



## **Trigon Pacific LPG Project**

### **Initial Project Description**

June 12, 2026

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## 1 Executive Summary

Canada has established a clear strategic imperative to diversify and grow Canadian exports with a specific focus on doubling non-U.S. exports by mid-2035. Trigon Pacific Terminals (Trigon) strongly supports these efforts and is working to diversify its terminal operations and transshipment operations for new products that will help meet these critical Canadian objectives, increase capital investment across Western Canada, grow Canada's GDP, in addition to the federal, provincial and local tax base.

Canada currently produces approximately 200 million barrels per year of liquid propane gas (LPG) including propane and butane. Of that, half (100 million) is exported with the majority (58%) destined for the United States, as there is insufficient export terminal capacity to supply other markets. Existing and new projects under development are expected to create more than 110,000 b/d of new LPG supply, however, there remains a notable export capacity shortfall. As such, Trigon is proposing to construct and operate an LPG storage and transload facility (the Project).

### **Project Scope**

The Project will be sited on lands leased from the Prince Rupert Port Authority (PRPA), located in Prince Rupert, British Columbia. It will use an existing brownfield area, requiring neither no new land clearing nor any in-water works. It will also leverage existing infrastructure, including rail in Trigon's yard, berth, piping, and related LPG loading arms. In line with market needs and global necessities, the Project will target to achieve a low GHG operation, by connecting to the BC Hydro power grid and using the latest electric drive technologies.

The Project will receive LPG from BC and Alberta via CN Rail's northern line and will use Trigon's current rail yard coupled with new off-loading facilities of up to 20 rail unloading racks to provide efficient complete unit train receipt and handling. The LPG will be transferred to intermediate pressurized storage tanks before being chilled and transferred to a refrigerated tank at atmospheric pressure. The refrigerated LPG will be transferred to Very Large Gas Carriers (owned and operated by others) using Trigon's existing berth and loading arms, for shipment to global markets. The Project will be designed to maximize throughput at the terminal with a potential storage capacity of 158,000 m<sup>3</sup>, which allows for an estimated throughput of approximately 2.4 million metric tonnes per annum.

### **Project Benefits**

The Project will deliver a number of significant benefits.

By repurposing existing infrastructure and developed land, Trigon will add an estimated 85,000 barrels per year of throughput and 158,000 cubic metres of new LPG storage capacity, providing the lowest cost new export opportunity for Canadian propane producers. Using brownfield lands also avoids or reduces potential environmental effects through efficient design, minimized project footprint, maximizing use of existing infrastructure, and using proven and effective mitigation measures.

It will open future opportunities for economic benefits to northwest coast region and Prince Rupert specifically, by enabling long-term economic growth, creating and sustaining local jobs through construction and future operations, and by extension, enhancing the PRPA's economic well-being.



It will open the door for Canadian commodity producers to export their products through a truly open access terminal. By focusing exclusively on storage and transshipment services, Canadian exporters from BC, Alberta and Saskatchewan, and global offtakers will be able to select any processing, rail logistics, or vessels they may choose to bring product to and from the facility.

Importantly, it will also create further benefits by incentivizing capital investment by others in additional natural gas production and fractionation infrastructure.

### **Review**

The Project exceeds commodity storage thresholds set forth in the *Physical Activities Regulations* and as such, the environmental aspects of the Project are expected to be reviewed by federal authorities led by the Impact Assessment Agency of Canada (IIAC), under the *Impact Assessment Act* (IAA). The Project is not a Reviewable Project under the *BC Environmental Assessment Act* (BCEAA). Subject to the timing of regulatory approvals, the in-service date for the LPG export terminal is anticipated as early as Q4 2031.

### **Engagement & Work to Date**

Trigon, partly owned by the Lax Kw'alaams Band and Metlakatla First Nation, is committed to open and transparent communication with Indigenous Nations, the local community, and stakeholders throughout the life of the Project.

A pre-FEED level design, environmental studies, and two and a half years of consultation and engagement with six Tsimshian Nations has been completed, and the Project that has received an 'approval to proceed' from Trigon's owners.

Based on initial engagement with local communities, the Project has received support from Lax Kw'alaams Band and Metlakatla First Nation leadership, the City of Prince Rupert, the District of Port Edward, the International Longshore and Warehouse Union Local 523 (ILWU523), the International Longshore and Warehouse Union Canada (ILWUC), as well as a number of Canadian propane producers, and offtakers in Japan and Korea. Further, an offtake partner has signed an agreement committing to a significant portion of Trigon's export capacity.

Trigon is committed to ensuring Indigenous Nations, local communities, stakeholders, including regulatory authorities, and other affected parties know why a new LPG export terminal is needed today, how it supports Canadian LPG producers and Canada's growth strategy, what the facility will do, how it will be operated, and the measures that will be taken to ensure that the terminal is safe. Trigon will continue to engage meaningfully and also to incorporate concerns into design changes. Trigon commits to operating the Project in a safe and environmentally sound manner.



## 2 General Information

### 2.1 Proponent Information

Trigon Pacific Terminals (Trigon) is a multi-commodity, dry and liquid bulk export terminal operating within the Port of Prince Rupert, as a vital trade link in Canada's North Pacific export corridor.

Trigon currently handles metallurgical coal, thermal coal, and petroleum coke, as well as Liquefied Petroleum Gas (LPG). Trigon is actively looking to diversify its product mix. This will ensure job opportunities are expanded and that the facility is able to continue to play a positive role in the community and the country.

The Trigon Pacific LPG Project (Trigon LPG) is located on Ridley Island on federal port land administered by the Prince Rupert Port Authority that is leased to Trigon (Figure 2-1).

Ridley Island falls under the Port of Prince Rupert 2020 Land Use Management Plan (2020) that designates zoning for industrial and port terminal development, including the provision for dry and liquid bulk terminals. PRPA land is leased to Trigon and supports a fully operational coal terminal built in 1983 and an LPG terminal commissioned in 2019. The entire Trigon lease occupies an area of about 400 acres (including water lot lease areas).

### 2.2 Project Location

Trigon Pacific Terminals (Trigon) is located on Ridley Island, approximately 10 km south of Prince Rupert, BC (Table 2-1, Figure 2-1). Prince Rupert is in northwestern BC, approximately 775 km from Vancouver.

The terminal is accessible by land, sea, or air. Highway 16 connects Ridley Island to the mainland by road. The Canadian National Railway (CN Rail) main line extends from eastern Canada and southern United States through the Winnipeg hub to Prince Rupert, providing rail access from Trigon to much of Canada and the US. The airport, located on Digby Island, has daily flights to Vancouver. The connection to Prince Rupert occurs by a ferry service that is coordinated with flights. For access by sea, Trigon is located in Chatham Sound and is strategically located for passage to Asia and other international destinations.

Land to the north and east of Ridley Island is forested mountain of Kaien Island between the port and the city of Prince Rupert. Porpoise Harbour is connected to Chatham Sound between Ridley and Lelu Islands, and to Wainwright and Morse Basins to the east.

<b>Site Location</b>	Ridley Island, BC (south of Prince Rupert)
<b>Geographic Coordinates</b>	54°13'40.12"N, 130°19'39.95"W
<b>UTM Coordinates</b>	09U 412952.32 E, 6009691.80 N

**Table 2-1: Site Identification**

### 2.3 Legal Description of Land

All land and water rights required for the project are currently under a lease agreement with the Prince Rupert Port Authority

Land Lot: Parcel Name 005-047-714 PRP 10924 Parcel H

Water Lot: 005-047-943 PRP 10934 Lot 1

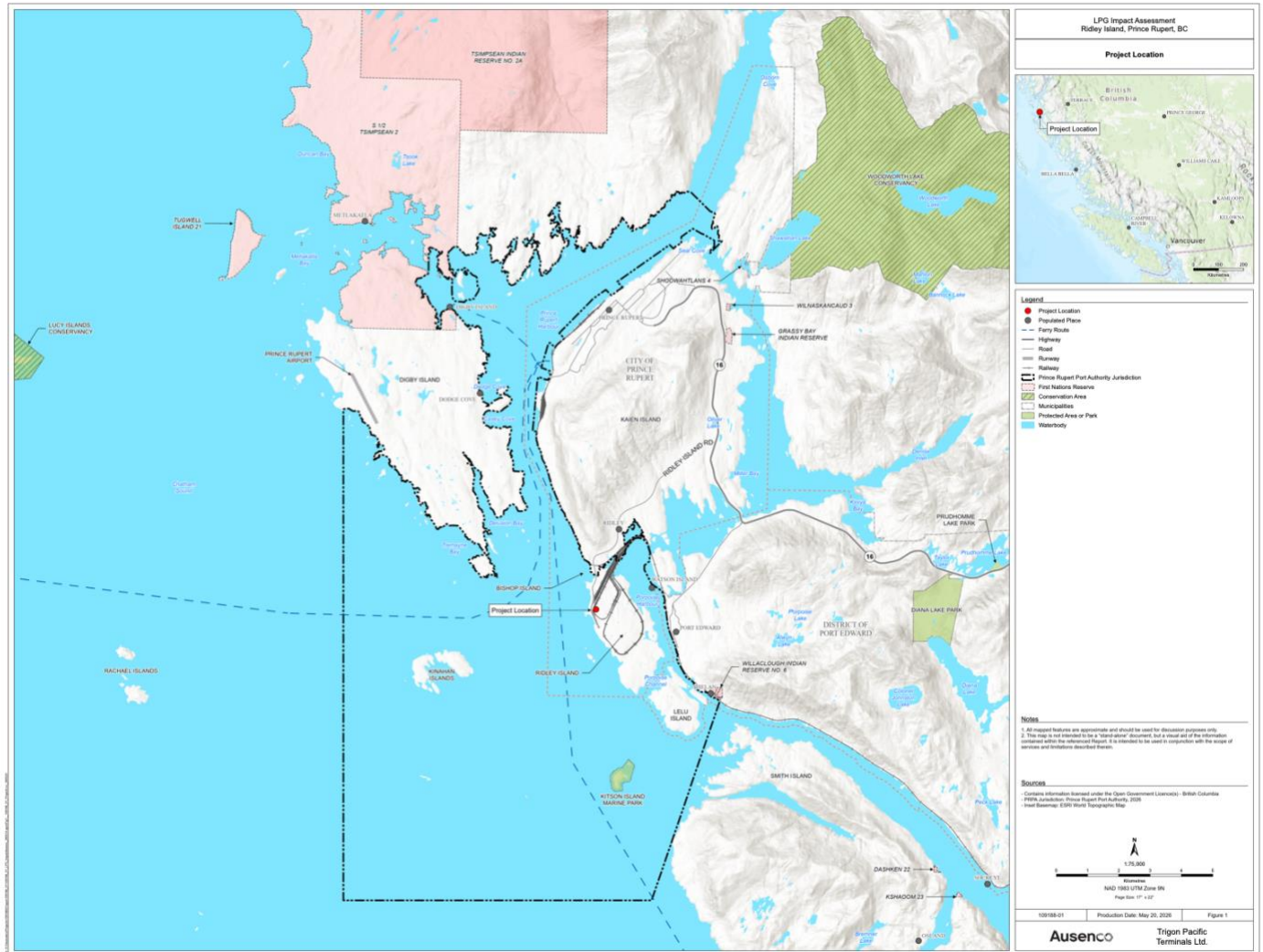


Figure 2-1: Project Location

### 2.4 Preliminary Spatial Boundaries

The impact assessment will evaluate the Project’s potential to cause significant adverse effects across five key areas: environmental, economic, social, heritage, and health. As Project planning progresses, Trigon will continue collaborating with applicable regulatory bodies, potentially affected Indigenous

Groups, and other stakeholders to identify concerns and issues. Input from this engagement will guide the selection of valued components (VCs) within each of these five areas.

Spatial boundaries for each VC will reflect the geographic range over which measurable environmental, economic, social, heritage, and health effects may occur. Initial boundaries have been established based on the anticipated zones where Project activities and VCs may interact.

These boundaries may be confined to the Project footprint or extend beyond it, depending on how a VC is distributed or moves across the landscape at local, regional, or broader scales. The Project footprint refers to the land directly affected by construction and associated activities. The Local Study Area (LSA) represents the area where a VC is most likely to experience Project-related effects. The Regional Study Area (RSA) includes the LSA as well as surrounding areas where any remaining Project effects could interact cumulatively with existing or reasonably foreseeable developments.

Preliminary spatial boundaries for assessing Project effects are outlined in Table 2-2. These boundaries will be refined further as VC selection is finalized and additional scoping work is completed.

Table 2-2: Preliminary Study Area Boundaries

Pillar	LSA Boundary and Rationale	RSA Boundary and Rationale
Environment	<p>The LSA will be defined for each Environmental VC and will be based on the zone of influence of the Project on the VC.</p> <p>The selection of the LSA will be informed by:</p> <ul style="list-style-type: none"> <li>• Guidelines for Air Quality Dispersion Modelling in British Columbia (BC MOE 2008) for potential effects to air quality (to be refined through modelling)</li> <li>• British Columbia Noise Control Best Practice Guideline (BC OGC 2009) where potential interactions are anticipated to occur with the acoustic environment</li> <li>• the Project footprint</li> <li>• the LSA for vegetation will be the project footprint</li> <li>• the LSA for wildlife resources will be the project footprint</li> <li>• the LSA for fish and fish habitat, if required, consists of a 100m buffer around the existing jetty</li> </ul>	<p>The RSA will be defined for each Environmental VC and will be based on the potential interaction of the effects of the Project with the effects of other existing or future effects on the same VC. The selection of the RSA will be informed by:</p> <ul style="list-style-type: none"> <li>• results of air dispersion modelling</li> <li>• BC OGC guidelines on acoustic effects, indicating that the RSA for the acoustic environment will extend 5 km from the Project boundary</li> <li>• the RSA for vegetation will consist of a 100m buffer surrounding the Project footprint</li> <li>• the RSA for wildlife resources will consist of a 100m buffer surrounding the Project boundary. The nearby locations of National Wildlife Areas and WMAs will further inform the RSA.</li> <li>• the RSA for fish and fish habitat, if required, consists of a 500m buffer around the existing jetty</li> </ul>

Pillar	LSA Boundary and Rationale	RSA Boundary and Rationale
Economic	The LSA for Economic conditions includes the City of Prince Rupert and District of Port Edward	The RSA for Economic conditions will be the North Coast Regional District and the Regional District of Kitimat-Stikine
Social	The LSA for Social conditions will include City of Prince Rupert, the District of Port Edward, and the boundaries of potentially affected Indigenous communities	The RSA for Social Conditions will be the North Coast Regional District and the Regional District of Kitimat-Stikine.
Heritage	The LSA for the archaeological and Heritage resources assessment will be the area of ground disturbance for the Project.	The RSA for the archaeological and Heritage resources assessment will be the same as the LSA
Health	The LSA for the assessment of potential Health risks to humans from potential changes to air quality will be the same as that for air quality	The RSA for the assessment of potential Health risks to humans from potential changes to air quality will be the same as that for air quality

## 2.5 Proposed Development

The Project will consist of up to twenty rail unloading racks, gas driven compressors<sup>1</sup>, connection to the BC Hydro grid, refrigeration processing equipment, and associated piping, which will allow for a minimum average throughput of approximately 2.4 million metric tonnes per annum. A natural gas connection to PNG may be utilized for back up and redundancy purposes. The Project footprint is shown in Figure 2-2.

No further berth development is required.

<sup>1</sup> Subject to power availability from BC Hydro and final engineering design.

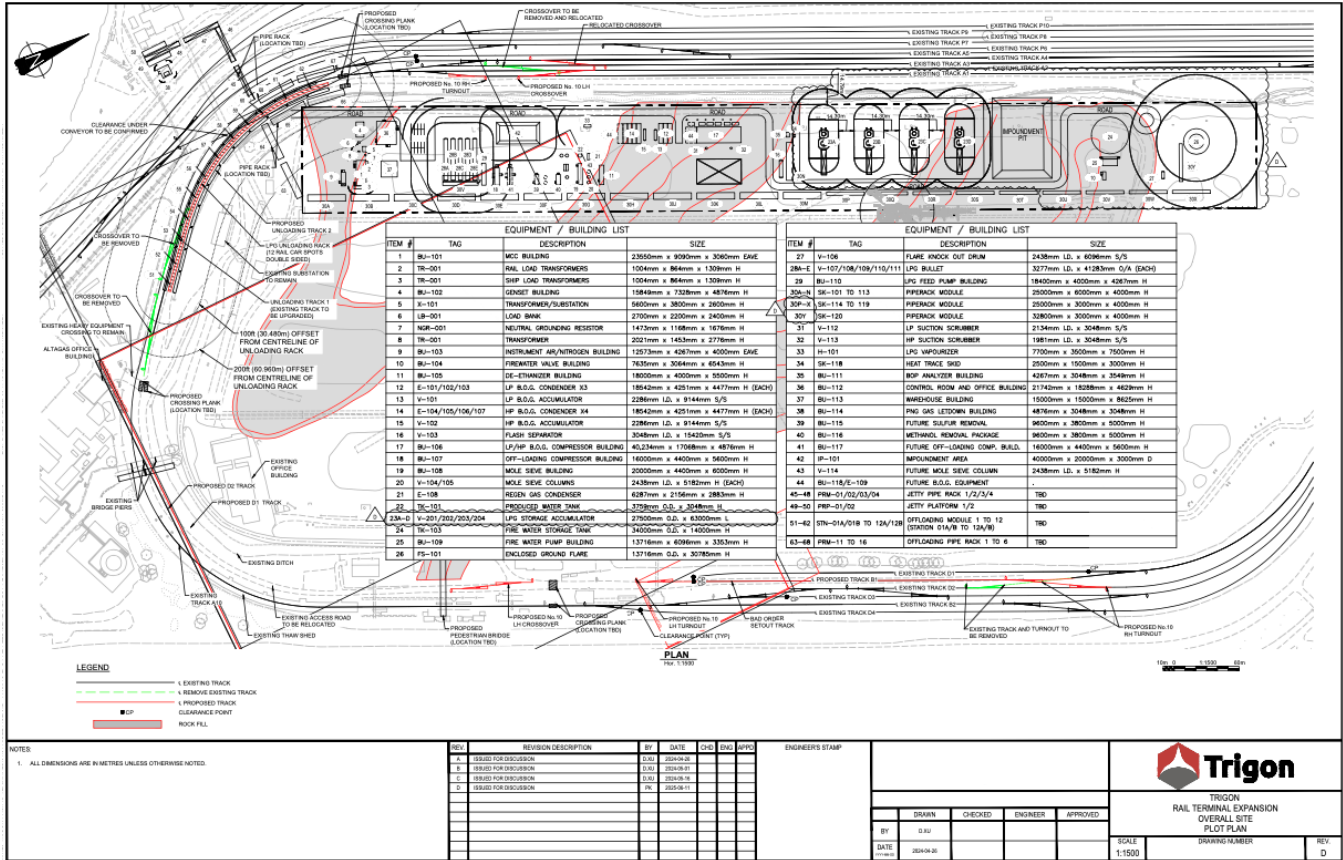


Figure 2-2: Project Footprint

## 2.6 Purpose and Need for the Project

The proposed Trigon LPG Project provides the following key benefits:

- Enhances Market Access for Canadian LPG Through Competitive Export Infrastructure;
- Supports Long-Term Canadian LPG Export Opportunities in Response to Growing Global LPG Demand;
- Unlocks Global Value Through Export Diversification;
- Builds a More Competitive and Resilient LPG Export Sector; and
- Provides employment and Economic Benefits that support Canada’s Economic Growth Objectives.

