

THE ENVIRONMENTAL QUALITY INDEX

**Environmental Quality Weighted
Oil and Gas Production**

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Written by

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EXECUTIVE SUMMARY

For many years there has been a political movement centered in North America and Europe seeking to halt oil and gas production in those regions.

Proponents claim this effort is justified in the name of protecting the environment and saving the earth from climate change. But this political movement has done little to eliminate the need for those products in developed countries. Nearly every facet of modern developed economies require petroleum products and natural gas to function and provide the comfortable lifestyles that citizens of developed countries have come to expect. These resources are necessary for agriculture, heavy industry, transportation by all modes – road, rail, air, or ship – and a great number of the products that we take for granted. They're ingrained in almost everything. Thus, efforts to reduce or eliminate oil and gas production in developed countries will simply shift production to other countries in order to meet ongoing global demand.

The great irony is that this political movement – which purports to be about protecting the environment – results in oil and natural gas production moving from countries with the highest environmental standards to countries with lower, or even functionally zero, environmental standards.

The contradictions of this approach are most apparent in the case of the United States, the largest producer of both oil and natural gas in the world. Reductions or limitations on domestic U.S. oil production must be made up elsewhere in the remaining major oil producing countries, which have far lower environmental standards than the U.S. This paper seeks to quantify that environmental gap 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. The results show that purely as a matter of environmental protection, replacing U.S. domestic production with foreign supply would be an overwhelmingly negative tradeoff.

The major points highlighted by this analysis are:

- For the 20 largest oil producing countries outside the United States, 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% 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 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% lower than that of the U.S.
- The United States, 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% of U.S. production, and that from gas producing countries is only 33.4% 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 harms 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 at the same time pollution and emissions have steadily declined across sources.
- Contrary to popular media characterizations, wealth created by energy development in free economies enhances environmental performance while making people's lives better.

SECTION 01

INTRODUCTION

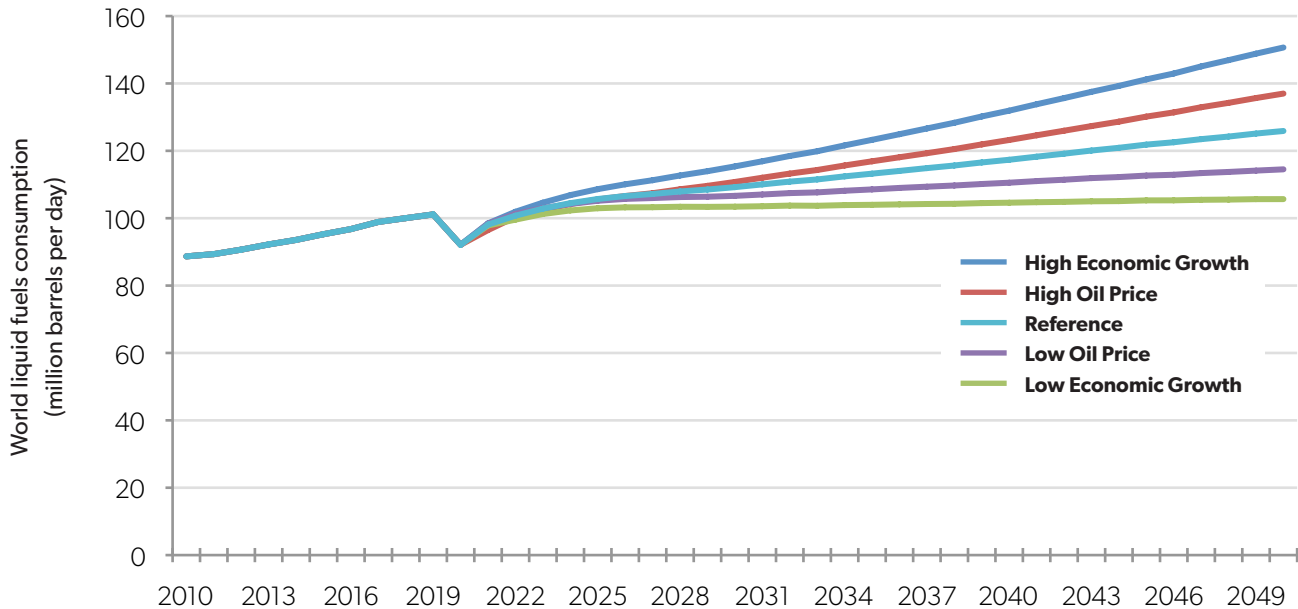


In general, freer economies are wealthier economies. This greater wealth allows people to consume more of the things they like, which includes environmental quality. It may seem counterintuitive but less overall government interference in the economy leads to greater environmental quality.¹ In large part this is due to the greater wealth that economic freedom creates. Economic freedom adds to environmental quality in other ways as well, such as allowing greater freedom to innovate.²

However, there is a disturbing movement, primarily in developed countries, that views economic growth as the enemy of environmental quality.³ Proponents of this idea think that population growth and economic growth will result in resource demands that the planet is unable to meet. These proponents believe that growth should be halted in order to prevent this. Paul Ehrlich's *Population Bomb*, a book that outlines fears surrounding overpopulation, is an example of this new Malthusianism, but it comes in many forms. In addition to overt degrowth philosophy, there are others, while not explicitly supporting degrowth, who want

to cut conventional energy production both in the U.S. and in Europe. Their policies masquerade as environmental protection, but the clear intent is to hobble and block production of oil and natural gas through lease cancellations, dragging out the permitting process, filing spurious lawsuits, and other tactics. These efforts are unlikely to improve the world's environment.

Efforts to restrict petroleum production in the U.S. could yield perverse impacts on the global environment. Economic growth is powered by energy. Most of the world is energy poor and few are willing to forego the poverty-ending growth we can achieve with abundant energy in the decades ahead. Due to a phenomenon called the environmental Kuznets curve,⁴ as societies get richer, they begin to prize a clean environment more highly. This has certainly been true in the U.S. By maintaining its position as the world's largest conventional energy provider, the U.S. can continue to satisfy its own energy needs and contribute to the economic growth of the developing world as well. Doing so is not only good for our economy and the world's

FIGURE 1: LIQUID FUELS CONSUMPTION RISES FROM 2020 IN ALL IEO CASES

Source: U.S. Energy Information Administration International Energy Outlook 2021,
<https://www.eia.gov/outlooks/ieo/consumption/sub-topic-01.php>

economy, but also better for the world's environment than the alternative.

