Pipeline Bubble

NORTH AMERICA IS BETTING OVER $1 TRILLION ON A RISKY FOSSIL INFRASTRUCTURE BOOM

Ted Nace, Lydia Plante, and James Browning

ABOUT GLOBAL ENERGY MONITOR

Global Energy Monitor (formerly CoalSwarm) is a network of researchers developing collaborative informational resources on fossil fuels and energy alternatives. Current projects include the Global Coal Plant Tracker, the Global Fossil Infrastructure Tracker, the CoalWire newsletter, and the CoalSwarm and FrackSwarm wiki portals.

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 oil, gas, and coal terminals. Developed by Global Energy Monitor, the tracker uses footnoted wiki pages to document each project. For further details, see "Methodology" at http://ggon.org/fossil-tracker/.

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FURTHER RESOURCES

For additional data on proposed and existing pipelines, see Summary Data at http://ggon.org/fossil-tracker/, which provides over 30 tables providing results from the Global Fossil Infrastructure Tracker (GFIT), broken down by nation and region. To obtain primary data from the GFIT, contact Ted Nace (ted@tednace.com).

Global Energy Monitor

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INTRODUCTION: FOOLED ME ONCE

From 2011 to 2016, following a period of heady optimism and over-expansion based on expectations of surging Asian demand, coal mining company values plummeted and bankruptcies decimated the sector (see Sidebar: "The Coal Mining Equities Crash"). Today, investors in the booming expansion of oil and gas infrastructure appear headed for a similar shock, as boom-fueled optimism runs into climate realities and fiscal limits:

- Rapid expansion: A newly completed survey of oil and gas pipeline projects by the Global Fossil Infrastructure Tracker reveals a tripling in the pace of oil and gas pipeline building since 1996, with over half (51.5%) of projects located in North America and gas projects dominating the mix by a 4:1 ratio over oil projects. North America's oil and gas pipeline expansion plans total $232.5 billion (pre-construction and construction) out of total North American oil and gas infrastructure expansion plans of over $1 trillion.

- Reliance on Asian growth: Domestic demand growth cannot support the current North American oil and gas infrastructure boom. Like the over-investment that occurred in the coal sector, the current expansion in oil and gas infrastructure is predicated on a "super cycle" of increased demand from overseas buyers, especially in Asia.

- Sectoral stigmatization on climate grounds: Like the coal sector in the 2011–2016 period, the oil and gas sector faces rapidly growing censure from civil society, including divestment actions by over 1,043 institutions representing over $8.7 trillion in capital. New findings by the Intergovernmental Panel on Climate Change have called for a 65% reduction in oil use and a 43% reduction in gas use by 2050, relative to 2020. Such reductions are incompatible with rapid infrastructure expansion.

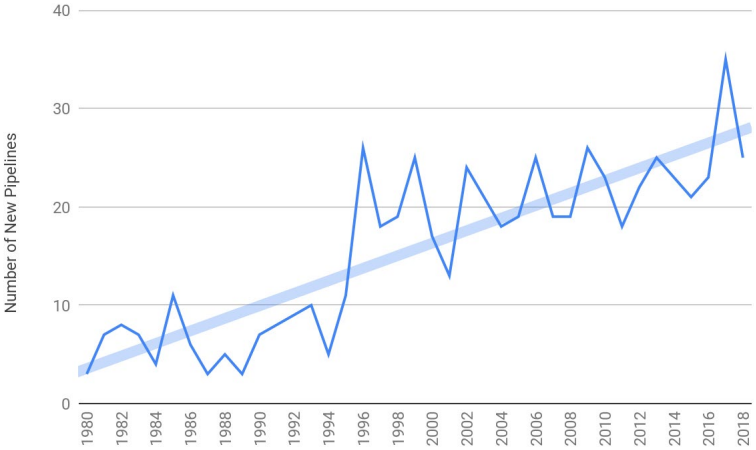
THE NEW PIPELINE BOOM

After adding an average of seven new pipelines a year from 1980 to 1995, the global system added an average of 25 new pipelines a year from 2009 to 2018. Currently 302 new pipelines are under development, including 78 in construction and 166 in pre-construction planning. If built, these projects will increase the number of global pipelines by 29%, including a 35% increase in the number of gas pipelines and a 19% increase in the number of oil pipelines.

