

Pipeline Bubble

TRACKING GLOBAL OIL AND GAS PIPELINES

James Browning, Greig Aitken, Lydia Plante, and Ted Nace





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- Global Fossil Infrastructure Tracker
- Europe Gas Tracker
- Global Gas Plant Tracker
- Global Coal Mine Tracker
- Global Steel Plant Tracker
- The Gas Index
- CoalWire newsletter
- GEM.wiki energy wiki

ABOUT THE GLOBAL FOSSIL INFRASTRUCTURE TRACKER

The Global Fossil Infrastructure Tracker is an online database that identifies, maps, describes, and categorizes oil and gas pipelines, and liquified natural gas (LNG) terminals. Developed by Global Energy Monitor, the tracker uses [footnoted wiki pages](#) to document each plant.

AUTHORS

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FURTHER RESOURCES

The Global Infrastructure Tracker (GFIT) provides [over 40 summary data tables](#) on oil and gas pipelines and terminals broken down by region, country, and company; [methodology notes](#); and an [interactive global map](#). To obtain primary data from the GFIT, contact Ted Nace (ted.nace@globalenergy-monitor.org).

ABOUT THE COVER

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Pipeline Bubble 2021

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EXECUTIVE SUMMARY

This report provides the results of a global survey of oil and gas transmission pipelines carried out by Global Energy Monitor at the close of 2020. The report includes the following points:

- **Stranded asset risk of \$1 trillion.** A planned 212,000-km expansion in the global system of oil and gas transmission pipelines, amounting to US\$1 trillion in capital expenditures, is on a collision course with commitments by most large economies to transition to carbon neutrality by mid-century, setting the stage for large amounts of stranded assets.
- **Lock-in of future emissions.** Pipeline projects under construction and in pre-construction will support a lifetime increase in oil and gas CO₂ emissions of 170 gigatonnes, only 15% less than the projected lifetime CO₂ emissions of the currently operating global coal plant fleet.
- **Gas dominates the mix.** 18 of the 20 longest pipelines in development and 82.7% of all pipelines in development globally will carry gas, reflecting the fossil fuel industry's success in perpetuating the myth that gas can be a "bridge fuel" to a clean energy future.
- **U.S. leads global capacity growth and climate risk.** The U.S. is the leading developer of pipelines as measured by capacity, with 19.6 million barrels of oil equivalent per day in development. This expansion presents a major climate risk since U.S. exports of liquified natural gas have the highest greenhouse gas intensity of any major exporter, according to Boston Consulting Group.
- **China.** China continues a massive 32,800-km expansion of the country's oil and gas pipeline network. That network is being

consolidated under a new company, PipeChina, which will soon be the largest builder of gas pipelines in the world.

- **Slowing growth.** The global pipeline expansion has slowed in the past decade and some projects were delayed in 2020 by the Covid-19 pandemic. Overall, however, the expansion curve has been bent rather than broken, with pipelines continuing to enjoy both policy support and financial support by governments and major financial institutions.
- **Stopping the Keystone clones.** The Biden Administration has canceled the Keystone XL pipeline and can determine the fate of “Keystone clones” such as the Line 3 replacement oil pipeline by taking action in seven major areas—pipeline approvals, green stimulus measures, FERC appointments, executive actions, cabinet nominations, overseas subsidies, and approvals for oil and gas export terminals.
- **Few restrictions on midstream financing.** An analysis of the Permian Basin, which has surpassed Saudi Arabia’s Ghawar Field to become the biggest-producing oil field in the world, shows financial support by more than 100 institutions. While 50 major financial institutions have now implemented policies restricting support for tar sands or Arctic extraction, only four so far have restricted pipelines.
- **Pipelines losing their social license.** Intense opposition from landowners, indigenous groups, and climate activists is causing the cancellation or delay of high-profile pipelines, and is changing perceptions of pipelines as a “safe” investment.

INTRODUCTION

This report provides the results of a global survey of oil, gas, and natural gas liquids (NGL) transmission pipelines carried out by Global Energy Monitor at the close of 2020. The survey found that the Covid-19 pandemic has disrupted investment decisions and construction work on numerous pipelines, particularly in North America, shifting the general outlook for oil and gas production and infrastructure expansion, and accelerating the transition to clean energy. Nevertheless, with most of the disruption coming in the form of delays rather than cancellations, the growth curve of the global pipeline system is bent but not broken, with 468 new pipelines or pipeline expansions in active development. If completed, projects under construction or in pre-construction development will expand the global oil and gas pipeline systems by 37,000 km and 175,000 km respectively, amounting to US\$1.07 trillion in capital expenditures.

With many projects stalled due to the Covid-19 pandemic, the resulting crash in oil and gas prices, and poor returns on existing pipeline projects (see “Financing the Permian Boom” below), the oil and gas industry finds itself at an inflection point. As more and more civil society organizations (CSOs) call for

a managed decline of fossil fuel production, can the industry convince governments and financial institutions to invest in a further expansion of fossil fuel infrastructure? Many of the world's largest economies, including China, the European Union, Japan, and Korea, have now committed to achieving net zero emissions within the projected lifespan of pipeline infrastructure currently being proposed, raising the possibility that such projects, if built, will be prematurely retired.

The economics of oil and gas infrastructure are under short-term pressure due to the effects of pandemic-related demand reduction and long-term pressure due to the global transition away from fossil fuels. For oil, the main threat in the coming decade is the prospect of vehicle electrification, as more governments announce transitions away from internal combustion sales and manufacturers respond by shifting investments toward electric vehicles. For gas, change is arriving most rapidly in the power sector, where combinations of renewables, batteries, and demand management now offer equivalent reliability at lower cost than gas-fired power plants.

PIPELINE BUILDING TRENDS DOWNWARD, FOLLOWING INDUSTRY DECLINE

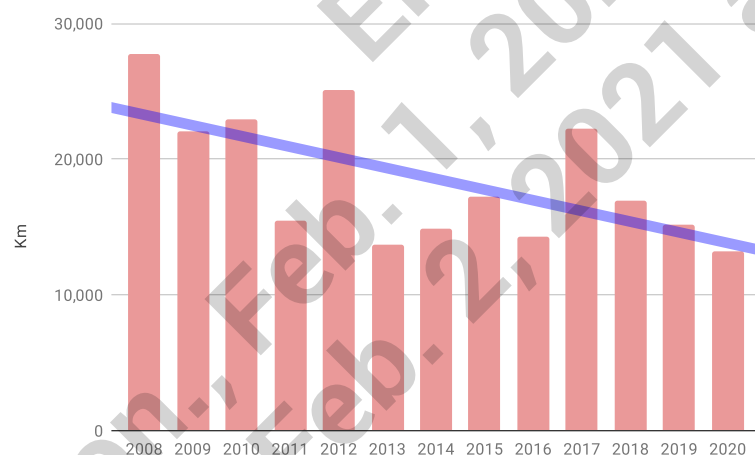
During 2020, developers completed 3,600 km of oil pipelines and 9,619 km of gas pipelines, or an overall average of 1,102 km per month for oil and gas pipelines combined. As shown in Figure 1, this continues the steady dropoff in construction levels since 2008.

The decline in pipeline completions parallels a general financial decline in private-sector oil company balance sheets and market value during the same period. In the decade ending August 17, 2020, the per-share value of ExxonMobil, Chevron, and Total **declined** by 11.8%, compared to an increase of 209.6% in the same period for the S&P 500. In response to the oil industry's general financial stress, major companies have announced plans to reduce capital expenditures, with ExxonMobil announcing a reduction of capex from US\$35 billion per year

prior to the pandemic to US\$25 billion per year going forward. Topping the Fortune 500 as recently as 2011, ExxonMobil was **dropped** from the Dow Jones Industrial Average in 2020 and its market capitalization was briefly surpassed by “clean supermajor” NextEra, owner of 20,000 MW of renewable power capacity. A report by Goldman Sachs projected that post-pandemic capital expenditures in renewables would surpass capital expenditures for oil and gas exploration and development (Eckhouse 2020). Given these trends, it appears that the decline in oil and gas pipeline building may continue in the coming years.

As described below, ownership of pipelines is dominated by state-owned enterprises, and such companies may be somewhat insulated from the market forces that are impacting the publicly traded oil majors.

Figure 1. Annual Oil and Gas Pipeline Completions, 2008–2020 (km)



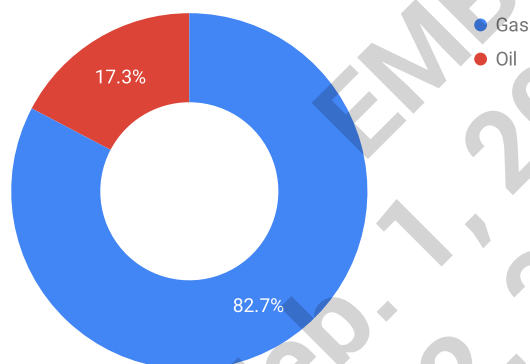
Source: GEM, Global Fossil Infrastructure Tracker, December 2020

GAS DOMINATES THE MIX

Gas dominates the global mix, accounting for 82.7% of global pipelines in pre-construction and construction, as shown in Figure 2. The dominance of gas pipelines reflects the shift from oil to gas in the global energy economy. In 1978, oil's share peaked at 45% of global primary energy consumption, subsequently falling to 33% in 2019. In the same period the share of fossil gas increased from 16% to 24% (BP 2020). Moreover, gas supply chains are lengthening, which means larger investments in infrastructure and greater stranded assets if and when projects stall or are prematurely retired. The global gas system now includes not only more LNG terminals, which have grown from supplying nine countries in 2000 to supplying 43 countries

in 2020, but also more long-distance gas transmission pipelines, some supplying LNG terminals for overseas transport and others moving large quantities of gas by land (Plante et al). Of the longest 20 pipelines currently in development globally, 18 will carry gas, sometimes crossing national boundaries from production areas such as Russia's Yamal Peninsula to Western Europe, at other times remaining within a single large country's own boundaries, such as the pipelines that connect remote fields to population centers in China ([Xinjiang Coal-to-Gas pipeline](#), 8,372 km), Brazil ([GASUN gas pipeline](#), 4,989 km), and Nigeria ([Trans Nigeria gas pipeline](#), 4,128 km).

Figure 2. Shares of Oil and Gas in Global Pipeline Development (by Length)



Source: Global Fossil Infrastructure Tracker, December 2020

METHODOLOGY

The Global Fossil Infrastructure Tracker is based on public data sources including industry, news, and government websites. For each project, a footnoted wiki page on [GEM.wiki](#) provides location, ownership, background, developmental status, and background information. Wiki pages are updated every 6 months. The main status categories are proposed, construction, shelved, canceled,

operating, mothballed, and retired. Proposed projects with no reported developmental progress after two years are considered shelved, and after two more years are considered canceled. An interactive map of all projects, including links to all wiki pages and summary data sheets, can be found at [GlobalEnergyMonitor.org](#), along with additional notes on methodology.