Limiting oil production in the U.S. shifts production to countries who, for the most part, have significantly lower environmental standards.

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extended poverty and more environmental degradation.

The Organization for Economic Cooperation and Development (OECD) projects the world economy will double by 2050.⁵ Given this growth, it is no surprise that the Energy Information Administration projects global liquid fuels consumption will rise as much as 50 percent by 2050 as shown in Figure 1 above.⁶

The U.S. is not only the world's leading liquid fuels producer, it is one of the few major petroleum producers with high environmental standards. Of course, there are other countries that perform just as well as the U.S., and some perform somewhat better. However, the U.S. is the world's largest producer and isn't outranked on environmental quality by any country that produces even one quarter of its output for either oil or natural gas. Because of its high standards and even higher production, it makes sense to compare U.S. production to the remainder of top world producers.

SECTION 02

ENVIRONMENTAL QUALITY
WEIGHTED BY PETROLEUM AND
NATURAL GAS PRODUCTION

In order to compare the environmental quality of fuel production between countries, we selected the Environmental Performance Index (EPI) produced annually by the Yale Center for Environmental Law & Policy to use as our proxy for national environmental standards. “Using 40 performance indicators across 11 issue categories, the EPI ranks 180 countries on climate change performance, environmental health, and ecosystem vitality.”⁷ Though the index does not directly measure the impact of oil production, we use it as a proxy under the assumption that the internal demand for a country’s environmental quality is broad based. These national EPI scores are then multiplied by national production volumes to create a production weighted environmental quality score for a group of countries.

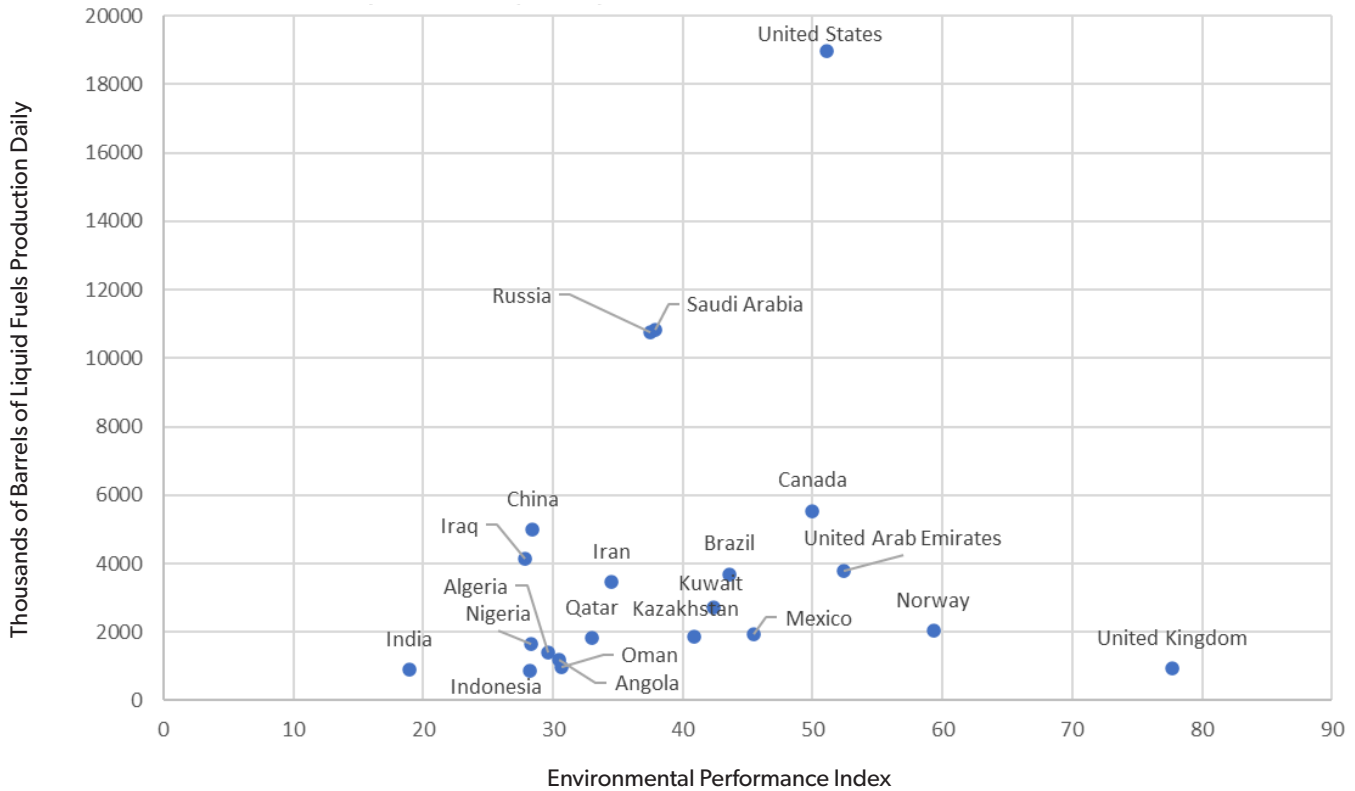
Figure 2 below shows 21 of the top 22 petroleum producers as of 2021 (Since Libya is not ranked in the EPI,

they are omitted), their 2022 EPI rating, and their 2021 liquid fuels production.

For the 20 largest producers outside the U.S., the average EPI score, weighted by liquid fuels production, is 39. At the same time, the U.S. EPI score is 51.1. That is, the average barrel of non-U.S. petroleum is produced in a country with an EPI score that is 23.6% lower than the EPI score for the U.S.

To make the policy contrast even more stark, we can exclude other developed democracies like Canada and Norway, which face the same political pressure to halt domestic oil production. Without those countries’ high environmental scores skewing the average, the weighted environmental score of the remaining oil production falls to just 36.5, 28.6% lower than the U.S. EPI score.

