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LNG exports and carbon credits

CREDITS WHERE CREDIT IS DUE

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MLI
TRUE NORTH IN CANADIAN PUBLIC POLICY

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Under the basic current climate accounting rules to which Canada and all other UNFCCC parties have agreed, countries are responsible for reducing GHG emissions within their own national borders. If a country supported a project in another country, it would receive zero credit, no matter what help it may have provided. Therefore, countries have a big incentive to fund projects only within their own borders to help meet their own national carbon reduction goals. That is unfortunate for the planet's emission reduction efforts. The focus on emission targets within national borders is a shortfall in the nationally based climate accounting system.

To address this shortcoming, the UNFCCC has adopted a framework covered in Article 6 of the Paris Agreement enabling countries to cooperate and share emission reductions. This framework allows carbon credits (known as internationally transferable mitigation outcomes, or ITMOs) to be transferred from the country where the reductions occurred to the country that helped undertake the emissions reduction project.

Sharing emissions reductions through Article 6 is possible when liquefied natural gas (LNG) replaces coal in power generation. This substitution is especially important because coal-fired power plants are expected to produce large amounts of the world's energy (and GHGs) over the next several decades, even though coal emits much more carbon than other primary fuel sources. Even more troublesome is that new coal plants are still being built in significant numbers. Those new plants alone are expected to emit over 1,415 Mt CO2e (mega tonnes of CO2 equivalent) per year, which dwarfs Canada's national targeted reductions of approximately 310 Mt CO2e per year by 2030.

Canada, meanwhile, is preparing to become a supplier of LNG. New LNG projects within British Columbia are amongst the least carbon-intensive sources of LNG in the world. BC's LNG exports could lower global carbon emissions by displacing coal power, particularly in the Asia-Pacific region. Developing markets in Asia would welcome rapidly rising LNG imports. Realistically, BC LNG should be fully used as a substitute fuel to mitigate the carbon emissions impact of existing coal-based power plants, especially those currently used for heating.

While the concept of Article 6, where carbon credits are shared for collaboratively developed projects, is straightforward, the criteria and rules for implementing it are complex. This paper makes the case for how Canada can earn ITMOs based on exports of British Columbia-sourced LNG. An important criterion for making projects ITMO eligible is that the project would not have gone ahead without carbon credits being available. This suggests deals should be structured involving LNG exports along with some other value-added Canadian participation that assists a developing country in switching from coal to LNG as a fuel source. The ITMOs Canada receives could offset any incremental costs we would incur.

If Article 6 is used, the assertion that British Columbia's pursuit of LNG production would prevent the province from meeting its emission reduction becomes inaccurate. Just over half of LNG Canada's Phase 1 production capacity in British Columbia would result in approximately 1.2 Mt CO2e emissions annually. Using the same production capacity to replace coal for power generation in Asia has the potential to significantly reduce emissions, ranging from 14.9 to 35.2 Mt CO2e per year. Such outcomes underscore the importance of international collaborative efforts.

Canada should announce its intent to use Article 6 as a tool to help meet its emissions reduction targets. The federal government should then work with industry to identify candidates for bilateral agreements. Common methodologies for measuring, tracking, and verifying carbon mitigation outcomes would all need to be developed as would a registry for tracking and transferring ITMOs. These are complex issues, but we can learn from other countries that have already established processes for managing such projects. MLI

Selon les règles fondamentales de comptabilisation convenues par les parties à la Convention-cadre des Nations Unies sur les changements climatiques (dont le Canada), les pays sont tenus de réduire les émissions de gaz à effet de serre à l'intérieur de leurs frontières. Un pays qui soutiendrait un projet à l'étranger ne recevrait aucun crédit, quelle que soit l'aide apportée. Les pays sont donc fortement incités à financer des projets uniquement sur leur territoire pour atteindre leurs propres objectifs nationaux. Malheureusement, cela n'aide en rien les efforts de réduction mondiaux. L'accent mis sur les objectifs d'émissions intrafrontalières est une lacune du système national de comptabilité climatique.

Pour combler cette lacune, les parties à la Convention-cadre ont adopté le mécanisme gouverné par l'Article 6 de l'Accord de Paris, qui permet aux pays de coopérer en partageant leurs réductions d'émissions. Ce mécanisme autorise le transfert des crédits carbone (appelé utilisation de résultats d'atténuation transférés à l'échelle internationale ou RATI) du pays qui est l'hôte des réductions vers le pays qui a aidé à la réalisation du projet de réduction.

En vertu de l'Article 6, il est possible de partager des réductions d'émissions lorsque le gaz naturel liquéfié (GNL) remplace le charbon dans la production d'électricité. Cette substitution revêt une importance particulière en raison des grandes quantités d'énergie exploitable (et de GES) que les centrales électriques au charbon produiront mondialement au cours des prochaines décennies, malgré le fait que le charbon émet beaucoup plus d'émissions que les autres sources d'énergie primaire. Encore plus troublant, de nouvelles centrales au charbon continuent d'être construites en grand nombre. Elles devraient émettre, à elles seules, plus de 1 415 mégatonnes d'équivalent en CO2 par an, ce qui éclipse les réductions nationales visées par le Canada, à savoir d'environ 310 mégatonnes d'équivalent en CO2 par an d'ici 2030.

Entre-temps, le Canada se prépare à devenir un fournisseur de GNL. Les nouveaux projets en Colombie-Britannique comptent parmi les sources de GNL les moins carbo-intensives dans le monde. Les exportations britanno-colombiennes de GNL pourraient réduire les émissions mondiales en remplaçant le charbon des centrales, en particulier dans la région de l'Asie-Pacifique. Les marchés en expansion de l'Asie accueilleraient favorablement une hausse rapide des importations de GNL. Soyons réalistes : les GNL de la Colombie-Britannique devraient être pleinement utilisés comme combustible de substitution pour atténuer l'impact des émissions de carbone des centrales au charbon existantes, en particulier celles qui sont actuellement dédiées au chauffage.

