Gas at a Crossroads

WHY THE EU SHOULD NOT CONTINUE TO EXPAND ITS GAS INFRASTRUCTURE

Mason Inman

ABOUT THE COVER

The Adriatic Rovigo LNG Terminal. Courtesy of Floydrosebridge via Wikipedia (CC BY-SA 3.0).

ABOUT GLOBAL ENERGY MONITOR

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

ABOUT THE EUROPE GAS TRACKER

The Europe Gas Tracker is an online database that identifies, maps, describes, and categorizes gas extraction areas, gas-fired power plants, fossil gas pipelines, and liquified natural gas (LNG) terminals. Developed by Global Energy Monitor, the tracker uses footnoted wiki pages to document each project. For further details see https://globalenergymonitor.org/europe-gas-tracker/.

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PRODUCTION

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FURTHER RESOURCES

To obtain primary data from the Europe Gas Tracker or the Global Fossil Infrastructure Tracker, contact Ted Nace (ted@tednace.com).

CORRECTION

The original version of this report contained errors in the compilation of data for power plants, which led to the power plant capacity shown in Table 1 being doubled, and the costs being increased by ~50% for many countries. This affected the text in the Introduction, Figure 1, Table 1, and the estimate of potential annual spending on page 5. In the original report, the total cost of gas infrastructure under construction or proposed was estimated to be 117 million euros; in the corrected version, the estimate is 99 million euros. The correction does not change the report's overall conclusions.

INTRODUCTION

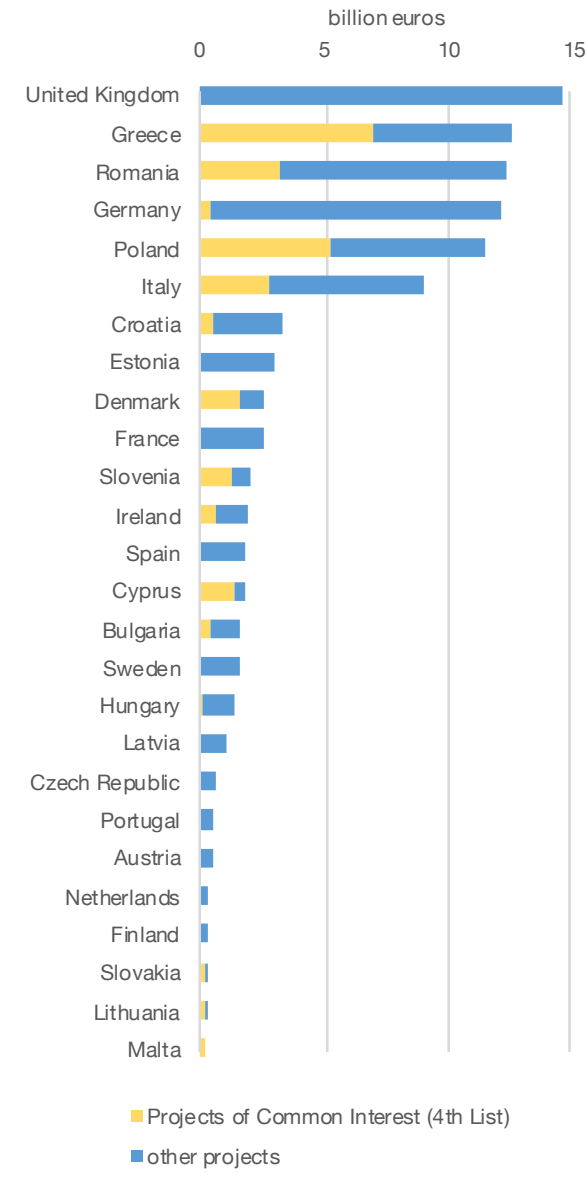
Global Energy Monitor (GEM) has completed the first comprehensive project-level survey of proposed natural gas infrastructure across the European Union (EU)[1], including gas-fired power plants, liquefied natural gas (LNG) import terminals, and gas pipelines.

According to GEM's survey, companies are already building or are proposing to build gas infrastructure that would add 233 billion cubic meters (bcm) per year to the EU's import capacity, with 138 bcm per year from pipelines and 95 bcm per year from LNG import terminals. Of that, 75 bcm per year of pipeline capacity and 9 bcm per year of LNG import capacity are now under construction.

Building all the gas infrastructure currently in pre-construction or construction would add more than 30% to the EU's current gas import capacity of 707 bcm per year. The EU already has large excess gas infrastructure. The EU gas import capacity is nearly twice as high as EU gas consumption (see page 9). EU gas-fired power plants also generate only about one-third the electricity that they could (see page 15).

GEM's survey finds that €99 billion in new EU gas projects is in development, including €52 billion for gas pipelines, €12 billion for LNG import terminals, and €35 billion for gas-fired power stations. Table 1 and Figure 1 provide a breakdown of the developmental pipeline by country.

Figure 1. Cost of future EU gas infrastructure, by country



Source: Global Energy Monitor, Europe Gas Tracker, February 2020

1. Although the United Kingdom left the EU on January 31, 2020, all recent analyses referred to here cover the 28 EU member countries in 2019, so for the purposes of this analysis, we have retained the United Kingdom with the EU.