FIGURE 2: 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

The story of world natural gas production is similar. The production-weighted average for major non-U.S. natural gas producers is also well below that of the United States. Figure 4 below shows the dry-gas production (bcf in 2021) by the U.S. and the next twenty largest producers along with their EPI scores.

Similar to that of the non-U.S. oil producers, the production-weighted EPI score for the 20 largest non-U.S. natural gas producers is only 38.6 compared to the 51.1 EPI score of the U.S. Thus, the average bcf of non-U.S. natural gas is produced in a country with an EPI score 24.5% lower than that of the U.S. The U.S. score is 32.4% higher than the

average production-weighted EPI score. This value was arrived at by averaging the EPI score per billion cubic feet of production of the other countries on the list and comparing the two.

Here again, to make the policy contrast even more stark, we can exclude developed democracies like Canada, Australia, and Norway which face the same political pressure to halt domestic natural gas production. Without those countries' high environmental scores skewing the average, the weighted environmental score of the remaining natural gas production falls to just 35, 31.5% lower than the U.S. EPI score.

FIG. 3 THE WORLD'S TOP PETROLEUM PRODUCERS IN 2021, THEIR EPI RATING, AND THEIR LIQUID FUELS PRODUCTION IN 2021

Country	EPI	Production (Thousand barrels per day)
United States	51.1	18,981
Saudi Arabia	37.9	10,835
Russia	37.5	10,776
Canada	50	5,537
China	28.4	4,993
Iraq	27.8	4,149
United Arab Emirates	52.4	3,785
Brazil	43.6	3,689
Iran	34.5	3,457
Kuwait	42.4	2,716
Norway	59.3	2,030
Mexico	45.5	1,923
Kazakhstan	40.9	1,863
Qatar	33	1,822
Nigeria	28.3	1,650
Algeria	29.6	1,415
Angola	30.5	1,196
Oman	30.7	980
United Kingdom	77.7	935
India	18.9	891
Indonesia	28.2	858

Country	EPI
United States	51.1
20 Largest Non-U.S. Petroleum Producers (average)	39

Source: Yale EPI data and U.S. Energy Information Administration data, <https://www.eia.gov/international/data/world/petroleum-and-other-liquids/annual-refined-petroleum-products-consumption?>

FIG. 4 THE WORLD'S TOP NATURAL GAS PRODUCERS IN 2021, THEIR EPI RATING, AND THEIR NATURAL GAS PRODUCTION IN 2021

Country	EPI	Production (Billion cubic feet)
United States	51.1	34,518
Russia	37.5	24,775
Iran	34.5	8,767
China	28.4	7,486
Canada	50	6,435
Qatar	33	5,968
Australia	60.1	5,196
Saudi Arabia	37.9	4,082
Norway	59.3	4,066
Algeria	29.6	3,607
Turkmenistan	37.0	3,073
Malaysia	35.0	2,507
Indonesia	28.2	2,082
Egypt	35.5	2,452
United Arab Emirates	52.4	2,252
Uzbekistan	38.2	1,755
Nigeria	28.3	1,568
Argentina	41.1	1,428
Oman	24	1,383
Thailand	38.1	1,284
Pakistan	24.6	1,179

Country	EPI
United States	51.1
20 Largest Non-U.S. Natural Gas Producers (average)	38.6

Source: Yale EPI data and U.S. Energy Information Administration data, <https://www.eia.gov/international/data/world/natural-gas/dry-natural-gas-production>

SECTION 03

PRODUCTION WEIGHTED AVERAGE BY FREEDOM SCORES



Perhaps even more troubling than potentially shifting production to countries with lower environmental standards is the possibility that constraining U.S. production shifts demand, wealth, and power to countries with much worse records on human freedom. Figure 5 shows the largest oil producers and their Freedom House Global Freedom score.

The production-weighted average Global Freedom score for the non-U.S. petroleum producers was only 34 versus 83 for the U.S. The average also obscures the worst of it. Saudi Arabia and Russia, with scores of 7 and 19 respectively, were the second and third largest oil producers after the U.S. They are also among the countries with the largest additional capacity which would replace U.S production. Recent events only serve to emphasize the problems with increasing energy dependency from despotic regimes. There is of course a range of indices available to gauge the relative freedom of different

countries. It would be quite difficult to argue that either Russia or Saudi Arabia is a particularly free place to live and do business or that the world would be better off by shifting the balance of production towards them and away from the U.S.

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Many factors contribute to the environmental impacts of a country's oil and gas infrastructure. Political events can cause a situation in which it is impractical – or

even impossible – to produce in an effective manner. For some countries, this may originate with degrowth policies that undermine the economics of energy production.

These policies haven't come to fruition in the U.S. yet, but elsewhere there have been examples of these ideas failing already. The energy crisis in Europe provides a clear example of the consequences that rapid reduction in our baseload energy capacity can have. The idea of what could come from similar policies in the U.S. is a sobering one, and should be considered when the concept of degrowth is invoked. Further, some countries haven't reached the point in their economic development where it's possible to consider degrowth in the first place, so rather than squander existing prosperity, these policies instead prevent them from achieving it.