GAS DOMINATES THE MIX

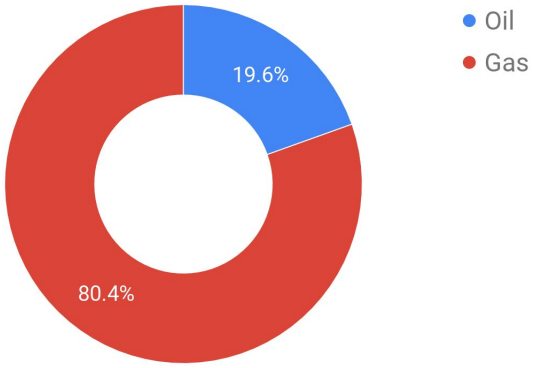
Since 1980, global production of natural gas has grown at three times the rate of oil—148% for gas, 48% for oil (Ritchie 2019). The ongoing production shift toward gas is reflected in the respective length of pipelines under development, which also favor gas over oil by 4:1 ratio, as shown in Figure 2.

Figure 1. New pipelines per year, 1980–2018



Source: Global Fossil Infrastructure Tracker, January 2019.

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



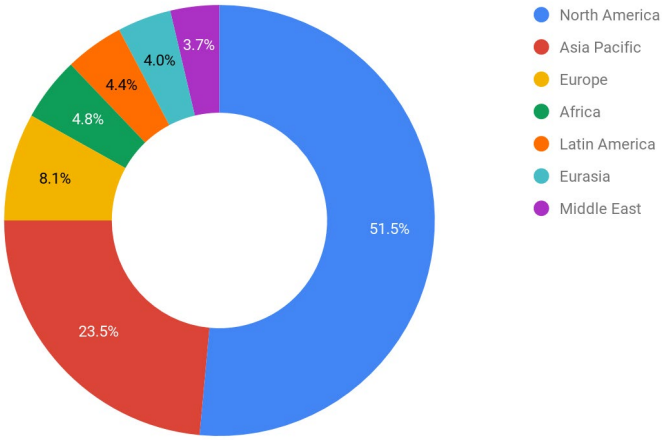
Includes projects in construction and pre-construction stages. Source: Global Fossil Infrastructure Tracker, January 2019.

ACTIVITY BY REGION: NORTH AMERICA'S BUILDING SPREE

By all measures, North America leads the world in development of new pipelines, followed by the Asia Pacific region. As shown in Figure 3 and Table 1, North America accounts for over half of pipeline projects under development (if measured by number of projects) or for over a third (if measured by pipeline lengths). This includes 64% of oil pipelines in development worldwide (36 out of 56) and 48% of gas pipelines in development worldwide (104 out of 216).

North America's pipeline projects are concentrated in three areas. The most active area is the Permian Basin of west Texas and southeast New Mexico, where numerous pipelines aimed at feeding Gulf Coast refineries and export terminals are currently under development. At least 12 pipelines originating in Texas fields are under construction, with an additional 26 in pre-construction development. If built, these Texas-originating pipelines will add over 16,000 km (10,000 miles) to the North American

Figure 3. Regional Shares in Global Pipeline Development (by Number of Projects)



Based on number of projects (construction and pre-construction categories). Source: Global Fossil Infrastructure Tracker, January 2019.

