operating conditions, according to geological and engineering information.



Data source: Energy Institute - Statistical Review of World Energy (2023)

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Source: <https://ourworldindata.org/fossil-fuels>

which are oil sands.<sup>42</sup> Oil sands are sand and rock material that contain bitumen, a dense, viscous form of oil that is extracted and processed using either mining or in-situ recovery.<sup>43</sup> The mining method uses trucks and shovels to scoop oil sands from the ground, transporting the oil sands to extraction plants where bitumen is separated from the sand by using steam. The tailings are then pumped into settling basins. In the in-situ process, companies drill vertical or horizontal

wells (or in some cases both) to inject steam to facilitate the flow of oil. In 2022, oil sands production was 3.2 million barrels per day compared with 1.7 million barrels per day of other oil production.<sup>44</sup> Oil sands production has exceeded conventional production in Canada since 2010.<sup>45</sup>

Canada consumed 1.7 million barrels of oil per day in 2022 (620 million barrels).<sup>46</sup> At that consumption

<sup>42</sup> Natural Resources Canada, *Energy Fact Book 2023-2024*, 2023, <https://energy-information.canada.ca/sites/default/files/2023-10/energy-factbook-2023-2024.pdf>

<sup>43</sup> Ali Hussain, *Oil Sands*, Investopedia, May 26th, 2022, <https://www.investopedia.com/terms/o/oilsand.asp>

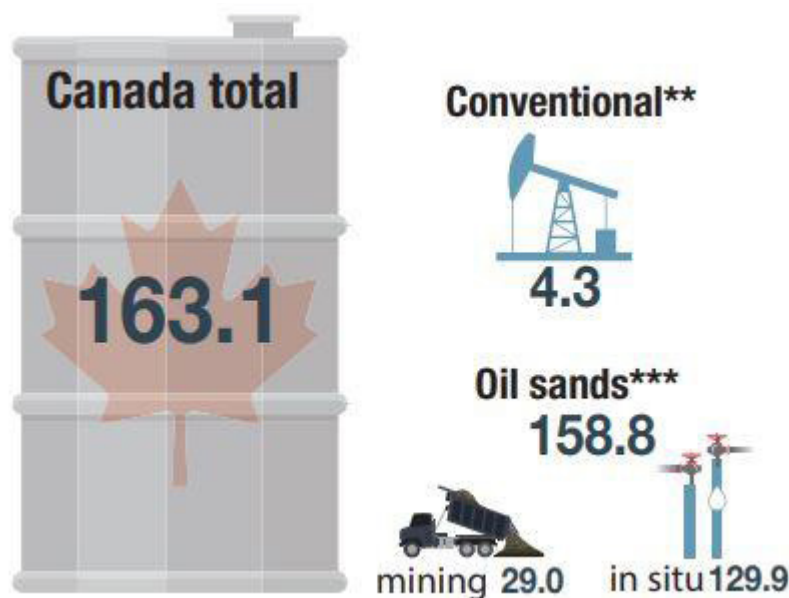
<sup>44</sup> Natural Resources Canada, *Energy Fact Book 2023-2024*, 2023 <https://energy-information.canada.ca/sites/default/files/2023-10/energy-factbook-2023-2024.pdf>

<sup>45</sup> *Id.*

<sup>46</sup> *Id.*

## CANADIAN RESOURCES (REMAINING ESTABLISHED RESERVES\*)

(billion barrels, as of December 2021)



\* Reserves known to exist and recoverable under current technological and economic conditions. Totals may not sum due to rounding

\*\* Reserves also include proved reserves of pentanes plus (a crude-oil equivalent that is associated with oil production).

\*\*\* With improved technology, it is estimated that 315 billion barrels are ultimately recoverable from the oil sands. Totals may not sum due to rounding.

Source: Energy Fact Book, 2023-2024, <https://energy-information.canada.ca/sites/default/files/2023-10/energy-factbook-2023-2024.pdf>

rate, Canada has 263 years of oil supply from proved reserves and 523 years of supply from technically recoverable oil resources.

Canada has the fourth-largest global supply of proved oil reserves (9 percent of the world's total), after Venezuela (18 percent), Saudi Arabia (15 percent) and Iran (12 percent). Of the 4.9 million barrels per day of oil produced by Canada in 2022, 3.8 million barrels per day, or 78 percent, were exported.<sup>47</sup> In 2022, Canada was the largest foreign supplier of oil to the U.S., accounting for 60 percent of total U.S. crude oil imports

and 97 percent of Canadian oil exports.<sup>48</sup> Despite the U.S. being a net oil exporter, its refineries were retrooled years ago to process heavy oil, the type of which Canada is our biggest supplier.

### Canada Natural Gas Resources

IER estimates Canada's technically recoverable natural gas resources at 1,368 trillion cubic feet<sup>49</sup>—80 percent higher than in IER's last inventory report. Canada's proved natural gas reserves total 87 trillion cubic feet at the end of 2021—40 percent higher than in IER's 2011 report.<sup>50</sup> Canada consumed 7.11 billion cubic feet per

<sup>47</sup> *Id.*

<sup>48</sup> *Id.*

<sup>49</sup> Canadian Gas Association, *Natural Gas Resource Base- Canada 2022*, 2022, [https://www.cga.ca/wp-content/uploads/2020/03/Natural-Gas-Resources-Canada\\_Ressources-en-gaz-naturel-Canada.pdf](https://www.cga.ca/wp-content/uploads/2020/03/Natural-Gas-Resources-Canada_Ressources-en-gaz-naturel-Canada.pdf)

<sup>50</sup> Natural Resources Canada, *Energy Fact Book 2023-2024*, 2023, <https://energy-information.canada.ca/sites/default/files/2023-10/energy-factbook-2023-2024.pdf>

day of natural gas in 2022 (2,595 trillion cubic feet).<sup>51</sup> At that level of consumption, Canada has 34 years of natural gas supply from proved gas reserves and 527 years from its technically recoverable natural gas resources. Like the U.S., Canada has vast gas hydrate resources.<sup>52</sup>

Canada's natural gas market is heavily integrated with that of the U.S. largely because of the location of supply basins, demand centers, and the availability of transportation infrastructure, as well as existing Canada-U.S. trade agreements. These factors allow for consumers and distributors on either side of the border to freely access natural gas from the lowest cost supplier. Canada exported 8.2 billion cubic feet per day of natural gas to the U.S. and imported 2.4 cubic feet per day from the U.S. in 2022.<sup>53</sup>

### Canada Coal Resources

IER estimates Canada's technically recoverable coal resources at 9.6 billion short tons and its proved coal reserves at 7.3 billion short tons—the same amount as in IER's 2011 report. Canada produced 52.5 million short tons of coal in 2021 and consumed 24 million short tons, exporting the rest.<sup>54</sup> At that consumption rate Canada's proved coal reserves would last 304 years and its technically recoverable coal resources would

last 400 years. Like the U.S., Canada is reducing its consumption of coal in the generation sector. Between 2010 and 2021, Canada's electric utility consumption of coal dropped 58 percent.<sup>55</sup>

### Mexico Oil Resources

Mexico's in place oil resources are estimated at 418 billion barrels with technically recoverable resources estimated at 30.6 billion barrels.<sup>56</sup> As of January 2023, Mexico's proved oil reserves were 6.0 billion barrels, including crude oil, lease condensate, natural gas liquids, and oil sands.<sup>57</sup> The Sureste Basin, which is located mostly offshore of Mexico's southeast coast (previously known as the Campeche Basin) accounts for 81 percent of those reserves. Mexico's reserves are located 70 percent offshore (primarily in the Sureste Basin, which straddles both the onshore and offshore) and 30 percent onshore (primarily in the Tampico-Misantla Basin). Currently, no known reserves exist in deepwater.<sup>58</sup> Mexico produced an average of 1.9 million bpd of oil and other liquids in 2022. Mexico's production peaked in 2004 at 3.8 million bpd.<sup>59</sup>

Mexico's energy sector has stagnated primarily due to policies of the López Obrador administration to roll back the 2013 reforms of the Enrique Peña Nieto administration and restore the near monopoly of

<sup>51</sup> *Id.*

<sup>52</sup> Petroleum Technology Alliance of Canada, *Unconventional Gas Technology Roadmap*, June 2006, <https://www.ptac.org/wp-content/uploads/2016/08/ptac-ugtr.pdf>

<sup>53</sup> Natural Resources Canada, *Energy Fact Book 2023-2024*, 2023 <https://energy-information.canada.ca/sites/default/files/2023-10/energy-factbook-2023-2024.pdf>