Bien que le concept de partage des crédits carbone prévu à l'Article 6 pour les projets collectifs paraisse simple, les critères et les règles de mise en œuvre sont complexes. Le présent document explique comment le Canada pourrait obtenir des RATI sur la base des exportations de GNL britanno-colombiennes. En effet, pour que les projets soient admissibles aux RATI, ils ne doivent se concrétiser qu'avec l'aide des crédits carbone – un critère important. Il conviendrait donc de structurer les accords en associant les exportations de GNL à certaines autres participations canadiennes propices à la transition des pays en développement du charbon au GNL. Les RATI obtenus par le Canada pourraient compenser tous les coûts supplémentaires encourus.

Le recours à l'Article 6 permettrait de réfuter l'affirmation selon laquelle la production durable de GNL en Colombie-Britannique empêche la province d'atteindre ses objectifs en matière de réduction des émissions. Plus de la moitié de la capacité productive de la phase 1 de LNG Canada sera à même de générer des émissions annuelles d'environ 1,2 mégatonne d'équivalent en CO2. Substituer cette capacité au charbon pour produire de l'électricité en Asie pourrait réduire considérablement les émissions, soit de 14,9 à 35,2 mégatonnes d'équivalent en CO2 par an. De tels résultats soulignent l'importance de la collaboration internationale.

Le Canada devrait annoncer son intention de recourir à l'Article 6 pour atteindre ses objectifs de réduction des émissions. Le gouvernement fédéral travaillerait ensuite avec l'industrie pour désigner les candidats à des accords bilatéraux. Des méthodologies communes de mesure, de suivi et de vérification des résultats en matière d'atténuation *des émissions de carbone devront être élaborées, de même qu'un registre pour le suivi et le transfert des RATI. Il s'agit de questions complexes, mais nous pouvons tirer des leçons des pays qui ont déjà mis en place des processus de gestion pour de tels projets.* MLI

Introduction

Recognizing the importance of international cooperation for carbon mitigation

All greenhouse gas (GHG) emissions contribute to climate change, regardless of their origin. Therefore, it is crucial for countries to collectively mitigate GHGs to the greatest degree possible, no matter where they occur. The United Nations Framework Convention on Climate Change (UNFCCC) requires countries to reduce emissions within their own borders. But this approach doesn't factor in the potential for cross-border projects to make a big impact on lowering carbon emissions worldwide.

For instance, consider a hypothetical scenario involving two countries, let us say Canada and Malaysia. Canada can undertake one of two potential carbon mitigation projects. The first project, in Canada, can reduce GHGs by 8 million tonnes (Mt) per year. The second project is in Malaysia. It costs the same as the Canadian-based project but will mitigate 12Mt of GHGs per year. All else equal, almost everyone would agree that Canada should pursue the latter project as it will have the greatest impact on reducing global carbon emissions.

However, under our basic current climate accounting rules, which Canada and all other UNFCCC parties have agreed to, Canada would receive zero credit towards meeting its own GHG reduction goals if it went ahead with the project in Malaysia, no matter the financial, technological, or other types of help it may have provided. The emissions reduction benefits would all accrue to Malaysia. Therefore, Canada would likely undertake the first project within its borders to help meet its own national carbon reduction goals. And that would be unfortunate for the planet's emission reduction efforts. The focus on emission targets within national borders is a shortfall in the nationally based climate accounting system.

To address this shortcoming, the UNFCCC has adopted a framework covered in Article 6 of the Paris Agreement, enabling countries to cooperate and share emission reductions. This framework allows carbon credits, more formally referred to as internationally transferable mitigation outcomes (ITMOs), to be transferred from the country where the reductions occurred to the country that helped in undertaking the emissions reduction project.

> *The UNFCCC has adopted a framework covered in Article 6 of the Paris Agreement, enabling countries to cooperate and share emission reductions.*

Article 6 is rooted in the economic concept that when countries trade based on their comparative advantages, both will obtain higher financial benefits than if they had produced all the goods independently. In the context of emission reduction projects, countries may have comparative advantages in technologies, lower local costs, or mitigation opportunities. An analysis by the University of Maryland and the International Emissions Trading Association estimates that nations cooperating in this manner could realize annual savings of up to $300 billion (Gessaroli 2023).

Looking back to the above hypothetical mitigation projects, if Canada used the Article 6 framework, the highest impact carbon mitigation project in Malaysia would now be worth pursuing. The perverse incentive favouring unilateral emissions reduction projects would have been removed.

Carbon credits and BC LNG

Liquified natural gas (LNG) is a less GHG intensive fossil fuel than coal or petroleum. Moreover, new LNG projects within British Columbia are amongst the least carbon-intensive sources of LNG in the world (Findlay 2019).

For some time now, industry, government, and policy experts have discussed using BC's LNG exports to displace existing coal generation, generally in the Asia-Pacific region, as a way to lower global carbon emissions. Another topic of discussion has been whether Canada should receive credit towards its own carbon emission goals when BC-sourced LNG replaces coal use in other countries. (Rioux 2019; Speer, Henderson, and Feenan 2021; CAPP 2019; The Electricity Forum [2019]; Tasker 2019; Canadian Press 2023).

These discussions were ongoing even before the UNFCCC established Article 6 in 2015. The new framework allows countries to receive credit for their contributions to emission reductions outside their borders. The first example of a cooperative agreement to lower carbon emissions under Article 6 involves Switzerland and Ghana. Through jointly undertaken mitigation projects in Ghana, Switzerland became eligible to receive a portion of the emission credits (ITMOs) generated by these initiatives.