Table 1. Regional Distribution of Pipeline Development (Km)

	Oil		Gas			
Region	Proposed	Construction	Proposed	Construction	Total	Share
Africa	6,602	2,336	8,910	497	18,344	10%
Asia Pacific	952	69	34,775	7,460	43,255	24%
Eurasia	1,384	0	9,510	5,372	16,266	9%
Europe	0	0	13,345	2,520	15,865	9%
Latin America	475	0	6,907	6,145	13,527	7%
Middle East	4,415	0	7,795	1,900	14,110	8%
North America	17,592	2,144	31,356	11,058	62,149	34%
Total	**31,419**	**4,549**	**112,597**	**34,952**	**183,517**	

Source: Global Fossil Infrastructure Tracker, January 2019

pipeline system and will increase the capacity of the system by at least 12 million barrels of oil equivalent per day. By length, Texas-originating pipelines account for 34% of North America's proposed and under-construction new pipelines; by capacity, they account for 40%.

The second major origination area for new pipelines is the Marcellus and Utica shale formations in Pennsylvania, Ohio, and West Virginia, with pipelines feeding refineries and terminals located on the Atlantic coast and Great Lakes. In addition, some pipelines will transport liquid natural gas byproducts within the region to new ethane cracker facilities located along the Ohio River (Bruggers 2009).

The third major origination area is the Canadian tar sands of Alberta, with pipelines transporting oil southwest toward the Pacific coast and southeast toward the Gulf Coast.

Table 2. Pipeline Development by Originating State or Province, Ranked by Length

Originating State or Province	Number	Length (km)
Texas	38	16,747
Alaska	3	4,715
Alberta	10	4,415
British Columbia	8	3,955
Illinois	2	2,334
Oklahoma	8	2,148
Pennsylvania	14	1,974
Ohio	6	1,711
West Virginia	4	1,678
New Mexico	4	1,379
Utah	1	1,046
Louisiana	7	797
Chihuahua	1	625
South Carolina	1	579
Veracruz	2	496
Oaxaca	1	440
Hidalgo	1	420
Oregon	2	394
Wyoming	3	388
San Luis Potosi	1	374
Maryland	1	306
Durango	1	290
New York	1	286
Colorado	4	238
Michigan	2	219
Yucatan	1	159
California	1	155
Washington	1	129
Virginia	1	91
North Carolina	2	79
North Dakota	2	54
New Jersey	1	48
Sonora	2	45
New Hampshire	1	44
North America	**138**	**48,756**

Includes projects in construction and in pre-construction development. Length in km. Source: Global Fossil Infrastructure Tracker, January 2019.

WHAT'S DRIVING THE NORTH AMERICA BOOM?

North America's own domestic appetite for natural gas and oil is not the primary reason for the boom in pipeline activity. According to the U.S. Energy Information Agency, overall U.S. demand for petroleum liquids will decline from 2020 to 2035 by about three quads (quadrillion British thermal units) (U.S. EIA 2019), or about 8% of current consumption. Similarly, for natural gas, domestic demand growth, which the U.S. EIA estimates will be about two quads from 2020 to 2035, or about 10%, is not sufficient to support the large boom taking place in new infrastructure (U.S. EIA 2019).

With domestic demand insufficient to drive the oil/gas infrastructure boom, sponsors of pipeline projects are looking instead to overseas markets, especially the Asia Pacific region, where natural gas is expected increasingly to replace coal in power generation and industrial processes. In this version of the future, encapsulated in the International Energy Agency's "Current Policies" scenario, natural gas demand grows 1.6% percent per year worldwide from 2017 to 2040, with the Asia Pacific region growing at 3.1% per year in the same period as natural gas increasingly replaces coal (IEA 2018). By 2040, gas demand relative to 2017 rises by 55% and oil demand by 26% under the Current Policies scenario.

THE COAL MINING EQUITIES CRASH

On April 13, 2016, the largest U.S. coal company, Peabody Energy, declared bankruptcy. By that point four other major companies had already filed for Chapter 11 protection: Arch Coal, ANR, Patriot Coal, and Walter Energy. One analyst called it "the day coal died in the United States."