Table 1. Future gas infrastructure proposed or under construction in EU countries
(Includes projects on the 4th list of Projects of Common Interest)

	Pipeline Length (km)	Pipeline Cost (million euros)	LNG Import Capacity (bcm/y)	LNG Terminal Cost (million euros)	Gas Plant Elec. Capacity (MW)	Gas Power Plant Cost (million euros)	Total Cost (million euros)
Austria	118	503					503
Bulgaria	570	1,559					1,559
Croatia	381	1,628	7.9	1,023	750	675	3,326
Cyprus	632	1,624	2.4	209			1,833
Czech Republic	161	688					688
Denmark	499	2,552					2,552
Estonia	342	2,598	2.4	370			2,968
Finland	24	183	0.1	95			279
France			10.6	1,923	696	626	2,550
Germany	743	4,472	23.4	1,882	6,446	5,733	12,087
Greece	2,482	8,948	6.1	370	3,451	3,106	12,424
Hungary	174	555			920	828	1,383
Ireland	25	106	12.2	1,820	100	45	1,971
Italy	897	3,655	0.4	74	5,830	5,247	8.976
Latvia	124	939	1.5	128			1,067
Lithuania	130	258					258
Malta	69	176					176
Netherlands			2.0	361			361
Poland	1,587	6,646	6.9	827	4,429	3,949	11,422
Portugal	131	559					559
Romania	2,687	9,529	8.2	1,480	1,400	1,229	12,237
Slovakia	124	272					272
Slovenia	445	1,901			155	115	2,015
Spain	294	1,258	3.0	579			1,837
Sweden	205	1,557	0.5	105			1,662
United Kingdom			8.2	697	16,473	13,848	14,544
EU total	**12,842**	**52,167**	**95.9**	**11,942**	**40,650**	**35,401**	**99,509**

Units: km: kilometers; bcm/y: billion cubic meters per year; MW: megawatts

Source: Global Energy Monitor, Europe Gas Tracker, February 2020

If all this infrastructure were built, the spending would average €10 billion euros per year over the 2020s.

Among the projects under development are €24 billion for EU pipelines and €1.7 billion for EU LNG terminals that are on the European Commission's fourth list of Projects of Common Interest (PCI), adopted in October 2019. The projects on the 4th PCI List are detailed in Table 2. In February 2020, the European Parliament will vote on whether to accept the PCI list drawn up by the European Commission. If the PCI list is accepted, these projects will be eligible to receive grants from public EU funds. Approval as Projects of Common Interest also enables the projects to receive loans from the European Investment Bank (EIB), even after its recently announced withdrawal from almost all fossil-fuel lending by the end of 2021 (EIB 2019a).

Companies' plans to expand the EU's gas infrastructure stand in striking contrast to EU requirements to cut greenhouse emissions to at least 40% below 1990 levels by 2030, as well as the goal—backed by the EU Parliament and the European Commission, with the support of all Member States except Poland—to achieve net-zero emissions by 2050. Once built, gas infrastructure can be expected to last for decades. Historically, power plants usually last at least 30 years, pipelines 40 years, and LNG import terminals more than 40 years.

Widely used scenarios, including from the European Commission, show agreement that cutting EU emissions to net-zero by 2050 will require sharply reducing the consumption of fossil gas. Given the need to transition away from the current system, directing major capital expenditures into that system creates the twin problems of lock-in (entrenching the current system further) and stranded assets (infrastructure that becomes obsolete well before mid-century, as a system based on cleaner and cheaper renewables supplants it).

Andrew McDowell, the EIB's vice-president for energy, pointed to the financial and policy problems inherent in building new infrastructure with long lifespans: "From both a policy and from a banking perspec-tive, it makes no sense for us to continue to invest in 20-25–year assets that are going to be taken over by new technologies and do not deliver on the EU's very ambitious climate and energy targets."

The objections expressed by McDowell are reflected in the EIB's decision in November 2019 to end nearly all funding of fossil fuel projects, including gas infrastructure. The announcement by the EIB follows similar announcements by more than 100 globally significant banks and investors divesting from the coal sector, and shows that campaigns to divest from all categories of fossil fuel spending are gaining momentum. As noted by Larry Fink, CEO of BlackRock, in his annual 2019 CEO letter, "Last September, when millions of people took to the streets to demand action on climate change, many of them emphasized the significant and lasting impact that it will have on economic growth and prosperity—a risk that markets to date have been slower to reflect. But awareness is rapidly changing, and I believe we are on the edge of a fundamental reshaping of finance."

In short, both for the goal of facilitating a rapid transition to a climate-friendly energy system and for the goal of avoiding risky investments, a major new expansion of fossil gas infrastructure in Europe should not be undertaken.

Table 2. Future gas infrastructure on the 4th list of Projects of Common Interest

	Pipeline Length (km)	Pipeline Cost (million euros)	LNG Import Capacity (bcm/y)	LNG Terminal Cost (million euros)	Total Cost (million euros)
Austria	5	23			23
Bulgaria	187	381			381
Croatia	59	251	3.5	234	485
Cyprus	439	1,172	2.4	209	1,381
Denmark	373	1,594			1,594
Germany	93	399			399
Greece	1,923	6,556	6.1	370	6,926
Hungary	38	163			163
Ireland	25	106	2.7	493	600
Italy	695	2,791			2,791
Lithuania	118	168			168
Malta	69	176			176
Poland	1,300	4,800	4.5	383	5,183
Romania	754	3,225			3,225
Slovakia	83	186			186
Slovenia	292	1,246			1,246
EU total	**6,453**	**23,238**	**19**	**1,689**	**24,927**
Albania	200	1,031			1,031
Armenia	27	11			11
Azerbaijan	589	240			240
Belarus	35	50			50
Georgia	179	73			73
Israel	176	470			470
Serbia	1	5			5
Turkey	218	89			89
Turkmenistan	757	308			308
Non-EU total	**2,184**	**2,277**			**2,277**

The 4th PCI List includes two pipelines that partially or fully are outside the EU. The Trans-Caspian gas pipeline, proposed to be built from Turkmenistan to Turkey, is deemed to support EU gas supplies. The East Med Gas Pipeline would connect the EU to Israel.

