An uncertain future

Expanding B.C.'s nascent LNG industry would require big trade-offs for the province's economy, electricity system, and climate goals

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An Uncertain Future

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Prepared by: Dr. Stefan Pauer & Jana Elbrecht

Clean Energy Canada is a program at the Morris J. Wosk Centre for Dialogue at Simon Fraser University in Vancouver, British Columbia, located on the unceded traditional territories of the Musqueam, Squamish, and Tsleil-Waututh peoples.

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Executive summary

For the last 15 years, proponents have touted B.C. liquefied natural gas (LNG) as a cleaner substitute for coal in Asian power plants that would lower global emissions while growing B.C.'s economy. The LNG industry points to the province's abundant natural gas reserves, proximity to Asian markets, and the ability to produce LNG with fewer carbon emissions than its competitors as reasons why B.C.'s LNG industry is positioned for takeoff.

But the world is a very different place in 2024 than it was in 2009, and cracks are showing in this rosy picture. While the province's LNG industry is set to begin exports next year, bringing jobs and opportunities to some B.C. communities, **the reality is that in the coming years the world may no longer need B.C.'s LNG. And betting the province's economy on the fossil fuel may instead deliver rising gas and electricity prices for families while worsening climate change by locking out cleaner, cheaper energy sources.**

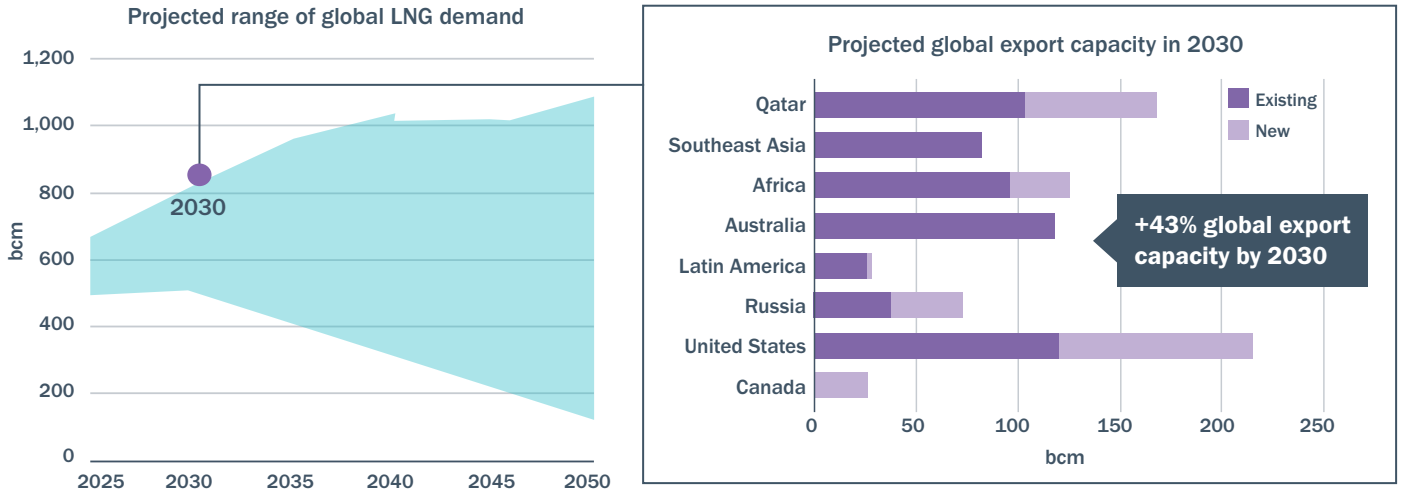
As it stands, B.C.'s nascent LNG industry comprises six projects at various stages of development, with two under construction and currently slated to begin operation in 2025 and 2027. This report explores the risks of further LNG development to the province's economy, B.C. ratepayers and taxpayers, and efforts to reduce global emissions.

More supply than demand

For starters, future demand for LNG is highly uncertain. The International Energy Agency (IEA) holds that there is no need for investment in new fossil fuel supply in a world that reaches net zero by 2050.[1] LNG-specific forecasts vary wildly. Importantly, energy trends and policy developments in some of the key export markets for B.C.'s LNG suggest a future decline in demand. Japan's LNG imports, for example, have steadily declined over the last decade and fallen to the lowest level in 14 years as the country restarts nuclear power plants and builds out renewables.[2] Put simply, there is far from a guaranteed market for B.C.'s LNG, and governments should think carefully before providing financial incentives, loan guarantees, taking equity positions, or funding electricity grid upgrades for these projects.

What's more, B.C. has plenty of competition in the market. Global LNG export capacity is anticipated to increase by 43% from today by the end of the decade, just as B.C.'s export projects are planned to come online.[3] Oversupply may be even more pronounced in likely export markets for B.C.'s LNG, with **key competitors—many of which are able to supply much lower-cost LNG—projected to add around 50% more export capacity by 2030 compared to today.**

There is a big range in projections of global LNG demand out to 2050



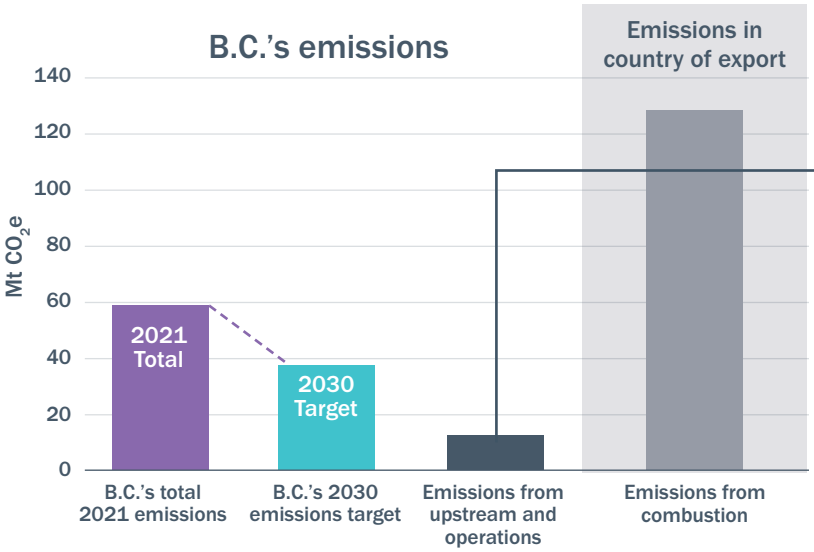
Sources: Based on a range of forecasts (see figure 1 for details), IEA (export capacity)

LNG undermines B.C.'s climate ambitions

LNG is far from clean, with emissions associated with every step of the supply chain, from extraction to liquefaction to combustion. Even if the latter is undertaken elsewhere in the world, the implications for B.C.'s emissions from the first two are still vast. If all six proposed LNG projects were to be built, their operational and upstream emissions alone would make up 40% of the province's 2030 emissions target (that is even assuming most facilities are electrified).[4,5] And that's just B.C.'s emissions. The emissions from combusting the exported fuel at its destination—which is accounted for in the importing countries' greenhouse gas inventories—would be 10 times greater. And those combustion emissions don't even account for the transportation emissions from shipping the LNG from the export facility to its destination.

In addition, the assumption that LNG can reduce emissions by displacing coal is highly uncertain, with some studies suggesting it could actually have a negative overall impact on emissions.[7–13] LNG production and transportation leads to leakage of methane, which is a potent greenhouse gas with significant near-term warming potential.[13] In addition, there are emissions from shipping the LNG to its destination, and, once it arrives, there is a risk that instead of replacing coal it displaces cleaner sources of energy, like renewables. Furthermore, any expansion or reliance on LNG risks crowding out public and private-sector investments in renewable energy and locking in fossil-fuel-related infrastructure.

Put simply, LNG expansion is difficult to square with and arguably incompatible with a world—and a province—that achieves net zero.



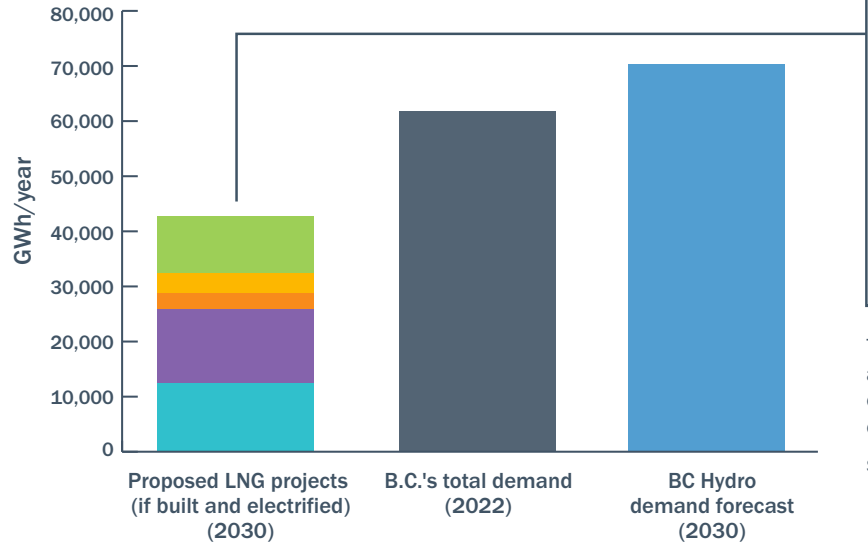
LNG would add **13 Mt** to B.C.'s emissions if all six projects become operational, while the province aims to lower its emissions by **21 Mt** by 2030.

Projected LNG emissions assume full electrification of all terminals except LNG Canada Phase 1, plus partial electrification of upstream natural gas production. The degree of upstream electrification and associated emissions assumes all of B.C.'s proposed LNG projects become operational by 2030 and allow the province to achieve its CleanBC 2030 target.

Sources: Pembina Institute,[4] Government of B.C.,[5] Government of Canada,[6] Clean Energy Canada

A high price to pay

Emissions aside, B.C. will pay for LNG in other ways. For starters, electricity. If all six LNG facilities were to be built, they would require around 43 TWh of electricity per year.[4] For context, that's 69% of B.C.'s total 2022 demand, or the equivalent of the electricity from more than **eight Site C dams.[4,14] Diverting this much power to LNG would mean less is available for households or cleaner industries.**



The estimated emissions and electricity demand are based on the full electrification of all terminals except LNG Canada Phase 1, plus partial electrification of upstream natural gas production.

Sources: Pembina Institute,[4] Canada Energy Regulator,[14] BC Hydro[15]

Indeed, B.C. has many promising alternative economic opportunities with less uncertain futures. Critical minerals and metals and clean hydrogen are among the key sectors of B.C.'s economy that are poised for growth.[16]

LNG would also come at a cost to household affordability, jobs, and possibly the taxpayer. Importing just one Site C's worth of electricity would cost B.C. ratepayers, or potentially taxpayers, around $600 million annually (see page 17). Meanwhile, the U.S. government anticipates that LNG exports could cause domestic natural gas prices to increase by up to 28% over the next 25 years.[17]

Building these facilities would divert construction workers away from housing and other projects, such as expanding B.C.'s clean electricity grid and generation, at a time when this kind of labour is projected to be in short supply. And because there are very limited options to repurpose LNG terminals,[18,19] new infrastructure risks creating stranded assets when demand dries up amid the global energy transition, potentially leaving the taxpayer on the hook.

In short, the future of LNG is uncertain, and expanding the industry means trade-offs for B.C.'s economy and electricity system.

So what needs to change?

The risk is real that more LNG development will crowd out cleaner industries better poised for growth in the coming decades, and so is the risk of future stranded assets backed by government incentives drawing on taxpayer dollars. **To minimize these risks to the province's economy and the B.C. taxpayer, the B.C. government should:**

- **Develop an economy-wide industrial strategy** that aligns with a net-zero economy, prioritizes opportunities for clean economic growth, and considers the scarcity of resources like electricity supply, government incentives, and construction workers.
- **Develop specific roadmaps for net-zero aligned industries** that lay out the timelines and actions needed to secure the necessary clean energy, labour, and infrastructure for these sectors.
- **Develop a decision-making framework** to prioritize the use of available clean electricity that supports household affordability, underpins energy security, and prioritizes industrial investments in alignment with climate targets.
- **Amend the province's environmental assessment process** to require the consideration of emissions from the use of exported LNG (termed scope 3 emissions).

