

Global gas pipeline expansion: Nearly US\$200 billion under construction, with Asia building over 80%

Key points

- Approximately 69,700 kilometers of gas transmission pipelines are under construction globally, an 18% increase over the previous year, at a cost of US\$193.9 billion.
- Asia leads the globe in gas pipeline construction, accounting for 82% (**Figure 1**) at an estimated cost of US\$117.2 billion, with China and India accounting for the majority of development due to goals for economic growth, a coal-to-gas transition, and better connected national gas grids. Russia and Iran are building pipelines to increase piped and shipped export capacity, while Pakistan's buildout is focused on increasing import capacity.
- The U.S. aims to bolster export capacity out of the Permian Basin and Haynesville Shale through its pipeline buildout, in order to capitalize on present and future European and Asian import markets. Australia, another major gas exporter, is taking the same approach.
- South America is poised for extreme gas infrastructure growth in the coming years after inaugurating a pipeline carrying gas from the Vaca Muerta formation, the second-largest shale gas reserve in the world, in July 2023.

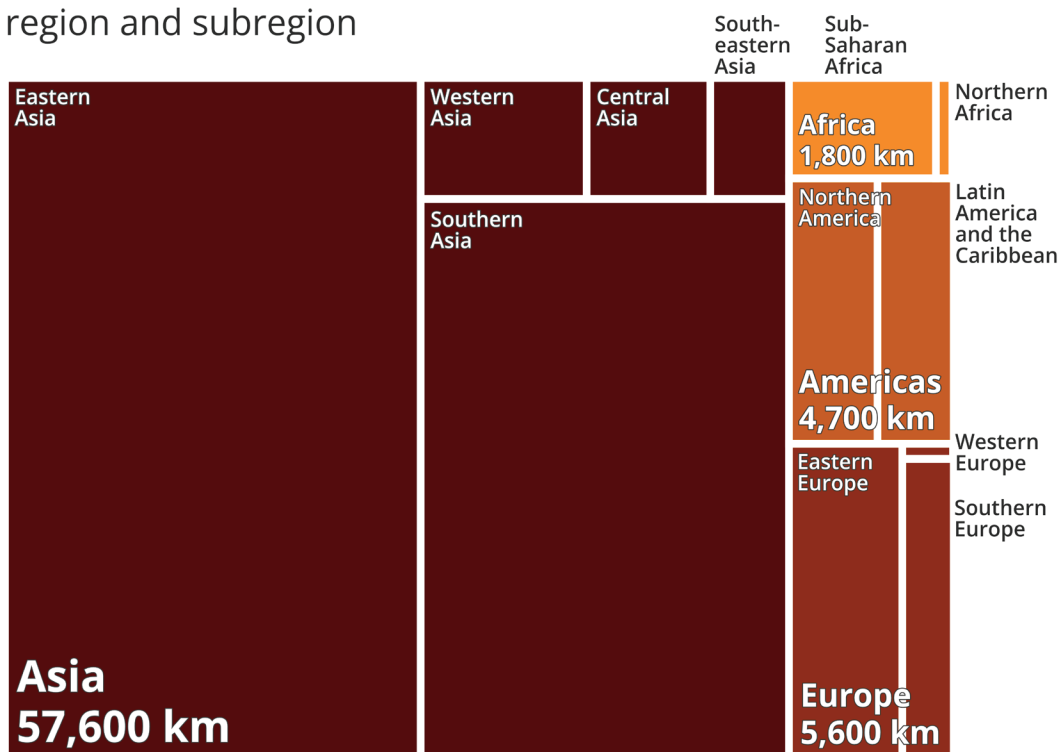
Summary

Research from Global Energy Monitor (GEM) shows that **82%** of the world's gas transmission pipeline kilometers (km) currently under construction worldwide are being built in Asia, costing an estimated **US\$113.3 billion** in capital expenditure. This push in Asia is encouraging expansions in other parts of the world, particularly North America, to match this growth.

Globally, a total of **228,700 km** of gas transmission pipelines are in development — projects that have been proposed or are under construction — with a total price tag of **US\$723 billion**, and **69,700 km** of this length is under construction at a cost of **US\$193.9 billion** (**Table 1; Table A1**). The amount under construction globally represents nearly a **18% increase** from the end of 2022, suggesting a very active 2023 and an uptick in pipeline projects.