### 2.6.1 Enhancing Market Access for Canadian LPG Through Competitive Export Infrastructure

Targeted development of Canada’s rich natural gas resources has resulted in an oversupply of propane in the Western Canadian Sedimentary Basin (WCSB). The oversupply has persisted for over a decade and has led to the development of three propane export terminals on the west coast of North America.

Despite the addition of new export facilities, propane oversupply persists and will continue to increase as new gas processing and LNG export infrastructure are developed. Existing export terminals currently operate at or near capacity, and new infrastructure is required to balance market demand with supply. In addition, much of the LPG export capacity on the west coast of Canada is operated by a single company that manages a fully integrated supply chain from Edmonton through to Asia. This fully integrated model limits the ability of other companies with potentially more cost-effective logistics solutions to compete for market share. Trigon's model is different as it is only a terminal (i.e. it does not control the entire supply chain) thereby allowing producers and Asian customers the ability to optimize logistics solutions between themselves. By providing a solution that allows more participants in the LPG logistics network, Trigon believes its new facility will help develop a more resilient and reliable supply chain for Canada's Asian customer base.

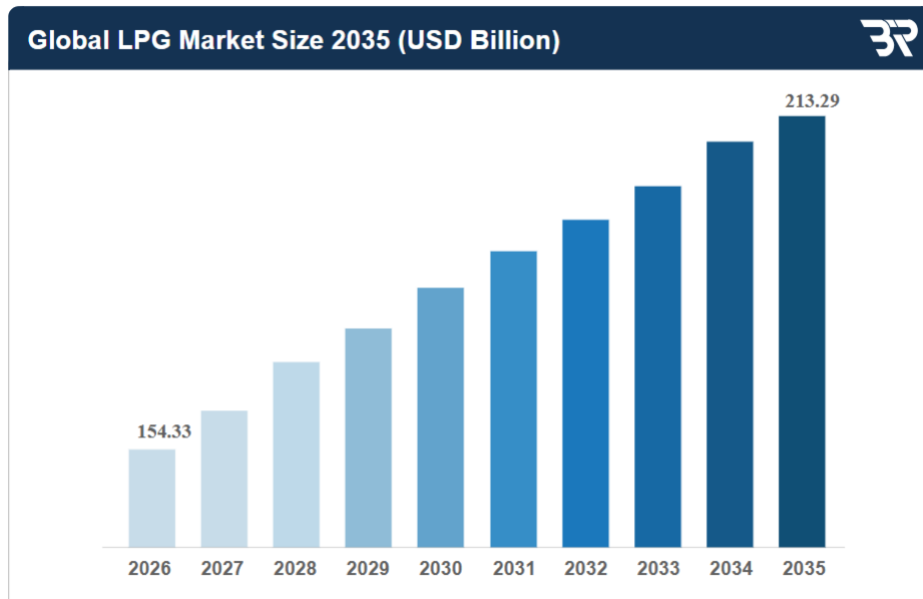
Furthermore, by using existing infrastructure and a brownfield site, CAPEX for the Trigon LPG project will have lower total costs than any project that requires land clearing or new infrastructure. A lower CAPEX results in a lower handling rate, which provides a competitive advantage for customers over other domestic export terminals as well as international competitors, such as those in the US Gulf Coast.

Canadian LPG producers want multiple egress options to move their products to non-US markets so that they can ensure there is resilient and competitive land scape to move their LPG customers. Trigon's new LPG export facility would be one of these alternatives demonstrating to the global markets Canada as a nation supports competitive and reliable commodity supply chains.

### **2.6.2 Supports Long-Term Canadian LPG Export Opportunities in Response to Growing Global LPG Demand**

According to Business Research Insights, the global LPG market stood at USD\$ 154.33 Billion in 2026 (Figure 2-3) and is expected to reach USD 213.29 Billion by 2035 driven by a CAGR of 3.66% from 2026 to 2035 and highlight the following key market metrics.

- Key Market Driver: Asia-Pacific accounted for 49.2 % share, driving demand through strong residential and industrial consumption growth.
- Major Market Restraint: Infrastructure and storage limitations impact more than 40 % of potential LPG supply chains globally.
- Emerging Trends: Packaged/bottled LPG segment dominated with 54.5 % share, highlighting rising preference for cylinder-based distribution.
- Regional Leadership: Asia-Pacific maintained leadership with 47–49.2 % share of the global LPG market.
- Competitive Landscape: Top 5–10 companies controlled a significant portion of the market, with moderate concentration levels.
- Market Segmentation: Refinery sources contributed 43.4 % share of total LPG production.
- Recent Development: China accounted for 21.5 % of global LPG consumption, reinforcing its dominance in demand.



**Figure 2-3: Propane Market Size Source Business Research Insights**

Data from the U.S. Energy Information Administration (EIA) shows that China is the largest importer of U.S. LPG, followed by Japan and South Korea. In 2025, approximately 55%-60% of all U.S. propane exports went to markets in Asia, and the three major East Asian economies (China, Japan and South Korea) accounted for the majority of Asia’s propane market, however, in early 2026 the US began exporting LPG to India for the first time, a huge and growing market for LPG

Canada has benefited from this growth as Asian buyers transition from propane supplied by the Middle East to propane supplied by North America. Currently, Canada supplies approximately 11% of Japan’s LPG market, 14% of the Korean Market and as of mid 2026 approximately 6% of the Chinese market. In 2026 LPG cargos from Canada also were delivered to Indonesia for the first time. The shipping distance from Canada’s export terminals to northeast Asia is roughly half the distance to terminals along the US Gulf Coast (USGC), resulting in a cost advantage. It is expected that continued shipping congestion in the Panama Canal along with ongoing conflicts in the middle east will support increased demand for propane exported from Canada far into the future.

### **2.6.3 Unlocking Global Value: Canadian LPG and Export Diversification**

Canada’s export diversification strategy aims to reduce the country’s long-standing dependence on the United States by expanding access to global markets. Liquefied petroleum gas (LPG), particularly propane, has become a leading example of this shift. For decades, most Canadian LPG exports flowed south to the U.S., leaving producers exposed to price discounts and market fluctuations tied to a single buyer. With the build out of Canada’s own export infrastructure producers are now able to capitalize on global market pricing capturing the value increase themselves. As Prime Minister Mark Carney has stated, “we are diversifying our trade and attracting massive new investment” to create new

opportunities for Canadian businesses and workers. This reflects a broader policy goal of building “a stronger, more independent, and more resilient economy” by connecting Canadian energy products, including LPG, to a wider range of global markets. However, even today with the lack of Canadian LPG export capacity over 200,000B/D of Canadian LPG moves to the US which could be capturing higher market value.

The focus on expanding exports to higher-value regions, especially in Asia, where demand for LPG is growing as a cleaner-burning fuel and in petrochemical production is not only about increasing export volumes, but also about improving the value Canada receives for its resources. As the government emphasizes, diversification helps create “greater certainty, security and prosperity at home” by reducing reliance on any single trading partner.

Overall, LPG has emerged as a clear success story within Canada’s export diversification agenda. It demonstrates how targeted infrastructure investment, access to global markets, and a strategic shift in trade policy can transform a regionally constrained resource into a globally traded commodity, while advancing the federal government’s broader goals of economic independence, stability, and growth.

A new LPG export facility would directly advance Canada’s export diversification goals by providing the infrastructure needed to reach new markets, improve pricing, and reduce reliance on the United States. The facility would expand access to high-growth global markets, particularly in Asia. Export terminals, especially on the West Coast, allow Canadian LPG to reach countries like Japan, South Korea, India and China, where demand for propane is strong and often commands higher prices. By connecting Western Canadian supply to these premium markets, the facility would help capture greater value per barrel, aligning with the government’s goal of maximizing the economic return on natural resources.

In addition, it would enhance Canada’s role as a reliable global energy supplier. By increasing export capacity, Canada can offer consistent, long-term supply to international partners seeking stable and politically secure sources of energy. In a global context where energy security is increasingly important, this strengthens Canada’s geopolitical positioning and trade relationships which is another key objective of the federal governments diversification policy.

#### **2.6.4 Building a More Competitive and Resilient LPG Export Sector**

A new LPG export facility developed by an independent operator would strengthen Canada’s export diversification strategy by introducing competition into a part of the value chain that is currently highly concentrated. At present, LPG export capacity on the West Coast is limited and controlled by a single dominant operator, which can create bottlenecks and constrain how efficiently Canadian producers access global markets. Expanding capacity through a new entrant would help shift the system toward a more competitive and open export landscape.

Additional independent capacity would increase competition and improve market access for producers. When export infrastructure is concentrated in one set of hands, producers may face limited access, rigid contract structures, or reduced bargaining power. A new facility would create alternative pathways to international markets, giving producers greater flexibility and leverage in how they sell their product. This supports the federal objective of building a more competitive and resilient trade system.

Furthermore, it would help maximize price realization for Canadian LPG. Competition between export terminals can lead to more efficient pricing, better commercial terms, and improved netbacks. In a highly concentrated system, some of the value gained from accessing global markets can be absorbed at the infrastructure level rather than flowing back to producers and the broader economy. Introducing another operator helps ensure that more of that value is retained within Canada's energy sector.

A new facility would accelerate export growth and reduce capacity constraints. Limited export infrastructure can slow the pace at which Canadian LPG reaches non-U.S. markets, even when global demand is strong. By adding new capacity, Canada can increase export volumes more quickly and more reliably, particularly to high-growth regions like Asia. This directly advances the goal of reducing dependence on a single export market.

In addition, it would reduce systemic risk and improve resilience. Relying on a single export channel creates vulnerabilities, whether due to operational disruptions, commercial disputes, or strategic shifts. A more diversified infrastructure base spreads that risk across multiple operators, making the overall system more robust and dependable which is an important consideration in a volatile global energy environment.

Finally, from a strategic standpoint, having multiple export facilities strengthens Canada's credibility as a global supplier. International buyers tend to prefer supply systems that are not dependent on a single operator, as this reduces risk and improves flexibility. A broader base of export infrastructure signals that Canada can deliver reliable, scalable supply over the long term and better achieve its goals of market diversification, higher value capture, and long-term economic stability.

#### **2.6.5 Provides employment and Economic Benefits that support Canada's Economic Growth Objectives**

The project supports Canada's economic growth objectives by creating substantial employment opportunities during both construction and long-term operations. Development of the terminal, marine infrastructure, storage facilities, and supporting utilities is expected to create up to 250 jobs at peak construction, including skilled trades, engineering, project management, and local service-sector employment over a multi-year period. Once operational, the project would support approximately 40 permanent full-time positions in terminal operations, maintenance, logistics, safety, and administration.

In addition to these direct jobs, the project generates broader economic activity and indirect employment across marine transportation and logistics, rail services, trucking, equipment supply, and regional support industries, contributing to long-term economic resilience, trade competitiveness, and workforce development in Canada.

### **2.7 Alternative Means of Carrying Out the Project**

Trigon has considered a range of alternative means of carrying out the Project, considering technical feasibility, economic viability, environmental performance, greenhouse gas (GHG) emissions, and input from Tsimshian Nations, as well as the Project's contribution to Canada's trade and market diversification objectives.

One alternative considered is a phased or modular development approach. Under this approach, the export terminal would be constructed in stages, beginning with smaller-scale capacity (e.g., rail-to-ship loading) and expanding over time in response to market demand. This approach could reduce initial capital requirements and financial risk while maintaining flexibility for future expansion. However, smaller initial configurations may result in reduced operational efficiency and higher unit costs. Trigon also considered a reduced storage configuration that would not trigger a federal impact assessment; however, market demand for the ability to store both propane and butane supports the need for larger storage capacity. Furthermore, additional storage capacity allows for a more resilient supply chain by providing ample storage capacity to manage logistical upsets both on the rail and marine side of the supply chain. While the assessment considers total storage capacity exceeding the threshold for review, a staged final investment decision remains possible, with propane infrastructure potentially developed prior to butane.

A joint venture or shared infrastructure model was also considered. This approach would involve multiple producers or midstream companies participating in the ownership and operation of the facility, potentially improving utilization rates and distributing financial risk. However, this model may introduce additional complexity related to governance and decision-making. At present, Trigon is advancing the Project as the sole owner, although alternative ownership structures may be considered in the future.

Integration with pipeline infrastructure was also evaluated as an alternative to rail-based supply. A pipeline connection from production regions to the terminal could improve long-term transportation efficiency and reliability and reduce emissions associated with rail transport. However, this option would require substantial capital investment, additional regulatory approvals, and extended development timelines. Based on current and reasonably foreseeable LPG volumes, a pipeline connection is not considered economically justified at this time.

Several alternative locations on Trigon leased lands were evaluated alongside Yard 4, including Area A and the 35-acre site at the north end of the coal yard. At present, Yard 4 remains the preferred option as it represents the most efficient utilization of space. While developing the 35-acre site is a viable alternative, it would incur a higher capital expenditure (CAPEX). Similarly, although Area A is already cleared, it would require additional capital for site grading and the construction of supplementary rail infrastructure.

## **2.8 Alternatives to the Project**

Trigon considered alternatives to developing a new liquefied petroleum gas (LPG) export terminal in Canada, including reliance on existing infrastructure and market pathways. These alternatives were evaluated in relation to the Project's purpose, which includes providing reliable and competitive access to international LPG markets for multiple producers.

Canada's export diversification objectives include expanding access to global markets beyond the United States, particularly in higher-growth regions such as Asia. While existing LPG export infrastructure has enabled access to international markets, available capacity on the West Coast is limited and may be subject to commercial arrangements that restrict access for some producers. As a

result, not all market participants may be able to access export capacity on comparable or transparent terms.

Under these conditions, reliance on existing infrastructure may not fully meet the objective of providing broad-based and competitive access to global markets. Similarly, continued reliance on exports to the United States or on U.S.-based export terminals may limit direct access to overseas markets and increase dependence on infrastructure and market conditions outside of Canada.

An export facility designed to provide open access to multiple users was identified as an alternative that could address these limitations. In this context, “open access” refers to the availability of capacity to third-party users on transparent and non-discriminatory terms. Such an approach may support increased competition among producers, facilitate access to higher-value markets, and enable more efficient utilization of export capacity.

The “no project” alternative would not address the identified need for additional export capacity or improved access to international markets and may limit the ability of Canadian producers to respond to future demand.

These considerations informed the identification of the Project as a means of meeting the stated objective of providing additional LPG export capacity with accessible and competitive market participation.

## **2.9 Engagement**

### **2.9.1 Indigenous Engagement**

Trigon has been engaging with six Tsimshian communities on the project since January 2024. Details of the engagement as well as key issues raised are provided in Section 6.

### **2.9.2 Industry Engagement**

Trigon has been discussing the project with Canadian LPG producers and offtakers in Asia since 2022. The project is being advanced in response to a strong desire from Canadian LPG producers and offtakers in Asia for a competitive alternative to existing LPG export infrastructure, in addition to the need for more LPG export capacity on Canada’s west Coast. As noted previously, an offtake partner has signed an agreement committing to a significant portion of Trigon’s export capacity. No substantive issues or concerns have been raised to date.

### **2.9.3 Public and Stakeholder Engagement**

Trigon has publicly shared information on the project via social media, public presentations, and conferences. No substantive issues or concerns have been raised to date. A public and stakeholder engagement plan has been prepared that will commence following the initiation of the IAAC regulatory process. Trigon looks forward to sharing information about the project and receiving feedback from the public and stakeholders through face-to-face interactions, digital platforms, and open houses.



## **2.10 Support for the Project**

### **2.10.1 Support from Community and Industry**

Based on initial engagement with local communities, the Project has received support from the City of Prince Rupert, the District of Port Edward, the International Longshore and Warehouse Union Local 523 (ILWU523), the International Longshore and Warehouse Union Canada (ILWU Canada), as well as a number of Canadian propane producers, and offtakers in Japan.

### **2.10.2 Support From Indigenous Communities**

While Trigon will undertake full and comprehensive engagement and consultation with the Coast Tsimshian Nations, as equity owners and partners, the economic development representatives of the Lax Kw'alaams Band and Metlakatla First Nation have indicated their support for Trigon's proposed LPG Export Project.

### **2.11 Proponent Contact Information:**

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#### **Primary Contact:**

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Project Developer and Regulatory Strategist  
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Telephone: 604-505-0518

### 3 Description of the Project

#### 3.1 Project Scope

The Project will be optimized to overcome known design and operational challenges of existing LPG export facilities in Canada. The major components of the project scope are shown below in Table 3-1.

Description	Design Basis
Product	LPG
Annual Throughput Capacity	30M barrels/annum (2.4 million metric tonnes per year); which averages ~80,000 B/D
New Rail	A limited amount of new rail required all on Trigon lease land
Rail Operations	Unit train receiving and handling on Trigon lease land
Rail Offloading	Up to 20 offload stations
Total Storage	≤158,000 m <sup>3</sup>
Refrigerated Tank Type	Fully Contained Concrete Tank or five accumulator storage tanks
Berth and Vessel Loading	Tie into Trigon's existing berth one and use of existing piping and loading arms
In Water Works	Not applicable – there will be no work in or above water
Facility Processing Power	Gas Drive <sup>2</sup>
Power Availability	Existing Trigon substation
Quantitative Risk Assessment (QRA)	The QRA for the facility is expected to remain within Trigon controlled fence line

**Table 3-1: Project Scope**

#### 3.2 Phased Approach

A phased approach will be adopted whereby ~95,000m<sup>3</sup> of storage will be built as the initial phase. Final investment decision on the second phase (63,000m<sup>3</sup> of storage) will be made in response to market demand.