Purpose of the paper

Article 6 of the Paris Agreement allows for cooperative mitigation projects between countries where a portion of a project's emission reductions in one country can be transferred to another participating country. While the concept is relatively straightforward, implementing it is complex.

An essential condition for eligible cooperative mitigation projects is that they remove "additional" amounts of GHGs from the atmosphere. The "additionality rule" for such projects is satisfied when projects lower GHG emissions beyond the level they would have been reduced if the transferable credits were not available, and the activity would not have gone ahead. While there are many other requirements, meeting the additionality rule is essential for an activity to be eligible to transfer ITMOs.

This paper makes a case for Canada earning ITMOs based on exports of British Columbia-sourced LNG to foreign markets.

Coal-fired power plants are not going away anytime soon

Coal-fired power plants are expected to produce large amounts of the world's energy (and GHGs) over the next several decades, notwithstanding the fact that coal emits much more carbon than other primary fuel sources and the widespread political rhetoric proclaiming the need to move away from coal. Even more troublesome is that new coal plants are still being built in significant numbers. As of July 2023, 637 new coal plants worldwide have been announced or permitted, and another 402 are already under construction (Global Energy Monitor 2023). Many of these plants are being built in Asia, as fast-growing Asian economies struggle to meet domestic energy demands.

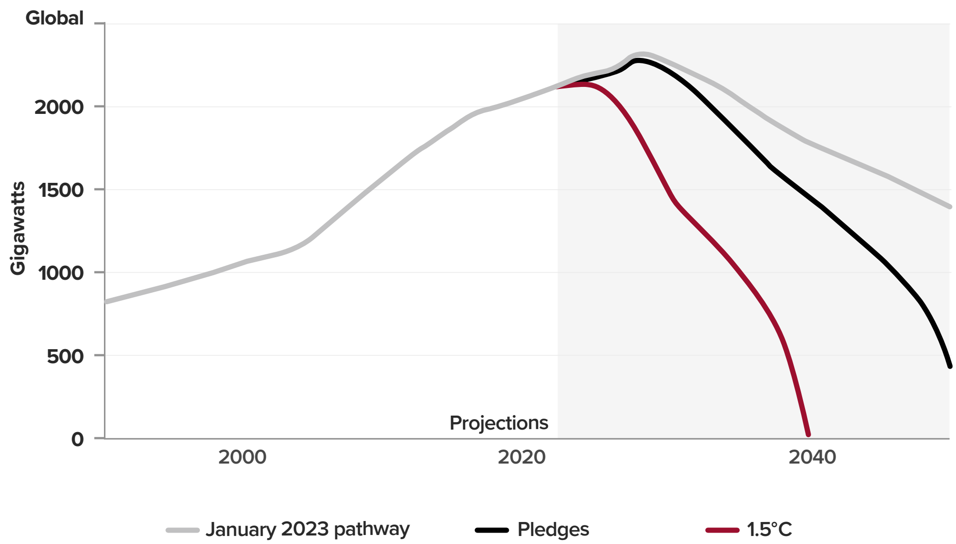
To put the ongoing coal plant build-out into perspective, the plants announced or planned alone are expected to emit over 1,415 Mt CO2e per year (Global Energy Monitor 2023). This figure dwarfs Canada's national targeted reductions of approximately 310 Mt CO2e per year by 2030.[1]

Figure 1 shows the forecasted energy generated by coal plants under various scenarios. Neither the "business-as-usual" (grey line) nor "national pledges" (black line) scenarios to reduce coal-based GHG emissions will come close to meeting the 2018 agreement needed to limit an overall temperature increase to 1.5°C.

The relative newness of Asia's coal infrastructure poses another challenge to emissions reductions in the short and medium term. Existing coal plants in China, India, and Southeast Asia, on average, are between eight and 14 years old, meaning most will be operational for decades to come – coal plants have an average lifespan of around 50 years (IEA 2022a). Even under each nation's pledged carbon reduction scenario, countries will keep their plants operating on average for 30 years (IEA 2021a). The IEA estimates US $1 trillion is currently invested in coal plants, and their politically influential owners will not want to see their investments prematurely decommissioned (IEA 2022a; Global Energy Monitor and Centre for Research on Energy and Clean Air 2022).

No matter the national pledges or exhortations from policy experts and politicians, coal-fired power plants will be a significant source of GHG emissions for the foreseeable future. We must now look to halt further construction and offset the emissions from existing plants.

FIGURE 1: GLOBAL COAL RETIREMENTS FORECAST: BUSINESS-AS-USUAL, PLEDGED, VS 1.5°C GOAL



Source: Boom and Bust Coal 2023: Tracking the Global Coal Plant Pipeline - Global Energy Monitor