REGIONAL DISTRIBUTION AND CAPITAL EXPENDITURES

Development of new gas pipelines is dominated by the Asia Pacific region, which outweighs the next two regions, North America and Africa, combined, as shown in Table 1. Overall, the Asia Pacific region accounts for 42% of gas pipelines, as measured by distance, in pre-construction or construction. Development of new oil pipelines is dominated by North America, with 39% of oil pipelines (as measured in km) in pre-construction or construction.

Worldwide, the capital expenditure associated with projects in pre-construction or construction amounts to US\$1.07 trillion, as shown in Table 2. Based on an average of US\$5.04 million per km, pipelines completed in 2020 amount to US\$42.6 billion in capital investments.

Asia Pacific pipeline development is concentrated in China, with over 14,466 km of gas transmission pipelines under construction, and India, with over 11,017 km of gas pipelines under construction, as shown in Table 3.

Table 1. Pipeline Development by Region (km)

Region	Gas		Oil		Total
	Proposed	Construction	Proposed	Construction	
Asia Pacific	45,925	27,669	2,539	3,869	80,001
Africa	20,446	4,452	6,912	1,980	33,789
North America	12,620	4,034	10,012	4,152	30,818
Europe	15,770	5,911	1,550	207	23,438
Eurasia	15,609	4,469	0	0	20,078
Latin America	8,354	5,479	55	0	13,888
Middle East	2,027	2,559	2,589	2,862	10,037
Total	120,749	54,573	23,657	13,070	212,048

Source: Global Fossil Infrastructure Tracker, December 2020

Table 2: Estimated Capital Cost of Pipelines Under Development (Billion US\$)

Region	Gas	Oil	Total
Asia Pacific	371	32	403
Africa	126	45	170
North America	84	71	155
Europe	109	9	118
Eurasia	101	0	101
Latin America	70	0	70
Middle East	23	27	51
Total	884	185	1,069

Source: Global Fossil Infrastructure Tracker, December 2020. Includes projects in construction and pre-construction stages. Based on US\$4.75 million per km in 2016 (adjusted to US\$5.04 million per km in 2020 dollars) from "Natural gas pipelines profits, construction both up," *Oil & Gas Journal*, November 2018. Average pipeline diameter is assumed to be 30 inches. For further notes, see "[Oil and Gas Pipeline Construction Costs](#)," GEM.wiki.

Table 3. Pipeline Expansion Plans by Country by Length, Top 20 Countries (km)

Country	Gas		Oil		Total Gas & Oil
	Pre-Construction	Construction	Pre-Construction	Construction	
China	14,466	15,001	2,060	2,746	34,273
USA	9,010	1,991	8,100	2,643	21,744
India	11,017	9,423	235	0	20,675
Russia	13,820	3,233	0	0	17,053
Australia	8,458	79	0	0	8,537
Brazil	2,679	5,344	0	0	8,023
Nigeria	2,104	4,255	0	110	6,469
Canada	2,180	670	1,912	1,508	6,271
Iran	1,223	1,900	539	2,332	5,994
Mozambique	4,158	0	0	0	4,158
Bangladesh	2,740	401	237	440	3,818
South Africa	3,630	0	0	0	3,630
Romania	2,501	904	0	0	3,405
Tanzania	1,228	0	1,948	0	3,176
Poland	1,192	1,193	496	0	2,880
Indonesia	2,060	625	0	136	2,821
Mexico	1,430	1,373	0	0	2,803
Niger	1,454	0	0	1,210	2,665
Pakistan	1,714	772	0	0	2,486
Kenya	0	0	2,358	0	2,358

Source: Global Fossil Infrastructure Tracker, December 2020.

Table 4. Pipeline Expansion Plans by Country by Capacity, Top 20 Countries (barrels of oil equivalent per day)

Country	Gas		Oil		Total Gas & Oil
	Pre-Construction	Construction	Pre-Construction	Construction	
USA	8,336,450	2,458,626	5,873,857	2,960,300	19,629,233
China	3,346,269	3,468,013	2,785,829	0	9,600,111
Russia	4,285,714	1,779,935	0	0	6,065,650
India	1,122,091	2,277,487	500,000	0	3,899,579
Canada	456,489	517,170	2,761,143	0	3,734,802
Iran	234,289	669,666	1,778,350	1,000,000	3,682,305
Iraq	0	0	2,402,178	0	2,402,178
Australia	2,219,868	0	0	0	2,219,868
Jordan	0	0	1,467,385	0	1,467,385
Germany	0	1,130,497	137,754	0	1,268,251
Poland	106,715	180,610	771,017	0	1,058,343
Nigeria	366,656	676,090	4,986	0	1,047,732
Indonesia	27,582	642,182	250,000	0	919,764
Turkey	269,135	0	630,019	0	899,154
Oman	83,636	0	781,776	0	865,413
Brazil	503,124	275,236	0	0	778,360
Italy	421,883	231,006	0	0	652,889
Angola	0	0	602,599	0	602,599
Kazakhstan	0	0	0	600,000	600,000
Argentina	414,113	0	155,000	0	569,113

Source: Global Fossil Infrastructure Tracker, December 2020.

OWNERSHIP: WHO IS BUILDING PIPELINES?

At least 84 companies are developing oil pipelines, and 257 companies are developing gas pipelines. The top 15 companies building oil pipelines are shown in Table 5 below, and the top 20 companies building gas pipelines are shown in Table 6 on the next page. A list of all companies can be found at the [Global Fossil Infrastructure website](#). As shown in the tables, virtually all pipeline development outside North America is by state-owned companies. Notably, with the exception of Total at #14 among oil pipeline developers, none of the seven traditional oil majors (Eni, Statoil, Total, Chevron, BP, Shell, and ExxonMobil) is represented in the top ranks of developers of oil or gas pipelines.

At the #3 position on both lists, PipeChina is an important new player in the pipeline sector. The company was announced in December 2019, and in October 2020 it took over midstream assets from China's three major national oil companies: China National Petroleum Corporation (CNPC), China Petroleum & Chemical Corporation (Sinopec), and China National Offshore Oil Corporation (CNOOC) (Downs 2020). As shown in the tables, the Global Fossil Infrastructure Tracker still assigns ownership of some pipelines to Sinopec and China National Petroleum Corporation. While full integration is expected to take some time, PipeChina will likely emerge within the early part of the 2020 decade as the world's leading builder of both oil and gas pipelines.

Table 5. Top 15 Developers of Oil Pipelines (km)

Parent Company	Proposed	Construction	Total	Ownership	Country
Iran Ministry of Petroleum	539	2,422	2,961	State	Iran
Iraq Ministry of Oil	2,680	0	2,680	State	Iraq
PipeChina	1,100	1,158	2,258	State	China
Sinopec	960	1,160	2,120	State	China
Plains GP Holdings	1,728	339	2,067	Public	U.S.
China National Petroleum Corporation	0	1,980	1,980	State	China
TC Energy	0	1,897	1,897	Public	Canada
Eagle Spirit Energy Holdings	1,601	0	1,601	Private	Canada
Government of Kenya	1,534	0	1,534	State	Kenya
Government of Zambia	1,146	0	1,146	State	Zambia
Phillips 66	1,137	0	1,137	Public	U.S.
Tallgrass Energy	1,127	0	1,127	Private	U.S.
Canada Development Investment Corporation	0	980	980	Private/State	Canada
Total S.A.	928	0	928	Public	France
Magellan Midstream Partners	805	0	805	Public	U.S.

Source: Global Fossil Infrastructure Tracker, December 2020

Note: "Public" refers to publicly traded corporations. "State" refers to state-owned enterprises. "Private" refers to corporations that are not listed on public stock exchanges.

Table 6. Top 20 Developers of Gas Pipelines (km)

Parent Company	Proposed	Construction	Total	Ownership	Country
Gazprom	13,442	3,161	16,604	Public / State	Russia
Sinopec	1,463	8,731	10,194	State	China
PipeChina	6,916	2,096	9,012	State	China
Nigerian National Petroleum Corporation	4,637	4,255	8,892	State	Nigeria
Gas Authority of India Limited	4,738	3,565	8,303	State	India
Petrobras	647	5,344	5,991	State	Brazil
China National Petroleum Corporation	2,285	2,647	4,932	State	China
Ministry of Petroleum of Iran	1,880	1,900	3,780	State	Iran
Transgaz	1,952	1,440	3,392	State	Romania
Moroccan National Board of Hydrocarbons and Mines	2,830	0	2,830	State	Morocco
Transnet	2,660	0	2,660	State	South Africa
Gujarat State Petronet	614	2,042	2,656	State	India
TC Energy	1,411	1,237	2,647	Public	Canada
Oil and Natural Gas Corporation Limited	2,633	0	2,633	State	India
Bangladesh Petroleum Corporation	2,583	0	2,583	State	Bangladesh
Indian Oil Corporation Limited	868	1,445	2,313	Public / State	India
Turkmengaz	150	2,147	2,297	State	Turkmenistan
Gaz-System	948	1,151	2,099	State	Poland
Sonatrach	1,828	197	2,025	State	Algeria
Jemena	1,971	0	1,971	State	China

Source: Global Fossil Infrastructure Tracker, December 2020.

Note: "Public" refers to publicly traded corporations. "State" refers to state-owned enterprises. "Public / State" refers to state-owned enterprises that are also listed on public stock exchanges.

IMPACT OF COVID-19

Beginning in March 2020 the Covid-19 pandemic caused severe short-term problems for the oil and gas industry including plummeting demand, record-low prices, logistical difficulties that slowed construction of new pipelines and terminals, and a climate of uncertainty that is discouraging investment in new projects. Many governments are using Covid-19 relief packages to promote renewables and transition away from fossil projects whose pre-pandemic finances were already shaky. In the U.S., President Biden is proposing a US\$2 trillion program to transition the country to carbon-free electricity generation by 2035. In May 2020 the EU announced that the EU Green Deal prioritizing renewables over fossil fuels would be central to Europe's long-term recovery (IISD 2020).

At the same time EU member states are continuing to invest in fossil fuels, according to research by Energy

Policy Tracker which finds that G20 governments have committed US\$242 billion to fossil fuel projects since the beginning of the pandemic, compared to US\$180 billion for renewables (Energy Policy Tracker 2020). Australia's government is also using the crisis to fund fossil projects that had failed to attract funding in a pre-pandemic environment (see this report's regional summary for Australia).

Net zero emissions pledges by countries, cities, local governments, and businesses roughly doubled between September 2019 and September 2020 (New Climate Institute 2020); and while many of these pledges would likely have occurred without the pressures of the pandemic, the declining fortunes of the oil and gas industry have contributed to a climate in which political and corporate leaders are more willing to make this pledge.