#### 3.3 Project Components and Activities

All new equipment and facilities required for the Project will be located on Trigon lease land and within the existing terminal footprint.

<sup>2</sup> With optionality to convert to electric drive when sufficient power available from BC Hydro.

### 3.3.1 Project Components

The Project will include the following components:

#### **New Project Infrastructure**

- One new rail track within the Trigon railyard;
- Up to twenty unloading racks and roof;
- Storage bullets (~8,000m<sup>3</sup>);
- LPG cooling equipment;
- LPG pre-treatment equipment (de-ethanizer, methanol removal, water removal);
- Boil off gas recovery system;
- Refrigerated storage tank(s) (~150,000m<sup>3</sup>), or five accumulator storage tanks (30,000m<sup>3</sup> each);
- Piping from the tank to the intertie point with existing berth piping;
- Enclosed ground flare;
- Process control and safety systems;
- Nitrogen and instrument air systems;
- Fire water system;
- Electrical house, PNG natural gas connection;
- Control room, roads and car parking.

#### **Existing Shared Project Infrastructure with Trigon Operating Facility (no construction necessary)**

- Existing railyard;
- Berth one;
- Liquid loading and vapour return lines;
- Administration building, and sanitary waste disposal (shared use);
- Warehouse and maintenance shop;
- Loading arms on berth one to offload LPG to the VLGCs;
- Trigon substation;
- Stormwater management system.

### 3.3.2 Project Activities Overview

The Project includes the following activities:

#### **Construction:**

The project is estimated to require approximately 400 person years of construction activity.

- Site preparation and existing coal yard site optimization;
- Construction of the rail track;
- Connection to the BC Hydro grid;
- Installation of unloading racks;
- Installation of piping to the intertie point on the berth;
- Installation of the LPG storage tank and bullets;



- Installation of refrigeration equipment and facility process modules;
- Installation of utilities, including electrical power and fire protection;
- Post construction clean-up;
- Facility commissioning;

#### **Operations:**

- Receiving and unloading LPG from CN trains;
- LPG pre-treatment and refrigeration process;
- Storing LPG;
- Terminal and vessel handling operations required for loading LPG carriers for export;
- Full-time direct employment for approximately 45 people and is expected to operate 24 hours per day, 365 days per year.

#### **Decommissioning:**

- Removal of land-based above-ground infrastructure on the Trigon site;
- Decommissioning of infrastructure on the jetty.

### **3.3.3 Receiving, Storing and Offloading LPG**

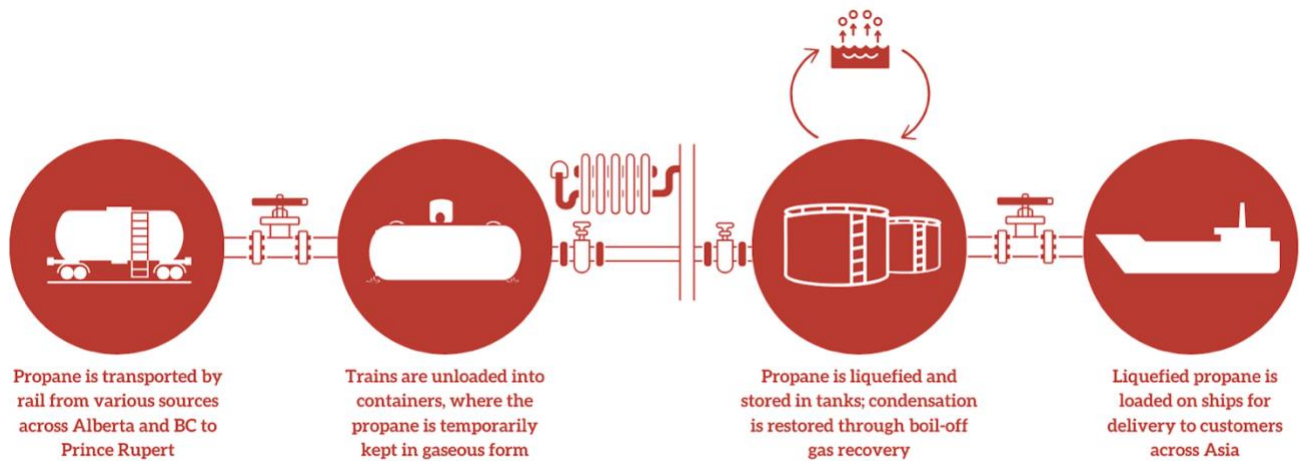
#### **3.3.3.1 Transportation of LPG to Terminal by Rail**

LPG will be brought by rail to the Trigon site from processing facilities further east in BC and Alberta. Transport of LPG to the facility will be handled by unit trains owned and operated by CN and/or producers in rail cars certified for LPG transportation. CN currently transports rail cars of LPG to the Port of Prince Rupert, where the product is loaded onto VLGC vessels at Trigon's berth one.

LPG is regulated for transport under the federal *Transportation of Dangerous Goods (TDG) Act* and Regulations. Rail tank cars that carry LPG are specifically designed and built for that purpose and are required to meet well-established engineering codes and the requirements of Transport Canada. The tank cars are intended to ship LPG at ambient temperatures, and as such they are pressurized to keep the LPG in liquid form.

#### **3.3.3.2 LPG Terminal Operation**

LPG terminal operations consist of receiving pressurized LPG by rail; offloading it to temporary pressurized storage; pre-treating the LPG stream before cooling it; storing it in an unpressurized, refrigerated tank until it is offloaded using the existing Trigon berth and LPG loading arms to a VLGC sized carrier for export. A simplified schematic outlining the operation of the terminal is shown in Figure 3-1 below. Detailed piping and instrumentation diagrams will be completed as part of the detailed design of the terminal.



**Figure 3-1: Simplified LPG Operations Schematics**

### 3.3.3.3 Unloading

Normal operations will consist of unloading unit trains arriving and then departing on CN every day. Total deliveries are expected to be 98 to 120 railcars per day, in 12 to 18 months from the start of operations. Unit trains of LPG will be received and handled at Trigon which allows for higher facility efficiencies.

The Project will be designed to accommodate the maximum daily number of railcars that could potentially be delivered by CN. Direct labour is required only for connecting the railcars to the unloading rack and from the berth loading arms to the vessel. All other operations will be managed from a control room operated by Trigon personnel.

Pressurized liquid LPG will be unloaded from railcars to intermediate storage tanks (bullets), which will hold the pressurized LPG in advance of it being refrigerated and brought to atmospheric pressure. Transfer from the rail tank cars will be done using specially designed unloading arms, which will be mounted on a common platform connected to the centrally located unloading rack.

Unloading of rail cars will occur in one continuous operation in one of two 12-hour shifts, with 24/7 unloading capability. Up to twenty rail cars will be unloaded at a time. It is anticipated that shuttling of the cars into position will be accomplished by either an indexer or electric shunting locomotives that are leased and operated by Trigon.

### 3.3.3.4 Pre-Treatment, Refrigeration and Storage

The next step takes place in the refrigeration facility and consists of removing any water from the LPG to prevent the water from freezing and obstructing the flow of LPG further down the process. Other trace amounts of ethane, sulphur, and methanol may also be removed, depending on the source of propane and the time of year. Once pre-treatment stage is completed the LPG is chilled to approximately -42°C. At this point, the LPG will be at atmospheric (low) pressure, and transferred to the refrigerated storage tank, where it is held until a carrier is ready for loading.

### 3.3.3.5 Boil-off Gas and Ground Flare

Although the storage tank will be insulated, some minor amounts LPG will boil off over time. These boil off gasses are compressed, cooled and pumped back into the refrigerated storage tanks, which are part of the overall integrated cooling process. The terminal will have an enclosed ground level flare, which will be used to safely start up and shut down the facility, to vent and combust flammable LPG gases that arise from facility startup and shut down, process upsets, or from periodic process venting associated with normal operations when pipes need to be opened for maintenance purposes. The flare will not emit a visible flame, nor will it emit radiant energy that will impact adjacent properties.

### 3.3.3.6 Carrier Loading

Carriers that call at the terminal will be owned and operated by third party companies that are specialists in the safe transport of LPG. New piping will be connected from the Trigon LPG tank to the existing Trigon berth and associated LPG piping in order to deliver LPG from the terminal to the carriers. Electric motor driven pumps will transfer the chilled LPG along the pipes from the unpressurized storage tank to the carrier. It is anticipated that carrier loading operations will occur approximately once every four to nine days, which at full capacity results in approximately 42 to 83 carriers per year depending on customer demand. Loading will take approximately 40 hours and will be completed in accordance with Trigon's terminal rules and regulations as well as PRPA's rules and regulations. There is an established safety zone around the terminal that was created in consultation with Trigon, PRPA and Transport Canada.

### 3.3.3.7 Power Supply

Trigon estimates that up to 13.5 MW will be required for on-site power of the terminal. The preferred power source will come from BC Hydro. Should insufficient power be available to operate the facility, the terminal may use alternatives sources to drive compressors. In order to maximize site safety, critical process equipment and emergency systems will be backed up by an emergency backup generator. The backup generator will only start up in emergency scenarios where the back-up power from the grid connection was insufficient. If gas driven compressors were to be used, it will be supplied by pipeline quality natural gas.

### 3.3.3.8 Shipping of LPG to Market by Carrier

VLGCs specially designed to handle chilled LPG will be brought to the Trigon terminal by experienced pilots from the Pacific Pilotage Authority. Shipping and shipping related activities will be handled by third party owners and operators. LPG is currently handled safely and routinely from Trigon's existing berth one. Berthing and loading processes are well understood and the project is expected to follow existing protocols.

LPG carriers typically have a beam of 36 meters, and length of 230 metres and carry approximately 45,000 tonnes of LPG. Carrier scheduling is planned well ahead of actual loading. Trigon will confirm physical acceptability of the carrier after reviewing the documents associated with the carrier. In addition to the physical aspect, Trigon will also review the record of maintenance, accident reports, on board inspection reports, and any certificates by major companies based on a SIRE report. Selecting

reliable buyers who provide sound carriers in a timely manner is an important requirement of the Project.

### **3.3.4 Marine Berth: Project Facilities Design, Operations, and Safety Systems**

Trigon has been responsible for the safe berthing and handling of LPG vessels since May 2019 and have successfully handled more than 150 LPG vessels since the terminal began LPG operations. Trigon will be responsible for all aspects of the Project associated with maintaining and operating the existing marine berth. A new berth or vessel loading infrastructure is not required for the Project, nor will there be any in-water works required.

Trigon will adopt the existing “Terminal Rules and Regulations” document as well as producing a “Port Information Booklet” specific to the handling of LPG at the existing berth. These documents detail the mandatory procedures and regulations, as well as general information for the carrier to follow prior to arrival and while moored at the berth. Details will be specific to the following:

- Carrier acceptance (vetting);
- Pilotage;
- Tug assistance;
- Carrier berthing;
- Carrier mooring;
- Limiting environmental operating conditions;
- Cargo transfer;
- Product safety specifications;
- Communications;
- Fire protection;
- Carrier and terminal security;
- Carrier access;
- Carrier repair and provisioning;
- Spill prevention;
- Emergency response.

The following provides a brief description of the marine-related safety systems and operational measures that will be adopted for the Project.

#### **3.3.4.1 Carrier Vetting**

As part of Trigon’s operational procedures, all carriers will be vetted and required to meet Trigon’s safety and environmental standards and the terminal’s rules and regulations prior to arrival at the terminal. Carrier vetting procedures are already in use and were developed from regional and global best practices.

The carrier vetting procedures specify that all carriers calling at the terminal will be modern, double-hulled carriers equipped with firefighting systems, inert gas systems (part of the firefighting system), and electronic navigation systems including radar, collision avoidance systems, global positioning systems, electronic chart display and information system, and automatic identification system. Carriers



also need to have been constructed and regularly inspected in accordance with recognized classification society rules.

#### 3.3.4.2 Pilotage Requirements

Pilotage and escort requirements will be in accordance with the PRPA's "Harbour Practices and Procedures" and the *Canada Shipping Act*, the federal *Pilotage Act*, and the Pacific Pilotage Requirements.

#### 3.3.4.3 Escort Requirements

Trigon will comply with tug escort requirements that are defined in the PRPA's "Harbour Practices and Procedures" guidance and as determined in consultation with the Pacific Pilotage Authority, Transport Canada, and the Canadian Coast Guard.

#### 3.3.4.4 Carrier Berthing Operations

Harbour tugs will be required to meet the carrier at the direction of the Pilot and Master to assist the carrier in safely berthing and mooring at the marine terminal. A docking aid system has been installed at the existing berth to assist the pilots and terminal operators in carrier berthing. The system monitors and displays the carrier's approach speed, distance, and angle with respect to the berthing dolphins. The system improves the safety of the berthing operation and reduces the risk of abnormal berthing events by allowing the Pilot to manage the carrier's speed and approach vector in order to verify that the approach procedure is within the specified terminal limits.

Inbound carriers arriving in a ballasted condition normally berth with their port sides to the loading platform allowing for the bow of the carrier to be head on into the prevailing current and wind direction.

#### 3.3.4.5 Carrier Mooring Operations

No changes to existing carrier mooring operations are required for the Project.

#### 3.3.4.6 Maximum Operating Conditions

Operational safety limits have been established to cover visibility, wind, and sea conditions.

The preliminary limiting environmental operating criteria are as follows:

- |   |                                 |
|---|---------------------------------|
| • Berthing maximum wind speed                         | 35 knots                        |
| • Loading/unloading shutdown maximum wind speed       | 32 knots                        |
| • Loading/unloading arm disconnect maximum wind speed | 40 knots                        |
| • Carrier to vacate berth                             | Captains discretion (~40 knots) |
| • Maximum current                                     | 2.5 knots                       |
| • Minimum visibility                                  | 1.0 km                          |

Meteorological and oceanographic sensors have been installed to monitor wind speed and direction; current speed and direction; visibility; tidal changes; and wave height and direction. Real-time data from the sensors will be transmitted to the control room for display and logging.

### 3.3.4.7 LPG Transfer System

The Project will include the pipelines, valves, fire protection, carrier access, and control systems required to safely transfer the LPG and crew between the shore, the berth, and the carrier. All loading equipment on the berth will be controlled by a central control room located in Trigon’s administration building. Topside equipment and systems can be categorized into cargo transfer systems, safety and security systems, emergency response systems, carrier services, and control systems.

The cargo transfer system includes marine loading arms, manifolds, pipelines, booster pumps and valves. All cargo pipelines and hoses connecting the carrier to the marine terminal will conform to industry standards. The actual connection between the carrier and the marine terminal for the purpose of transferring LPG will be made with the use of existing marine loading arms. The loading arms feed into an adjacent manifold, which controls the flow of product being transferred through the system. In turn, the manifold is connected to pipelines running along the access trestle to the onshore tank facilities. There will be up to three new pipelines built for the Project from the storage tank to the new berth tie-in location with the existing berth piping: two liquid loading lines (size to be determined, one for product loading and a liquid return line) and one vapour return line (size to be determined).

### 3.3.4.8 Emergency Response Requirements

Trigon will establish and manage all land-based and marine emergency response plans and intends to comply with all Emergency Response Plan (ERP) requirements that have already been established for the terminal. The ERP will be modified as necessary to address LPG specific response plans.

## 3.4 Project Schedule

The Project is expected to operate for at least 50 years. The Project milestone schedule is presented in Table 3-2:

<b>Project Phase</b>	<b>Timing</b>
Regulatory and Permitting	Q2 2026 – Q3 2027
Engineering	Q2 2027 – Q3 2028
Construction	Q4 2028 – Q4 2031
Start of Operations	Q4 2031
Decommissioning	2081 or later

**Table 3-2: Project Schedule**

## **4 Past Studies, Land Use and Regulatory Overview**

### **4.1 Past Studies**

Ridley Island and the Port of Prince Rupert have been the subject of numerous environmental studies, assessments, planning initiatives, and environmental monitoring that are all publicly available. The Project Description is a compilation of a number of these reports, including but not limited to the following:

- Ridley Island Master Development Plan (2008);
- PRPA 2020 Land Use Management Plan, Updated (2021);
- Canpotex Potash Terminal Project (2011);
- AltaGas Ridley Island Propane Export Terminal Project (2016);
- Pacific North Coast Integrated Management Area (DFO 2016);
- Vopak Pacific Canada Bulk Liquids Export Terminal Project (2018);
- Pacific Northwest LNG Project (2016).
- Trigon – Wildlife Habitat Survey and Bat Emergence Survey (2025)

There are no regional assessments carried out under the IAA that Trigon is aware of that are relevant to the Project. Strategic Assessment of Climate Change developed by ECCC is relevant to the Project.

### **4.2 Land Use Designation**

Under PRPA's Updated 2020 Land Use Management Plan, the Project footprint is entirely situated in areas zoned for industrial development and which are currently being used for the purpose of coal receiving, storing, and exporting metallurgical and thermal coal (PRPA 2021).

### **4.3 Federal Financial Support**

No federal financial support is required for the project.

### **4.4 Regulatory Framework**

The Project will be supported by an established and robust regulatory framework for the safe storage and transport of LPG in Canada, as well as the safety and environmental regulatory framework of the Prince Rupert Port Authority. Collective oversight and safe passage of vessels travelling through PRPA waters is ensured by a coordinated effort between the Canadian Coast Guard's Marine Communications and Traffic Services, the Pacific Pilotage Authority, BC Coast Pilots, SAAM Towage Canada, the Western Canada Marine Response Corporation, the Canada Border Services Agency, and the Prince Rupert Port Authority. Trigon will also work with PRPA's Emergency Operations Center to ensure effective response in the event of a spill.

The Project is a 'Designated Project' under the IAA's (2019) Physical Activities Regulations. Since the Project is being entirely developed on a brownfield site using existing infrastructure, its impacts are expected to be localized with no significant effects anticipated. As such, the environmental aspects of the Project are expected to be assessed by the Impact Assessment Agency of Canada under the *Impact Assessment Act* (IAA 2019).