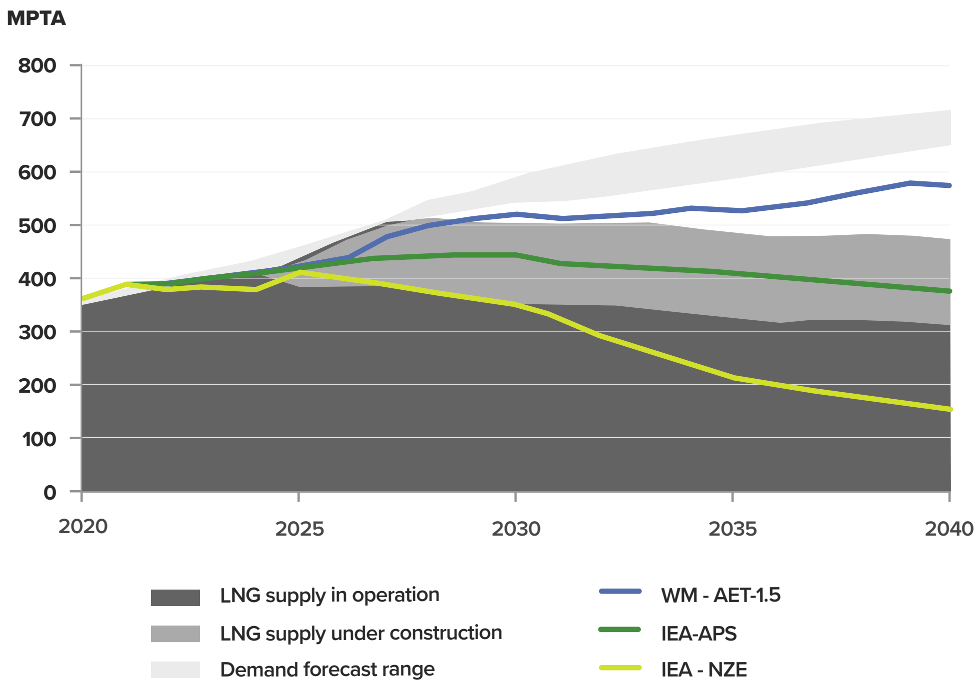
LNG as a Substitute Fuel for Coal

LNG is seen as a "transition fuel" by the EU and others (European Commission 2022; Kumagai 2021; Norsyahida, Ishak, Mustapa, and Ayodele 2021). LNG-powered facilities can also complement renewable power sources. While wind and solar energy are often cost-competitive, variability in wind and sunlight requires these sources to have a backup power source during periods of calm winds or low or no sunlight. Gas-fueled plants are often used as a dispatchable and peaking power source since they can quickly respond when renewable-sourced power falters (IEA 2023).

Global consulting firm McKinsey & Company sees LNG as a viable transition fuel, forecasting its demand will be the most resilient of all fossil fuels. McKinsey also believes LNG demand will be more resilient than demand for non-liquified natural gas due to LNG's greater flexibility in reaching markets with limited or no gas pipeline infrastructure, and that its use will not peak until the mid-2040s (Agosta, Bresciani, and Heringa 2021).

An analysis from Fitch Solutions indicates that developing markets in Asia "look set for a rapid rise in LNG imports." Growth [within the region] is

FIGURE 2 GLOBAL LNG SUPPLY VS DEMAND SCENARIOS[a]



[a] IEA-APS and IEA-NZE are the International Energy Agency's (IEA) two different scenarios used to forecast emissions reduction to 2050. WM – AET-1.5 is the Woods Mackenzie scenario forecasting emissions reduction to 2050.

Source: Shell LNG Outlook 2023.

increasingly well-diversified," continues the analysis, "although India emerges as a clear leader in volume terms." Fitch concludes that "Strong underlying economic and demographic trends, rising policy support for gas, limited domestic gas supplies, and a lack of pipeline alternatives all paint a bullish picture for LNG demand in the region." (Richards, 2022)

India and China, the region's two most populous countries, are both investing heavily in new gas pipeline networks. Between the two countries, over 32,000 km of new pipelines are under construction, at a cost totalling US $42 billion (Langenbrunner 2023). Of note, China has an additional 40,000 km of new pipelines planned for construction (Global Energy Monitor 2022).

Figure 2 shows Shell's long-term forecast for LNG supply and under various demand scenarios.

Significant carbon reductions from coal to LNG switching

Researchers from the University of British Columbia, the University of Calgary, and Stanford University conducted a comprehensive lifecycle emissions study. The study examined the emissions of Chinese coal-fired power plants and an alternative fuel, Canadian LNG. According to the study's findings, as shown in Table 1, coal plants emitted 848 to 1,114 grams of CO2e per kilowatt-hour (kWh), while using Canadian LNG resulted in emissions ranging from 427 to 556 grams of CO2e per kWh. This fuel significantly reduced greenhouse gas emissions from 34 to 62 percent.

In terms of scale, if one billion cubic feet of natural gas were produced daily (just over half of LNG Canada's Phase 1 daily output), the annual abatement of GHGs would range from 14.9 to 35.2Mt of CO2e. The emissions analysis encompassed not only the combustion phase but also accounted for emissions associated with the production, transportation, liquefaction, and shipping the LNG to China (Nie et al. 2020).

A separate study focused exclusively on British Columbia LNG exports to China, investigating BC LNG as a substitute for coal as a fuel for district heating power plants (Kotagodahetti et al. 2022).[2] This study also considered lifecycle emissions and showed that using BC LNG exports resulted in a 60 percent reduction in GHG emissions when used in district heating power plants. This finding aligns with the upper end of the reduction range observed in the previous study.

TABLE 1: LIFECYCLE EMISSIONS (LCE) FROM CHINESE COAL PLANTS AND REDUCTIONS FROM USING CANADIAN LNG

LCE, Chinese coal plants	848g – 1,114g CO2e/kWh
LCE, LNG from Canada	427g – 556g CO2e/kWh
Reduction CO2e possible	291g – 687g CO2e/kWh
Reduction in CO2e per year	14.9Mt – 35.2Mt CO2e[a]

[a] based on one billion cubic feet per day (Bcf/d) of natural gas converted to LNG and shipped.

Source: Nie, et al., 2020.

TABLE 2: C02E TONNES EMISSIONS INTENSITY BY SOURCE OF LNG

SOURCE OF LNG	CO2e tonnes emissions intensity (per tonne of LNG)
LNG Canada (BC)	0.15
Cedar LNG (BC)	0.08
Woodfibre LNG (BC)	0.03
LNG average (worldwide)	0.26 – 0.35

Sources: LNG Canada; Cedar LNG Project Environmental Assessment Certificate Application; Canadian Energy Centre.