Source: Global Energy Monitor, Europe Gas Tracker, February 2020

HISTORICAL NATURAL GAS CONSUMPTION IN THE EUROPEAN UNION

Burning fossil gas was responsible for about one-quarter of EU greenhouse gas emissions in 2017 (IEA 2020). In recent years, fossil gas use has increased while coal use has decreased, so in 2018 fossil gas likely surpassed coal to become the EU's second-largest source of greenhouse gas emissions, after oil (Eurostat 2020) (Figure 2).

Emissions from all these fossil fuels—coal, fossil gas, and oil—have to be reduced to near-zero for the EU to achieve net-zero emissions by 2050 (European Commission 2018). That means most uses of these fossil fuels will have to be avoided through higher efficiency or replaced by clean energy. When fossil fuels are used, their greenhouse gas emissions will have to be avoided using carbon capture and storage (CCS).

In the EU, fossil gas is burned primarily for heat in buildings (both residential and commercial), accounting for 37% of use in 2017 (IEA 2020). Burning fossil gas in power plants, many of which also generate heat used in buildings or industrial processes, accounts for another 31% of fossil gas use. Industry accounts for another 21% of use (Figure 3).

Figure 2. EU greenhouse gas emissions 1990–2017

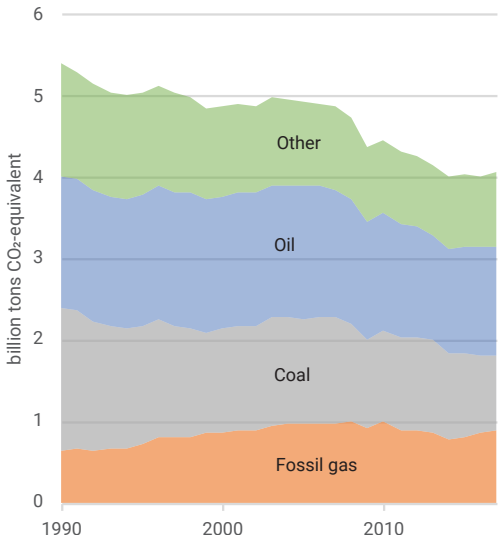
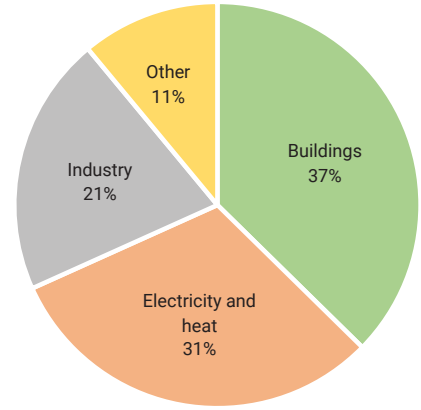


Figure 3. EU uses of fossil gas in 2017



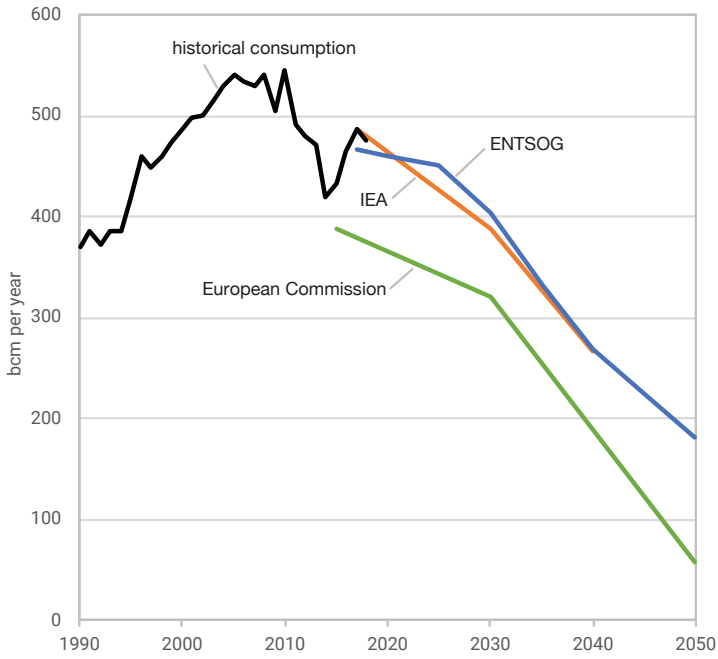
THE FUTURE OF GAS CONSUMPTION IN THE EUROPEAN UNION

To achieve net-zero greenhouse gas emissions by 2050, the EU will need to significantly cut its consumption of fossil gas—that is, gas extracted from the ground. By mid-century, any remaining use of fossil gas will have to be accompanied by carbon capture and storage (CCS), to prevent most of the carbon dioxide (CO_2) emissions from entering the atmosphere.