PIPELINES AND CLIMATE CHANGE

As the impacts of climate change accelerate, CSOs are increasingly focusing on supply side measures such as stopping oil and gas pipelines. In 2017, representatives of over 530 CSOs signed the Lofoten Declaration, an international manifesto calling for an end to the further expansion of fossil fuel reserves and a phase-out in production. Since the initial release of the declaration, the list of signatories has grown to over 600 organizations in 76 countries. More recently, civil society groups have launched the [Fossil Fuel Non-Proliferation Treaty](#) initiative, aimed at spurring multilateral action among governments to formally wind down production levels and sequester reserves.

From the standpoint of limiting climate change, the importance of avoiding further expansion of oil and gas production has been underlined by several recent studies:

- **Burning the Gas “Bridge Fuel” Myth.** According to this analysis by Oil Change International, one of the co-signers of the [Lofoten Declaration](#), avoiding the development of new oil and gas fields is crucial since the CO₂ emissions that would be released even from the exploitation of coal, gas, and oil fields that are already operating or under construction is almost as large as the carbon budget associated with a 66% chance of limiting global warming to 2°C and twice the carbon budget associated with a 50% chance of staying within 1.5°C of warming (Stockman 2019).
- **Five Years Lost: How Finance Is Blowing the Carbon Budget.** This recent survey by thirteen CSOs identified eight of the largest oil and gas expansion areas, all requiring new infrastructure investments to proceed. According to the study, exploiting these areas fully would use up nearly half of the remaining carbon budget that would provide a 66% probability of limiting global warming to 1.5°C (Urgewald 2020).
- **Production Gap report.** According to this report by the United Nations Environment Programme and

four think tanks, limiting global warming to 1.5°C or well below 2°C, as outlined by the 2015 Paris Agreement, will require significant reduction in fossil fuel production within the coming decade, with oil and gas production declining by 4% and 3% respectively between 2020 and 2030 (U.N. Environment Programme 2020). However, based on current expansion plans, including the nearly US\$1.07 trillion in pipelines being developed globally, fossil energy production will increase by 2% per year. The gap between the necessary annual reductions of 3%–4% and the planned increase of 2% annual amounts to a level of production in 2030 dramatically above the level consistent with Paris goals.

Among initiatives aimed at the supply side, pipelines have attracted particular attention due to their massive size. For example, the [Nord Stream 2 pipeline](#) will have the capacity to transport 30 billion cubic meters per year of fossil gas from Russia to Europe. When combusted, that gas will produce 106 million tonnes of carbon dioxide per year, equivalent to the emissions of 28 large (1000 megawatt) coal-fired power plants. The massive size of pipelines makes them high-profile targets for civil society and governmental action on climate change, which increasingly aims at removing the financial underpinnings of projects. Scalewise, pipelines are among the most expensive elements in the fossil fuel system, with some projects costing over US\$20 billion, or ten times as much as a typical coal-fired power plant (Przbylo 2019).

In addition to their massive size, pipelines are seen by CSOs as strategically important in expanding the geographic scope of extraction. Particularly as extraction moves to increasingly remote areas such as Canada’s tar sands and Russia’s Yamal peninsula, extraction plans cannot proceed without the building of new pipelines and other supportive infrastructure.

Further adding to the view of pipelines as crucial targets for civil society action on climate change is their long lifespan, with 60% of U.S. transmission pipelines being older than 50 years. Such durability amplifies the related

issue of “lock-in,” since any pipeline built in 2021 will still be operable in 2071, long after the point in time by which the Paris Climate Agreement calls for fossil fuels to be fully phased out (Sittler 2018). “Lock in” refers to the fact that once fossil infrastructure has been built, it represents a sunk cost that rational producers will ignore as long as the market price is high enough to cover their marginal cost of production, thereby impeding the transition to renewables (Green 2018).

Table 7 shows the lifetime levels of carbon dioxide emissions that will be produced by the additional amounts of oil and gas transported by pipelines

currently in construction or pre-construction development. Such estimates are inherently uncertain, since they depend on the level of utilization of pipelines. The table assumes 50% utilization, which may be too high or too low, depending on region and the point in time. As shown in Figure 3, at such a utilization rate the combined lifetime CO₂ emissions enabled by gas pipelines and oil pipelines under development (construction or pre-construction) will support a lifetime increase in oil and gas CO₂ emissions of 170 gigatonnes, only 15% less than the projected lifetime CO₂ emissions of the global coal plant fleet.

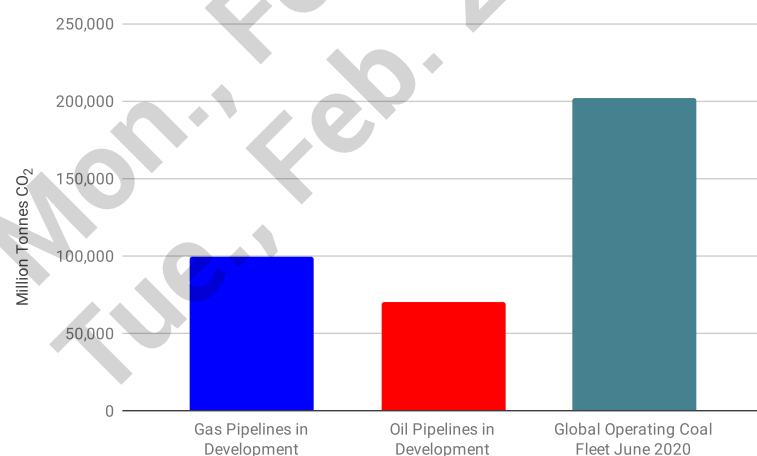
Table 7. Oil and Gas Pipelines: Lifetime CO₂ (Million Tonnes)

Region	Gas		Oil		Total
	Proposed	Construction	Proposed	Construction	
North America	19,979	7,630	20,493	6,752	54,855
Asia Pacific	16,642	16,046	6,126	5,882	44,696
Europe	5,501	6,645	5,167	465	17,778
Eurasia	11,338	5,264	0	0	16,602
Middle East	747	1,693	12,559	7,731	22,730
Africa	2,676	1,683	4,496	284	9,139
Latin America	2,911	656	489	0	4,056
Total	59,795	39,617	49,330	21,114	169,857

Source: Global Fossil Infrastructure Tracker, December 2020

Note: Assumes average pipeline capacity utilization rate of 50%, 40 year lifespan

Figure 3. Comparative Lifetime CO₂ Emissions from Gas Pipelines and Oil Pipelines in Development (Construction and Pre-Construction) and the Global Fleet of Operating Coal-Fired Power Plants



Sources: Gas and oil pipelines: Global Fossil Infrastructure Tracker, December 2020; coal plants: Global Coal Plant Tracker, July 2020. Assumes 40-year lifespan for gas pipelines, oil pipelines, and coal plants; 50% utilization rate for gas and oil pipelines; 51% utilization rate for coal plants.

DIVESTMENT AND INSTITUTIONAL RESTRICTIONS

At the close of 2020, divestment policies and institutional restrictions related to investments in oil and gas pipelines were far fewer and less comprehensive than similar policies related to coal-fired power plants. However, that situation appears to be on the verge of change, as civil society efforts aimed at restricting finance to coal are broadening to also include oil and gas production and infrastructure.

In the coal sector, pressure to divest from coal-related stocks and to implement restrictions against institutional financing of coal-related companies traces back a decade. Early student-led campaigns aimed at divestment of college endowment funds from coal-related companies, while at the same time, CSOs such as Rainforest Action Network pushed for private and public financial institutions to enact formal restrictions against coal-related lending. Initially, campaigners focused primarily on the most destructive mining practices, in particular mountaintop removal mining. But as both divestment campaigns and campaigns aimed at financial institutions gained traction, they widened their scope to include the full gamut of coal mining, transport, and power industry enterprises. As of January 2021, divestment campaigns claim to have secured commitments from 1,307 institutions and 58,000 individual investors, covering US\$14.5 trillion in assets (Fossil Free: Divestment 2021). At least 131 banks and insurers have announced [divestment](#) from coal mining or coal-fired power plants, according to IEEFA.

In the coal sector, there has been a clear pattern among financiers and institutional investors of first adopting narrow restrictions, such as the exclusion of lending for mountaintop removal mining, and

then over time widening the scope of the exclusion to include a wider set of activities. Similarly, in the oil and gas sector, policy restrictions have initially focused on narrow areas of activity, mainly Arctic drilling and tar sands extraction. Since the first oil and gas restrictions appeared in 2017, the pace of announcements of such restrictions has quickened: four institutions in 2017, five in 2018, 21 in 2019, and 32 in 2020. For the first time, exclusions affecting the entire spectrum of oil and gas extraction activities appeared in 2020, announced by Suncorp Group and Government Pension Fund Global (GPF). But examination of the policies of other institutions suggests that the scope is likely soon to widen to include pipelines and other infrastructure.

The [policy](#) established by Zurich Insurance Group is typical. While expressly prohibiting investments in or insurance for companies generating at least 30% of their revenue directly from the extraction of oil from oil shale, the insurer's policy also excludes "transportation infrastructure operators for oil sands products, including pipelines and railway transportation."

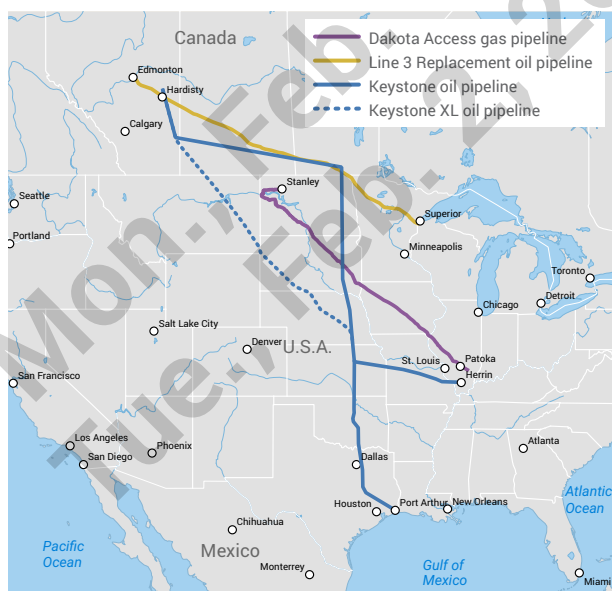
As a practical matter, including midstream infrastructure in restrictions aimed at the most damaging sorts of oil and gas extraction gives a far wider scope to the restrictions. For example, financing for three of the most controversial projects of the past several years, the [Keystone XL oil pipeline](#) connecting Alberta tar sands to Gulf of Mexico export terminals, the [Baltic Pipe Project](#) to transport fossil gas from Norway to Poland via Denmark, and the [Alaska LNG pipeline](#) connecting Alaska's Arctic coast to southern Alaska ports, would all have been affected.

