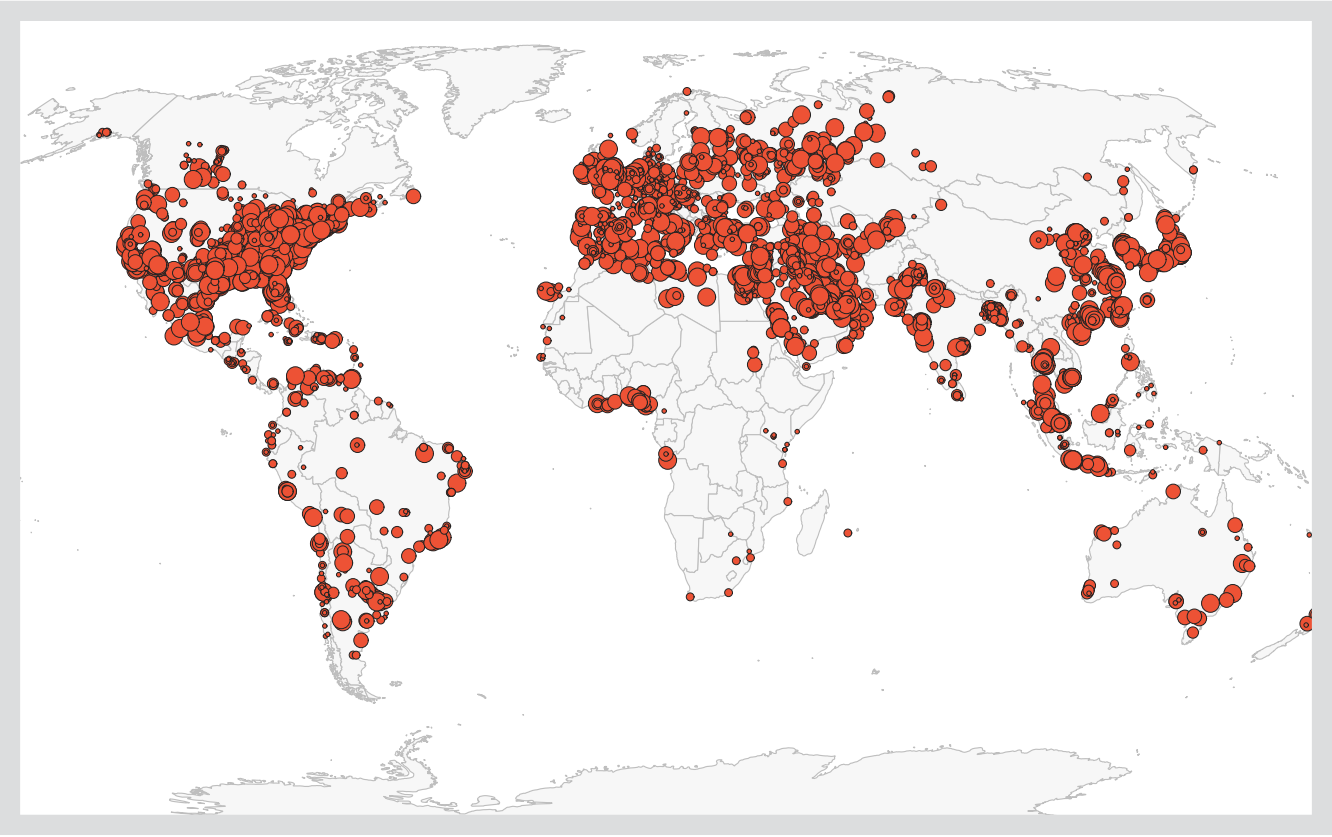
Gas Glut

2023

GLOBAL GAS POWER EXPANSION CONTINUES TO THWART ENERGY TRANSITION



ABOUT GLOBAL ENERGY MONITOR

Global Energy Monitor (GEM) develops and shares information in support of the worldwide movement for clean energy. By studying the evolving international energy landscape and creating databases, reports, and interactive tools that enhance understanding, GEM seeks to build an open guide to the world's energy system. Follow us at www.globalenergymonitor.org and on Twitter @GlobalEnergyMon.

ABOUT THE GLOBAL OIL AND GAS PLANT TRACKER (GOGPT)

The Global Oil and Gas Plant Tracker (GOGPT) is an online database that identifies and maps every known oil- and gas-fired generating unit and every new unit proposed since January 1, 2020 (20 MW and larger in the European Union and United Kingdom, 50 MW or larger elsewhere). Developed by Global Energy Monitor, the tracker uses footnoted wiki pages to document each plant and is updated biannually. For further details see the tracker landing page and methodology overview.

ABOUT THE COVER

The cover image is a map created by Scott Zimmerman of operating global oil- and gas-fired power plants.

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FURTHER RESOURCES

For additional data on proposed and existing oil and gas plants, see Summary Tables on the GEM website. To obtain primary data from the GOGPT, visit the Download Data page.

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INTRODUCTION

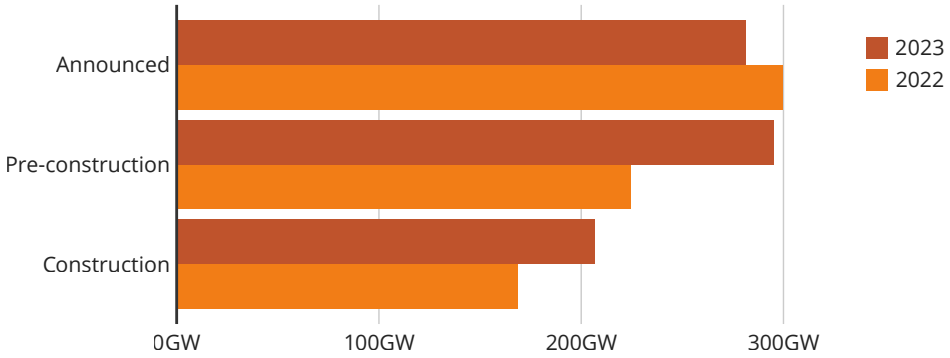
Oil and gas have had a big year. Oil- and gas-fired[1] power plants in development—projects that have been announced or are in the pre-construction[2] and construction phases—increased 13% in the last year to 783 gigawatts (GW), mainly driven by increases in capacity of projects in the pre-construction and construction phases. (Figure 1)

If built, these projects would grow the global oil and gas fleet by a third at an estimated cost of US$611 billion in capital expenditure, creating a lifetime emissions potential equivalent to more than six and half years of the United States' emissions.

Driven by concerns over energy security and promises of a durable transition fuel to decarbonize economies, countries around the world are developing oil and gas, most notably in Asia and the United States. Russia's war in Ukraine has changed the calculus for Europe in terms of its energy supply choices, while in places with extensive renewables potential and comparatively smaller fossil fuels sectors like Africa and Latin

Figure 1. Changes in oil and gas capacity in development, mid-2022 to mid-2023.

Global oil & gas power pant capacity in development in gigawatts (GW), mid-2022 to mid-2023



Source: Global Oil and Gas Plant Tracker, Global Energy Monitor

1. GEM historically has tracked gas and dual fuel (ie: gas/oil, gas/coal, gas/bioenergy) power plants in the Global Gas Plant Tracker (GGPT). In the expanded and renamed Global Oil and Gas Plant Tracker (GOGPT), GEM is now including oil, dual fuel (with gas or oil), and gas fired power plants.
2. Pre-construction projects include those that are actively moving forward in seeking governmental approvals, land rights, or financing.

America and the Caribbean, plans for oil and gas plants are gaining a foothold.

But it has also been a big year for extreme weather events. During these critical moments when energy has been needed the most, fossil fuel generation has at times failed. From fatal power outages in the U.S. during the winter Arctic blasts to rising temperatures across the Middle East buckling gas turbines, variable weather patterns brought on by a changing climate have upended notions of fossil fuel's reliability.

At the same time, gas' reputation as a cleaner transition fuel continues to unravel, as its significant contribution to climate change due to methane leakages at extraction and transportation becomes better understood.

By some estimates, methane leakage as low as 0.2% puts gas' climate impact on par with coal, and the actual leakage rates range from 3.7% to 9% or higher. It's no surprise then that 150 countries, representing nearly half of global methane emissions, have signed the Global Methane Pledge, endorsing its goal of reducing methane emissions 30% by 2030.

Against this backdrop, the call from the international scientific community to stop any new construction on fossil fuel infrastructure in order to limit planetary warming to 1.5°C becomes more urgent.

Expanding oil and gas capacity represents a costly stranded asset risk while also diverting resources away from the energy transition, which by some estimates calls for tripling installed renewable power capacity by 2050. Coupled with the rapidly declining cost of renewables and battery storage, as well as the increased volatility of gas prices, a move away from gas toward clean energy has never been more attractive.