<sup>54</sup> *Id.*

<sup>55</sup> *Id.*

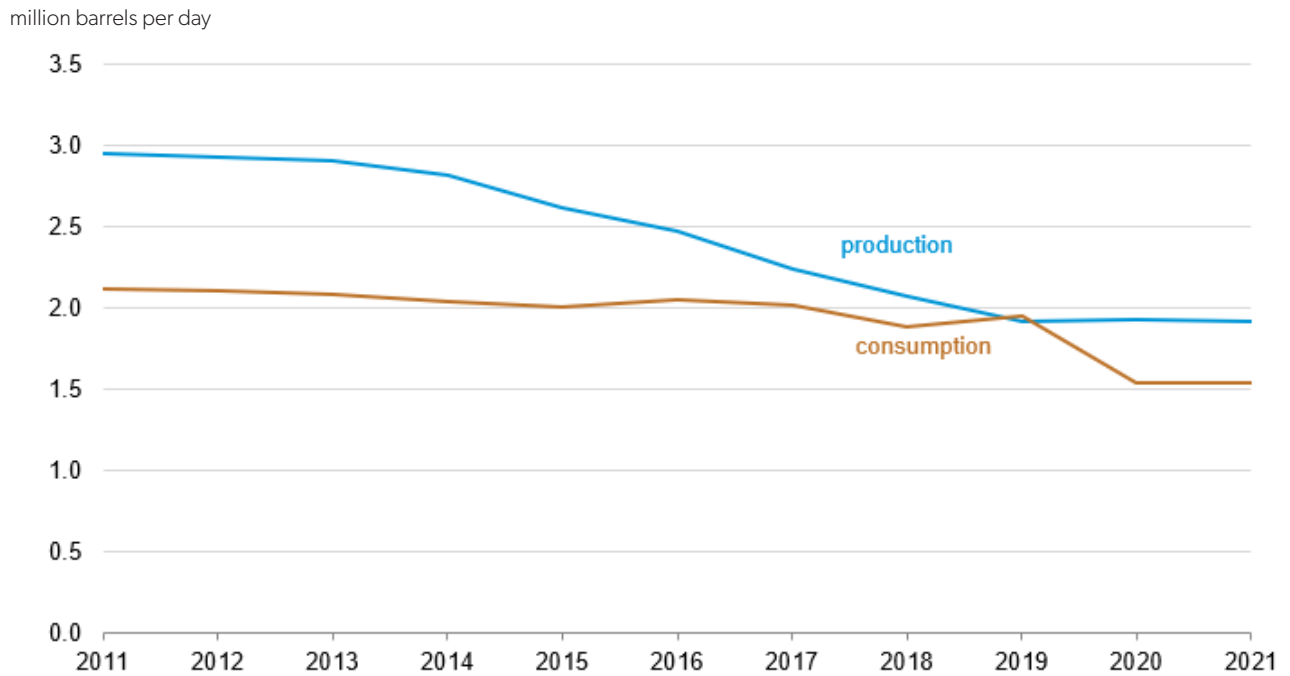
<sup>56</sup> Base de Datos Institucional de Pemex y Comisión Nacional de Hidrocarburos, *Hydrocarbon Information System* (Accessed January 16, 2024), <https://sih.hidrocarburos.gob.mx/> and U.S. Energy Information Administration, *Technically Recoverable Shale Oil and Shale Gas Resources: Mexico*, September 2015, [https://www.eia.gov/analysis/studies/worldshalegas/pdf/Mexico\\_2013.pdf](https://www.eia.gov/analysis/studies/worldshalegas/pdf/Mexico_2013.pdf)

<sup>57</sup> U.S. Energy Information Administration, *Mexico Analysis Brief*, March 31, 2023, <https://www.eia.gov/international/analysis/country/MEX>

<sup>58</sup> *Id.*

<sup>59</sup> *Id.*

## MEXICO LIQUID FUELS PRODUCTION AND CONSUMPTION (2011-2021)



Data source: U.S. Energy Information Administration, *International Energy Statistics*

Source: <https://www.eia.gov/international/analysis/country/MEX>

Pemex, Mexico's state-owned oil company, that dates back to the 1960s.<sup>60</sup> Since 2019, however, Mexico's production declines have slowed as private investment has increased and condensate production has risen. In 2019, Pemex accounted for 96 percent of oil production while private firms accounted for 4 percent, a growing share since 2017.<sup>61</sup> As of December 2022, private companies accounted for 6 percent of production.<sup>62</sup> Mexico is capable of producing and finding more energy. However, a reversion back to a

state owned monopoly structure means that they are limited more by policy than by geology.

### Mexico Natural Gas Resources

Mexico's in place natural gas resources are estimated at 2,266 trillion cubic feet and its technically recoverable resources are estimated at 577 trillion cubic feet. Mexico has 11 trillion cubic feet of proved natural gas

<sup>60</sup> Baker Institute for Public Policy Center for the U.S. and Mexico, *Mexico Country Outlook 2024*, January 18, 2024, <https://www.bakerinstitute.org/research/mexico-country-outlook-2024>

<sup>61</sup> U.S. Energy Information Administration, *Mexico Analysis Brief*, March 31, 2023, <https://www.eia.gov/international/analysis/country/MEX>

<sup>62</sup> *Id.*

reserves, coming primarily from Mexico's southern region, the Sureste Basin and Veracruz Basin.<sup>63</sup> Mexico produced 0.8 trillion cubic feet of dry natural gas in 2021.<sup>64</sup> Its dry natural gas production has decreased every year since a high of 2.1 trillion cubic feet in 2009.<sup>65</sup> Since its natural gas consumption is steadily increasing, it relies on the U.S. for much of its gas supplies. Like petroleum production, private production of natural gas accounted for 5 percent of total gas production in 2022 while Pemex produced

the remainder.<sup>66</sup> Private natural gas production was less than 1 percent of production in 2017.<sup>67</sup>

## Mexico Coal Resources

Mexico's in place coal resources are estimated at 3.3 billion short tons and its technically recoverable resources at 1.3 billion short tons<sup>68</sup>—the same as its coal reserves. Mexico produced and consumed less than 10 million short tons of coal in 2021.<sup>69</sup>

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63 Base de Datos Institucional de Pemex y Comisión Nacional de Hidrocarburos, *Hydrocarbon Information System* (Accessed January 16, 2024), <https://sih.hidrocarburos.gob.mx/>

64 U.S. Energy Information Administration, *Mexico Analysis Brief*, March 31, 2023, <https://www.eia.gov/international/analysis/country/MEX>

65 *Id.*

66 *Id.*

67 *Id.*

68 Global Energy Monitor, *Mexico and Coal*, GEM.wiki, July 27th, 2021, [https://www.gem.wiki/Mexico\\_and\\_coal#cite\\_note-BGR-2](https://www.gem.wiki/Mexico_and_coal#cite_note-BGR-2)

69 U.S. Energy Information Administration, *Mexico Analysis Brief*, March 31, 2023, <https://www.eia.gov/international/analysis/country/MEXf>

# THE BENEFITS OF THE U.S. LEADING THE WORLD IN OIL AND GAS PRODUCTION



It is almost impossible to overstate the myriad benefits to the U.S. of leading the world in oil and gas production. Abundant and reliable energy shields the U.S. from the vagaries of foreign risks. At least since the Arab embargo of the 1970s, far-flung events in history have led to expenditures of blood and treasure by Americans to ensure pathways of imported oil. Today, that no longer dominates our foreign policy objectives. Our energy security allows families and businesses to make plans for the future less encumbered by worries of price spikes caused by instability in oil-rich regions like the Middle East.

The production of oil and gas is also essential to the U.S. because it generates good skilled careers that pay well within the industry and throughout the larger economy. The industrial capacity to support drilling two or more miles vertically, turning a bit to allow horizontal drilling for another two miles, and extracting, transporting, and processing energy resources means factories and foundries and manufacturers of all products can

invest in facilities here at home knowing they have a stable supply of affordable and reliable energy right at their fingertips. Today's technologies also support technical engineering, earth science and other STEM-dependent careers (science, technology, engineering, and mathematics) throughout the value and supply chains. Oil and gas wells here at home are literally wells of wealth and opportunity for all Americans.