Trigon will avoid or minimize potential environmental effects through thoughtful design and careful assessment of any potential impacts and will subsequently develop a robust avoidance and/or mitigation strategy that will be documented in Construction and Operations Environmental Management Plans. The safe handling of LPG and operation of the facility will be documented in an Operational Management Plan that will incorporate all relevant legislation, regulations, policy, and guidance.

These management plans will be submitted to PRPA to satisfy the requirements of the Port Authority Operations Regulations, which ensure the safe and environmentally responsible operation of all Port facilities.

The following is a preliminary list of federal legislation, regulation, policy, and guidance that may be relevant to the Project:

- *Impact Assessment Act* (2019);
- Port Authority Operations Regulations (PRPA);
- *Railway Safety Act* (1985);
- Transportation of Dangerous Goods Regulations in Canada (1992);
- Transportation of Dangerous Goods by Rail Security Regulations (2019);
- *Canadian Environmental Protection Act* 1999 (CEPA);
- Technical Safety BC: Boiler and Pressure Vessel Registration (Provincial).

#### **4.4.1 Federal Regulations**

##### **4.4.1.1 Impact Assessment Act**

The *Impact Assessment Act*, 2019 (IAA 2019) defines responsibilities and procedures for environmental assessment (EA) of projects involving the federal government and establishes a process for determining environmental effects of projects. The Project is a designated project under IAA 2019's "Physical Activities Regulations" as the storage volume exceeds the criteria set out in Section 37(f) of the regulations: "the construction, operation, decommissioning and abandonment of a new natural gas liquids storage facility with a storage capacity of 100,000 m<sup>3</sup> or more."

The following potential triggers were considered, as described in the Physical Activities Regulations. No exceedances of criteria in these aspects of the regulations were identified.

- Section 28(c) of the Regulations, applicable to "the proposed construction decommissioning, or abandonment of a marine terminal designed to handle vessels larger than 25,000 Dead Weight Tonnes (DWT) unless the terminal is located on lands that are routinely and have historically been used as a marine terminal or that are designed for such use in a land-use plan that has been the subject of public consultation," does not apply as the Project will use the existing

Trigon berth and as such will not be building a new dock. Trigon's berth expansion was permitted under a separate environmental assessment and construction is already underway. The LPG Project was not under consideration at the time the berth project was advanced and is not expected to be used for Trigon LPG.

- Section 29(a) of the Regulations, applicable to "the proposed construction of a railway line more than 32 km in length on a new right of way" does not apply as the length of rail being built for the Project is less than 32 km.

Section 14(a) of the Regulations, applicable to "the proposed construction of an oil and gas pipeline more than 75 km in length on a new right-of-way" does not apply as no pipeline will be built on a new right-of-way and the length of piping required for the Project is under 75 km.

### **Port Authority Operations Regulations**

Port Authorities Operations Regulations, made under the *Canada Marine Act*, outline provisions relating to the operations carried out at PRPA: "Unless otherwise authorized under these Regulations, no person shall, by act or omission, do anything or permit anything to be done in a port that has or is likely to have any of the following results: a) to jeopardize the safety or health of persons in the port; b) to interfere with navigation; c) to obstruct or threaten any part of the port; d) to interfere with an authorized activity in the port; e) to divert the flow of a river or stream, cause or affect currents, cause silting or the accumulation of material or otherwise reduce the depth of the waters of the port; f) to cause a nuisance; g) to cause damage to ships or other property; h) to adversely affect soil, air or water quality; or i) to adversely affect port operations or the property managed, held or occupied by the port authority."

#### **4.4.1.2 Railway Safety Act (1985)**

The Act sets out requirements for anyone operating over the tracks of a federally regulated railway. The Act, administered by Transport Canada, has the power to protect people, property, and the environment by ensuring railways operate safely within a national framework.

#### **4.4.1.3 The Transportation of Dangerous Goods Regulations (Transport Canada)**

The Transportation of Dangerous Goods (TDG) Program develops safety standards and regulations, provides risk-based oversight, and gives expert advice on dangerous goods to promote public safety in the transportation of dangerous goods by all modes of transport regulated by Transport Canada.

#### **4.4.1.4 Transportation of Dangerous Goods by Rail Security Regulations**

These regulations were made pursuant to the *Transportation of Dangerous Goods Act, 1992*. These regulations aim to mitigate the security risks of transporting dangerous goods by rail.

#### **4.4.1.5 Canadian Environmental Protection Act**

The *Canadian Environmental Protection Act 1999* (CEPA) applies to activities undertaken by Crown Corporations on federal lands. In order to satisfy the requirements of the Act, the Project will adopt an appropriate set of Environmental Management Plans (EMPs), including Spill Management Plans, which satisfy the Act and support the safe and environmentally sound construction and operation of the



facility. In addition, an Environmental Emergency Plan (E2 Plan) will be prepared that satisfies the requirements of the Environmental Emergency Regulations.

#### **4.4.2 Provincial Regulations**

##### **4.4.2.1 Technical Safety BC**

Boilers and pressure equipment, as defined in the *BC Safety Standards Act* and Regulations require design registration in accordance with CSA B51 “Boiler, Pressure Vessel, and Pressure Piping Code.” Technical Safety BC has jurisdiction to regulate boilers and pressure equipment on Ridley Island.

##### **4.4.2.2 British Columbia Environment Assessment Act**

Trigon is located on Ridley Island, which is federal land subject to federal legislation.

##### **4.4.2.3 BC Energy Statutes Amendment Act**

Trigon is located on Ridley Island, which is federal land subject to federal legislation.

## 5 Environmental Overview

The Project will be built on a brownfield site currently used for coal storage and handling. No new environmental footprint is required for the Project, and no in-water works are required. The following describes the environmental setting for the area around the facility.

Environmental and socio-economic information has been gathered over several decades, resulting in a substantial amount of available data for the site and adjacent areas. Development began at Ridley Island when an access road was constructed in 1982 connecting the island with Highway 16 north of Port Edward, BC. Trigon's coal facility was constructed after the completion of this access road and has been operating on Ridley Island since 1984.

### 5.1 Atmospheric Environment

#### 5.1.1 Climate

The Project site experiences precipitation patterns consistent with a maritime climate and is in a temperate rainforest. The coastal climate is characterized by high annual rainfall and moderate temperatures, with annual precipitation averaging approximately 2620 millimetres, with the wettest periods occurring between October and April, primarily as rain with some snow (Government of Canada 2023). Average temperatures experienced in this climate fall within a narrow range of ~2 degrees Celsius (°C) - 14°C, with the highest temperatures in the summer months, (average daily temperatures of ~12°C - 13°C) and lowest temperatures in January (average daily temperatures of ~2.4°C; Government of Canada 2023).

#### 5.1.2 Air Quality

The Prince Rupert airshed benefits from consistent coastal wind flow generally without persistent stagnant conditions that can affect inland airsheds in BC.

The regional airshed is not currently considered 'challenged' due to relatively few industrial emission sources and import of air contaminants is not an issue, given the community's remote location. The PRPA measures ambient levels of particulate matter, nitrogen oxides, sulfur dioxide and tropospheric zone daily (PRPA 2023a).

Contaminants associated with shipping emissions (sulphur dioxide, PM, nitrogen dioxide) have substantially decreased with implementation of the Emission Control Area established for the west coast of North America by the International Maritime Organization.

#### 5.1.3 Noise and Vibration

The nearest noise receptors to the Project site are located across Porpoise Harbour in Port Edward, approximately 2 km east of the Project. Noise and vibration experienced at these receptors are currently affected by existing Ridley Island operating facilities. These operational noise sources include marine vessels, non-road engines, compressors, heavy- and light-duty vehicles, and movement of inbound and outgoing cargo.

#### 5.1.4 Light

Sources of light emissions at Trigon and on Ridley Island are the high and low mast lighting that is necessary to safely operate at night. This light source currently has limited or no visibility from Port Edward.

### 5.2 Terrestrial Environment

#### 5.2.1 Terrain, Geology and Soil

The Project site is on a flat, brownfield site several meters above sea level. The site is engineered fill (rock and compacted mineral soil) of varying depths. The surficial geology of the broader Ridley Island is composed of a poorly drained organic veneer of peat and muck (humisol), a glaciomarine silt/clay veneer and bedrock (PRPA 2020). The bedrock on Ridley Island is composed of weather metasedimentary biotite-muscovite schists. The high rainfall and moderate temperatures characteristic of the region result in very wet soils low in nutrients, and slow decomposition of organic matter, with bog forests or woodlands on uncleared land (PRPA 2020).

#### 5.2.2 Ground and Surface Water

There are no natural watercourses on the Project site. Rainfall runoff on Trigon is gathered in drainage ditches and channeled to a settling pond before being discharged or occurring naturally through seepage.

#### 5.2.3 Vegetation Communities and Ecosystems

Trigon is within the Coastal Western Hemlock (CWH) biogeoclimatic zone, which characterizes low lying to middle elevations on the BC coast. The shorelines have limited vegetation cover (primarily alder [*Alnus* sp.]) and riparian habitat. Coastal areas around the island include a beach along the southwest shore, and several tidal sloughs, notably along the northern side.

While not relevant to the Project, undeveloped areas of Ridley Island have a mosaic of mature coastal forest, wetland ecosystems (muskeg, bogs and marshes with open water, treed swamps) and transitional zones between forest and wetland. There are no known federally listed rare plant species on the Project lands.

#### 5.2.4 Wildlife

##### 5.2.4.1 Mammals

There is no suitable habitat for mammals on the Project site. Mammals known to occur on Ridley Island include black-tailed deer (*Odocoileus hemionus*), black bear (*Ursus americanus*), grey wolf (*Canis lupus*), cougar (*Puma concolor*), North American river otter (*Lontra canadensis*), Pacific marten (*Martes americana*), red squirrel (*Tamiasciurus hudsonicus*), beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), and North American porcupine (*Erethizon dorsatum*) (Jacques Whitford AXYS Ltd. 2008; Stantec 2011; Stantec 2014; AECOM 2014; Vopak Pacific Canada 2020c). The presence of these species near to industrial sites indicates some degree of habituation by these individuals. Several species of coastal bats are also known to inhabit the Prince Rupert region but are not known to roost

on the Project site, including little brown myotis (blue-listed; SARA Endangered *Myotis lucifugus*) (Stantec 2011, 2014, AECOM 2014, Stantec and West 2023).

#### 5.2.4.2 Birds

There is no known suitable habitat for birds on the Project site. Ridley Island, however, provides habitat for several species of migratory and resident birds. There are abundant nest opportunities for common and other songbirds on forested areas of Ridley Island. Barn swallow (*Species at Risk Act* (SARA) Threatened; *Hirundo rustica*), build their nests on buildings and other anthropogenic features (Government of Canada 2019). Similarly, several coastal birds have been documented on and around Ridley Island (see Section 5.3.5). There are no known nests for diurnal raptors near the Project site. Breeding sites for owl species in the vicinity of the Project are unknown, but unlikely given the lack of contiguous forest habitat.

#### 5.2.4.3 Amphibians and Reptiles

There is no suitable habitat for amphibian breeding at the Project site. Three species of amphibians have been detected on Ridley Island; western toad (*Anaxyrus boreas*), northwestern salamander (*Ambystoma gracile*), and rough-skinned newt (*Taricha granulosa*) (Stantec 2011; Stantec 2014b; AECOM 2014d; Vopak Pacific Canada 2020b, Trigon 2025).

### 5.3 Marine Environment

As noted previously, the Project will require no in-water works. The following describes the marine environment as part of the broader environment that the Project is part of.

#### 5.3.1 Marine Water Quality

PRPA has conducted marine water quality monitoring in PRPA waters since 2013. Coastal waters are monitored for oceanographic properties, heavy metals, polycyclic aromatic hydrocarbons, and bacteriological properties.

#### 5.3.2 Marine Habitat

The western shoreline of Ridley Island, where Trigon's existing two berths are located, is a steep, rocky intertidal zone composed primarily of bedrock, boulder, and cobble (WorleyParsons 2012). The intertidal zone supports a diverse community of marine biota. Dominant algal species include rockweed (*Fucus gardneri*), sea lettuce (*Ulva* spp.), Turkish washcloth (*Mastocarpus papillatus*), sea sac (*Halosaccion glandiforme*), and various understory kelps (e.g., *Laminaria* spp., *Alaria* spp.). Common invertebrate species include barnacles (*Balanus* spp.), snails (*Tegula* spp., *Littorina* spp.), limpets (*Tectura* spp., *Lottia* spp.), and chitons (*Tonicella* spp.) (Stantec 2011).

#### 5.3.3 Marine Fish and Invertebrate

Chatham Sound supports a diverse number of marine fish and invertebrate species. Resident and migratory fish species that may use the shoreline of Ridley Island at different seasonal periods of the year include: chum salmon (*Oncorhynchus keta*), coho salmon (*O. kisutch*), pink salmon (*O. gorbuscha*), sockeye salmon (*O. nerka*), chinook salmon (*Oncorhynchus tshawytscha*), halibut (*Hippoglossus*

*stenolepis*), Pacific herring (*Clupea pallasii*), surf smelt (*Hypomesus pretiosus*), rockfish (*Sebastes* spp.), lingcod (*Ophiodon elongates*), Pacific cod (*Gadus macrocephalus*), eulachon (*Thaleichthys pacificus*), Pacific halibut (*Hippoglossus stenolepis*), skates (Family Rajidae), and flounder and sole (Order Pleuronectiforms). Important invertebrate species expected to be year-round in Chatham Sound include: Dungeness crab (*Metacarcinus magister*), red rock crab (*Cancer productus*), Pandalid shrimp and prawn (Family Pandalidae), pink scallop (*Chlamys rubida*), green sea urchin (*Strongylocentrotus droebachiensis*), red sea urchin (*Mesocentrotus franciscanus*), various clams and cockles (e.g., *Macoma* spp., *Clinocardium* spp., *Saxidomus gigantea*), orange sea cucumber (*Cucumaria miniata*) and California sea cucumber (*Parastichopus californicus*).

#### 5.3.4 Marine Mammals

The Pacific North Coast Integrated Management Area (PNCIMA) is one of five large federal ocean management areas in Canada and covers an area of approximately 102,000 square kilometers (Department of Fisheries and Oceans (DFO) 2016). The Project area falls within PNCIMA, and the DFO mapping data indicates that the Prince Rupert area of the PNCIMA includes important foraging, resting, and migrating areas for humpback whales (*Megaptera novaeangliae*), northern resident killer whales (*Orcinus orca*), and Steller sea lion (*Eumetopias jubatus*) (DFO 2016b).

Multiple local environmental assessment studies have also indicated that several species of marine mammals regularly use the Prince Rupert area, including: humpback whales (SARA Special Concern, northern resident killer whales (red-listed, SARA Threatened), harbour porpoises (blue-listed, SARA Special Concern; *Phocoena phocoena*), Dall's porpoises (*Phocoenoides dalli*), Pacific white-sided dolphins (*Lagenorhynchus obliquidens*), Steller sea lions (blue-listed, SARA Special Concern), and harbour seals (*Phoca vitulina richardsi*). Many of these marine mammal species increase in numbers during spring and summer months in the Prince Rupert area in relation to seasonal increases in prey (Stantec 2014a, Vopak 2020a).

Northern abalone (red-listed; SARA Endangered; *Haliotis kamtschatkana*), Green sturgeon (blue-listed, SARA Special Concern; *Acipenser medirostris*) and white sturgeon (SARA Endangered; *Acipenser transmontanus*) occur in coastal marine waters, estuaries and the lower reaches of large rivers (BC CDC 2023).

#### 5.3.5 Seabird/Waterfowl

Coastal birds noted in the vicinity of the Project site include several species of seabirds, waterfowl, waders and gulls, such as common loon (*Gavia immer*), red-necked grebe (*Podiceps grisegena*), common merganser (*Mergus merganser*), double-crested cormorant (blue-listed; *Phalacrocorax auritus*), great blue heron *fannini* subspecies (blue-listed, SARA Special Concern; *Ardea herodias fannini*), marbled murrelet (blue-listed, SARA Threatened; *Brachyramphus marmoratus*), Barrow's goldeneye (*Bucephala islandica*), surf scoter (blue-listed; *Melanitta perspicillata*), bufflehead (*Bucephala albeola*), mallard duck (*Anas platyrhynchos*), Canada goose (*Branta Canadensis*), and glaucous-winged gull (*Larus glaucescens*; Stantec 2011, Stantec 2014b).

### 5.3.6 Marine Resource Use

Marine resource use in the vicinity of the Project site includes industrial and commercial marine activities associated with PRPA and Port Edward Harbour Authority, recreational activities and Indigenous, commercial, and recreational fisheries.

The following facilities are all currently part of the Port of Prince Rupert within the jurisdiction of the PRPA: Fairview Container Terminal, Trigon (coal, petroleum coke, dry bulks, LPG and liquid bulks), Pinnacle Pellets (wood pellets), Prince Rupert Grain, Northland Cruise Terminal, the BC Ferries Terminal, the Alaska Marine Highway Terminal, and the Atlin Terminal (small cruise ships). These facilities create marine traffic into and out of Prince Rupert.

In addition to PRPA, Port Edward Harbour Authority serves small craft harbours in each of the small vessel marinas in Prince Rupert and Port Edward (Fairview Harbour, Porpoise Harbour, Rushbrook Harbour, and Cow Bay Harbour). There are several other types of marine facilities within Prince Rupert and Port Edward including marinas, yacht clubs, public wharves, and coastal ecotourism and fishing lodges.

Recreational activities in the area include recreational boating (powered and self-propelled) and tourism activities associated with the nearby Kitson Island Marine Provincial Park located approximately five km south of the Project site. Four Coast Guard Stations (CGS) are located on the North Coast. One of these stations is located in Prince Rupert at the Seal Cove Seaplane Base. The Prince Rupert Canadian Coast Guard (CCG) Station offers services to assist maritime safety (DFO 2007).

### 5.3.7 Indigenous, Commercial, and Recreational Fisheries

Indigenous, commercial, and recreational fisheries have been highlighted due to their significance to Indigenous Nations, the local communities, and provincial and federal regulators in an environmental assessment context, including the *Fisheries Act* administered by DFO. Fisheries interests have played a substantive role in the evaluation of projects in and around Prince Rupert.