EXPANDING THE GLOBAL OIL AND GAS PLANT TRACKER

In August 2023, Global Energy Monitor (GEM) released its first dataset for the newly renamed and expanded Global Oil and Gas Plant Tracker (GOGPT). This expansion now includes oil-fired power plants as well as plants that use internal combustion (IC) technology. While this expansion marks a definitive change in the inclusion criteria of the data collected, global oil-fired power generation generally consists of older peaker plants. The expanded data release includes:

- 118 GW of operating oil-fired power plants
- 9.8 GW of in-development oil-fired power plants
- 36.9 GW of operating internal combustion plants, 3.7 GW IC in development

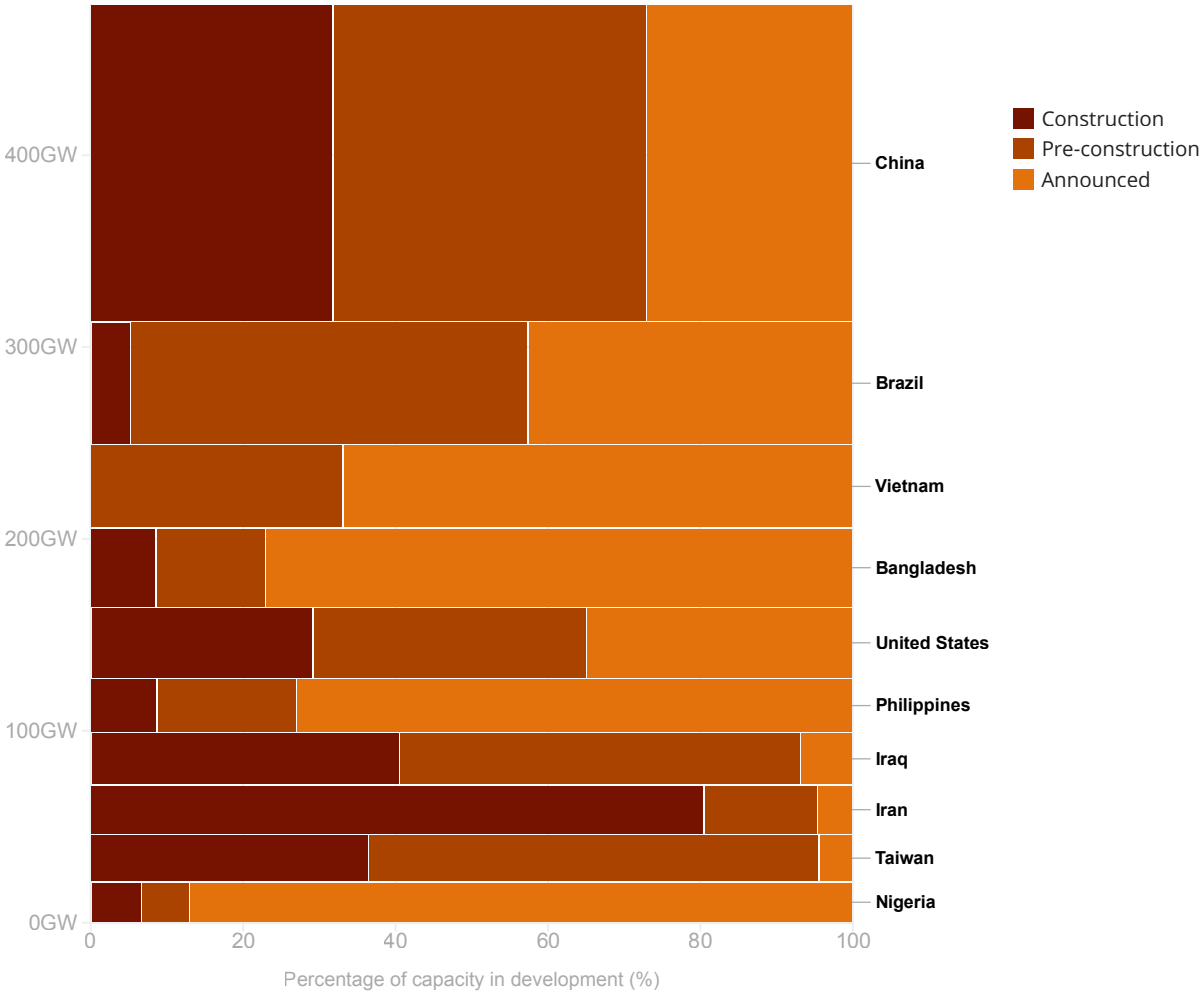
While the latest data release includes oil-fired power plants, there are only 7.5 GW of exclusively oil-fired power plants in development with the remainder gas-fired or dual fuel (ie: gas and oil-fired).

KEY POINTS FROM THE GLOBAL OIL AND GAS PLANT TRACKER:

- Five countries—China, Brazil, Vietnam, Bangladesh, and the United States—constitute 45% of all new global gas-fired capacity in development (Figure 2), and the top 20 countries make up 79%.
- Approximately 207 GW is in the construction phase, a 23% increase compared to last year, and 295 GW is in the pre-construction phase, a 32% increase.
- If built, the 783 GW of gas plants in development would add a total of 41,239 million tonnes CO_2e lifetime emissions, equivalent to more than six and half years of the entire U.S.' emissions.
- The boom of oil and gas plants in development dwarfs the 12 GW of gas-fired capacity that was retired in the last year.
- About two-thirds of the world's oil and gas plant capacity in development is located in Asia. East and Southeast Asia are dominated by plans to import LNG or expand domestic production,

Figure 2. In-development oil and gas capacity, top 10 countries.

Status of oil & gas power plant capacity in development in the 10 countries with highest totals, in gigawatts (GW)



Source: Global Oil and Gas Plant Tracker, Global Energy Monitor

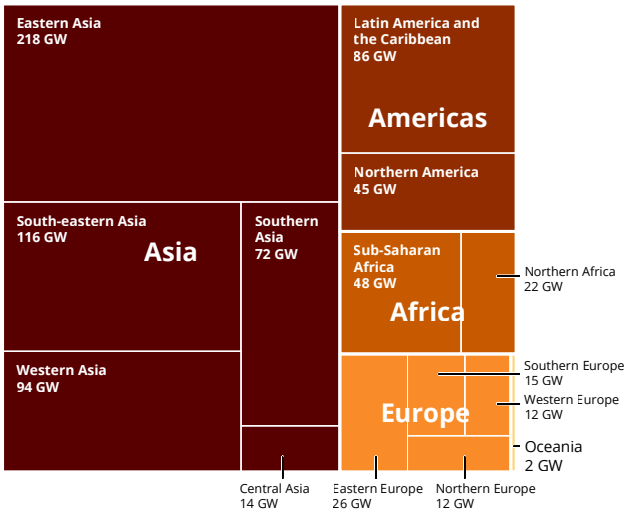
Note: Data only includes gas-fired generating units 20 MW and larger for the European Union and United Kingdom, and units 50 MW and larger elsewhere globally.

while Western Asia remains committed to gas-fired power generation to meet its energy needs. (Figure 3)

- Almost three-quarters of the world's oil and gas plant capacity in construction is located in Asia, with a third located in East Asia, mainly concentrated in China. Southern and Western Asia together account for nearly 30% of the world's oil and gas plant capacity in construction.
- Globally, China leads in the development of new gas capacity, with 21% of the world's total gas-fired capacity in development (Figure 2), and the largest increase compared to last year. (Figure 4)
- Despite announced clean energy goals, the United States leads the globe in existing oil- and gas-fired capacity, with 26% of the world's total, and still generates a significant amount of its power from fossil fuels.

Figure 3. Where are oil and gas plants in development?

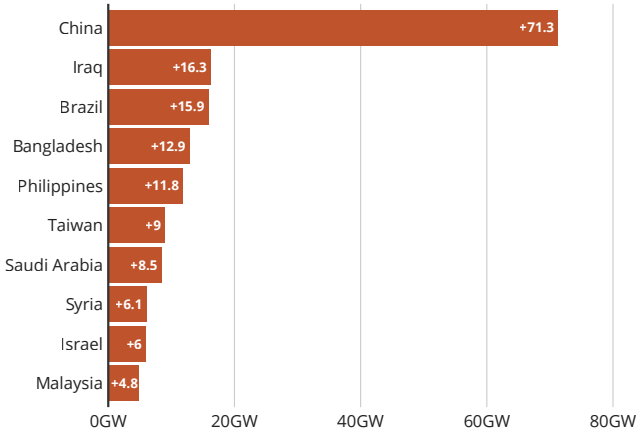
Capacity of planned oil & gas plants by continent and region, in gigawatts (GW)



Source: Global Oil and Gas Plant Tracker, Global Energy Monitor

Figure 4.Top countries with increases in planned oil and gas capacity.

Change in oil & gas capacity announced, in pre-construction and construction from mid-2022 to mid-2023, in gigawatts (GW)



Source: Global Oil and Gas Plant Tracker, Global Energy Monitor

RELIABILITY UNCERTAINTY OF FOSSIL FUEL POWER PLANTS DURING EXTREME WEATHER

As the effects of global heating become more apparent through more frequent and extreme weather events, it is crucial to highlight the false narrative of fossil fuel reliability. The Arctic blast that hit the United States last winter, which prompted rolling blackouts and killed dozens, clearly demonstrates the continued performance problems of fossil fuel power, with more than 100 GW of coal- and gas-fired generation that failed to start or were forced offline across multiple regional transmission operators. In fact, PJM's report shows that gas plants accounted for more than 70% of unplanned outages during the storm, despite extensive preparations in advance. This comes after new reliability requirements were issued after Winter Storm Uri in 2021, during which gas-fired power plants failed to operate due to freezing components and gas supply issues, resulting in widespread power outages and more than 200 deaths. The North American Electric Reliability Corporation's (NERC) latest State of Reliability report, which highlights coal and gas power generation setting a record for outages in 2022, states that "extreme weather events continue to pose the greatest risk to reliability due to the increase in frequency, footprint, duration and severity." During the recent heatwave in Texas, solar and wind, which provided 35% of the state's power, combined with battery storage, was crucial to ensuring reliability when nearly 10 GW of gas and coal capacity went offline.