It is also worth noting that not all LNG has the same carbon emissions profile. Its source, the processes involved in its extraction, transportation, and the type of energy used for liquefaction, all affect the carbon content of natural gas. The distance travelled during shipping also affects the LNG's overall carbon footprint. British Columbia's natural gas possesses one of the lowest carbon emission profiles among all sources of LNG produced worldwide, as shown in Table 2.

Coal to natural gas switching is a just transition

Any successful move away from coal-fueled power production will need to account for the social and economic consequences of affected employees, communities, and ratepayers, as well as the need for financial sustainability. Coal plants are often the primary employer in small communities. Such a large employer ceasing operations would adversely impact employment, housing values, tertiary services, and local tax revenues needed to pay for basic services. An Australian study of 12 coal power plant closures showed that unemployment rises initially, as expected, but remains higher even two years after a coal plant's closure, suggesting some negative longer-term structural impacts. Similar concerns are evident in United Kingdom and the United States (Burke , Best, and Jotzo 2018).

The case for converting coal-fueled plants to natural gas plants is strong. 103 coal plants have switched to natural gas in the United States between 2011 and 2019, (U.S. EIA, 2020). And between 2005 and 2019, coal-to-gas fuel switching in the US reduced GHG emissions by 530Mt (U.S. EIA 2021).

The IEA also suggests that repurposing coal plants to other fuel sources could reduce job losses and other economic consequences associated with the decommissioning of coal plants:

> The *conversion* [italics added] of coal power plants should be seriously considered before their closure is planned, as it enables the owner to retain some of the value of the existing assets and the community to maintain a source of jobs and taxes. Conversion can also aid the smooth functioning of the electricity system. Policy makers, regulators and other stakeholders should be aware of that potential and set up the legal and social framework necessary to extract ongoing value from existing coal power plants (IEA 2021b, 18-19).

Two common conversion methods are replacing the coal-fueled plant with a combined cycle natural gas plant and replacing the coal plant's steam boiler. Either option will take advantage of the existing grid connections, sub-stations, lower remediation costs, and reusing existing infrastructure (Henkel 2023). An existing skilled local workforce and ancillary services in the community can also support a coal-to-gas converted power plant (Siemens Energy [2023]). While solar or wind facilities can theoretically be built on the same site, factors such as solar radiation, terrain, size, and wind levels may pose barriers to these options.

Stranded coal plants and the financial cost to society

Coal power plants can have an economic lifespan of 30 years or more. We can measure economic life in several ways – such as the years taken to depreciate the plant on a balance sheet or years until the cost of operating the plant is greater than the earnings stream it provides. The goal of net zero emissions by 2050 would require a much faster decommissioning of coal-powered plants than in the business-as-usual case.

For example, let us say that a coal plant costs $1 billion to build and has an economic lifespan of 30 years. Before proceeding, a utility must be confident that the plant can generate revenues over 30 years to cover its operating costs, the $1 billion investment, and a minimum rate of return acceptable to investors.

Now assume the coal plant was built 10 years ago but will have to be decommissioned in 20 years rather than 30 years. Assuming the plant is being depreciated over 30 years – by year 20, its early decommissioning date, the utility will value the plant at $333.3 million on its balance sheet. The utility would then have to write off the $333.3 million. And if the plant was financed by debt, there would still be $333.3 million of debt to be repaid.

The utility would also have to replace the power lost from the plant's closure. Let's say it develops a combination of wind and solar facilities at a total cost of $900 million. The utility will probably have to pay a higher interest rate on the new debt incurred to build the solar and wind facilities, as it is now less creditworthy due to the coal plant write-off.

A regulated utility would ask the energy regulator to set rates that will cover the $900 million investment, a minimum acceptable return to investors, and the principal and interest payments remaining on the $333.3 million debt it still holds. This places an onerous burden on ratepayers and disproportionately hurts lower-income households, as they spend a larger portion of their income on heat and power.

The above scenario also does not consider the added costs for dispatchable power, which will be needed as a backup power source in times of low wind or sunlight. This cost will also be factored into the new rate charged to households.

When we take the above scenario and multiply it by the thousands of power plants that would be decommissioned early worldwide, the cost skyrockets into hundreds of billions of dollars. Governments would likely not be able to protect households from large rate increases.

One way to ameliorate, but not altogether eliminate, the financial hit of transitioning away from coal is to repurpose some of the coal plants slated for decommissioning to use natural gas. In many cases, this can be accomplished more cost-effectively than full decommissioning and new greenfield renewable development. And emission reductions could range from 34 to 62 percent, depending on how the plant is used.