Asia is building over 80% of gas pipelines

Total gas pipeline km under construction, grouped by region and subregion



Source: Global Gas Infrastructure Tracker



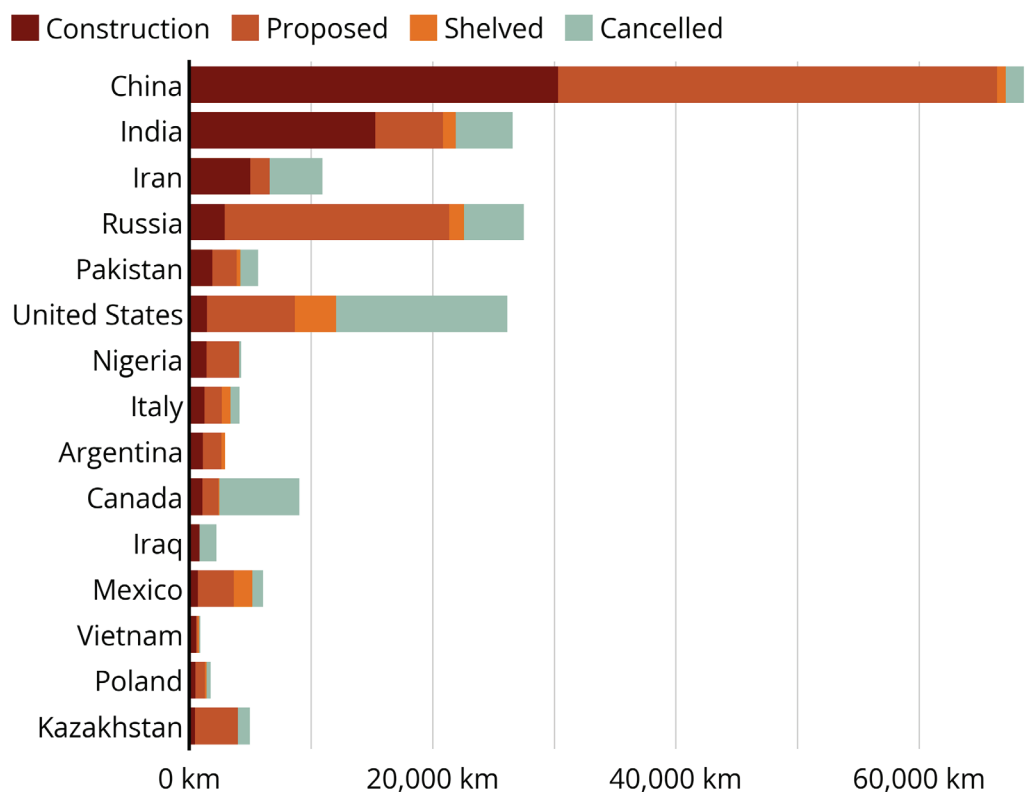
Figure 1. Area is equivalent to gas pipeline km under construction in each region and subregion. See Table A1 for values. Note that Northern Europe and all of Oceania are not included because there is either no construction happening in these places, or the area is too small to be visualized.

These findings follow those of GEM's January 2023 gas pipeline report, which [indicated](#) that China and India are building more gas transmission pipelines than the rest of the world combined, and dovetails with GEM's September 2023 [findings](#) that nearly two-thirds of the planned increase in global oil- and gas-fired power capacity are in Asia, where 514 gigawatts (GW) at an estimated US\$385 billion are in development, mainly in China and Southeastern Asia. Additionally, GEM research last year [identified](#) that 65% of all new LNG import capacity globally was in various stages of development in Asia.

Asia is home to 14 of the 15 longest pipeline projects under construction globally (**Table A2**), and the five leaders in pipeline construction reflect this: China, India, Iran, Russia, and Pakistan (**Figure 2; Table A3**). These countries — a collection of gas importers and exporters — are gambling on more entrenched fossil fuel use and encouraging other major economies to do the same, highlighting the region's commitment to gas as a transition fuel at a time when renewables are [cheaper](#), natural gas emissions are potentially [worse](#) than coal when transport is considered, and the International Energy Agency (IEA) is [predicting](#) peak gas demand by 2030.

China, India, Iran, Russia, and Pakistan lead the gas pipeline buildout

The top 15 countries ranked by gas pipeline km under construction



Source: Global Gas Infrastructure Tracker

Figure 2. See Table A3 for numbers.



Table 1. Estimated capital expenditure for in-development gas pipelines by region and subregion.