Fishing is an important cultural, commercial, and recreational activity for Indigenous Nations and the people of the Prince Rupert and Port Edward area. Pacific salmon (sockeye [*Oncorhynchus nerka*], Chinook [*Oncorhynchus tshawytscha*], coho [*Oncorhynchus kisutch*], pink [*Oncorhynchus gorbusha*] and chum [*Oncorhynchus keta*]) and eulachon (*Thaleichthys pacificus*) have long been of importance to Indigenous Nations and salmon are also an important contributor to local fisheries throughout Chatham Sound. Other Indigenous, commercial and recreational fisheries species include halibut (*Hippoglossus stenolepis*), Pacific herring (*Clupea pallasii*), rockfish (*Sebastes* spp.), lingcod (*Ophiodon elongates*), Pacific cod (*Gadus macrocephalus*), Dungeness crab (*Cancer magister*) and shrimp (*Pandalus* spp.). Other invertebrates are commonly harvested in Chatham Sound by Indigenous peoples including cockles (*Clinocardium* spp.), butter clams (*Saxidomus* spp.), mussels (*Mytilus* spp.) and littleneck clam (*Protothaca staminea*; Pacific NorthWest LNG 2014).

## **5.4 Project Social and Economic Background**

The following section provides a general description of the social and economic setting of the area surrounding the Project site.

### **5.4.1 Local Community**

The Project is situated within the traditional territory of the Coast Tsimshian Peoples and falls within the North Coast Regional District (NCRD) on the north coast of BC. The District Municipality of Port Edward is the closest community to the Project site, located approximately 2.5 km east and across Porpoise Bay. The population of Port Edward is estimated at 470 residents. Port Edward has an elementary school, which enrolls students from kindergarten to Grade 5, and a community centre which offers a large gymnasium. The City of Prince Rupert, located 5 km north of Port Edward, is the closest urban centre to the Project site.

Between 2011 and 2021, the NCRD experienced a decrease in population of 3.2%. During this period, the economy of the NCRD shifted from a reliance on traditional sectors such as forestry, fishing, and hunting to the transportation and warehousing sector.

### **5.4.2 Emergency and Health Services**

The BC Ministry of Health delivers health services in the province through five regional health authorities, one provincial health authority, and the First Nations Health Authority. The Project falls within the Northern Health Authority's service area. The closest primary healthcare facility to the Project is the Prince Rupert Regional Hospital and the closest major medical transfer centre is located in Prince George (Northern Health 2023).

Emergency and health services for the region are based primarily in Prince Rupert. These services include: the BC Ambulance Service, which operates under the authority of the BC Emergency Health Services; fire services, delivered by the Prince Rupert Fire Rescue Department (PRFD); and police services, delivered by the Royal Canadian Mounted Police (RCMP). The Port Edward Volunteer Fire Department provides fire services to Port Edward and is supported by the PRFD through a mutual aid agreement. The Prince Rupert RCMP detachment has an Integrated Road Safety Unit, West Coast Marine Section, Border Integrity Section, and Federal Drug Enforcement Unit.

The Canadian Coast Guard, Pacific Pilotage Authority, BC Coast Pilots, SMIT Marine, Prince Rupert Port Authority (PRPA) and its tenants also offer emergency and health services in the area.

### **5.4.3 Economy**

The main industries in Prince Rupert are transportation and warehousing, retail trade, healthcare and social assistance, educational services, and public administration. In Port Edward, the main industries include public administration, accommodation and food services, retail trade, construction, and transportation and warehousing.

The PRPA and the tenants on port lands are also an important part of the economy of the Prince Rupert and Port Edward area. The terminals include Trigon Pacific, Fairview, Harbour, the Prince Rupert Grain, Watson Island Bulk, Westview Wood Pellet, the domestic passenger/vehicle ferry, and Northland

Cruise. In 2022, 24,593,720 tonnes of foreign cargo were processed by the PRPA and its tenants (PRPA 2023b, PRPA 2023c).

The PRPA and its partners continue to diversify and expand the Port and its capabilities to enable Canadian trade. Tourism is playing an increasing role in the regional economy, capitalizing on the area's high level of natural beauty and the abundance of eco-adventure opportunities.

#### **5.4.4 Work Force and Employment**

From the late 1990s to the present, the NCRD, including the City of Prince Rupert and the District of Port Edward and surrounding areas, has experienced industrial closures in the resource sector. In 2021, Prince Rupert had a labour force participation rate of 67.3% and an unemployment rate of 9.5% (Statistics Canada 2023). Over the same time period, the broader NCRD had a participation rate of 64.6% and an unemployment rate of 9.6%, 1.2 percentage points higher than that of the provincial average. A relatively high unemployment rate of 9.8% was recorded for the Prince Rupert Census Metropolitan Area (CMA)<sup>3</sup>, which includes Port Edward, compared to the province as a whole (8.4%) (Statistics Canada 2023).

The economic situation in northwest BC has shown considerable improvement over the past four years as new major industrial projects have been proposed, or are under construction, including hydro transmission lines, pipelines, LNG facilities, mines, and container ports. While some projects are underway, others await environmental approvals and final decisions by their investors. These initiatives are expected to be major drivers of new development and employment activity in the region.

At present, it is anticipated that a significant portion of the workforce expected for the construction of the terminal will be residents of the Prince Rupert and surrounding communities. Other workers are expected to be accommodated in a third party operated off-site work camp and other temporary lodgings in the area.

#### **5.4.5 Land Use**

The Project site is located on land zoned for industrial and transportation activities. The land is designated by PRPA for port use in the PRPA's "2020 Land Use Management Plan" for the lands under their jurisdiction (PRPA 2021). The land on which the Project will be located is disturbed and currently used for industrial and port related activities. Rail transportation will be on lands already developed and used for rail transport, both on PRPA and Trigon lease lands, and on CN lands. Activities in marine areas will be on pre-existing structures and shipping will use waters already designated for vessel movements.

Managing land-use intensity is critical to efficient infrastructure development. Success hinges on the ability to move the maximum possible tonnage through the smallest physical footprint. By maximizing land use within existing operational boundaries, Trigon can drastically minimize environmental impacts and eliminate the need for further greenfield development. Trigon's project embodies this principle,

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<sup>3</sup> Inclusive of the Lax Kw'alaams 1 Indian Reserve, North Coast A Regional Electoral Area, District Municipality of Port Edward, City of Prince Rupert, and S1/2 Tsimpsean 2 Indian Reserve.



delivering the high-density throughput required to genuinely meet Trigon and PRPA's growth objectives all within the existing geographic footprint.

#### **5.4.6 Indigenous Use of Land for Traditional Purposes**

The history of Indigenous use of Ridley Island is well documented as evidenced by oral and written history and the presence of Culturally Modified Trees (CMT). No CMTs have been identified within the Project footprint, as the Project footprint is developed, industrial land. Use of the land or resources on the Project site by the Indigenous community for traditional purposes has been restricted by PRPA since the site was developed for industrial use in the 1980s. However, the Indigenous community continues to use the marine environment surrounding Ridley Island for various uses, including fishing and travel.

#### **5.4.7 Archaeology**

An archaeological survey was completed by Millennia Research Ltd. in a small area southwest of the current Trigon facilities in 2006. The survey identified a site containing seven CMT archaeological features (Brunsden 2010). Additional CMTs have been identified on Trigon's Area A leased land, which are not associated with this Project. There is no current evidence of archaeological sites within the Project footprint.

## 6 Indigenous Peoples and Traditional Land Use

### 6.1 Overview

The Project sits within the territories of the following Indigenous Nations:

- Gitxaala Nation;
- Gitga'at First Nation;
- Kitselas First Nation;
- Kitsumkalum First Nation;
- Lax Kw'alaams Band;
- Metlakatla First Nation.

Trigon is committed to ensuring local Indigenous Nations, local government, residents, businesses, government agencies, and neighboring communities have a voice and involvement with the Project. As part of the Impact Assessment, Trigon will continue to engage with Indigenous Nations and local communities to bring awareness of the Project and to receive feedback from Indigenous Nations and local communities for consideration within the Project scope and the Impact Assessment.

Trigon has substantial experience and success engaging with communities around the terminal and has adopted the following five guiding principles in its approach to Indigenous and public engagement:

- Accountability – act in accordance with the commitments it makes to Indigenous Rights-holders and demonstrate that results and outcomes are consistent with promises it makes;
- Inclusiveness – strive to reach, involve, and hear from those who are affected, whether directly and indirectly;
- Transparency – provide clear, timely and complete information, and endeavor to ensure decision processes, procedures, and constraints are understood and followed;
- Commitment – allocate appropriate resources for effective consultation; and,
- Responsiveness – be responsive, accessible and endeavor to understand Indigenous Rights-holders concerns.

Trigon's Indigenous engagement plan aims to:

- To support the Indigenous groups' understanding of the Project and Project components;
- Meaningfully engage with Indigenous groups and provide opportunities for Indigenous groups to provide comments and concerns on the Project; and
- Seek to understand key interests and concerns of Indigenous groups and attempt to address them where practical.

The most proximal reserves to the Project are ~5km and ~8.5km away.

## 6.2 Consultation and Engagement

Trigon has engaged with the aforementioned Indigenous Nations on the Project since January 2024. Documents shared for review and feedback include:

- Draft Project Description (issued January 14, 2024)
- Draft Terms of Reference for an environmental effects assessment (February 29, 2024)
- Draft Environmental Effects Assessment (June 26, 2024).
- Wildlife Surveys (July-October 2024).
- Archaeological Overview Assessment, results verbally shared (December 2024)
- Updated Draft Project Description (May 2026)

In addition, updates have been held bilaterally with each Nation bi-weekly or monthly where project updates and feedback are shared. These meetings continue today and will continue for the life of the project.

Trigon has documented all feedback from each Nation and updated the Project and/or project documentation where appropriate. Capacity funding has been provided and will continue to be provided to support the continued engagement by each Nation on the project.

## 6.3 Key Issues Raised

A complete record of consultation can be provided at IAAC's request. Key concerns raised during consultation, anonymized and generalized, include:

- Traffic along rail corridor: concerns were raised about cumulative impacts resulting from the increasing traffic volumes along the rail corridor between Prince Rupert and Smithers resulting from overall growth at the Port. Trigon is open to working with new or existing regional initiatives such as the North Coast rail forum to address cumulative effects of rail outside of Trigon's care and control.
- Shipping concerns: concerns were raised about cumulative impacts to marine mammals as well as fishing and harvesting opportunities from increasing shipping volumes in and around Prince Rupert resulting from growth at the Port. Trigon is open to working with the Transport Canada's Cumulative Effects of Marine Shipping Assessment and/or PRPA's cumulative effects framework to address the cumulative effects of shipping in Port waters.
- Safety concerns: safety concerns were raised at both land and sea owing to the cumulative increase in rail and shipping traffic and increasing volume of transportation of dangerous goods in and out of the PRPA.
- CO<sub>2</sub> emissions: Nations have expressed interest in the project having the best GHG performance practicable, acknowledging the limited grid power available in Prince Rupert at this time.

Additional engagement dialogue:

- Questions about workforce participation and opportunities for Nation members. Trigon committed to working with Nations to identify employment, training, and procurement opportunities.
- Consideration to the potential effects on community health and services: Trigon has communicated that it will work with local community health and service providers to identify how to avoid and/or minimize impacts. For example: Trigon will provide a workcamp to avoid impacts to hotel and housing.
- Concerns raised about accidents and malfunctions: Trigon has added an accidents and malfunctions section to this IPD to address interests raised by Nations with regards to accidents and malfunctions.
- Questions about scope of EA, specifically around inclusion of rail and shipping. Trigon has communicated that Trigon will not be the owner of the product, or rail or marine shipper. Rail is regulated by the *Railway Act* and in accordance with Transportation of Dangerous Goods legislation and is out of Trigon's care and control. Similarly, shipping will be provided by third party shippers who must be compliant with all Canadian legislation as well as rules set forth by the PRPA and the Canadian Marine Pilots Association.
- Concerns raised about potential impacts to Indigenous rights and interests. A summary of potential impacts to Indigenous rights and interest from the Project is provided below. Trigon has communicated that as the project is being built on a brownfield site on land leased from PRPA that has excluded public and Indigenous rights from being practiced for several decades, Trigon believes that impacts to Indigenous rights and interests will be limited.
- Questions about the geographic and temporal scope of the project. In response to questions raised, Trigon has provided additional details on proposed local and regional study area boundaries herein.
- Questions related to expansion: Since the first version of the project description was circulated to Nations in 2024, the market has shifted and suggests higher than previously LPG export volumes. As such, Trigon has increased the proposed storage capacity of the facility and adopted a phased approach to expansions where the whole project is included up front and assessed in the impact assessment.

#### **6.4 Potential Changes Affecting Indigenous Interests**

Access for the use of land or resources on the Project site for exercise and practice of Indigenous rights has been restricted since 1982 when Ridley Terminals Inc. was established. Access to the island continues to be restricted by PRPA. Trigon understands that access to marine resources in proximity to the island remains available. The Impact Assessment will identify and assess potential changes caused by the Project that could affect Indigenous interests.

Given the long history of restricted access to Ridley Island, Section 35 rights are not expected to be materially impacted by the project, however, it is noted that associated rail movement and shipping may affect those rights. Managing those impacts is out of the care and control of Trigon and are best addressed by the Transport Canada, PRPA, CN Rail, and shippers. Trigon is aware that Transport

Canada has been working on a Cumulative Effects of marine Shipping Assessment for the region as well as hosting rail forums with the Nations since 2023 to address Indigenous concerns around rail movement. In addition, PRPA is initiating a cumulative effect management framework to consider rail, shipping, and other cumulative environmental concerns. Trigon is open to participating in each of those forums.

#### 6.4.1 Impact to Indigenous health, social, economics

Trigon is engaging with the Tsimshian Nations to determine the potential impacts to health, social, and economic conditions that may arise from project development. Trigon believes that the project can provide an overall positive benefit to Indigenous Peoples, particularly regarding economic opportunities and the associated outcomes arising from procurement, employment and training opportunities. Potential impacts will be assessed in the Impact Statement and may include:

- Human health considerations related to emissions (including effluent, air quality, and noise);
- Changes to community well-being;
- Contributions to cumulative effects already being experienced in the region; and

These potential effects will be determined through ongoing engagement activities and the environmental approvals process. Indigenous Knowledge will be considered in the impact assessment if provided by the Nations.

#### 6.4.2 Preliminary Assessment of Potential Impacts to Indigenous Groups Resulting from Project Activities

This section will be further informed by input from Indigenous Groups during the Early Engagement Phase.

The following is a preliminary assessment of potential impacts to Indigenous Groups including rights and title, current use of land and resources for traditional purposes, heritage resources, health, and socioeconomic impacts as a result of carrying out the Project.

The potential effects identified in Table 6.1 below apply to all Project phases and activities, including construction and operations. Further understanding of these impacts is expected to result from consultation and engagement with Indigenous Groups throughout the assessment process. Mitigation measures and appropriate management plans will be developed based on comments received from Indigenous Groups through the EA process.

Table 6.1: Preliminary Assessment of Potential Impacts to Indigenous Groups Resulting from Project Activities

Category	Potential Effects
Established or asserted Indigenous rights, title, and other interests	Change in sense of place and cultural continuity due to changes in accessibility and environmental quality
Current use of land and resources for traditional purposes	None expected
Health and socio-economic conditions	Sensory disturbance due to increased noise and light levels

	<p>Decrease in air quality due to air emissions during operations and dust during construction</p> <p>Potential safety risks due to increased traffic and industrial activities</p> <p>Change in sense of place and cultural continuity</p> <p>Increase in employment, training and contracting opportunities</p>
<p>Physical and cultural heritage, including any structure, site or thing that is of historical, archaeological, paleontological, or architectural significance</p>	<p>None expected</p>

## 7 Potential Project Effects

An overview of potential project effects is provided in Table 7-1 below. More detailed analysis of potential effects and mitigations will be developed during the Environmental Effects Evaluation, and as design of the Project and engagement with Indigenous Nations and stakeholders progresses.

Topic	Construction	Operation
Atmospheric Environment	Ground disturbance and dust from construction will result in reduced air quality. Trucks and construction equipment will result in increased greenhouse gas (GHG) emissions and criteria air contaminants (CAC).  Noise and/or light disturbance from construction activities to Port Edward residents and other sensitive receptors (e.g. marine and land-based wildlife).	Operation of the facility and flaring will result in reduced air quality and increased GHG emissions.
Terrestrial Environment	None. Project uses existing infrastructure.	None. Project uses existing infrastructure.
Marine Environment	None. Project uses existing infrastructure. No pollution to boundary waters, or interprovincial waters, or international waters, or the marine environment outside of Canada is anticipated to result from the Project.	Noise from additional vessels. No pollution to boundary waters, or interprovincial waters, or international waters, or the marine environment outside of Canada is anticipated to result from the Project.
Fish and Fish Habitat	None. Project uses existing infrastructure. No in-water works or works above water are required.	Noise from additional LPG vessels
Aquatic Species	None. Project uses existing infrastructure. No in-water works or works above water are required.	Noise from additional LPG vessels
Migratory Birds	Noise, vibration, and light from construction activities could disrupt normal behaviour. Collision risk possible in low visibility conditions.	Flaring risk (an enclosed ground flare has been selected to minimize this concern), artificial lighting could disorient birds, collision risk with infrastructure, noise and human activity disturbance.
Social and Economic Environment	Creation of construction jobs and local investment.	Increase local jobs
Indigenous Peoples	Project is not expected to have impact on Indigenous lands and rights.	Project is not expected to have impact on Indigenous lands and rights.
Federal Lands	No change in federal land use or access. Some impact to air emissions.	No change in federal land use or access. Some impact to air emissions.

Topic	Construction	Operation
	Cumulative impacts of increasing industrialization of Ridley Island.	
Accidents and Malfunctions	Spills could impact health if waters are impacted	

**Table 7-1: Potential Effects of the Project During Construction and Operation Phases**

## 7.1 Anticipated Project Emissions

### 7.1.1 Construction Phase

Trigon anticipates the following types of emissions during the construction phase of the Project:

- **Air emissions:** from construction equipment used during site preparation, and construction. Project sources will emit particulate matter, nitrogen oxides, sulphur oxides, carbon monoxide, volatile organic compounds, and GHGs.
- **Stormwater runoff:** runoff and drainage from precipitation events will be managed through existing erosion and sediment control measures, ensuring water quality meets guidelines prior to discharge to the environment.
- **Sanitary Wastewater:** will result from grey water and sewage from sanitary facilities on site. Sanitary wastewater will be disposed of using existing facilities on site.
- **Light:** from construction equipment, machines and vehicles, and security lighting.
- **Noise:** from construction equipment, machines, and vehicles.
- **Waste soils and cleared vegetation:** None. No new land clearing. Project uses existing infrastructure.
- **Solid waste:** from construction materials (e.g. packaging, lumber, paper, metals).
- **Hazardous waste:** such as batteries, oil filters, solvents and used oil from construction equipment, machines, and vehicles.