A recent IEA commentary noted that the performance of gas-fired power plants, which account for 74% of electricity generation in the Middle East and North Africa (MENA) region, can be negatively affected by warmer air mass flow entering the gas turbine compressor. More than 80% of MENA's installed gas-fired capacity faces an annual addition of more than 20 hot days in the 2081–2100 period during a low-emissions scenario and over 40 hot days in a high-emissions scenario.

During critical weather events, at a time when generation is needed the most, fossil fuel generation has proven to be unreliable. Energy systems will need to become more climate resilient as the world experiences the impacts of climate change. Therefore, it is imperative that we end our reliance on fossil fuels and pivot to flexible renewable energy to ensure grid reliability.

REGIONAL BREAKDOWN

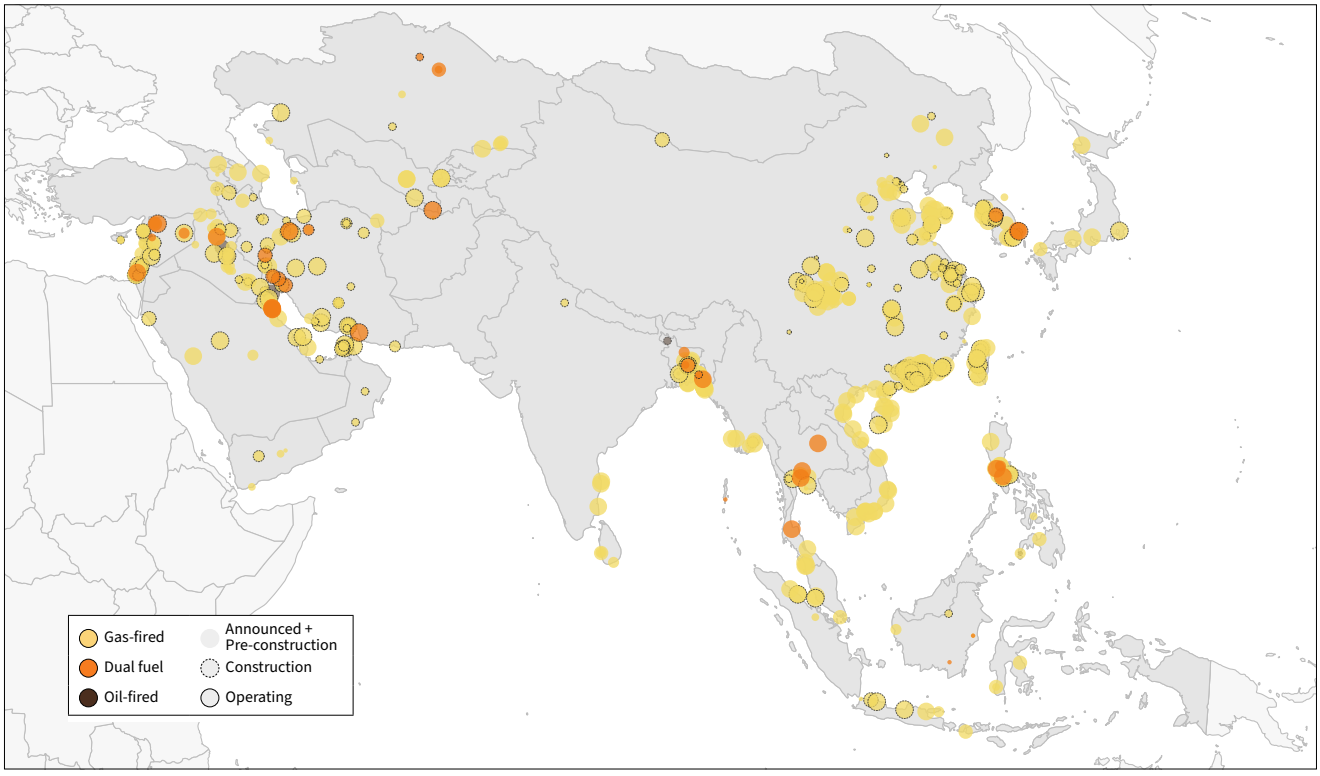
Asia

Asia, particularly Eastern Asia, dominates the planned global gas-fired power plant buildout.

High LNG prices have pushed some developing countries in Asia, including Bangladesh and Pakistan, away from procuring LNG cargoes. In other cases, in a bid to avoid a repeat of the LNG price crisis, countries are turning to boosting domestic gas production and building up LNG infrastructure and storage facilities. Notably, Japan announced it will establish a LNG reserve system, and in India, gas regulators are pushing to build gas storage. Building new gas plants, or converting coal plants to run on gas, will only risk stranded assets and LNG import dependency that is subject to volatile prices and global supply constraints in the future.

According to TransitionZero's Coal-to-Clean Price Index the levelized cost of electricity (LCOE)[3] from solar with storage, as well as wind with storage, is below the cost of gas-fired power in China. Globally,

Figure 5. Oil- and gas-fired power plants in development, Asia.



3. Levelized cost of energy (LCOE) is defined by TransitionZero as "the average total costs of building and operating a power plant, based on per unit of electricity generated over its assumed lifetime." The LCOE for gas power represents the price per megawatt hour ($/MWh) at which project costs can be recovered and investors can achieve a minimum rate of return—known as the "hurdle rate"—on the capital and lifetime operational costs of the plant. This includes the fixed costs of building and maintaining the plant as well as the short-run marginal cost of buying fuel and operating it. For utility-scale solar or onshore wind with storage, LCOE is the price ($/MWh) needed to recover project costs and attain a required hurdle rate on investment. The methodology assumes a battery with half the capacity of the paired renewable source, capable of discharging for four hours. For example, a 10 megawatt (MW) solar site would have a 5MW battery holding 20MWh.

on average, the LCOE from wind with storage and solar with storage is below the cost of gas-fired power.

The majority of the world's 81 GW of gas projects cancelled in the last year are located in Asia. However, when compared to the net increase of 91 GW of projects in development a year ago, the global gas expansion rate is increasing.

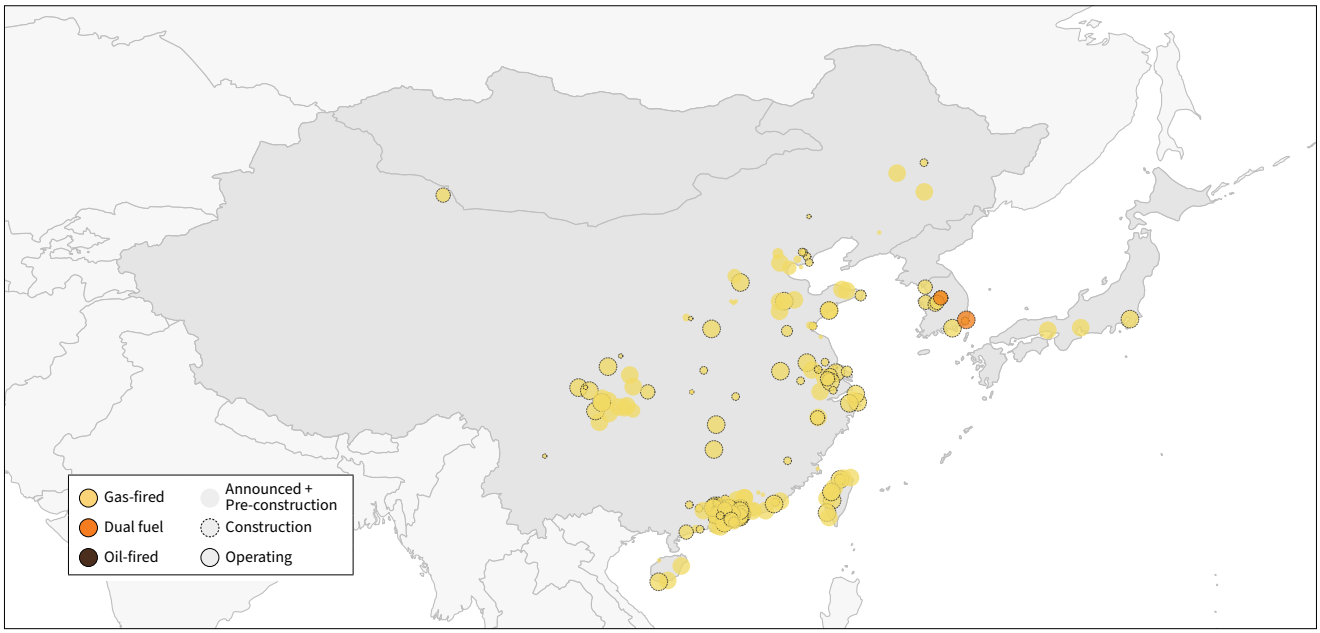
Asia, with 514 GW at an estimated total cost of US$385 billion, has nearly two-thirds of the world's oil- and gas-fired capacity in development. The majority of the planned expansion is in East Asia. Overall, the nearly 218 GW in East Asia represents 29% of the global in-development capacity and 42% of in-development capacity in Asia. If built, this will increase East Asia's existing gas-fired capacity, 300 GW as of mid-2023, by over 72%. The East Asia region is home to the world's three biggest LNG importers: China, Japan, and South Korea.