OPPOSITION AND SOCIAL LICENSE

Little more than a decade ago, oil and gas pipelines were lumped together with other infrastructure such as bridges, sewage systems, and telephone lines as rather boring, uncontroversial investments. The fourth phase of the Keystone Pipeline System, Keystone XL, changed the image of pipelines from “safe” to “controversial.” Keystone XL attracted sustained opposition from a coalition of Midwestern landowners, Native American tribal governments, and climate activists that culminated in 1,000 nonviolent arrests at the White House and the eventual rejection of the pipeline by the Obama administration.

Since Keystone, protests against pipeline construction have been chronic in much of the world, as part of growing challenges to the oil and gas industry’s social license to operate. In Germany, activists near Wrangelsburg occupied the [Nord Stream 2 gas pipeline](#), interfering with construction. In Mexico, members of the Yaqui tribe disabled a major segment of the [Guaymas-El Oro gas pipeline](#), forcing the pipeline to be idled. In Canada, protests by the Wet’suwet’en tribe against the [Coastal GasLink pipeline](#) in British Columbia in the winter of 2020 launched a nationwide movement in which

students, environmentalists, and other First Nations clans blocked roads, barricaded access to shipping ports, and occupied the offices of elected officials. In the U.S., a series of successful protests and legal actions against oil and gas pipelines in mid-2020 led some energy observers to ask “[Are Pipelines Over?](#)” Despite a U.S. Supreme Court ruling that would have allowed it to cut across the Appalachian Trail, the [Atlantic Coast pipeline](#) was canceled by its sponsors due to the prospect of further protests, delays, and losses on a project whose cost had risen to US\$8 billion. Construction of the [Keystone XL pipeline](#) was halted when a Federal judge ruled that the Army Corps of Engineers had failed to properly assess the pipeline’s impact on endangered species. The [Dakota Access oil pipeline](#) was ordered to be shut down by a federal judge on grounds that the pipeline’s impact on the environment and the Standing Rock Sioux tribe had not been fully considered as required under the National Environmental Protection Act (NEPA). This shut-down order was then stayed by an appeals court but the Army Corps of Engineers is still required to conduct a new, more thorough environmental assessment.



BIDEN AND PIPELINES

As the biggest developer of oil and gas pipelines by capacity (Table 4), and the second biggest developer (after China) by length (Table 3), the U.S. will play a key role in determining whether the expansion of global fossil emissions can be brought under control. The Biden Administration will have the opportunity to change the heavily pro-fossil stance of the Trump Administration in multiple ways.

- **Pipeline Approvals:** A key promise of Biden's presidential campaign was the commitment to cancel Keystone XL, which has been the center of controversy for over a decade and was halted by the Obama administration after initially being supported by Obama. Equally controversial is the Dakota Access oil pipeline (DAPL), which was also halted by the Obama administration. Both projects were restarted by the Trump administration.
- **Green Stimulus Bills:** In January 2021 the U.S. Congress overrode a presidential veto to [pass](#) an economic stimulus bill that included a shift in federal energy funding from fossil fuels to renewables. Despite the U.S. Senate's undemocratic filibuster rule, which requires 60 votes for a bill to pass, Biden can shift U.S. policy through add-ons to future stimulus bills and through the budget reconciliation process.
- **FERC Appointments:** The success to date of the U.S. gas industry in building out its pipeline network can be attributed in large part to the Federal Energy Regulatory Commission (FERC), which rejected just two out of 400 pipelines applications it received between 1999 and 2017. Yet by late 2020 FERC's complete embrace of fossil fuels had begun to loosen slightly, with Trump demoting his own Chairman Neal Chatterjee as punishment for [supporting](#) carbon pricing and opening energy markets to rooftop solar. With Biden appointees soon assuming a 3–2 majority of FERC's serving commissioners, the agency will also have the opportunity to more strongly enforce a 2016 Obama rule that requires pipelines and other fossil fuel projects to account for their impact on GHG emissions.
- **Executive Actions:** Biden has pledged to reverse many of the more than [80 executive actions](#) taken by the Trump Administration to weaken environmental protections and promote the further use of fossil fuels. In December 2020 the Department of Energy [exempted](#) natural gas exports from review under the National Energy Policy Act, and in January 2021 the EPA finalized a new rule that would [limit](#) the use of scientific studies for which underlying data is not publicly available. Biden can also rescind a new Army Corps of Engineers [regulation](#) that would make it easier for pipelines such as the [Mountain Valley gas pipeline](#) to cross bodies of water.
- **Diversity and Equity:** Deb Haaland, Biden's nominee for Secretary of the Interior, would be the first Native American cabinet secretary in U.S. history, and environmentalists see her as a [potential ally](#) in the fight against the Line 3 oil pipeline in Minnesota. Biden's nominee for EPA Director Michael S. Regan brings a focus on equity and racial justice, but has been criticized for granting a water quality certification to the now canceled [Atlantic Coast gas pipeline](#). Biden's initial nominees represent a radical departure from the Trump administration's strategy of filling environmental posts with former lobbyists and executives for the fossil fuel industry.
- **Ending Fossil Fuel Subsidies Overseas:** Biden appointees to the U.S. Export-Import Bank (US EXIM) can back up and financially support his administration's commitments to provide international leadership on climate issues. From 2010–2019 US EXIM [directed](#) more than 90% of its funding for overseas energy projects to fossil fuels, and recently provided a [US\\$5 billion loan](#) to Total's carbon-intensive Mozambique LNG project. In December 2020 Prime Minister Boris Johnson [announced an end to financial support](#) for the fossil fuel sector from the U.K.'s equivalent overseas finance agency.
- **Terminals:** The Biden Administration can reduce the danger from one of the world's biggest "carbon bombs," the Permian Basin, by withholding or rescinding federal approvals for nine new oil export terminals and sixteen new LNG export terminals that are being developed in Texas and Louisiana.

In December 2020 members of the Ojibwe tribe temporarily halted construction of the new [Line 3 oil pipeline](#) through their territory in northern Minnesota with the [construction of a ceremonial lodge](#) along the pipeline's route near the Mississippi River. If commissioned the 915,000 barrel-per-day Line 3 would be one of the world's largest oil pipelines and would be carrying a type of oil, Canadian tar sands, that is among the dirtiest. Environmental and Native American groups have sued to have the pipeline's state permits revoked and can potentially have its federal permits revoked

NORTH AMERICA

United States

Before the Covid-19 pandemic began in March 2020 the United States was projected to become the world's largest exporter of fossil gas by 2024. Construction of new fossil gas pipelines and LNG export terminals was booming as the U.S. gas industry—despite flagging profits from fracking and domestic sales of gas—anticipated a commensurate boom in new LNG import terminals in Europe and Asia.

By December 2020 the U.S. gas industry confronted a starkly different reality. Gas prices had collapsed as a result of the pandemic and numerous pipelines and terminals were being delayed or canceled due to an inability to obtain financing. Several high-profile pipelines had also been canceled or shut down as a result of protests, legal challenges, and failures by their sponsors and the Army Corps of Engineers to obtain proper permits and conduct thorough environmental impact assessments. Public concern about climate change intensified as the west coast endured historic, devastating wildfires, and the southern and eastern U.S. endured hurricanes, flooding, and drought. These factors and the election of Joe Biden as President have led environmentalists to hope that the U.S. has reached a crossroads on fossil fuels and that the country can now move more aggressively towards renewable energy.

by proving that Enbridge's assessment of the pipeline's environmental impacts is inaccurate.

The welfare of oil and gas workers in a decarbonizing world is also at stake as the U.S. sector [shed](#) more than 100,000 jobs in the first three months of the Covid-19 pandemic. In September 2020 a [survey](#) of oil and gas workers in the U.K. found that while most were not familiar with the term “just transition,” four in five would be willing to transition to work in another sector, and more than half would be willing to work in renewables instead of oil and gas.

Unstoppable FERC vs. Immovable States

The success to date of the U.S. gas industry in building out its pipeline network can be attributed in large part to the Federal Energy Regulatory Commission (FERC), which rejected just two out of 400 pipelines applications it received between 1999 and 2017. Now, as state officials and state agencies are taking a stronger stance in opposition to pipelines, FERC and the federal government have taken unprecedented steps to strip power from these local officials and substantially nationalize the process for approving pipelines.

The US\$1 billion [PennEast pipeline](#) is being built to carry fracked gas from Pennsylvania to New Jersey. After its sponsors were unable to acquire necessary land for the New Jersey portion of the pipeline, FERC took the extraordinary step of [granting](#) its sponsor the right “to exercise the federal government's power of eminent domain to secure necessary rights-of-way for the construction of an interstate pipeline.” In September 2019 the Third Circuit Court of Appeals found this grant to be a violation of the 11th Amendment, a ruling which sponsors are now asking the U.S. Supreme Court to overturn. In December 2020, facing continuing delays and the imminent replacement of Trump's FERC Chairman with a Biden appointee, the pipeline's

main sponsor New Jersey Resources [removed](#) the pipeline from its long-term financial projections.

The Permian Basin in west Texas and southeast New Mexico [contains](#) an estimated 50% of all U.S. gas reserves and has the potential to be the source of approximately 55 billion tons of CO₂ by 2050—a “carbon bomb” that would consume ten percent of the world’s allowable carbon budget if we are to have a 50/50 chance of limiting global warming to 1.5°C (Trout 2019). (See Section: *Financing the Permian Boom*.) Designed to bring gas from west Texas to hubs in east Texas, the recently commissioned [Permian Highway gas pipeline](#) is being challenged in separate lawsuits alleging that it violates NEPA, violates the Safe Drinking Water Act, and that it is improperly classified as an “intrastate” pipeline, allowing it to escape federal scrutiny and regulation. Two other projects under construction in the Permian, the [Rio Bravo gas pipeline](#) and the [Double E pipeline project](#), are being challenged on the grounds that FERC failed to fully consider their environmental impact on nearby communities or their contribution to global GHG emissions.

Canada

Like the United States, Canada continues to plan an expansion of its export pipeline network and new LNG export terminals despite cratering demand, historically low prices, and increasing skepticism from investors and the public about fossil fuels.

Construction of the 670 km [Coastal GasLink pipeline](#) from Dawson Creek, British Columbia to the proposed LNG Canada Terminal is proceeding with an estimated C\$250–500 million from Export Development Canada. In June British Columbia’s Environmental Assessment Office (BCEAO) found that Coastal Gaslink had commenced construction through hundreds of wetlands without first completing the required environmental

The Jordan Cove LNG Terminal and its feeder, the [Pacific Connector pipeline](#), are opposed by a coalition that includes nearby residents, farmers, indigenous groups, fisherfolk, conservation groups, land rights advocates, and many of the state’s leading elected officials. The pipeline and terminal were twice denied FERC approval and have failed to obtain state permits including a water quality certification and coastal zone management determination. In March 2020 FERC voted a third time and [approved](#) the two projects with Chairman Neal Chatterjee noting, “All the signals I see from domestic participants, as well as our international allies [are] that people continue to be bullish about the prospects for US LNG.” In October 2020 the DC Circuit Court of Appeals [affirmed](#) FERC’s authority to continue seizing land for the projects through eminent domain despite the fact that the terminal and pipeline would be used to export gas to other countries. In January 2021, in a surprise move that may herald a new approach under the Biden Administration, FERC denied a petition by the project’s sponsors to waive Oregon’s regulatory authority and, in effect, nationalize the pipeline approval process.

fieldwork, and BCEAO issued a “cease and remedy” order for any construction activities within 30 meters of one of these protected wetlands. BCEAO ordered further assessments for both the damaged wetlands and the wetlands yet to be impacted.