All credible scenarios for sharp emissions cuts in the EU agree on this general outlook, as shown in Figure 4. This includes European Commission scenarios for achieving net-zero emissions by 2050 (European Commission 2018), the International Energy Agency's Sustainable Development Scenario (IEA 2019), and the industry group European Network of Transmission System Operators for Gas, in its Ten Year Network Development Plan (TYNDP) 2020 (ENTSOG and ENTSOE, 2019). It is clear that achieving carbon neutrality will involve a sharp reduction in the use of fossil gas.

The EIB's Andrew McDowell made the case for ending financing of gas projects in an October 2019 speech to the bank's board of directors: "According to the European Commission's long term modelling, while gas does indeed play a role in the energy transition, the consumption of natural gas (excluding non-energy use) is expected to be severely reduced by 2050. . . . Investment needs for gas networks in the period till 2040 are projected to fall to just 2% of the total EU energy investment needs" (EIB, 2019b).

Figure 4. Scenarios for EU fossil gas consumption



The European Commission line is the average of two scenarios for achieving net-zero emissions, called 1.5TECH and 1.5LIFE (European Commission, 2018). The ENTSOG line is the average of the two low-emissions scenarios in the Ten Year Network Development Plan 2020, called Global Ambition and Distributed Energy (ENTSOG and ENTSO-E, 2019).

EUROPEAN UNION GAS IMPORTS

Extraction of fossil gas within the EU has been declining, and gas imports have been rising. Nonetheless, with EU gas consumption expected to decrease significantly in all major scenarios for sharply cutting emissions, EU gas imports are expected to also decrease significantly by 2050 (Figure 5). Some scenarios, such as those by ENTSOG (ENTSOG and ENTSO-E, 2019), expect a modest increase in natural gas imports through the mid-2020s followed by a decrease. The IEA's Sustainable Development Scenario (IEA, 2019) and the European Commission's scenarios for achieving net-zero emissions also expect EU gas imports to decline in the future—especially sharply after 2030.

Even though EU gas imports have spiked in the past few years, the levels are still well below the existing capacity of pipelines and LNG terminals to import gas into the EU. In 2019, EU countries had the capacity to import 707 billion cubic meters (bcm) of gas per year, with 503 bcm per year (~70%) from pipelines (ENTSOG, 2019a), and 204 bcm per year (~30%) from LNG import terminals, according to Global Energy Monitor's gas infrastructure survey. The utilization rate in 2018 was ~60%, with ~40% spare capacity. Therefore, the EU already has the capacity to import much more gas than it consumes today.

Despite these scenarios calling for a transition away from natural gas, there are many gas pipelines and LNG terminals proposed or under construction that would increase the EU's import capacity (see Tables 3 through 6). Gas infrastructure that is under construction would add 84 bcm per year of import capacity (75 bcm per year from pipelines and 9 bcm per year from LNG terminals). There are also proposals to build another 150 bcm per year of import capacity (63 bcm per year from pipelines and 87 bcm per year from LNG terminals).

Figure 5. EU natural gas imports and import capacity

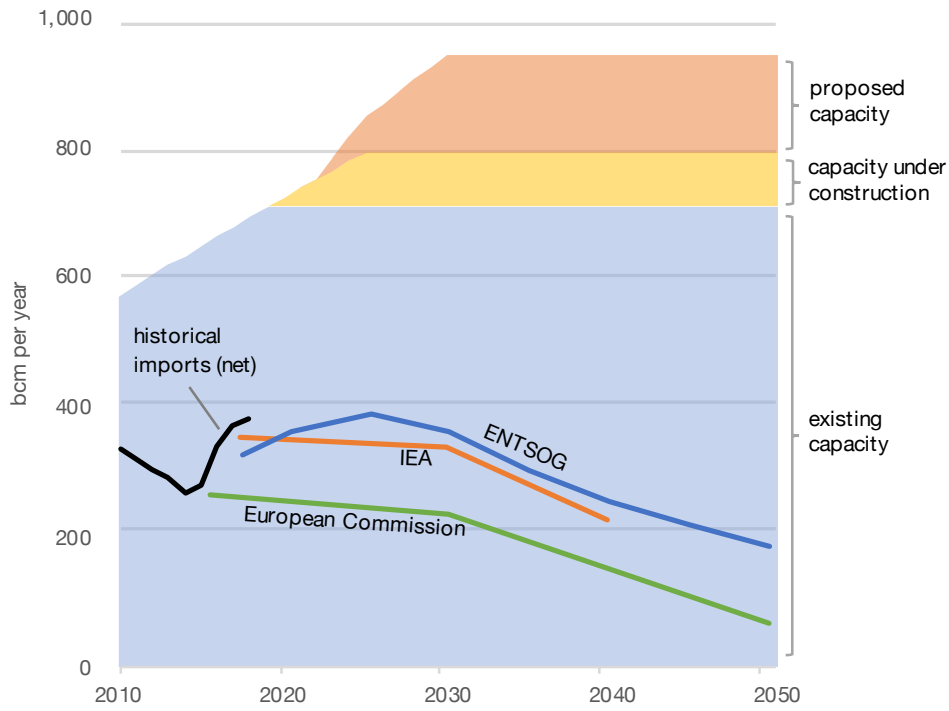


Figure 5 assumptions: linear implementation of projects currently under construction between 2020 and 2025, linear implementation of projects currently in pre-construction development between 2023 and 2030, no retirement of currently operating infrastructure, and no further projects entering development.

Sources: Historical pipeline capacity from ENTSOG 2010, ENTSOG 2019. Future pipeline capacity, and LNG capacity (both historical and future), from Global Energy Monitor, Europe Gas Tracker, February 2020.