Other regions in Asia also have considerable gas expansion plans. Southeast Asia has 116 GW of oil- and gas-fired capacity in development, at an estimated cost of US$98 billion and a twofold increase compared to the region's existing capacity. Southern Asia has 72 GW of oil- and gas-fired capacity in development, at an estimated cost of US$59 billion. If built, this will increase the region's existing gas-fired capacity, 141 GW, by over 50%. Western Asia has approximately 94 GW of oil- and gas-fired capacity in development, at an estimated capital cost of US$75 billion. If built, Western Asia's existing oil- and gas-fired capacity will increase by about a third. Central Asia has approximately 15 GW of oil- and gas-fired capacity in development, at an estimated capital cost of US$12 billion. If built, Central Asia's existing oil- and gas-fired capacity will increase by almost two-thirds.

Eastern Asia[4]

The world's gas expansion is concentrated in China, with approximately 164 GW in development. Globally, China leads in the development of new gas capacity, with 21% of the world's total gas-fired capacity in development, more than the next leading three countries—Brazil, Vietnam, and Bangladesh—combined, and more than the current operating capacity of Saudi

Figure 6. Oil- and gas-fired power plants in development, Eastern Asia.



4. Includes: China, Hong Kong, Japan, Macao, South Korea, Taiwan

Arabia and Iran combined. A quarter of the world's gas expansion in the construction phase is happening in China. If all projects in development are built, China's existing gas-fired capacity will more than double.

Oil- and gas-fired power generation accounted for just over 4% of China's electricity generation in 2022 and represented only 5% of the country's total power capacity. Despite having committed to reach peak carbon emissions by 2030 and to be "carbon-neutral" by 2060, at the recent G20 climate negotiations, China rejected calls for economy-wide targets to reduce total emissions by almost half by 2030, as well as an agreement for global emissions to peak by 2025. Even as China ramps up its renewables buildout, gas-fired capacity continues to grow at an alarming rate, driven by increasing electricity demand and coal-to-gas replacements. Rystad forecasts that China's installed gas-fired capacity will more than triple from 2022 levels, to 355 GW, by 2050.

Japan has the second-highest operating gas-fired capacity in the region and ranks fourth in the world, with 107 GW. In the 1970s, the country was heavily reliant on oil-fired power plants. However, it has since diversified its fuel sources to include coal, LNG, and nuclear, bringing the share of oil to less than 5% by 2019. Currently, gas contributes about 24% to the total energy mix and makes up 36% of the power generation mix. Japan relies almost entirely on LNG imports for its gas needs. Due to high LNG prices in 2022, Japan announced plans to speed up the restarting of seven nuclear reactors starting in mid-2023. It also announced plans to launch a strategic "LNG reserve system" to secure gas for unexpected situations. Currently, Japan has only around 7 GW of gas power plants in development. Despite the abundant evidence of economic, climate, and health risks of gas dependency, Japan continues to promote LNG as a transition fuel. The recently approved "Green Transformation" policy finances and encourages LNG; ammonia co-firing; fossil hydrogen; and carbon capture, utilization, and storage in Asia. As part of its efforts to reduce greenhouse emissions, Japan has set a goal of increasing its annual hydrogen supply by six times from the current level to 12 million tons by 2040. However, most of the hydrogen currently being used in the country is sourced from fossil fuels.

East Asia has 36 GW of coal-to-gas conversions or replacements in development, representing approximately 16% of the region's total. These are mostly concentrated in South Korea and Taiwan. Of South Korea's 20 GW of gas-fired capacity in development, 12.8 are coal-to-gas replacements.

Similar to Japan, South Korea has negligible domestic gas production and is primarily dependent on LNG imports. In its 10th Basic Plan, the proposed 2030 and 2036 energy mix scenarios show LNG accounting for nearly 23% and over 9%, respectively. While South Korea has committed to no new coal plants entering into construction and phasing out coal by 2050, the government is planning to meet the energy demand by converting 28 aging coal plants into LNG plants by 2036. Furthermore, the latest Green Taxonomy classifies LNG as a "'green" fuel. A recent Climate Analytics report shows that there is no room for new gas capacity, a 1.5 degree compatible gas phaseout for South Korea must happen by 2034, and there is more than enough potential renewables capacity to replace fossil fuels.

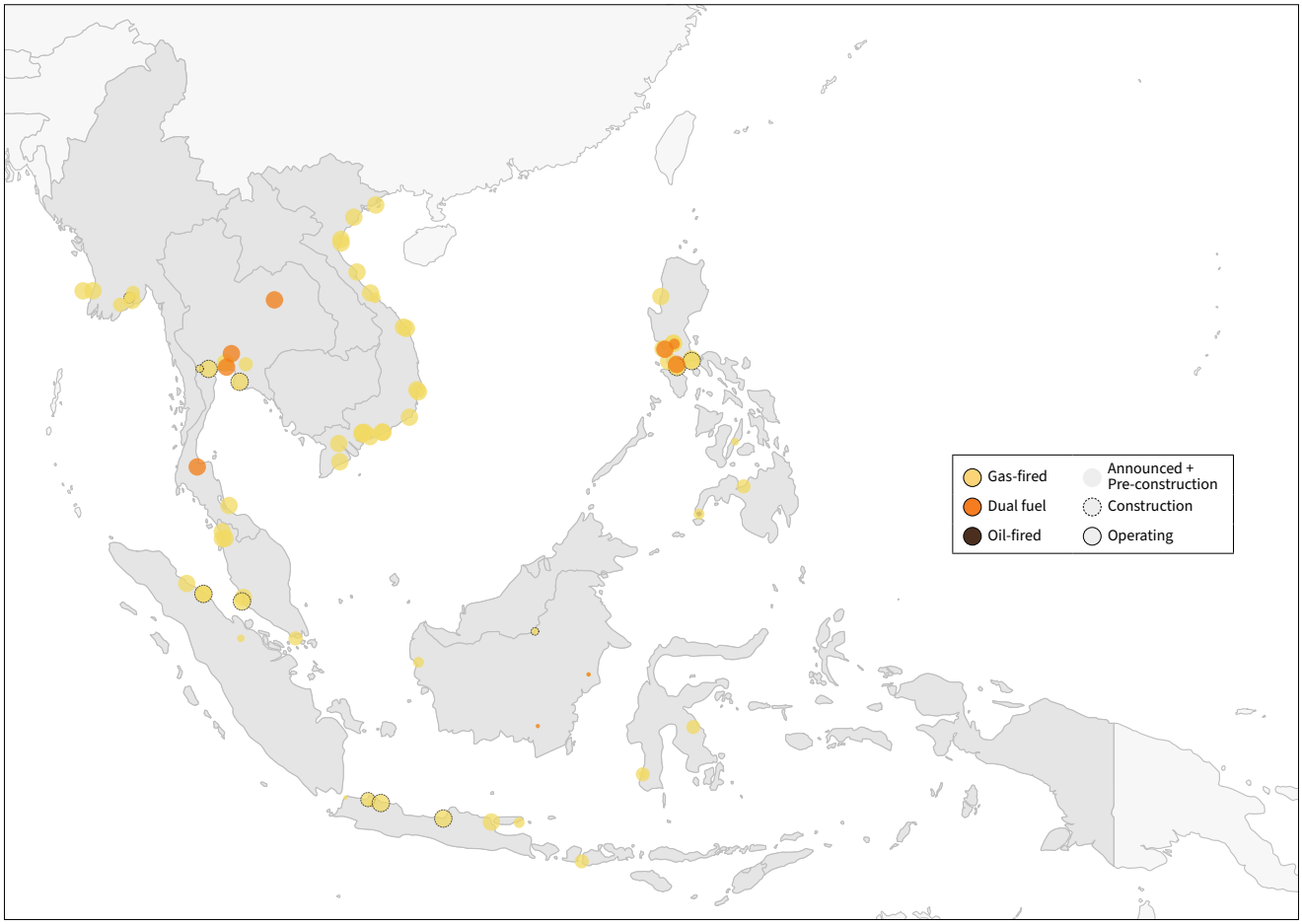
Taiwan plans to continue its reliance on LNG as it pivots from coal to gas and phases out nuclear power. Of the nearly 25 GW of in-development gas-fired capacity in Taiwan, more than half are coal-to-gas replacements in the pre-construction or construction stage. Under the Renewable Energy Development Act, Taiwan has set a goal to increase gas-fired generation to 50% and renewable power to 20% by 2025. The target also calls for coal-fired generation to fall to about 30% from the current 47% level.

Southeast Asia[5]

Globally, Vietnam ranks third for in-development gas-fired capacity with nearly 44 GW of projects in the announced or pre-construction stage, representing more than a fivefold increase over existing capacity. Vietnam's gas sector development is largely driven by its bid to overcome the longstanding power crisis while also turning away from coal-fired power generation. The country's US$135 billion Power Development Plan (PDP), approved in May 2023, aims to increase gas-fired power generation from 9.3% in 2022 to around 25% by 2030 by adding 15% LNG-fuelled power. The plan also calls for a decrease in coal-fired power generation from 33% in 2022 to 20% by 2030. In December 2022, Vietnam announced a US$15.5 billion JETP agreement, which will aid in its transition from coal but leaves room for gas-fired expansion, including the country's first LNG-fired power plant—Nhon Trach 3, which is currently in construction.