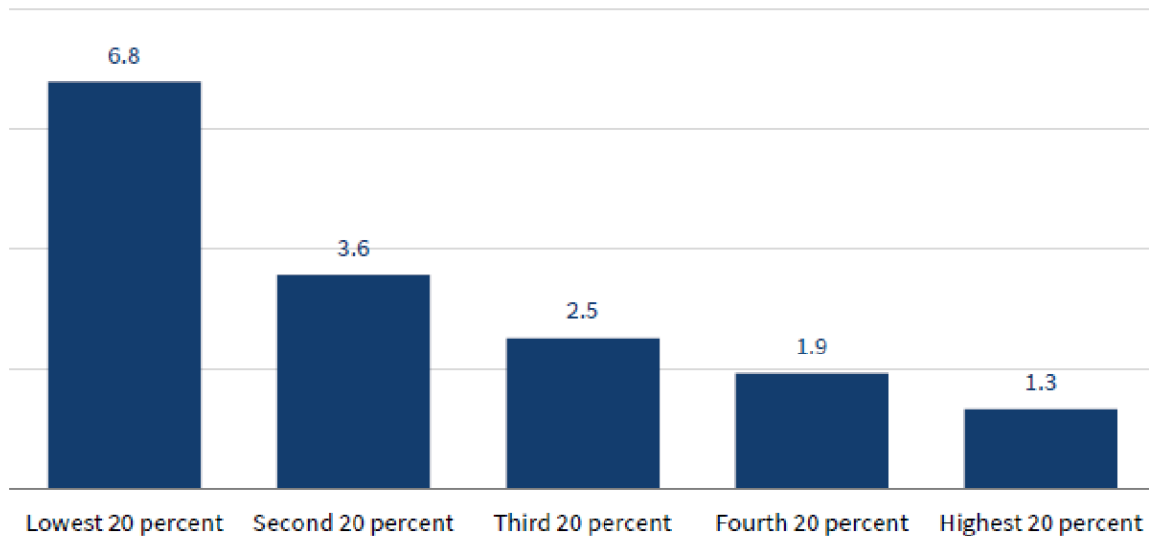
## Economic and Environmental Benefits

The results are manifest, according to the White House Council on Economic Advisors (CEA):

From 2007 to 2019, innovation in shale production brought an eight-fold increase in extraction productivity for natural gas and a nineteen-fold increase for oil. These productivity gains have reduced costs and spurred production to record-breaking levels. As a result, the U.S. has become

## CONSUMER SAVINGS AS A SHARE OF INCOME BY HOUSEHOLD INCOME QUINTILE

Share of income (percent)



Sources: Bureau of Labor Statistics; CEA calculations as described in the appendix.

Note: Values represent CEA's estimates of consumer savings as a share of pre-tax income in 2018.

Source: <https://trumpwhitehouse.archives.gov/wp-content/uploads/2019/10/The-Value-of-U.S.-Energy-Innovation-and-Policies-Supporting-the-Shale-Revolution.pdf>

the world's largest producer of both commodities, surpassing Russia in 2011 (for natural gas) and Saudi Arabia and Russia in 2018 (for oil).<sup>70</sup>

CEA went on to estimate that:

Greater productivity has reduced the domestic price of natural gas by 63 percent as of 2018 and led to a 45 percent decrease in the wholesale price of electricity. Shale production has also reduced the global price of oil by 10 percent as of 2019. By lowering energy prices, we estimate that the shale revolution saves U.S. consumers \$203 billion annually, or \$2,500 for a family of four. Nearly 80 percent of the total savings

stem from a substantially lower price for natural gas, of which more than half comes from lower electricity prices. Oil accounts for the other roughly 20 percent of the savings, most of which are transportation sector savings on fuel costs. Because low-income households spend a larger share of their income on energy bills, lower energy prices disproportionately benefit them: shale-driven savings represent 6.8 percent of income for the poorest fifth of households compared to 1.3 percent for the richest fifth of households. These consumer savings are in addition to economic benefits linked to greater employment in the sector.<sup>71</sup>

<sup>70</sup> The Council of Economic Advisers, *The Value of U.S. Energy Innovation and Policies Supporting the Shale Revolution*, The Executive Office of the President, Oct. 2019, <https://trumpwhitehouse.archives.gov/wp-content/uploads/2019/10/The-Value-of-U.S.-Energy-Innovation-and-Policies-Supporting-the-Shale-Revolution.pdf>

<sup>71</sup> *Id.*



All of this happened while U.S. carbon dioxide emissions dropped by 9 percent from 2005 levels.

### Lower Energy Prices from U.S. Energy Production Benefit Lower Income Earners

As made clear by the CEA report, those who benefit the most from lower costs for energy flowing from more production are those in the lowest income brackets. Nothing hurts the poor and those on fixed incomes more than increasing energy costs as they consume a higher percentage of their household budgets on energy. In addition, higher energy costs make employment opportunities more scarce. Higher energy costs mean businesses are more restrained in the work they do and the wages they can pay, or the investments they can make. Government policies that increase energy costs force people to use less and inordinately affect those who can least afford it.

### Jobs from Domestic Energy Production

The U.S. has enjoyed an explosion of job growth because of increased energy production and the accompanying lower-priced energy. In addition to the STEM jobs modern energy exploration, development, production, and transportation produce, lower energy prices act as “fertilizer” driving roots deep into the economic soil of the country. The need for skilled jobs on-site and all the equipment required means more Ford Super Duty trucks, Carhartt clothing, Caterpillar and John Deere equipment, as well as 18-wheeler trucks, trailers, and train cars, and more. All those new employees require housing, groceries, and services of

all kinds including medical, dental, and personal care, creating even more jobs for Americans.

The reduction in energy prices spins off demand for new investments here, as industries seek lower-cost energy and feedstocks for their enterprises. A review of the literature covering the early expansion (2006-2013) of natural gas production in the U.S. attributed a growth in manufacturing jobs of between 24,000 and 361,000 due to lower-cost energy, with up to 30% of jobs created in energy-intensive industries. In addition, an attraction of over \$200 billion in new chemical plant investments was announced in less than a decade, much from foreign firms seeking lower-priced energy and feedstocks available in the U.S.<sup>72</sup>

### Germany: The Flip Side of the Coin

Countries choosing to de-energize segments of their economy or replace on-demand energy with intermittent renewable energy soon learn that much of the progress they have made at bettering the lives of their people must be foregone because of the energy scarcity they create. Germany has long been the industrial center of Europe, making it the economic powerhouse of the continent. Beginning around 2010, Germany made a series of bad energy decisions and later was confronted with the reality of its growing dependence on Russian natural gas. Led by anti-nuclear and anti-hydrocarbon sentiment, Germany has become the worst-performing developed country,<sup>73</sup> and is facing a contraction of its economy.

Manufacturers in Germany are struggling, as prices escalate and their workers suffer steeply higher energy

<sup>72</sup> Keith B. Belton and John A. Rupp, *Job Creation from the US “Shale Gale,”* Indiana University Public Policy Institute, Issue 15, Sept. 2019, <https://policyinstitute.iu.edu/doc/mpi/insight/2019-09.pdf>

<sup>73</sup> The Institute for Energy Research, *Germany Went from the Best to the Worst Performing Developed Economy*, The Institute for Energy Research, Oct. 5th, 2023, <https://www.instituteforenergyresearch.org/international-issues/germany-went-from-the-best-to-the-worst-performing-developed-economy/>

bills at home.<sup>74</sup> Some German businesses have already moved operations to the U.S. in pursuit of lower priced energy. Others are considering doing so.<sup>75</sup>

## The European Union

Germany is not alone. Throughout the European Union (EU) energy prices are increasing despite the government putting more money into intermittent renewable sources of energy as part of its commitment to climate action.<sup>76</sup> “According to the European Commission, industrial output in the Euro area plummeted 5.8 percent in the 12 months ending November 2023. Capital goods production was down nearly 8.7 percent. Investment in plants and equipment has plummeted. Europe’s current account surplus, which has averaged more than 3 percent of GDP for decades, was wiped out in a single year by soaring energy imports.”<sup>77</sup>

This is what happens when nations refuse to use their own resources and reject what has proven to lift people out of poverty. With prices for electricity as much as three or four times higher because of a lack of domestic production of energy and reliance upon others, European energy prices are now subject to massive swings. As a result, businesses are averse to investing capital with unpredictable price inputs.

## The U.S. Model of Production of Resources Yields Enormous Benefits

The model of energy production in the U.S. is seldom mentioned, but it is critical to understanding America’s oil and gas success over the last 15 years. The key to this model is private property.