Of this future capacity, pipelines on the 4th PCI List would add 45 bcm per year of import capacity into the EU, with 15 bcm per year of that pipeline capacity now under construction. LNG terminals on the 4th PCI list would add 18 bcm per year of capacity, with 2.6 bcm per year of that LNG capacity now under construction.

The expansion of the EU's gas infrastructure by the projects on the 4th PCI List isn't needed for EU gas security through 2030, according to a recent study by the consultancy Artelys (Artelys, 2020), even in the event of year-long disruptions in gas imports from Ukraine, Belarus, or Algeria. "Existing EU gas infrastructure is sufficiently capable of meeting a variety of future gas demand scenarios in the EU28, even in the event of extreme supply disruption cases," the study concluded. "This suggests that most of the 32 gas infrastructure projects on the 4th PCI list are unnecessary from a security of supply point of view, and represent a potential overinvestment of tens of billions of euros, supported by European public funds." The study also concluded that there have been improvements to the gas network in the past several years that have already alleviated potentials for shortages in certain areas, such as Southeastern Europe.

Alternatives to fossil gas—such as biomethane, synthetic methane, and hydrogen—are expected to be produced mainly within EU countries, rather than being imported from outside the EU (OIES 2019). These alternatives to fossil gas would use little or none of the pipeline and LNG import infrastructure for bringing fossil gas into the EU. (See the next section for more on these other gaseous fuels.)

If the EU sharply decreases its fossil gas consumption—as is envisioned by all credible scenarios for achieving net-zero emissions—then much of the additional capacity to import gas into the EU will not be needed, and many of the pipelines and LNG terminals now under development will become stranded assets.

Table 3. Pipelines on the 4th List of Projects of Common Interest
(pipelines to directly import gas from outside EU are marked with *)

Pipeline Name	Capacity (bcm/y)	Country	Length (km)	Cost (million euros)
Under Construction				
BRUA Gas Pipeline	4.4	Romania	754	3,225
Gas Interconnection Poland-Lithuania (GIPL)	2.4	Belarus	35	50
		Lithuania	118	168
		Poland	239	339
Poland–Slovakia Gas Pipeline	5.7	Poland	37	84
		Slovakia	83	186
Trans-Adriatic Gas Pipeline*	15	Albania	200	1,031
		Greece	505	2,603
		Italy	81	415
Proposed				
Adriatica Pipeline	8.8	Italy	419	1,792
Baltic Pipe Project*	10	Denmark	373	1,594
		Germany	93	399
		Poland	89	382
Bulgaria Serbia Interconnection	1.8	Bulgaria	57	245
Croatia Slovenia Austria Interconnection	5	Croatia	56	241
		Slovenia	56	239
East Med Gas Pipeline*	20	Cyprus	439	1,172
		Greece	1,277	3,408
		Israel	176	470
		Italy	64	170
Gas Interconnector Greece–Bulgaria (IGB)	5	Bulgaria	130	136
		Greece	16	17
Gustorzyn Wronów Pipeline	n/a	Poland	259	1,107
Hermanowice Jaroslaw Pipeline	n/a	Poland	34	146
Hermanowice Strachocina Pipeline	n/a	Poland	54	233
Hungary Slovenia Italy Interconnection	1.2	Hungary	38	163
		Slovenia	236	1,007
Jaroslaw Rozwadów Pipeline	n/a	Poland	78	333
Malta–Italy Gas Pipeline	2.0	Italy	86	220
		Malta	69	176
Pogórska Wola Tworzen Pipeline	n/a	Poland	140	600
Poseidon Gas Pipeline	20	Greece	123	527
		Italy	44	189
Rembelszczyzna Wronów Pipeline	n/a	Poland	125	536
Rozwadów Końskowola Wronów Pipeline	n/a	Poland	119	508
Shannon Gas Pipeline	87.9	Ireland	25	106
Strachocina Pogórska Wola Pipeline	n/a	Poland	80	344
Trans-Caspian Gas Pipeline	16	Armenia	27	11
		Azerbaijan	589	240
		Georgia	179	73
		Turkey	218	89
		Turkmenistan	757	308
Tworóg Tworzen Pipeline	n/a	Poland	44	188

Source: Global Energy Monitor, Europe Gas Tracker, February 2020

Table 4. Other future EU gas pipelines
(only portions in EU countries listed; pipelines to directly import gas from outside EU marked with *)