What's striking is how fast the coal industry went from boom to bust. In 2010, forecasts about the future of global coal demand closely resembled today's optimistic forecasts about growing global demand for natural gas. Those optimistic expectations were reinforced by a strong upward trend in coal prices, with benchmark coal prices increasing from $100 per tonne in January 2010 to $140 per tonne in January 2011. In early 2011, coal mining company stocks hit an all-time high, as analysts predicted a "super cycle" of growth based on China's domestic consumption. In its *World Energy Outlook 2010*, the IEA projected that the coal mining industry would see continued growth, including a 38% increase in Chinese production from 2008 to 2015, supporting coal-supply infrastructure investment of $720 billion in the period 2010–2035.

Figure 4. Peabody Energy stock chart, 2011–2016

Based on the confluence of indicators pointing safely toward an ongoing boom, coal mining companies took on increased debt as they undertook aggressive ramp-ups in new acquisitions of mines and investments in new mines.

In retrospect, the warning signs were clear, and the parallels with today's gas boom are particularly striking:

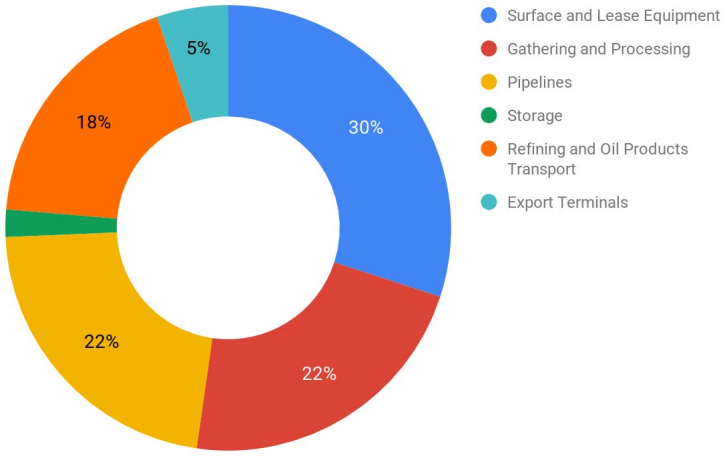
- Mining companies were convinced that coal, long touted as the cheapest fuel, would maintain that advantage into the future. Similarly, today's boom in North American pipelines is based on a belief that the fracking boom has given North American producers a long-term advantage in global markets. But just as the fracking revolution enabled natural gas to push coal out of North American power markets, today plunging solar and wind cost structures threaten to similarly drive the displacement of natural gas.
- Mining companies, along with their political allies in Washington, D.C., and other capitals, failed to factor growing global concern over carbon pollution and other environmental impacts into their growth calculations. As of February 2019, over 24 governments had committed to phasing out coal and over 100 banks and other financial lenders had instituted restrictions on coal financing.

PIPELINES AS PART OF A $1 TRILLION EXPANSION

Banks, equity investors, and bondholders are in the process of placing over $600 billion in bets on an expanded pipeline system with an expected lifespan of 40 years or more. Table 3 estimates the capital costs by region in pipelines that are currently in pre-construction or construction.

As shown in Table 3, $232.5 billion, or 37% of the total, is for pipelines in North America. This estimate falls at the low end of the oil and gas industry's own projections for pipeline capital expenditures for the U.S. in the period 2017–2035, which range from $234 billion to $362 billion and account for 22% of projected capital spending during that period for U.S. oil and gas industry infrastructure, as shown in Figure 5, according to the base case scenario developed for the American Petroleum Institute by ICF (Petak 2017). Applying API's ratio to the $232.5 billion North American and $632.5 billion global estimates shown in Table 3 suggests overall infrastructure expansion plans of $1.05 trillion for North America and $2.9 trillion globally.

