UNBUILT AND BUILT LNG PROJECTS

WHO DECIDES AND HOW?

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SEPTEMBER 2021

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The author thanks the reviewers who helped improve the initial draft: Anil Hira (Professor in Political Science at Simon Fraser University), Peter Tertzakian (Managing Director of ARC Financial and Deputy Director of the ARC Energy Research Institute), and Positive Energy research team members Monica Gattinger, Marisa Beck, and Brendan Frank. The efforts of Marisa Beck coordinating the review and editing were greatly appreciated. In addition, the author thanks the many retired senior executives from the energy sector who generously provided insights into the dynamics of Final Investment Decisions for LNG projects. Finally, the author thanks Julien Tohme and Emily Lee for assisting with research and preparing the graphics, respectively.

As is customary, any errors or omissions in fact or analysis are the responsibility of the author.

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POSITIVE ENERGY FINANCIAL SUPPORTERS

We would like to thank the following organizations for their financial support:

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EXECUTIVE SUMMARY

Over the last forty years, the liquefied natural gas (LNG) industry has attracted a series of project proposals across the globe that have seen varying degrees of success: some never obtained adequate funding or permits, others proceeded to a final investment decision (FID) and then commissioning. The global LNG market is extremely competitive: very few project proposals ever reach FID and even fewer receive a positive FID. Moreover, it can take several years and often decades from a gas discovery to the FID for an LNG project.

This study examines the history of the LNG sectors in Western Australia and British Columbia during two key periods: the 1980s and the 2010s. While Western Australia is now the world's second largest LNG exporter, only one project has begun construction in British Columbia to date (LNG Canada). What explains this difference in track records between the two jurisdictions? This study aims to answer this question.

The research objective is to provide an overview of the commercial considerations of the private companies that propose and sanction LNG investments. Drawing on data from six project proposals from Western Australia and British Columbia, this report unpacks some of the factors that may drive a positive final investment decision, defined as a project being financially sanctioned, funded, and on the road to commissioning.

Even in a policy environment that is characterized by the objective to achieve net-zero greenhouse gas emissions by 2050, natural gas and blue hydrogen will likely be used as fuels. Therefore, a new pipeline of projects for FID consideration may be emerging. The comparative analysis may help Canadian policymakers gain insights from the Australian example.

This research draws on documents in the public realm and material from the field of energy economics, as well as the burgeoning literature in environmental history, which considers the impacts of energy projects over an expanded time-period and a range of geographical zones. It is informed by the author's ongoing work in utilities, energy, and infrastructure, as well as informal discussions with retired energy executives that have been involved in LNG projects.

Findings from this research are applicable to major energy investments beyond the LNG sector, including hydrogen and renewable energy technologies. Investments in these technologies include multi-decade long investments, a large geographical footprint, off-take agreements with foreign businesses, significant impacts on local energy systems, Indigenous engagement and employment considerations, and a complex interplay between local, state, and international governments.

The analysis suggests that there are some important commonalities between the projects that succeeded and those that failed across Western Australia and British Columbia.

While it is impossible to create a checklist for successful FIDs because each project proposal is unique and so are market and government dynamics at the time of a decision, findings indicate that the following factors tend to influence the fate of LNG project proposals:

- the specific requirements of project location, siting, and infrastructure placement with regards to environmental impacts and Indigenous rights;
- the extent to which proponents are able to sign sale purchase agreements with domestic or international customers early on in the process;
- the degree of public support for/opposition to LNG development;
- the level of policy and regulatory certainty in the jurisdiction where the project is located; and relatedly,
- cross-partisan political support for the project and the industry.

The analysis also reveals some important, structural differences between Australia and Canada that may have contributed to the countries' varying experiences with attracting LNG investments. For instance, Australia's states all have access to the ocean, while Canada has to rely on British Columbia to provide that access.

Further, so-called 'state agreements' that are common practice in Australian jurisdictions provide investors with a high degree of political certainty. Such agreements do not exist in Canada. Finally, Australia also enjoys the benefits of its first-mover advantage. By entering the global LNG market early, Australia has been able to build important relationships with customers and gain valuable experience.

While this analysis is historical in nature, it is important to note that the LNG investment environment is in constant flux. Future trends that may alter companies' decision criteria and practices include innovations that may significantly reduce the emissions profile of LNG projects such as new offset mechanisms, carbon capture and storage technologies, and unexpected international crises. Moreover, ESG investment practices may significantly alter LNG proponents' access to capital markets, and we may see a shift from 'greenfield' to 'brownfield' project development.

All Canadian provinces and Australian states are considering their future energy mix and drivers of growth for the 2020s and beyond. In doing so, they will make decisions on the optimal policy and regulatory framework to facilitate investment according to local priorities. Findings from this study aim to inform decision-making by policymakers, regulators, the business community, as well as scholars examining the future of energy in Canada.

FOREWORD: OLD AND NEW

The International Energy Agency's *Net Zero by 2050: A Roadmap for the Global Energy Sector* would appear to make a study on Liquefied Natural Gas (LNG) project sanctioning less relevant given the expected accelerated shift away from natural gas (International Energy Agency, 2021). However, global natural gas markets remain extremely relevant. The IEA is still factoring natural gas in the global energy mix for decades to come (including for blue hydrogen) and it will be part of the energy mix for decades, independent of actions by Australia and Canada.

While this study is looking to the past, it is expected that many of the major energy investments related to hydrogen and renewables will have the same features of the LNG sector. Specifically, this includes multi-decade long investments; a large geographical footprint; offtake agreements with foreign businesses separated by oceans; impacts on local energy systems; Indigenous engagement and employment considerations; and a complex interplay between local, state, and international governments. Accordingly, natural gas and LNG remain an important area of study.

The links between old and new forms of energy and between Australia and Canada seem particularly pertinent in the case of the Australian subsidiary Fortescue Future Industries. Through the significant revenues from iron ore sales, this company is seeking to develop new renewable energy projects that support the establishment of green hydrogen and other green industrial products. One of these projects being considered is on Gull Island in Labrador, an untapped resource with a 2,250-megawatt generating capacity (Antle, 2021). This project is still at an early stage. Much of the technology and economics of green hydrogen and green industrial projects are still uncertain.

Like many proposed LNG projects, development of a green industrial complex on Gull Island may go through several iterations when (and if) it is ever sanctioned with a firm investment commitment. Such uncertainty should be embraced as there will likely be many false starts before a viable commercial outcome is achieved. Forcing growth, as has occurred in the past, may result in provinces underwriting risky and unviable ventures (Mathias, 1971).

There is a delicate balance for provincial officials and elected members of parliament in facilitating mega-projects without taking on commercial risk or favouring insiders. Provincial-federal relations are also relevant, especially when energy infrastructure crosses borders. This is beyond the scope of this study, but has been carefully examined by Positive Energy in *Energy-Environmental Federalism in Canada: Finding a Path for the Future* (Bratt, 2021).

There is no magical formula or template for success in attracting the billions of dollars necessary for an energy mega-project. Even within the LNG sector, the nature of projects in the 1990s, 2000s, and 2010s are all different. Contextual analysis of mega-projects, in this case LNG projects, helps shed some light on the dynamics of international capital and the energy sector. Of all sub-national jurisdictions, Western Australia and British Columbia are perhaps closer than others to provide learnings and insights, not least because of their common Westminster system and physical location on a western coastline. However, the relevance of this study for Canada's energy future is much broader, including jurisdictions other than British Columbia and technologies other than LNG.

All Canadian provinces and Australian states are considering their future energy mix and drivers of growth for the 2020s and beyond. In doing so, they will make decisions on the optimal policy and regulatory framework to facilitate investment according to local priorities. This study aims to inform decision-making by policymakers, regulators, the business community, as well as scholars examining the future of energy in Canada.

INTRODUCTION

Over the last forty years, the liquefied natural gas (LNG) industry has attracted a series of project proposals across the globe that have seen varying degrees of success: some never obtained adequate funding or permits, others proceeded to a final investment decision (FID) and then commissioning. The potential benefits that LNG plants have on their host communities through building and commissioning stages is significant and can last decades in the form of jobs, corporate profits, tax receipts and associated economic activity. There may also be costs to host communities and the hinterland related to the construction of LNG plants and pipelines. For onshore plants and extraction sites there is the physical disturbance caused by both production and liquefaction. Important but often overlooked are risks relating to the impact that these projects have on local labour markets, especially in isolated areas or where technical skills are limited. Finally, extracting, liquifying, and burning natural gas causes greenhouse gas emissions.[1]

This independent analysis forms the basis for future academic studies. It stands in contrast to the large volume of highly optimistic studies by project proponents and the very negative reports from those opposed to these projects. This analysis does not take a view or position on the merits of any LNG project, other than in commercial terms, which require the project to satisfy hurdle rates for return on capital and sanctioning by private-sector boards.

By analyzing LNG projects across Western Australia and British Columbia, this report unpacks the factors that lead to a positive final investment decision (FID), defined as a project being financially sanctioned, funded, and on the road to commissioning. A positive FID does not mean that the project has universal public support, nor that it is even desirable. Perspectives on desirability of new LNG projects differ both within and across Canadian jurisdictions (as well as in Australia). Failure to achieve a positive FID can be for many reasons, including public resistance, challenges with regulatory requirements, or simply poor project economics. There is no value connotation in an FID being successful. This is a commonly used industry term and an important aspect of understanding the perspective of project proponents.