As domestic gas supply runs dry, the Philippines plans to turn to LNG imports with over 28 GW of mostly LNG-fired power plants in development, a more than sixfold increase over existing capacity. The long-term economic sustainability of LNG-fueled power is already facing obstacles as two power supply agreements are being renegotiated due to high costs. The revised power supply agreements will likely pass the

Figure 7. Oil- and gas-fired power plants in development, Southeast Asia.



5. Includes: Brunei, Cambodia, Indonesia, Malaysia, Myanmar, Philippines, Singapore, Thailand, Timor-Leste, Vietnam

high fuel costs on to consumers, who are already paying some of the highest tariffs in Asia.

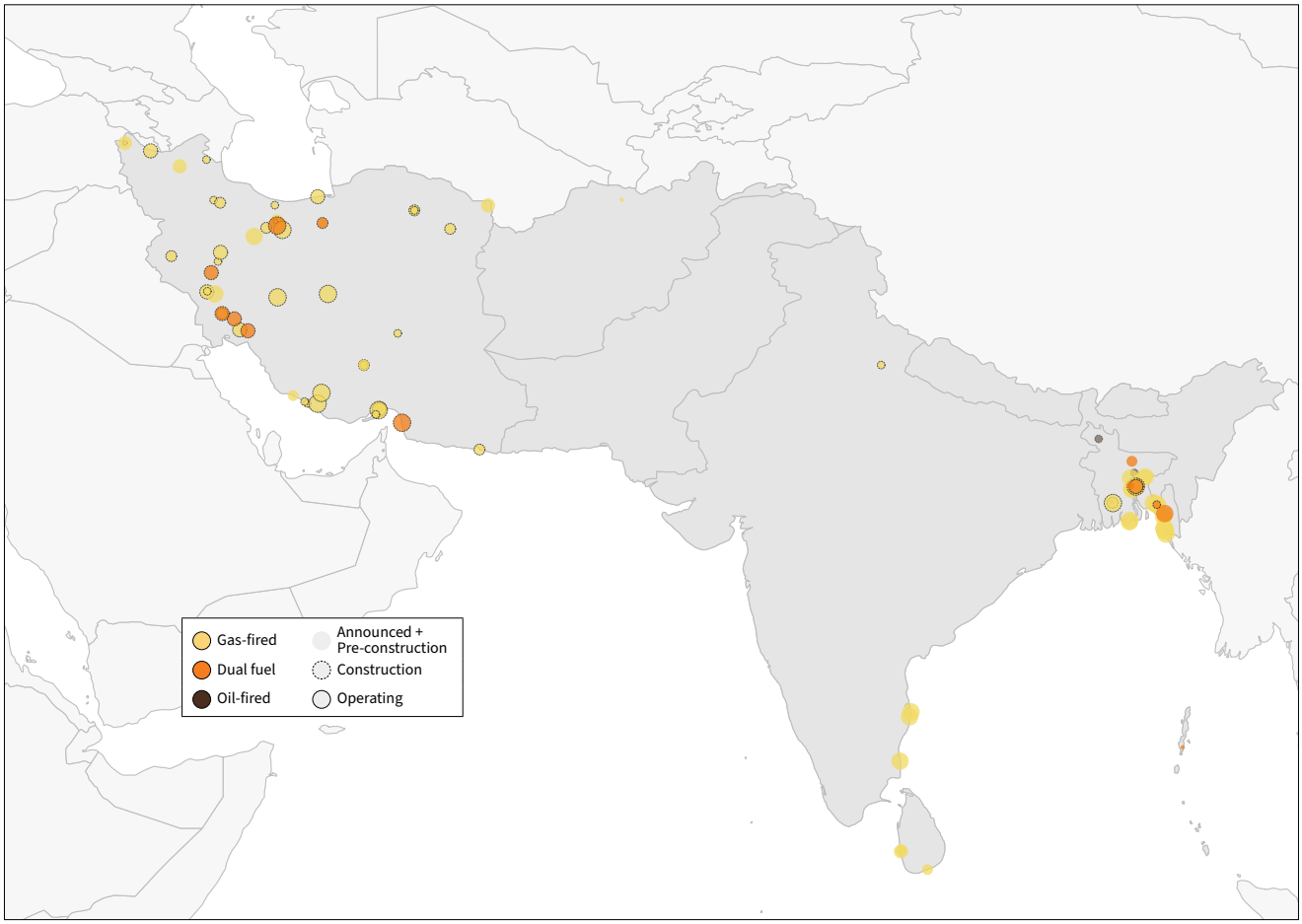
In November 2022, it was announced that Indonesia would receive US$20 billion in JETP funding to aid the country in a just transition from coal to renewables. Despite high infrastructure costs, the Indonesian government is seeking to use JETP funding to convert up to 55 of its diesel-fired power plants into gas plants.

Thailand, which has nearly 13 GW of gas-fired capacity in development and generates almost 65% of its electricity from gas and oil, has been increasing LNG imports to meet demand. In a push to avoid a potential surge in LNG prices, Thailand recently announced its intention to ramp up domestic gas production at its Erawan field.

Southern Asia[6]

Iran leads the region with 72 GW of operational gas and oil-fired power capacity and ranks second in terms of the planned gas expansion with nearly 26 GW in development. The share of gas in the country's power generation mix is about 71%; just over one-quarter of the country's electricity is produced from oil. Iran has continued to invest in fossil generation by upgrading its older units into combined cycle plants and building new combined cycle units.

Figure 8. Oil and gas-fired power plants in development, Southern Asia.



6. Includes Afghanistan, Bangladesh, India, Iran, Pakistan, Sri Lanka

Bangladesh ranks first in the region in terms of gas expansion, with approximately 41 GW in development, more than double its current operating capacity. Currently, gas accounts for 55% of electricity production in Bangladesh, with about a quarter of the gas imported. But the majority of the planned gas buildout will rely on imported LNG, as the country's gas reserves are drying up. The planned gas buildout in Bangladesh is at odds with the country's power sector overcapacity, with some estimates as high as 50%. The capacity utilization is projected to decline further in the next decade as planned capacity additions come online. Despite receiving an IMF loan, the country's dollar crisis has been further exacerbated by rising capacity payments leading to power plant shutdowns. As a result, Bangladesh is struggling with power outages due to fuel shortages, which could result in rolling blackouts until 2026. As the benefits of a renewables pathway becomes evident, continued reliance on highly volatile imported LNG will pose an economic and energy security risk. India is facing a similar situation where at least 10 GW of its gas-fired power capacity sat idle in FY2023 due to a lack of domestic gas and high import prices.

Recently, Pakistan declined the offer to purchase two LNG cargo shipments for the upcoming winter at a 30% premium over market price, despite the worsening fuel shortage issues. The LNG price spike has had a slight dampening effect on gas expansion plans with Pakistan announcing plans to gradually phase out LNG-fired power generation and instead rely on domestic energy resources. Nevertheless, the planned gas expansion in the region remains significant and pivoting to a renewable transition pathway is imperative.

Western Asia[7]

Iraq leads the region with a planned oil- and gas-fired expansion of 27 GW, a third of which is oil-based. Despite an abundance of domestic oil and gas resources, Iraq continues to deal with frequent energy shortages due to political instability, rising energy demand, and reliance on gas imports from Iran. A recently signed $27 billion deal with TotalEnergies aims to help alleviate the energy crisis with investments in oil production as well as fossil fuel and renewables development. In addition to increasing its oil- and gas-fired capacity, Iraq has set a target of generating 25% of its electricity from renewable energy by 2030.

Kuwait has nearly 21 GW of gas-fired power in development, which would double its existing operating capacity if built. As the country has shifted from gas to oil for its power generation fuel over the last decade, none of the plants in development will be fueled by oil, and only 15 GW will be dual fuel. Currently, Kuwait is almost entirely dependent on oil and gas for its power production but has committed to diversifying its energy portfolio, with a goal of 15% renewable energy generation by 2030.

Despite having only 9 GW of in-development gas power capacity, Saudi Arabia remains reliant on gas and oil to meet its power generation needs. In early 2023, Saudi Arabia made a commitment to equip all future power generation plants with carbon capture technology. Despite Saudi Arabia's goal of achieving net zero emissions by 2060, the country remains reluctant to fully embrace a renewables buildout. According to its Vision 2030 plan, the country aims to generate its electricity from gas and renewables (50/50 mix) by 2030, eliminating oil from its power fuel mix.

7. Includes Armenia, Azerbaijan, Bahrain, Cyprus, Georgia, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Palestine, Qatar, Saudi Arabia, Syria, Türkiye, United Arab Emirates, Yemen

The United Arab Emirates, the host of COP28, plans to add 6 GW of gas-fired capacity. Although gas still dominates the power generation mix, the country's Energy Strategy 2050 plan aims to diversify its energy mix to 44% renewable, 38% gas, 12% clean coal, and 6% nuclear by 2050 and triple the contribution of renewable energy by 2030.

Central Asia[8]

Uzbekistan leads the region with 8 GW of oil- and gas-fired capacity in development, exceeding the rest of the countries in the region combined. Uzbekistan's power generation mix continues to be dominated by gas, which is supported by government subsidies for gas and electricity and therefore discourages investment in renewables. Once the in-development projects are built, Uzbekistan's existing gas-fired capacity will increase by over half.