In the U.S., private landowners generally own both rights to the surface and the subsurface mineral rights. In property rights arrangements around the world, private ownership of the subsurface is rare. For example, even in Canada, the private owners of surface rights do not generally own mineral or subsurface rights. Instead, those mineral rights are publicly owned by the Crown through the federal or the provincial government.<sup>78</sup>

While there is substantial oil and gas production on U.S. federal lands, the majority occurs on private lands. Private ownership of mineral rights means that oil and gas production is more controlled by people making market decisions rather than political decisions. Government control of resources leads to more decisions being made by political decisions and actors.

The federal government manages a mineral estate of 700 million acres onshore and 1.76 billion acres offshore, for a total of 2.46 billion acres. The total surface land area of the U.S. is 2.263 billion acres. Private and state lands, at 1.563 billion surface acres,

<sup>74</sup> David McHugh, *Germany went from envy of the world to the worst-performing major developed economy. What happened?*, Associated Press, Sept. 19th, 2023, [https://apnews.com/article/germany-economy-energy-crisis-russia-8a00eebbfab3f20c5c66b1cd85ae84ed?taid=6509662a0289550001ea5c3f&utm\\_campaign=TrueAnthem&utm\\_medium=AP&utm\\_source=Twitter](https://apnews.com/article/germany-economy-energy-crisis-russia-8a00eebbfab3f20c5c66b1cd85ae84ed?taid=6509662a0289550001ea5c3f&utm_campaign=TrueAnthem&utm_medium=AP&utm_source=Twitter)

<sup>75</sup> Hannah Ward-Glenton, *German Energy Prices Are So High They’re Driving Companies to Relocate, Industry Body Says*, CNBC, June 21<sup>st</sup>, 2023, <https://www.cnbc.com/2023/06/21/high-german-energy-prices-are-seeing-some-companies-relocate-bdi.html>

<sup>76</sup> Directorate General Economic and Financial Affairs, *Developments in Energy Prices in the Euro Area and Policy Responses*, European Commission, Dec. 1st, 2023, [https://www.consilium.europa.eu/media/69388/eg\\_energy-prices-and-competitiveness-note\\_final-to-eg-for-publication.pdf](https://www.consilium.europa.eu/media/69388/eg_energy-prices-and-competitiveness-note_final-to-eg-for-publication.pdf)

<sup>77</sup> Mario Loyola, *High Electricity Prices Have Europe Facing Deindustrialization; Don’t Let it Happen Here*, The Hill, Jan. 28th, 2024, <https://thehill.com/opinion/energy-environment/4426579-high-electricity-prices-have-europe-facing-deindustrialization-dont-let-it-happen-here/>

<sup>78</sup> Lexpert.com, *Surface rights: what it means for landowners*, Aug. 14, 2023, <https://www.lexpert.ca/legal-faq/surface-rights-what-it-means-for-landowners/378700>.

make up only 39 percent of the total onshore and offshore subsurface area. The federal government owns 61 percent of the U.S. onshore and offshore mineral estate, but only 25 percent of the nation's oil and 11 percent of our natural gas comes from those federal lands and waters. And that number is declining.<sup>79</sup>

Private decision-making in oil and gas production is one of the keys that separates the United States from the rest of the world. Private ownership was one of the key factors of the hydraulic fracturing revolution. There are potential shale plays around the world, but the shale resources on private lands in the U.S. is where the shale revolution began and has flourished. States hold most of the regulatory power over private lands, which makes sense since they are more knowledgeable about local conditions than a faraway government in Washington, D.C. As a result, oil and gas production on those lands has boomed in the United States over the past 15 years.

Private ownership of the majority of oil and gas production has reduced the ability of OPEC+ to dictate the price of oil. OPEC+ is composed of governments and for much of 2023 into 2024, they tried to drive up the price of oil. However, increased oil production from the United States thwarted their efforts. It is the private control of oil and gas that has led to more stable prices as decisions have been driven by market factors more than political factors.

Energy decisions driven by market considerations give us more stability in energy prices, unlike the destabilizing effects of volatile prices currently being suffered in Europe. In the U.S., businesses and families are able to plan and budget energy costs more closely.

Instability in energy pricing created by market

distortions is a major risk factor for anyone planning or preparing new investments, whether purchasing a car or appliance, or for a business owner, an entirely new factory. American energy abundance provides stability and provides a buffer against such risk.

While private property is a key factor driving the growth in oil and gas production, coal production has been heavily impacted by political decisions. One of the main reasons is that much of the coal resources in the U.S. are located on federal lands. Also, federal regulations have greatly hindered the use of coal for electricity generation in the U.S.

*Private decision-making in oil and gas production is one of the keys that separates the United States from the rest of the world.*

In the U.S., political factors work against coal use, but in other countries, such as China, India, and South Africa, the politics have been substantially different. For the Chinese, the abundant production of coal has been critical to powering their economy. As a result, China now produces eight times as much coal as the U.S. while consuming nine times as much coal as the U.S.<sup>80</sup> This is even though the U.S. has the largest-in-the-world coal reserves.<sup>81</sup>

<sup>79</sup> Institute for Energy Research, Oil and Natural Gas Production on Federal and Non-Federal Lands, Dec. 7. 2021, <https://www.instituteforenergyresearch.org/fossil-fuels/gas-and-oil/oil-and-natural-gas-production-on-federal-and-non-federal-lands/>

<sup>80</sup> Energy Institute, *Statistical Review of World Energy 2023, Coal Production and Coal Consumption*, p. 39 and p. 42, [https://www.energyinst.org/\\_\\_\\_data/assets/pdf\\_file/0004/1055542/EI\\_Stat\\_Review\\_PDF\\_single\\_3.pdf](https://www.energyinst.org/___data/assets/pdf_file/0004/1055542/EI_Stat_Review_PDF_single_3.pdf)

<sup>81</sup> Energy Institute, *Statistical Review of Energy Data 2023, Coal Reserves*, [https://www.energyinst.org/\\_\\_\\_data/assets/excel\\_doc/0007/1055545/EI-stats-review-all-data.xlsx](https://www.energyinst.org/___data/assets/excel_doc/0007/1055545/EI-stats-review-all-data.xlsx).

## Environmental Excellence

As Americans have become wealthier through the production and use of our domestic natural resources, one of the enduring success stories too infrequently told is that we are doing this while improving the environment at the same time. The EPA has reported that even as our GDP has increased by 304 percent, vehicle miles traveled by 186 percent, population by 62 percent, and energy consumption by 48 percent over the past 70 years, the worst pollutants have dropped 78 percent.<sup>82</sup>

Moreover, it matters where our energy comes from. For example, the U.S. leads the world in state-of-the-art, technically advanced, oil and gas operations.<sup>83</sup> IER's 2023 *Environmental Quality Index*, quantifies the environmental gap between the U.S. and other oil and gas producing countries. It does so by creating an environmental quality score, weighted by production, for oil and gas production in countries around the world using the well-known Environmental Performance Index (EPI) produced by Yale University. Using 40 performance indicators across 11 issue categories, the EPI ranks 180 countries on a scale from 0 (low score) to 100 (perfect score) on environmental health, ecosystem vitality, and other factors.

According to the report:

- For the 20 largest oil-producing countries outside the U.S., the average EPI environmental score, weighted by liquid fuels production, is 39. When compared to the U.S. EPI score of 51.1, it means the average barrel of non-U.S. petroleum is produced in a country with an environmental score that is 23.6 percent lower than that of the U.S.
- For the 20 largest non-U.S. natural gas producers, the average EPI environmental score weighted by production is only 38.6. So compared to the 51.1

*Americans have become wealthier through the production and use of our domestic natural resources...while improving the environment at the same time.*

