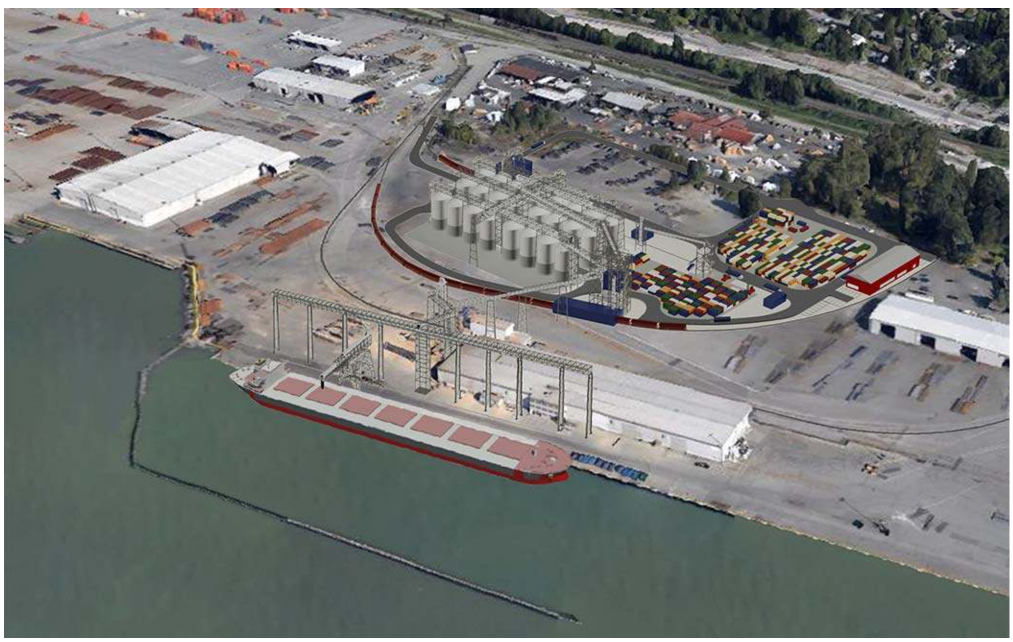
FGT

FRASER GRAIN TERMINAL

PROJECT ENERGY STUDY

PREPARED FOR THE

DEVELOPMENT PERMIT APPLICATION



ENGINEERING GROUP

CMC ENGINEERING AND MANAGEMENT LIMITED

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GLOSSARY

The following abbreviations, acronyms and consecrated terms are used in this document:

ITEM	MEANING
Bekaert	Bekaert Canada Limited
BATNEC	**B**est **A**vailable **T**echnology **N**ot **E**ntailing **E**xcessive **C**ost
CMC	CMC Engineering and Management Ltd.
ECM	Energy Conservation Measure
EIA	Environmental Impact Analysis
FGT	Fraser Grain Terminal
FSD	Fraser-Surrey Docks LP – Pacific Rim Stevedoring
PER	Project Environmental Review
P&H	Parrish & Heimbecker, Limited
t	tonne (1 000 kg)
VFPA	Vancouver Fraser Port Authority

0- EXECUTIVE SUMMARY

FGT is proposing to develop a new grain handling facility along the Fraser River in Surrey BC. The PER checklist dictated by VFPA called for the preparation of Project Energy Study. A review of the associated study guidelines revealed that it was geared towards existing facilities embarking upon capital projects involving (directly, or indirectly) energy conservation measures (ECM). This approach did not lend itself to the FGT project which is a green-field application and where current, “state of the art” technology and operational philosophies have already been included in the preliminary design process.

After discussions with VFPA and BC Hydro, it was agreed that the intent of the study could be met by taking a reverse approach to the analysis:

- IE: Compare the current energy usage calculations with the revised “non-optimised” design; the difference would be analogous to the potential savings normally identified in the retrofit scenario.