The title of this study draws on a publication by Jonathan Peyton titled *Unbuilt Environments: Tracing Postwar Development in Northwest British Columbia* (Peyton, 2017). Like Peyton's work, this report examines why certain projects did not proceed at specific points in time within specific geographical contexts. For LNG projects, failure is not permanent; many sites are associated with a range of failed proposals before one succeeds.

1. While greenhouse gas emissions will be an ever-larger aspect of both regulatory and investment decision-making, this is a historical analysis of LNG project sanctioning. It should be noted that there was a significant change in approval requirements with regards to greenhouse gas emissions in Western Australia over time. This aspect will become more pronounced as existing fields decline and 'backfill' options are considered.

RESEARCH OBJECTIVES AND METHODOLOGY

In Canada there are very limited academic or public policy studies on LNG investments that consider the factors influencing decision-making across time and between jurisdictions.[2] This contribution to the discussion addresses part of the larger question of "who decides and how?" in work by the University of Ottawa's Positive Energy program. (See Box 1 for an overview of projects in the Roles and Responsibilities Research Stream).

The research objective of this study is to provide an overview of the commercial considerations of private companies proposing and sanctioning LNG projects. While presenting insights into the corporate decision-making process regarding LNG projects, the author acknowledges that the decision to develop an LNG sector is ultimately for the Canadian public and their elected representatives.

For confidentiality reasons, internal decisions of commercial entities are not divulged. However, many of the FID steps are publicly disclosed and flagged in both trade publications and popular press, as well as in company announcements. This research draws on documents in the public realm and material from the field of energy economics, as well as the burgeoning literature in environmental history, which considers the impacts of energy projects over an expanded time period and a range of geographical zones. It is informed by the author's ongoing work in utilities, energy, and infrastructure, as well as informal discussions with retired energy executives that have been involved in LNG projects.

As this study analyzes the investment allocation question, it is narrowly focused on corporate decision-making as opposed to the usual focus of Positive Energy studies on public authorities. This does not mean to diminish the critical and over-riding role of public authorities. Without their consent, projects will not proceed. Governments have a role in setting policy frameworks for private investment decisions. For instance, tax rates, labour regulations, and local-content requirements influence capital allocations. Furthermore, the election cycle both at federal and state/provincial levels is also a factor.

To illustrate the dynamic decision processes, this study uses historical case studies to highlight critical decision points at which projects either proceed to a successful FID or fail. Analysis is based on data from six project proposals from Western Australia and British Columbia.

2. There are several notable exceptions. For example: https://journalhosting.ucalgary.ca/index.php/sppp/article/view/42470

BOX 1: POSITIVE ENERGY'S RESEARCH ON ROLES AND RESPONSIBILITIES

The second three-year phase of Positive Energy (2019-2021) aims to address the following question: How can Canada, an energy-intensive federal democracy with a large resource base, build and maintain public confidence in public authorities (federal, provincial, and territorial policymakers and regulators, Indigenous governments, municipal governments and the courts) making decisions about the country's energy future in an age of climate change?

Three fundamental questions form the research and engagement agenda. How can Canada effectively overcome polarization over its energy future? What are the respective roles and responsibilities between policymakers, regulators, the courts, municipalities and Indigenous governments, when it comes to decision-making about its energy future? What are the models of and limits to consensus-building on energy decisions?

Clearly articulating and strengthening roles and responsibilities between and among public authorities is one of the most pivotal but understudied factors shaping Canada's energy future in an age of climate change. Confidence of the public, investors and communities in government decision-makers – be they policymakers, regulators, courts, Indigenous governments or municipalities – is a critical success factor in Canada's ability to successfully chart its energy and emissions future.

Positive Energy's research and engagement over the last five years reveals that answering two questions will be fundamental to confidence in public institutions: Who decides? How to decide? Positive Energy's research and engagement also underscores that two core principles should inform answers to these questions: Informed Reform and Durable Balance.

The roles and responsibilities research programme includes projects in the following areas:

- Federal-provincial relations
  - A research report examining evolving models and practices for intergovernmental relations over energy and climate
  - A comparative study of factors driving final investment decisions for liquefied natural gas facilities in British Columbia and Western Australia (present report)
- Policy-regulatory-judicial relations
  - A literature review on regulatory independence in Canada's energy systems: origins, rationales and key features
  - Historical case studies of federal and provincial regulators exploring the evolution of regulatory independence over time
  - Policy-regulatory relations: analyzing innovations in policy-regulatory relations to identify 'What Works?' (research collaboration with CAMPUT) (present report)
  - A case study of the expanded role of the federal cabinet in pipeline projects (TC Energy's 2021 NGTL System Expansion)
- New imperatives in energy decision-making
  - Emerging technologies: interviews with provincial and municipal policymakers and regulators to identify the impact of emerging technologies on decision-making
  - Public engagement: analyzing innovations in regulators' engagement practices to identify 'What works?' (research collaboration with CAMPUT)

WHAT IS LNG? DIFFERENCES BETWEEN THE CONVENTIONAL GAS SECTOR AND LNG

Many Canadians, especially in British Columbia, Alberta, Saskatchewan, and Newfoundland and Labrador, will have some familiarity with the oil and gas sector. This includes conventional hydrocarbon reserves across these major oil and gas producing provinces. In addition, Alberta has capacity of oil sands production. The Government of Canada states on the Natural Resources Canada website that: "Canada is the fourth largest producer and sixth largest exporter of natural gas" and "Canadian marketable resources of natural gas can sustain current production levels for up to 300 years" (Government of Canada, n.d.). Such abundance has long been overlooked as exports fed into a series of interconnected pipelines serving the US market.

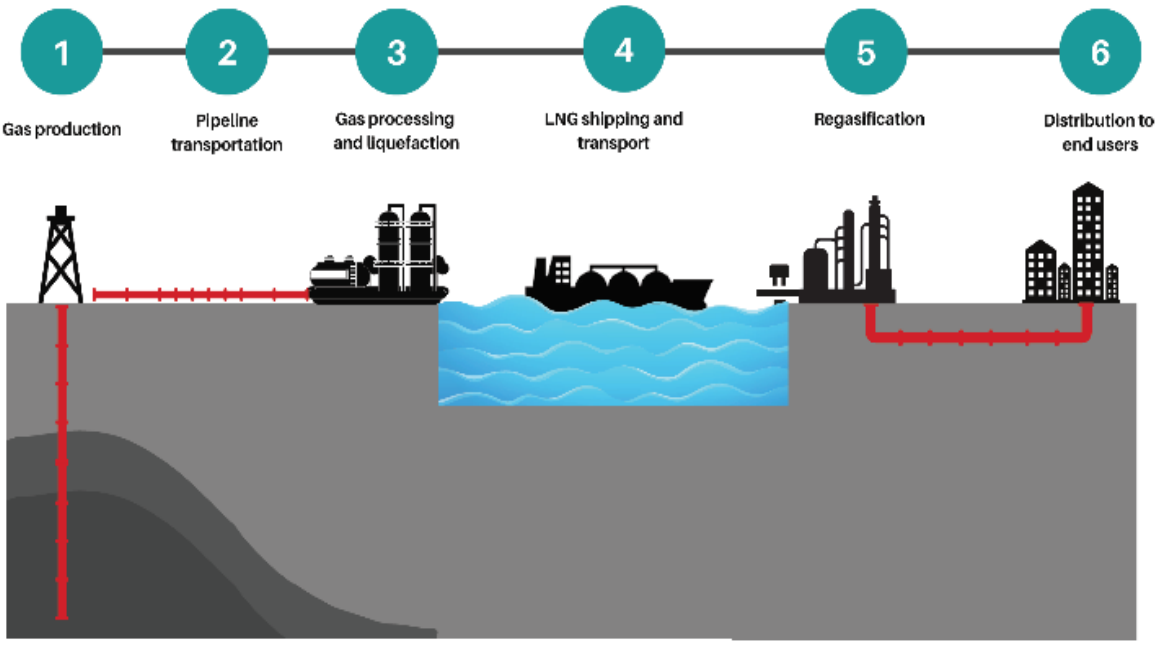
Canadian natural gas has been exported via pipelines due to the physical proximity between producer and consumer. LNG is fundamentally the same product, but it is liquefied and shipped rather than exported in gaseous form through a pipeline. Liquefied natural gas refers to the end-result of a process whereby natural gas is cooled to a liquid form, which reduces its volume to 1/600th of its gaseous state to allow its transportation on ships. In the instance of a large supply of natural gas that exceeds domestic requirements, LNG can be exported and is shipped on purpose-built oceanic vessels to end user markets (see Figure 1). Once an ocean and significant distance separate producer and consumer, the economics of a project shift, and delivery of LNG becomes more attractive than delivery through a pipeline. LNG has traditionally been sold under long-term commercial relationships. Conversely, natural gas delivered through pipelines is generally sold through short-term agreements, often on the spot market.