FIG. 5 THE WORLD'S TOP PETROLEUM PRODUCERS IN 2021, THEIR FREEDOM HOUSE GLOBAL FREEDOM SCORES, AND THEIR LIQUID FUELS PRODUCTION IN 2021

Country	Freedom House	Production (Thousand barrels per day)
United States	83	18,981
Saudi Arabia	7	10,835
Russia	19	10,776
Canada	98	5,537
China	9	4,993
Iraq	29	4,149
United Arab Emirates	17	3,785
Brazil	73	3,689
Iran	14	3,457
Kuwait	37	2,716
Norway	100	2,030
Mexico	60	1,923
Kazakhstan	23	1,863
Qatar	25	1,822
Nigeria	43	1,650
Algeria	32	1,415
Angola	30	1,196
Oman	24	980
United Kingdom	93	935
India	51	891
Indonesia	49	858

Source: Freedom House scores and U.S. Energy Information Administration data, <https://www.eia.gov/international/data/world/petroleum-and-other-liquids/annual-refined-petroleum-products-consumption?>

SECTION 04

ECONOMIC FREEDOM AND POLITICAL STRUCTURE AS FACTORS



Repressive regimes often restrict property rights and take over businesses. Under these conditions, the incentive structures of a free market are turned on their head. When people own things, they usually take better care of them. When a person or company owns the mineral rights or has a lease in a particular area, it is in their best interest to steward that resource. They have a vested interest in the continued quality of the land, and the value that they can derive from it. Because of this, they're unlikely to squander that resource. But under repressive regimes, notably ones that have a collectivist bent, this incentive structure inverts. There are quotas to be hit, and anything that doesn't pertain to a particular directive is simply collateral damage. Two case studies involving regimes in this way are Russia, the world's third largest oil producer, as well as Venezuela, which has fallen off the list of top producers, but has the largest proven reserves of oil in the world.

RUSSIA

The environmental and human freedom record of Russia is very clearly on display today. Following the start of the Russian invasion of Ukraine in February 2022 countries began applying sanctions to its products, notable among them, its oil and natural gas resources. At the same time, companies began voluntarily pulling their business out of the country, including some of the world's oil majors. In this situation, the pull out of Russia was because of military action. But that's not the only reason to deemphasize Russia in our oil and gas supply.

In 2019, the Trump Administration EPA administrator Andrew Wheeler told the audience at a Houston energy conference that Europe would do better environmentally to purchase its natural gas from the U.S. than from Russia

because of the cleaner practices used in the industry in the U.S.⁸ Good practices, as captured in the EPI, aren't about the environment alone, they affect human health and safety, as well as reliability. Where poor practices exist, crisis tends not to be far behind.

In 2019, Russian oil exporters found themselves in a crisis after it was discovered that the oil they had been exporting was contaminated with more than twenty times the acceptable limit of organic chloride. The situation created chaos for international trade as tankers full of the contaminated oil sat at ports in Europe and Asia with buyers unwilling to take possession of the contaminated crude and risk damaging their equipment by processing it.⁹ All told, more than 5 million metric tons of oil, approximately 36 million barrels, were involved and Transnet, the Russian pipeline giant, faced up to a billion dollars in claims from its buyers and distributors.¹⁰

Russia's pipeline infrastructure also has issues with leaks, and the country has broader oil spill issues. The Russian Ministry of Energy identified 17,000 leaks in 2019 alone. For context, in 2018 the U.S. had 137 spills. Canada, with similar climate conditions to much of Russia, had 60 spills in 2019.

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VENEZUELA

From Figure 3, 4, and 5 above, it's abundantly clear that oil and gas are sometimes viewed as monolithic industries that produce the same product in the same manner everywhere in the world. This is far from the truth. The location of these activities has a huge impact on both the implications of the industry for regional and global economics, and for the environmental impacts that it produces. Venezuela, home to the world's largest oil reserves at 303 million barrels, is a clear example of this. PDVSA, the state run oil company, has a long history of environmental degradation. Decades of government mismanagement and poor investment has caused the industry to collapse. Further, the imposition of international sanctions, which followed human rights abuses by authoritarian President Nicholas Maduro, has starved the nation of key export markets. In March of 2022 it was estimated that it would take \$250 billion to restore the Venezuelan oil industry, and that it would take between 7 and 8 years.¹² Restarting Venezuelan oil would be more expensive, and worse for the environment, than making domestic investments.

Amid high U.S. gas prices, the Biden Administration has been working to adjust sanctions to allow U.S. companies to resume working on Venezuelan oil projects, and to open imports again. Rather than supporting domestic industry, or taking legislative or administrative action to improve domestic production, they're looking to Saudi Arabia, the rest of OPEC, and Venezuela to fill the gap from now missing Russian production. Meanwhile, the environmental impact of Venezuelan oil has become continually more severe. In 2016, PDVSA stopped reporting oil spills entirely.¹³