Region	Subregion	Proposed (US\$ billion)	Construction (US\$ billion)	Proposed+Construction (US\$ billion)
Americas subtotal		123.4	52.2	175.6
	Latin America & the Caribbean	62.9	6.3	69.2
	Northern America	60.5	45.9	106.4
Asia subtotal		175.5	117.2	292.6
	Central Asia	5.7	7.6	13.3
	Eastern Asia	53.4	48.3	101.7
	South-eastern Asia	17.1	3.9	21.0
	Southern Asia	39.2	49.6	88.9
	Western Asia	60.1	7.8	67.9

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Europe subtotal		119.4	13.0	132.4
	Eastern Europe	64.8	9.8	74.6
	Northern Europe	13.4	0.0	13.4
	Southern Europe	25.1	2.8	27.9
	Western Europe	16.1	0.4	16.5
Oceania subtotal		24.0		24.0
	Australia and New Zealand	23.1	0.05	23.1
	Melanesia	0.9		0.9
	Micronesia			
	Polynesia			
Total		529.1	193.9	723.0

Gas expansion in Asia

China

China has **30,300 km** of gas pipelines currently under construction across an estimated 150 projects (**Figure 3**). Some large trunk lines, like the [Xinjiang Coal-to-Gas Pipeline Project](#), will form major arteries to pipe gas across the country. Other, more centrally-located buildouts, like the [Anhui Gas Pipeline Network](#), will increase gas accessibility within provinces. Additional expansive projects are meant to connect rural regions, like the [Inner Mongolia Gas Pipeline Network](#), which will move substantial quantities of coalbed methane produced in Inner Mongolia both nearby and farther afield.

The forces behind this buildout are manifold. Several of China's [20 main objectives](#) within its 14th Five-Year Plan are the primary culprits, including closing the urban-rural divide, energy security, and economic growth — the last of which implies a doubling of the Chinese economy by 2035. It may be expected that Chinese oil- and gas-fired power plant expansion (**Figure 3**) would coincide with the pipeline buildout. While this is true to an extent — e.g., the dense pipeline expansion where power plants are being sited in Shandong and Jiangsu Provinces, as well as in Taiwan — there are other areas where power plants are in development without a colocated buildout of gas transmission pipelines, such as in Guangdong

Province near the Hong Kong and Macao industrial centers, or in areas not currently well-connected to a national network. Pipeline buildout is also associated with the dense cluster of LNG terminals in development throughout the Chinese coastline, and with the location of oil and gas extraction areas.

China's previous Five-Year Plan focused on a [coal-to-gas transition](#), and the current version is consistent with this goal, aiming to increase gas storage and production, accelerate pipeline network construction, and improve rural gas transmission access. Yet this expansion is decreed alongside China's plan to spur green economic development, increasing the [tension](#) between the continued buildout of fossil fuel infrastructure and the country's global dominance in scaling up renewable energy. The current slate of gas pipelines under construction in China has an estimated capital expenditure of **US\$48.1 billion**, 41% of the US\$117.2 billion estimated for Asia as a whole. With global gas demand projected to peak this decade, it is quite possible that China will end up with a continent-sized network of pipelines and little economic incentive to push gas through them.

Chinese pipelines are largely clustered with fields, plants, and terminals

Gas pipeline expansion in China, showing in-development and operating oil and gas projects

○ LNG terminals ▲ Oil and gas fields ■ Oil and gas plants



Source: Global Gas Infrastructure Tracker,
Global Oil and Gas Plant Tracker,
Global Oil and Gas Extraction Tracker



Figure 3. For pipelines, LNG terminals, and oil and gas fields, projects in development are shown in red, and operating projects are shown in gray. For oil- and gas-fired power plants, projects in development are shown in orange, and operating projects are shown in gray.

Russia

Russia currently has **2,900 km** of gas pipelines under construction at a cost of **US\$8.2 billion**, with nearly ten times that amount proposed (**Figure 4**). Led by state-owned Gazprom, this expansion is driven by a desire for better-connected domestic transmission, as well as increased pipeline and coastal LNG terminal export capacity. Substantial pipeline transmission infrastructure is also focused where extraction areas are operating or planned. In the ongoing fallout of the Russia-Ukraine War, including loss of Europe as a gas buyer, Russia has refocused on China and Asia for exports – though many

pipelines appear to be encountering delays. This includes the [Power of Siberia 2 Gas Pipeline](#), which would cut an ambitious path through Mongolia but is on [shaky ground](#), as well as pipelines sourcing gas from the Yamal Peninsula, like the [Ukhta-Torzhok 3 Gas Pipeline](#), which appears to be [shelved](#) after exports to Germany dwindled in 2022. LNG export terminal-bound [Gryzaovets-Volkhov Gas Pipeline](#) is also delayed. Another major project, the 1,625-km [Pochinki-Anapa Gas Pipeline](#), originally began construction for export to Austria, but has since been repurposed for domestic gas transmission.

Pipeline development in Russia primarily aligns with gas exports

Gas pipeline expansion in Russia, showing in-development and operating oil and gas projects

- LNG terminals
- ▲ Oil and gas fields



Source: Global Gas Infrastructure Tracker, Global Oil and Gas Extraction Tracker



Figure 4. Projects in development are shown in red, and operating projects are shown in gray.