Extracting and using natural gas in Canada has a long history. Historically, investment decisions in this sector have been subject to technical and economic discussions, with political debates mostly relating to jurisdictional and taxation issues. From the early 2000s, however, climate change and other environmental factors have added another dimension, although for much of this period natural gas was seen favourably as a 'clean fuel' or 'transition fuel'. This view has shifted significantly since around 2015, with natural gas now often considered an obstacle to rapid decarbonization. However, even in the most aggressive scenarios, natural gas use is projected to continue for decades as per the IEA's Net Zero by 2050 report (International Energy Agency, 2021).

The natural gas sector, a successor to earlier manufactured gas, has a long history in Canada (Duncan & Sandwell, 2016). A sparse population, long distances between producers and consumers, and relatively early industrialisation made Canada a leader in gas transportation. A gas transmission line in Québec built in 1853 established Canada as a pioneer in pipeline construction (About Pipelines, n.d). This 25-kilometre cast-iron pipeline transported natural gas to Trois-Rivières, Québec, which was used primarily for street lighting.

Subsequently, in 1895, Ontario's Essex field was connected to Windsor, Ontario, and across the river to Detroit, Michigan, through a pipeline laid under the Detroit River (Heckathorn, 2003). As gas supply declined, the Ontario government banned exports in 1901 (Heckathorn, 2003). In Alberta, the Turner Valley natural gas discovery in 1914 stimulated investment and development of these fields, which led to use of natural gas in towns and cities, notably Calgary.

FIGURE 1: THE LNG SUPPLY CHAIN: FROM GAS PRODUCTION TO DISTRIBUTION



Source: Author's analysis

By the late 1950s, in the context of the Cold War and post-World War II expansion, natural gas exports to the US recommenced through long-distance pipelines and continued to grow for the rest of the century. After a peak in the early 2000s, by the 2010s, as the shale gas revolution accelerated, Canadian natural gas exports to the US declined (Energy Information Agency, n.d.).

This brief history of Canadian natural gas exports to the US is important. Until the 2000s, the primary driver of the expansion of Canadian natural gas exports was demand from a growing US market. At the time, discussions of natural gas in North America were shifting to the option of importing LNG. This expected shortfall of US natural gas supply also drew international interest from several countries. In the early 2000s, Australian delegations to California, led by its Prime Minister, pitched LNG options (Howard, 2004).

As the global gas market evolved, the legacy systems and the US focus of Canadian exports forced a reconsideration. Canada produced gas that went into the pipeline network configured on a north-south basis. However, commodity markets are rarely predictable and the five decades of expansion of pipeline gas sales was unusual in duration and consistency. The shale gas supply shock, North American oversupply, and rapid growth in Indo-Pacific markets shaped a very different global gas market than was forecast as recently as 2010.

It would be difficult to overstate the impact that shale gas has had on North American and global energy markets as well as on geopolitics. The key innovations which led to shale gas development - precision horizontal drilling and hydraulic fracturing - unlocked significant new production volumes. Productivity improvements, facilitated by an influx of capital, resulted in downward pressure on costs and an overall shift to a net surplus position, which enabled LNG export options and investments.

As differentials between domestic and international prices widened, exporting gas molecules in liquid form on ships, as opposed to gaseous form in pipelines, became commercially viable.

While the LNG industry is relatively new and until recently, less familiar to Canada, it has a longer international history. Transporting natural gas in a liquefied format was trialled in the 1959 with a shipment from Louisiana, United States, to Canvey Island, England. Technology matured during the 1960s and 1970s and became widespread by the end of the century. Algeria, Brunei, and Indonesia were amongst the first exporters of LNG. Since then, significant commercial, engineering, and support services have been established around a transnational LNG ecosystem.

The global LNG industry is populated by large multinational oil and gas companies with expansive asset portfolios. Some of these companies are state-owned or implicitly state-backed, a feature of many companies in the Middle East. The sector refers to these companies as 'National Oil Companies' (NOCs). Conversely, privately-owned Western companies are referred to as 'International Oil Companies' (IOCs). Individual LNG projects are typically supported by two or more joint venture partners, with one company being responsible for the operation of the project and referred to as the 'operator'. The 'operator' physically manages the extraction, liquefication and logistics associated with the project.

The significant funds required for major capital investments are generally raised through debt or equity. A new trend has been for LNG customers, such as Asian utilities and power producers, to take an equity position in the gas field or overall project.

Large capital outlays are typically underwritten by long-term sales and purchases agreements with industrial consumers, and prices on these volumes can be significantly lower than spot values. This financing model, including high upfront costs and a long payback period, differentiates the LNG sector from the conventional natural gas sector, where cash flow can occur as soon as production comes on stream.

The decision-making process about proposals for new LNG projects begins with the identification of an 'investment window', which arises a few years before an expected tightening of global LNG markets. Such a window occurred in LNG markets in the 2010s. After a number of years of disinterest in long-term LNG contracts, "the fog lifted" (Macdonald-Smith, 2018, p. 2), and there was an increase in appetite for new LNG projects.

Due to the dominance of the conventional gas industry and pipeline sales, understanding of LNG business models and cycles is limited in Canada. By its nature, expertise is largely confined to those in large energy companies who have had exposure in international LNG jurisdictions. This study aims to address this gap.

The research examines the capital allocation decision-making within firms and seeks to shed light on what criteria tend to result in a positive investment decision. LNG has become a global industry with large firms and allocators of capital agnostic about geographical locations. With major technological advances seen in the Australian Gorgon and Prelude projects, as well as the Russian Sakhalin project, the frontier of viable LNG projects is expanding to a larger number of basins and gas fields.

The global LNG market is extremely competitive. There are many gas fields suitable for supplying international markets, and many host governments are actively courting investment and working with project proponents. At any point in time, every proposed LNG project is competing against a range of alternative options.

WHO DECIDES AND HOW: AN OVERVIEW OF COMMERCIAL DECISION-MAKING FOR LNG PROJECTS

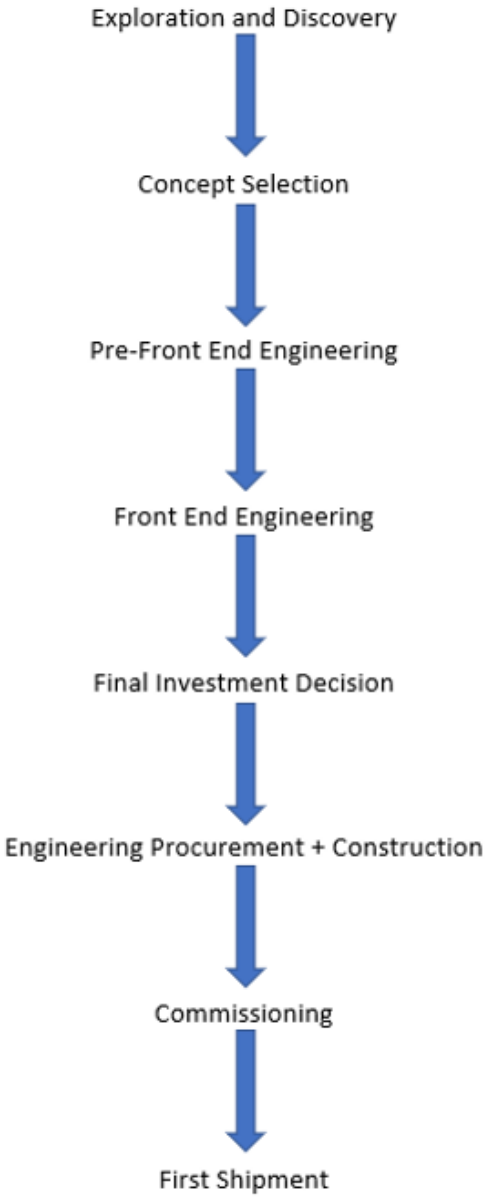
It can take several years and often decades from a gas discovery to the FID for an LNG project. After the initial discovery, much of the preliminary analysis and work occur between large energy companies and external engineering consultants. Outside of the industry and its trade journals, very little of this work is ever reported or made publicly available. Only critical events, such as major approvals, investment decisions, or safety incidents may reach the business pages. In analyzing decision-making, it is important to be familiar with the commercial processes within the sector (Figure 2).

Companies begin by identifying a substantial, untapped supply of natural gas, which, if exploited, will presumably create value for the firm and their shareholders. This may involve review of existing or newly discovered fields. After clarifying the opportunity and approximately quantifying the extent of the reserves, the company assesses the feasibility of project development. In simple terms, this relates to the costs of assets to bring gas from the reservoir to a pipeline or plant as well as the plant costs. This phase includes technical inspection of the area to predict the available resource supply and to verify that infrastructure development is feasible. For example, some of the largest gas fields may never be developed if the infrastructure requirements are too substantial. Financial analysis is then conducted to estimate the required capital expenditures and expected project returns and to determine if the project's benefits exceed the associated costs.