LNG projects in B.C.

Table 1 on the following pages offers an overview of LNG projects in B.C. at various stages of development: those undergoing regulatory review, those awaiting final investment decision, and those under construction. Four projects are planned for the North Coast region (LNG Canada Phases 1 and 2, Cedar LNG, and Ksi Lisims LNG), while two would be located at the South Coast (Woodfibre LNG and Tilbury LNG's Phase 2 expansion). LNG Canada Phase 1 is expected to begin operation in 2025, while the other projects are planned to commence operations in 2027 and 2028. If all projects were to become operational, their combined export capacity would be 47.9 million tonnes of LNG per year.

Apart from LNG Canada Phase 1, all projects intend to fully electrify their facilities.[4] The province's CleanBC 2030 target and the recently announced energy action framework provide further incentives for electrification, including upstream.[20,21]

While public information on the scale of government financial incentives for the LNG sector in the province is scarce, LNG Canada and Woodfibre LNG are reported to have been granted a combined total of around $7 billion in financial supports from the B.C. government to date.[22,23] The package of incentives for the LNG industry appears to include discounted electricity prices, exemptions from increases in the provincial carbon tax, a corporate income tax break, and the deferral of provincial sales tax on construction.[24]

In February of this year, yet another prospective project for LNG exports from B.C. emerged: Summit Lake PG LNG would liquefy natural gas not at the coast, but inland near Prince George and transport the LNG via rail in shipping containers to Prince Rupert for export to Asia by container ship.[25] The proposed project would produce up to 2.7 million tonnes of LNG per year and has just entered the B.C. environmental assessment process.[26] Little more is known about the project at this point, which is still at an early stage of development.

Table 1: Overview of LNG projects

	LNG Canada Phase 1	LNG Canada Phase 2	Woodfibre LNG
Status	Under construction Final investment decision secured Regulatory review completed	Awaiting final investment decision Regulatory review completed	Under construction Notice to proceed issued Regulatory review completed
Proponent(s)	Shell, Petronas, PetroChina, Mitsubishi, Korea Gas	Shell, Petronas, PetroChina, Mitsubishi, Korea Gas	Woodfibre LNG
Location	Kitimat	Kitimat	Squamish
Export capacity	14 MTPA	14 MTPA	2.1 MTPA
Start of operation	2025	N/A	2027
Emissions (annual)	Facility: 2.1 Mt CO_2e Upstream: 3.4 Mt CO_2e Combustion at destination: 37.6 Mt CO_2e	Facility: 0.8 Mt CO_2e Upstream: 3.1 Mt CO_2e Combustion at destination: 37.6 Mt CO_2e	Facility: 0.1 Mt CO_2e Upstream: 0.3 Mt CO_2e Combustion at destination: 5.6 Mt CO_2e
Social cost of carbon exported (annual)	$11.1 billion (in 2030) $14.8 billion (in 2050)	$11.1 billion (in 2030) $14.8 billion (in 2050)	$1.7 billion (in 2030) $2.2 billion (in 2050)
Electricity demand (annual)	Facility: 788 GWh Upstream: 9,766 GWh	Facility: 3,204 GWh Upstream: 10,164 GWh	Facility: 1,095 GWh Upstream: 863 GWh
Operational lifespan	40 years	Same as LNG Canada Phase 1	At least 25 years
Contracts to offtake LNG	Project partners to offtake LNG in line with their respective equity interests	Project partners to offtake LNG in line with their respective equity interests	BP (1.95 MTPA plus 0.15 MTPA on a flexible basis, over 15 years) = 100% of export capacity
Contracts to supply natural gas for liquefaction	In January 2024, Tourmaline, Canada's largest natural gas producer with operations in B.C.'s Montney Formation, signed a seven year LNG agreement for 0.5 MTPA with commodity trader Trafigura starting in 2027, with the potential for extension through 2039 (LNG Prime). Through the Coastal GasLink pipeline, the Montney Formation is slated to supply natural gas to LNG Canada, Woodfibre LNG, Cedar LNG, and Ksi Lisims LNG (Canadian Energy Centre).		
Construction costs	$25-40 billion	Part of LNG Canada Phase 1 estimate	$5.1 billion
Direct employment in B.C. (FTEs, annual)	Construction (5 years): 5,260 Operation: 500-1,200 Decommissioning (2 years): 2,150-3,350	Construction (4 years): 2,550 Operation: N/A Decommissioning: N/A	Construction (2 years): 895 Operation: 100 Decommissioning (2 years): N/A
Provincial government revenue (direct, indirect, and induced)	Construction: $385-625 million Operation: $690-1,605 million (annually) Decommissioning: $125-180 million	Part of LNG Canada Phase 1 estimate	Construction: $45.4 million Operation: $91.6 million (annually) Decommissioning: N/A
Provincial government's financial incentives	$5.3 billion	Part of LNG Canada Phase 1 estimate	$1.6-1.9 billion
Other information	Coastal GasLink, a natural gas pipeline to be operated by TC Energy and completed in October 2023, will be supplying LNG Canada	Phase 2 is an expansion of the LNG Canada project	The Squamish Nation and Woodfibre LNG concluded an agreement worth $1.1 billion in benefits in November 2018, following the Squamish Nation's environmental approval of the project
Sources	LNG Canada, BC Environmental Assessment Office (including submitted documents, such as project overview, employment and economy), *The Globe and Mail*, Natural Gas World, *The Narwhal*, Pembina Institute, Clean Energy Canada	Riviera Maritime, Pembina Institute, Clean Energy Canada	BC Environmental Assessment Office (including submitted documents, such as project overview, employment and economy, government revenue), LNG Prime, LNG Prime, Gas Outlook, *Vancouver Sun*, Pembina Institute, Clean Energy Canada

Notes: Emissions and electricity demand assume full electrification of all terminals except LNG Canada Phase 1, plus partial electrification of upstream natural gas production. The degree of upstream electrification and associated emissions assumes all projects become operational by 2030 and allow the province to achieve its CleanBC 2030 target. Combustion emissions are based on export capacity and emissions factors from the Government of Canada. The Social cost of carbon is calculated based on estimates from the Government of Canada.

	Cedar LNG	Ksi Lisims LNG	Tilbury LNG (Phase 2 expansion)
Status	Awaiting final investment decision Regulatory review completed	Undergoing regulatory review (environmental assessment) Project proponents submitted an application for an environmental assessment certificate in October 2023	Undergoing regulatory review (environmental assessment) Project proponent to submit an application for an environmental assessment certificate within three years from June 2022
Proponent(s)	Haisla Nation, Pembina	Nisga'a Nation, Western LNG, Rockies LNG	FortisBC
Location	Kitimat	Gitlaxt'aamiks	Delta
Export capacity	3 MTPA	12 MTPA	2.8 MTPA
Start of operation	2027	2028	2028
Emissions (annual)	Facility: 0.3 Mt CO_2e Upstream: 0.7 Mt CO_2e Combustion at destination: 8.1 Mt CO_2e	Facility: 0.2 Mt CO_2e Upstream: 1.1 Mt CO_2e Combustion at destination: 32.2 Mt CO_2e	Facility: 0.2 Mt CO_2e Upstream: 0.6 Mt CO_2e Combustion at destination: 7.5 Mt CO_2e
Social cost of carbon exported (annual)	$2.4 billion (in 2030) $3.2 billion (in 2050)	$9.5 billion (in 2030) $12.7 billion (in 2050)	$2.2 billion (in 2030) $3 billion (in 2050)
Electricity demand (annual)	Facility: 1,461 GWh Upstream: 2,293 GWh	Facility: 5,256 GWh Upstream: 4,957 GWh	Facility: 957 GWh Upstream: 1,900 GWh
Operational lifespan	At least 25 years	At least 30 years	At least 60 years
Contracts to offtake LNG	None announced to date	Shell (2 MTPA, over 20 years) = 17% of export capacity	None announced to date
Contracts to supply natural gas for liquefaction	In January 2024, Tourmaline, Canada's largest natural gas producer with operations in B.C.'s Montney Formation, signed a 7-year LNG agreement for 0.5 MTPA with commodity trader Trafigura starting in 2027, with the potential for extension through 2039 (LNG Prime). Through the Coastal GasLink pipeline, the Montney Formation is slated to supply natural gas to LNG Canada, Woodfibre LNG, Cedar LNG, and Ksi Lisims LNG (Canadian Energy Centre).		None announced to date
	ARC Resources (1.5 MTPA, over 20 years) = 50% of export capacity		
Construction costs	$2.4 billion	$9.9-11.8 billion	$3-3.5 billion
Direct employment in B.C. (FTEs, annual)	Construction (4 years): 561 Operation: 270 Decommissioning (1 year): 100-150 (workers)	Construction (3-4 years): 3,055-3,275 Operation: 465-945 Decommissioning (1 year): 1,055	Construction (5 years): 6,000 Operation: 110 Decommissioning (2 years): N/A
Provincial government revenue (direct, indirect, and induced)	N/A	Construction: $166-184 million Operation: $15-$60 million (annually) Decommissioning: $61 million	Construction: $308 million Operation: $58 million (annually) Decommissioning: N/A
Provincial government's financial incentives	None announced to date	None announced to date	None announced to date
Other information			This project is an expansion of the existing Tilbury LNG facility (0.03 MTPA), which has been operating since 1971 with a domestic focus on industrial, residential and maritime (ferry) sectors
Sources	BC Environmental Assessment Office (including submitted documents, such as project overview, employment and economy), LNG Prime, LNG Prime, Pembina Institute, Clean Energy Canada	BC Environmental Assessment Office (including submitted documents, such as project overview, employment and economy), *The Globe and Mail*, Pembina Institute, Clean Energy Canada	BC Environmental Assessment Office (including submitted documents, such as detailed project description), Government of Canada, Pembina Institute, Clean Energy Canada

Notes: Emissions and electricity demand assume full electrification of all terminals except LNG Canada Phase 1, plus partial electrification of upstream natural gas production. The degree of upstream electrification and associated emissions assumes all projects become operational by 2030 and allow the province to achieve its CleanBC 2030 target. Combustion emissions are based on export capacity and emissions factors from the Government of Canada. The Social cost of carbon is calculated based on estimates from the Government of Canada.

Demand: energy markets around the world

Expected LNG demand around the world varies widely and key export markets are undergoing their own transitions away from fossil fuels over the next decade.

Based on a review of publicly available data from government and intergovernmental organizations, consultancies, and oil and gas companies, forecasts of global and regional LNG trade and natural gas demand show a wide range of outcomes, highlighting the uncertainties and risks involved in B.C.'s LNG export plans. This section also presents energy trends and policy developments in some of the province's key export markets that suggest a future decline in LNG demand.

Projections of LNG trade and natural gas demand through 2050 vary widely

A review of global forecasts of LNG trade and natural gas demand shows a wide range of projections through 2050 compared to 2022, the latest year available, from declines exceeding 75% to increases exceeding 50%. This range of outcomes reflects various scenarios and estimates from government and intergovernmental organizations, consultancies, and oil and gas companies.

The various projections are based on business-as-usual or current policy scenarios, net-zero by 2050 scenarios, and scenarios falling in between these (although the degree to which their assumptions around policies, technology costs, and other inputs are disclosed varies). The review covers data from the following organizations: BloombergNEF,[27] BP,[28] DNV,[29] ExxonMobil,[30] International Energy Agency,[31] McKinsey & Company,[32] Rystad Energy,[33] Shell,[34,35] U.S. Energy Information Administration (EIA),[36] and Wood Mackenzie.[34]

Modelling indicates a huge range of potential outcomes on global LNG trade, suggesting a high level of uncertainty and thus risk from a business perspective, with the average of all projections showing a trajectory that is initially flat after 2035 before declining from 2040 onward.

Adding to the uncertain outlook is that future LNG demand is highly sensitive to China's economic trajectory.[31] The country's GDP growth is projected to average just under 4% per year to 2030, according to the International Energy Agency. If China's near-term growth were to slow by another percentage point, the country's LNG imports would decline by more than 20% by the end of the decade, with major implications for global LNG trade.