The analysis took into account the following parameters:

- Energy loads in the plant:
  - Motor loads
  - Lighting
  - Miscellaneous house loads
- ECMs inherent in the current design:
  - Type of equipment (different efficiency levels).
  - Operational methodology (using only the equipment that is required).

The end results showed supplementary energy usages of:

- 4.91% due to equipment choices
- 20.9% due to operational methodology choices added to the equipment choices.

The limiting factor to the energy usage differences lies in the fact that 97% of the plant load is motor based, an area that displays inherently high efficiencies even with “standard” equipment.

1- INTRODUCTION

1.1 PROJECT OVERVIEW

FGT is proposing to develop a new grain handling facility along the Fraser River in Surrey BC. A full description of the proposed plant is presented in the lead document of the PER application, and the reader is encouraged to refer to this document and its associated appendices for further details.

This particular document is one of the referenced appendices and is meant to be part of this overreaching application, as opposed to a stand-alone study.

1.2 HISTORY

The early stages of the FGT project go back to late 2014 with the presentation of a feasibility study to the client in 2015 April at which point, the client was already in discussion with VFPA regarding a potential lease agreement for the concerned property.

FGT made their first formal application for the opening of a PER application in late 2015. Shortly thereafter, VFPA presented FGT with a set of revised PER guidelines for the project using their newly adopted methodology and classification procedures; as a result of this change, the FGT project was re-classified to a Level D application with the highest levels of review.

This new methodology introduced revised requirements regarding the need for the proponent to demonstrate:

- The use of modern technologies, and
- To address energy consumption as part of the plant design.

The former was dealt with under the guidelines for the production of a BATNEC study; the reader is referred to a document entitled:

Fraser Grain Terminal
BATNEC REPORT
Prepared for the
Development Permit Application

The VFPA guidelines for the Project Energy Study were published later (see Bibliography, Reference #1).

1.3 EXISTING GUIDELINES

VFPA's "Guidelines – Project Energy Study" were reviewed and in CMC's opinion, these were difficult, if not impossible to apply to the letter on the FGT project. The difficulty stemmed from the assumptions that were being used in the guidelines:

- The project under consideration involved the upgrade, in one form or another, of an existing facility.
- The study required:
  - The cataloguing of existing energy consumption.
  - The identification of potential Energy Conservation Measures (ECM).
  - The analysis of the theoretical effect of the ECMs.

In contrast, the FGT project:

- Did not involve an upgrade, this is an entirely new development with no precedent to refer to.
- There is no existing power consumption level to measure or categorise.
- The majority of the plant's general design characteristics have already been developed:
  - General arrangement.
  - Mechanical equipment quantities and characteristics.
  - Major structural elements.
  - Electrical power distribution.
  - Control system architecture.
  - Lighting.
- As outlined in the BATNEC report, FGT had requested that the plant's design incorporate current best technologies, an approach which included ECMs to reduce power consumption (and thus cost of operation). As such, there are no major no ECMs to consider and evaluate.

A telephone conference was held on 2016 November 25 between personnel from VFPA, BC Hydro, FGT, and CMC to discuss this matter. CMC outlined the difficulties mentioned above and how these made it impossible to meet the letter of the guideline's requirements. However, CMC also explained what data could be analysed and how this could be used to meet the intents of the Project Energy Study Guideline Studies:

- Identify the ECMs that had been applied to the plant design.
- Take the existing energy utilisation calculations and modify them by removing the identified ECM (more details on this in Section 1.4).

- Compare the current energy usage calculations with the revised “non-optimised” design; the difference would be analogous to the potential savings normally identified in the retrofit scenario.

This approach was discussed by the parties to the meeting and it was agree that this would be an appropriate way to demonstrate that the FGT design will meet the intents of the PER Energy guidelines.

2- STUDY METHODOLOGY

The ECMs identified for analysis are the following:

Table 2: ECMs identified for analysis.