Once a company deems a project feasible, it proceeds to **concept selection**. This involves evaluating different technically viable options to select the best possible project location and facility type. Many proposed projects examined in this study are located in the same general area with several Western Australian projects in the Carnarvon Basin, and British Columbian projects primarily choosing Kitimat, drawing on inland gas reservoirs. In terms of project design, there have historically been a mix of onshore, offshore, and floating LNG proposals. Finally, the scale of the project in terms of the expected capacity and lifespan is an important factor to consider, particularly in association with the project's expected returns. The sector traditionally works on long time frames of 20+ years with some plants and facilities running for much longer.

If the above steps point to favourable economics and the company is still interested in pursuing the project upon concept selection, the information is compiled into a project proposal, and the **pre-Front-End Engineering Design (FEED)** stage commences. The firm may propose their concept to another firm or form a joint venture. In this case, ownership is contractually determined between the involved parties with one of the companies accepting the role of project operator. At this stage, project owners pursue the necessary project approvals.

FIGURE 2: STEPS IN COMMERCIAL DECISION-MAKING ABOUT LNG PROJECT PROPOSALS



Where applicable, permits for land access need to be negotiated. This generally involves forming an agreement with impacted groups, particularly First Nations/Indigenous communities, and can include revenue sharing and equity positions in addition to employment benefits. Environmental, government, and export agreements are also essential for LNG projects with regulatory specifics varying by jurisdiction. Obtaining these approvals involves trade-offs between economic, social, and environmental interests. It is impossible to prepare a checklist or formula for these approvals as they are locational and time specific. In both jurisdictions, Western Australia and British Columbia, over the past few decades, there have been significantly greater levels of First Nations/Indigenous engagement as well as environmental reviews.

Once the permits or approvals have been obtained or are reasonably likely to be granted, project owners move into the **FEED stage.** The company conducts detailed technical planning and estimation of the costs to build the LNG plant and associated infrastructure. This stage considers the specifics of reliably financing the project, through debt or equity, to cover engineering, procurement, and construction costs. At the same time, to ensure a market for future products, LNG Sale Purchase Agreements are negotiated with customers. These industrial consumers benefit from prices on contract volumes that are significantly lower than spot values and also from the guaranteed supply over a long period of time. Increasingly, customers acquire a minority stake in the project or gas field to align the interests of all participants.

The costings and plans for contracting the engineering and procurement suppliers are drawn up. These contracts cover supply, commissioning, and starting up of the LNG infrastructure, including the gas treatment plant, the gas pipeline, the LNG plant, and related facilities.

As key costs and project plans are finalized and purchase agreements are signed, the joint venture partners engage in their internal decision-making processes to determine if the project should be sanctioned. Given that the project costs are often in the billions, the joint venture partners will generally need to access debt or equity.[3] At this point, the project reaches what is known as a **Final Investment Decision (FID).**

This is a significant decision taken by the boards of companies and at a specific point in time, signalled years in advance. Typically, large companies have a pipeline of projects and investment decisions both for new, major 'greenfield' LNG projects and expansions or upgrades to existing 'brownfield' LNG projects. The ordering of projects in the pipeline is not fixed and will be adjusted depending on the state of the gas market, perception of the jurisdiction, and company priorities.

If the FID is positive, the joint venture partners, through the operator, proceed with procurement and commence preliminary construction. This leads into the **Engineering, Procurement, and Construction (EPC)** phase where project development may include preparation of storage facilities and export infrastructure, LNG trains, pipeline construction and installation, and dredging processes.

3. This analysis is focused on countries where LNG projects are led by private, international oil companies. This contrasts with national oil companies (NOCs) that are state-owned and backed. NOCs will approach project sanctioning in a different way due to their larger balance sheets and access to state-backed debt. Thus, Qatar developed its LNG sector in a different manner compared to that of LNG producers where the financing is led and sourced by the private sector.

At each stage of the project, the level of investment increases. Even prior to the FID, companies may spend $200-$300 million on detailed engineering studies. However, these expenditures represent sunk costs, and each major investment decision will succeed or fail on its merits. It is apparent that the numerous proposed LNG projects in British Columbia during the 2010s were misunderstood by policy makers, legislatures, and even parts of the industry. This author was asked to provide briefings in British Columbia on the Australian experience with LNG, which revealed a distorted perception of FID processes.

Some Canadian actors perceived positive FIDs as inevitable and guaranteed, which led to political leaders counting tax revenue and allocating it prior to any confirmed investments. Instead, the projects were still at various stages in the commercial decision-making process. It appeared that the government's eagerness to introduce new, LNG-specific taxes caused several proponents to reconsider their international priorities.

A key driver of FID for LNG projects is certainty over policy and regulatory settings.[4] This relates to issues such as incentives, tax structures, and environmental settings. Unlike FEED studies, political risk is an intangible factor. Within corporations and joint ventures, there are attempts to quantify political risk. At a minimum, there is an expectation that host governments provide assurances that existing policies, such as environmental compliance targets and local content requirements, will not change. Formal agreements, which in the case of Western Australia are legislated into law (discussed further below), are seen to lower political risks for LNG investment decisions.

Beyond working with the government of the day, project proponents typically engage a sophisticated and in-depth review of the domestic political process and often interact and discuss policies with opposition parties. This approach is based on the understanding that the life of an LNG asset spans several political cycles. Consultation and analysis can be extremely detailed and reach the level of factions within political parties in efforts to gauge the views of the overall caucus. During the 2010s, there has been an increasing expectation and concern among investors for policy stability and policy certainty due to accelerating changes in energy and climate policy.

Very few project proposals ever reach FID and even fewer receive a positive FID. For Canadians, this is akin to the National Hockey League and winning the Stanley Cup. At the beginning of the season, there are high expectations for many Canadian teams, investment in talent, and hopeful plans. By the end of the season, only one team emerges as the winner; this winner may not even be Canadian. The following year the process begins again, and actors try again to find that elusive winning formula.

4. Considerations for policy certainty are not unique to LNG investments and are also relevant for assets such as toll roads. Proponents of renewable energy projects are also very attuned to political risk given the direct and indirect subsidies necessary to make a project viable.


L N G

SETTING THE SCENE: COMPETITION BETWEEN WESTERN AUSTRALIA AND BRITISH COLUMBIA IN THE 1980S

This paper is focused on the success and failure of LNG proposals in Western Australia and British Columbia during the 2010s. However, there is a much longer history of LNG proposals in both jurisdictions, as well as direct competition between them. In the early 1980s, Dome Petroleum in British Columbia, targeted Japanese buyers at the same time as they also considered the Western Australian North West Shelf (NWS) project. News stories reported that during key periods of negotiation, the Canadian and Australian teams literally bumped into each other in the elevators of the Tokyo buying houses (Oil & Gas Today, 2019).

Better understanding competition between Canada and Australia (as well as other prospective LNG producers) requires some context.

While natural gas – and before it, manufactured gas – has been used for over a century, as noted previously, the liquefication and seaborne transport of LNG began during the 1960s. It was initially focused on supply to Japan as it emerged as a fast developing and energy poor nation during its period of economic expansion. During the 1970s, the OPEC oil crisis led to a shift in policies in developed nations to consider both energy security as well as the monetization of existing reserves. At this time, the environmental movement was still in its infancy, and LNG – indeed most fossil fuels – were widely accepted across the political spectrum.

In the Canadian context, proposals such as the Petro Canada-led Arctic Pilot Project, which aimed to transport gas in the form of LNG from Melville Island in the Arctic Islands to a terminal location in Eastern Canada on a year-round basis using icebreaking LNG carriers, illustrated the enthusiasm for bringing new projects online and to market (Bailey, 1983). The promotional materials for this project envisaged a significant investment to determine trial technologies for larger development opportunities in the Canadian Arctic (Petro Canada, n.d.). Interest in these gas fields continues, growing and waning in direct correlation with gas prices (Natural Gas Intelligence, n.d.).

As demand for imported LNG to Japan increased, several countries entered supply contracts. Japanese buyers defined the parameters and framework for successive LNG contracts, including a deal to import LNG from Alaska in 1967, a 1970 agreement with Brunei, and a 1973 agreement with Indonesia (Weems & Howell, 2014). By 1980 there was an expected shortfall in imported LNG. Dome Petroleum in British Columbia and the NWS project in Western Australia were two project proponents seeking to capitalize on this investment window.

The Dome proposal was centred in Grassy Point, British Colombia, and was a partnership between the Canadian proponent and Nissho Iwai, Japan's largest LNG trading company at the time. The project envisaged delivery of 2.9 million tonnes per annum over 20 years and CAD$3.5-$4-billion in revenue. Dome received high level government backing. Both the federal and provincial governments were strong supporters of the project (Peyton, 2017). Dome and the NWS were vying for lucrative Japanese contracts, but the NWS project was the ultimate victor. One Japanese representative referred to the Canadian relationship as a 'divorce' and the Australian relationship as a 'marriage' (Oil & Gas Today, 2019).

Construction for the NWS commenced in 1980. At the time it was the largest ever private infrastructure project in Australia. Domestic gas facilities were commissioned in 1984. The project included offshore and onshore facilities, subsea and land-based pipelines, and a substantial export agreement.

The success of the NWS, according to some commentators, led to a 'first mover' advantage for Australia (Tan, 2019). First movers may have greater capacity to scale and, crucial with Asian trading partners, establish strong relationships with buyers before their competitors.