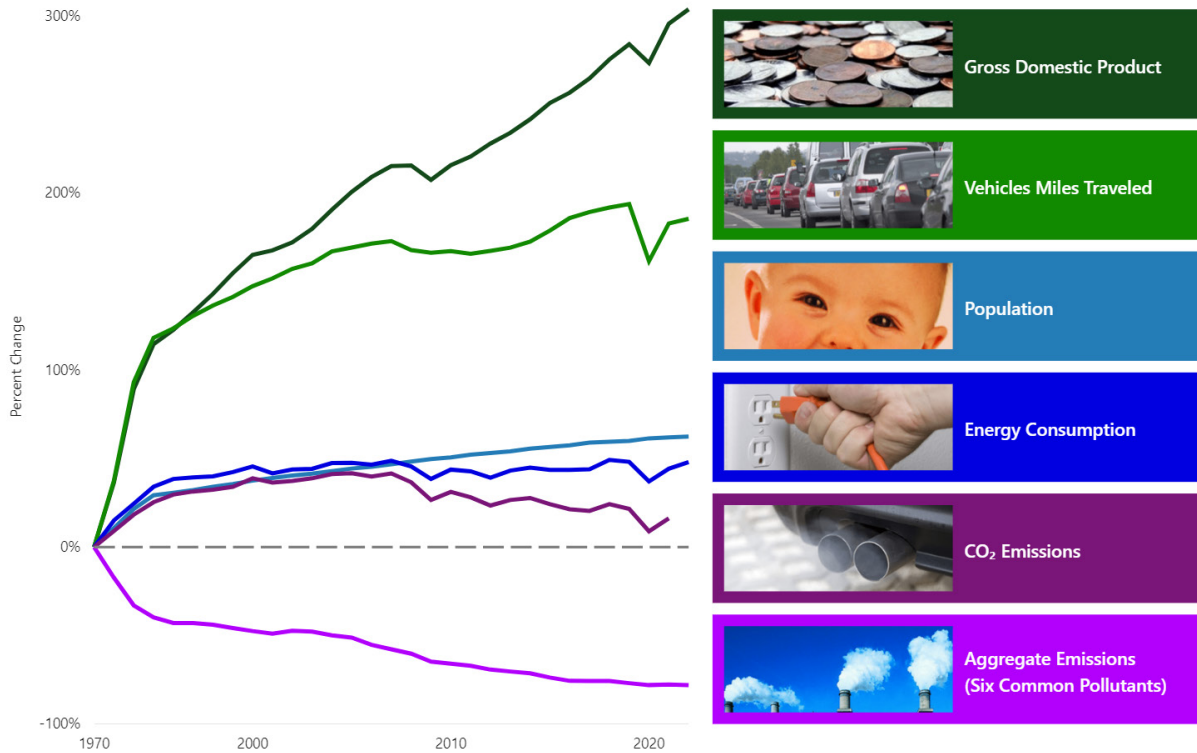
EPI score of the U.S., the average bcf of natural gas is produced in a country with an environmental score that is 24.5 percent lower than that of the U.S.

- The U.S., the world's largest producer of both oil and natural gas, is only outranked on environmental quality by 3 of the top 20 oil producers and 3 of the top gas producers. None of those countries produce even one-quarter of the volumes of oil or natural gas coming from the U.S. Indeed, all oil production from countries scoring higher on environmental quality amounts to only 35.7 percent of U.S. production, and that from gas-producing countries is only 33.4 percent of U.S. production. The sheer size of U.S. production combined with its excellent environmental standards means that U.S. production disproportionately reduces the environmental impacts of oil and gas production on a global scale.
- U.S. production of crude oil and natural gas has increased over the last 40 years, while pollution and emissions have steadily declined across sources at the same time.

82 U.S. Environmental Protection Agency, *Our Nation's Air: Trends Through 2022*, [https://gispub.epa.gov/air/trendsreport/2023/#growth\\_w\\_cleaner\\_air](https://gispub.epa.gov/air/trendsreport/2023/#growth_w_cleaner_air)

83 David W. Kreutzer & Paige Lambermont, *The Environmental Quality Index: Environmental Quality Weighted, Oil and Gas Production*, <https://www.instituteforenergyresearch.org/wp-content/uploads/2023/02/IER-EQI-2023.pdf>.

### COMPARISON OF GROWTH AREAS AND DECLINING EMISSIONS, 1970-2022



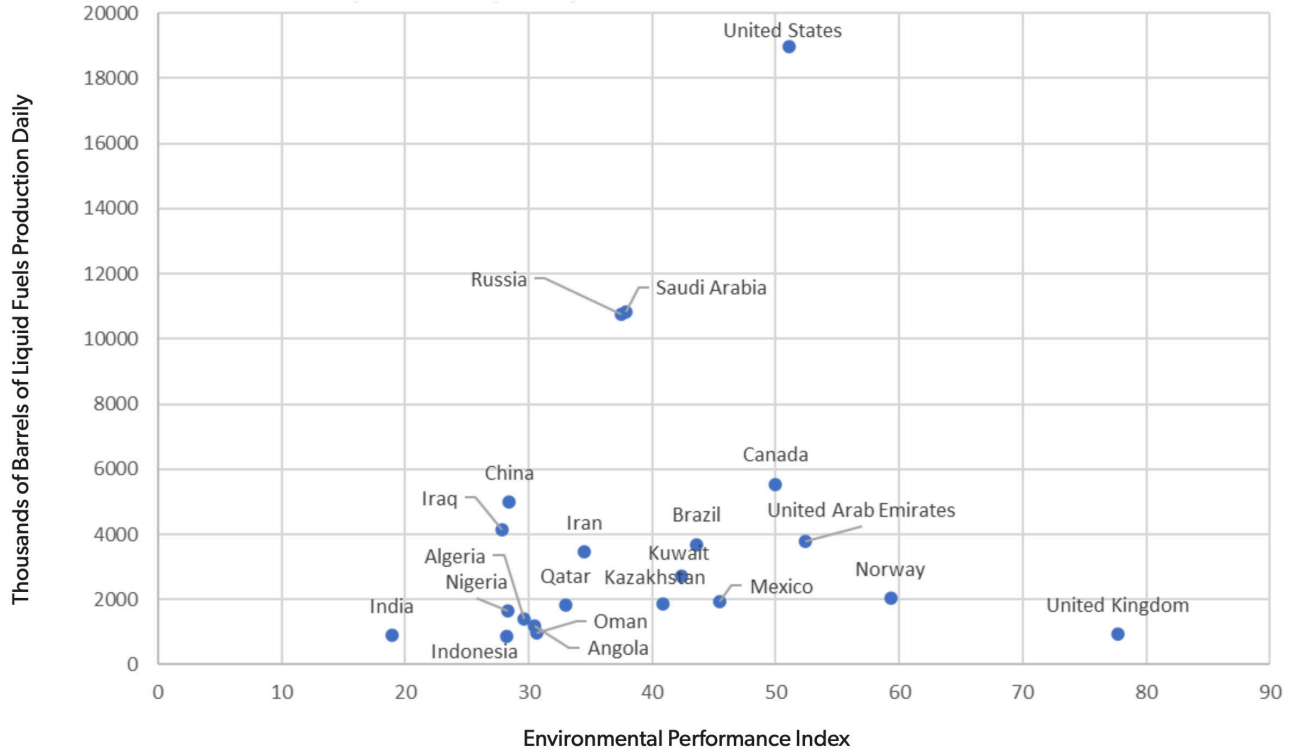
Source: [https://gispub.epa.gov/air/trendsreport/2023/#growth\\_w\\_cleaner\\_air](https://gispub.epa.gov/air/trendsreport/2023/#growth_w_cleaner_air)

- Contrary to popular media characterizations, wealth created by energy development in free economies enhances environmental performance while making people’s lives better.

Exploring, developing, producing, and transporting energy in the U.S. contributes to our economy and

environment, but also improves the global environment. Given that we have such enormous energy riches in the U.S., and it is the most environmentally friendly place in which to produce, it defies logic that anyone who is concerned about the environment would oppose producing more of it here at home.

### ENVIRONMENTAL PERFORMANCE INDEX AND PRODUCTION BY COUNTRY AMONG TOP LIQUID FUELS PRODUCERS IN 2021



Source: Yale EPI data and U.S. Energy Information Administration data

Source: <https://www.instituteforenergyresearch.org/wp-content/uploads/2023/02/IER-EQI-2023.pdf>

# BENEFITS OF DOMESTIC OIL, NATURAL GAS, AND COAL PRODUCTION—IMPROVED ENERGY SECURITY



The growth of U.S. oil and natural gas production in the past 15 years, and since the publication of the previous inventory, has completely reordered U.S. geopolitical priorities. Historic dependence on Middle East-sourced oil has been supplanted by American domestic production, largely due to the shale revolution. Coupled with America's expansion of natural gas, the U.S. is now more judicious in foreign intervention with respect to securing imported energy supplies.