An expansion of the [Trans Mountain oil pipeline](#) is “built on financial quicksand,” according to [IEEFA](#), but is proceeding after the Canadian government bought the troubled project from Kinder Morgan for CN\$5.6 billion in 2018. The pipeline’s total estimated cost to Canadian taxpayers has since [risen](#) from CN\$9.7 billion to CN\$17.1 billion.

Mexico

In June 2020 the commissioning of the [Villa de Reyes-Aguascalientes-Guadalajara pipeline](#) marked the completion of the 1,446-km Wahalajara system carrying gas from the Waha hub in Texas to Guadalajara. The system is fed by the [Trans Pecos pipeline](#) in Texas which has been classified as an “intrastate” pipeline that falls under the jurisdiction of the Texas Railroad Commission for most of its length, while only a 1,093-foot segment of the pipeline that runs under the Rio Grande required review under the United States’ National Environmental Policy Act.

Another key project is the [Sur de Texas-Tuxpán pipeline](#) (commissioned in 2019), which runs 800 km from Brownsville, Texas through the Gulf of Mexico to Tuxpán, Veracruz. At Tuxpán, the pipeline feeds into Mexico’s existing national network and will eventually connect with the proposed [Tuxpán-Tula](#) and [Tula-Villa de Reyes](#) pipelines and join the Wahalajara network at Villa de Reyes.



LATIN AMERICA

Argentina has the second largest shale gas reserves in the world, and burning all of the gas in the Neuquén basin would [consume](#) 11.4% of the world’s 1.5 carbon budget. In July 2020 the Argentine government proposed a new 2,055-km pipeline from Vaca Muerta in the Neuquén basin to Brazil after a proposed 1,040-km pipeline from Vaca Muerta to Buenos Aires failed to obtain financing.

Peru plans to revive and expand its proposed 1,050-km [Southern gas pipeline \(SIT\)](#), which has been stalled since 2017. If constructed, the newly revamped project would bring fossil gas to 900,000 households in southern Peru over the next 35 years. A tender for the US\$4.5 billion project is scheduled for 2021, with completion of the pipeline anticipated in 2025 or 2026.

In Colombia a tender is scheduled for early 2021 for the 110-kilometer [Buenaventura-Yumbo gas pipeline](#), which will transport fossil gas inland from the new Pacific LNG Terminal on Colombia’s Pacific coast to



Yumbo, where it will link up with Colombia’s existing gas pipeline network. Canacol is currently seeking an environmental permit for the first phase of the 508-km [Northwestern gas pipeline](#), which will link Colombia’s Jobo gas fields with Medellín, Mariquita and Bogotá between now and 2028.

EUROPE

The European Union's climate goal of full decarbonization by 2050, with an interim target to cut greenhouse gas emissions to at least 55% below 1990 levels by 2030, is at odds with the glut of gas pipelines and LNG terminals operating across most of the bloc's 28 member states. This situation is set to worsen if a list of currently proposed pipelines and terminals are realized.

Global Energy Monitor research in February 2020 found that, despite the existence of already large excess gas infrastructure in the EU, companies are developing projects which would add 233 billion cubic meters per year to the EU's gas import capacity. These plans involve 12,842 kilometers of pipeline at a cost of €52 billion as well as an increase in LNG terminal capacity of 54% which requires investment of €12 billion. More than €25 billion of the funding could come from EU public subsidies with the European Commission's blessing (Inman 2020).

This level of proposed build-out of gas infrastructure assets is out of sync with official Brussels projections in the last couple of years on how EU gas usage has to be reduced by at least [30 percent](#) by 2030 and by [90 percent](#) by 2050 if Europe is to meet its climate change targets. Civil society organizations including Global Witness, WWF Europe, and Corporate Europe Observatory have asserted that with EU gas consumption declining due to the rapid uptake of renewable energy, and the need for further cuts to meet the decarbonization goals, expanding the gas system makes no sense (Global Witness 2020). These organizations point to the influence of European gas companies over EU gas policy, coordinated across the continent since 2009 by the European Network of Transmission System Operators for Gas (ENTSOG) trade association, as a driver of excess gas infrastructure capacity. Such arguments were affirmed by an examination of EU gas supply security by consulting firm Artelys, which concluded that "existing EU gas infrastructure is sufficiently capable of meeting a variety of future gas demand scenarios," and that most proposed expansion projects were "unnecessary from a security of supply point of view, and represent a

potential overinvestment of tens of billions of EUR, supported by European public funds (Artelys 2020)."

The European Investment Bank, the "EU's bank" and owned by the member states, has read the runes and announced an end to its financing of oil and gas by the end of 2021. The chief architect of the bank's policy has pointed to both the incompatibility of further financial support to the sector with the EU's climate targets and the looming stranded asset risks (Inman 2020).

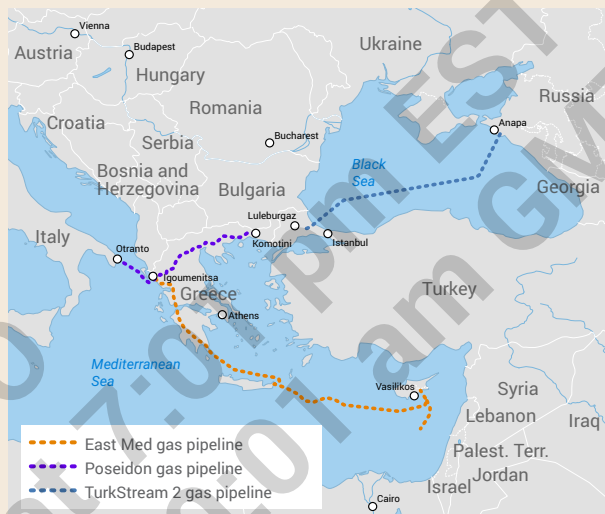
In contrast, Germany, the EU's most powerful state, is demonstrating the political and reputational risks of backing gas. As it holds out in the face of international opposition and a U.S. sanctions regime against the completion of Gazprom's [Nord Stream 2 gas pipeline](#), the German government is also facing public opposition over its potential state funding support for the proposed [Goldboro LNG Terminal](#) in Nova Scotia, Canada, which would export to planned import terminals in Germany. One such project proposal, the [Wilhelmshaven LNG Terminal](#) in Lower Saxony, was canceled in November due to a lack of gas demand. Other proposed German import projects such as the [Brunsbüttel LNG Terminal](#) may experience a similar fate as political and public opposition [mounts](#) in Europe against importing gas produced by fracking tight shale formations in the U.S.



CASE: EAST MED GAS PIPELINE

Originally proposed in 2012 following the discovery of large gas reserves within the exclusive economic zones of Cyprus and Israel, the US\$6 billion [East Med gas pipeline](#) has become a focus point in the debate over how the EU plans to pursue and financially support its decarbonization plan. The EU has already awarded the project US\$40 million for feasibility studies under its Projects of Common Interest (PCI) program. At a proposed 1,900 km, East Med would be the world's longest and deepest offshore pipeline, carrying between 10 and 20 billion cubic meters annually of fossil gas from Israel and Cyprus via the island of Crete to mainland Greece. From there it would hook up with the proposed [Poseidon gas pipeline](#) to transport gas across the Adriatic Sea to southern Italy. European environmental groups have called on the European Commission to remove East Med and Poseidon from the PCI program and further European public funding support as they are incompatible with EU climate targets and risk becoming [stranded assets](#) due to projected declines in gas demand and already existing excess import capacity.

Major players including ExxonMobil, Shell, and Total are engaged in East Mediterranean exploration and licensing negotiations. Yet despite concerted statements of political support from Cyprus, Greece, Israel, the EU, and also the U.S., East Med has made limited commercial progress towards a hoped for start date of 2025. The project's



prospects have also been caught up in the [escalation](#) of regional tensions which saw a “collision” between Greek and Turkish warships in the East Mediterranean in August 2020, a flare-up rooted in long-standing grievances including over the [ownership](#) of hydrocarbon reserves and gas export routes. These underlying tensions are not expected to disappear quickly and will continue to present a major challenge to project promoters attempting to realize a highly complex, mega gas pipeline.

AFRICA AND MIDDLE EAST

Between 2011 and 2014 approximately 20 percent of global oil discoveries occurred in Africa, along with nearly 50 percent of global gas discoveries between 2011 and 2018 (Enerdata 2020). The East African states of Kenya, Tanzania, Mozambique, and Uganda now make up one of the world's top hydrocarbon hotspots. Western and Chinese oil and gas majors most notably are lining up to produce and transport the region's reserves for ultimate shipping to international markets across the Indian Ocean. One of the most controversial pipeline developments is Total and China National Offshore Oil Corporation's [Uganda-Tanzania crude oil pipeline](#)—see more details below. The bottom line,

according to Total CEO Patrick Pouyanné, is that this highly contested [project](#) is “in line with [Total's] strategy of acquiring long-term resources at low cost.”

Oil and gas extractivism by multinationals in Africa continues, however, to come with high costs and risks attached—and not just for millions of inhabitants, the environment, and the climate. For the continent's pipelines to advance, regional infrastructure deals are required. These remain vulnerable to political and security challenges, a lack of clear regulatory frameworks, the prevalence of corrupt practices on all sides, protracted wrangling between state governments and

promoter companies, and a host of other complex, unstable local realities.

The Uganda-Tanzania pipeline was born out of uncertainties over the now canceled [Uganda-Kenya crude oil pipeline](#). Subsequently compelled to go it alone with Tullow Oil and Total, the Kenyan government-backed [Lokichar-Lamu oil pipeline](#) is facing significant delays, made worse by Covid-19 and plunging oil

Chinese presence and influence

China's national oil industry and its new conglomerate PipeChina are continuing to face down these challenges after entering Africa's oil sector 25 years ago. With an upstream [presence](#) in almost 20 African states, China's state-owned giants are pressing forward and seeking to expand their influence via major pipeline projects, usually in tandem with significant Chinese financial support. This is part of a long-term effort now enshrined under the Belt and Road Initiative which intertwines global economic, geopolitical and strategic expansion with supplying China's growing demand for domestic energy.