### 7.1.2 Operations Phase

Trigon anticipates the following emissions during the operations phase of the Project:

- **Air emissions:** operation sources such as trains, vehicles, vessels and HVAC will emit particulate matter, nitrogen oxides, sulphur oxides, carbon monoxide, volatile organic compounds, and GHGs.
- **Stormwater:** drainage systems will collect and dispose of stormwater using existing facilities.
- **Sanitary Wastewater:** from grey water and sewage from existing sanitary facilities on site.
- **Light:** from office lighting, train, vehicle and yard operations, and safety and security lighting. Little new lighting will be required for the project.
- **Noise:** from train movements, vehicles, and compressors.
- **Solid waste:** from packaging, food waste, scrap lumber, and office paper. Will be managed using existing facilities.

- **Hazardous waste:** from used oil and solvents, used cleaning materials, machinery, equipment, and vehicles. Will be managed using existing off-site facilities.

## 7.2 GHG Estimate

### 7.2.1 Overview

The Project will generate greenhouse gas (GHG) emissions primarily from combustion-related sources associated with process operations. The principal GHG emitted is carbon dioxide (CO<sub>2</sub>), arising from flaring, power generation, and gas compression systems.

The estimated total direct CO<sub>2</sub> emissions from the Project are approximately 789.3 kilotonnes per year (kt CO<sub>2</sub>/year). A Pre-FEED level emission estimate review was completed by Enerflex in March 2024 and forms the basis of this summary. The report is provided in Appendix A.

### 7.2.2 Emission Sources

Key stationary emission sources associated with the Project include:

- **Ground Flare:** The ground flare is the primary emission source, with estimated emissions of 655.1 kt CO<sub>2</sub>/year, representing approximately 83% of total project emissions. This source is associated with routine and non-routine flaring of hydrocarbon streams.
- **Electric Generator:** The on-site power generation unit contributes approximately 66.2 kt CO<sub>2</sub>/year (~8% of total emissions), resulting from fuel combustion for electricity generation.
- **Boil-Off Gas Compressors**
- **Low-pressure compressors:** 24.0 kt CO<sub>2</sub>/year
- **High-pressure compressors:** 25.7 kt CO<sub>2</sub>/year  
These units collectively account for approximately 6% of total emissions and are required for gas handling and system pressure management.
- **LPG Vaporizer:** The LPG vaporization unit contributes 18.2 kt CO<sub>2</sub>/year, representing approximately 2% of total emissions.

### 7.2.3 Emissions Characteristics

Combustion exhaust streams are characterized by:

- Carbon dioxide (CO<sub>2</sub>): approximately 5.8–9.7 mol%
- Nitrogen (N<sub>2</sub>): approximately 73–75 mol%
- Water vapor (H<sub>2</sub>O): approximately 9–14.5 mol%
- Residual oxygen (O<sub>2</sub>): approximately 2.5–9.6 mol%

### 7.2.4 Key Considerations

The Project's GHG emissions profile is dominated by flaring activities, which represent the most significant opportunity for emissions management.

Flare emissions have been estimated with the flare operating in start-up mode, resulting in a highly conservative estimate. Variability in oxygen concentrations across exhaust streams suggests differing combustion efficiencies among equipment. Emissions are expected to be continuous for certain sources (e.g., power generation) and intermittent or variable for others (e.g., flaring events).

### 7.2.5 Preliminary Mitigation Considerations

Consistent with the requirements of the *Impact Assessment Act*, Trigon will further evaluate technically and economically feasible measures to reduce GHG emissions, including:

- Minimization of routine flaring (e.g.) flaring only if required and analysis of flare gas recovery systems;
- Optimization of combustion efficiency across all emission sources;
- Evaluation of low-carbon energy alternatives for on-site power generation; and
- Integration of energy efficiency and heat recovery measures where feasible.

### 7.3 Accidents and Malfunctions

The Impact Statement will describe potential accidents and malfunctions that may occur in connection with the Project, including credible worst-case scenarios, the potential effects of such events on the environment, health, social and economic conditions, and the measures proposed to avoid, mitigate, and respond to such incidents.

For an LPG export facility, potential accidents or malfunctions may result in the release of liquefied petroleum gas (LPG; primarily propane and/or butane), flammable liquids, or pressurized gas from storage tanks, transfer piping, refrigeration systems, or marine loading infrastructure during commissioning or operation. Credible scenarios include loss of containment during marine loading or unloading, failure of loading and unloading arms or hoses, tank overfill, process equipment rupture, or vessel-related incidents at berth. These events may lead to the formation of flammable vapour clouds and present risks of fire, explosion (overpressure), and injury to workers and the public.

LPG is flammable and forms explosive mixtures with air within defined concentration ranges. Propane is flammable at approximately 2.1 to 9.5 percent by volume in air, and butane at approximately 1.8 to 8.4 percent. Within these ranges, the presence of an ignition source may result in flash fires or vapour cloud explosions. LPG vapours are heavier than air and may accumulate in low-lying areas or along the water surface, potentially travelling away from the source prior to ignition. In a marine export context, releases during loading operations or from berthed vessels may result in vapour dispersion over water, with potential effects on nearby shorelines, marine users, and sensitive habitats.

The Project will be designed, constructed, and operated in accordance with applicable codes, standards, and regulatory requirements.

A prevention-focused approach will be applied through the implementation of engineered and administrative controls, including containment systems, gas detection, emergency shutdown systems, fire and explosion protection, and operational procedures. In addition, emergency management and response plans will be developed and described in the Impact Statement, including measures to respond to accidental releases, fires, and explosions. These plans will be developed in consideration of



federal, provincial, and local requirements, and in coordination with relevant authorities, Indigenous groups, and marine and community emergency responders.

Training, drills, and emergency response exercises will be conducted to support preparedness and response capability throughout the life of the Project. Follow-up and monitoring programs will be described to verify the effectiveness of mitigation measures and to support adaptive management, consistent with IAAC requirements.

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**Appendix A: Preliminary Emissions Estimate**

Project Name	Trigon Pacific LPG - Pre-Feed Study	Created	Parinaz Tehrani	<b>ENERFLEX</b>
Enerflex Project #	E004782-01	Checked	Matthew Graham	
Location	Prince Rupert, BC	Approved	Matthew Graham	
Document Title	Preliminary Emissions Estimate	Date	March 11, 2024	
Document #	2023101-90-PR-ENER-009-A	Revision	A	

### EMISSION SUMMARY

Sources	CO <sub>2</sub> Emission (KTPA)	Location (Ref Plant Datum x,y,z = 0,0,0)			Exhaust Temp (°C)	Exhaust Gas Composition (mol%)			
		X	Y	Z		CO <sub>2</sub>	N <sub>2</sub>	H <sub>2</sub> O	O <sub>2</sub>
LPG Vaporizer	18.2	234000	38000	TBD	413	9.7	14.5	14.5	2.5
Ground flare	655.1	566000	36000	TBD	2529	5.88	74.35	11.77	8.00
3 LP boil-off gas compressors	24.0	126000	50000	TBD	815	6.01	75.45	8.99	9.55
2 HP boil-off gas compressors	25.7	126000	50000	TBD	797	9.43	73.43	14.10	3.04
Electric Generator	66.2	34000	21000	TBD	797	5.80	74.10	10.20	9.00
<b>Total</b>	789.3								

Notes:

1. It is assumed that the LPG Vaporizer is operating in startup mode with complete vaporization for this analysis.
2. For this analysis, the electric generators are presumed to be Jenbacher JMS 620 unit chosen to operate at its full load of 100%.
3. Electric generator is assumed to be comprised of five units, each generating 3MW, resulting in a total output of 15MW when operating on a blend of methane and ethane fuel.
4. It is assumed that the pilot gas for the ground flare is combusted completely for the purpose of this analysis.
5. The engines chosen for the LP BOG compressors are CAT3606.
6. The engines chosen for the HP BOG compressors are CAT3608.
7. For this analysis, all compressor's engines are presumed to operate at its full load of 100%.

## LPG VAPORIZER

Exhaust Gas Flow	kg/hr	13729
Exhaust Gas Composition		
O <sub>2</sub>	mol%	2.54
N <sub>2</sub>	mol%	73.28
CO <sub>2</sub>	mol%	9.70
H <sub>2</sub> O	mol%	14.48
Exhaust Gas Mol Wt		28.2
Exhaust Gas Molar Flow		486.5
Exhaust Gas CO <sub>2</sub> - Molar Flow	kmol/hr	47
Exhaust Gas CO <sub>2</sub> - Mass Flow	kg/hr	2077
	KTPA	18.19
Exhaust Temperature	°F	413

**Notes:**

1. Analysis is conducted with a focus on the LPG vaporizer's 100% firing rate.
2. 15% excess air is calculated.

### Combustion Data

Type Of Fuel	Natural Gas	
Fuel LHV	BTU/gal	914
Fuel HHV	BTU/gal	1016
Excess Air, %		15%
Combustion Air Design Temperature	°F	70
Steady State Firing Rate (LHV Basis)	MMBTU/hr	5.36
Steady State Firing Rate (HHV Basis)	MMBTU/hr	5.96
Calculated Fuel Efficiency	% LHV Basis	86.7%
Estimated Flue Gas Temperature	°F	508
Shell Side Operating Pressure	in W.C.	0.1
Required Shellside Flowrate	lb / hr	17727
Required Shellside Flowrate (Volumetric)	(act)ft <sup>3</sup> / min	14416
Shell Side Pressure Drop	in W.C.	0.06
Combustion Air Preheat		No

### Burner Selection & Emission Requirements

Burner Type	Natural Gas Burners	
NOx Required (if any)	ppm	N/A
CO Required (if any)	ppm	N/A
Burner Design Margin	%	18%
Design Firing Rate (HHV Basis)	Btu / hr	7,027,651
Number of Burner	#	1
Burner Turndown		10:1
Steady State Fuel Flow Rate	(std)ft <sup>3</sup> / hr	5861
Total Fuel Consumption @ High Fire	(std)ft <sup>3</sup> / hr	6916
Steady State Air Flow Rate	(std)ft <sup>3</sup> / hr	1092
Total Air Consumption @ High Fire	(std)ft <sup>3</sup> / hr	1289
Recirc Flow Rate	(act)ft <sup>3</sup> / hr	3651
Selected Burner Make	Maxon	
Selected Burner Size	OvenPak	
Oxygen Trim	No	
Combustion Control Type	Single Point Positioning	
Burner Duty Cycle	Intermittent	
BMS Type	Standard	
Combustion Control Type	Standard	
Fuel Supply Pressure to Regulator	lb / in <sup>2</sup> (g)	80 to 100
Fuel Train Type	Sigma Thermal Standard	
Fuel Train Location	Heater Mounted	
Fuel Train Piping Direction	Left to Right	
Fuel Train / BMS Code Compliance	CSA B149.3	

## GROUND FLARE

Exhaust Gas Flow	kg/hr	812000
Exhaust Gas Composition		
O <sub>2</sub>	mol%	8.00
N <sub>2</sub>	mol%	74.35
CO <sub>2</sub>	mol%	5.88
H <sub>2</sub> O	mol%	11.77
Exhaust Gas Mol Wt		28.1
Exhaust Gas Molar Flow		28898.4
Exhaust Gas CO <sub>2</sub> - Molar Flow	kmol/hr	1699
Exhaust Gas CO <sub>2</sub> - Mass Flow	kg/hr	74783
	KTPA	655.10
Exhaust Temperature	°F	2529

**Notes:**

1. It is assumed that the pilot gas for the ground flare is combusted completely for the purpose of this analysis.
2. When burning 1 mole of CH<sub>4</sub>, it is considered that 16 moles of air are required with a 15% excess of O<sub>2</sub>
3. The temperature of the exhaust is computed based on July dry ambient temperature.

### General Information:

Tag No.:	HEI-1
Model No.:	HEIC-22-T/T
Operation:	Manual/Automatic
No. of Pilots Ignited:	22
Area Classification:	TBD
Spark Intensity:	Approx. 1,000 Volts

### Fuel Gas Data:

Molecular Weight:	18.0
L. H. V.:	1,000 BTU/SCF
Temperature:	100 Deg. F
Pressure:	15 psig

### Utility Consumption:

Pilot Gas (Per Pilot):	65 SCFH
Pilot Gas (Total):	1,430 SCFH
Power Available:	120 Volt, 1 Phase, 60 Hertz

## Three LP BOIL-OFF GAS COMPRESSORS (Engine CAT3606)

**Data is supplied on a per-unit compressor basis.**

Engine Maximum Rating@ 100% Load			Engine@ 75% Load			Engine@ 50% Load		
Engine% Load	%	100	Engine% Load	%	75	Engine% Load	%	50
Engine Power	bkW	1495	Engine Power	bkW	1088	Engine Power	bkW	727
Exhaust Gas Temperature	°F	815	Exhaust Gas Temperature °F	880	Exhaust Gas Temperature °F	955		
Exhaust Gas Pressure	kPa	347	Exhaust Gas Pressure kPa	264	Exhaust Gas Pressure kPa	189		
Exhaust Gas Flow	kg/hr	10136.1	Exhaust Gas Flow	kg/hr	7529	Exhaust Gas Flow	kg/hr	5191
	Nm <sup>3</sup> /hr	7953		Nm <sup>3</sup> /hr	5908		Nm <sup>3</sup> /hr	4078
CO <sub>2</sub> Emission Rate	g/bhp.hr	456.00	CO <sub>2</sub> Emission Rate	g/bhp.hr	471.00	CO <sub>2</sub> Emission Rate	g/bhp.hr	508.00
	kg/hr	914.19		kg/hr	687.19		kg/hr	495.25
	KTPA	8.01		KTPA	6.02		KTPA	4.34
Fuel Gas Flow	Nm <sup>3</sup> /hr	237	Fuel Gas Flow	Nm <sup>3</sup> /hr	179	Fuel Gas Flow	Nm <sup>3</sup> /hr	129
	kmol/hr	10.6		kmol/hr	8.0		kmol/hr	5.8
Air Flow(@inlet air temp ,101.3 kPa)	m <sup>3</sup> /hr	8103	Air Flow(@inlet air temp ,101.3 kPa)	m <sup>3</sup> /hr	6213	Air Flow(@inlet air temp ,101.3 kPa)	m <sup>3</sup> /hr	4275
	kmol/hr	339.2		kmol/hr	252.3		kmol/hr	173.6
Exhaust Gas Composition			Exhaust Gas Composition			Exhaust Gas Composition		
CO <sub>2</sub>	%	6.01	CO <sub>2</sub>	%	6.15	CO <sub>2</sub>	%	6.37
N <sub>2</sub>	%	75.45	N <sub>2</sub>	%	75.37	N <sub>2</sub>	%	75.23
H <sub>2</sub> O	%	8.99	H <sub>2</sub> O	%	9.19	H <sub>2</sub> O	%	9.53
O <sub>2</sub>	%	9.55	O <sub>2</sub>	%	9.29	O <sub>2</sub>	%	8.86

**Notes:**

1. The cells containing data highlighted in yellow are sourced directly from the Gas Engine Technical Data available through GERP.

GAS COMPRESSION APPLICATION

ENGINE SPEED (rpm):	1000	RATING STRATEGY:	STANDARD
COMPRESSION RATIO:	7.6	RATING LEVEL:	CONTINUOUS
AFTERCOOLER TYPE:	SCAC	FUEL SYSTEM:	GAV
AFTERCOOLER - STAGE 1 INLET (°C):	79		WITH AIR FUEL RATIO CONTROL
JACKET WATER OUTLET (°C):	88		
ASPIRATION:	TA	<b>SITE CONDITIONS:</b>	
COOLING SYSTEM:	JW+1AC, OC+2AC	FUEL:	Gas Analysis
CONTROL SYSTEM:	ADEM4	FUEL PRESSURE RANGE(kPag): (See note 1)	400-485
EXHAUST MANIFOLD:	DRY	FUEL METHANE NUMBER:	53.8
COMBUSTION:	LOW EMISSION	FUEL LHV (MJ/Nm3):	60.66
NOx EMISSION LEVEL (g/bhp-hr NOx):	0.5	ALTITUDE(m):	15
SET POINT TIMING:	16	MAXIMUM INLET AIR TEMPERATURE(°C):	27
		STANDARD RATED POWER:	1499 bkW@1000rpm

RATING	NOTES	LOAD	MAXIMUM RATING	SITE RATING AT MAXIMUM INLET AIR TEMPERATURE			
			100%	100%	75%	50%	
ENGINE POWER (WITHOUT FAN)	(2)	bkW	1495	1451	1088	727	
INLET AIR TEMPERATURE		°C	18	27	27	27	
AFTERCOOLER - STAGE 2 INLET (°C):	(3)	°C	32	43	43	43	

ENGINE DATA							
FUEL CONSUMPTION (LHV)	(4)	MJ/bkW-hr	9.61	9.63	9.99	10.75	
FUEL CONSUMPTION (HHV)	(4)	MJ/bkW-hr	10.52	10.54	10.94	11.77	
AIR FLOW (@inlet air temp, 101.3 kPa)	(WET) (5)(6)	m3/bkW-hr	5.42	5.66	5.71	5.88	
AIR FLOW	(WET) (5)(6)	kg/bkW-hr	6.58	6.66	6.71	6.91	
FUEL FLOW (0°C, 101.3 kPa)		Nm3/hr	237	230	179	129	
INLET MANIFOLD PRESSURE	(7)	kPa(abs)	347	345	264	189	
EXHAUST TEMPERATURE - ENGINE OUTLET	(8)	°C	435	435	471	513	
EXHAUST GAS FLOW (0°C, 101.3 kPa)	(WET) (9)(6)	Nm3/bkW-hr	5.32	5.38	5.43	5.61	
EXHAUST GAS MASS FLOW	(WET) (9)(6)	kg/bkW-hr	6.78	6.86	6.92	7.14	

EMISSIONS DATA - ENGINE OUT							
NOx (as NO2)	(10)(11)	g/bhp-hr	0.50	0.50	0.50	0.50	
CO	(10)(11)	g/bhp-hr	2.50	2.50	2.50	2.50	
THC (mol. wt. of 15.84)	(10)(11)	g/bhp-hr	3.55	3.73	3.95	4.21	
NMHC (mol. wt. of 15.84)	(10)(11)	g/bhp-hr	3.21	3.37	3.57	3.81	
NMNEHC (VOCs) (mol. wt. of 15.84)	(10)(11)(12)	g/bhp-hr	0.32	0.33	0.35	0.38	
HCHO (Formaldehyde)	(10)(11)	g/bhp-hr	0.21	0.21	0.22	0.25	
CO2	(10)(11)	g/bhp-hr	456	457	471	508	
EXHAUST OXYGEN	(10)(13)	% DRY	11.0	11.1	10.9	10.4	

HEAT REJECTION							
HEAT REJ. TO JACKET WATER (JW)	(14)	kW	415	409	337	271	
HEAT REJ. TO ATMOSPHERE	(14)	kW	89	93	95	92	
HEAT REJ. TO LUBE OIL (OC)	(14)	kW	220	214	197	169	
HEAT REJ. TO A/C - STAGE 1 (1AC)	(14)(15)	kW	259	252	122	36	
HEAT REJ. TO A/C - STAGE 2 (2AC)	(14)(15)	kW	181	153	98	54	

COOLING SYSTEM SIZING CRITERIA			
TOTAL JACKET WATER CIRCUIT (JW+1AC)	(15)(16)	kW	729
TOTAL STAGE 2 AFTERCOOLER CIRCUIT (OC+2AC)	(15)(16)	kW	454
A cooling system safety factor of 0% has been added to the cooling system sizing criteria.			