Pipeline Name	Capacity (bcm/y)	Country	Length (km)	Cost (million euros)
Under construction				
Bidirectional Austrian-Czech Interconnector (BACI)	n/a	Austria	112	480
European Gas (EUGAL) Pipeline	51	Germany	389	2,649
Larino-Chieti Gas Pipeline	n/a	Italy	108	464
Nord Stream 2 Gas Pipeline*	55	Denmark	126	958
		Estonia	342	2,598
		Finland	24	183
		Germany	94	711
		Latvia	124	939
		Lithuania	12	90
		Poland	187	1,419
		Sweden	205	1,557
Poland Ukraine Interconnector Pipeline*	4.5	Poland	56	240
San Marco-Recanati Pipeline	n/a	Italy	24	103
Zeelink Gas Pipeline	n/a	Germany	167	713
Proposed				
Anamur to North Cyprus Gas Pipeline	n/a	Cyprus	43	184
Beglej-Dermantsi-Batultsi-Kalugerovo Pipeline	n/a	Bulgaria	57	243
Black Sea shore–Podișor Pipeline	n/a	Bulgaria	93	399
		Romania	311	1,329
Celorico-Spanish border Pipeline	n/a	Portugal	130	554
Cyprus-Egypt gas pipeline	n/a	Cyprus	23	96
Czech-Polish Gas Interconnector (CPI)	n/a	Czech Republic	40	171
		Poland	44	187
Eastring Pipeline	20	Bulgaria	212	446
		Hungary	86	182
		Romania	902	1,897
		Slovakia	41	85
Hrvatska Gas Pipeline	8	Croatia	30	127
Interconnection ES-PT Gas Pipeline	n/a	Spain	72	306
Ionian Adriatic Gas Pipeline (IAP)	5	Croatia	198	845
Israel Cyprus Gas Pipeline*	1	Cyprus	127	173
Kateřinský Potok Junction Point–Přimda Junction Point Pipeline	n/a	Czech Republic	117	500
Komotini–Thesprotia Gas Pipeline	n/a	Greece	473	2,024
Lugo-Zamora Gas Pipeline	n/a	Spain	223	952
Matagiola-Massafra Gas Pipeline	n/a	Italy	70	297
Nea-Messimvria to Eidomene/Gevgelija pipeline	n/a	Greece	43	184
North Macedonia-Greece Interconnector	n/a	Greece	43	184
North-Vest Romania Pipeline	n/a	Romania	420	1,794
Pince–Lendava–Kidričevo Gas Pipeline	n/a	Slovenia	57	242
Romania–Serbia Interconnection Gas Pipeline	n/a	Romania	75	319
Slovakia Hungary Interconnection	n/a	Hungary	48	206
South Interconnection BH-Croatia Gas Pipeline	n/a	Croatia	82	349
Umag–Plovanija–Koper Pipeline	n/a	Slovenia	13	54
Valchi Dol–Preselka	n/a	Bulgaria	21	91
White Stream Gas Pipeline*	32	Romania	226	965
Šempeter–Vodice Pipeline	n/a	Slovenia	84	359

Source: Global Energy Monitor, Europe Gas Tracker, February 2020

Table 5. Planned EU LNG import terminals on the 4th PCI List

Country	Name	Capacity (bcm/y)	Cost (million euros)
Under Construction			
Croatia	Hrvatska LNG Terminal	3.5	234
Proposed			
Cyprus	Cyprus LNG Terminal (Import)	2.4	209
Greece	Alexandroupolis LNG Terminal	6.1	370
Ireland	Shannon LNG Terminal	2.7	493
Poland	Polish Baltic Sea Coast Terminal	4.5	383

Source: Global Energy Monitor, Europe Gas Tracker, February 2020

Table 6. Other planned EU LNG import terminals

Country	Name	Capacity (bcm/y)	Cost (million euros)
Under construction			
Finland	Hamina LNG Terminal	0.1	95
Italy	HIGAS LNG Terminal	0.4	74
Poland	Świnoujście Polskie LNG Terminal Expansion	2.4	444
Spain	Gran Canaria LNG Terminal	1.4	272
	Tenerife LNG Terminal	1.4	272
Proposed			
Croatia	Hrvatska LNG Terminal Phase 2	4.4	789
Estonia	Paldiski LNG Terminal	2.4	370
Finland	Rauma LNG Terminal	n/a	n/a
France	Fos Cavaou LNG Terminal Expansion 1	2.7	493
	Fos Cavaou LNG Terminal Expansion 2	5.4	986
	Montoir LNG Terminal Expansion	2.4	444
Germany	Hamburg LNG Terminal	8.0	450
	Rostock LNG Terminal	0.4	74
	Stade LNG Terminal	5.0	510
	Wilhelmshaven LNG Terminal	9.9	848
Ireland	Cork LNG Terminal	4.0	340
	Shannon LNG Terminal Expansion	5.4	986
Latvia	Skulte LNG Terminal	1.5	128
Netherlands	Gate LNG Terminal Expansion	2.0	361
Romania	Constanta LNG Terminal	8.2	1,480
Spain	Reganosa Ferrol LNG Terminal Expansion 3	0.3	36
United Kingdom	Port Meridian FLNG Terminal	8.2	697

Source: Global Energy Monitor, Europe Gas Tracker, February 2020

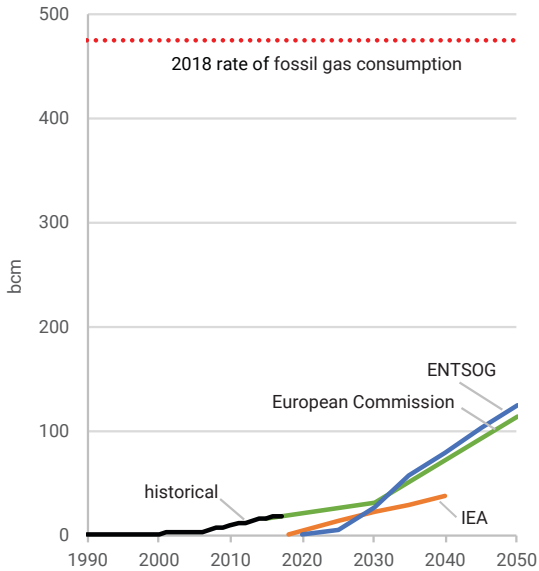
ALTERNATIVES TO FOSSIL GAS

Although net-zero scenarios from the European Commission and ENTSOG agree that fossil gas use has to be largely phased out, these scenarios have different expectations for the potential of other sources of methane (the main component of fossil gas). Other sources of methane could be scaled up to some degree, but each faces limits and/or cost issues.