For over 50 years, U.S. foreign policy has been dominated, in part, by fears of oil shortages and conflicts which resulted in oil price volatility. A significant portion of the world's crude oil production is located in countries where political unrest is quite common. This unrest is a constant threat to disrupt the

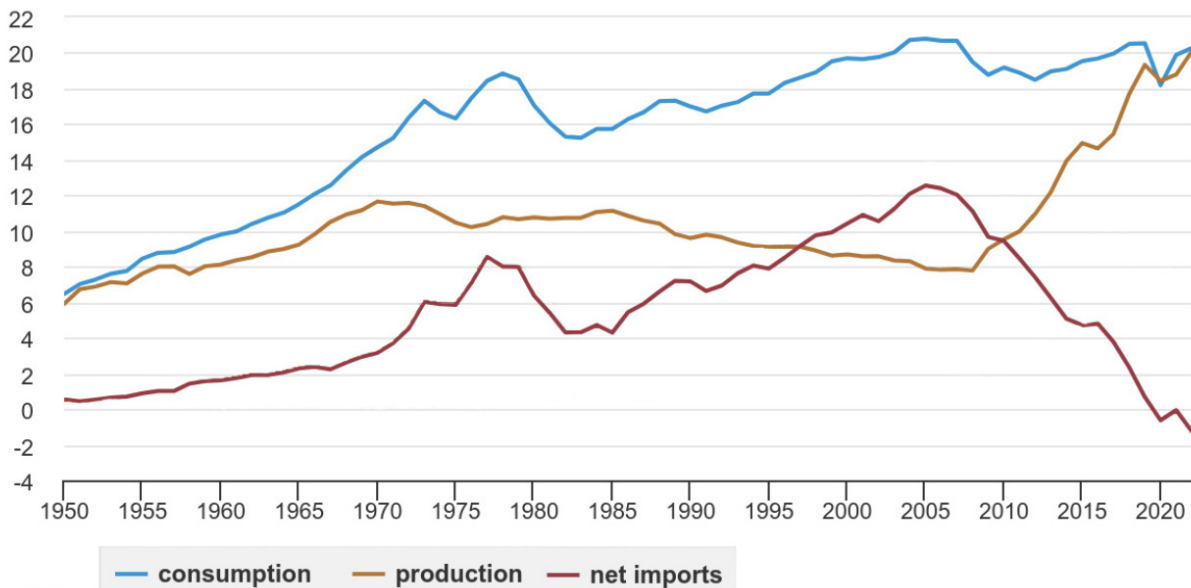
supply of oil to global markets. By the early 2000s, the U.S. had become heavily dependent on imported oil. In 2006, imports accounted for an astounding 60 percent of all U.S. oil consumption.<sup>84</sup> As indicated by the charts below, maximum import dependence peaked in August 2006 at an alarming 4.5 million bpd. As a result of excessive dependence on foreign oil, the U.S. placed itself at the mercy of unstable foreign regimes. It also led to government interventions that placed an emphasis on reducing our dependence on foreign oil either by demand reduction policies or the promotion of alternative sources of energy such as ethanol, synthetic fuels, wind power, and solar power.

As illustrated by the graphic below, swings in oil prices have directly correlated to notable events from the region, such as the Arab Oil Embargo of 1973, which

<sup>84</sup> The Independent Task Force on Energy and U.S. Foreign Policy, *National Security Consequences of U.S. Oil Dependency: Independent Task Force Report No. 58*, Council on Foreign Relations, 2006, [https://cdn.cfr.org/sites/default/files/report\\_pdf/0876093659.pdf?\\_gl=1\\*1okxi27\\*\\_ga\\*MjA4NzU1OTEyNS4xNzAxMzcyMjcy\\*\\_ga\\_24W5E70YKH\\*MTcwODExNzI3Ni4xMy4xLjE3MDgxMTczMDluMzQuMC4w](https://cdn.cfr.org/sites/default/files/report_pdf/0876093659.pdf?_gl=1*1okxi27*_ga*MjA4NzU1OTEyNS4xNzAxMzcyMjcy*_ga_24W5E70YKH*MTcwODExNzI3Ni4xMy4xLjE3MDgxMTczMDluMzQuMC4w)

## U.S. PETROLEUM CONSUMPTION, PRODUCTION, & NET IMPORTS, 1950-2022

million barrels per day



Data source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 3.1, September 2023

Source: [https://www.eia.gov/dnav/pet/pet\\_move\\_impcus\\_a2\\_nus\\_epc0\\_im0\\_mbb\\_l\\_a.html](https://www.eia.gov/dnav/pet/pet_move_impcus_a2_nus_epc0_im0_mbb_l_a.html)

saw prices jump to \$20.20 per barrel (adjusted for inflation) and the Iran-Iraq war of 1980, which saw prices rise to \$95.42 per barrel (adjusted for inflation).<sup>85</sup>

### Crude Oil Prices and Key Geopolitical and Economic Events

As a result of American dependence on foreign oil, the U.S. has felt compelled to build a military presence in multiple nations throughout the Middle East, frequently in countries that were not entirely welcoming of that presence. The U.S. has additionally intervened militarily in numerous conflicts in the region, often in the name of protecting global oil supplies, resulting in the deaths

of thousands of American service members. America's reliance on foreign oil, and the subsequent decades-long deployment of military resources to protect oil supply chains, has drained substantial wealth and resources that could have been better used elsewhere.

The recent growth of American oil production to record levels changes the geopolitical calculation that those decades of intervention were based on. While the U.S. is still impacted by global oil price fluctuations, there is no longer any concern about shortages or lack of supply domestically.

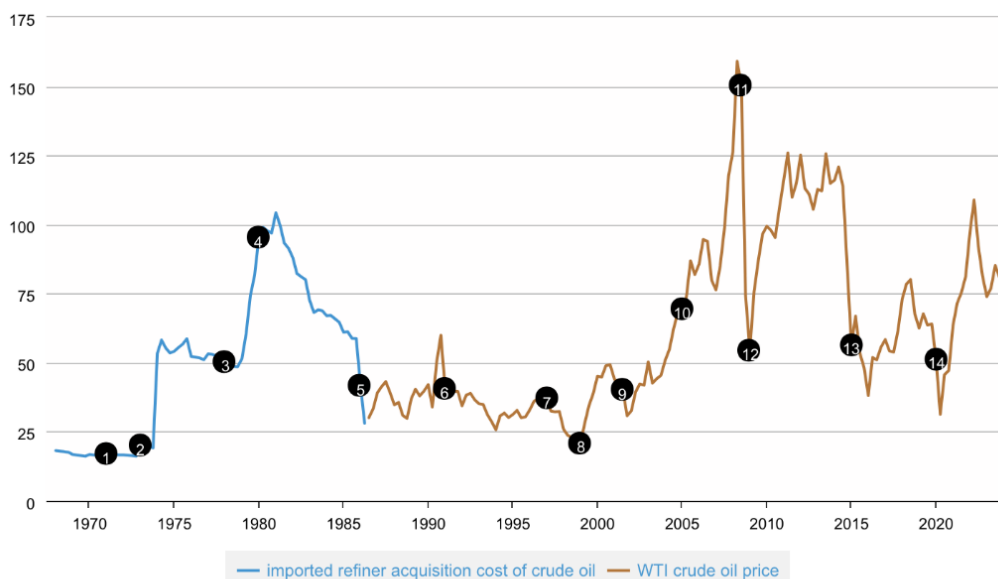
The production increases have also provided the U.S. with the ability to become the largest exporter of LNG

<sup>85</sup> U.S. Energy Information Administration, *What Drives Crude Oil Prices: Spot Prices*, Dec. 31st, 2023, [https://www.eia.gov/finance/markets/crudeoil/spot\\_prices.php#:~:text=Several%20major%20oil%20price%20shocks,Persian%20Gulf%20War%20in%201990.](https://www.eia.gov/finance/markets/crudeoil/spot_prices.php#:~:text=Several%20major%20oil%20price%20shocks,Persian%20Gulf%20War%20in%201990.)



## CRUDE OIL PRICES AND KEY GEOPOLITICAL AND ECONOMIC EVENTS

\$/b (real 2022 dollars)



Data source: U.S. Energy Information Administration, Refinitiv An LSEG Business

Updated: Quarterly | Last Updated: 12/31/2023

- |                                       |  |
|---------------------------------------|--|
| 1: US spare capacity exhausted        | 8: OPEC cuts production targets 1.7 mmbpd  |
| 2: Arab Oil Embargo                   | 9: 9-11 attacks                            |
| 3: Iranian Revolution                 | 10: Low spare capacity                     |
| 4: Iran-Iraq War                      | 11: Global financial collapse              |
| 5: Saudis abandon swing producer role | 12: OPEC cuts production targets 4.2 mmbpd |
| 6: Iraq invades Kuwait                | 13: OPEC production quota unchanged        |
| 7: Asian financial crisis             | 14: Global pandemic reduces oil demand     |

Source: [https://www.eia.gov/dnav/pet/pet\\_move\\_impcus\\_a2\\_nus\\_epc0\\_im0\\_mbbLa.html](https://www.eia.gov/dnav/pet/pet_move_impcus_a2_nus_epc0_im0_mbbLa.html)

and the fourth largest exporter of oil.<sup>86</sup> Increased production has enabled U.S. natural gas producers to stabilize electricity prices in Europe following Russia’s invasion of Ukraine.<sup>87</sup> Furthermore, without the record expansion of domestic production, the sanctions implemented against Venezuela in 2019<sup>88</sup> would not

have been possible a mere decade ago out of fear of losing their oil supply.