Kazakhstan, still largely reliant on cheap domestic coal, is currently grappling with its aging infrastructure, which has resulted in numerous power plant failures and interruptions of energy supply. The average lifetime of a cogeneration power plant is 61 years, and about three-quarters of the power stations in the country have been in operation for over 50 years. The 4.5 GW planned gas-fired expansion, almost half of which are coal-to-gas conversions or replacements, will double the country's existing capacity. However, these projects have been slow to develop, and in some cases, upgrades of the existing equipment have been reported instead of the previously announced conversion plans.

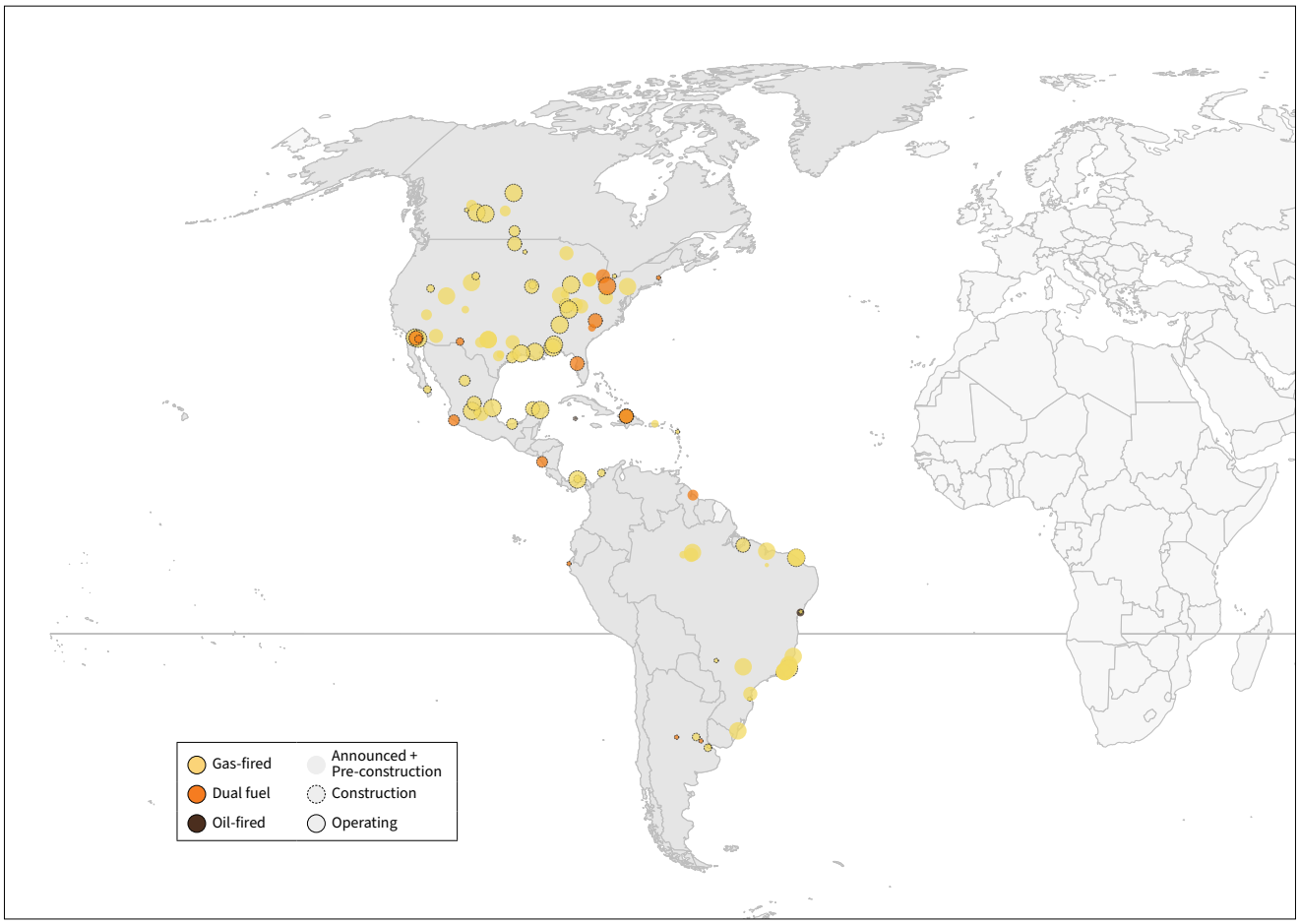
8. Includes: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan

Americas

In order to keep 1.5°C of global heating within reach, the region has an important role to play by aggressively accelerating its renewables transition, especially considering that the United States has the greatest historical responsibility for current warming. While the United States has committed to 100% clean power by 2035, fossil fuels generated nearly 60% of energy in 2022. Similarly, despite clean energy commitments, Mexico is still mostly reliant on oil and gas, with 74% of energy generated by fossil fuels in 2022. Canada, Mexico, and the United States are all signatories of the Global Methane Pledge.

Latin America and the Caribbean account for roughly 86 GW of oil- and gas-fired capacity in development, mainly concentrated in Brazil and Mexico, of which more than three-quarters have not reached the construction phase. Northern America has almost 45 GW of oil- and gas-fired capacity in development, with nearly half of these being coal-to-gas conversions or replacements. If the region's 131 GW of oil and gas capacity is built, this will increase Northern America's existing oil- and gas-fired capacity by one-fifth at a cost of US$113 billion.

Figure 9. Oil- and gas-fired power plants in development, Americas.



Latin America and the Caribbean

Globally, Brazil ranks second, with 64 GW of in-development gas and oil power capacity, representing a more than threefold increase over existing capacity. Brazil's ongoing uptick in gas plant development reflects a desire to capitalize on the nation's significant onshore and offshore domestic reserves and the impact of a 2021 gas law that opened the market to greater competition, prompting a flurry of gas-to-power projects fueled by imported LNG. As dozens of companies race to get in on the boom, Brazil has seen significantly more new gas plant proposals than any other Latin American country; however, less than 5 GW have progressed to the construction phase.

Mexico leads the region with nearly 48 GW of operating oil and gas power capacity. The "Mexico first" energy policies of President Andrés Manuel López Obrador (AMLO) have prioritized projects developed by the federal electricity commission CFE over those of foreign investors and has led to the extension of retirement dates for existing CFE-operated plants, as well as a surge in new power plant construction. The government's goal of controlling two-thirds of the nation's electricity market by 2024 drove Iberdrola's sale of 12 combined cycle plants to Mexico Infrastructure Partners, following years of disputes. In order to meet law-mandated clean energy targets, the Mexico energy regulator reclassified some gas-fired power plants as "clean."

Northern America[9]

At over 560 GW of oil- and gas-fired capacity, the United States has the largest existing gas-fired capacity of any other region or country (over 29% of the world's total). Gas remains the largest source of power generation in the United States, increasing from a 37% share of U.S. generation in 2021 to 39% in 2022. While the United States has only 400 GW of coal-fired generation in development, it ranks fifth globally in planned gas-fired expansion, with 39 GW in development.

In May, the United States' Environmental Protection Agency (EPA) issued new emission standards for power generation units. The draft rule requires most fossil fuel-burning power plants to reduce their GHG pollution 90% between 2035 and 2040. Gas-fired combustion turbines with capacities above 300 MW and utilization rates greater than 50% would be subject to strict emission limits. Operators could either install carbon capture and sequestration (CCS) technology or co-fire with hydrogen to reduce emissions. Analysis from BTU Analytics estimates that 79 gas-fired combined cycle units, or 72.5 GW, would have to meet the EPA's proposed standards. In August 2022, the Inflation Reduction Act was passed, which provides nearly $400 billion to incentivize investment in clean energy and emissions reductions.

9. Includes: United States, Canada

Europe

Although renewable power generation is now cheaper than oil- and gas-fired power generation in the EU as well as globally, continued discussion of and financial investment in gas as a "transition fuel" ignores this reality. Europe has nearly 66 GW of oil- and gas-fired capacity in development, a 10.5% decrease compared to last year. The majority of this expansion is happening in Eastern Europe, with 26 GW of in-development capacity, representing 40% of Europe's in-development capacity. Shelved projects increased to nearly 32 GW, compared to 21 GW last year, showing a turn in development of gas-fired capacity. However, attempts to move away from gas need to happen more quickly if net zero goals are going to be met.

Eastern Europe[10]

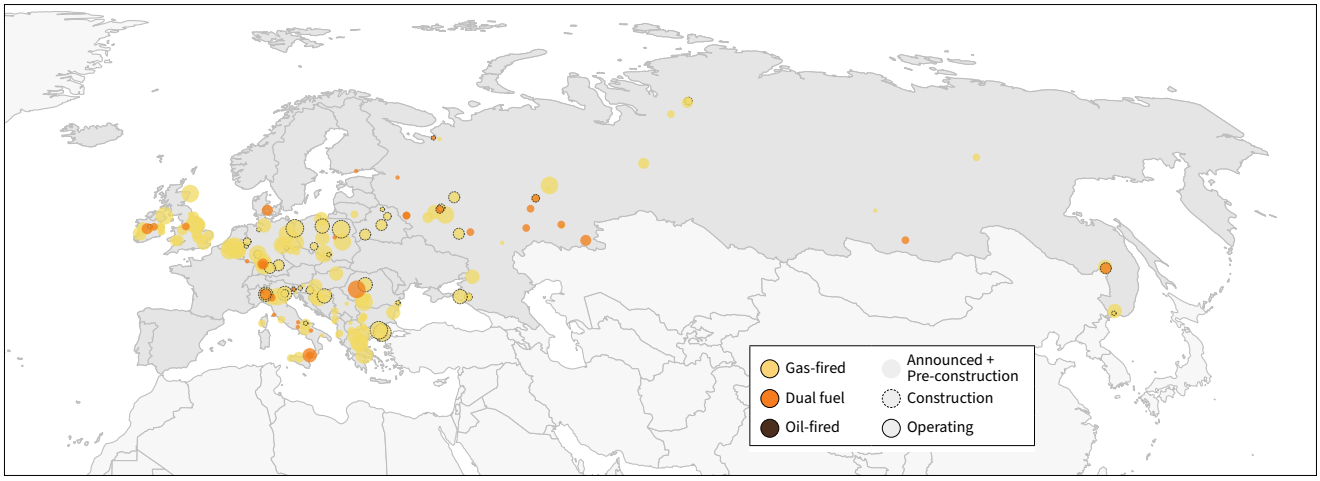
Russia leads the region with almost a third of the region's existing oil- and gas-fired capacity, at 111 GW, and planned gas expansion of almost 11 GW—an addition of about 10% to its current capacity and 42% to the Eastern Europe region. According to GEM data, the capacity in development shows that Poland, Bulgaria, and Romania are planning to increase their gas-fired capacity by 217%, 191%, and 124%, respectively.