Biogas and biomethane: Biogas can be created from crops, manure, and waste materials. Biogas typically has a large fraction of carbon dioxide (CO_2) mixed in, which can be separated out to create biomethane. Biogas accounted for 4% of EU gas consumption in 2017 (Eurostat 2020). According to analysis by the IEA, biogas has limited additional potential in the EU and is relatively expensive, with "only modest scope for costs to fall because the technology is generally mature" (IEA 2019).

Synthetic methane (also known as "e-gas" or "power-to-methane"): Methane can also be synthesized using electricity. If done in a specific way—using clean electricity, such as from wind turbines, and using CO_2 captured from fossil fuels or from the air—and used in an ideal way, then using e-gas would not add any greenhouse gas emissions. However, in practice some of the methane would inevitably leak from pipelines during transportation—and methane is a powerful greenhouse gas. Also, this power-to-methane process would be expensive; it involves significant losses in converting energy from electricity into synthesized methane, and capturing CO_2 to use in the process also consumes significant energy. Projections from the European Commission see some potential for e-gas, but it is limited, even in an aggressive climate policy scenario (European Commission 2018).

Figure 6. Scenarios for non-fossil sources of methane



Due to these limitations, no credible scenario foresees other sources of methane serving as a complete replacement for current fossil gas. The European Commission (2018) scenarios for reaching net-zero emissions involve consumption of biogas and synthetic methane totaling about 126 bcm per year in 2050 (Figure 6), only about one-quarter the rate of EU fossil gas consumption in 2018. Scenarios from the IEA (2019) and ENTSOG (2019) foresee lower rates of use of alternative methane.

Renewable electricity can be used to create clean hydrogen, which could replace some uses of fossil gas. ENTSOG expects that hydrogen would scale up by 2050 to supply the energy equivalent of about one-fifth of current fossil gas use (ENTSOG and ENTSO-E 2019). However, existing gas transmission pipelines can only handle a small percentage of hydrogen or they risk corrosion and other damage; widespread use of hydrogen would require either new transmission pipelines or extensive upgrades to existing pipelines (IEA 2019). Hydrogen could instead be produced locally, in which case it wouldn't require long-distance transmission pipelines (IEA 2019).

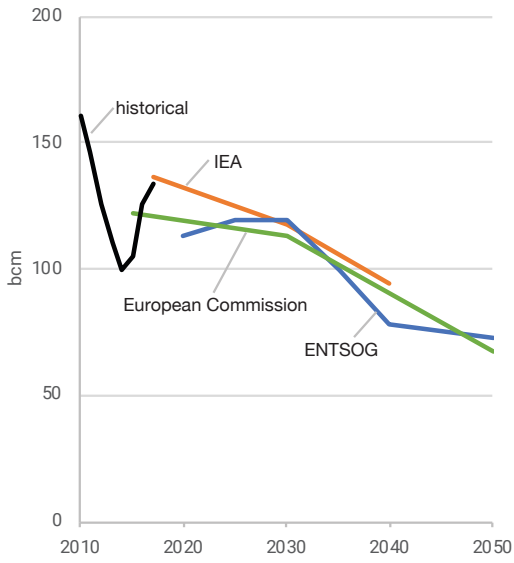
EU ELECTRICITY FROM GAS

To achieve net-zero emissions, the EU's power sector must decrease its emissions to near zero. This will require retiring all coal-fired power plants, but simply switching to gas-fired power plants would not be enough to cut emissions. The power sector's use of all forms of gas—fossil gas as well as biomethane and synthetic methane—will need to be reduced, according to scenarios for approaching or achieving net-zero emissions (Figure 7).

According to GEM's gas infrastructure survey, 84 new gas-fired electricity generating units are under development in the EU, at 67 power plant locations. Units now under construction would add 3 GW of generating capacity, and projects in pre-construction development would add another 38 GW of generating capacity, compared with 183 GW currently installed. Completion of all the gas power plants in pre-construction development and under construction would increase the EU's generating capacity by 22%.

Many of the power plants under development are large combined-cycle power generating units, with capacities of 400 MW or higher (Table 7). Such large gas units are suitable for baseload power, but not ideal for the variable operation needed to serve as a complement to fluctuating renewables. For that reason, these large gas power plants could contribute to lock-in of fossil gas consumption in the EU, rather than contributing to the EU's transition to a net-zero emissions economy.

Figure 7. Total gas consumption for electricity generation (fossil gas, biomethane, and synthesized methane)



Source: European Commission 2020.

Non-fossil methane—biomethane or synthetic methane from clean sources—could be burned in gas power plants to generate low-emissions electricity. However, scenarios in which the EU sharply cuts emissions foresee that non-fossil methane will be relatively expensive, and will be used predominantly for other sectors, such as industry, transportation, and buildings (European Commission 2018, IEA 2019).

Global comparisons show that gas-fired power capacity is currently overbuilt in the EU, compared to other regions. According to the International Energy Agency, the average systemwide load factor for gas in the EU was 34.9% in 2018, compared to 51.1% in Japan, 37.5% for North America, and 40.0% for the world as a whole. Under its Stated Policies scenario, the IEA projects that EU gas-fired power generation will decline by 17%, relative to 2018, by 2040. Under the IEA's Sustainable Development scenario, EU gas-fired power generation will fall much farther: by 36% in 2040, relative to 2018. Under either scenario, the implementation of plans to expand the EU's gas-fired power fleet will cause load factors that are already low by world standards to decline even further (IEA 2019).