India, Pakistan, and Iran

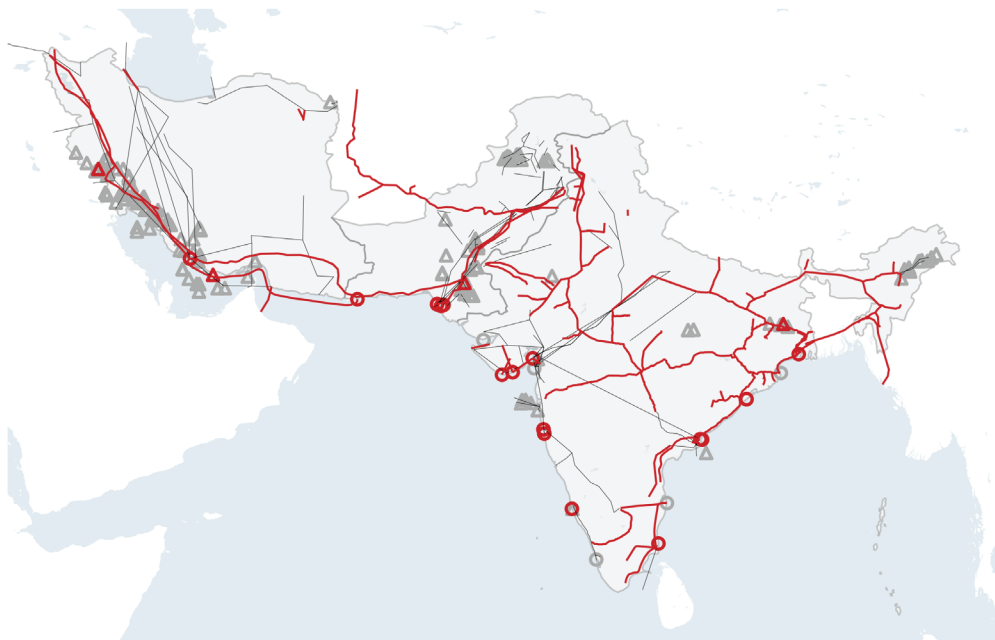
India, Pakistan, and Iran round out the list of top five gas pipeline builders (**Figure 5**). India is [in the midst](#) of modernizing and expanding its gas pipeline network, aiming to establish a National Gas Grid that would nearly [double](#) in size by 2025 and [increase](#) natural gas consumption to 15% of the country's total energy use. Over **15,000 km** of pipeline are under construction at an estimated cost of **US\$26.2 billion**, and over twice that amount is operational and serving western and northern India. Major projects under construction as of November 2023, led by state-owned GAIL, are intended to connect the eastern and southern regions to this grid. For north-eastern states, this expansion is occurring under the

[North East Natural Gas Pipeline Grid Project](#) and the Pradhan Mantri Urja Ganga Pipeline Project. The latter consists of the [Barauni-Guwahati Gas Pipeline](#), [slated](#) to become operational by the end of 2023, and the [Jagdishpur-Haldia-Bokaro-Dhamra Natural Gas Pipeline \(JHBDPL\)](#), with segments in eastern Indian states that are complete and ready to pipe gas. In addition, the [Mumbai-Nagpur-Jharsuguda Gas Pipeline](#) is a major route under construction that will connect west to east, and the [Kochi-Koottanad-Bangalore-Mangalore Gas Pipeline](#) and [Ennore-Tuticorn-Bengaluru Gas Pipeline](#) under construction will provide more connections for southern India.

Pipeline buildout in India, Pakistan, and Iran will serve regional imports and national gas grids

Gas pipeline expansion across India, Pakistan, and Iran, showing in-development and operating oil and gas projects

○ LNG terminals ▲ Oil and gas fields



Source: Global Gas Infrastructure Tracker,
Global Oil and Gas Extraction Tracker



Figure 5. Projects in development are shown in red, and operating projects are shown in gray.

Iran is currently building about **5,000 km** of gas pipelines at an estimated cost of **US\$17.8 billion**. The country is in the process of expanding the Iran Gas Trunkline (IGAT) network, including the 1,200-km [IGAT 11 Gas Pipeline](#) under construction and expected to be completed in 2026, as well as the [IGAT 9 Gas Pipeline](#), still under construction after experiencing delays on an original 2022 startup. This buildout will [help](#) the country meet high gas demand across domestic and industrial sectors. Neighboring Pakistan's pipeline buildout, at nearly **1,800 km**