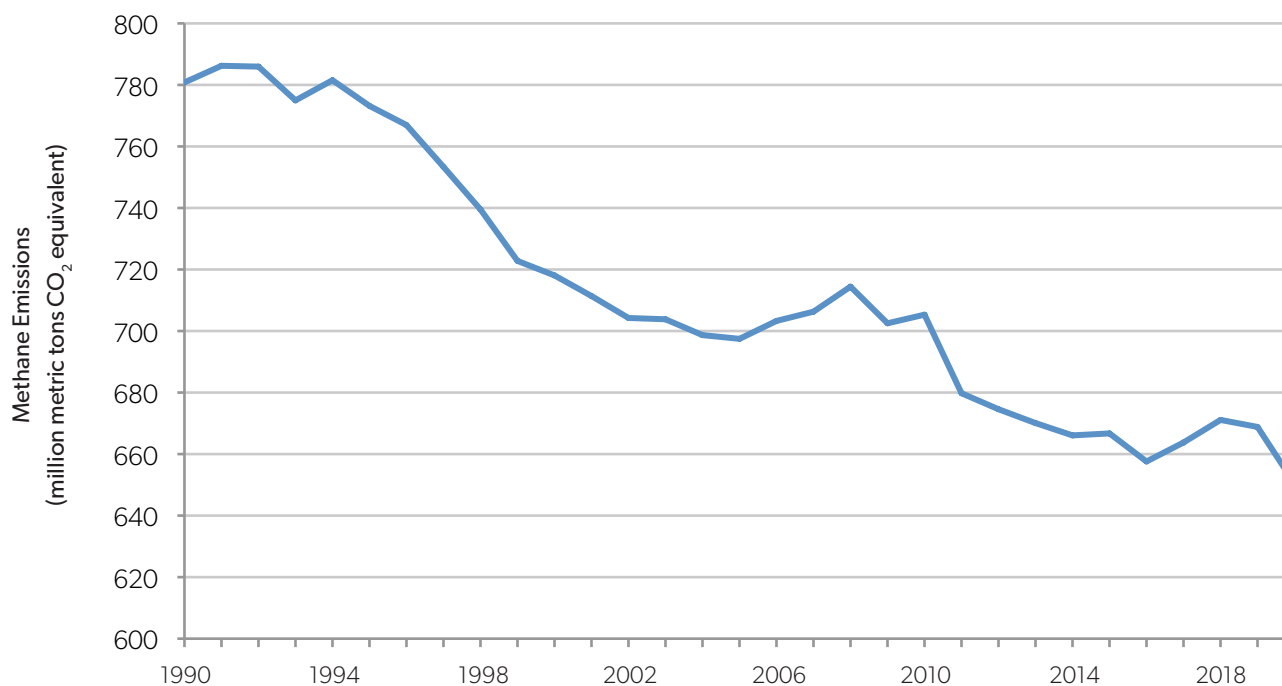
U.S. IMPROVEMENTS

Over the last 30 years, methane emissions in the U.S. have seen a significant decrease. Over the same period of time both oil production and dry natural gas production have increased enormously. Figures 6, 7, and 8 below show this relationship.

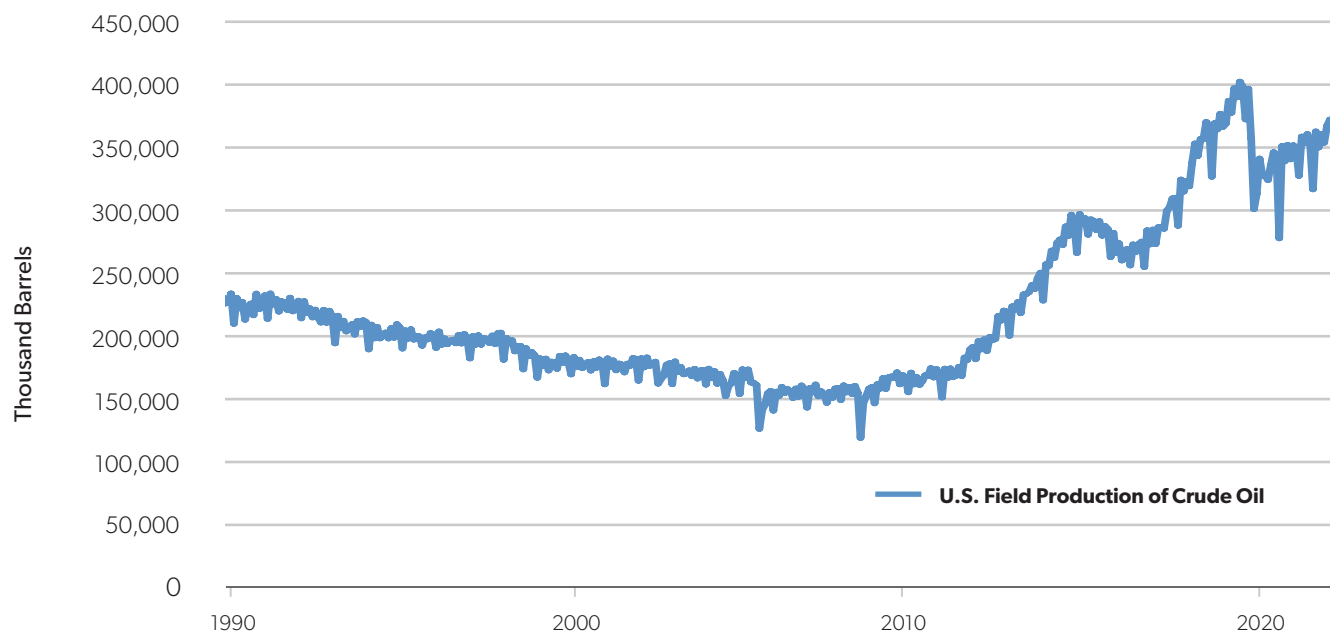
The improvement in the technology of the domestic oil and gas industry over the decades has come in many forms. One important improvement has been the innovation of

horizontal drilling technology. Drillers in the U.S. have moved to 3-mile lateral wells, meaning that they drill a single well downward, and are able to extend the well outward, covering that area from only a single site on the surface. This allows up to 30 square miles to be covered from a single 1-acre production site.¹⁷ This is demonstrated in Figure 9 below. Although many mineral rights are purchased in rectangular rather than round plots, this figure displays what the maximum technologically possible radius of 3 miles would look like showing the area around the White House as an example of how much an area that size could encompass.

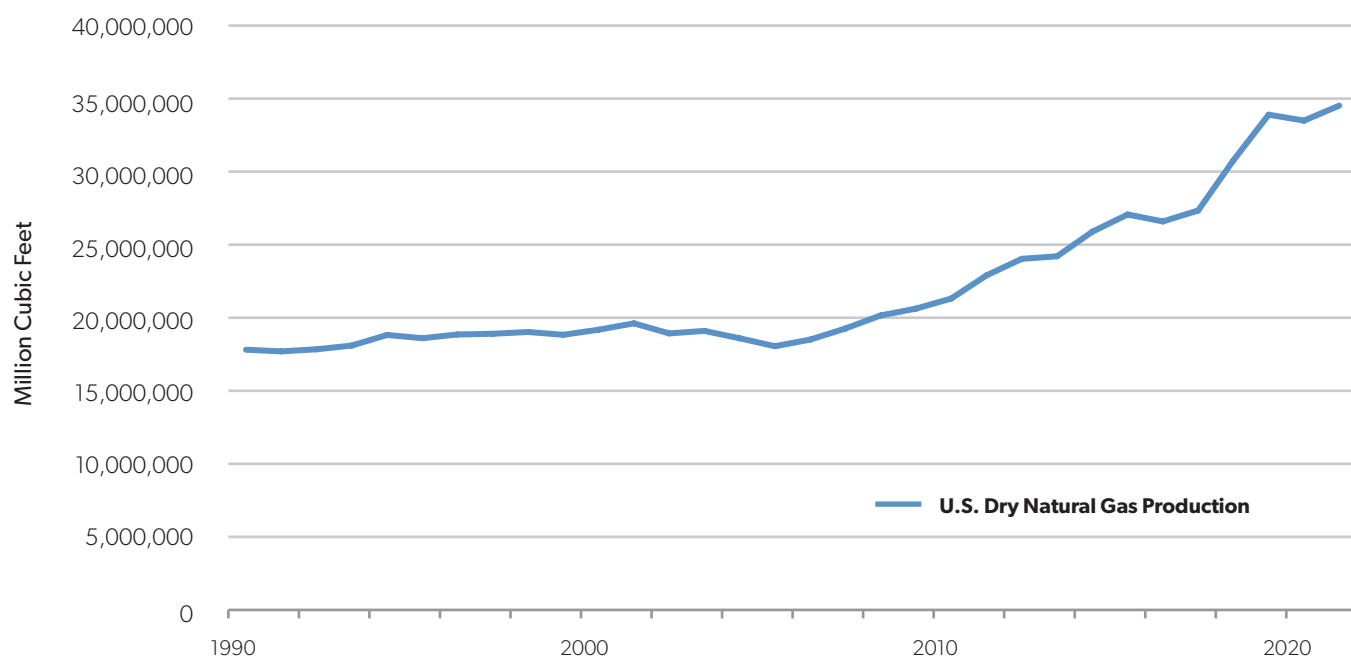
FIGURE 6: U.S. METHANE EMISSIONS FROM 1990-2020