In fact, the evolution of key economies in Asia is of crucial importance to B.C.'s LNG industry. Japan and South Korea have been identified as the strongest fit for Western Canadian LNG exports in a 2023 study commissioned by the First Nations Climate Initiative, followed by China, which was described as a moderate fit.[37] The panel of charts in Figure 2 shows projected energy use under current policies and population forecasts in these markets. The data illustrates that energy demand in each country is relatively level or decreasing through mid-century while their populations are in decline.

Figure 1: Projections of global LNG trade through 2050

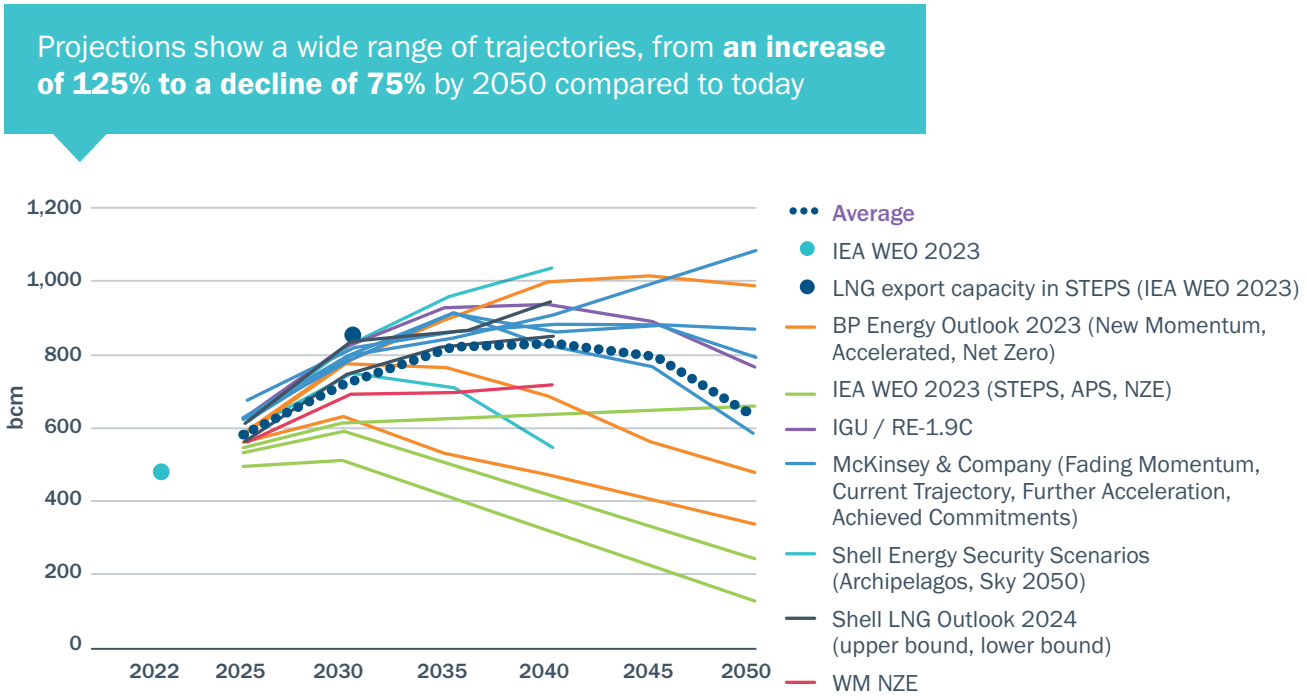
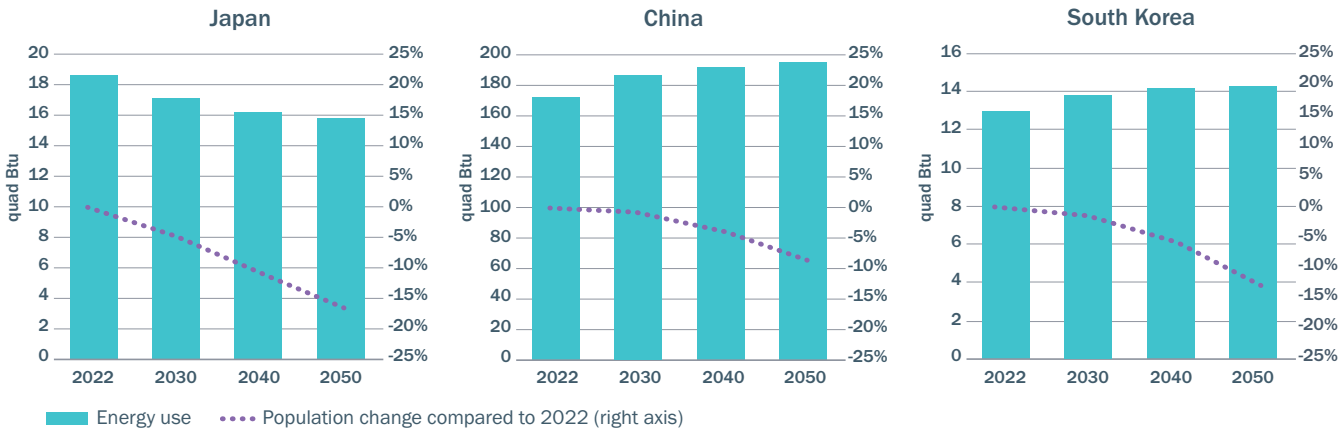


Figure 1 shows various forecasts of global LNG trade through 2050. It also includes, for reference, global LNG trade in 2022 (479 billion cubic metres, or bcm) and total estimated export capacity in 2030 (832 bcm) under current policies, both from the International Energy Agency.[31]

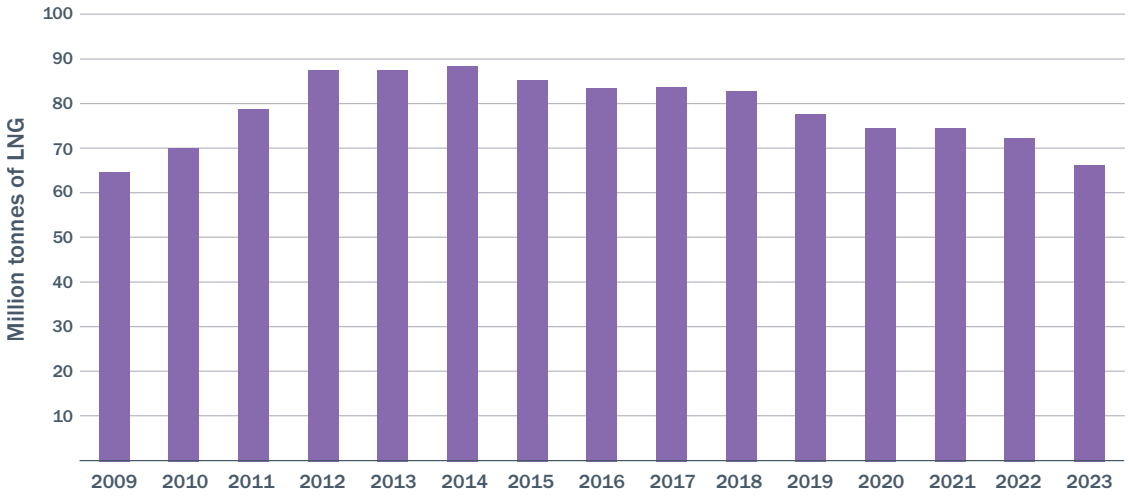
Figure 2: Energy forecasts and population trends in key Asian markets



Data sources: U.S. EIA,[35] World Bank[37] (population data)

Taking a closer look at Japan, which relies on LNG imports for virtually all of its natural gas consumption and is expected to be the primary destination of B.C.'s planned LNG exports,[37,39] the country's LNG imports fell by 8% in 2023 compared to the year before.[40] This decline to the lowest level since 2009 follows Japan's nuclear electricity restarts and increased use of renewables. Last year, Japan passed an extension to the lifetime of nuclear power plants beyond 60 years.[41] The decline of LNG imports is in line with the International Energy Agency's business-as-usual projections, which estimate natural gas demand in Japan to be cut by 32% by 2030 compared to 2022.[31] If announced policies are accounted for as well, the International Energy Agency projects a decline of even 38% by the end of the decade.

Figure 3: Japan's LNG imports since 2009

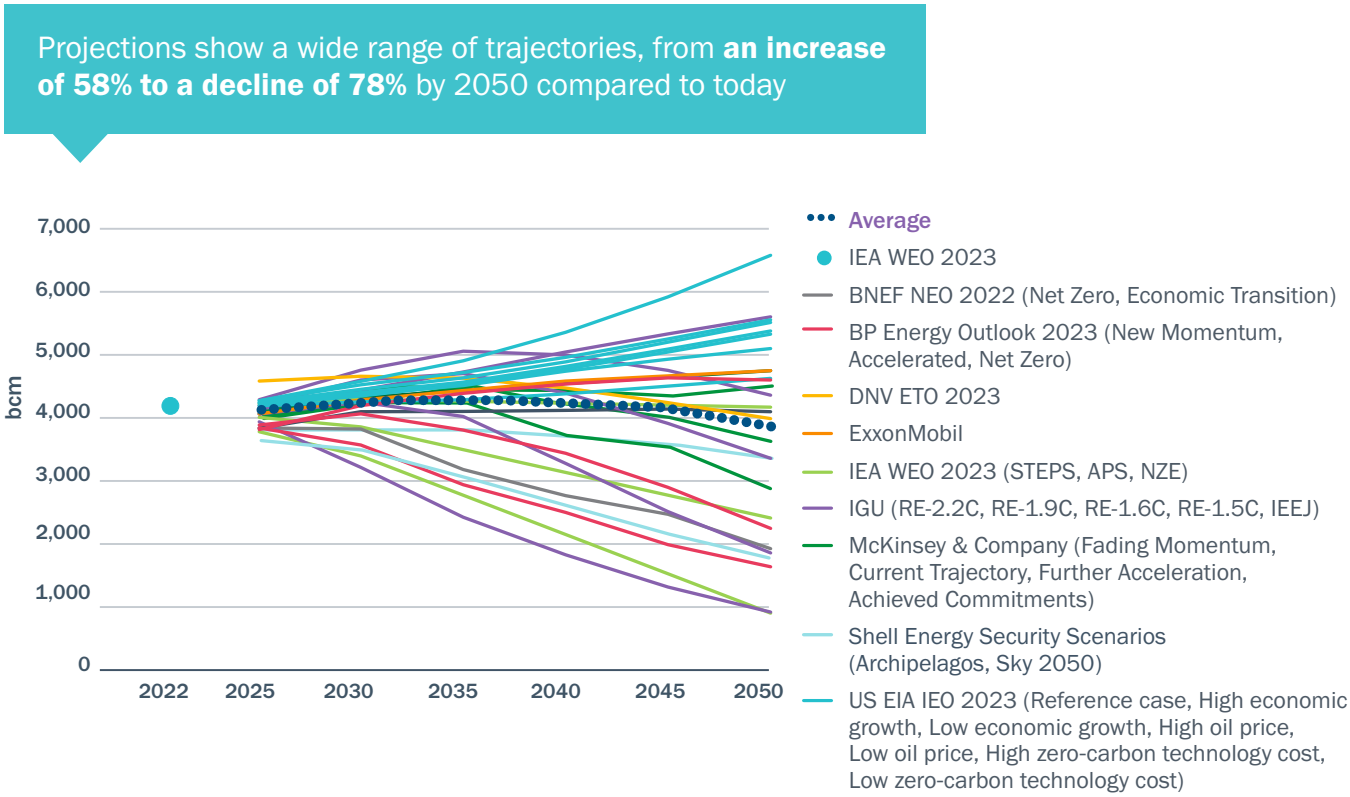


Data source: Government of Japan[2]

New policies are boosting the prospects for clean electricity in places like South Korea and China, too. The former plans to increase nuclear power to 35% of total generation and renewables to 31% from 10% in 2021 by 2036, diminishing the role of LNG in its power mix.[42] Meanwhile, China's 14th Five-Year Plan raises its renewables target to 33% of power consumption by 2025.[43]