In February, the Ministry of Energy of Russia released a new program of national energy system development for 2023–2028, which includes a large number of construction, upgrade, and retirement proposals. Over the past year, the development of new gas-fired expansion projects has slowed since Russia has not been able to scale up the domestic production of gas turbines. The previous contracts were cancelled by foreign manufacturers due to the war in Ukraine. In Ukraine, approximately 6 GW of previously operating oil- and gas-fired generation have been destroyed or damaged by the ongoing war.

Northern Europe[11]

The past year has showcased a slowdown in the development of new oil- and gas-fired power projects in Northern Europe. Many countries, including Finland, Denmark, Sweden, Norway, and the UK have announced plans for the decarbonization of their electricity systems by 2040, resulting in the cancellation or shelving of several large-scale power generation projects, such as Drax power station and the Tees Combined-Cycle power station. Countries such as Finland and Sweden are dropping new oil and gas

Figure 10. Oil- and gas-fired power plants in development, Europe.



10. Includes: Belarus, Bulgaria, Czech Republic, Hungary, Poland, Moldova, Romania, Russia, Slovakia, Ukraine
11. Includes: Denmark, Estonia, Finland, Iceland, Ireland, Isle of Man, Latvia, Lithuania, Norway, Sweden, United Kingdom

projects in favor of biomass-fired power generation to meet their net-zero targets.

However, these commitments have not prevented a continued buildout of oil and gas power generation capacity, with a number of smaller projects continuing to move forward. Many of these projects, such as the Eggborough power station and Immingham power station are so-called "peaker" plants just under the 300 MW threshold, beyond which gas plants are required to be carbon-capture ready. The UK expects to double its electricity generation capacity by 2035, of which 8.5 GW of capacity are expected to be from gas- and oil-fired projects already in development. Ireland has the largest expected percentage growth in oil- and gas-fired power generation, with more than 3 GW of projects in development. A large proportion of the region's 12 GW of power generation in development will be from diesel- and gas-fired engines for large data centers of companies such as Microsoft and Google.

Southern Europe[12]

Southern Europe continues to ramp up investments in oil and gas, with over 15 GW of additional generation capacity in various phases of development. Italy and Greece feature the largest expected increases in oil- and gas-fired power generation (11.5 GW), with LNG terminals and additional connections to Northern Africa providing more gas supplies.

Additionally, the overall gasification of the region continues, with Bosnia and Herzegovina, Albania, Montenegro, and North Macedonia (currently powered mainly by coal- and oil-fuelled power generation) all expecting their first gas-fired power plants to go online over the next few years. Serbia also continues to develop its gas-fired power generation, alongside investments in cross-border pipelines and other infrastructure links to supply gas to the newly gasified areas. While a move away from coal in the region is necessary, the commitment to building out new gas infrastructure to replace or supplement this capacity remains deeply concerning. These developments are unlikely to reduce GHG emissions, and despite strong arguments for a direct transition to renewable energy sources, many of these countries have announced plans to eventually blend fuels, such as green hydrogen, into their gas infrastructure as part of their energy transition in order to justify ongoing investment and expansion.

Western Europe[13]

Western Europe features some of the countries most heavily impacted by the Russian invasion of Ukraine, with Germany, France, and the Netherlands all substantially revising their plans for the development of their power systems in response to the crisis. The REPower EU plan, released in May of 2022, focuses on loosening restrictions on the buildout of fossil fuel infrastructure. The plan features the diversification of fossil gas supply away from Russia, while still maintaining a heavy reliance on LNG and other fossil fuels.

For instance, a number of countries including the Netherlands, Germany, and Austria have announced delays in their coal phase-out, along with a host of new gas-fired power generation projects, with the need for "security of supply" of energy resources being touted as the foremost priority in the region.

The unwillingness to set aside gas is also evident in the EU's rapid investment in hydrogen as a future power generation fuel, with a number of countries testing small scale blending of hydrogen and methane gas in conventional gas turbines. Germany has announced the development of 24 additional GW of gas- and hydrogen-fuelled power stations, with the intention of eventually converting them to be exclusively hydrogen fuelled. France, Netherlands, and Belgium have also announced a number of integrated hydrogen production, transport, and end-use projects titled "Hydrogen Valleys," although the majority of these projects are still in very early stages of development.

12. Includes: Albania, Bosnia and Herzegovina, Croatia, Greece, Italy, Malta, Montenegro, North Macedonia, Portugal, San Marino, Serbia, Slovenia, Spain

13. Includes: Austria, Belgium, France, Germany, Liechtenstein, Luxembourg, Monaco, Netherlands, Switzerland

Africa

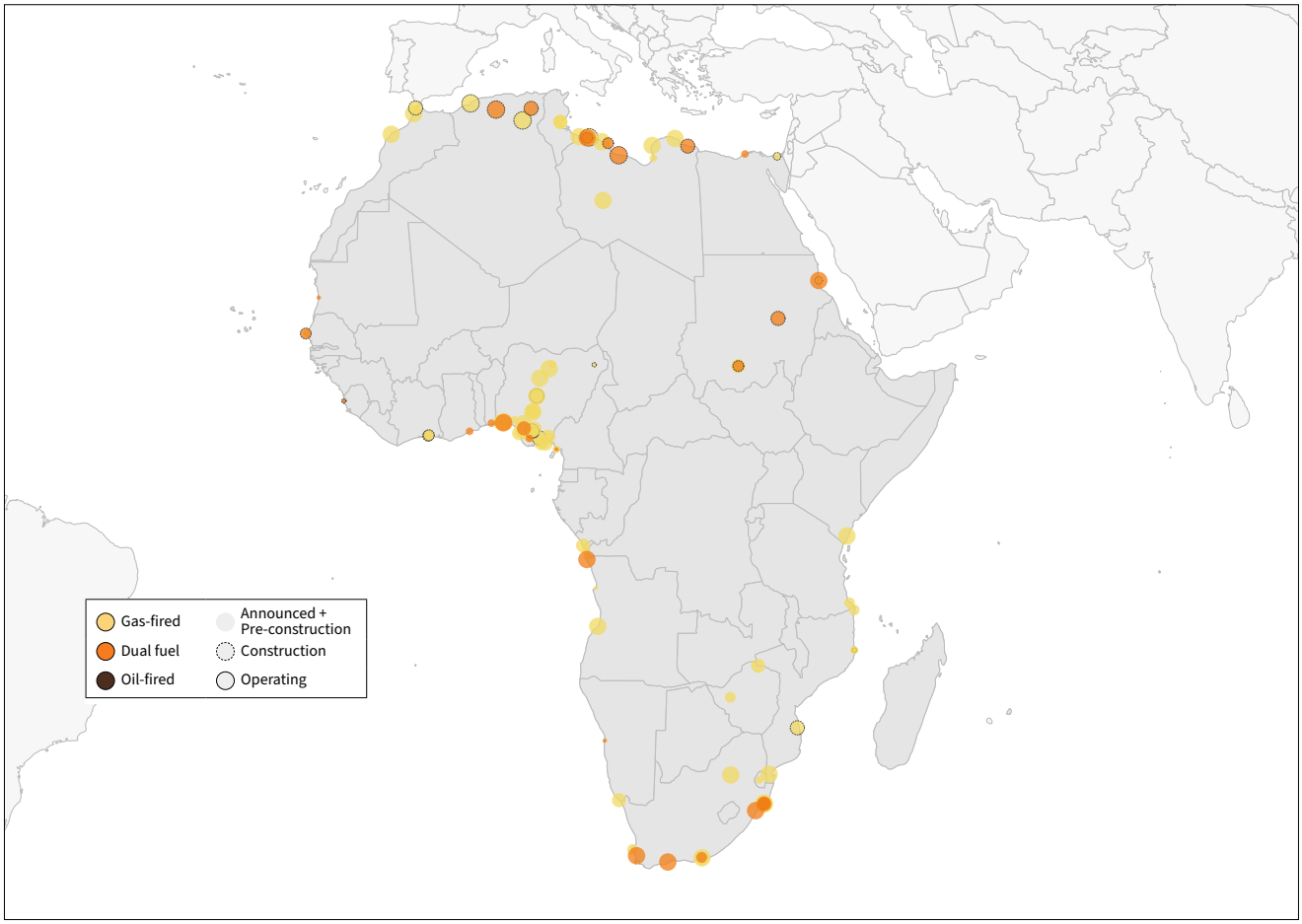
While Africa has comparatively less gas-fired capacity in development, the region is important because there is still time to invest in a renewable energy buildout and avoid the gas dependency pitfalls facing Asia and other regions.