Australia has subsequently become an LNG powerhouse. During the 2010s, it attracted AUD$200 billion of investment into new LNG projects (Thornhill, 2020). In 2019, Australia exported AUD$48.7 billion of LNG, making it the largest exporter in the world (Canberra Times, 2020). Western Australia alone is the world's second largest LNG exporter. The NWS venture is now joined by other projects. The cumulative Western Australian LNG developments are outlined in Table 1. As of late 2021, Western Australia had installed almost 50 million tonnes per annum of LNG export capacity.

The firm commitments for LNG export capacity in British Columbia included LNG Canada, which will have 14 million tonnes per annum of LNG export capacity once it is operational by the end of 2025, as well as Woodfibre LNG, which, once operational, will have a capacity of 2.1 million tonnes per annum. The Western Australian firm Woodside, equal owner of the Kitimat LNG project with Chevron, withdrew their support in early 2021.

TABLE 1: WESTERN AUSTRALIA'S LNG PROJECTS AS OF APRIL 30, 2021

Project (under construction or committed only)	Stakeholders (share of total capital expenditures)	Capital exp. (AUD$B):	Capacity (Mt/y)	Start of operations
North West Shelf Trains 1-5	Woodside (16.67%), BHP (16.67%), BP (16.67%), Chevron (16.67%), MIMI (16.67%), Shell (16.67%)	34.0	16.9	September 1989
Pluto Train 1	Woodside (90%), Tokyo Gas (5%), Kansai Electric (5%)	15.0	4.9	April 2012
Gorgon Trains 1-3	Chevron (47.3%), ExxonMobil (25%), Shell (25%), Osaka Gas (1.25%), Tokyo Gas (1%), JERA (0.417%)	55.0	15.6	March 2016
Wheatstone Trains 1-2	Chevron (64.14%), KUFPEC (13.4%), Woodside (13%), PE Wheatstone (8%), Kyushu Electric (1.46%)	40.0	8.9	October 2017
Ichthys Trains 1-2	Inpex (66.245%), Total (26%), CPC (2.625%), Tokyo Gas (1.575%), Osaka Gas (1.2%), Kansai Electric (1.2%), JERA (0.735%), Toho Gas (0.42%)	27.2*	n.a.	October 2018
Prelude Floating LNG vessel	Shell (67.5%), Inpex (17.5%), KOGAS (10%), CPC (5%)	19.6	3.6	June 2019

Sources: WA LNG Profile - April 2021, page 4, https://www.wa.gov.au/government/publications/western-australias-economy-and-international-trade.

**EnergyQuest, Energy Quarterly; WA Department of Jobs, Tourism, Science and Innovation; and company investor information (announcements, reports and presentations).*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WHERE LNG PROJECTS ARE COMMISSIONED: COMPETITION BETWEEN JURISDICTIONS AND PROJECTS

Once a proposed LNG project overcomes initial internal hurdles, management simultaneously undertakes several tasks/steps. Despite being private companies – often joint ventures – very little of this activity is exclusively in their control. Most proposed projects interface with local, state/provincial, national as well as foreign governments. This is in addition to First Nations/Indigenous engagement. Furthermore, each project is unique. Most large energy firms consider several project proposals at any one time, in multiple locations. It is impossible to prepare a checklist or template for these processes. However, based on discussions with retired industry executives, the following factors typically influence where LNG projects are commissioned:

- **Environmental and Government Permits**
  A jurisdiction's procedure to apply for and obtain environmental and government permits has a significant impact on the success of a proposed project. Jurisdictions with experience in LNG regulatory issues, and with established practices in place for assessing LNG projects, generally have faster processing periods making projects more competitive. There is an increasing trend for emissions reduction targets to be considered in the approval processes. Within the evaluation process, there is an assessment and often weighting on the durability of policies which take into account the risk that the permits may become subject to change, cancellation or other influences over the project lifetime.

- **Indigenous Engagement and Agreements**
  Many LNG projects fall on land significant to Indigenous/First Nations populations and there are explicit legal rights and responsibilities. Engagement with Indigenous communities can take many forms. The success of the consultation process often depends on whether the company is genuinely seeking to address Indigenous/First Nations' concerns in a meaningful way and to conclude durable agreements. The precedent for deep engagement has been set by Woodfibre LNG in British Columbia where an agreement with Squamish First Nation resulted in it becoming a de facto regulator. The Squamish First Nation produced its own environmental impact study and Woodfibre agreed to abide by all 25 of its recommendations.

- **Human Resources**
  LNG projects are often located in remote areas with limited access to skilled workers. This results in competition between projects over competent management, capable labourers, and experienced engineering, procurement and construction contractors. As the demand for such workers typically exceeds the readily available supply, labour costs are driven up, becoming a substantial liability. Jurisdictions that have a wider pool of available skilled workers are viewed positively.

- **Sales Purchase Agreements**
  At present, Asian markets are the main consumers of LNG, although this has been evolving as LNG becomes a more widespread energy source. While the format and nature of long-term SPAs have evolved, they are still fundamental to the process and represent a de facto indication of the buyer's interest in a new project and their perception of success.

- **Public Opposition and Non-Governmental Organizations**
  There is always engagement with the host community, which can extend beyond the siting of the LNG plant to the site of extraction and transport corridors. In addition, non-governmental organizations (NGOs) interact with project proponents and are an active participant as projects mature and move towards FID. Opposition to projects, be it by local communities or by NGOs, is a common aspect of developing energy projects in democratic nations. The intensity of opposition and the extent to which opposition is expected to be an ongoing issue factors into decision-making.

- **Political Dynamics and Risk**
  Perhaps one of the most significant aspects relating to the decision around LNG projects relates to the political dynamics of a host country. This extends beyond the formal approval process and relates to the interaction with local, state/provincial, and national level governments. While not publicly documented, proponents undertake careful analysis and engage with elected officials, especially at the state/provincial level and national level, to gauge interest across the political spectrum. If governments are in favour or actively supporting the project, there is careful consideration of the views of the main opposition party (or parties). Specifically, even if current policies are favourable to the potential project, proponents anticipate whether a government change might put that political support at risk. If there are radical differences on energy policy between political parties, a history of nationalizations, or experiences with sharp regulatory changes in the past, the risk factor (or premium) increases. States such as Western Australia have used a political-legal instrument known as a "State Agreement" to de-risk projects (see Box 2).

BOX 2: WESTERN AUSTRALIAN STATE AGREEMENTS

At their core, State Agreements are quite simple. The Western Australia state government describes them on its website: "State Agreements detail the rights, obligations, terms and conditions for the development of the specific project, and are administered by the Department of Jobs, Tourism, Science and Innovation on behalf of the Western Australian Government" (Government of Western Australia, 2020a). In practice, the project proponent - typically a company or joint venture - negotiates with the government about how it will develop a resource; usually these negotiations consider questions related to commodity production and export. The obligations placed on the private entity can vary. At times, obligations included building infrastructure and even entire towns. They may also involve other social obligations. Once conditions are settled, an agreement is formalized. This type of agreement between a government and a private entity is not unique to Western Australia and occurs in many other jurisdictions. The difference in Western Australia is that the agreement is ratified by parliament and once passed, becomes a formal law. It is a legislated agreement that raises the bar for any subsequent unilateral negotiation by an individual party.

The use of State Agreements is largely uncontroversial, and they enjoy bi-partisan support. That a centre left, Australian Labor Party proudly describes them as "a highly visible sign of WA's and the proponent's support for and commitment to the project" shows the level of endorsement across the political spectrum (ibid). This does not mean that political parties do not differ on their priorities, but these are largely peripheral. From the perspective of a project proponent, these instruments are attractive as the negotiation process involves the coordination of approvals and, after agreement, these are legislated. This means that the projects are 'de-risked' from a political perspective. It means that investors can have confidence that there will not be any unilateral alterations to the agreement, which may have the effect of nationalizing the operations or reducing profits.

There are currently 64 State Agreements in Western Australia. They cover a range of commodities and related infrastructure, including alumina, charcoal iron and steel, coal, copper, diamonds, energy, forest products, gas, gold, iron ore and steel, mineral sands, nickel, salt, uranium, oil, railways, and silicon (Government of Western Australia, 2020b). The types and variety of State Agreements have evolved with technology, societal expectations, environmental realities, and commodity demand patterns. State Agreements have been one of the reasons why Western Australia has attracted billions of dollars of investment into its mineral and energy sector over the past six decades.

The above discussions and processes occur simultaneously. Even within a single company, these interactions can be siloed and limited to subject matter specialists, with some of the environmental specialists barely interacting with the engineers. Only senior executives consider the project in its entirety, and their key task is to align these processes to present to their board for FID.

The decision on where to commission an LNG project has long-term implications. Again, the NHL Stanley Cup is a suitable metaphor: when LNG proponents are to commit to multi-year investments of billions of dollars, they need certainty that the rules of the game will not change over those years. Finally, successes or failures over time can accumulate to produce a trendline. Similar to the US shale gas experience, there may be significant 'black swan' events, which are rapid, unforeseen, and unexpected changes to the investment context.