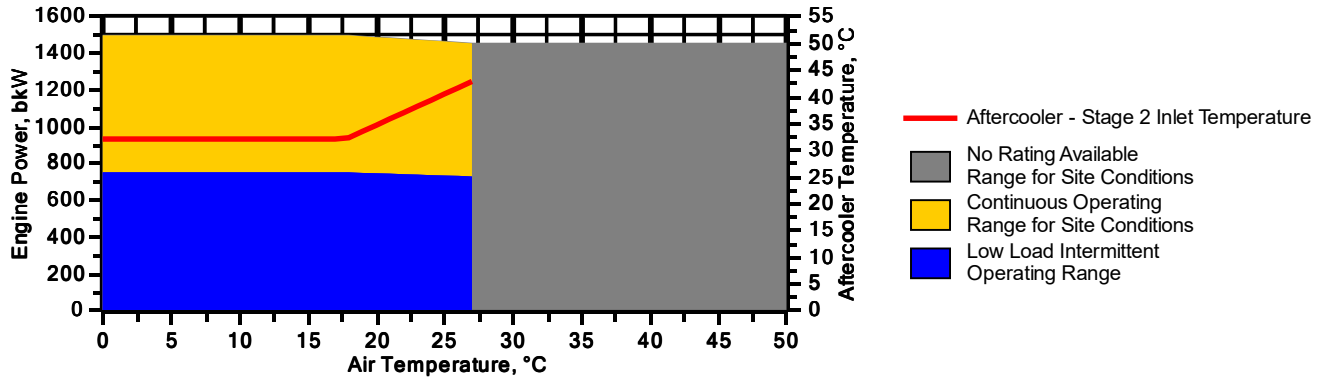
**CONDITIONS AND DEFINITIONS**

Engine rating obtained and presented in accordance with ISO 3046/1, adjusted for fuel, site altitude and site inlet air temperature. 100% rating at maximum inlet air temperature is the maximum engine capability for the specified fuel at site altitude and maximum site inlet air temperature. Maximum rating is the maximum capability at the specified aftercooler inlet temperature for the specified fuel at site altitude and reduced inlet air temperature. Lowest load point is the lowest continuous duty operating load allowed. No overload permitted at rating shown.

For notes information consult page three.

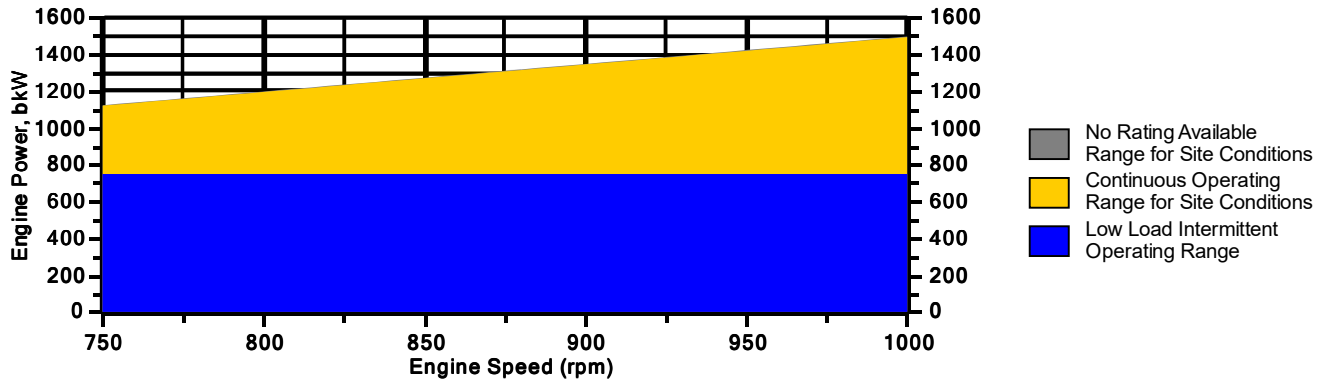
### Engine Power vs. Inlet Air Temperature

Data represents temperature sweep at 15 m and 1000 rpm



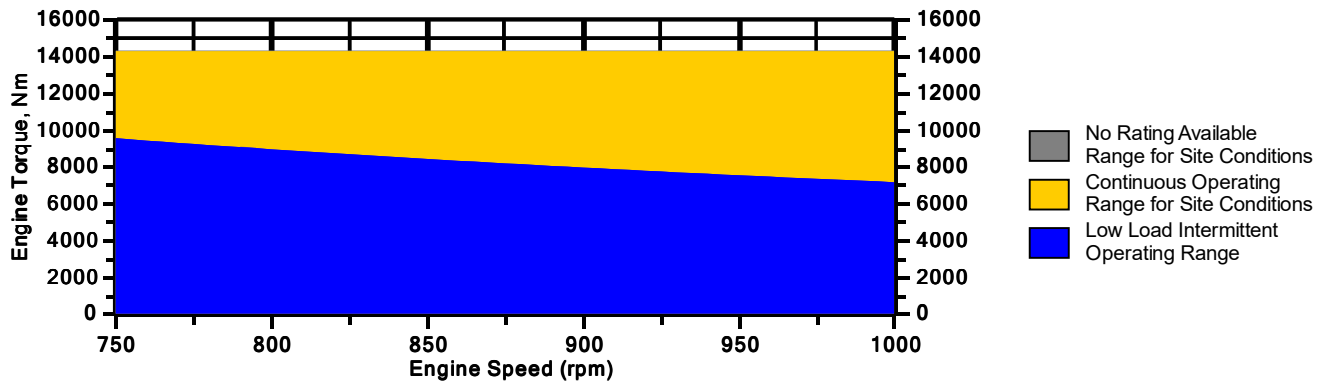
### Engine Power vs. Engine Speed

Data represents speed sweep at 15 m and 27 °C



### Engine Torque vs. Engine Speed

Data represents speed sweep at 15 m and 27 °C



Note: At site conditions of 15 m and 27°C inlet air temp., constant torque can be maintained down to 750 rpm. The minimum speed for loading at these conditions is 750 rpm.

### NOTES

1. Fuel pressure range specified is to the engine gas shutoff valve (GSOV). Additional fuel train components should be considered in pressure and flow calculations.
2. Engine rating is with two engine driven water pumps. Tolerance is  $\pm 3\%$  of full load.
3. Aftercooler temperature is based on site specified cooling system ambient capability. Refer to the table below.

Site Ambient Capability	
AC Temp.	Ambient Cap.
32°C	18°C
43°C	27°C
54°C	27°C
65°C	27°C

4. Fuel consumption tolerance is  $\pm 2.5\%$  of full load data.
5. Air flow value is on a 'wet' basis. Flow is a nominal value with a tolerance of  $\pm 5\%$ .
6. Inlet and Exhaust Restrictions must not exceed A&I limits based on full load flow rates from the standard technical data sheet.
7. Inlet manifold pressure is a nominal value with a tolerance of  $\pm 5\%$ .
8. Exhaust temperature is a nominal value with a tolerance of (+)35°C, (-)30°C.
9. Exhaust flow value is on a "wet" basis. Flow is a nominal value with a tolerance of  $\pm 6\%$ .
10. Emissions data is at engine exhaust flange prior to any after treatment.
11. Values listed are higher than nominal levels to allow for instrumentation, measurement, and engine-to-engine variations. They indicate the maximum values expected under steady state conditions. Fuel methane number cannot vary more than  $\pm 3$ . THC, NMHC, and NMNEHC do not include aldehydes. An oxidation catalyst may be required to meet Federal, State or local CO or HC requirements.
12. VOCs - Volatile organic compounds as defined in US EPA 40 CFR 60, subpart JJJJ
13. Exhaust Oxygen level is the result of adjusting the engine to operate at the specified NOx level. Tolerance is  $\pm 0.5$ .
14. Heat rejection values are nominal. Tolerances, based on treated water, are  $\pm 10\%$  for jacket water circuit,  $\pm 50\%$  for radiation,  $\pm 20\%$  for lube oil circuit, and  $\pm 5\%$  for aftercooler circuit.
15. Aftercooler heat rejection includes an aftercooler heat rejection factor for the site elevation and inlet air temperature specified. Aftercooler heat rejection values at part load are for reference only. Do not use part load data for heat exchanger sizing.
16. Cooling system sizing criteria are maximum circuit heat rejection for the site, with applied tolerances.

Constituent	Abbrev	Mole %	Norm
Water Vapor	H2O	0.0000	0.0000
Methane	CH4	18.0600	18.0600
Ethane	C2H6	76.3600	76.3600
Propane	C3H8	5.5800	5.5800
Isobutane	iso-C4H10	0.0000	0.0000
Norbutane	nor-C4H10	0.0000	0.0000
Isopentane	iso-C5H12	0.0000	0.0000
Norpentane	nor-C5H12	0.0000	0.0000
Hexane	C6H14	0.0000	0.0000
Heptane	C7H16	0.0000	0.0000
Nitrogen	N2	0.0000	0.0000
Carbon Dioxide	CO2	0.0000	0.0000
Hydrogen Sulfide	H2S	0.0000	0.0000
Carbon Monoxide	CO	0.0000	0.0000
Hydrogen	H2	0.0000	0.0000
Oxygen	O2	0.0000	0.0000
Helium	HE	0.0000	0.0000
Neopentane	neo-C5H12	0.0000	0.0000
Octane	C8H18	0.0000	0.0000
Nonane	C9H20	0.0000	0.0000
Ethylene	C2H4	0.0000	0.0000
Propylene	C3H6	0.0000	0.0000
TOTAL (Volume %)		100.0000	100.0000

Fuel Makeup: Gas Analysis  
Unit of Measure: Metric

**Calculated Fuel Properties**

Caterpillar Methane Number: 53.8  
Lower Heating Value (MJ/Nm3): 60.66  
Higher Heating Value (MJ/Nm3): 66.41  
WOBBE Index (MJ/Nm3): 61.34  
THC: Free Inert Ratio: Not Applicable  
Total % Inerts (% N2, CO2, He): 0%  
RPC (%) (To 35.64 MJ/Nm3 Fuel): 100%  
Compressibility Factor: 0.993  
Stoich A/F Ratio (Vol/Vol): 15.78  
Stoich A/F Ratio (Mass/Mass): 16.14  
Specific Gravity (Relative to Air): 0.978  
Fuel Specific Heat Ratio (K): 1.202

**CONDITIONS AND DEFINITIONS**

Caterpillar Methane Number represents the knock resistance of a gaseous fuel. It should be used with the Caterpillar Fuel Usage Guide for the engine and rating to determine the rating for the fuel specified. A Fuel Usage Guide for each rating is included on page 2 of its standard technical data sheet.

RPC always applies to naturally aspirated (NA) engines, and turbocharged (TA or LE) engines only when they are derated for altitude and ambient site conditions.

Project specific technical data sheets generated by the Caterpillar Gas Engine Rating Pro program take the Caterpillar Methane Number and RPC into account when generating a site rating.

Fuel properties for MJ/Nm3 calculations are at 0C and 101 kPa.

Caterpillar shall have no liability in law or equity, for damages, consequently or otherwise, arising from use of program and related material or any part thereof.

**FUEL LIQUIDS**

Field gases, well head gases, and associated gases typically contain liquid water and heavy hydrocarbons entrained in the gas. To prevent detonation and severe damage to the engine, hydrocarbon liquids must not be allowed to enter the engine fuel system. To remove liquids, a liquid separator and coalescing filter are recommended, with an automatic drain and collection tank to prevent contamination of the ground in accordance with local codes and standards.

To avoid water condensation in the engine or fuel lines, limit the relative humidity of water in the fuel to 80% at the minimum fuel operating temperature.

## TWO HP BOIL-OFF GAS COMPRESSORS(CAT3608)

**Data is supplied on a per-unit compressor basis.**

Engine Maximum Rating@ 100% Load			Engine@ 75% Load			Engine @ 50% Load		
Engine% Load	%	100	Engine% Load	%	75	Engine% Load	%	50
Engine Power	bkW	2500	Engine Power	bkW	1875	Engine Power	bkW	1250
Exhaust Gas Temperature	°F	835	Exhaust Gas Temperature	°F	868	Exhaust Gas Temperature	°F	924
Exhaust Gas Pressure	kPa	101.3	Exhaust Gas Pressure	kPa	101.3	Exhaust Gas Pressure	kPa	101.3
Exhaust Gas Flow (@engine outlet temp,14.5 psia)	kg/hr	12935	Exhaust Gas Flow (@engine outlet temp,14.5 psia)	kg/hr	9798.5	Exhaust Gas Flow (@engine outlet temp,14.5 psia)	kg/hr	6705
	m <sup>3</sup> /hr	27310		m <sup>3</sup> /hr	21229		m <sup>3</sup> /hr	15147
CO <sub>2</sub> Emission Rate	g/bhp.hr	438.00	CO <sub>2</sub> Emission Rate	g/bhp.hr	450.00	CO <sub>2</sub> Emission Rate	g/bhp.hr	482.00
	kg/hr	1468.40		kg/hr	1131.47		kg/hr	807.95
	KTPA	12.86		KTPA	9.91		KTPA	7.08
Fuel Gas Flow(@60°F ,14.7psia)	Sm <sup>3</sup> /hr	528.4	Fuel Gas Flow(@60°F ,14.7psia)	Sm <sup>3</sup> /hr	411	Fuel Gas Flow(@60°F ,14.7psia)	Sm <sup>3</sup> /hr	294
	kmol/hr	22.3		kmol/hr	17.4		kmol/hr	12.4
Air Flow(@77°F ,14.7psia)	m <sup>3</sup> /hr	10602	Air Flow(@77°F ,14.7psia)	m <sup>3</sup> /hr	8024	Air Flow(@77°F ,14.7psia)	m <sup>3</sup> /hr	5483
	kmol/hr	443.8		kmol/hr	325.8		kmol/hr	222.6
Exhaust Gas Composition			Exhaust Gas Composition			Exhaust Gas Composition		
CO <sub>2</sub>	%	9.43	CO <sub>2</sub>	%	10.02	CO <sub>2</sub>	%	10.38
N <sub>2</sub>	%	73.43	N <sub>2</sub>	%	73.08	N <sub>2</sub>	%	72.87
H <sub>2</sub> O	%	14.10	H <sub>2</sub> O	%	14.98	H <sub>2</sub> O	%	15.52
O <sub>2</sub>	%	3.04	O <sub>2</sub>	%	1.92	O <sub>2</sub>	%	1.23

**Notes:**  
 1. The cells containing data highlighted in yellow are sourced directly from the Gas Engine Technical Data available through GERP.