The need for adequate, reliable, and flexible power

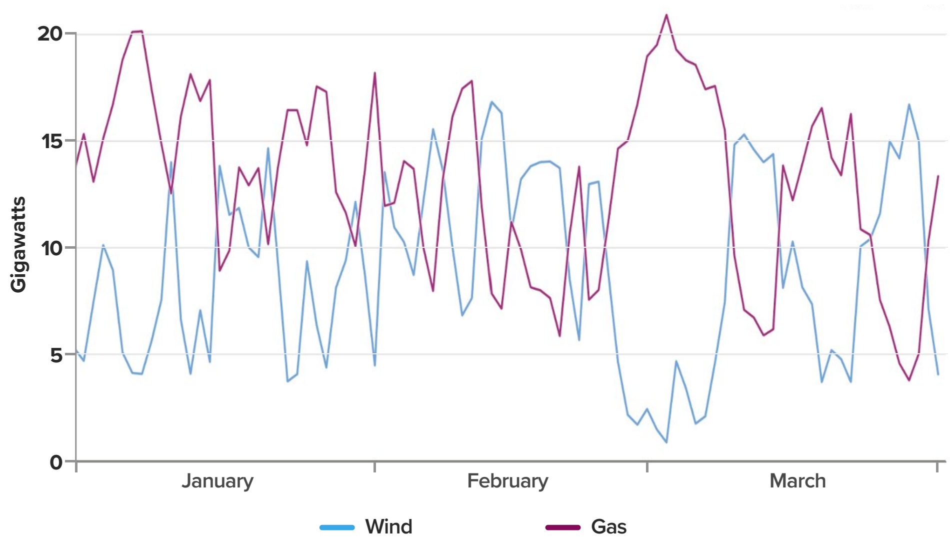
Between 2010 to 2022, solar power generation has expanded at a compounded annual growth rate of 26 percent, while wind power increased by 10 percent per year over the same period (IEA 2022b). While ongoing investments in renewable energy are encouraging, power must be available consistently – not just when the sun is shining, or the wind is blowing. Wind and solar intermittency are well known issues, and the ability of alternative sources to quickly generate power during shortfalls is essential.

Power demand varies by time of day and during times of very high temperatures (air conditioning is widely used) or very low temperatures (household and commercial heating systems are more heavily relied upon). Compounding the challenge of meeting demand with supply is the reality of wind and solar power intermittency. Power systems presently deal with these challenges by turning to alternative sources of generation that can quickly fill supply gaps. Depending on the circumstances, either dispatchable power plants or peaking power plants are used. Utilities often use natural gas-powered plants for both purposes due to multiple advantages over alternatives. They can quickly start up to rapidly meet changing power demands and have significant generating capacity.

> *A case illustrating the importance of supplementing wind and power occurred in March 2021 in the United Kingdom.*

A case illustrating the importance of supplementing wind and power occurred in March 2021 in the United Kingdom (Jansen, Stafell, Green, and Green 2021). Wind power generated ranged from a low of 0.6 GW on March 3 to a high of 18.1 GW later that month – an enormous variation. Concurrently, there was an 11-day period when winds blew significantly below the seasonal norm, and wind power generation did not exceed 20 percent of its total potential.

FIGURE 3 DAILY AVERAGE OUTPUT FROM WIND FARMS AND GAS POWER STATIONS DURING QUARTER 1 OF 2021[a]



Source: When the wind goes, gas fills in the gap | Q1 2021 Quarterly Report | Electric Insights

Figure 3 shows how Britain compensated for the intermittent and low amounts of power generated by its wind farms. Natural gas generated power made up for 84 percent of wind's reduced output. As the authors of the report noted, "The output from Britain's wind farms is almost exclusively balanced by gas power stations. Throughout the quarter their outputs were the mirror image of one another, performing an elaborate dance to keep the system balanced" (Jansen, Stafell, Green, and Green 2021).

The country's battery storage capacity and pumped hydro plant were not nearly large enough to compensate for the loss of wind generated power. Past data suggests such an extraordinary wind drop-off occurs once every two decades, so it cannot be passed off as a one-off event.

The realities of LNG and fossil fuel use

We can summarize some of the key points above, as follows:

- the young average age (11 to 13 years) of coal-fueled power plants in Asia will make them very expensive to decommission;

- the sizeable number of new coal-fueled power plants (634) planned or already under construction;
- that China and India are investing in extensive natural gas pipelines networks;
- the fact that gas-fired plants are used for dispatchable power generation and the increased need for dispatchable (and peaking) power to back up renewable power generation;
- the expected growth in demand for LNG continuing until the mid-2040s;
- that LNG can cost-effectively be substituted for fuel in coal-fired power plants;
- that Canadian LNG reduces GHG emissions by 34 – 62 percent compared to coal and is very effective in reducing emissions in heating applications; and
- that BC-produced LNG emitted significantly fewer GHGs compared to other worldwide LNG sources.

Realistically, BC LNG should be fully used as a substitute fuel to mitigate the carbon emissions impact of existing coal-based power plants, especially those currently used for heating.

Additionality, ITMOs, and BC LNG

The primary objective of the additionality provision is to promote carbon-reduction initiatives that would not have been pursued without the ability to transfer emission credits between nations. This point is crucial because it establishes a key criterion of whether proposed projects are eligible for ITMOs.

In the case of British Columbia, a question arises whether exporting LNG satisfies the additionality criteria, allowing the province to claim ITMOs that contribute to meeting its GHG reduction goals. To evaluate this, we need to consider two potential LNG agreements.

Agreement A is a conventional Sale and Purchase Agreement (SPA) for LNG. This arrangement covers standard terms and conditions for the commercial sale of LNG. Although replacing coal with LNG would lower emissions, it is doubtful this SPA would meet the additionality condition. The reason is that even without the availability of ITMOs, this deal would have still proceeded, indicating that it lacks the necessary additionality to qualify. Note that this deal is still beneficial for lowering carbon emissions, it just may not be able to qualify for the ITMOs.

Agreement B outlines a coal-to-gas switching LNG project designed to meet the additionality criterion. For example, an Asia-based company, Utilityco, would like to alter a plant it operates by substituting coal with natural gas as a fuel source. The plant in question is a smaller coal facility providing energy for district heating. Utilityco is concerned about forthcoming government emission regulations. Retrofitting emission controls on the plant is uneconomical.

This conversion will allow the plant to operate as a peaking power source once renewable energy sources like solar and wind are more widely built out.