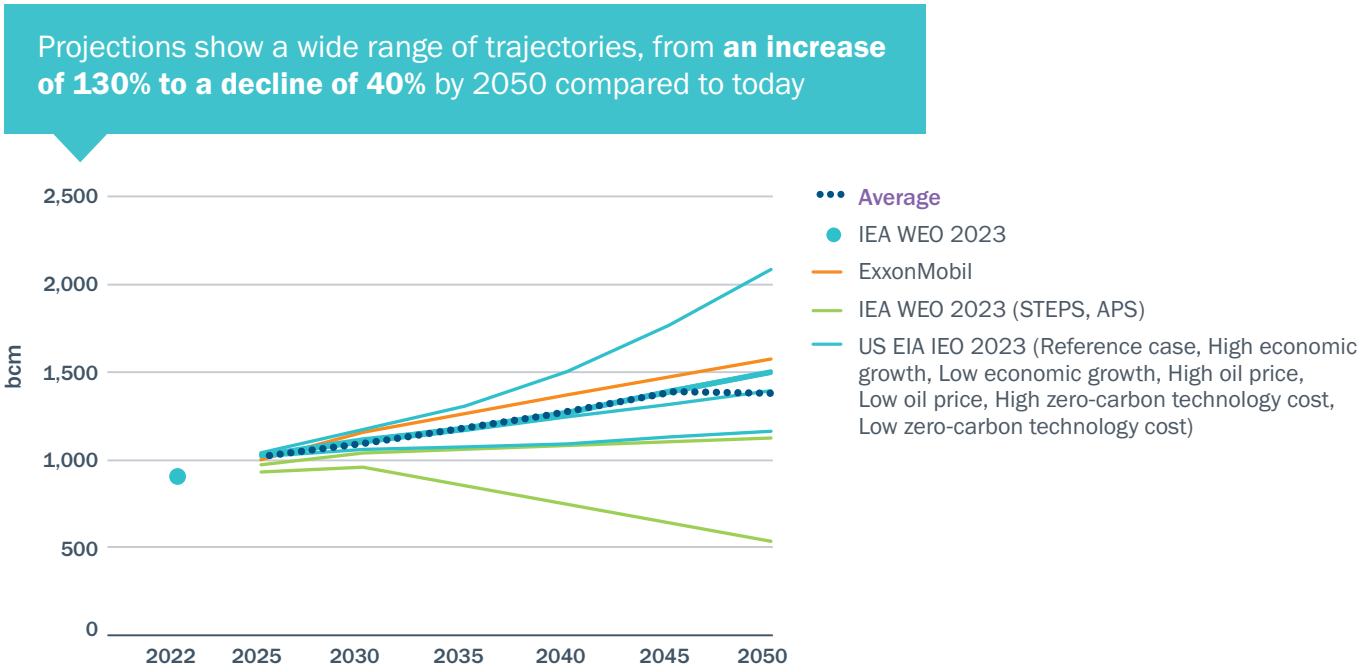
Similar to the forecasts of global LNG trade, the outlook for global natural gas demand (some of which will be met with LNG) is characterized by a wide range of outcomes. Figure 4 plots various trajectories of global natural gas demand through 2050, plus the demand in 2022 for reference. The range of potential outcomes on global natural gas demand indicates a high level of uncertainty, with the average of all projections showing a trajectory that is relatively flat before slowly declining from 2035 onward.

Figure 4: Projections of global natural gas demand through 2050



Some forecasts include a regional breakdown for the Asia Pacific region, which is anticipated to be the destination of B.C.'s planned LNG exports.[37] Similar to forecasts at the global level, the trajectories indicate a wide range of outcomes and thus uncertainty for the role of natural gas in the region, with some of this demand to be met with LNG. The average of the projections available specifically for this region shows a moderate increase in demand until reaching a plateau in 2045.

Figure 5: Projections of Asia Pacific natural gas demand through 2050

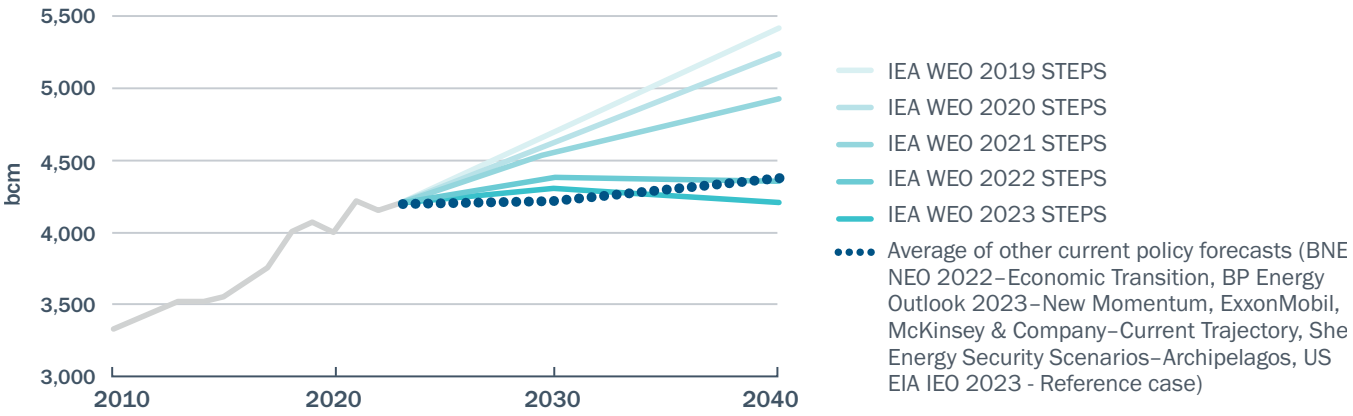


Evolution of markets, technology, and policy have tangible impact even on business-as-usual estimates

Markets, technology, and policy are evolving over time. Even current policy projections have undergone consecutive downward revisions in response to these fundamental drivers. Figure 6 illustrates this point by comparing the International Energy Agency's current policy estimates of natural gas demand over the past five iterations. As shown in the graph, the IEA has historically overestimated global natural gas demand under current policies. The downward revisions were driven by the rapid deployment of renewables that exceeded expectations and the global energy crisis in the wake of the Russian invasion of Ukraine.[31]

The chart also includes the average of current policy projections from other organizations, showing that the IEA's estimates are largely in line with those from other analysts. Collectively, all of them see demand growth slowing down after 2030.

Figure 6: Projections of natural gas demand through 2040 under current policies



Supply: competitors to B.C. LNG

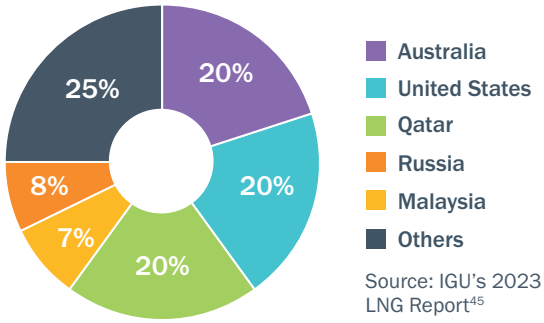
Having set out the uncertain prospects of future LNG demand around the world and in key destinations of B.C.'s planned exports, this section addresses the current and projected global supply of LNG.

In the second half of this decade, global LNG export capacity is expected to increase significantly—by 43% compared to today—just as B.C.'s export projects are planned to come online.[3] According to LNG market analysts, this will result in global LNG oversupply by 2030. Oversupply may be even more pronounced in likely export markets for B.C. LNG, with key competitors projected to add around 50% of LNG export capacity by 2030 compared to today. Additionally, some of B.C.'s competitors have a significant cost advantage for delivery to Asian markets, with Qatar's shipments expected to be around 40% below the cost of B.C. LNG.[44] Combined with oversupply that tends to lead to lower market prices, abundant and cheap LNG from B.C.'s competitors puts any hoped-for economic benefits for the province at risk.

Current LNG exports and projected capacity by market

The world's largest LNG exporters—collectively responsible for 75% of the global total—are currently, in descending order of export share: Australia, the U.S., Qatar, Russia, and Malaysia.[45] The top three countries each account for 20% of global exports.

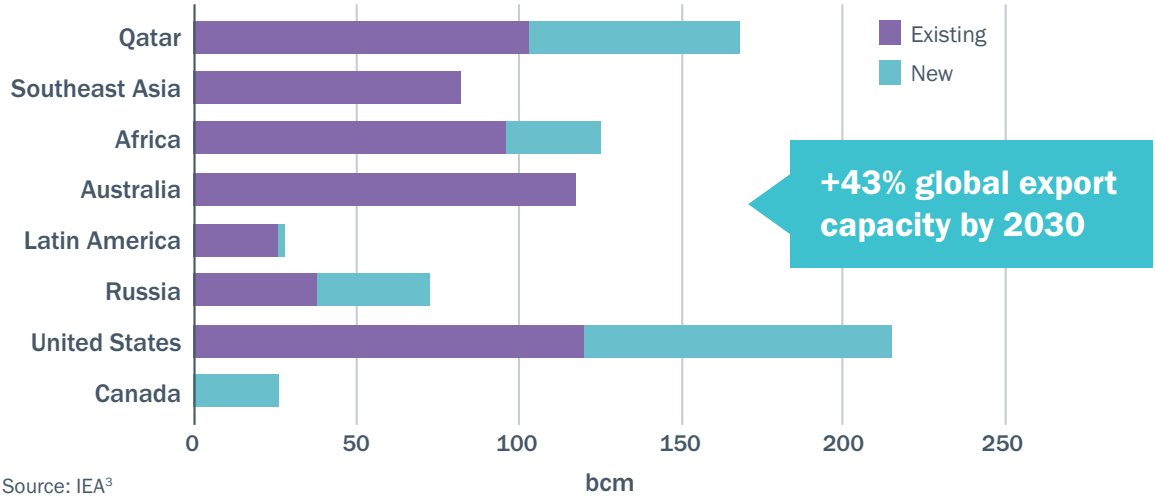
Figure 7: LNG exports by market (2022)



Source: IGU's 2023 World LNG Report[45]

By 2030, the IEA expects global LNG export capacity to increase by 43% compared to 2022, with Canada accounting for 3% of total export capacity at the end of the decade.[3] Around 250 bcm of new LNG projects are set to come online starting in 2025, leading to a potential oversupply of LNG in the second half of this decade.[31] Analysts from BloombergNEF and the Institute for Energy Economics & Financial Analysis similarly anticipate strong growth in global LNG export capacity by 2030.[46,47] The U.S. and Qatar are expected to account for 60% of this capacity increase, Asia being the intended market. In fact, Asia is the final destination for almost all of the additional Middle East LNG supply. New LNG projects around the world are slated to increase global supply at an uncertain time as global gas demand growth has slowed considerably since its "golden age" of the 2010s. As a result, more than a third of the new gas producers are expected to be looking to find buyers on the short-term market.[31]

Figure 8: Projected global LNG export capacity by 2030 compared to 2022



Source: IEA[3]

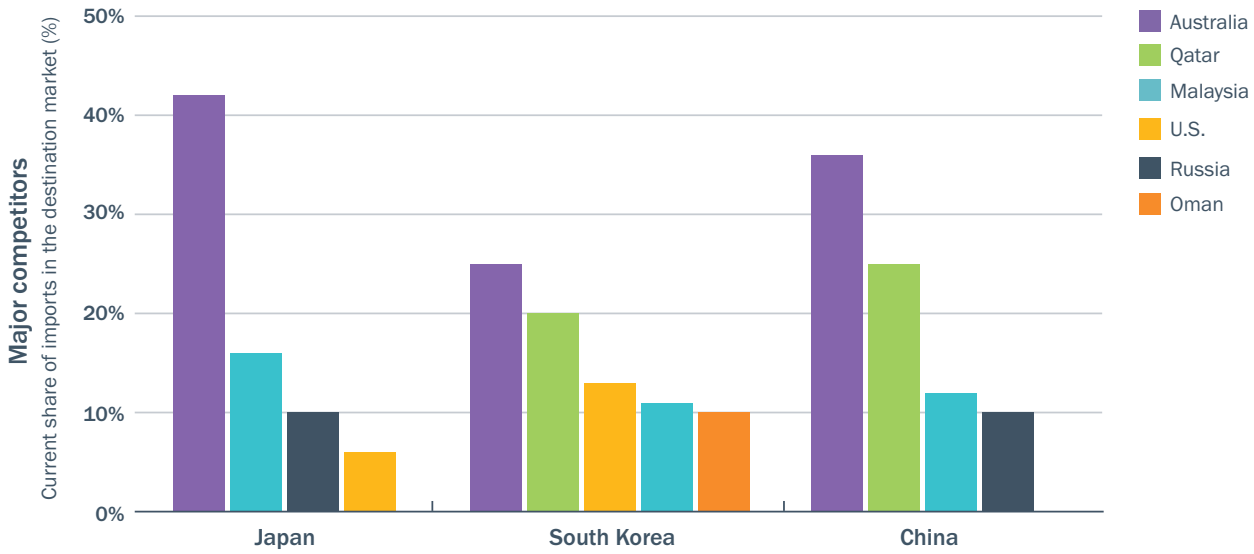
Notably, these estimates may be underestimating the extent of the impending global LNG oversupply as the projected global export capacity may be on the lower end of LNG capacity coming online by 2030. The IEA's estimated capacity[3] of 26 bcm from Canada appears to account for LNG Canada Phase 1, Woodfibre LNG, and Cedar LNG, but not for the other B.C. projects that could become operational by the end of the decade, namely LNG Canada Phase 2, Ksi Lisims LNG, and Tilbury LNG's Phase 2 expansion. If all proposed B.C. LNG projects go ahead and are operational by 2030, they would represent up to about 65 bcm of export capacity from Canada, boosting the global 2030 estimate by 5% to approximately 870 bcm.