In 2019 CNPC abandoned plans to build the [Niger Chad oil pipeline](#) over security concerns and disputes with the Chadian government and is instead advancing with the US\$7 billion, 90,000 barrels per day [Niger Benin oil pipeline](#). And, as part of long-delayed gasification ambitions in Nigeria, Bank of China is providing the under-construction [Trans Nigeria gas pipeline](#) with US\$2.6 billion in debt financing. More than US\$36 billion of Chinese foreign direct investment has been pumped into African oil and gas projects between 2005 and 2019 (American Enterprise Institute 2020), establishing a so-called “playground for Chinese

prices. The mammoth [Nigeria-Morocco gas pipeline](#), planned to run along the west coast of Africa for 5,660 km and connect to every coastal state, would take 25 years to complete and faces myriad obstacles. Forty African and international organisations have raised fundamental environmental, social, and economic concerns in a joint declaration against the project (CADTM 2018).



interests” on the continent. This has been accompanied over the past two decades by almost US\$150 billion in Chinese lending across all sectors to African governments and state-owned companies, resulting in mounting debt [distress](#) for various states.

Development deficits mount

Ongoing African pipeline expansion, heralded as providing economic development, is bringing a rash of environmental, social, and economic consequences while helping to accelerate climate change. As this build-out continues, the unignorable reality, according

to the World Meteorological Organization, is that African nations are already [spending](#) between 2% and 9% of their gross domestic product on climate adaptation and mitigation measures.

CASE: UGANDA-TANZANIA CRUDE OIL PIPELINE

The [Uganda-Tanzania crude oil pipeline](#), or East African Crude Oil Pipeline (EACOP), is a proposed US\$3.5 billion, 1,444-km pipeline that would transport 216,000 barrels of oil a day from Uganda's Albertine Graben oilfields to the Tanzanian port of Tanga for shipment to international markets. After several years of protracted negotiations, the host governments reached an agreement on the pipeline's construction in September 2020. A final investment decision from the project promoters Total and the China National Offshore Oil Corporation, which had been expected to conclude before the end of 2020, is still to be finalized. US\$2.5 billion in loans will be needed to finance the project's construction and several international commercial banks are currently acting as financial advisors despite the many risks attached (BankTrack 2020).

Legal challenges are being mounted by CSOs at the East African Court of Justice and in French courts, as part of efforts to ensure that the promoters address failings in the project's environmental and social impact assessments.

Shortcomings in these assessments carried out by Total, allege Friends of the Earth France and Survie, have downplayed the number of people whose human rights are being infringed in the Great Lakes communities along the pipeline route. Based on collected testimonies and field surveys conducted in 2020, the French NGOs estimate that the rights of 100,000 people—including property, education and freedom of expression rights—are being compromised in a worsening humanitarian crisis brought by the project (Friends of the Earth France 2020). The pipeline threatens water and food access for millions of people, with 460 km traversing the freshwater basin of Lake Victoria. The project's scale means that many critical ecosystems, including Uganda's Murchison Falls National Park, are at risk and nearly 2,000 square kilometers of protected wildlife habitats could be negatively impacted (WWF 2017). It has also been estimated that the oil flow through EACOP, when burned, would [result](#) in 34 million tonnes of carbon emissions per year—equivalent to the annual emissions of Denmark.

Middle East

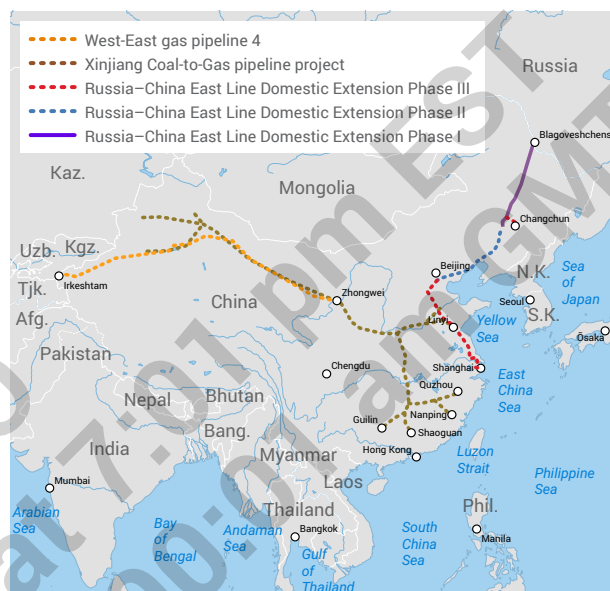
In the Middle East, ten pipelines are in construction and an additional seven are in pre-construction development, amounting to 10,037 km of new pipelines overall and adding 1.8 million barrels per day of oil capacity and 1 million barrels per day equivalent of gas capacity. Nine of these pipelines are located within Iran or connect Iran to neighboring countries. Among the most significant projects under development in the region are the [IGAT 9 gas pipeline](#), connecting Azerbaijan to the Persian Gulf, and the

[Iran-Pakistan gas pipeline](#), also known as the Peace Pipeline. Construction of the IGAT 9 gas pipeline has been completed, and operations are expected to begin in 2022. The Pakistan portion of the Iran-Pakistan gas pipeline has been completed, but the Iran portion has been delayed by U.S. economic sanctions. In Oman, three major pipelines are in construction: [Oman Main Line–Ras Markaz oil pipeline](#), [Fahud-Sohard gas pipeline](#), and [Fahud-Sohard NGL pipeline](#).

CHINA

China's pipeline projects aim to support major increases in the country's gas supplies from five different sources: imported LNG, gas imported from Central Asia, gas imported from Russia, gas from domestic fossil gas sources, and gas produced from coal seam projects. China is on a path to [surpass](#) Japan as the world's leading LNG importer by 2022, with twelve new LNG import terminals under construction. Overall, the expansion of China's access to sources of gas has spurred the world's largest expansion of gas pipelines on a length basis (as shown in Table 3), including 4,646 km of gas pipelines under construction and a further 13,345 km of gas pipelines in pre-construction development. In light of the expected 50-year lifespan of oil and gas pipelines, this major expansion is at odds with China's recent pledge to ameliorate climate change by becoming carbon neutral by 2060.

The longest of China's new pipelines is the 8,372-km [Xinjiang Coal-to-Gas pipeline project](#) which has been partially commissioned and was scheduled to be fully commissioned by the end of 2020. The [West-East gas pipeline 4](#) will run 3,123 km from China's western border, carrying gas sourced in Turkmenistan, Uzbekistan and Kazakhstan. The first 1,067-km phase of the [Russia-China East Line Domestic Extension](#) was commissioned in 2019, and the pipeline's 1,110-km second phase was scheduled to be completed in 2020. China also plans to boost exports from Turkmenistan



through the 1,000-km [Central Asia–China gas pipeline Line D](#), which is scheduled for completion in 2022.

In October 2020, the Chinese central government completed the consolidation of several pipeline companies to form PipeChina, with the goal of creating a more integrated national gas network and increasing the country's use of gas. As noted above (see “Ownership: Who Is Building Pipelines?”), this consolidation is expected to make PipeChina the world's leading builder of both oil and gas pipelines.

RUSSIA

The development of the [Arctic LNG 2 Terminal](#), [Yamal LNG Terminal](#), and several new pipelines on the Yamal peninsula have been described as Russia's “[answer](#)” to the U.S. shale boom. [Two pipelines](#) carrying a combined 115 bcm/yr already run to Ukhta from the peninsula's Bovanenkov field, which holds an estimated 4.9 trillion cubic meters of gas. A third line, the 69 bcm/yr [Bovanenkovo-Ukhta III gas pipeline](#), is in development with an estimated completion date of 2023. Environmentalists warn that melting permafrost in the Russian Arctic will lead to more disasters such

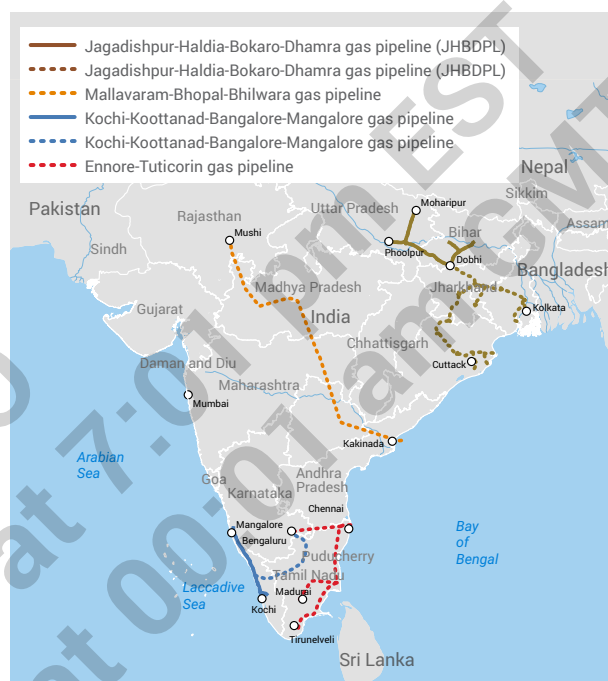
as the May 2020 spill of 21,000 tons of diesel into fragile wetlands near the Norilsk Nickel power station.

Russia commissioned the 930-km [TurkStream gas pipeline](#) in January 2020 but completion of the [TurkStream 2 gas pipeline](#) has been slowed by economic sanctions [imposed](#) by the U.S. in July 2020. TurkStream 2 is 1,646 km and would deliver Russian gas to Bulgaria, Serbia, and Hungary. In eastern Russia the 2,022 km [Power of Siberia gas pipeline](#) began delivering gas to China in 2019. An 800-km extension of the pipeline is scheduled for completion in 2022.

SOUTH AND SOUTHEAST ASIA

Two countries that have been primarily dependent on coal to meet their energy needs, India and Bangladesh, are transitioning to gas and investing heavily in pipelines and LNG import terminals, a development that would lock in decades of new GHG emissions.