Record American production, which reached over 13.3 million barrels per day in December 2023, has allowed the U.S. to pick and choose what conflicts to

<sup>86</sup> OPEC, *Data Download, Table 5.2 World crude oil exports by country*, [https://asb.opec.org/data/ASB\\_Data.php](https://asb.opec.org/data/ASB_Data.php).

<sup>87</sup> Ashish Kumar Sen, *A Look at the Implications of Trump’s Decision to End Sanctions Waivers for Countries Importing Iranian Oil*, Atlantic Council, April 22<sup>nd</sup>, 2019, <https://www.atlanticcouncil.org/blogs/new-atlanticist/trump-ends-sanctions-waivers-for-countries-importing-iranian-oil/>

<sup>88</sup> U.S. Department of the Treasury, *Treasury Sanctions Venezuela’s State-Owned Oil Company Petroleos de Venezuela, S.A.*, Jan. 28<sup>th</sup>, 2019, Press Releases, <https://home.treasury.gov/news/press-releases/sm594>

intervene in, both in the Middle East and elsewhere.<sup>89</sup> Fear of losing vital energy supplies no longer dominates foreign policy discussions like in the past. The reason for this is evident when comparing the large oil price fluctuations during past conflicts, such as the ones from the image above, and the price of oil from January 2023 to today, which has remained remarkably stable.

The price stability is surprising given ongoing conflicts happening around the world impacting oil producing countries: civil war in Libya, civil war in Sudan, the Houthis in Yemen attacking shipping in the Red Sea,<sup>90</sup> Iran harassing shipping through the Strait of Hormuz, Venezuela threatening to invade Guyana,<sup>91</sup> the Israel-Hamas war, and embargo and price cap efforts restricting Russian oil exports. With all this conflict and instability, oil prices would have certainly been more volatile in the past.

As mentioned above, oil markets are not alone in being impacted by expanded American production. U.S. LNG exports, having grown rapidly, are now having a similar stabilizing effect globally. After a brief spike at the start of the Russian invasion of Ukraine, natural gas prices have rebalanced, and Europe has been able to a large degree replace Russian gas supplies with U.S. LNG. However, this stability could be threatened due to government policies like the recently imposed freeze in licenses for new LNG export facilities.<sup>92</sup>

It is hard to overstate how significant this change in energy outlook is, and the very short time over which this change has occurred. Looking back just 20 years, the Bush administration was obsessed with securing oil supplies. Today, much of the Middle East is consumed by conflicts of varying intensity, but oil markets barely notice, and Americans notice even less. This is overwhelmingly due to U.S. production increases.

89 Matt Egan, *The United States is Producing More Oil Than Any Country in History*, CNN, Dec. 19<sup>th</sup>, 2023, <https://www.cnn.com/2023/12/19/business/us-production-oil-reserves-crude/index.html>

90 Caleb Jasso, *Houthi Attacks Continue, Iran Launches Their Own*, The Institute for Energy Research, Jan. 19<sup>th</sup>, 2024, <https://www.instituteforenergyresearch.org/international-issues/houthi-attacks-continue-iran-launches-their-own/>

91 Luke Taylor, *'People are fearful': Guyana alert for land grab by Venezuela*, The Guardian, Sept. 9<sup>th</sup>, 2023, <https://www.theguardian.com/world/2023/dec/09/us-flyover-guyana-venezuela-border-disputed-territory>

92 The Institute for Energy Research, *Biden is on the Warpath Against New LNG Facilities*, January 26, 2024, <https://www.instituteforenergyresearch.org/fossil-fuels/gas-and-oil/biden-is-on-the-warpath-against-new-lng-facilities/>

# WHAT ARE THE IMPEDIMENTS TO DOMESTIC OIL, NATURAL GAS, AND COAL PRODUCTION?



As this report shows, consistent with IER's 2011 *Inventory*, the U.S. has massive oil, natural gas, and coal resources—enough for hundreds of years to come. Often, the biggest impediment to the exploration, production, and use of these energy resources is regulatory policy.

## Regulatory Impediments to Energy Production

The current administration has been aggressively anti-oil and natural gas. IER has chronicled hundreds of actions taken by the government to make it harder to produce domestic oil and natural gas in the future.<sup>93</sup> Some of these impediments include rescinding the previous administration's attempts to

*The U.S. has massive oil, natural gas, and coal resources—enough for hundreds of years to come.*

streamline regulations on American energy production, promulgating a five-year offshore plan with only three lease sales (the fewest in history), canceling the Keystone XL pipeline, imposing a moratorium on new oil and natural gas leases, halting approvals for new LNG export terminals, and many more.

Despite these regulatory actions, oil and gas production

<sup>93</sup> "Institute for Energy Research, *200 Ways the Biden Administration and Democrats Have Made It Harder to Produce Oil & Gas*, March 7, 2024. <https://www.instituteforenergyresearch.org/regulation/200-ways-the-biden-administration-and-democrats-have-made-it-harder-to-produce-oil-gas/>.

has continued to grow in the U.S. There are two main reasons for this. The first reason is that the majority of oil and natural gas production now occurs on private and state lands and not on federal lands. Texas alone produces over 40 percent of the nation's oil<sup>94</sup> and almost all of that occurs on private lands.

The second reason that oil and natural gas production has continued to increase despite the wave of regulatory impediments is that the rule of law still protects producers on federal land who have valid permits. Some projects, especially offshore projects which occur in federal waters, can take over a decade from lease sale to actual production. The law generally prohibits a new administration from stopping production that's already occurring. But these regulatory actions, absent a total reversal by future administrations, will likely have a major impact on future production.

Coal production in the U.S. is also hindered by regulatory impediments both directly and indirectly. Unlike oil and natural gas, which is found on private, state, and federal lands, coal is located largely on federal lands. Wyoming produces over 40 percent of the nation's coal,<sup>95</sup> almost all of which is located on federal lands. As a result, federal policies can more easily impact coal production and consumption. For example, the Obama administration imposed a complete moratorium on new coal leases in 2016 to reduce coal production.

Besides working to reduce coal production, the Obama administration and now the Biden administration put forward regulations to reduce coal demand. For example, the Obama administration imposed a Mercury Air Toxics Standards rule to harm the prospects of coal

*Coal production in the U.S. is also hindered by regulatory impediments both directly and indirectly. Unlike oil and natural gas, which is found on private, state, and federal lands, coal is located largely on federal lands.*

use that was eventually deemed illegal by the U.S. Supreme Court. Even though it was eventually struck down, the rule had its intended effect. As President Obama's EPA administrator Gina McCarthy said, "even if we don't [win at the Supreme Court], it was three years ago [that we finalized the rule]. Most of [the utilities] are already in compliance, investments have been made..."<sup>96</sup>

Another key to reducing coal production in the U.S. has been generous federal subsidies for wind and solar production. The subsidies, such as the wind production tax credit, incentivizes wind producers to produce electricity no matter the value to the grid. Fluctuating wind generation on the grid means fewer hours that coal plants can run, harming the economics of coal plants. Existing coal plants are made to be base

94 U.S. Energy Information Administration, *Crude Oil Production*, [https://www.eia.gov/dnav/pet/pet\\_crd\\_crpdn\\_adc\\_mbbldpd\\_m.htm](https://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbldpd_m.htm)

95 U.S. Energy Information Administration, *Quarter Coal Report, Table 2. Coal production by state*, <https://www.eia.gov/coal/production/quarterly/pdf/t4p01p1.pdf>.

96 Timothy Cama and Lydia Wheeler, *Supreme Court overturns landmark EPA air pollution rule*, The Hill, June 29, 2015, <https://thehill.com/policy/energy-environment/246423-supreme-court-overturns-epa-air-pollution-rule/>.

load plants and cannot efficiently ramp up and down in response to intermittent renewables. Because of government policies, wind and solar units are generally dispatched before coal units. As a result, the capacity factors of many coal units have fallen to the point that many are no longer economic and have retired prematurely.