It should be noted that the 'majors' in the energy industry have long been accustomed to assessing macroeconomic risk, unforeseen events, and commodity price risk. For instance, Shell became famous for its innovative use of scenario planning which helped it respond to the OPEC oil shocks of the 1970s. Firms now must also consider and assess policy risk as a key factor in FIDs, especially within democratic nations where consensus on development and industrial scale projects has been steadily declining.

SUCCESS AND FAILURE IN ATTRACTING LNG INVESTMENTS: ANALYSIS OF PROJECTS IN WESTERN AUSTRALIA AND BRITISH COLUMBIA

In a general review of the proposed LNG projects, it becomes evident that there are commonalities between the projects that succeeded and those that failed across Western Australia and British Columbia. Six projects were selected and reviewed in depth. These are summarized in Appendix 1. They include examples of success and failure in both Western Australia and Canada.

Based on analysis of successful proposals, a pattern becomes clear. The Western Australian Pluto and British Columbia LNG Canada projects obtained the relevant government, environmental approvals, and export licenses early in the project development process, and they secured significant sales purchase agreements with Asian gas and power companies.

Conversely, there are many reasons why projects may be unsuccessful at the FID stage. Challenges associated with project location, siting, and infrastructure placement are a recuring theme. Locations with cultural or environmental significance that require substantial environmental upheaval and challenged relationships with First Nations/ Indigenous communities add complications that may decrease the likelihood of obtaining the necessary environmental approvals and benefit agreements. Woodside's proposed James Price Point project for Browse is an obvious example.

Another recurring problem is financing. Projects that fail often do not have firm sale purchase agreements in place with domestic or Asian customers. During difficult economic periods, investors may lose faith in the LNG industry and project owners may attempt to sell their stake or reduce project funding.

In the pre-FEED and FEED stages, gaining the support of third-party stakeholder groups is essential, yet appears to be a common issue. Proponents can increase viability of their projects by proactively reaching out to affected parties rather than waiting for regulatory mandates. Demonstrating an effort to address environmental questions and choose low-emission, high-efficiency options is increasingly important, as is emphasizing the financial and employment benefits that LNG projects may offer local communities and businesses.

Obtaining long-term off-take agreements is often more complex than simply outlining the proposed output and financials of the transaction. Cross-cultural understanding and familiarity between parties may make the difference between two otherwise similar ventures, as in the case of the Dome and the North West Shelf projects. It should be noted that Western Australia had significant prior experience dealing with Japanese buyers through its existing iron ore trade.

Regulatory bodies play a substantial role in LNG project development. Awareness of the industry dynamics by the bureaucracy can assist given the dynamics of investment windows and timing pressures. In the current environment, LNG companies constantly have to adapt to a changing policy environment. The historical practices that had previously served as a template for project assessment have been upended and replaced by a continuous process of adaption. The situation remains dynamic, and there is no perfect approach.

The need for bi-partisan (in the Australian context), cross-partisan (in the Canadian context), and high-level political support is quite important, especially in the lead up to the FID. Two projects where this is clearly illustrated are the Ichthys proposal for Western Australia and Pacific North West LNG in British Columbia. Separating political and economic aspects of these investment decisions is difficult. In both cases, there was not the requisite bi-partisan support for the projects (Australian Broadcasting Corporation, 2008; Scotti, 2017).

Understanding the negative FDI for the Ichthys project in Western Australian requires some context. It was proposed during a mining boom, when there was significant investment occurring outside of the sector. It was one of the many project proposals that were vying for the attention of the Premier and the government. At a key point in the process, there were reports that the then Premier, Alan Carpenter, would not answer the phone call of the project proponent, Inpex. Conversely, the Northern Territory government actively courted the investment, which may have contributed to the plant ultimately being located near Darwin as opposed to the Western Australian coast. Pacific North West LNG faced a variety of challenges, not least the then new NDP government that was not fully supportive of the venture.

In all public comments, energy companies typically downplay the impact of politics on the FID. However, this is a factor that is incredibly important for boards as they understand that their negotiation ability decreases as soon as they start a capital expenditure and thus become captive. For those in this sector, nationalizations or indirect nationalizations are an ongoing concern.

A key differentiator between Australia and Canada is that all Australian states and territories have access to the ocean and possess their own coastline (Ogle, 2019). If all Canadian provinces enjoyed such access, British Colombia would not have a de facto veto option over new projects, and there could be competition between provinces around hosting new LNG plants, as occurred with Ichthys between Western Australia and the Northern Territory.

Another difference beyond geography is the use of 'State Agreements' in Western Australia. In cases where a bi-partisan position on LNG investments can be reached in Canadian provinces, this mechanism for documenting agreement would help de-risk projects and make financing easier. The potential for this political-legal instrument to be applied in Canadian provinces is unclear, but in common law jurisdictions, providing a state-sanctioned and legislated agreement is not a new or novel concept.

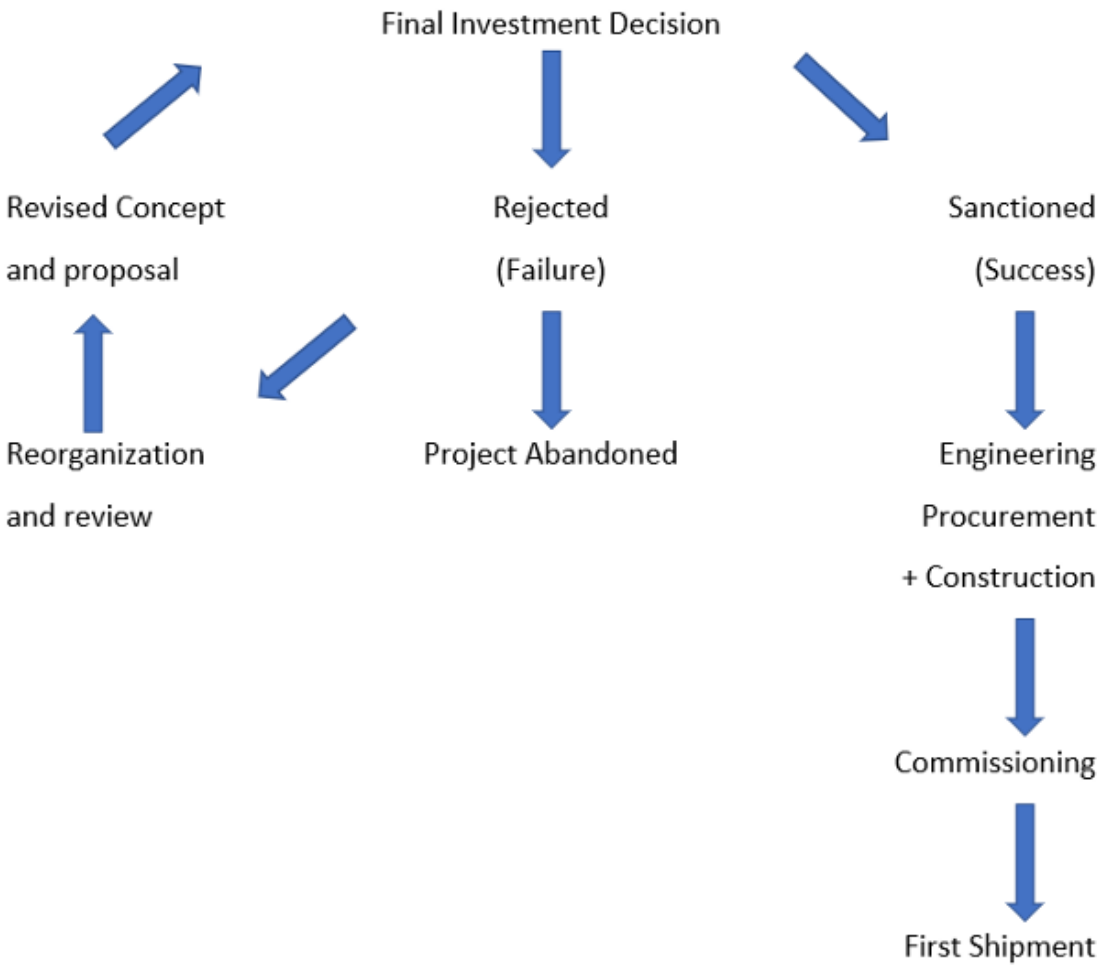
An emerging trend has been the impact of the movement to divest from companies in the fossil fuel sector as well as the filter of "Environmental, Social and Governance" (ESG) metrics that fund managers increasingly apply. This additional set of investment criteria created an issue for many of the projects in British Columbia as companies started adapting to this new trend. Conversely, Australian projects reached FID when ESG investment practices were not as common yet. While many Australian projects were successful reaching FID when they did, outcomes may be different if these projects were proposed in 2021 or 2022.

In Australia, ESG forces have contributed to delinking energy prices from share prices of the major, listed firms. Historically, the two prices have tracked each other closely. Since early 2020, a disconnect has emerged, and the listed prices of major Australian firms drifted. Access to capital markets for LNG projects – bonds and equity – has become more challenging over the past five years.