In India, gas imports rose from 31% of total gas supply in 2012 to 50% in 2019 (U.S. EIA 2020). Six LNG import terminals were commissioned during this time and four more are scheduled to come online by 2023 (Plante et al 2020). However the utilization of these terminals depends on plans to expand the gas transmission network to deliver gas inland. The Indian government is making its first ever direct [grant](#) for the construction of a gas pipeline, contributing US\$770 million toward the US\$1.9 billion [Jagadishpur-Haldia-Bokaro-Dhamra gas pipeline](#) that will carry gas from the Dhamra LNG Terminal. As of August 2020 the 750-km northwestern Phulpur-Varanasi-Gaya-Patna-Barauni section of this pipeline had been commissioned. In northeast India the 30.9 bcm/year [Ennore-Tuticorin gas pipeline](#) is being built to deliver gas from the recently commissioned Ennore LNG Terminal. In southern India construction of the 6.6 bcm [Kochi-Koottanad-Bangalore-Mangalore gas pipeline](#) (KKBMPL) to carry gas from the Kochi LNG Terminal has been [opposed](#) by residents who say the pipeline will impact paddy cultivation and is being routed in between houses that are as little as five meters apart. Overall the number of gas pipelines under construction and in development in India would more than double the country's pipeline capacity from 181 bcm/year to 392 bcm/year. In June 2020 India's Petroleum and Natural Gas Regulatory Board [relaxed](#) licensing restrictions for building new LNG terminals and PNGRB's chair pledged to address the



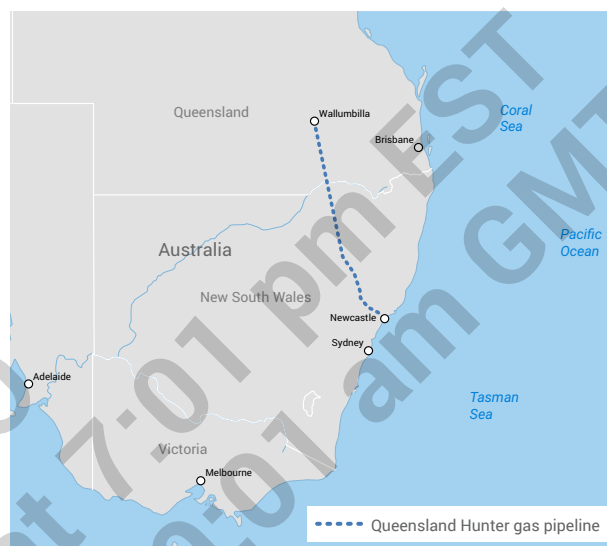
issue of “cascading tariffs” that accrue as gas travels through multiple pipelines.

In Bangladesh a transition from coal to gas-fired power plants is [accelerating](#) as coal projects have failed to attract financing from China and Japan. Currently there are 480 km of gas pipeline under construction and a further 2,740 km of gas pipelines in development. Imports from two new floating storage and regasification units (FSRUs) have been less than anticipated due to the [difficulty](#) of operating them during monsoon season, and more recently due to the Covid-19 pandemic. The 12.4 bcm/yr [Moheshkhali-Anowara parallel gas pipeline](#) is being built to deliver gas from the newly commissioned Moheshkhali FSRU.

AUSTRALIA

In August 2020 the National Covid-19 Commission (NCC) recommended that the Australian government dramatically increase spending for new pipelines, gas hubs, and other gas infrastructure as part of a “gas-fired recovery” promised by Prime Minister Scott Morrison. Under the guise of addressing the Covid-19 crisis, the NCC recommendations would have “taxpayers subsidising the gas industry up and out of Covid-19 for the next 30–40 years,” [according](#) to Bruce Robertson of IEEFA. The NCC has been led by Andrew Leveris, a Saudi Aramco board member, and Nev Power, the CEO of Fortescue Metals, and reportedly developed its recommendations with help from the Dragoman lobbying firm, whose clients [include](#) numerous gas companies.

Among the projects targeted for government support is the proposed [Queensland Hunter gas pipeline](#), which will cost an estimated A\$1.2 billion and run from the Wallumbilla gas hub in Queensland to Newcastle, South Wales. The pipeline was originally proposed in 2009 as part of a plan to bring coal seam gas from the Narrabi project to market; shortly after the NCC issued its recommendations, the Independent Planning Commission (IPC) of New South Wales finally [approved](#) a plan for 850 coal seam wells in and around the Pillaga State Forest. According to local landowners, environmentalists, and First Nations communities, the pipeline and CSG wells will lead to contamination or depletion of ground and surface water, pollution of waterways, health impacts on workers and nearby



residents, and damage to biodiversity. In August 2020, 25 leading Australian scientists [warned](#) that for the country to achieve net zero emissions by 2040–2050 and become a Paris-aligned economy “requires a rapid phase-out of existing fossil fuel infrastructure, leaving no room for expansion of the gas industry.” In August 2020 the Victorian government refused to delay the environmental assessment process for the Crib Point LNG Terminal, which would feed the proposed [Crib Point Pakenham gas pipeline](#), despite protests that Victoria’s Covid-19 lockdown was preventing citizens from participating in the assessment process.

FINANCING THE PERMIAN BOOM

The ability of the oil and gas industry to overcome near-term challenges to its Permian Basin expansion plans, such as the Covid-19 pandemic and the collapse of prices, will depend in part on the appetite of banks and governments to continue funding midstream infrastructure. Should they decide to do so, it will be in spite of the industry's long-term decline and growing concerns over the global climate emergency.

Research by Global Energy Monitor finds that US\$102.3 billion in debt financing (loans and bond issues) has been provided since 2014 to:

- the developers of oil and gas pipelines originating in the Permian Basin, and to the developer of two pipelines transporting Permian gas in Mexico;
- a handful of major oil and LNG export terminals along the U.S. Gulf Coast supplied by Permian pipelines.

US\$10.8 billion was identified for pipelines and US\$91.5 billion for export terminals. The financing came from 107 financial institutions from around the world, predominantly commercial banks but also private equity firms, investment funds, development banks, and export credit agencies.

Muddle in the Middle

Tracking the funding sources of Permian pipelines is complicated by the fact that many projects are financed through corporate loans and bond issues which are provided and arranged by banking consortia for general business use by many midstream operators. Moreover, most individual banks disclose scant information about their general funding for the oil and gas sector. Information about oil and gas terminals by contrast is more readily available owing to the sector's far greater reliance on dedicated project finance and bond issues tied to project refinancing.

Support for terminals explains the presence of Bank of America, Goldman Sachs, JPMorgan Chase and Morgan Stanley in Table 8 on the next page, despite the low pipeline figures identified for these well-established midstream backers. Citi, with more than half of its oil and gas business portfolio tied to North American markets, does not feature in Table 1 but [reported](#) that it funded US\$2.3 billion in the midstream oil and gas sector in Q3 2020 alone.

Recent analysis shows the dependence of certain Permian midstream players on corporate debt and points to growing evidence of their financial vulnerability (Bailout Watch 2020). Since the U.S. Federal Reserve began its bailout of corporate debt markets in late March, energy companies with significant interests in the Permian have issued corporate bonds worth tens of billions of dollars. Some, including Enterprise Products, ExxonMobil, Marathon Petroleum Corporation, The Williams Companies and Sabine Pass LNG, have also had these bonds directly purchased by the Federal Reserve under its Secondary Market Corporate Credit Facility. Despite receiving what amounts to direct government aid, ExxonMobil, Marathon and Williams are among twelve U.S. fossil fuel companies which have received downgrades of their short-term debt, long-term debt, credit or default ratings from major credit rating agencies in the last six months. Citi [rated](#) 22% of its funding to oil and gas companies as CCC or lower as of Q3 2020, up from 20% in Q2 and only 6% in Q4 2019.

Due to the research providing only partial and fragmented finance data for individual projects, discernible trends are difficult to establish, though the institutional appetite for Permian pipeline financing is clearly international in nature. Japanese commercial banks are prominent, with coordinated export credit support for LNG terminals coming from the Japan

Bank for International Cooperation (Aitken 2020). Eleven of the top 20 pipeline banks are among the prominent funders of export terminals, indicative of the contractual and ownership relationships between Permian pipeline and Gulf Coast terminal promoters and their ties to reliable, oil and gas friendly financial backers.

Table 8. The top 20 identified funders of Permian oil and gas pipelines and Gulf Coast export terminals, 2014 to November 2020

Financier	Country	Pipelines (US\$)	Terminals (US\$)	Total (US\$)
Sumitomo Mitsui Banking Corporation	Japan	1,081,270,000	6,345,250,000	7,426,520,000
MUFG	Japan	1,340,110,000	5,710,060,000	7,050,170,000
Mizuho	Japan	878,540,000	5,320,320,000	6,198,860,000
Japan Bank for International Corporation	Japan	0	5,195,000,000	5,195,000,000
Société Générale	France	152,500,000	4,676,795,000	4,829,295,000
ING	Netherlands	227,530,000	4,423,350,000	4,650,880,000
Royal Bank of Canada	Canada	323,800,000	3,568,060,000	3,891,860,000
HSBC	United Kingdom	70,000,000	3,162,120,000	3,232,120,000
Scotiabank	Canada	373,800,000	3,212,980,000	3,586,780,000
Goldman Sachs	United States	175,000,000	2,883,620,000	3,058,620,000
JPMorgan Chase	United States	70,000,000	2,892,480,000	2,962,480,000
Morgan Stanley	United States	0	2,817,540,000	2,817,540,000
Crédit Agricole	France	52,500,000	2,678,920,000	2,731,420,000
Credit Suisse	Switzerland	0	2,358,980,000	2,358,980,000
Bank of America	United States	323,800,000	2,249,907,000	2,573,707,000
IFM Investors	Australia	0	2,243,000,000	2,243,000,000
Santander	Spain	117,740,000	2,078,810,000	2,196,550,000
Natixis	France	114,030,000	2,033,900,000	2,147,930,000
Intesa Sanpaolo	Italy	257,070,000	2,124,900,000	2,381,970,000
BBVA	Spain	150,000,000	1,876,440,000	2,026,440,000

Construction boom during a bust in prices and demand

Since the U.S. Congress lifted a long-time ban on crude oil exports in December 2015 and set in motion booming production levels in the Permian Basin, midstream companies have raced to remove export bottlenecks in order to get soaring volumes of largely fracked, Permian-sourced hydrocarbons to international markets. As shown by the confirmed financing

for pipelines carrying Permian oil and gas in Table 9 below, commercial banks primarily have supported the industry's plans for a rapid expansion of takeaway capacity from the Permian over the last five years. In doing so they have helped bring about the pipeline overbuild in the region which is now causing widespread financial tremors for project promoters.

Table 9. Financed pipelines transporting Permian oil and gas

Pipeline	Capacity	Status	Start Year	Financial Close	Debt Finance (US\$)
Roadrunner Gas Pipeline, Phase 1	640 MMcf/d	Operating	2019	2015	230,000,000
Trans-Pecos Gas Pipeline	1400 MMcf/d	Operating	2017	2015	646,980,000
Waha-San Elizario Gas Pipeline	1135 MMcf/d	Operating	2017	2015	508,220,000
La Laguna-Aguascalientes Natural Gas Pipeline	1319 MMcf/d	Operating	2019	2016	737,000,000
Villa de Reyes-Aguascalientes-Guadalajara Gas Pipeline	886 MMcf/d	Operating	2020	2016	485,000,000
Agua Blanca Gas Pipeline	1250 MMcf/d	Operating	2018	2017	141,000,000
Epic Natural Gas Liquids Pipeline	600,000 bpd	Operating	2019	2018	800,000,000
Agua Blanca Gas Pipeline Expansion	1250 MMcf/d	Proposed	2021	2018	113,000,000
Epic Oil Pipeline	590,000 bpd	Operating	2020	2019	1,075,000,000
Gray Oak Oil Pipeline*	900,000 bpd	Operating	2019	2019 & 2020	2,630,000,000
Permian Highway Gas Pipeline	2100 MMcf/d	Operating	2020	2019	545,000,000
Wink to Webster Oil Pipeline	1,000,000 bpd	Operating	2020	2020	657,260,000
Whistler Gas Pipeline	2000 MMcf/d	Construction	2021	2020	2,079,000,000

*Funding for the Gray Oak Pipeline comprises a US\$1.23 billion initial project finance loan in June 2019 and three bond issues in September 2020 worth US\$1.4 billion for refinancing of the project. Information on the institutions which provided funding for individual pipelines are available at GEM.wiki by clicking on the project links.