North Africa has 22 GW of oil- and gas-fired capacity in development, of which nearly half is currently under construction. Notably, 96% of the region's nearly 99 GW of operating oil- and gas-fired power plants are concentrated in Egypt, Algeria, Libya, and Tunisia. Sub-Saharan Africa has about 48 GW of oil- and gas-fired capacity in development, primarily concentrated in Nigeria and South Africa, representing a nearly two-and-a-half-fold increase from operating capacity. If developed, Africa's operational oil and gas plant capacity would increase by 60% at a cost of US$54 billion.

North Africa[14]

Although oil- and gas-fired power generation currently dominates its electricity supply, Egypt has only 375 MW of oil and gas power plants in development and plans to increase the share of renewables in the electricity mix to 42% by 2030, partly by replacing inefficient gas plants with renewables.

Figure 11. Oil- and gas-fired power plants in development, Africa.



14. Includes: Algeria, Egypt, Libya, Morocco, Sudan, Tunisia, Western Sahara

Sub-Saharan Africa

Nigeria leads the region with 21 GW of in-development oil- and gas-fired plants, a twofold increase from existing capacity. With 43% of Nigeria's population lacking access to reliable electricity, this planned expansion reflects Nigeria's continued effort to leverage its oil and gas resources to meet growing energy needs.

While coal still dominates the electricity mix in South Africa, gas power makes up less than 1 GW of South Africa's existing power capacity, and the nearly 17 GW of in-development gas-fired capacity are still in the announced or pre-construction phase. The US$8.5 billion Just Energy Transition Partnership (JETP) signed at COP26, coupled with South Africa's minimal existing gas-fired capacity, signifies a great opportunity to leapfrog gas in favor of a coal-to-clean transition.

Oceania[15]

This region's pivot to renewables is a great example of the coal-to-clean transition. The Oceania region accounts for less than 1% of in-development gas- and oil-fired capacity. While Australia remains largely reliant on coal-fired power generation, some proposed gas projects, including Summerfield power station, have recently been shelved or cancelled in favor of battery storage projects instead. The updated 2022–23 GenCost report, released by the Australian government agency CSIRO, shows that renewables, including

Figure 12. Oil- and gas-fired power plants in development, Oceania.

15. Inclues: Australia, New Zealand, New Caledonia

solar PV and wind, continue to be the cheapest new-build power option in Australia despite a 20% increase in technology costs. A recent IEEFA report highlights that since 2014, renewables' share of power generation has had a two-and-a-half-fold increase, while gas-fired generation has halved and is forecasted to drop to 4% of electricity production by 2030. With Australia aiming to increase the share of power generation coming from renewables to 82% by 2030, coupled with the low cost of new-build renewables, it is clear that gas is not a transition fuel.

APPENDIX

Table 1. Estimated Capital Costs for Gas Plants in Development by Region[16]

Region/Subregion	Announced Capital Cost (USD billion)	Pre-Construction Capital Cost (USD billion)	In Construction Capital Cost (USD billion)	Total Regional Capital Cost (USD billion)
Africa	**$24.8**	**$19.0**	**$10.2**	**$54.0**
Northern Africa	$3.8	$5.1	$7.4	$16.4
Sub-Saharan Africa	$21.0	$13.9	$2.8	$37.6
Americas	**$43.2**	**$41.9**	**$27.7**	**$112.8**
Latin America and the Caribbean	$31.4	$28.0	$13.8	$73.2
Northern America	$11.8	$13.9	$13.9	$39.5
Asia	**$145.2**	**$132.0**	**$107.3**	**$384.5**
Central Asia	$3.6	$4.3	$4.2	$12.1
Eastern Asia	$42.2	$52.9	$44.9	$140.0
Southeast Asia	$57.7	$29.9	$10.4	$98.0
Southern Asia	$30.8	$9.3	$19.0	$59.2
Western Asia	$10.9	$35.7	$28.7	$75.2
Europe	**$9.9**	**$37.4**	**$11.1**	**$58.3**
Eastern Europe	$4.9	$11.1	$6.0	$22.0
Northern Europe	$0.4	$10.3	$0.2	$10.9
Southern Europe	$2.0	$7.8	$3.9	$13.6
Western Europe	$2.6	$8.3	$1.0	$11.9
Oceania	**$0.2**	**$0.6**	**$0.8**	**$1.5**
Australia and New Zealand	$0.2	$0.6	$0.8	$1.5
Total	**$223.3**	**$230.8**	**$157.0**	**$611.1**

16. Gas/oil plant costs are estimated using the August 2023 Global Oil and Gas Plant Tracker database. The estimate for OECD member countries is based on CCGT capital costs ($1000/kW) for the U.S. and Europe from IEA World Energy Model inputs. The estimate for non-OECD countries (except China) is based on CCGT capital costs that average India ($700/kW) and EU ($1000/kW) CCGT capital costs from IEA World Energy Model inputs. China uses CCGT capital costs of $560/kW from IEA World Energy Model inputs. CCGT technology is assumed for gas plants with technology type that is not known. OCGT capital costs are estimated to be 74.4% of CCGT costs, based on a comparison of costs for "Combustion Turbine H Class, 1100-MW Combined Cycle" to "Combustion Turbine F Class, 240-MW Simple Cycle," as detailed in the 2020 EIA Report.

Table 2: In-Development Lifetime CO_2 Equivalent Emissions (million tonnes)

Region/Subregion	Announced	Pre-construction	Construction	In Development (Announced + Pre-construction + Construction)
Africa	**1,713**	**1,178**	**631**	**3,522**
Northern Africa	214	278	441	932
Sub-Saharan Africa	1,499	900	191	2,590
Americas	**2,982**	**2,757**	**1,759**	**7,497**
Latin America and the Caribbean	2,300	2,038	1,050	5,389
Northern America	681	718	709	2,108
Asia	**9,490**	**9,197**	**7,717**	**26,404**
Central Asia	186	282	270	738
Eastern Asia	2,968	3,935	3,268	10,171
Southeast Asia	3,552	1,878	615	6,045
Southern Asia	2,055	676	1,623	4,354
Western Asia	729	2,425	1,941	5,095
Europe	**640**	**2,321**	**757**	**3,717**
Eastern Europe	450	768	481	1,699
Northern Europe	29.9	648	10.2	688
Southern Europe	26	386	203	615
Western Europe	134	518	63	715
Oceania	**12**	**37**	**51**	**100**
Australia and New Zealand	12	37	51	100
Melanesia				
Total	**14,836**	**15,488**	**10,915**	**41,239**

Table 3: Oil and Gas Plants by Region (MW), August 2023

Region/Subregion	Announced	Pre-construction	Construction	In Development (Announced + Pre-construction + Construction)	Shelved	Cancelled	Operating	Mothballed	Retired (2020 – H1 2023)
Africa	**32,996**	**23,906**	**13,516**	**70,418**	**10,554**	**10,572**	**118,208**	**1,200**	**1,040**
Northern Africa	4,725	7,263	10,004	21,992	3,000	5,007	98,532	300	1,040
Sub-Saharan Africa	28,271	16,643	3,512	48,426	7,554	5,565	19,676	900	
Americas	**51,126**	**48,432**	**31,104**	**130,664**	**19,975**	**33,973**	**693,850**	**21,357**	**8,410**
Latin America and the Caribbean	36,685	33,183	15,823	85,691	15,128	12,648	133,118	12,432	1,230
Northern America	14,441	15,249	15,281	44,973	4,847	21,325	560,732	8,925	7,180
Asia	**184,911**	**181,227**	**148,292**	**514,431**	**40,182**	**104,186**	**860,798**	**19,488**	**12,326**
Central Asia	4,596	5,110	5,130	14,836	921	857	24,227	120	
Eastern Asia	62,248	85,656	69,835	217,740	15,246	20,884	299,685	8,150	7,688
Southeast Asia	68,347	35,224	12,463	116,034	15,610	64,440	101,807	5,398	2,824
Southern Asia	36,369	11,228	24,504	72,101	4,908	9,100	141,087	2,036	766
Western Asia	13,351	44,009	36,360	93,720	3,497	8,905	293,992	3,784	1,048
Europe	**12,158**	**40,683**	**12,857**	**65,699**	**31,722**	**19,094**	**352,401**	**17,427**	**7,408**
Eastern Europe	6,723	12,238	7,043	26,004	10,466	1,811	136,515	8,315	3,703
Northern Europe	530	11,436	190	12,156	12,800	7,400	51,016	4,210	1,689
Southern Europe	2,345	8,536	4,420	15,301	5,175	6,678	95,266	1,302	1,357
Western Europe	2,560	8,473	1,204	12,238	3,281	3,205	69,604	3,600	659
Oceania	**237**	**750**	**1,037**	**2,024**	**2,840**	**512**	**17,594**	**200**	**480**
Australia and New Zealand	237	750	1,037	2,024	2,840	512	17,539	200	480
Melanesia							55		
Total	**281,428**	**294,998**	**206,806**	**783,236**	**105,273**	**168,337**	**2,042,851**	**59,672**	**29,664**