The response in Australia to ESG trends has been industry consolidation. Planned mergers between Woodside and BHP's petroleum division as well as between Santos and Oil Search are going to create much larger entities that have the capacity to invest in new projects with less reliance on capital markets. The Woodside-BHP merger was completed by issuing shares, meaning that there was no need to raise additional capital, which maintained the balance sheet. The equity sale of Woodside's Pluto Train 2 development, in the form of a tolling agreement is indicative of the industry's response to the pressures of ESG on companies' balance sheets.

While the dynamics around FID change constantly, a crude representation of the decision-making process is illustrated in Figure 3. Many Australian projects have been (re)proposed multiple times in different forms and have been unsuccessful at the FID stage. This is a feature of the industry which is better understood in jurisdictions with a mature sector. In Canada, unsuccessful FID outcomes are seen as a point of no return. This need not necessarily be a permanent state of affairs.

FIGURE 3: THE FID FOR LNG PROJECTS: SUCCESS AND FAILURE



FUTURE TRENDS

In the 2020s and 2030s, the criteria driving FIDs for LNG and large energy projects will be different from what we have experienced in the past.

In interviews with retired industry executives, there were repeated references to the dramatic changes in energy markets over the decades. They commonly warned about relying on forecasts. Several trends were identified which can be expected to reshape LNG markets, including:

- **Carbon offsets and capture may enable a second wind for LNG**
  It is possible that there may be a shift back to natural gas and LNG in a scenario where new approaches to offsets, emissions abatement, and/or carbon capture and storage boost acceptance (Macdonald-Smith, 2021). In new projects, cuts to the carbon intensity of the liquification process (which is energy intensive) are being actively promoted. For proponents in British Columbia, access to renewable hydropower allows them to position their projects as at the low end of carbon emissions. The first step toward a hydrogen sector will likely require natural gas, with blending and use of ammonia as an intermediate carrier before establishing a dedicated hydrogen infrastructure. Those looking at Japan, long seen as a leader in the transition to a hydrogen economy, are already pointing to emulating their effective creation and nurturing of the LNG sector (Dvorak, 2021).

- **International Crisis and Dislocation**
  In a bleaker future, including major conflict or accelerated geopolitical competition potentially triggered by an incident in the South China Sea, energy choices will differ. Evenden's Allied Power maps out the massive deployment of hydroelectricity in Canada supporting the war effort in World War II (Evenden, 2015). Should a crisis develop in the 2020s, defence and strategic planners will certainly review the options for energy and industrial needs, which could again re-draw the energy map and bring new resources online in a very short period. Concerns over emissions and environmental impact would likely be secondary to national security. The projects may be domestically focused, but the build out (like in World War II) would guide future energy decisions and options.

- **Greenfields versus Brownfields**
  Even in a business-as-usual scenario, there remain several questions relating to legacy assets and brownfield expansions. Woodside's planned AUD$16 billion Scarborough FID is due in the second half of 2021 (Macdonald-Smith, 2021). A return to the wave of major investments that Australia experienced in the 2010s is unlikely.

- **ESG Investment Criteria**
  The trend toward ESG investment criteria may, in the short to medium term, lead listed, Western companies to limit their deployment of capital to new LNG projects. In the future, potential equity investors may even be expanded to include a wider range of partners such as sovereign wealth funds, infrastructure funds, national pension funds, and regional development corporations. How this finance is structured, measured, and deployed remains an open question.

CONCLUSION

This paper examines the LNG sector in Western Australia and British Columbia during two key periods: the 1980s and the 2010s. At each point there were multiple FIDs for new LNG projects under consideration. Some were successful and others not.

It would be impossible to create a checklist for successful FIDs because each project proposal is unique and so are market and government dynamics at the time of a decision. This analysis of LNG decision-making illustrates the complex and at times decades-long preparations for reaching a FID. These long timelines can be explained in terms of 'investment windows' that differ from the conventional energy sector.

Australia's success in attracting large LNG investments may be (partly) attributed to its first-mover advantage. If Dome had edged out the North West Shelf in the 1980s, it is possible that a large LNG sector would have developed in British Columbia and a Vancouver-based analyst would have written this paper, rather than this author, who is based in Perth.

Should a Canadian jurisdiction decide to actively pursue developing an LNG sector, Western Australia, with its use of 'State Agreements', is a useful model. Similarly, if Australia sought to establish a hockey league, it would likely emulate Canada. In the 2018-19 season 419, or 43.8 percent of all NHL players, were Canadian. Australia had one player (Nathan Walker).

Even in a 'net-zero by 2050' policy environment, natural gas and blue hydrogen will likely be an important interim step before green hydrogen is viable. This analysis may help Canadian policymakers gain insights from the Australian example.

If energy demand for gas intensifies, new proposals will resurface for LNG projects in Canada. They may have a different ownership mix with a more prominent role for state-owned companies, incorporate hydrogen, and have a lower carbon footprint. A new pipeline of projects for FID consideration may be emerging.

REFERENCES

About Pipelines (n.d.). *Pipelines: Part of Canada's past and future.* https://www.aboutpipelines.com/en/blog/pipelines-part-of-canadas-past-and-future/ (accessed November 17, 2020).

Antle, R., (2021, June 11). An Australian iron ore company is shifting to green energy, and Labrador is in its sights. *CBC News.* https://www.cbc.ca/news/canada/newfoundland-labrador/nl-fortescue-labrador-green-hydrogen-1.6060904

Australian Broadcasting Corporation (2008, August 28). *Labor should admit WA's lost Inpex gas plant: Barnett.* https://mobile.abc.net.au/news/2008-08-28/labor-should-admit-was-lost-inpex-gas-plant-barnett/492270?pfmredir=sm&pfm=sm

Bailey, R. (1983). *The Arctic Pilot Project. Energy Exploration and Exploitation* 2(1): 5-24.

Bratt, D. (2021). *Energy-Environment Federalism in Canada: Finding a Path for the Future.* Ottawa: Positive Energy, University of Ottawa. https://www.uottawa.ca/positive-energy/content/energy-environment-federalism-canada-finding-path-future

Canberra Times (2020, July 7). Australia becomes the largest liquefied natural gas exporter in the world. https://www.canberratimes.com.au/story/6568957/australia-now-the-worlds-largest-natural-gas-exporter/?cs=14231

Duncan, C.A.M. and Sandwell, R.W. (2016). Manufactured and Natural Gas. In R.W. Sandwell (Ed.), *Powering up Canada: a history of power, fuel, and energy from 1600.* London: McGill-Queen's University Press, pp. 300-328.

Dvorak, P. (2021, June 13). How Japan's Big Bet on Hydrogen Could Revolutionize the Energy Market. *The Wall Street Journal.* https://www.wsj.com/articles/japans-big-bet-on-hydrogen-could-revolutionize-the-energy-market-11623607695

Energy Voice (2021, May 7). *Qatar and Russia set to benefit from China's robust LNG demand.* https://www.energyvoice.com/oilandgas/320971/qatar-and-russia-set-to-benefit-from-chinas-robust-lng-demand/

Energy Information Administration (n.d.). Natural Gas. https://www.eia.gov/dnav/ng/hist/n9102cn2a.htm (Accessed November 17, 2020).

Evenden, M. (2015). *Allied Power: Mobilizing Hydro-electricity during Canada's Second World War.* Toronto: University of Toronto Press.

Government of Canada (n.d.). *Natural Gas Facts.* https://www.nrcan.gc.ca/science-data/data-analysis/energy-data-analysis/energy-facts/natural-gas-facts/20067

Government of Western Australia, Department of Jobs, Tourism, Science and Innovation (2021). *Western Australia Trade Profiles – April 2021.* https://www.wa.gov.au/government/publications/western-australias-economy-and-international-trade

Government of Western Australia, Department of Jobs, Tourism, Science and Innovation (2020a). *State Agreements.* https://www.wa.gov.au/organisation/department-of-jobs-tourism-science-and-innovation/state-agreements

Government of Western Australia, Department of Jobs, Tourism, Science and Innovation (2020b). *List of State Agreements in Western Australia.* https://www.wa.gov.au/sites/default/files/2020-10/List%20of%20State%20Agreements.pdf

Heckathorn, M. E. (2003). Canada's Gas Production Ebbs as US Demand Continues to Grow. *Natural Gas Week* 19(44).

Howard, J. (2004, July 28). Address at Woodside's North West Shelf Operations LNG Plant Karratha. Western Australian Government, Department of the Prime Minister and Cabinet, https://pmtranscripts.pmc.gov.au/release/transcript-21418

International Energy Agency (2011, June 6). *IEA special report explores potential for 'golden age' of natural gas.* https://www.iea.org/news/iea-special-report-explores-potential-for-golden-age-of-natural-gas

International Energy Agency (2021). *Net Zero by 2050: A Roadmap for the Global Energy Sector.* https://iea.blob.core.windows.net/assets/beceb956-0dcf-4d73-89fe-1310e3046d68/NetZeroby2050-ARoadmapfortheGlobalEnergySector_CORR.pdf

Kaplan, L. and Milke, M. (2021). A tale of two countries: Oil and gas in Australia and Canada over the past decade. Canadian Energy Centre. https://www.canadianenergycentre.ca/a-tale-of-two-countries-oil-and-gas-in-australia-and-canada-over-the-past-decade/

Macdonald-Smith, A. (2018, February 23). LNG investment back on the table but it's harder now. *The Financial Review.* https://www.afr.com/companies/energy/lng-investment-back-on-the-table-but-its-harder-now-20180223-h0wiw1 (accessed 13 September 2018).