U.S. reinforces buildout abroad

The U.S. ranks sixth in pipeline km under construction, building **1,500 km** with a **US\$11.5 billion** price tag, and fifth globally for pipeline km in development. U.S. pipeline infrastructure expansion is largely devoted either to bulking up existing transmission capacity (via capacity increases along existing transmission routes and route expansions) or to increasing export capacity from the Permian Basin and Haynesville Shale (**Figure 6**). This ambitious and ongoing buildout of pipeline infrastructure to serve the Gulf Coast is in lockstep with the massive LNG export terminal expansions occurring there, where

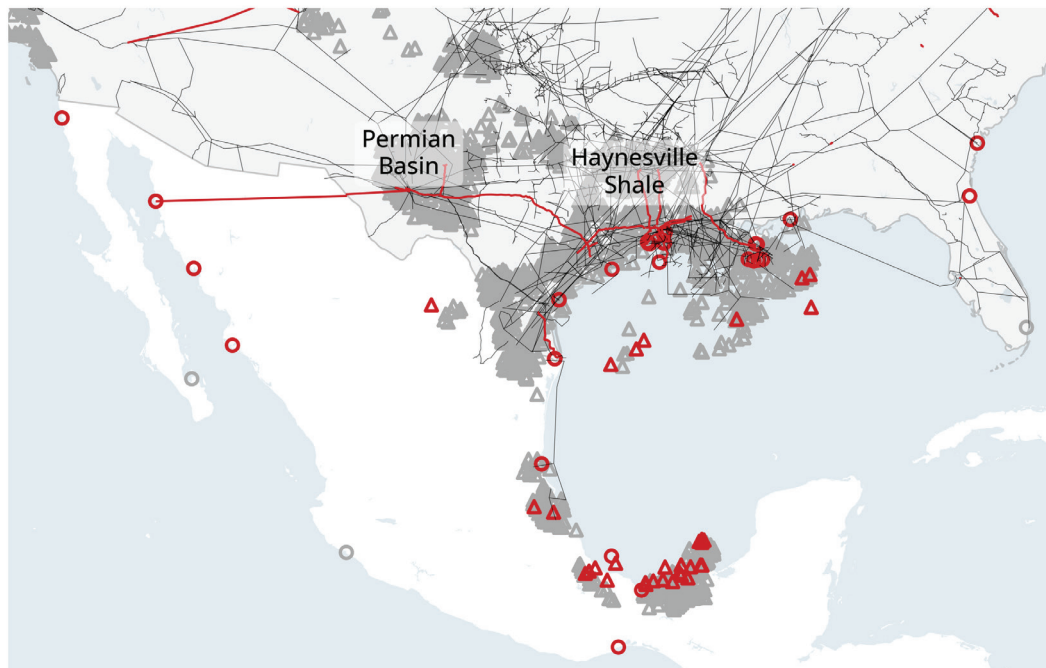
and a cost of **US\$3.7 billion**, is largely focused on maintaining reliable energy imports. Ensuring these imports is not without geopolitical obstacles, however. The [Iran-Pakistan Pipeline](#), planned for gas import from Iran, is a decade overdue. Iran's portion is complete, but Pakistan [halted](#) construction after the U.S. placed sanctions on Iran in 2014. In August 2023, Pakistan [issued](#) a notice of force majeure to avoid finishing the pipeline, and Iran has not been receptive, threatening a [penalty](#) of up to US\$20 billion for the delays.

tankers are filled for [European and Asian markets](#). Research estimates that **4,600 km** of gas pipeline, associated with **US\$27.8 billion** of capital expenditure costs, are in construction, proposed, or shelved phases and are planned to directly serve export capacity out of these regions. The export buildout is not confined to U.S. soil. The [Saguaro Connector Pipeline](#), a route that would link to the proposed [Saguaro Energía Gas Pipeline](#), embodies a plan to export piped gas to Mexico, where it will then be exported via the [Saguaro Energía LNG Terminal](#). It is expected to enter construction by the end of 2023.

U.S. pipeline development primarily aligns with gas exports

Gas pipeline expansion in the U.S., showing in-development and operating oil and gas projects

○ LNG terminals ▲ Oil and gas fields



Source: Global Gas Infrastructure Tracker, Global Oil and Gas Extraction Tracker



Figure 6. Projects in development are shown in red, and operating projects are shown in gray. Some Mexico infrastructure is included for additional regional context.