Due to these and other regulations, combined with the surplus of natural gas available for electricity generation, coal production has fallen in the U.S., even though the U.S. has the largest coal resources in the world. From 2009 (the beginning of President Obama's first term) through 2022, coal production has fallen by 45 percent.<sup>97</sup>

### Other Impediments

Besides the regulatory impediments to domestic oil, natural gas, and coal production, there are other significant impediments to note. The Biden administration has taken an all-of-government approach to attacking domestic oil, natural gas, and coal production and use. For example, both the

Consumer Products Safety Commission (CPSC) and the Department of Energy announced plans to regulate natural gas stoves (though Congress recently passed a law prohibiting the CPSC from banning them). The Department of Energy has also proposed strict regulations on natural gas water heaters and furnaces.

Besides working to reduce demand for natural gas through these regulations, the Biden administration is also working to reduce demand for oil from cars and trucks through three different regulatory approaches—EPA's regulation on carbon dioxide emissions from vehicles, National Highway Traffic Safety Administration's (NHTSA) fuel economy standards, and EPA considering whether to grant a waiver to California allowing them (and other states) to effectively ban vehicles with internal combustion engines.

Another challenge for oil, natural gas, and especially coal companies is in raising capital. For several years, anti-fossil fuel activists have pushed to cut off access of oil, natural gas, and coal companies to financial markets through the promotion of Environmental, Social and Governance (ESG) investing. As a result, many banks have stated they will not lend to oil, natural gas,<sup>98</sup> or coal companies.<sup>99</sup>

<sup>97</sup> U.S. Energy Information Administration, *Monthly Energy Review January 2024, Table 6.1 Coal Overview*, [https://www.eia.gov/totalenergy/data/monthly/pdf/sec6\\_3.pdf](https://www.eia.gov/totalenergy/data/monthly/pdf/sec6_3.pdf).

<sup>98</sup> See e.g. Theo Leggett, *Barclays to end direct financing of new oil and gas fields*, BBC, 9 Feb. 2024, <https://www.bbc.com/news/business-68249168>.

<sup>99</sup> See e.g. Dan Ennis, *Citi pledges to stop thermal coal-mining financing by 2030 to aid shift from fossil fuels*, *Utility Dive*, Apr. 22, 2020, <https://www.utilitydive.com/news/citibank-pledge-stop-thermal-coal-mining-financing/576511/>.

# TRADING THE BENEFITS OF NORTH AMERICAN ENERGY PRODUCTION WITH A DEPENDENCE ON CHINA



IMAGE: CAROL M HIGHSMITH VIA RAWPIXEL

The U.S. enjoys tremendous benefits from the wealth of secure, reliable, and affordable energy produced here at home. As shown in this report, our premier status as the world's largest producer of oil and natural gas, combined with our coal resources which are the largest in the world, ensure we can continue to rely upon those benefits for generations to come.

Europe, in contrast to North America, faces limitations in terms of resource abundance. Additionally, there seems to be a reluctance to fully exploit the resources available. As Europe enacts policies that seek to transition from a hydrocarbon-based energy and economic system towards a minerals-based "renewables" future, their economies, political stability, national security, and long-term prospects have come

under scrutiny. The shift away from continuous, robust energy sources to a reliance on intermittent, less potent energy raises serious questions about the stability of the electricity grid and the economy in the region.<sup>100</sup>

It is not just Europe that is choosing this path. The current administration and many "blue states" are aggressively embracing the very policies that are failing in Europe.

The International Energy Agency has warned that "China currently dominates global solar PV supply chains."<sup>101</sup> For example, China's share in all the key manufacturing stages of solar panels exceeds 80 percent today for key elements including polysilicon wafers. It is set to increase to more than 95 percent

<sup>100</sup> The Institute For Energy Research, *The Challenges and Costs of Net-Zero and the Future of Energy*, August, 2023, <https://www.instituteforenergyresearch.org/wp-content/uploads/2023/08/THE-CHALLENGES-AND-COSTS-OF-NET-ZERO-AND-THE-FUTURE-OF-ENERGY.pdf>

<sup>101</sup> International Energy Agency, *Solar PV Global Supply Chains*, July 2022, <https://www.iea.org/reports/solar-pv-global-supply-chains>.

in the coming years, based on current manufacturing capacity under construction. The agency indicates, “This level of concentration in any global supply chain would represent a considerable vulnerability.”<sup>102</sup> For perspective, in 2022 the members of OPEC produced close to 40 percent of total world oil.<sup>103</sup>

The consequences of Europe’s present energy plans are to move further away from energy supplied at home and instead rely on energy technology and energy products from China. Although the numbers differ, the predominance of China in other “transition” areas is stark. China leads the world in EV battery production, in inverters and transformers necessary for conversion of direct current to grid-ready alternating current and grid conversion generally. They lead the world in polysilicon production and wind turbine manufacturing. China views energy logically, as a strength to be exploited for all its benefits at home and abroad. It makes all these products for export to willing foreign governments by burning over one-half of all the world’s coal and running the world’s largest hydroelectricity system.

China chooses not to replace reliable energy sources, but rather, to use renewable energy as a supplement to their grid, which has the largest capacity in the world. To the extent that supplementation is scaled up to bring manufacturing costs down, it willingly sells its devices to other governments who, as a matter of policy, force consumers to buy them.

Europe and the U.S. are trading energy from abundant and affordable sources for energy dependent upon China, including our transportation system as well as our electrical grid, which powers modern life. The geopolitical consequences of this seem lost on the current cast of elected leaders in Europe and the U.S.

*China views energy logically, as a strength to be exploited for all its benefits at home and abroad.*

<sup>102</sup> International Energy Agency, *Solar PV Global Supply Chains: Executive Summary*, July 2022, <https://www.iea.org/reports/solar-pv-global-supply-chains/executive-summary>.

<sup>103</sup> Anshu Siripurapu & Andrew Chatzky, *OPEC in a Changing World*, Council on Foreign Relations, Mar. 9, 2022, <https://www.cfr.org/backgrounder/opec-changing-world>.

# CONCLUSION

North America has vast energy resources, including oil, natural gas, and coal. These resources are enough to meet the country's needs for hundreds of years to come. The first edition of the *North American Energy Inventory*, released in 2011, challenged the myth of energy scarcity and demonstrated the abundance of energy resources in North America.

Since 2011, the U.S. has become the world's top producer of both oil and natural gas, thanks in large measure to technology. This has led to lower energy prices, job creation, and environmental benefits. The U.S. now has 227 years of oil supply, 130 years of natural gas supply, and 485 years of coal supply.

Canada also has abundant energy resources, including the fourth-largest global quantity of oil reserves. Mexico, on the other hand, has seen its energy production and reserves decline in recent years due primarily to government policies.

The current administration has taken hundreds of actions to make it harder to produce oil, natural gas, and coal in the U.S. In addition to regulatory impediments, the oil, natural gas, and coal industries face other challenges, such as difficulty raising capital, anti-fossil fuel activism, and competition from subsidized renewable energy sources.

## Benefits of Domestic Oil Production:

- **Abundant and reliable energy:** The U.S. is the world's largest producer of oil and natural gas, which provides a secure and reliable supply of energy for the country.
- **Lower energy prices:** Oil prices have largely

shrugged off events like Russia invading Ukraine and instability in the Middle East—activities that would have driven up oil prices a decade or two ago. U.S. oil production is key to this new stability, saving drivers money and making the U.S. more competitive in the global economy.

- **Job creation:** The oil and gas industries support millions of jobs in the U.S., both directly and indirectly. These jobs are often well-paying and provide good benefits.
- **Environmental improvements:** The U.S. has made significant progress in reducing air pollution in recent years, even as energy production has increased. This is due, in part, to improved pollution control technologies.

## The Future of U.S. Energy Production:

As baseball legend Yogi Berra once said, "it's tough to make predictions, especially about the future." That certainly applies to the future of U.S. energy production. However, the U.S. has abundant energy resources that can meet the country's needs for generations to come. The key to unlocking them is to ensure that they continue to be accessed and used in a responsible manner. Very few people could have predicted the energy revolution currently taking place in the U.S. today. Given the vast natural resources in this country and North America at large, there is no reason it can't continue. That is, at least, if those who encourage innovation and promote free market principles prevail over those who seek to direct the way we work, live, and act.





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