Source: U.S. Environmental Protection Agency, <https://www.epa.gov/climate-indicators/climate-change-indicators-us-greenhouse-gas-emissions>

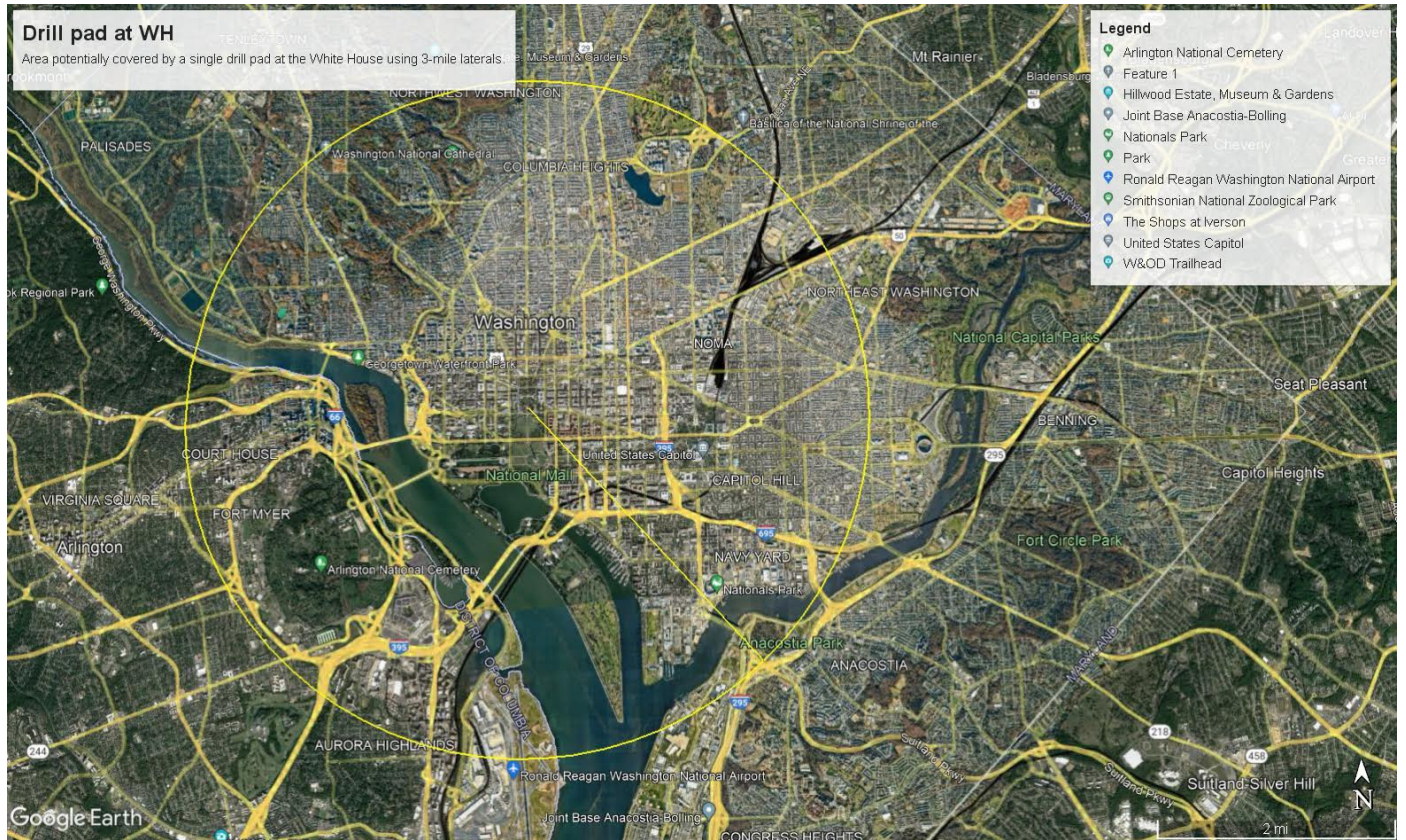
FIGURE 7: U.S. FIELD PRODUCTION OF CRUDE OIL

Source: U.S. Energy Information Administration

FIGURE 8: U.S. DRY NATURAL GAS PRODUCTION

Source: U.S. Energy Information Administration

FIGURE 9: 3-MILE RADIUS AROUND WASHINGTON D.C.



Source: Google Earth

SECTION 05

OVERALL AIR QUALITY IMPROVEMENTS



For decades, air pollution across sources has been steadily declining in the U.S. The decline in the U.S. is an example of the environmental Kuznets curve in action. With both comparably low and declining emissions in the U.S., it is hard to make the argument that domestic production should be abandoned in favor of production in places with far lower Environmental Performance Index scores.