Figure 5. Shares of U.S. Oil and Gas Infrastructure Capital Expenditures 2017–2035



Source: Petak, K. et al. "U.S. Oil and Gas Infrastructure Investment Through 2035." American Petroleum Institute, 2017. Base case scenario. http://bit.ly/2SEW72M

Table 3. Estimated Investments in Pipelines Under Development (Billion $)

Region	Gas (billions)	Oil (billions)	Total (billions)
Africa	41.8	31.4	73.2
Asia Pacific	137.4	4.5	141.9
Eurasia	69.9	6.6	76.5
Latin America	35.1	2.3	37.3
Middle East	50.2	21.0	71.1
North America	148.9	83.6	232.5
Total	**483.3**	**149.2**	**632.5**

Includes projects in pre-construction and construction stages. Based on $4.75 million/km ($7.65 million/mile) for proposed onshore US gas pipeline projects in 2015–16, as reported by "Natural gas pipeline profits, construction both up," *Oil & Gas Journal*, November 2018. Based on estimated and reported pipeline lengths, Global Fossil nfrastructure Tracker, January 2019.

INVESTOR RISK FACTOR #1: IS FOSSIL FUEL INFRASTRUCTURE LOSING ITS SOCIAL LICENSE?

The message that today's energy system must transition away from fossil fuels took on new urgency with the release of an October 2018 report by the Intergovernmental Panel on Climate Change (IPCC), "Global Warming of 1.5°C." According to that report, developed by 91 scientists from 40 countries, gas and oil production must begin to drop within the coming decade, not expand further. As shown in Table 4, which is based on pathways that would allow a one-in-two to two-in-three chance of limiting global warming to 1.5°C above pre-industrial levels, gas and oil usage must decline 15% and 21% respectively by 2030 relative to 2020. By 2050, reductions must be steeper: 43% for gas, 65% for oil. Failure to make such changes will result in cascading levels of damage to the global ecosystem and human society, including sea level rise and coastal inundation, heat waves, drought, accelerated species extinction, and widespread crop failures. In North America, the current pipeline boom can only pay off if these warnings are brushed aside and greenhouse gas levels are permitted to rise to ever more damaging levels.

Changing the trajectory of oil and gas use means changing levels of upstream extraction, and it also means avoiding further lock-in of new midstream infrastructure. In that regard, it is important to remember that new infrastructure not only follows the development of new extraction areas, but also facilitates further extraction. For that reason investments in pipelines, terminals, and other midstream components of the energy system are increasingly being challenged on ethical grounds.

Many of those challenging the moral and financial wisdom of fossil fuel investing were once among the industry's most important allies: banks and sovereign wealth funds. Challenges to the social license for fossil fuel infrastructure include divestment actions by over 1,043 institutions representing more than $8.7 trillion in capital (Fossil Free: Divestment 2019), a growing bipartisan support for alternative energy over fossil fuels (Gallup 2016), the proliferation of citizen protests and direct action campaigns targeting individual pipelines or terminals, and a growing array of institutional policies aimed at restricting investment in fossil fuels. Restrictive measures toward oil and gas extraction have been adopted by the World Bank as well as the governments of New Zealand, France, Costa Rica, Belize, New York, and Maryland (Trout 2019). Most recent was been the action of Norway's massive pension fund to divest from independent oil and gas producers and to begin investing in unlisted renewable energy infrastructure (Reed 2019).

The growing trend toward institutional restrictions on support for oil and gas parallels a similar trend by over 100 financial institutions to restrict support for coal. As one analyst noted, "Global capital is fleeing the thermal coal sector. This is no passing fad." (Buckley 2019).

Table 4. Median primary energy supply (Exajoules) for below IPCC 1.5°C pathways with low overshoot.