Other consequential expansions

Australia

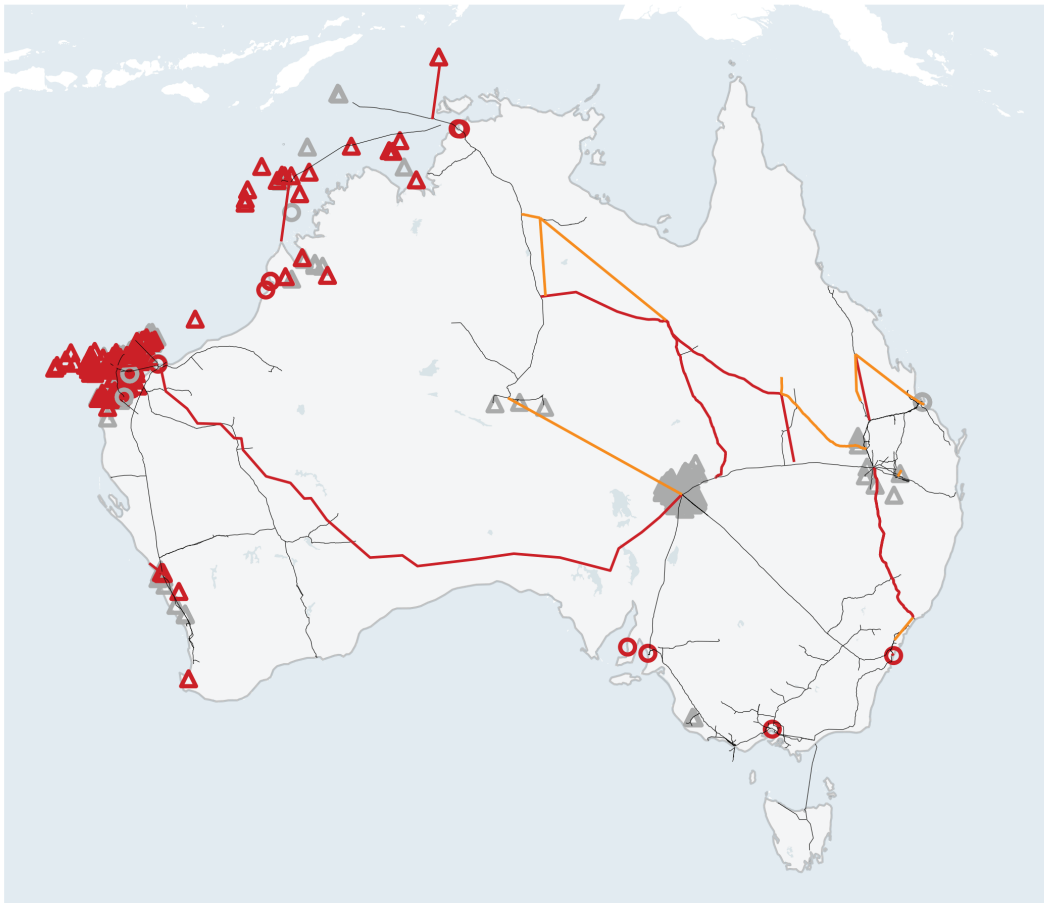
Another major gas exporter, Australia ranks fourth globally in gas pipelines in development with about **10,000 km** planned in some form, but the country drops to 41st place when considering the length currently under construction, which, according to GEM data, is around **4 km** costing approximately **US\$48.6 million**. This seeming contradiction is a result of an extremely gas-friendly national infrastructure plan released in 2021 that focused on expanding production in northern and southern Australia. Several

of these extraction areas and associated pipeline projects have not come to fruition (see shelved pipeline projects in **Figure 7**), in part because leadership change to a more climate-conscious government [caused](#) many ambitious projects to falter — at least temporarily.

Australia gas buildout will increase export capacity and tap existing and in-development gas fields

Gas pipeline expansion in Australia, showing in-development and operating oil and gas projects

○ LNG terminals ▲ Oil and gas fields



Source: Global Gas Infrastructure Tracker,
Global Oil and Gas Extraction Tracker



Figure 7. Projects in development are shown in red, and operating projects are shown in gray. Shelved projects, whose development has stalled, are highlighted in orange for contrast.

Australia's hopes of expanding its gas export business are a combination of its desire to increase LNG export capacity to Asia and the potential to harness the sizable oil and gas reserves locked in various basins within the continent's interior and off the coast of Western Australia. The dreams for expansion

South America

2023 has been consequential for South American gas infrastructure, particularly in Argentina, which is building about **1,100 km** of gas pipelines at a cost of **US\$4.1 billion**. There, the Vaca Muerta formation — the second-largest shale gas resource in the world — is being connected to the rest of the continent and, via LNG export terminals, potentially to the world (**Figure 8**). This recent connection began with the first phase of the [Néstor Kirchner Gas Pipeline](#) that was completed in July 2023. A second phase will extend the operating 573-km segment an additional 467 km north to San Jerónimo. There the system will link with the [Gasoducto Norte](#), which is currently set up for gas imports directed south into Argentina

still seem to persist, as the new government [has not](#) explicitly canceled projects or ceased approvals for new production, and some project branding [relies](#) on greenwashing techniques such as green hydrogen and carbon capture and storage (CCS), which can make them more amenable to decision makers.