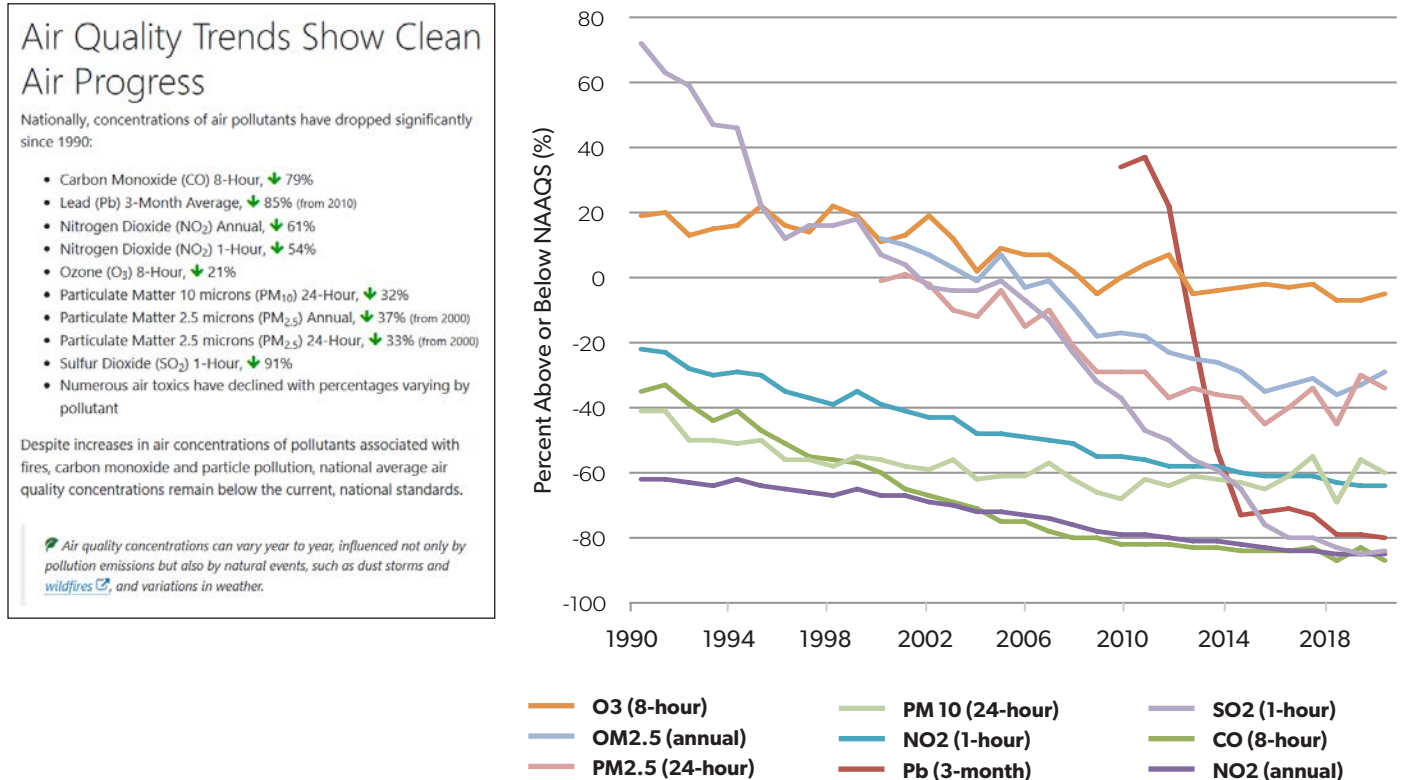
For decades, air pollution across sources has been steadily declining in the United States.

Particulate matter (PM) is a mixture of solid particles and droplets that are found in the air. Some of them are microscopic, while others are large enough to be visible

to the human eye. This category includes a variety of pollution like sulfur dioxide, carbon monoxide, and small particles of other materials. PM prevalence is a good proxy for understanding levels of air pollution.

Particulate matter data are available across many countries to enable cross-country air quality comparisons. According to data from the World Bank, high-income nations have dramatically lower particulate matter than any other income group showing that economic development could be a vehicle for global improvement on this and other air quality metrics.

Data from the World Bank shows that since 1990, PM levels are up in low-income, lower-middle-income, and middle-income countries. In upper-middle income and high-income countries, however, PM levels have fallen. This shows that as the economies of countries grow, air quality improves. In other words, there is a correlation between economic growth and environmental quality.