ENGINE SPEED (rpm):	1000	RATING STRATEGY:	STANDARD
COMPRESSION RATIO:	7.6	APPLICATION:	GAS COMPRESSION
AFTERCOOLER TYPE:	SCAC	RATING LEVEL:	CONTINUOUS
AFTERCOOLER - STAGE 2 INLET (°F):	130	FUEL:	NAT GAS
AFTERCOOLER - STAGE 1 INLET (°F):	174	FUEL SYSTEM:	GAV
JACKET WATER OUTLET (°F):	190	FUEL PRESSURE RANGE(psia): (See note 1)	WITH AIR FUEL RATIO CONTROL 72.5-84.8
ASPIRATION:	TA	FUEL METHANE NUMBER:	85
COOLING SYSTEM:	JW+1AC, OC+2AC	FUEL LHV (Btu/scf):	905
CONTROL SYSTEM:	ADEM4	ALTITUDE CAPABILITY AT 100°F INLET AIR TEMP. (ft):	7694
EXHAUST MANIFOLD:	DRY		
COMBUSTION:	LOW EMISSION		
NOx EMISSION LEVEL (g/bhp-hr NOx):	0.5		

RATING	NOTES	LOAD	100%	75%	50%
ENGINE POWER	(2) (WITHOUT FAN)	bhp	2500	1875	1250
ENGINE EFFICIENCY	(3) (ISO 3046/1)	%	38.6	37.2	34.7
ENGINE EFFICIENCY	(3) (NOMINAL)	%	37.7	36.3	33.9

ENGINE DATA						
FUEL CONSUMPTION	(ISO 3046/1)	(4)	Btu/bhp-hr	6595	6835	7328
FUEL CONSUMPTION	(NOMINAL)	(4)	Btu/bhp-hr	6756	7002	7507
AIR FLOW (77°F, 14.7 psia)	(WET)	(5)(6)	ft <sup>3</sup> /min	6240	4723	3227
AIR FLOW	(WET)	(5)(6)	lb/hr	27667	20942	14310
FUEL FLOW (60°F, 14.7 psia)			scfm	311	242	173
COMPRESSOR OUT PRESSURE			in Hg(abs)	104.7	79.0	54.9
COMPRESSOR OUT TEMPERATURE			°F	383	306	218
AFTERCOOLER AIR OUT TEMPERATURE			°F	140	140	141
INLET MAN. PRESSURE		(7)	in Hg(abs)	102.5	77.5	54.0
INLET MAN. TEMPERATURE	(MEASURED IN PLENUM)	(8)	°F	140	140	141
TIMING		(9)	°BTDC	17	17	16
EXHAUST TEMPERATURE - ENGINE OUTLET		(10)	°F	835	868	924
EXHAUST GAS FLOW (@engine outlet temp, 14.5 psia)	(WET)	(6)(11)	ft <sup>3</sup> /min	16074	12495	8915
EXHAUST GAS MASS FLOW	(WET)	(6)(11)	lb/hr	28516	21602	14782

EMISSIONS DATA - ENGINE OUT						
NOx (as NO <sub>2</sub> )		(12)(13)	g/bhp-hr	0.50	0.50	0.50
CO		(12)(14)	g/bhp-hr	1.68	1.68	1.68
THC (mol. wt. of 15.84)		(12)(14)	g/bhp-hr	2.38	2.50	2.51
NMHC (mol. wt. of 15.84)		(12)(14)	g/bhp-hr	0.22	0.23	0.23
NMNEHC (VOCs) (mol. wt. of 15.84)		(12)(14)(15)	g/bhp-hr	0.15	0.16	0.16
HCHO (Formaldehyde)		(12)(14)	g/bhp-hr	0.17	0.17	0.18
CO <sub>2</sub>		(12)(14)	g/bhp-hr	438	450	482
EXHAUST OXYGEN		(12)(16)	% DRY	11.3	11.0	10.5
LAMBDA		(12)(16)		2.03	1.98	1.89

ENERGY BALANCE DATA						
LHV INPUT		(17)	Btu/min	281478	218788	156378
HEAT REJECTION TO JACKET WATER (JW)		(18)(26)	Btu/min	26513	24529	20159
HEAT REJECTION TO ATMOSPHERE		(19)	Btu/min	11347	11329	11250
HEAT REJECTION TO LUBE OIL (OC)		(20)(27)	Btu/min	12667	11815	10634
HEAT REJECTION TO EXHAUST (LHV TO 77°F)		(21)(22)	Btu/min	94828	74592	53957
HEAT REJECTION TO EXHAUST (LHV TO 350°F)		(21)	Btu/min	61127	49628	37800
HEAT REJECTION TO A/C - STAGE 1 (1AC)		(23)(26)	Btu/min	18811	9001	2011
HEAT REJECTION TO A/C - STAGE 2 (2AC)		(24)(27)	Btu/min	8352	5064	2408
PUMP POWER		(25)	Btu/min	2957	2957	2957

### CONDITIONS AND DEFINITIONS

Engine rating obtained and presented in accordance with ISO 3046/1. (Standard reference conditions of 77°F, 29.60 in Hg barometric pressure.) No overload permitted at rating shown. Consult the altitude deration factor chart for applications that exceed the rated altitude or temperature.

Emission levels are at engine exhaust flange prior to any after treatment. Values are based on engine operating at steady state conditions, adjusted to the specified NOx level at 100% load. Tolerances specified are dependent upon fuel quality. Fuel methane number cannot vary more than ± 3.

For notes information consult page three.

**FUEL USAGE GUIDE**

<b>CAT METHANE NUMBER</b>	<10	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	100
SET POINT TIMING	-	16	16	16	16	16	16	16	16	16	17	17	17	17	18	18	18	18
DERATION FACTOR	0	0.50	0.62	0.75	0.87	1	1	1	1	1	1	1	1	1	1	1	1	1
<b>WOBBE INDEX(BTU/scfm)</b>	700		850		1550		1870											
DERATION FACTOR	0.77		1		1		0.9											

**ALTITUDE DERATION FACTORS AT RATED SPEED**

<b>INLET AIR TEMP °F</b>	130	1	1	1	1	1	1	0.98	0.95	0.91	0.88	0.85	0.81	0.78
	120	1	1	1	1	1	1	1	0.99	0.96	0.92	0.89	0.86	0.82
	110	1	1	1	1	1	1	1	1	0.98	0.94	0.91	0.88	0.84
	100	1	1	1	1	1	1	1	1	0.99	0.96	0.92	0.89	0.85
	90	1	1	1	1	1	1	1	1	1	0.96	0.93	0.90	0.86
	80	1	1	1	1	1	1	1	1	1	0.97	0.94	0.91	0.87
	70	1	1	1	1	1	1	1	1	1	0.98	0.95	0.92	0.88
	60	1	1	1	1	1	1	1	1	1	0.99	0.96	0.92	0.89
	50	1	1	1	1	1	1	1	1	1	1	0.97	0.93	0.90
			0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000

ALTITUDE (FEET ABOVE SEA LEVEL)

**AFTERCOOLER HEAT REJECTION FACTORS (ACHRF)**

<b>INLET AIR TEMP °F</b>	130	1.32	1.36	1.41	1.46	1.51	1.56	1.62	1.67	1.73	1.74	1.74	1.74	1.74
	120	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.67	1.67	1.67	1.67
	110	1.19	1.23	1.28	1.33	1.38	1.43	1.48	1.53	1.58	1.60	1.60	1.60	1.60
	100	1.13	1.17	1.22	1.26	1.31	1.36	1.41	1.46	1.51	1.53	1.53	1.53	1.53
	90	1.06	1.11	1.15	1.20	1.24	1.29	1.34	1.39	1.44	1.46	1.46	1.46	1.46
	80	1	1.04	1.09	1.13	1.18	1.22	1.27	1.32	1.37	1.39	1.39	1.39	1.39
	70	1	1	1.02	1.06	1.11	1.16	1.20	1.25	1.30	1.32	1.32	1.32	1.32
	60	1	1	1	1	1.04	1.09	1.13	1.18	1.23	1.25	1.25	1.25	1.25
	50	1	1	1	1	1	1.02	1.07	1.11	1.16	1.18	1.18	1.18	1.18
			0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000

ALTITUDE (FEET ABOVE SEA LEVEL)

**MINIMUM SPEED CAPABILITY AT THE RATED SPEED'S SITE TORQUE (RPM)**

<b>INLET AIR TEMP °F</b>	130	750	750	750	750	750	750	750	750	750	750	1000	1000	1000
	120	750	750	750	750	750	750	750	750	750	750	750	1000	1000
	110	750	750	750	750	750	750	750	750	750	750	750	750	1000
	100	750	750	750	750	750	750	750	750	750	750	750	750	1000
	90	750	750	750	750	750	750	750	750	750	750	750	750	1000
	80	750	750	750	750	750	750	750	750	750	750	750	750	750
	70	750	750	750	750	750	750	750	750	750	750	750	750	750
	60	750	750	750	750	750	750	750	750	750	750	750	750	750
	50	750	750	750	750	750	750	750	750	750	750	750	750	750
			0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000

ALTITUDE (FEET ABOVE SEA LEVEL)

**FUEL USAGE GUIDE:**

This table shows the derate factor and full load set point timing required for a given fuel. Note that deration and set point timing adjustment may be required as the methane number decreases. Methane number is a scale to measure detonation characteristics of various fuels. The methane number of a fuel is determined by using the Caterpillar methane number calculation.

The Fuel Lower Heating Value (LHV) table shows the derate factor required for a given fuel. To determine the actual power available, use the lowest factor between the Fuel LHV table and the Caterpillar Methane Number table.

**ALTITUDE DERATION FACTORS:**

This table shows the deration required for various air inlet temperatures and altitudes. Use this information along with the fuel usage guide chart to help determine actual engine power for your site. The derate factors shown do not account for the external cooling system capacity. The derate factors provided assume the external cooling system can maintain the specified cooling water temperatures at site conditions.

**ACTUAL ENGINE RATING:**

To determine the actual rating of the engine at site conditions, one must consider separately, limitations due to fuel characteristics and air system limitations. The Fuel Usage Guide deration establishes fuel limitations. The Altitude/ Temperature deration factors and RPC(reference the Caterpillar Methane Program) establish air system limitations. RPC comes into play when the Altitude/Temperature deration is less than 1.0 (100%). Under this condition, add the two factors together. When the site conditions do not require an Altitude/Temperature derate (factor is 1.0), it is assumed the turbocharger has sufficient capability to overcome the low fuel relative power, and RPC is ignored. To determine the actual power available, take the lowest rating between 1) and 2).

- 1) Fuel Usage Guide Deration
- 2)  $1 - ((1 - \text{Altitude / Temperature Deration}) + (1 - \text{RPC}))$

**AFTERCOOLER HEAT REJECTION FACTORS(ACHRF):**

To maintain a constant air inlet manifold temperature, as the inlet air temperature goes up, so must the heat rejection. As altitude increases, the turbocharger must work harder to overcome the lower atmospheric pressure. This increases the amount of heat that must be removed from the inlet air by the aftercooler. Use the aftercooler heat rejection factor (ACHRF) to adjust for inlet air temp and altitude conditions. See notes (26) and (27) for application of this factor in calculating the heat exchanger sizing criteria. Failure to properly account for these factors could result in detonation and cause the engine to shutdown or fail.

**MINIMUM SPEED CAPABILITY AT THE RATED SPEED'S SITE TORQUE (RPM):**

This table shows the minimum allowable engine turndown speed where the engine will maintain the Rated Speed's Torque for the given ambient conditions.

**NOTES:**

1. Fuel pressure range specified is to the engine gas shutoff valve (GSOV). Additional fuel train components should be considered in pressure and flow calculations.
2. Engine rating is with two engine driven water pumps. Tolerance is  $\pm 3\%$  of full load.
3. ISO 3046/1 engine efficiency tolerance is (+)0, (-)5% of full load % efficiency value. Nominal engine efficiency tolerance is  $\pm 2.5\%$  of full load % efficiency value.
4. ISO 3046/1 fuel consumption tolerance is (+)5, (-)0% of full load data. Nominal fuel consumption tolerance is  $\pm 2.5\%$  of full load data.
5. Air flow value is on a 'wet' basis. Flow is a nominal value with a tolerance of  $\pm 5\%$ .
6. Inlet and Exhaust Restrictions must not exceed A&I limits based on full load flow rates from the standard technical data sheet.
7. Inlet manifold pressure is a nominal value with a tolerance of  $\pm 5\%$ .
8. Inlet manifold temperature is a nominal value with a tolerance of  $\pm 9^\circ\text{F}$ .
9. Timing indicated is for use with the minimum fuel methane number specified. Consult the appropriate fuel usage guide for timing at other methane numbers.
10. Exhaust temperature is a nominal value with a tolerance of (+)63°F, (-)54°F.
11. Exhaust flow value is on a 'wet' basis. Flow is a nominal value with a tolerance of  $\pm 6\%$ .
12. Emissions data is at engine exhaust flange prior to any after treatment.
13. NOx values are the maximum values expected under steady state conditions.
14. CO, CO<sub>2</sub>, THC, NMHC, NMNEHC, and HCHO are the maximum values expected under steady state conditions. THC, NMHC, and NMNEHC do not include aldehydes. An oxidation catalyst may be required to meet Federal, State or local CO or HC requirements.
15. VOCs - Volatile organic compounds as defined in US EPA 40 CFR 60, subpart JJJJ
16. Exhaust Oxygen tolerance is  $\pm 0.5$ ; Lambda tolerance is  $\pm 0.05$ . Lambda and Exhaust Oxygen level are the result of adjusting the engine to operate at the specified NOx level.
17. LHV rate tolerance is  $\pm 2.5\%$ .
18. Heat rejection to jacket water value displayed includes heat to jacket water alone. Value is based on treated water. Tolerance is  $\pm 10\%$  of full load data.
19. Heat rejection to atmosphere based on treated water. Tolerance is  $\pm 50\%$  of full load data.
20. Lube oil heat rate based on treated water. Tolerance is  $\pm 20\%$  of full load data.
21. Exhaust heat rate based on treated water. Tolerance is  $\pm 10\%$  of full load data.
22. Heat rejection to exhaust (LHV to 77°F) value shown includes unburned fuel and is not intended to be used for sizing or recovery calculations.
23. Heat rejection to A/C - Stage 1 based on treated water. Tolerance is  $\pm 5\%$  of full load data.
24. Heat rejection to A/C - Stage 2 based on treated water. Tolerance is  $\pm 5\%$  of full load data.
25. Pump power includes engine driven jacket water and aftercooler water pumps. Engine brake power includes effects of pump power.
26. Total Jacket Water Circuit heat rejection is calculated as:  $(\text{JW} \times 1.1) + (1\text{AC} \times 1.05) + [0.805 \times (1\text{AC} + 2\text{AC}) \times (\text{ACHRF} - 1) \times 1.05]$ . Heat exchanger sizing criterion is maximum circuit heat rejection at site conditions, with applied tolerances. A cooling system safety factor may be multiplied by the total circuit heat rejection to provide additional margin.
27. Total Second Stage Aftercooler Circuit heat rejection is calculated as:  $(\text{OC} \times 1.2) + (2\text{AC} \times 1.05) + [(1\text{AC} + 2\text{AC}) \times 0.195 \times (\text{ACHRF} - 1) \times 1.05]$ . Heat exchanger sizing criterion is maximum circuit heat rejection at site conditions, with applied tolerances. A cooling system safety factor may be multiplied by the total circuit heat rejection to provide additional margin.

**FREE FIELD MECHANICAL & EXHAUST NOISE**
**MECHANICAL: Sound Power (1/3 Octave Frequencies)**

Percent Load	Engine Power	Overall	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz
%	bhp	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
100	2500	126.0	86.3	94.5	99.2	98.8	101.7	105.9	108.0	110.7	108.4	107.3
75	1875	123.1	84.1	92.8	97.4	96.9	101.0	105.5	107.6	110.8	108.0	108.2
50	1250	120.9	86.3	99.0	97.2	97.3	101.3	104.6	108.5	111.8	108.0	107.2

**MECHANICAL: Sound Power (1/3 Octave Frequencies)**

Percent Load	Engine Power	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz
%	bhp	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
100	2500	108.0	109.0	113.2	108.2	108.4	111.8	114.5	124.9	108.8	107.8	111.3
75	1875	107.5	107.6	113.0	107.5	108.0	111.1	116.8	112.2	106.9	115.0	105.5
50	1250	106.9	107.0	112.8	106.9	107.2	110.8	111.5	108.3	107.1	104.8	100.9

**EXHAUST: Sound Power (1/3 Octave Frequencies)**

Percent Load	Engine Power	Overall	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz
%	bhp	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
100	2500	138.9	107.1	113.4	117.7	115.0	116.0	120.0	122.0	120.4	122.1	121.7
75	1875	136.7	107.6	108.7	110.6	109.0	110.9	114.2	115.4	113.2	115.3	116.0
50	1250	133.7	104.2	104.2	108.5	106.1	105.8	108.3	112.6	108.2	111.4	112.2

**EXHAUST: Sound Power (1/3 Octave Frequencies)**

Percent Load	Engine Power	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz
%	bhp	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
100	2500	124.8	123.2	123.9	125.9	126.6	130.6	131.3	130.6	129.6	128.0	124.2
75	1875	119.5	119.8	121.2	124.8	126.6	129.0	129.8	128.5	127.4	124.3	119.6
50	1250	116.1	117.3	119.6	122.3	124.4	126.4	127.1	125.5	124.0	119.6	114.0

**SOUND PARAMETER DEFINITION:**

Sound Power Level Data - DM8702-03

Sound power is defined as the total sound energy emanating from a source irrespective of direction or distance. Sound power level data is presented under two index headings:

Sound power level -- Mechanical  
 Sound power level -- Exhaust

Mechanical: Sound power level data is calculated in accordance with ISO 3747. The data is recorded with the exhaust sound source isolated.

Exhaust: Sound power level data is calculated in accordance with ISO 6798 Annex A. Exhaust data is post-catalyst on gas engine ratings labeled as "Integrated Catalyst".

Measurements made in accordance with ISO 3747 and ISO 6798 for mechanical and exhaust sound level only. Frequency bands outside the displayed ranges are not measured, due to physical test, and environmental conditions that affect the accuracy of the measurement. No cooling system noise is included unless specifically indicated. Sound level data is indicative of noise levels recorded on one engine sample in a survey grade 3 environment.

How an engine is packaged, installed and the site acoustical environment will affect the site specific sound levels. For site specific sound level guarantees, sound data collection needs to be done on-site or under similar conditions.

## ELECTRIC GENERATOR (JENBACHER JMS 620)

**Data below is on a per-unit generator basis.**

Engine Maximum Rating@ 100% Load		
Engine% Load	%	100
Engine Power	bkW	3123
Exhaust Gas Temperature	°F	797
Exhaust Gas Pressure	kPa	NA
Exhaust Gas Flow	kg/hr	NA
	Nm <sup>3</sup> /hr	NA
CO <sub>2</sub> Emission Rate	g/bhp.hr	361
	kg/hr	1512
	KTPA	13
Fuel Gas Flow	Nm <sup>3</sup> /hr	NA
	kmol/hr	#VALUE!
Air Flow(@inlet air temp ,101.3 kPa)	m <sup>3</sup> /hr	NA
	kmol/hr	#VALUE!
Exhaust Gas Composition		
CO <sub>2</sub>	%	5.80
N <sub>2</sub>	%	74.10
H <sub>2</sub> O	%	10.20
O <sub>2</sub>	%	9.00

**Notes:**

1. The cells containing data highlighted in yellow are sourced directly from the Gas Engine Technical Data available through Jenbacher.
2. Rows with NA & #VALUE! shows data are not available and TBC

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Product Program: PP2024

Valid until : 31.12.2024 00:00:00

Engine Type: J620 GS

BMEP [bar] : 20

Engine Version: J620 GS-J-13

RPM [1/min] : 1500

Fuel Gas : APG (CO2 <15 Vol%)

	ppm-Dry	mg/Nm <sup>3</sup> @5%O <sub>2</sub> -Dry	g/bhp-hr	g/kWh(mech)	g/GJ(th)	kg/hr	lbs/hr	tons/yr (short)
NOx	167	500	0.98	1.3	157	4.1	9	40
CO	576	1050	2.1	2.8	329	8.6	19	83

CO - Without After treatment system by INNIO Jenbacher, only as guiding value for information

Theoretical wet exhaust composition under assumption of 100 % fuel conversion

	vol.%	g/bhp-hr	g/kWh(mech)	g/GJ(th)	kg/hr	lbs/hr
CO <sub>2</sub>	5.8	361	485	57732	1512	3339
O <sub>2</sub>	9.0					
N <sub>2</sub>	74.1					
Ar	0.9					
H <sub>2</sub> O	10.2					