Macdonald-Smith, A. (2020, October 21). $3.5 extra a shipment but carbon-neutral LNG could take off. *Australian Financial Review.* https://www.afr.com/companies/energy/an-extra-us2-5m-going-carbon-neutral-in-lng-20201021-p56721

Macdonald-Smith, A. (2021, February 19). Woodside advances Scarborough with new LNG contract. *Financial Review.* https://www.afr.com/companies/energy/woodside-advances-scarborough-with-new-lng-contract-20210219-p57402

Mathias, P. (1971). *Forced Growth: Five Studies of Government Involvement in the Development of Canada.* Toronto: James Lewis & Samuel.

Natural Gas Intelligence (n.d.). *Canadians Thaw Out Plan for Arctic LNG.* https://www.naturalgasintel.com/canadians-thaw-out-plan-for-arctic-lng-2/ (Accessed November 17, 2020).

Ogle, K.J. (2019). *A Study of Liquefied Natural Gas Development in Australia and Requisite Learnings for Canada.* Ottawa: Canadian Global Affairs Institute. https://d3n8a8pro7vhmx.cloudfront.net/cdfai/pages/4312/attachments/original/1574112567/A_Study_of_Liquefied_Natural_Gas_Development_in_Australia_and_Requisite_Learnings_for_Canada.pdf?1574112567

Oil & Gas Today (2019, December 6). *Negotiating Australia's first LNG export contract.* https://www.oilandgastoday.com.au/negotiating-australias-first-lng-export-contract/

Petro Canada (n.d.). *Arctic Pilot Project.* http://pubs.aina.ucalgary.ca/misc/934.pdf (Accessed November 17, 2020)

Peyton, J. (2017). *Unbuilt Environments: Tracing Postwar Development in Northwest British Columbia.* Vancouver: UBC Press.

Scotti, M. (2017, July 26). What killed the $36-billion Pacific NorthWest LNG project?. *Global News.* https://globalnews.ca/news/3625528/what-killed-the-pacific-northwest-lng-project/

Tan, F. (2019, June 24). Cheniere Energy: First-mover advantage in the booming LNG market. *Fund Super Mart.* https://secure.fundsupermart.com/fsm/article/view/15213/cheniere-energy-first-mover-advantage-in-the-booming-lng-market

Thornhill, J. (2020, September 4). Australia's $200 Billion LNG Boom Waylaid by Covid and Cracks. *Bloomberg.* https://www.bloomberg.com/news/articles/2020-09-04/australia-s-200-billion-lng-boom-waylaid-by-covid-and-cracks

Weems, P.R. and Howell, N.M. (2014). *Japan's pivotal role in the global LNG industry's 50-year history. Lexology.* https://www.lexology.com/library/detail.aspx?g=1d775cb2-c99f-4019-b142-214731b8e828

APPENDIX 1: PROJECTS REVIEWED FOR THIS ANALYSIS

SUCCESSFUL PROJECTS

	Pluto	LNG Canada
Stakeholder(s)	Woodside (90 percent), Kansai Electric (5 percent), Tokyo Gas (5 percent)	Royal Dutch Shell (40 percent), PETRONAS (25 percent), PetroChina (15 percent), Mitsubishi (15 percent), Korea Gas (5 percent)
Final Investment Decision (FID)	July 27, 2007 (AUD$12-billion)	October 1, 2018 (CAD$40-billion)
Background to FID	The Pluto field was discovered in 2005 and the process to FID was fast-tracked.	In July 2016, Shell announced the FID on LNG Canada would be delayed indefinitely. In August 2017, Shell revisited the project announcing the company would aim for an FID in 2018.
Operator	Woodside	LNG Canada Development
Capacity	A single processing train with the capacity to produce 4.9-Mtpa (14% higher than the expected 4.3-Mtpa at the time of final investment decision in 2007)	Two processing trains with a capacity to produce 7-Mtpa each for an expected 14-Mtpa
Government and Environmental Approval	In 2006, the Pluto Domgas Arrangements were formed with the State Government. Woodside agreed to invest in planting trees, marine monitoring, and biodiversity offset programs to minimise marine life impact from dredging activities.	In February 2013, the project's export license was approved by the National Energy Board (NEB) for 24 MTA. Then, in June 2015, LNG Canada's Environmental Agreement was conditionally approved subject to BC EA/CEAA processes. In January 2016, another export license was approved by the NEB to ship a total of 52.7 Tcf of gas at a rate of up to 3.7 Bcf/d, for 40 years.
Commissioning	The first LNG cargo was shipped in May 2012.	The project is targeting commissioning in 2025.

UNSUCCESSFUL PROJECTS

	Australia: Ichthys Proposal 1	Australia: Browse Proposal 1	Canada: Kitimat	Canada: Pacific Northwest LNG
Feasibility and Concept Selection	Ichthys proposed a 220 km offshore platform Southwest of Darwin in Browse Basin, WA. The project planned exporting gas and condensate from Ichthys Field to nearby Maret Island. This required bulldozing the island and dumping it in the sea to enable the construction of the jetty and LNG base.	The Browse project proposed a large onshore plant at James Price Point, on the Dampier Peninsula, north of Broome, WA.	Kitimat proposed 10 Mtpa of LNG production in Bish Cove near Kitimat, British Columbia.	This project consisted of an LNG export facility in Lelu Island in Port Edward, British Columbia.
Government & Environmental Approval	Failed to obtain necessary environmental approvals due to island destruction and tidal zone issues.	Marine damage from the dredging and blasting of reefs and seabeds, damage to dinosaur fossils, waste deposition in the ocean, and negative effects on wildlife were major concerns. In August 2013, the WA Supreme Court overruled the Environmental Minister's decision to approve the project.	In June 2006, an Environmental Assessment Office (EAO) certificate was issued. The Certificate was extended in May 2011 with a conditional mandatory construction start by June 2016. The project's export license was then approved by the NEB in October 2011.	In December 2013, exports were approved by the NEB for 22 Mtpa. Then, in November 2014, the project obtained Environmental Approval from BC. In September 2016, the CEAA approved the project as well with 190 conditions.

Land Rights & Usage	N/A	An AUD$1.5-billion benefits package was negotiated with traditional owners Goolarabooloo Jabirr Jabirr. The onshore project was supported by 60 percent of voters under the 1993 Native Title Act. Many traditional owners raised legal objections over contractual conditions.	An impact-benefit agreement was successfully reached with the Haisla First Nation.	Pacific NorthWest LNG signed impact-benefit agreements with four of five First Nations it has to consult over the LNG terminal near Prince Rupert: Metlakatla, Kitselas, Kitsumkalum and Gitxaala. The fifth, the Lax Kw'alaams First Nation, offered conditional support for the project.
Financing	Operating manager INPEX held a 66.245% stake. Total was a project partner with a 26% stake. Asian purchasers CPC, Tokyo Gas, Kansai Electric Power, Osaka Gas, JERA, and Toho Gas received 2.6%, 2.625%, 1.575%, 1.23%, 1.2%, 0.735%, and 0.42% stakes respectively. The dredging and required jetty length rendered the project unfeasible.	Woodside, Shell, BP, Japan Australia LNG/MIMI, and Petro China had stakes of 30.6%, 27%, 17.33%, 14.4% and 10.67% respectively. In March 2008, a SPA was organized with CPC Corporation for A$45b (2-3Mtpa of LNG) and PetroChina for 2Mtpa. BHP originally owned an 8.3% stake which was sold to PetroChina in December 2012.	The project was originally owned by Chevron and Apache. Apache exited in July 2014, and Woodside entered in December 2014 splitting the equity 50/50 with Chevron. In January 2015, Chevron announced a significant decrease in spending on Kitimat and considered selling their stake in 2018.	The project was owned by Petronas, Japex, Petroleum Brunei, Indian Oil Corp and Sinopec.
Cancellation	The Maret Island proposal was replaced with a proposal to export gas to onshore facilities near Darwin via an 890 km pipeline. The second proposal achieved FID acceptance in January 2012 and commissioning in 2018.	Cancelled by the 2013 Supreme Court decision. The project was both relatively expensive with high carbon emissions undermining LNG's claim as cheaper and greener energy. A second and third Browse proposal followed.	Though the EAO announced the project was substantially started in September 2015, no FID was reached.	Project was cancelled on July 25, 2017.

NOTES

POSITIVE ENERGY AT THE UNIVERSITY OF OTTAWA USES THE CONVENING POWER OF THE UNIVERSITY TO BRING TOGETHER ACADEMIC RESEARCHERS WITH EMERGING AND SENIOR DECISION-MAKERS FROM INDUSTRY, GOVERNMENT, INDIGENOUS COMMUNITIES, LOCAL COMMUNITIES AND ENVIRONMENTAL ORGANIZATIONS TO DETERMINE HOW TO STRENGTHEN PUBLIC CONFIDENCE IN ENERGY DECISION-MAKING.

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