	2020	2030	2050
Gas	132.95	112.51	76.03
Oil	197.26	156.16	69.94

Source: IPCC, "Global Warming of 1.5°C," Table 2.6, October 2018

INVESTOR RISK FACTOR #2: OVEREXPANSION

A second risk factor for investors in oil and gas pipelines arises from what John Maynard Keynes termed "animal spirits" —the sense of optimism that has arisen from the extraordinary success of the fracking boom. Riding on the enthusiasm and production boosts of the U.S. fracking boom, the last decade of rapid growth for North America's oil and gas producers has created a sense of permanent global dominance. But there are many indicators that the current disproportionate growth in production occurring in North America will fade far sooner than the 40-year expected life of today's infrastructure investments. Overseas, surging growth is projected in numerous new and expanding extraction areas, including the following:

- Middle East. According to the IEA, Middle Eastern supplies of natural gas are expected to rise sharply in the coming decades, as major new fields come into production in Qatar (North Dome field), Iran (South Pars field), and Saudi Arabia. Overall, Middle Eastern production is projected to increase by 65% in 2040 relative to 2017 under the IEA's New Policies scenario (WEO 2018).

- Central and South America. New offshore fields in Brazil (Pre-salt field) and new onshore fields in Argentina (Vaca Muerta) are projected to drive the region's production upward by 60% in 2040 relative to 2017 under the IEA's New Policies scenario (WEO 2018).

- Asia Pacific. According to the IEA, by 2040 China's own production is projected to increase by 142%, with a 40% increase already recorded in 2018 in the Sichuan Basin (Aizu 2018, Jacobs 2019). The IEA projects India's gas production to grow by by 166% by 2040, with the country's oil ministry recently projecting that production would double in the coming four years (Abdi 2018). Finally, the IEA projects Australia's production of natural gas to increase by 98% by 2040 (WEO 2018).

- Africa. Africa's natural gas production is projected to increase by 131%, based on gas discoveries in 14 sub-Saharan countries and a U.S. government program to provide $175 billion in investment funds for the sector (Husseini 2018, WEO 2018).

Overall, global production of natural gas outside North America is projected to increase 46% between 2017 and 2040, while North American natural gas production is projected to increase by 36% in the same period. The discrepancy is even greater in the period from 2025 to 2040, when global production outside North America is projected to grow by 31%, compared to 12% in North America (WEO 2018).

Accelerating renewables also place an overbuilt North American pipeline network at risk of underutilization. Over the past decade, projections by the International Energy Agency about the pace of renewables have consistently proved to be overly conservative. According to Auke Hoekstra, who has documented the IEA's pro-fossil bias, the same tendency applies to battery storage and electric vehicles.

OWNERSHIP AND EXPOSURE

Globally, pipeline construction is primarily in the hands of state-owned enterprises, as shown in Table 5. This domination of transportation infrastructure matches the state domination of other parts of the oil and gas industry, including both reserves and production (Carpenter 2018). By definition, such enterprises are either partly or wholly shielded from private financial markets.

In North America, the ownership pattern is reversed, with most pipeline projects owned by private entities, as shown in Table 6 (on the next page.) One major exception is Alaska, where the quasi-public Alaska Gasoline Development Corporation appears to be weighing whether the $44 billion Alaska LNG pipeline project is too risky. Meanwhile the government of Canada has been widely criticized for acquiring the financially questionable C$5 billion Trans Mountain Pipeline after Kinder Morgan backed out of the project.

Table 5. The Top 20 Global Builders of Oil and Gas Pipelines (by km)