Recently published analysis of the relative economics of gas versus renewable power packages that include storage suggests that nearly all proposed combined-cycle generation in the EU is already uncompetitive, and that the gap will only widen as renewable costs continue to decline. For example, in the U.S. a recent project-by-project analysis by RMI concluded that clean energy portfolios (CEPs)—optimized combinations of demand-side management and wind, solar, and storage technologies—were lower in cost than 90 percent of proposed gas-fired power units at

Table 7. Large gas-fired power plants under development in the EU (generating capacities of 400 MW or higher)

Country	Plant name	Capacity (MW)	Cost (million euros)
Under construction			
Poland	Stalowa Wola power station	450	405
	Zeran power station	490	441
Romania	Iernut power station	430	387
United Kingdom	Keadby power station	840	756
Proposed			
France	Landivisiau power station	446	401
Germany	EDF Premnitz power station	400	360
	Gundelfingen Reserve power station	600	540
	Herne-6 power station	400	360
	Krefeld-Uerdingen power station	1,200	1,080
	Leipheim power station	680	612
	Leverkusen Currenta power station	570	513
	Scholven power station	700	630
Greece	Agios Nikolaos Power Station	650	585
	Alexandroupolis Industrial Area	650	585
	Energiaki Thessaloniki complex	826	743
	Gek-Terna Komotini power station	660	594
	Karatzis Larissa power station	665	599
Hungary	Szeged Energy power station	920	828
Italy	Andrea Palladio power station	840	756
	Brindisi Sud power station	1,680	1,512
	Marghera Levante power station	780	702
	Presenzano Edison power station	850	765
	Torrevaldaliga Nord power station	1,680	1,512
Poland	Dolna Odra power station	1,434	1,291
	Grudziadz power station	750	675
	Lagisza power station	413	372
	Rybnik power station	700	630
Romania	Bucharest Progresu power station	400	360
	Romgaz Mintia power station	500	450
United Kingdom	Belfast Harbour Estate power station	480	432
	Drax power station	3,600	3,240
	Eggborough power station	2,190	1,971
	Ferrybridge power station	2,200	1,980
	Hillhouse Enterprise Zone Power Station	900	810
	King's Lynn-B power station	1,700	1,530
	Tees Combined-Cycle Power Plant	1,700	1,530

Source: Global Energy Monitor, Europe Gas Tracker, February 2020

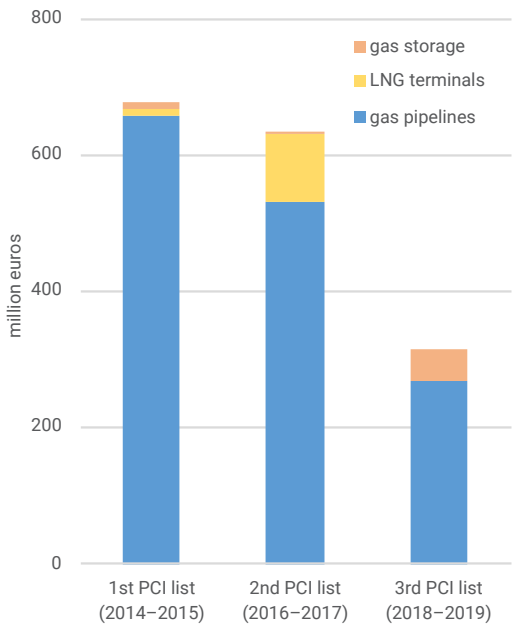
the proposed plant's in-service date. For the 68 GW proposed to be built in the US as of late 2019, the RMI study found the savings from implementing the CEPs rather than the gas plants to be US$29 billion (RMI 2019). With gas costs significantly higher in the EU than the US, it is likely that replacing the EU's proposed gas plants with CEPs would produce comparable if not greater savings.

BACKGROUND ON PROJECTS OF COMMON INTEREST

If the European Parliament and the European Council approve the 4th List of Projects of Common Interest (PCI) that the European Commission adopted in October 2019, the projects on the list will become eligible to receive grants through the EU's Connecting Europe Facility (CEF). Since 2014, CEF has provided an average of 270 million euros per year for gas projects, mainly pipelines (European Commission, 2020). CEF funding for gas projects has decreased in recent years, but still constitutes hundreds of millions of euros in public funding in support of fossil fuels (Figure 8).

The EIB announced in October 2019 that it will end funding for all fossil fuel projects by the end of 2021—but with two important exceptions: if the projects use carbon capture and storage (CCS), or if they are on the 4th PCI List (EIB 2019a). In those cases, projects will still be eligible for preferential loans from EIB, which can help make many projects viable that otherwise would not be.

Figure 8. EU grants from public funds for gas infrastructure included as Projects of Common Interest



METHODOLOGY

The Europe Gas 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 GEM.wiki. Each wiki page functions as a footnoted fact sheet for a particular piece of infrastructure, containing project parameters, background, and mapping coordinates. Each worksheet row tracks an individual 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 project 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 Europe Gas Tracker can be accessed at https://globalenergymonitor.org/europe-gas-tracker/

Further methodology notes can be found at https://www.gem.wiki/Europe_Gas_Report_Methodology_Notes

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