Whether the Biden administration's January 2024 move to pause approvals of U.S. LNG export projects will have a lasting impact on the global LNG supply picture is currently unclear.[48] The decision's influence will ultimately depend on whether the pause will become permanent, whether subsequent federal U.S. governments will maintain it, and, if the pause temporary, whether the delay will be long enough to have a tangible effect on the global LNG market. However, the pause does not apply to projects already in the construction phase.[49] Given that projects equivalent to some 100 bcm of export capacity are already under construction in the U.S.,[50] the pause is not expected to materially alter significant projected capacity growth until 2030.

B.C. competitors' costs and projected LNG exports

As indicated below, Japan, South Korea, and to a lesser extent China, have been identified as key destinations for any B.C. LNG exports.[37] Based on the current origins of significant LNG import volumes in these markets, shipments from B.C. will likely face competition from the following LNG-exporting countries: Australia, Qatar, Malaysia, U.S., and Russia.

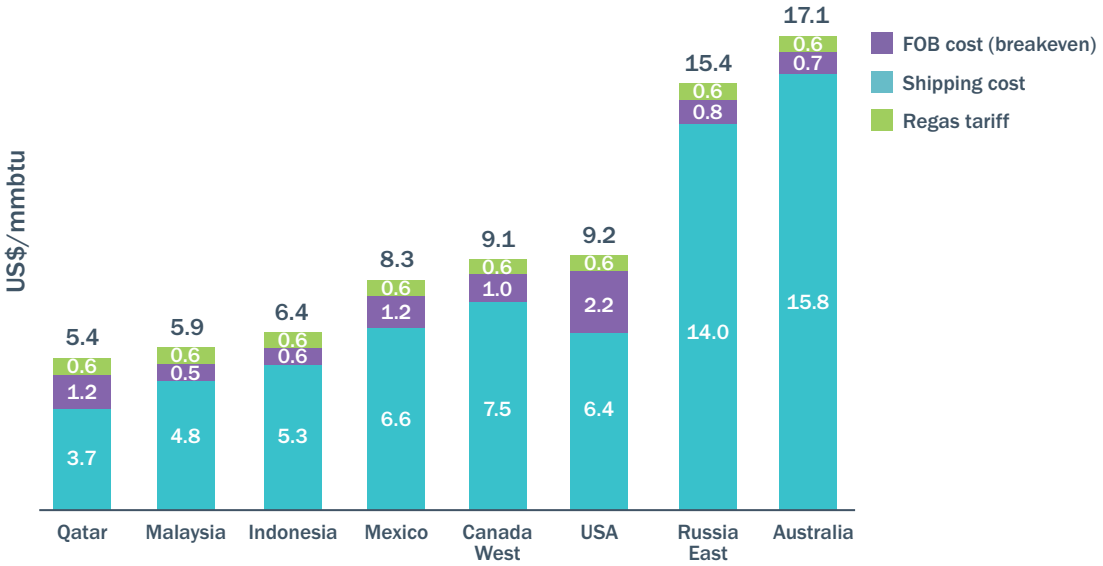
Figure 9: Current share of LNG imports by origin in key B.C. LNG export markets



Source: IGU's 2023 World LNG Report[45]

As shown in Figure 10, some of these competitors have a significant cost advantage over B.C. LNG for delivery to Asian markets. According to a recent analysis, B.C. LNG is expected to be more cost-competitive than that from Australia and Russia, but it is essentially on par with LNG from the U.S., while LNG from Qatar and Malaysia is estimated to be cheaper than B.C. LNG by 41% and 35%, respectively.[44]

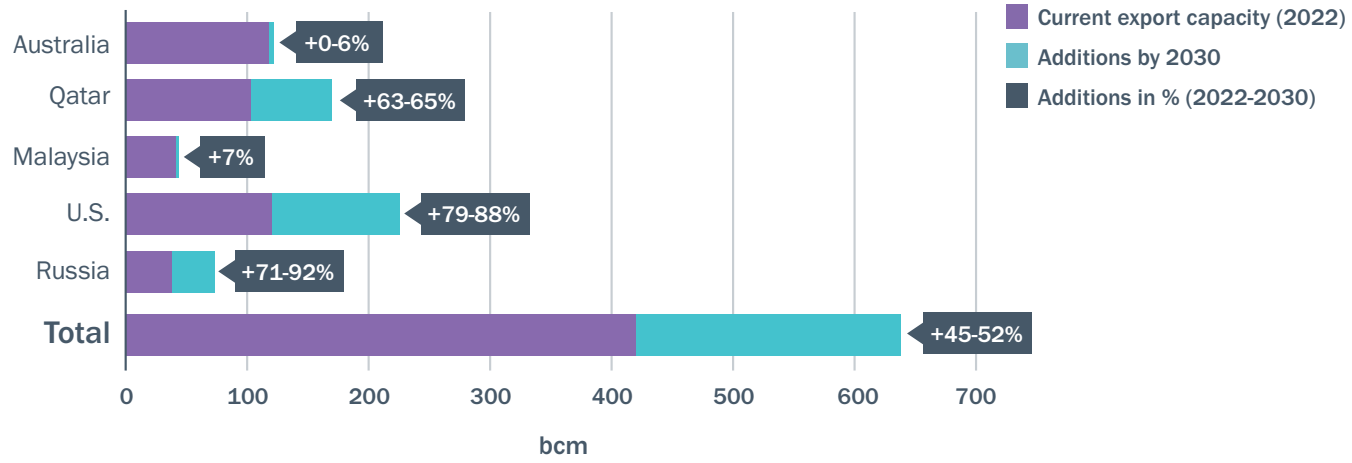
Figure 10: Average delivered cost of LNG to Asian markets from selected supply countries



Source: Wood Mackenzie[43]

Besides facing competition from lower-cost producers, most of B.C.'s LNG competitors also have plans for significant expansion of their export capacity, adding further pressure to any future exports from B.C. Figure 11 shows the projected capacity additions of B.C.'s likely competitors by 2030. On average, B.C.'s major competitors are expected to add around 50% of capacity by 2030 compared to today, similar to total global capacity additions shown in Figure 8 (page 14). Qatar, the U.S., and Russia are projected to add at least 63% and as much as 92% in export capacity. Only Australia, currently the world's largest exporter, and Malaysia are expected to add more modestly at up to 7% new capacity.

Figure 11: Current LNG export capacity and projected additions by 2030 of B.C.'s major competitors



Sources: IEA,[3] BloombergNEF,[46] LNG Prime,[51] Natural Gas World[52]

Opportunity costs of B.C. LNG

Not only is global demand for B.C. LNG uncertain and about to face a looming global oversupply, but developing exports would likely also have negative impacts on the cost of energy for British Columbians, exacerbating existing concerns around household affordability across the province.

The planned buildout would also divert construction workers away from housing and other projects (such as expanding B.C.'s clean electricity grid and generation) at a time when this kind of labour is projected to be in short supply.[55] Additionally, new LNG infrastructure risks creating stranded assets and delaying the energy transition.

B.C. LNG electrification needs far exceed supply

Apart from LNG Canada Phase 1, all projects intend to fully electrify their facilities,[4] with the province's CleanBC 2030 target and the recently announced energy action framework providing further incentives for electrification, including upstream.[20,21]

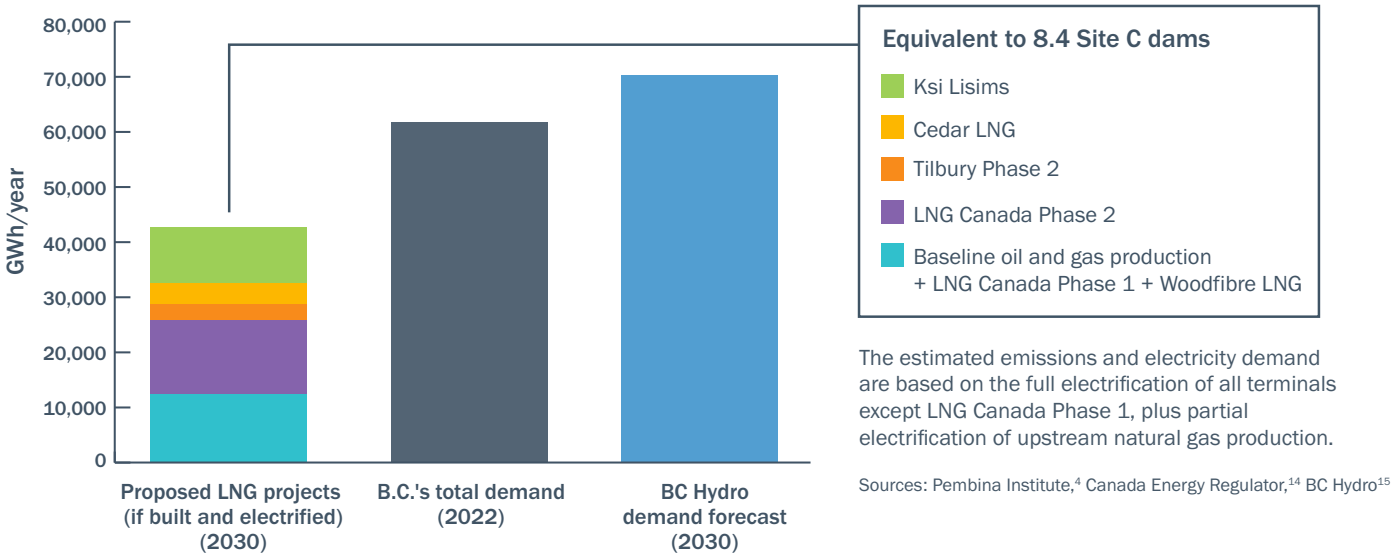
If all proposed LNG projects go ahead, they are estimated to require around 13 TWh of electricity per year for the facilities' operation, while demand for upstream electrification would amount to another 30 TWh.[4] The combined total of around 43 TWh annually is equivalent to the power provided by more than eight Site C dams. For further comparison, B.C.'s total electricity demand in 2022 was 62 TWh,[14] and BC Hydro forecasts total demand in 2030 to be 70 TWh.[15]

Impacts on affordability for British Columbians

The enormous electricity demand of LNG projects would require a significant buildout of electricity generation as well as the province's grid. If this electricity is not produced in the province and LNG proponents are guaranteed the BC Hydro industrial electricity rate, importing one Site C's worth of electricity would cost the B.C. ratepayer, or potentially taxpayer, approximately $600 million annually.*

* Based on the 2023 average price of electricity at the Mid Columbia hub, the Bank of Canada's average exchange rate for that year, and BC Hydro's estimated generation from Site C.