Owner	Proposed	Construction	Total	Ownership	Country
Gazprom	4,625	5,173	9,797	Private	Russia
Ministry of Petroleum of Iran	4,481	1,900	6,381	State-owned	Iran
TransCanada	4,530	1,311	5,841	Private	Canada
Gas Authority of India Limited	3,066	1,373	4,439	State-owned	India
Kinder Morgan	1,304	2,962	4,266	Private	U.S.
Alaska Gasline Development Corporation	3,888	0	3,888	State-owned	U.S.
Plains GP Holdings	2,627	628	3,255	Private	U.S.
Petrobras	0	3,100	3,100	Semi-private	Brazil
Bangladesh Petroleum Corporation	3,010	0	3,010	State-owned	Bangladesh
Iranian Ministry of Petroleum	2,800	0	2,800	State-owned	Iran
Pasargad Energy Development Company	2,800	0	2,800	Private	Iran
Gujarat State Petronet	709	2,042	2,751	State-owned	India
Iraq Ministry of Oil	2,460	0	2,460	State-owned	Iraq
Oil and Natural Gas Corporation	2,333	0	2,333	Private	India
Total S.A.	871	1,444	2,315	Private	France
Government of Kenya	1,799	446	2,245	State-owned	Kenya
Türkmengaz	300	1,814	2,114	State-owned	Turkmenistan
Pertamina	1,611	443	2,054	Private	Indonesia
Sonatrach	1,724	0	1,724	State-owned	Algeria
Indian Oil Corporation Limited	513	1,205	1,718	State-owned	India

Source: Global Fossil Infrastructure Tracker, January 2019

Table 6. The Top 20 North American Builders of Oil and Gas Pipelines (by km)

Owner	Proposed	Construction	Total	Ownership	Country
TransCanada	4,530	1,311	5,841	Private	Canada
Kinder Morgan	1,304	2,962	4,266	Private	U.S.
Alaska Gasline Development Corporation	3,888	0	3,888	State-owned	U.S.
Plains GP Holdings	2,627	628	3,255	Private	U.S.
Eagle Spirit Energy Holdings	1,601	0	1,601	Private	Canada
Tellurian Inc.	1,482	0	1,482	Private	U.S.
Williams Companies	1,437	17	1,454	Private	U.S.
Energy Transfer TP	0	1,341	1,341	Private	U.S.
Tallgrass Energy	1,304	0	1,304	Private	U.S.
Targa Resources	998	191	1,189	Private	U.S.
Sempra Energy	677	400	1,077	Private	U.S.
Magnum Development	1,046	0	1,046	Private	U.S.
Phillips 66	1,030	0	1,030	Private	U.S.
Canada Development Investment Corporation	980	0	980	State-owned	Canada
Dominion Energy	622	241	863	Private	U.S.
Fairbanks Pipeline Company	827	0	827	Private	U.S.
Fermaca	161	664	825	Private	Mexico
Comisión Federal de Electricidad	0	780	780	State-owned	Mexico
ExxonMobil	698	77	775	Private	U.S.
Magellan Midstream Partners	604	121	724	Private	U.S.

Source: Global Fossil Infrastructure Tracker, January 2019

THE PERFECT STORM

The short-term outlook for fossil fuel investors in North America may seem rosy, with large plays such as the Permian and Marcellus undergoing development, gas replacing coal in many markets, and the Trump administration advocating for more offshore drilling. A storm is coming, however, and the current surge in pipeline construction may prove to be fleeting as the legal system, public opinion, and financial markets increasingly challenge the fossil fuel industry.

Legal Obstacles: In 2016 the Obama Administration established a rule that applications to the Federal Energy Regulatory Commission (FERC) must include an assessment of a pipeline's or other project's impact on climate change. Given that FERC rejected just two out of 400 pipelines applications it received between 1999 and 2017, this new rule could have seismic implications (Horn 2017). With a majority of its five commissioners now serving as Trump appointees, FERC has taken a "see no evil" approach to findings submitted under this rule; for example, when a study found that the proposed Sabal Trail pipeline from Alabama to Florida would increase Florida's rate of greenhouse gas emissions by between 3.6% and 9.9%, FERC approved the project on the grounds that such an increase was not significant. However this rule may be interpreted in the future, the principle that projects must justify their existence in terms of their emissions is taking root in the legal community. In March 2019 a U.S. District Judge blocked the leasing of 500 square

miles for drilling in Wyoming on the grounds that the U.S. Bureau of Land Management had not considered the impact of emissions from oil and gas leases nationwide. "This is the Holy Grail ruling we've been after, especially with oil and gas," said Jeremy Nichols of WildEarth Guardians, which sued to block the leases. "It calls into question the legality of oil and gas leasing that's happening everywhere." (Brown and Mead 2019)

Shifting Public Opinion: American public opinion is also turning against the fossil fuel industry. A January 2019 poll by Yale University and George Mason University found that 69% of Americans are "worried" about climate change and 29% are "very worried." This represents an 8% rise among those who are "very worried" since these pollsters' previous survey in April 2018. The shift in public opinion comes as more Americans are personally affected by climate change, from historically-devastating fires in California to catastrophic floods in places such as Houston, Texas and the Carolinas.