from Bolivia but is undergoing a major reversal that by 2024 will allow for Vaca Muerta gas to be moved north, as Bolivia's gas supply [dwindles](#) and Argentina and Brazil look elsewhere. This reversal could also [connect](#) the Vaca Muerta to pipelines bound for Chile, Brazil, Bolivia, and Uruguay. Two other major proposals, an extension to the [Southern Cross Gas Pipeline](#) and the [Uruguaiiana-Porto Alegre Gas Pipeline](#), would move gas from Buenos Aires to Porto Alegre in southeastern Brazil, where there are LNG export terminals in development. Various other pipelines are in development to increase transmission capacity around offshore extraction areas.

Link to Vaca Muerta shale will drive major South American buildout

Gas pipeline expansion in South America, showing in-development and operating oil and gas projects

○ LNG terminals ▲ Oil and gas fields



Source: Global Gas Infrastructure Tracker, Global Oil and Gas Extraction Tracker



Figure 8. Pipeline and LNG terminals in South America. Projects in development are shown in red, and operating projects are shown in gray.

Methodology

Data

Data on gas transmission pipelines and LNG terminals are from GEM's [Global Gas Infrastructure Tracker](#) (GGIT) as of November 2023. Oil and gas extraction areas (in this briefing, used interchangeably with “fields”) are from a preliminary version of GEM's [Global Oil and Gas Extraction Tracker](#) (GOGET) as of November 2023. Oil- and gas-fired power plant data are from the August 2023 [Global Oil and Gas Plant Tracker](#) (GOGPT). In all maps, in-development projects represent anything in a

development phase that is not yet operating. For GGIT, this includes projects with a status of proposed and construction (and for Australia's map, shelved projects are shown as orange). For GOGET, in-development projects include anything with a status of exploration, in-development, and discovered. For GOGPT, in-development projects include anything with a status of announced, pre-construction, and construction.

Cost to build a pipeline

The GGIT database has cost estimates for just over 25% of projects, which are used to estimate cost projections at the subregional level (**Table A5**). To do so, these costs are normalized by the length of each pipeline to estimate the cost (in USD) to build a pipeline per unit km. The upper and lower 2.5% of outliers are first removed from the distribution to provide a more robust average, and any expansion projects are also removed to ensure the costs are

based on new pipeline builds. From there, costs are grouped by subregion, and an average is taken. In cases where pipeline cost data are not available for a given subregion, the broader average regional cost is used. This is the case for Melanesia, Micronesia, and Polynesia. Oceania's regional cost per km is used for these subregions, and this cost estimate is based on Australia and New Zealand's cost data.

Background on Global Energy Monitor

Global Energy Monitor (GEM) develops and analyzes data on energy infrastructure, resources, and uses. We provide open access to information that

is essential to building a sustainable energy future. Follow us at www.globalenergymonitor.org and on Twitter/X [@GlobalEnergyMon](https://twitter.com/GlobalEnergyMon).

Background on the Global Gas Infrastructure Tracker (GGIT)

[GGIT](#) is an information resource on natural gas transmission pipeline projects and liquefied natural gas (LNG) import and export terminals. The internal GGIT database and wiki pages are updated

continuously throughout the year, and an annual release is published and distributed with data summary tables. The data are released under a creative commons license and can be downloaded [here](#).

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Appendix

The planned global gas pipeline buildout by region and subregion

Region	Subregion	Proposed (km)	Construction (km)	Proposed+Construction (km)
Africa	Northern Africa	4,100	200	4,300
	Sub-Saharan Africa	18,600	1,600	20,100
Americas	Latin America and the Caribbean	17,100	2,200	19,300
	Northern America	8,600	2,500	11,100
Asia	Central Asia	3,900	1,600	5,500
	Eastern Asia	37,400	30,400	67,800
	South-eastern Asia	8,800	1,100	9,900
	Southern Asia	12,700	22,400	35,200
	Western Asia	6,000	2,200	8,200
Europe	Eastern Europe	21,300	3,800	25,100
	Northern Europe	1,100	0	1,100
	Southern Europe	8,500	1,700	10,200
	Western Europe	700	100	800
Oceania	Australia and New Zealand	9,900	0	9,900
	Melanesia	300	0	300
	Micronesia	0	0	0
	Polynesia	0	0	0
Total		159,000	69,700	228,700

Table A1. Values are rounded to the nearest 100. Source: Global Gas Infrastructure Tracker.