Figure 12: Comparison of estimated electricity demand for B.C. LNG and total provincial demand



The estimated emissions and electricity demand are based on the full electrification of all terminals except LNG Canada Phase 1, plus partial electrification of upstream natural gas production.

Sources: Pembina Institute,[4] Canada Energy Regulator,[14] BC Hydro[15]

Additionally, the export of B.C. natural gas in the form of LNG could affect provincial natural gas rates.[8,12] Indeed, the U.S. EIA notes that, all else being equal, higher LNG exports create a tighter domestic natural gas market, increasing domestic natural gas prices.[17] As set out in earlier sections, the level of demand for B.C. LNG on the global market is highly uncertain. However, LNG exports from B.C. could pose a concern for the affordability of home heating in the province, with implications for household affordability and impacts on commercial and industrial users of natural gas. While efforts are underway to address emissions from home heating in B.C.,[53] almost half of the heating systems in the province are currently still using natural gas and reducing this consumption is expected to take some time.[54] In the U.S., the EIA projected the effect of LNG exports on domestic natural gas prices and found potential increases of up to 28% over the next 25 years, depending on how quickly export capacity is ramped up.[17]

Impacts on labour supply

There is also a significant opportunity cost in allocating labour supply to the construction of LNG infrastructure. Skilled builders are in high demand and in short supply in B.C. as the province faces a housing shortage and a shortfall of construction workers that is expected to reach 25,000 by 2028.[55] The construction of LNG Canada Phase 1 alone requires 5,260 full-time workers over five years, and building Phase 2 would require another 2,550 over four years.[56] If all proposed projects go ahead, more than 18,000 full-time workers would be required over two to five years, implying a significant diversion of construction workers away from housing and other projects (such as expanding B.C.'s clean electricity grid and generation) at a time when they are projected to be in short supply.

Risk of stranded assets and delaying the energy transition

Creating new LNG export facilities in B.C. as well as facilitating new LNG import markets around the world would require a significant buildout of infrastructure that may soon become obsolete, from LNG export and import terminals to a network of gas pipelines. Building this infrastructure risks creating stranded assets backed by government incentives drawing on taxpayer dollars.

Large infrastructure investments like LNG are usually made with a long timeline in mind. However, building out new natural gas infrastructure less than three decades before Canada's and the world's goal of meeting net-zero emissions means LNG infrastructure that may soon become obsolete, which risks creating stranded assets and delaying the energy transition because of infrastructure lock-in and sunk cost fallacy.[57,58]

In 2022, both the governments of Canada and Germany justified the buildout of new LNG terminals by pointing to the potential future use for the export of hydrogen.[59,60] However, no practical experience exists in repurposing LNG terminals for hydrogen or ammonia, and experts have pointed out that repurposing existing LNG terminals for hydrogen would be uncertain, technically challenging, and expensive.[18,19]

Climate impacts of LNG

Numerous studies show that, when accounting for the full life-cycle emissions of LNG, it is far from clear whether LNG exports can lead to a reduction of global emissions, with estimates of potential emissions reductions or increases varying widely.

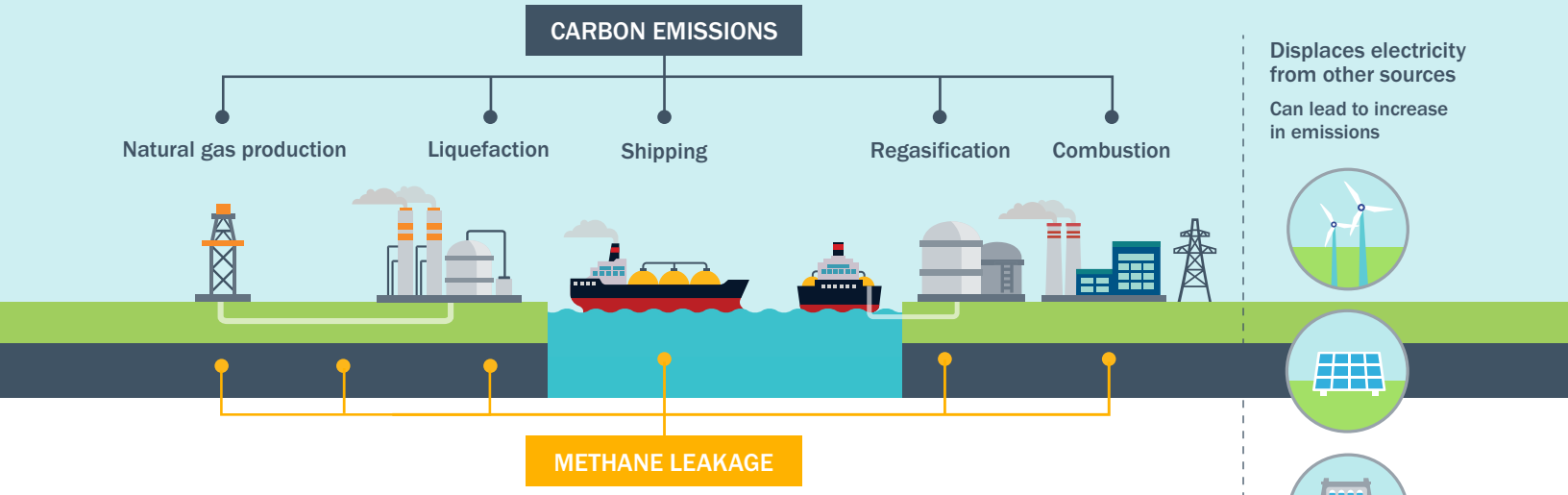
In fact, LNG exports could well lead to higher overall emissions. Key uncertainties include levels of methane leakage and venting along the supply chain, assumptions around the global warming potential of methane, emissions from shipping LNG to its destination, and the extent to which LNG replaces more polluting energy sources or near-zero-emissions renewables.

Additionally, there is a risk that LNG crowds out public and private sector investments in renewable energy and locks in infrastructure that is incompatible with a net-zero future.

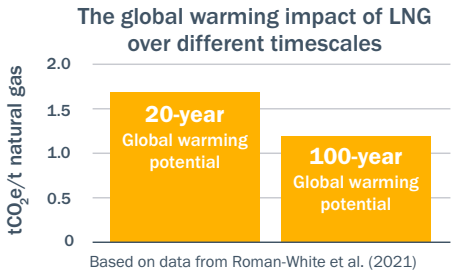
Can Canada get emissions credits for reducing coal use in Asian markets?

Some have suggested that, under the Paris Agreement, the export of LNG could generate emissions credits that could then be used to help Canada meet its own emissions reduction targets.[61] The argument is that coal use displaced by B.C. LNG could generate emissions reduction credits that could be transferred back to Canada under a mechanism known as internationally transferred mitigation outcomes (ITMOs). But in addition to the question of whether B.C. LNG actually displaces Asian coal use, it is unlikely that countries receiving B.C. LNG would be interested in giving away their credits—which they require to meet their own emission reduction targets—without any benefit in return.[62]

The effect of LNG on global emissions is highly uncertain



Methane leakage has a large global warming effect but goes uncounted or underreported. How strong the global warming effects are depends on whether you are looking at the short- or long-term.



Natural gas has the lowest direct combustion emissions among fossil fuels at 53 kg CO_2 per million Btu compared to 96 kg CO_2/MBtu for coal and 67 kg CO_2/MBtu for finished motor gasoline.[63] However, academic studies show that combustion emissions only provide a partial picture of climate impacts. Emissions associated with LNG are substantially higher when the full life-cycle and production emissions are taken into account, such as the emissions from liquefaction, flaring, and shipping.[64–67] Generally, exporting LNG significantly increases emissions compared to the use of natural gas domestically or exported through pipelines.[68,69]

Additionally, the upstream production of natural gas is associated with significant emissions of methane from leakage and venting, releasing a greenhouse gas that has 83 times the global warming potential of CO_2 over a 20 year period.[70] Natural gas production through hydraulic fracturing (also known as fracking) as is done in B.C. emits even higher levels of methane, with researchers in Saskatchewan finding methane emissions three times higher than at conventional sites.[71]

Methane leakage also occurs during transport and along the supply chain with studies finding leakage on ships being responsible for a third of the emissions from LNG transport,[65,72] and in pipeline incidents in B.C. being responsible for over 600 kt of CO_2e emissions since the 1980s.[73] These emissions are not accounted for in national emissions inventories. In fact, studies have found that overall methane emissions from oil and gas production have been consistently and severely underestimated in official reports, with studies in B.C., Canada, and the U.S. finding methane levels 1.5 to 2 times higher than official inventories.[74–80]

Numerous recent studies have modelled whether switching from imported coal to LNG in heating and electricity production in different Asian countries would reduce global emissions. Several studies mainly focused on the export of U.S. or Canadian LNG to China have found that a coal-to-LNG switch could lead to an emissions reduction of up to 62%.[66,81–84]

Estimates of potential emissions reductions vary widely though, with several key uncertainties and choices in methodology influencing the results. One of the studies modelling emissions reductions from a coal-to-Canadian LNG switch in Chinese power production conducted three independent life-cycle analyses.[83] While the analyses used the same data and scenarios, different methodological assumptions resulted in emissions reductions ranging from 34% to 62%.

When additional factors are taken into account such as the end-use of LNG, domestic market impact, induced additional energy consumption in importing countries, and methane leakage, estimate ranges become even wider and studies show that LNG could actually increase emissions compared to coal.[8,10,11]

Significant uncertainty is caused by the assumed levels of methane leakage in the supply chain.[8,11] A recent study found that gas systems leaking over 4.7% of their methane are on par with the emissions from comparable coal supply chains.[13] Moreover, life-cycle analyses of LNG supply chains often artificially spread out the global warming effects of methane over a 100 year period. However, this obscures the fact that methane has a much stronger global warming effect in the short term and climate scientists emphasize it will be crucial to rapidly eliminate methane emission as we transition to a low-greenhouse gas energy system.[85,86] Using a 20 year timeline to assess the impacts of methane emissions results in significantly higher emissions in the LNG supply chain.[11,65,87–89] A study that considered both a 100 and 20 year timeline showed that LNG supply chain emissions were 39% higher when using the latter.[82]

There is also no certainty that LNG would in fact replace coal at the destination. One study found that less than half of global coal capacity is within reach of natural gas pipelines, with an even lower share in heavily coal-reliant countries like India.[7] An increase in LNG supply could instead increase fuel usage overall or even displace renewables, leading to a much larger negative effect than any potential positive effects of coal-to-gas switching.[8,9] The Intergovernmental Panel on Climate Change estimates that the life-cycle emissions of combined-cycle gas power generation are more than 10 times the emissions of utility-scale solar PV and 41 times the emissions of offshore wind—and that is not accounting for the additional supply chain emissions of LNG, such as those from liquefaction, transport, and regasification.[90]

When modelling the global market effects, one study found that the effect of a new 2.1 Bcf/d LNG export facility in North America (around 16 million tonnes per annum and thus slightly larger than LNG Canada Phase 1) could be anywhere from reducing global emissions by 39 Mt CO_2e to increasing them by 11 Mt CO_2e, depending on the extent to which natural gas substitutes coal or increases overall energy use (notably, the study does not even consider the possible substitution of renewables).[12] Another study found that the effect on global life-cycle emissions could range from a decrease of 88 kt CO_2e to an increase of 170 kt CO_2e per Bcf of exports from the U.S. to Asia.[8]

The construction of LNG infrastructure itself also produces significant emissions. These alone are estimated to take anywhere between 1.3 and 20 years to be earned back through coal-to-gas emissions savings, if any.[91]