Shifting Economics: The world for which many North American pipelines are being built may no longer exist by the time they are completed. Because of their typical lifespans of 40 years or more, pipeline projects and their sponsors tend to be highly leveraged, with long payback periods. For example, as of late 2018 one analyst reported that Enbridge expected to end 2018 with a leverage ratio of 5.0 times debt to EBITDA (earnings before interest, taxes, depreciation, and amortization)—"a bit higher than its comfort zone"—not including a "massive slate" of $16.7 billion in additional pipeline projects (DiLallo 2018).

High Leverage and Unrealistic Expectations: The combination of high leverage and expectations for growth based on ever-increasing Asian demand set the stage for investor disappointment and losses. Such a possibility is not just hypothetical: it is exactly the combination of elements that created the coal mining meltdown of 2008 to 2014, as discussed in the sidebar, "The Coal Mining Equities Crash." While the crash of the coal mining industry cost investors tens of billions, a similar stumble in the oil and gas industry has much larger implications because of the larger size of the sector. At their peak in 2011, the combined equity value of the coal mining sector amounted to about $80 billion; by mid-2015 that value had dropped about $12 billion, a $68 billion loss (Coats 2015). In contrast, the amount of capital expenditure on pipelines alone is expected to be well over $200 billion over the coming decades, out of a total midstream oil and gas infrastructure investment of $1 trillion for the U.S. alone. The combination of large financial sums at stake, excess enthusiasm based on uncertain overseas markets, and growing social stigmatization are all factors that should cause both individual and institutional investors to turn away from further bets on pipelines and other midstream infrastructure investments.

METHODOLOGY

The Global Fossil Infrastructure Tracker uses a two-level system for organizing information. Summary data is maintained in Google sheets, with each spreadsheet row linked to a page on the SourceWatch wiki. Each wiki page functions as a footnoted fact sheet, containing project parameters, background, and mapping coordinates. Each worksheet row tracks an individual pipeline project. Under standard wiki convention, each piece of information is linked to a published reference, such as a news article, company report, or regulatory permit. In order to ensure data integrity in the open-access wiki environment, Global Energy Monitor researchers review all edits of project wiki pages by unknown editors. For each project, one of the following status categories is assigned and reviewed on a rolling basis:

- **Proposed:** Projects that have appeared in corporate or government plans in either pre-permit or permitted stages.
- **Construction:** Site preparation and other development and construction activities are underway.
- **Shelved:** In the absence of an announcement that the sponsor is putting its plans on hold, a project

is considered "shelved" if there are no reports of activity over a period of two years.

- **Cancelled:** In some cases a sponsor announces that it has cancelled a project. More often a project fails to advance and then quietly disappears from company documents. A project that was previously in an active category is moved to "Cancelled" if it disappears from company documents, even if no announcement is made. In the absence of a cancellation announcement, a project is considered "cancelled" if there are no reports of activity over a period of four years.
- **Operating:** The pipeline has been formally commissioned or has entered commercial operation.
- **Mothballed:** Previously operating projects that are not operating but maintained for potential restart.
- **Retired:** Permanently closed projects.

To allow easy public access to the results, Global Energy Monitor worked with GreenInfo Network to develop a map-based and table-based interface using the Leaflet Open-Source JavaScript library. The public view of the Global Fossil Infrastructure Tracker can be accessed at OilWire.org.

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