However, rather than decommissioning the plant prematurely and incurring a write-off, which could financially harm the company and its customers, it may be much more economical for Utilityco to meet the new emissions standards by converting the plant to run on natural gas. Furthermore, this conversion will allow the plant to operate as a peaking power source once renewable energy sources like solar and wind are more widely built out.

Agreement B also involves a Canadian company, Supplyco, assisting Utilityco in some manner to replace their old steam boiler to burn natural gas for district heating. This may be by providing engineering and technical expertise or through helping Utilityco arrange financing for this project, perhaps through the Export Development Corporation. The extent and type of assistance to Utilityco will be based on that company's needs, the size of the contract, and the expected value of emission credits.

The agreement also includes a provision that Utilityco will phase out its coal-burning capability.[3] As part of the overall deal, Utilityco agrees to buy

Supplyco's LNG, based on standard commercial terms and conditions. The LNG supply agreement will be sufficiently long to provide price stability for Utilityco, so it is not subject to large spot price fluctuations like those that occurred in 2021 and to provide the LNG exporter with business certainty.

The parties will also agree upon the project's forecasted GHG emission reductions and how many carbon credits (ITMOs) will be transferred to the Canadian side. Canada can then use these ITMOs to help fulfill its Nationally Determined Contributions (NDCs) under the Paris Agreement. The deal length must be sufficient, so it is economically viable for all parties, but not so long as to lock in LNG usage to the detriment of renewables.

Since there are a myriad of variables for any potential project, all with different economic values, the above is simply a conceptual framework rather than a firm economic model for an ITMO eligible LNG export deal.

Based on this framework, Agreement B is much more likely to meet the additionality criterion since the likelihood of the two parties finalizing a business deal without receiving ITMOs would be very low. Precedents exist for this type of project being eligible for transferable emission credits. The Kyoto Protocol Clean Development Mechanism, a precursor to Article 6, had methodologies in place to evaluate whether coal-to-natural gas switching projects qualified for emission credits (UNFCCC 2022).[4] Moreover, Japan's Joint Crediting Mechanism, which aligns with Article 6, has approved transferable emission credits for a similar coal-to-natural gas fuel switching project between Osaka Gas and the Thailand-based Parfun Textile (Osaka Gas 2021).

Estimated ITMO values from BC LNG exports

Structuring an LNG export deal to provide additionality is more complex than a simple sale and purchase agreement. It would also be more costly to the Canadian side due to incremental support in assisting with the coal-to-gas transitioning. Also, implementation of Article 6 is very new, so there is little direct data on an ITMO's value. One ITMO is based on one tonne of CO2e mitigated. A report prepared for the Swedish Energy Agency suggests a price range from US $10 to$50 per ITMO, while the *likely* value is between US $15 to $30 per ITMO (Schwieger, Brodmann, and Michaelowa 2019).

The annual ITMO values calculated in Table 3 are based on one billion cubic feet per day (Bcf/d) of natural gas being liquified and exported – the

TABLE 3: VALUE OF ITMOS FOR CANADA BASED ON ONE BCF/D OF NATURAL GAS EXPORTED IN LIQUID FORM

ITMO value per tonne[a] (USD)	Annual ITMO value to Canada, based on annual emissions abated[b] (US millions)	
	14.9Mt CO2e abated[c]	35.2Mt CO2e abated[c]
$10	$74.5	$176
$15	$111.8	$264
$20	$149	$352
$30	$223.5	$528
$40	$298	$704
$50	$372.5	$880

[a] $10, and $40+ per tonne figures are possible values. Most likely values are between $15 to $30, shaded area.

[b] Calculation based on the total emissions abated shared equally by both countries, e.g., 14.9Mt CO2e × 0.50 × US $10 per tonne CO2e = US $74.5 million.

[c] The 14.9Mt and 35.2Mt of CO2e values are taken from **Table 1** (see page 14).

ITMO value per tonne data from: Pricing of Verified Emission Reduction Units under Art. 6 (perspectives.cc)

equivalents of about 7.5 million tonnes of LNG annually (Canada Energy Regulator 2016) or roughly 54 percent of LNG Canada's Phase 1 output. The figures assume that emission reductions are shared equally. While we cannot say what the cost may be to Canada to agree on a deal that provides additionality, the substantial figures below suggest there is a business case to explore cooperative deals that provide additionality.

Arguments against LNG exports receiving ITMOs

Notwithstanding the arguments in favour presented above, there are several arguments against allowing LNG exports to be eligible to generate ITMOs.

1. LNG exports will occur whether or not the contracts include ITMOs; therefore, they do not meet the additionality requirement.

This may be true for a conventional LNG sale and purchase agreement (SPA). However, a project where the LNG seller also provides either technology, expertise, or financial support to assist in converting a buyer's power plant to natural gas, can be more convincingly argued as being additional.

2. The slippery slope argument.

The slippery slope argument suggests that if Canada negotiates ITMOs for LNG exports, then any nation that sells emission-reducing products such as solar panels or wind turbines to Canada can also demand ITMOs (Cosbey 2023). If Article 6.2 works as designed, this scenario will be highly unlikely. One of the article's strengths is that it is a voluntary, cooperation-based program. No single country can impose the transfer of carbon credits on another. Transferring carbon credits must be freely negotiated, and both sides must see value in the deal, or it simply will not proceed. The deal must also still meet the additionality requirement, which in the case of a straightforward sale of solar panels from one country to another, it would not.

If Canada and another country were each willing to enter into a bilateral agreement to pursue projects under Article 6.2 and then specific projects were identified and met all the article's conditions, including additionality, then indeed, the deal should go ahead. The Canadian side would no doubt see an extra benefit in signing the agreement – otherwise, we would not agree to it.