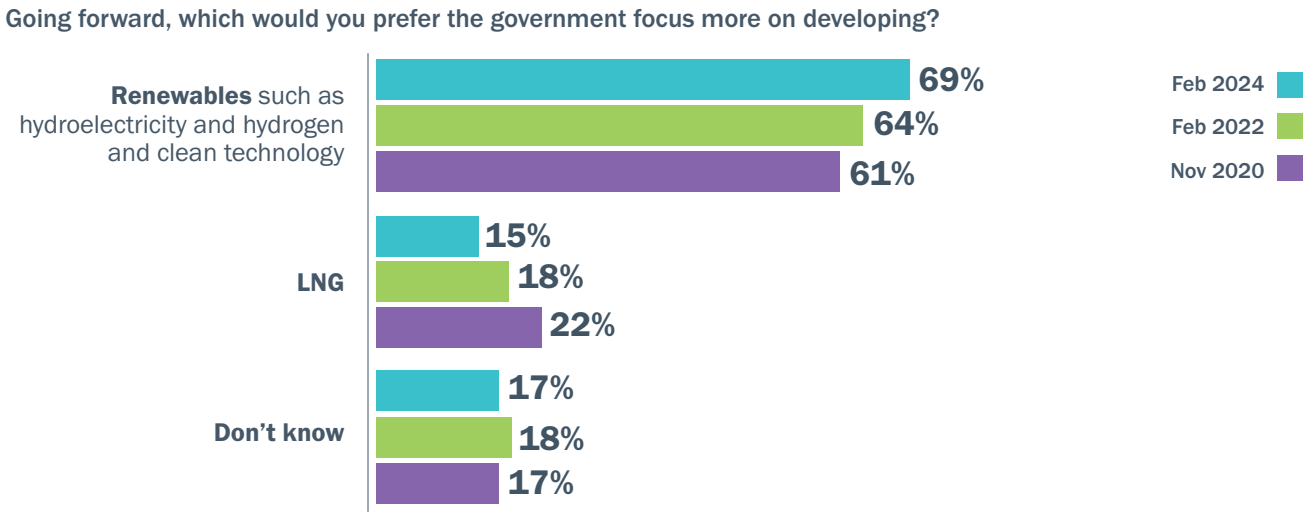
Having set out the significant uncertainties surrounding the role of LNG exports in reducing global emissions, it may also be worth noting that all but one of the studies finding that a coal-to-LNG switch could lead to emissions reductions were co-authored by employees of natural gas producing companies and/or funded by these companies.[81–84]

Lastly, investing in LNG as a bridge fuel could crowd out public and private-sector investments in renewable energy and lock in infrastructure that is incompatible with a net-zero future.[57,58] Indeed, the IEA found that there is no need for investment in new fossil fuel supply in a net-zero by 2050 pathway given the sharp decline in fossil fuel demand if the world is to achieve this climate goal.[1] Similarly, considering pathways compliant with the Paris Agreement, one modelling study found that LNG supply is already projected to outstrip demand and that there would be no additional benefit from any coal-to-gas switching after 2030 if the world is to stay within Paris targets.[92] Most of B.C.'s LNG export projects are currently slated to begin operations just two to three years before 2030, while LNG Canada Phase 1 is expected to start shipments in 2025, further minimizing any potential prospect of B.C. LNG reducing emissions at a global level.

Alternatives to developing B.C. LNG

Polling has consistently shown that British Columbians prefer developing the clean economy rather than LNG. Clean Energy Canada has commissioned periodic public opinion polls to gauge this question since 2020 and found an increasing number of respondents support developing renewables such as hydro electricity, clean hydrogen, and clean technology over LNG. Our latest survey, conducted in February 2024 by Stratcom, shows that 69% of respondents favour the B.C. government developing a clean economy, while only 15% prefer LNG.[93]

Figure 13: B.C. public opinion on LNG over time



Source: Stratcom for Clean Energy Canada[93]

Fortunately, B.C. has promising alternative economic opportunities to tap into rather than developing LNG exports amid uncertainty about future demand for this fossil fuel, a looming global oversupply, exacerbating affordability concerns for British Columbians, risking public dollar-backed stranded assets, and diverting construction workers away from housing and other projects.

Critical minerals, metals, and clean hydrogen are among the key sectors of B.C.'s economy that are poised for growth and offer economic alternatives to developing LNG exports. Before turning to these economic opportunities in the province, this section sets out the global context by surveying worldwide energy trends over the past decade and beyond.

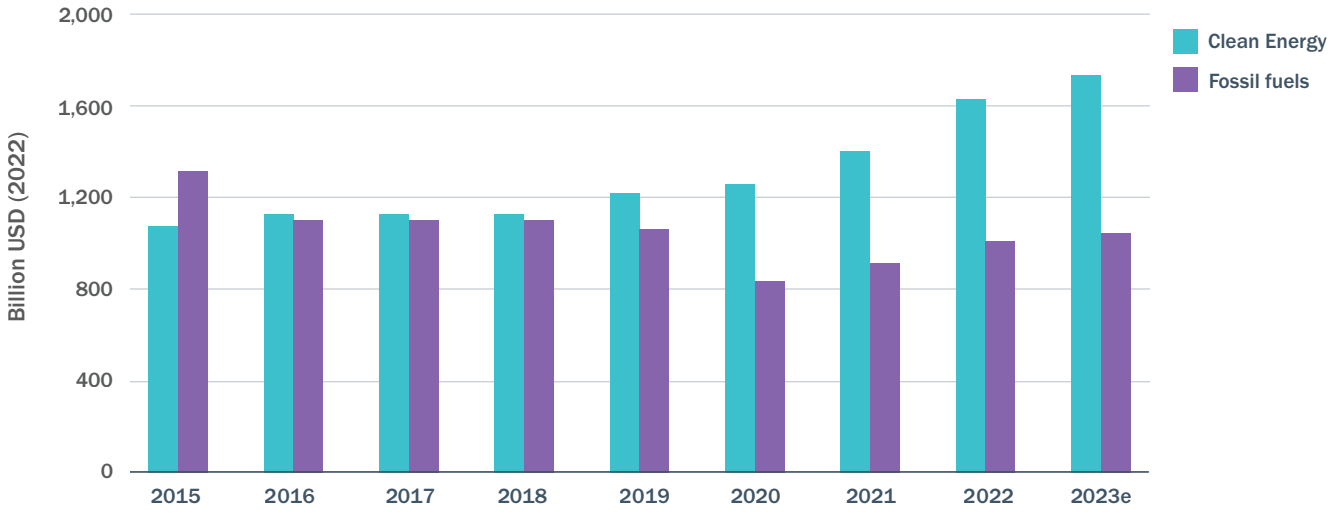
Global energy trends

The declining costs and increased deployment of clean technologies worldwide over the past few decades have impacted global energy investment, directing funds away from fossil fuels and toward clean energy. At the same time, most energy-economy models have historically underestimated deployment rates for renewable energy technologies and overestimated their costs.[94]

Global energy investment

The gap between clean and fossil energy investments has been widening over the last five years, with strong growth in clean energy outpacing investments in fossil fuels. Figure 14 illustrates this global trend.

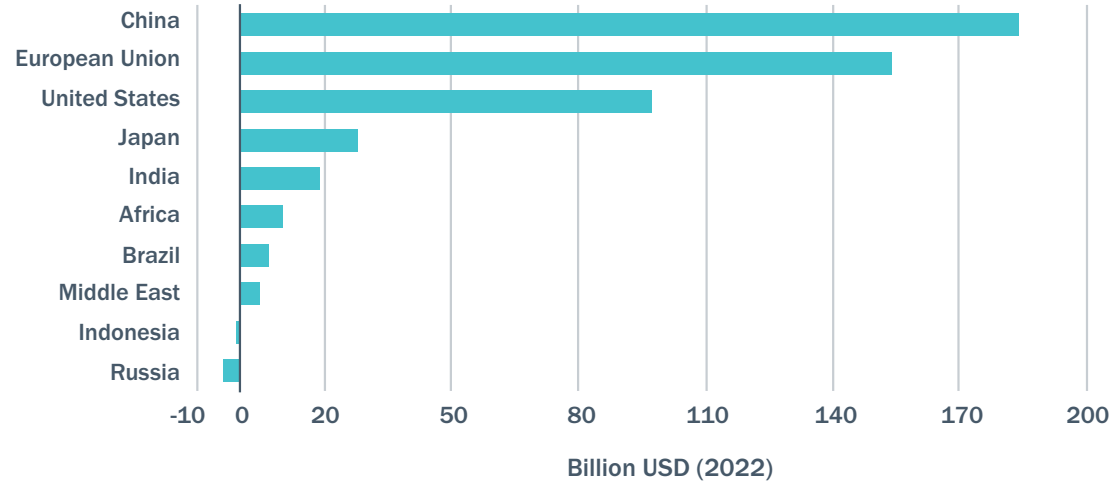
Figure 14: Trends in global energy investment



Source: IEA World Energy Investment 2023[95] Note: Data for 2023 is estimated

As shown in Figure 15, the increase in clean energy investments in China and Japan—both expected to be the destination of B.C.'s planned LNG exports,[37]—have been among the most pronounced in the world.

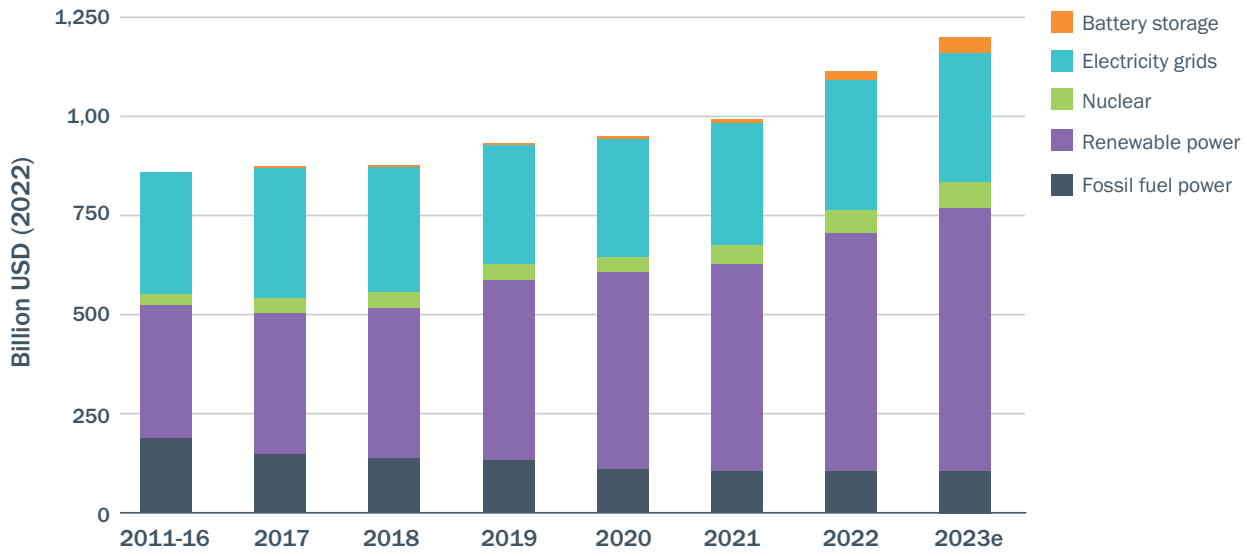
Figure 15: Increase in annual clean energy investment in selected countries and regions



Source: IEA World Energy Investment 2023[95]

Looking at the electricity sector specifically, Figure 16 shows how global investments in fossil fuel power have been declining while those in clean electricity have been surging over the past decade and beyond.