FIGURE 10: U.S. AIR POLLUTANT CONCENTRATION AVERAGES TREND DOWNWARD

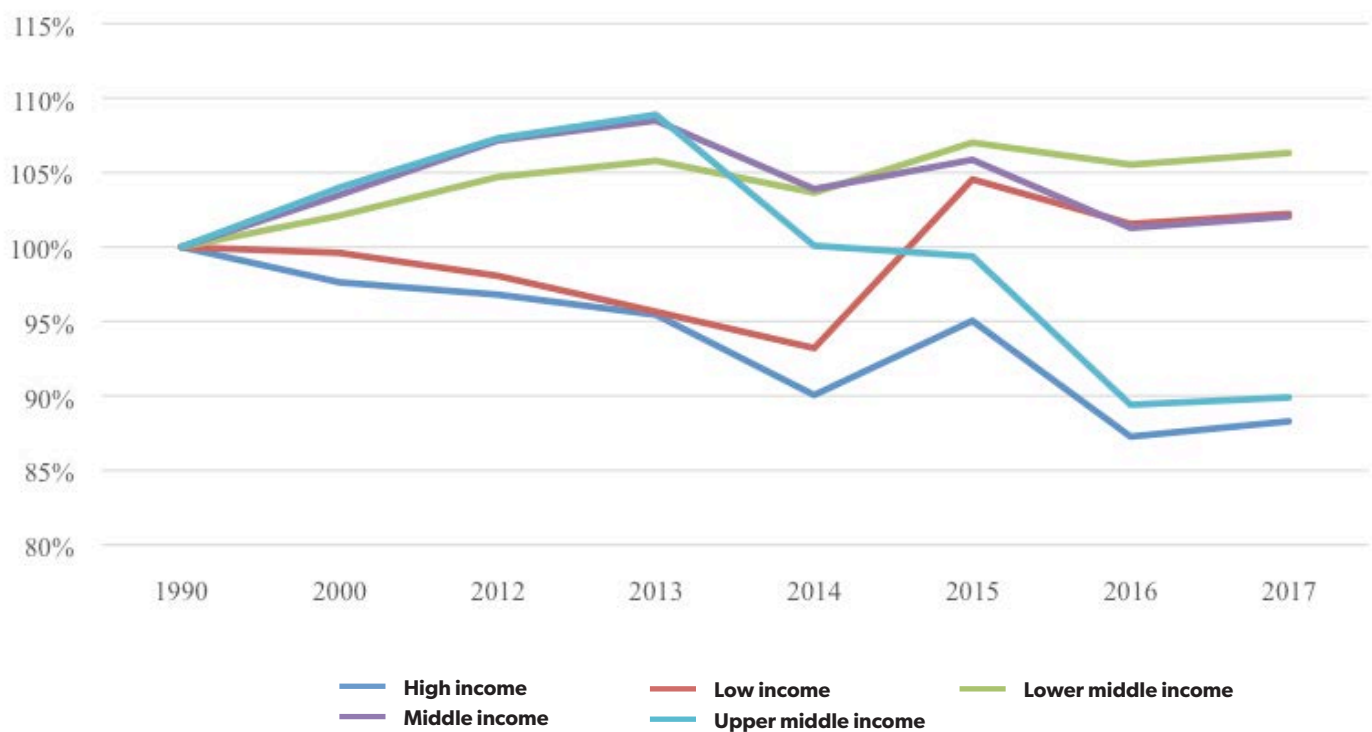
Source: U.S. EPA Air Quality System
https://gispub.epa.gov/air/trendsreport/2022/#air_trends

THE PROBLEM WITH DEGROWTH

We're already beginning to see the havoc that a degrowth mindset can wreak. The energy crisis that has been building in Europe is a prime example of this. European countries have been investing aggressively in wind and solar technologies, while largely shutting down many of the nuclear and coal power plants that provided the region's reliable energy for generations. Because much of the region's gas came from Russia, the war in Ukraine, and subsequent loss of that natural gas supply, revealed the poor state that the rest of Europe's energy grid was in.

Another prime example of the negative effects of the degrowth mindset is the famine in Sri Lanka. In a show of lower impact at any cost, Sri Lanka had embarked on a course to produce agricultural products with no fertilizers (for which natural gas is an important input). When this plan failed, widescale food shortages ensued.¹⁸

Degrowth ignores important human instincts. The first is that people tend to want to improve their quality of life. Central to this are the consistent availability of food and energy to allow us to carry out day to day activities in relative comfort and safety. Once people have experienced this state, it is very difficult to convince them to want

FIGURE 11: PERCENT CHANGE IN PM LEVELS BY COUNTRY INCOME 1990-2017

Source: World Bank, <https://data.worldbank.org/indicator/EN.ATM.PM25.MC.M3>

something else. It is also immoral to deprive developing countries of the ability to attain the same levels of prosperity that we have found through harnessing energy and agriculture.

The second failure of the degrowth concept is that it doesn't tend to take into account the fragility of human achievement. After generations, we tend to forget how

hard won energy prosperity is. The base state of man is abject poverty. Without the energy and food that we take for granted it is impossible to make the technological innovations necessary to meet any challenges that the world may face. Because of this, the attempt through degrowth to solve climate issues and other global problems would, if successful, actually prevent us from solving these issues in the long term.

SECTION 06

CONCLUSION



Oil and natural gas production isn't a monolith. Production in one location does not have the same environmental, health, or social impacts as that of

The world demands oil, natural gas, and their associated products. It is far better for the environment if that demand is met by production in countries like the United States with high environmental standards.

production elsewhere. There is a stark difference between the environmental impacts of production in countries with high environmental standards like the U.S., Canada, the United Kingdom, or Norway, and those countries that either don't have these standards at all, or where widespread corruption leads to the de facto nonexistence of such standards. A barrel of oil produced in Saudi Arabia or Venezuela rather than the U.S. on net is more negatively impactful to the global environment. This inescapable fact must be part of the policy discussion in developed economies as loud special interest groups seek to shut down safe and clean domestic oil and natural gas production. The world demands oil, natural gas, and their associated products. It is far better for the environment if that demand is met by production in countries like the U.S. with high environmental standards.

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- ⁶ Find original citation, start here: [EIA Sees Oil Demand Growing Until 2050, Based on the Way the World Is Now \(spe.org\)](https://www.spe.org/energy/analysis/energy-economics/EIA-Sees-Oil-Demand-Growing-Until-2050-Based-on-the-Way-the-World-Is-Now)
- ⁷ <https://epi.yale.edu/>
- ⁸ <https://www.chron.com/business/energy/article/EPA-chief-tells-world-to-buy-cleaner-American-13679797.php>
- ⁹ <https://www.reuters.com/article/us-russia-oil-contamination-exclusive/exclusive-dirty-oil-crisis-over-for-russia-but-contagion-felt-on-high-seas-idUSKCN1TP2WP>
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- ¹¹ <https://www.dw.com/en/russia-oil-spills-far-north/a-56916148>
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- ¹⁵ [U.S. Field Production of Crude Oil \(Thousand Barrels\) \(eia.gov\)](https://www.eia.gov/totals/production/total/total.php?series=oil&unit=thousands&country=usa)
- ¹⁶ [U.S. Natural Gas Gross Withdrawals \(Million Cubic Feet\) \(eia.gov\)](https://www.eia.gov/totals/gas/gas.php?series=usa&unit=thousands&country=usa)
- ¹⁷ <https://www.spe.org/energy/analysis/energy-economics/the-trend-in-drilling-horizontal-wells-is-longer-faster-cheaper>
- ¹⁸ <https://www.instituteeforenergyresearch.org/international-issues/sri-lanka-an-unnecessary-tragedy/>



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