3. Emissions reduction credits have value therefore, a buyer will not want to give them up.

It is true that reducing every single tonne of CO2e has value. But this value can be used to negotiate a beneficial deal for both parties. For example, the LNG seller may have ready access to the expertise needed to refurbish the plant using the latest technology. Extending the plant's operating life, reducing operating costs, and lowering GHG emissions are all valuable to the buyer. Thus, the buyer may find it more advantageous to trade some emission credits generated if they receive something they value more.

4. Encouraging LNG sales with ITMOs locks in fossil fuel usage.

Converting coal power plants to use natural gas may extend the life of such facilities in some cases. However unfortunate, large numbers of coal plants are still operating, and hundreds more are under construction. We cannot wish this away, and Canada has little sway globally to force the early retirements of these plants. We can, however, help reduce GHG emissions from some of these plants.

There will be a demand for coal in China, India and other developing nations for the foreseeable future, and its usage will continue in the absence of an affordable alternative with similar reliability characteristics. Actions to reduce coal usage by switching to natural gas, until sufficient renewable power and related zero-carbon technologies are available, will have significant mitigating effects. However, even with the widespread adoption of renewable energy, its intermittency will need to be managed with dispatchable power plants. Some of these backup plants, which will have been converted to use natural gas rather than coal, will continue to operate to stabilize the electricity supply when wind and solar power are unavailable.

5. Exporting LNG will make it impossible for British Columbia to meet its emissions reduction target.

It is important to analyze this claim carefully. Table 1 (page 14) shows that producing 1Bcf per day of natural gas for one year, liquifying it, and using it as a substitute for coal mitigates between 14.9-35.2Mt CO2e per year. These figures account for lifecycle emissions, which include emissions created in British Columbia from natural gas drilling, transportation, and liquefaction. If British Columbia did not pursue LNG production, the province would save 1.13Mt CO2e emissions per year.[5] However, the emission savings in Asia from switching from coal to BC LNG would then be lost, and emissions in Asia would rise between 14.9 to 35.2Mt CO2e per year. This is a poor trade-off to make.

Summary and recommendations

The number of coal plants, especially in Asia, is rapidly increasing. Moreover, their young average age of eight to 14 years will make shutting them down in the short to medium term very difficult, both economically and politically.

Canada can do little more than use diplomatic channels to persuade countries in Asia and elsewhere to decommission existing coal-fired plants and halt the construction of new ones. But we can help to *significantly reduce* the carbon emissions generated by selling LNG as a substitute fuel for coal to power these plants.

Liquified natural gas (LNG) is a lower source of carbon emissions than coal or petroleum. Moreover, new LNG projects within British Columbia are amongst the world's least carbon-intensive.

There is no inconsistency with Canada both arguing against the construction of new coal-fueled plants and offering to jointly work to reduce the emissions of existing coal plants.

Industry, governments, and policy experts have long discussed using BC LNG exports as a substitute for coal to lower carbon emissions. The previous analysis indicates there is a strong case for pursuing LNG exports. There is no inconsistency with Canada both arguing against the construction of new coal-fueled plants and offering to jointly work to reduce the emissions of existing coal plants.

A follow-up debate has ensued over whether Canada could receive carbon credits using Article 6 towards meeting its carbon reduction goals from the GHGs mitigated in other countries when LNG is used to replace coal.

The most challenging obstacle is arguably designing a project that meets Article 6's additionality criterion. By structuring a project that offers an LNG buyer added incentives to reduce emissions in return for ITMOs, a case can be made that a project that includes Canadian LNG exports could satisfy this criterion.

Canada should announce its intent to use Article 6 (specifically Article 6.2) as a tool to help meet its emissions reduction targets. The federal government should then work with industry to identify candidates for bilateral agreements. Government-to-government negotiations could then proceed to create a framework under which the resulting cooperative projects would operate. Common methodologies for measuring, tracking, and verifying carbon mitigation outcomes would all need to be developed. A registry for tracking and transferring ITMOs would also be needed. These are complex issues, but we can learn from countries like Switzerland, Japan, and Sweden that have already established processes for managing ITMO generating projects. MLI

About the author

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Jerome is the lead Canadian co-author of four editions of the finance textbook, *Financial Management Theory and Practice*. He holds a BA in Political Science and an MBA from the Sauder School of Business, both from the University of British Columbia. Prior to teaching, he worked in the securities industry. Jerome also has international business experience, having worked for one of Canada's largest industrial R&D companies developing overseas business opportunities in China, Hong Kong, Singapore, and India. MLI

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Endnotes

1 The 310 Mt figure is based on 42.5 percent, which is the midpoint of Canada's 40 to 45 percent emissions reduction target from its 2005 level which was 732 Mt.

2 The study looked at substituting BC LNG for coal for the chemical industry, textile industry, and district heating. All three sectors showed significant GHG reductions, with district heating having the largest reductions.

3 Some coal-to-gas conversions allow the plant operator to continue to use coal or natural gas as a fuel source. Writing into the contract a "no-use of coal" clause strengthens the business case for Article 6 compatibility.

4 The Clean Development Mechanism (CDM) has been criticized for allowing some projects that were not additional, exaggerated their benefits, or whose emission reductions were not permanent. A cursory review of the CDM methodology literature did not find such critiques pertaining to coal-to-gas switching projects.

5 The emissions reduction estimates of 14.9 – 35.2Mt CO2e per year shown in Table 1, is based on producing 1Bcf NG/day. The 1.12Mt CO2e per year was calculated as follows. 1Bcf NG/day equals 7.495Mt LNG/year. Table 2 shows LNG Canada's LNG emissions intensity of 0.15t CO2e per tonne of LNG. Therefore, 7.495Mt LNG/year × 0.15t CO2e per tonne LNG equals 1.13Mt CO2e per year.

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