Figure 16: Global average annual investment in the power sector

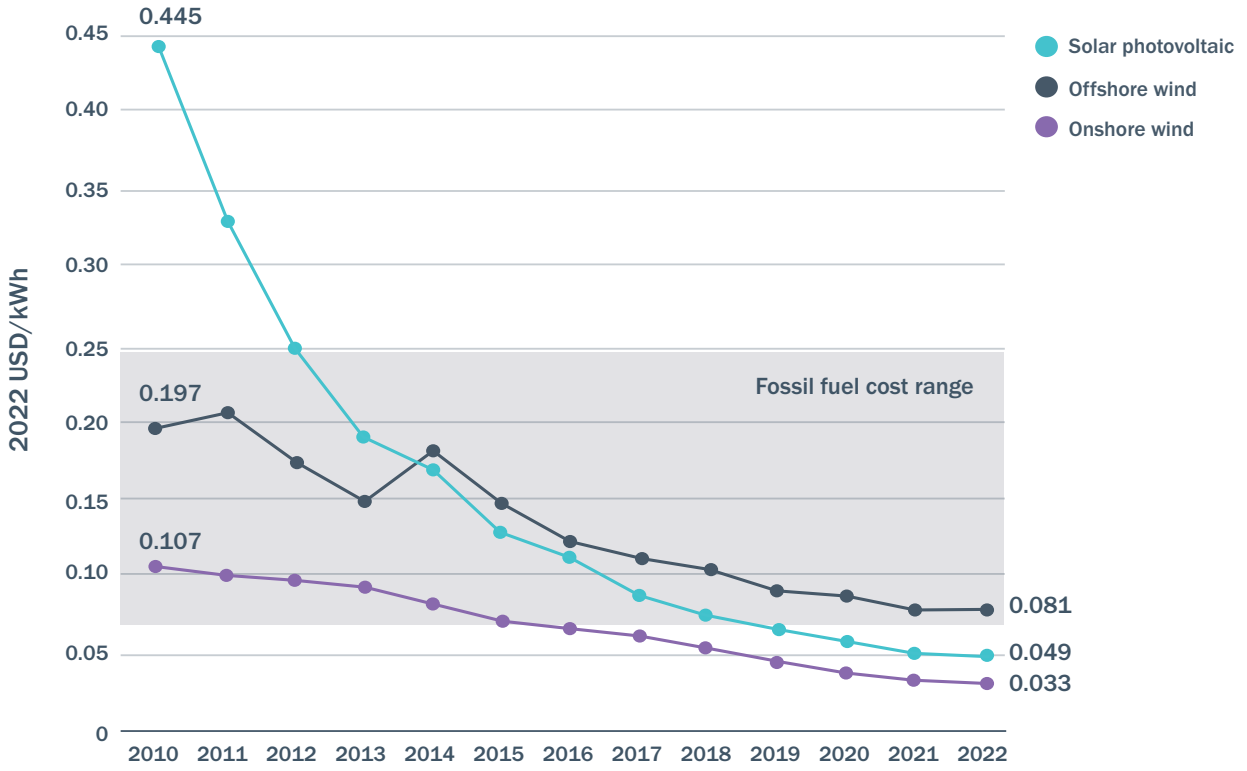


Source: IEA World Energy Investment 2023[95]

Renewable electricity

The cost of variable renewables has seen a strong decline worldwide over the past decade and beyond, as shown in Figure 17.

Figure 17: Global weighted average levelized cost of electricity from newly commissioned variable renewables



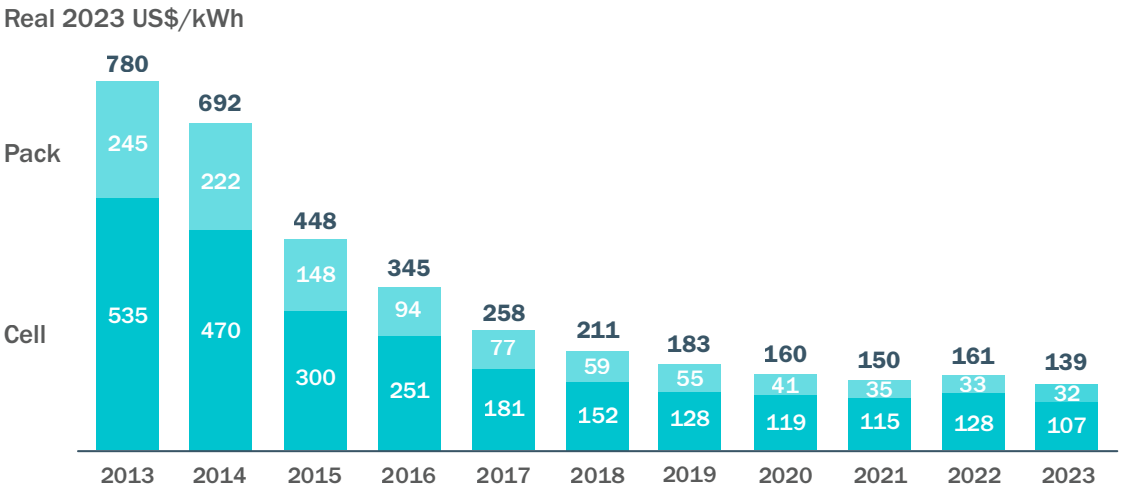
Source: International Renewable Energy Agency[96]

At the same time, global capacity additions of renewables have surged over the past two decades, outpacing capacity additions from all other electricity sources since 2016. More than 80% of capacity installations worldwide came from renewables in 2022. In fact, renewables are anticipated to provide more than one-third of total global electricity generation by early 2025, overtaking coal.[97]

Batteries

Variable renewables are expected to become even more cost-competitive with electricity from fossil sources like natural gas as energy storage costs continue to fall. For example, analysis from BloombergNEF in Figure 18 shows a decline of more than 80% in lithium-ion battery prices over the last 11 years across applications ranging from vehicles to stationary storage.[98] Looking ahead, the U.S. National Renewable Energy Laboratory projects utility-scale lithium-ion battery storage costs to potentially halve over this decade, with continued cost declines through 2050.[99]

Figure 18: Volume-weighted average lithium-ion battery pack and cell price split

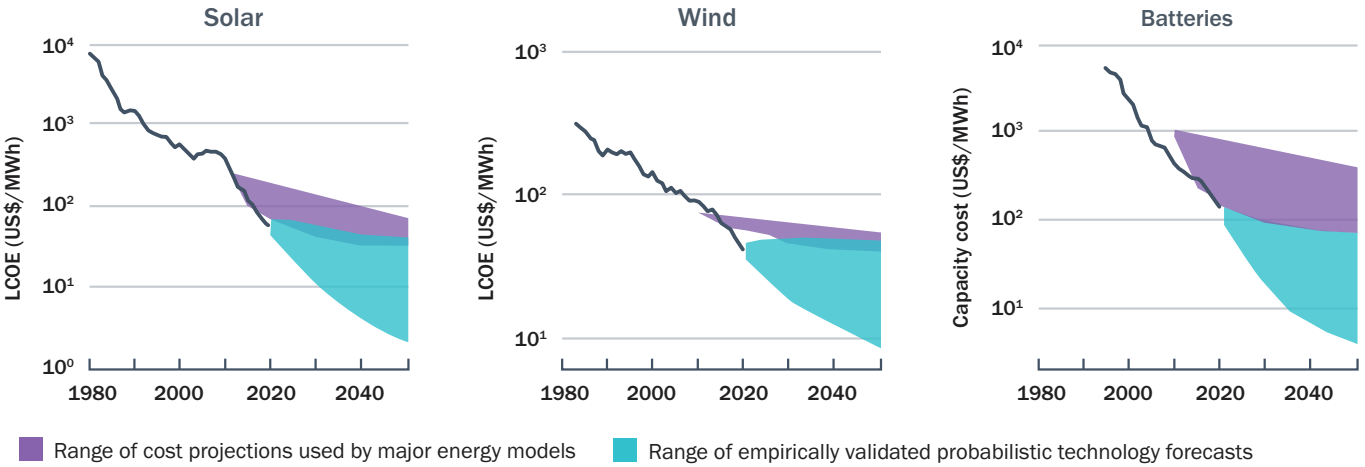


Source: BloombergNEF[99]

Overestimation of clean technology costs

The strong cost declines in clean technologies like renewables and batteries over the past few decades have exceeded expectations for many. Similarly, most energy-economy models have historically underestimated deployment rates for renewable energy technologies and overestimated their costs. A recent study generated probabilistic cost forecasts of energy technologies using a method that has been statistically validated on data for more than 50 technologies.[93] Using this approach to estimate future energy system costs, the authors find these technology cost estimates to be far lower than most energy economy models suggest.

Figure 19: Cost forecasts of solar, wind, and battery technologies through 2050



Source: Way et al.[94]

B.C. alternatives to LNG development

A recent Clean Energy Canada report found that B.C. is set to see 400,800 jobs in its clean energy sector by mid-century in a net-zero world, up from 83,100 in 2025—a growth of 6% per year.[101] This growth of the clean energy sector outpaces the decline in fossil fuel jobs.

Indeed, several sectors of B.C.'s clean economy are poised for growth and offer an economic alternative to developing LNG exports.[16] Key sectors include critical minerals, metals, and clean hydrogen. In contrast to LNG, these industries make a net-zero compatible use of B.C.'s scarce clean power resources.

Critical minerals and metals

Following the federal government's 2022 critical minerals strategy,[102] the B.C. government announced a provincial critical minerals strategy in January 2024.[103]

B.C. is Canada's largest producer of copper, only producer of molybdenum, and also produces zinc and manganese.[104] These four metals are elements on Canada's list of minerals and metals considered essential for continued economic success during the ongoing energy transition.[105] B.C. also has near-term potential to contribute significantly to the production of other critical metals required for the clean economy, including nickel, rare earth elements, niobium, tantalum, tungsten, and cobalt.[104] The province's shipments in copper alone exceeded $3.2 billion in 2022.[106] Driven by demand for critical minerals like copper which is needed to sustain wide-scale electrification, investments in mineral and metallurgical coal exploration in B.C. surged to a 10 year high of $740 million in 2022.[107] Globally, the production of certain metals and minerals could increase by up to nearly 500% over the next three decades to meet growing demand for clean technologies.[108]

Proposed critical-mineral mines in B.C. could each make $1 billion per year in revenues if approved.[109] This is according to a recent study commissioned by the Mining Association of B.C. that found the 16 proposed mines—ranging from a copper/gold operation in northern Vancouver Island to a niobium mine in northeastern B.C. and a nickel mine in the northwest could generate a combined $180 billion in labour income over their lifespans and generate more than $150 billion in tax revenue for all levels of government.[110]

B.C. has also proven success further down the battery supply chain that spans from mining and processing critical minerals to manufacturing batteries and their components. In November 2023, the province secured investment in a $1 billion lithium-ion battery cell manufacturing plant to be located in Maple Ridge that will create 350 new jobs.[111] Canada-wide, the battery supply chain has the potential to support up to 250,000 jobs by 2030 and add $48 billion annually to the Canadian economy.[112]

Clean hydrogen

Following the federal hydrogen strategy of 2020,[113] B.C.'s hydrogen strategy of 2021 set out the province's plan to become a leading hydrogen economy.[114] B.C.'s hydrogen export potential alone is estimated at $15 billion annually by 2050.[115] Canada-wide, the domestic market for direct hydrogen and related product sales could be worth more than $50 billion per year and create up to 350,000 jobs by 2050.[113]

An example of a recent major clean hydrogen project is the agreement of October 2023 between B.C. and McLeod Lake Indian Band to build a $7 billion clean hydrogen hub on the Kerry Lake Indian Reserve, 90 kilometres north of Prince George.[116] The project is expected to complete in 2026 and would create 500 permanent jobs and a temporary workforce of as many as 2,000 workers during construction.

Clean Energy Canada estimates that in a net-zero world, B.C.'s hydrogen fuel cell sector alone is set to grow by 25% annually and employ around 10,000 people in 2050.[101] The province is already home to several world-leading fuel cell manufacturers and Metro Vancouver has been described as the "Silicon Valley of fuel cell technology".[117]

Decisions ahead

The risk is real that more LNG development will crowd out cleaner industries better poised for growth in the coming decades, as is the risk of future stranded assets backed by government incentives drawing on taxpayer dollars. **To minimize these risks to the province's economy and the B.C. taxpayer, the B.C. government should:**

- **Develop an economy-wide industrial strategy** that aligns with a net-zero economy, prioritizes opportunities for clean economic growth, and considers the scarcity of resources like electricity supply, government incentives, and construction workers.

- **Develop specific roadmaps for net-zero aligned industries** that lay out the timelines and actions needed to secure the necessary clean energy, labour, and infrastructure for these sectors.

- **Develop a decision-making framework** to prioritize the use of available clean electricity that supports household affordability, underpins energy security, and prioritizes industrial investments in alignment with climate targets.

- **Amend the province's environmental assessment process** to require the consideration of emissions from the use of exported LNG (termed scope 3 emissions).

Endnotes

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CLEAN ENERGY CANADA

Clean Energy Canada
1628 West 1st Avenue, Suite 213
Vancouver, B.C., V6J 1G1

SFU MORRIS J. WOSK CENTRE FOR DIALOGUE