The Covid-19 pandemic and subsequent plunge in oil prices have impacted the Permian boom in drastic fashion. The first nine months of 2020 saw 27 oil and gas producer bankruptcies registered in Texas (Haynes and Boone 2020), and almost 65,000 job **losses** across the oilfield services sector in Texas—the hardest hit U.S. state—and New Mexico. U.S. Energy Information Administration estimates show a 10.7% **fall** in Permian oil production since March 2020 to approximately 4.24 million barrels per day in December. At this production level the region still has **excess** pipeline capacity of roughly 3 million barrels per day, according to the energy data firm East Daley Capital Advisors, which expects excess capacity to grow further to 4 million barrels per day by early 2021. Wood Mackenzie has

also pointed to the “structural overbuild” of long-haul crude oil pipeline capacity between the Permian and the Gulf Coast as pre-dating the March 2020 price crash. According to the energy consultancy, “For midstream companies that made huge investments based on pre-Covid-19 production forecasts, low utilization now presents a challenge. Midstream infrastructure projects, many of which were financed with high levels of debt, will struggle to deliver projected returns (Wood Mackenzie 2020).”

Supposed to have been a pioneering year for Permian pipeline expansion, five pipeline start-ups alongside two cancellations and various shelved or delayed projects indicate the region's difficulties in 2020.



Project Start-ups

- The 590,000 barrel per day [Epic oil pipeline](#) from the Permian Basin to Corpus Christi, Texas, entered into full service in April.
- The [Villa de Reyes-Aguascalientes-Guadalajara gas pipeline](#), the southernmost segment of the Waha-lajara network bringing Permian gas to Mexico via a series of interconnecting pipelines, entered into service in June.
- The [Lone Star Express natural gas liquids pipeline](#) expansion was completed in September.
- The main segment of the 1 million barrel per day [Wink to Webster oil pipeline](#) started transporting oil in October.
- The [Permian Highway gas pipeline](#) entered full service in January 2021.

Project Cancellations

- Enterprise Products Partners abandoned its 450,000 barrels per day [Midland to ECHO 4 oil pipeline](#) in September despite having committed oil shippers signed up to the project. Enterprise said the cancellation was due to necessary cuts in its capital expenditure budget, though industry observers believe the surprise move is proof of excess Permian pipeline capacity given the low levels of production in the basin arising from the US\$40 oil price.
- Marathon Petroleum Corporation canceled its 500,000 barrels per day [Belvieu Alternative natural gas liquids pipeline](#) in May.

Projects Shelved or Delayed

- Phillips 66 and Plains All American Pipeline's joint venture, the 400,000 barrels per day [Red Oak oil pipeline](#) was shelved in March as Phillips 66 announced US\$700 million in cuts to its capital expenditure budget.
- Namerico Energy, a private-equity backed logistics company, shelved its [Pecos Trail gas pipeline](#) in April. The company's president told the *Financial Times*, "We're just being responsive to what's going on, recognizing that the upstream sector is not going to see the growth that people had expected."
- The proposed 1,000,000 barrels per day [Jupiter oil pipeline](#), designed to supply Permian oil to Jupiter Energy's delayed [Brownsville Oil Terminal](#) in Texas, was put on hold indefinitely. The pipeline received undisclosed funding from the private equity firm Charon System Advisors in October 2018. In 2019 Jupiter expected both the pipeline and terminal to be operational in Q4 2020.
- Two proposed 500-mile gas pipelines, the [Bluebonnet Market Express pipeline](#) and the [Permian Katy pipeline](#), have not advanced in more than two years and are presumed to be shelved.
- Kinder Morgan's proposed [Permian Pass gas pipeline](#) is facing a delayed final investment decision of up to two years and an uncertain future, according to company sources, as no customers have been lined up for the project due to low prices.
- Tellurian shelved its proposed US\$4.2 billion [Permian Global Access gas pipeline](#) in December due to the company's financial difficulties which saw it receiving a delisting notice from Nasdaq in September. This and two other gas pipelines shelved in 2020 by Tellurian—the [Haynesville Global Access pipeline](#) and the [Delhi Connector pipeline](#)—were intended to supply the company's troubled and delayed US\$30 billion [Driftwood LNG Terminal](#) in Louisiana.
- A string of proposed deepwater oil-export terminals offshore Texas in the Gulf of Mexico are struggling to advance. The only two of these projects which are considered to be viable, Enterprise Products' [Sea Port Oil Terminal](#) and Phillips 66's [Bluewater Texas Terminal](#), are delayed and facing opposition on public health and environmental grounds.

Financial institutions can no longer afford to pump-prime the Permian

The international breadth of the financial sector's support for midstream infrastructure linked to the expansion of the Permian Basin is apparent: more than 100 institutions have been involved in the relatively few projects where Global Energy Monitor research was able to identify financing. This points to the almost total absence among financial institutions of policy restrictions closing off support for oil and gas pipelines and terminals. Two public finance institutions—the [French Development Agency](#) and the [European Investment Bank](#)—and Australia's biggest insurer [Suncorp](#) have recently made commitments to end entirely their financial backing for oil and gas projects and companies. Fifty globally significant financial institutions have introduced policies restricting their support for tar sands and/or oil and gas drilling in the Arctic, including 23 which have done so in 2020 (IEEFA 2020). However, to date across the commercial banking sector, only four banks—BNP Paribas, Rabobank, UniCredit and US Bancorp—[prohibit](#) financing for pipelines transporting shale oil and gas, and only BNP Paribas and UniCredit have additionally introduced marginal measures to [restrict](#) their financing of LNG projects and companies.

In April 2020, creeping acknowledgement of the social and environmental risks of oil and gas pipelines appeared for the first time in new policies unveiled by Mizuho and Sumitomo Mitsui Banking Corporation, two of the top funders of Permian midstream infrastructure. But the Japanese megabanks' weak formulations did not prevent them from participating in combined US\$692 million debt financing for the [Whistler gas pipeline](#) in June and combined US\$466 million refinancing for the [Gray Oak oil pipeline](#) in September. Another prominent Permian funder, Dutch bank ING, has recently disclosed how it plans to align its financing for the oil and gas sector with a 2°C temperature rise instead of the Paris Agreement's goal of a 1.5°C rise. ING's [model](#) for doing so—its “Terra” approach, based on the Sustainable Development

Scenario of the International Energy Agency (IEA) which top investors, climate scientists and NGOs have [criticized](#) for being too fossil fuel friendly—only covers upstream oil and gas. It does not cover ING's appetite, as captured in this research, for midstream financing.

A series of high profile announcements in the second half of 2020 by Morgan Stanley, JPMorgan Chase, Barclays and HSBC brought various “Paris alignment” pledges for achieving net zero carbon pollution across the banks' client portfolios by 2050. However, these [pledges](#) do not include firm commitments to end financial support for oil and gas expansion projects and companies. As these announcements were appearing, the IEA's World Energy Outlook 2020 warned of the climate and financial realities which the banking sector must now act on with more ambition, noting, “[I]nvestors are looking with increased scepticism at oil and gas projects due to concerns about financial performance and the compatibility of company strategies with environmental goals. Some of the financial concerns might ease if prices pick up and projects start to offer better returns, but questions about the industry's contribution to reducing emissions are not going to go away.”

Closing the midstream policy gap at financial institutions is key to mitigating the effects of climate change and the increasing risk that, in a decarbonizing world, many of these midstream assets will soon be stranded. Without the introduction of specific policies to restrict and then end financing for pipelines, banks will continue to back Permian players such as Enterprise Products whose CEO recently [commented](#): “I struggle with the term . . . energy transition.” By contrast, as [Moody's](#), the editorial board of the [Houston Chronicle](#), and others are pointing out, the financial, climate and social license risks attached to oil and gas are rapidly converging as investors and the public turn enthusiastically towards the “lower risk-positive return,” zero emissions industries of the future.

APPENDIX: COUNTRY DETAIL

Potential Stranded Assets

As discussed in the report, the need to decarbonize major economies by mid-century, combined with growing challenges to the social license of pipeline developers, has increased the risk of stranded assets if pipelines currently under development are retired before the end of their normal lifespan. Table A1 estimates the size of this risk, as measured by the estimated capital expenditures for projects in construction or preconstruction.

Table A1. Top 10 countries by estimated capital expenditures for projects in construction or pre-construction (US\$ billions)

Country	Gas	Oil	Total
China	149	24	173
USA	55	54	110
India	103	1	104
Russia	86	0	86
Australia	43	0	43
Brazil	40	0	40
Nigeria	32	1	33
Canada	14	17	32
Iran	16	14	30
Mozambique	21	0	21

Source: Global Fossil Infrastructure Tracker, December 2020, and analysis based on estimated and reported pipeline lengths at US\$5.04 million per km in 2020 dollars. The per-km figure is based on "Natural gas pipeline profits, construction both up," *Oil & Gas Journal*, November 2018, adjusted for inflation.

Greenhouse Gas Emissions

Table A2 shows the ten leading countries based on estimated lifetime CO₂ emissions from pipelines in construction or pre-construction, and the number of 1,000 MW coal-fired power plants that would emit the same level of CO₂. As discussed in the report (page 13), the overall lifetime CO₂ emissions of pipelines in construction and pre-construction worldwide is 15% less than the emissions of the operating global fleet of coal-fired power plants.

Table A2. Lifetime CO₂ Emissions for Gas and Oil Pipelines in Construction and Pre-Construction (Million Tonnes), Compared to the Number of 1,000 MW Coal Fired Power Plants that Produce the Same Amount of Emissions.

Country	Gas	Oil	Total	Number of 1,000 MW coal plants
USA	24,200	18,533	42,733	282
China	15,276	8,790	24,066	159
Russia	13,598	0	13,598	90
Canada	2,183	8,712	10,895	72
India	7,621	1,578	9,199	61
Iran	2,026	5,611	7,638	50
Iraq	0	7,579	7,579	50
Australia	4,976	0	4,976	33
Jordan	0	4,630	4,630	31
Poland	644	2,433	3,077	20

Source: Global Fossil Infrastructure Tracker, December 2020.

Note: Assumes average pipeline capacity utilization of 50%, 40-year lifespan. Based on 151.6 million tonnes lifetime CO₂ emissions for a 1,000 MW coal-fired power plant.

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