Longest 15 gas pipelines under construction globally

Pipeline	Length (km)	Capacity (bcm/y)	Countries	Status	Start year	Estimated cost (US\$ billion)
Xinjiang Coal-to-Gas Pipeline	4,159	30	China	Construction	2023	7.40
Jagdishpur-Haldia-Bokaro-Dhamra Natural Gas Pipeline (JHBDPL)	3,546	8	India	Construction	2023	1.70
West-East Gas Pipeline 4	3,340	15	China	Construction		5.9
Iran-Pakistan Pipeline	2,775	8	Iran, Pakistan	Construction	2024	7.5
West-East Gas Pipeline 3	2,090	25	China	Construction		7.2
IGAT 9 Gas Pipeline	1,900	40	Iran	Construction	2023	3.4
Mumbai-Nagpur-Jharsuguda Gas Pipeline	1,755	6	India	Construction	2023	3.10

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West-East Gas Pipeline 4	1,745	15	China	Construction		3.10
North East Natural Gas Pipeline Grid Project	1,656	2	India	Construction	2023	1.2
Pochinki-Anapa Gas Pipeline	1,625	63	Russia	Construction	2023	4.9
Mallavaram-Bhopal-Bhilwara-Vijaipur Gas Pipeline	1,446	29	India	Construction	2024	2.60
Ennore-Tuticorn-Bengalaru Gas Pipeline	1,431	31	India	Construction	2022	0.80
Trans Nigeria Gas Pipeline	1,300	36	Nigeria	Construction	2023	2.90
Sichuan-Shanghai Parallel Gas Pipeline	1,243	20	China	Construction	2023	2.2
IGAT 11 Gas Pipeline	1,200	40	Iran	Construction	2026	4.00

Table A2. Source: Global Gas Infrastructure Tracker.

Leading 15 countries building gas pipelines, ranked by km under construction

Country	Region	Subregion	Proposed (km)	Construction (km)	Proposed+Construction (km)
China	Asia	Eastern Asia	36100	30300	66400
India	Asia	Southern Asia	5600	15300	20900
Iran	Asia	Southern Asia	1600	5000	6600
Russia	Europe	Eastern Asia	18400	2900	21300
Pakistan	Asia	Southern Asia	2000	1900	3900
United States	Americas	Northern America	7200	1400	8700
Nigeria	Africa	Sub-Saharan Africa	2700	1400	4100
Italy	Europe	Southern Europe	1400	1300	2700
Argentina	Americas	Latin America and the Caribbean	1500	1100	2600
Canada	Americas	Northern America	1300	1100	2400
Iraq	Asia	Western Asia	0	800	800
Mexico	Americas	Latin America and the Caribbean	2900	700	3700
Vietnam	Asia	South-eastern Asia	100	600	700
Poland	Europe	Eastern Europe	800	500	1300
Kazakhstan	Asia	Central Asia	3500	500	4000

Table A3. Source: Global Gas Infrastructure Tracker.

Estimated capital expenditure costs for a gas pipeline buildout in leading 15 countries, ranked by km under construction

Country	Proposed (US\$ billion)	Construction (US\$ billion)	Proposed+Construction (US\$ billion)
China	51.5	48.1	99.7
India	13.5	26.2	39.8
Iran	9.9	17.8	27.7
Russia	49.3	8.2	57.5
Pakistan	6.2	3.7	9.9
United States	51.6	11.5	63.1
Nigeria	9.3	3.8	13.2
Italy	4.1	2.3	6.4
Argentina	10.9	4.1	15.1
Canada	8.9	34.5	43.3
Iraq	22.9	3.2	26.1
Mexico	21.6	2.1	23.7
Vietnam	0.2	2.0	2.2
Poland	6.6	1.2	7.9
Kazakhstan	4.0	0.5	4.5

Table A4. Source: Global Gas Infrastructure Tracker.

Regional and subregional cost estimates for building gas pipelines

Region	Subregion	Cost (million US\$ per km)	Number of data points going into average
Africa		3.10	29
	Northern Africa	2.65	26
	Sub-Saharan Africa	3.93	5
Americas		4.31	217
	Latin America and the Caribbean	2.96	43
	Northern America	4.65	179
Asia		1.78	456
	Central Asia	2.28	21
	Eastern Asia	1.43	374
	South-eastern Asia	2.44	8
	Southern Asia	2.26	21
	Western Asia	3.60	41

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Europe		3.00	134
	Eastern Europe	2.85	74
	Northern Europe	5.76	10
	Southern Europe	2.36	55
	Western Europe	4.76	13
Oceania		2.85	17
	Australia and New Zealand	2.85	17
	Melanesia	2.85	0
	Micronesia	2.85	0
	Polynesia	2.85	0

Table A5. Note these estimates are based on data availability in the Global Gas Infrastructure Tracker; see the Methodology for details.