#	ECM TARGET	AS SELECTED	DOWNGRADE
1	**SELECTED EQUIPMENT**		
2	Electric motors	Premium efficiency.	Regular efficiency.
3	Lighting equipment (outdoor)	All LED fixtures.	HID and fluorescent.
4	**OPERATIONAL METHODOLOGY**		
5	Electric motors	Control system runs equipment only when it is required.	Equipment runs continuously.
6	Lighting equipment	• Variable lighting levels. • Turned on only when required.	Full lighting dusk to dawn.

Although the Selected Equipment comparison is relatively self-explanatory the Operational Methodology comparison requires further explanation regarding what has been considered:

- The control system planned for FGT will operate only the equipment that is required:
  - For most functions, the plant has multiple source to destination routes possible, but can only move product along one of them, therefore all other pieces of equipment will be left off.
  - During breaks in the product flow, (waiting for new railcar, waiting for new vessel hatch, waiting for new destination, etc.), the equipment involved will be turned off.
  - The existing lighting system has several features to reduce energy consumption (and light pollution):
    - Walkway lighting will normally be maintained at the lowest possible levels to meet emergency egress requirements (code requirement). Should access be required for nighttime work, lighting levels will be increased to standard WSB approved levels on an ad-hoc basis. Timing sequences will revert back to low level lighting at prescribed intervals but, for safety and convenience, the plant

personnel will have the ability to remotely control the lighting levels. Plug-in task lighting will be utilised if repairs need to be done.
  - Mast lighting around the container handling areas will be turned on only if night time work is done (which should normally happen only if equipment has broken down and “catch up” shifts are required.
  - Road way lighting will be turned off or minimised if the plant is not in operation.

Other secondary ECMs were identified but were not analysed; these are as follows:

- Staggered starts in equipment routes (reduces peak demand levels).
- Load sensing hydraulic pumps.
- Reduction in pumping losses in dust control air ducts, due to the use of smaller, individual air filters.
- Reduction in pumping losses in hydraulic piping, due to the use of multiple smaller, area specific, hydraulic power units.

These secondary ECMs were not analysed because their effects would be considerably smaller than the primary ones.

3- SUMMARY OF RESULTS AND EXPECTED SAVINGS

The summary of the study results are as follows:

Table 3: Summary of energy savings.

#	ECM TARGET	AS SELECTED	DOWNGRADE	
			EQUIPMENT SELECTION	+ OPERATIONAL METHODOLOGY (See note 1)
	MOTORS	7 390 480 kWh/a (97.0% of total)	7 629 932 kWh/a (+3.24% change)	8 644 712 kWh/a (+13.3% change)
	LIGHTING EQUIPMENT	93 452 kWh/a (1.2% of total)	228 129 kWh/a (+144% change)	434 531 kWh/a (+90.5% change)
	MISCELLANEOUS HOUSE LOADS (admin, maintenance, controls)	135 000 kWh/a (1.8% of total)	135 000 kWh/a (no change, see note 2)	135 000 kWh/a (no change, see note 2)
	TOTAL	**7 618 932 kWh/a**	**7 993 061 kWh/a**	**9 214 243 kWh/a**
	CHANGES (with respect to "as selected")		**+374 129 kWh/a (+4.91% change)**	**1 595 311 kWh/a (+20.9% change)**

Notes:

1- The column "+ Operational Methodology" represents the scenario where both the equipment choices AND the operational methodology have been downgraded from the selected best practice scenario.

2- The "Miscellaneous House Loads":

   a. Represent of variety of types of loads (heating, office lighting and electronic equipment with the latter being difficult to optimise.

   b. Represent a small portion of the plant's total energy load and the resultant savings would be minor in comparison to those already projected for the motor and lighting loads, therefore,

   c. As part of this exercise, they have not been targeted for an ECM analysis.

3- The figures above are theoretical and approximate. The actual energy usage will depend (among other factors) upon the specific equipment selected.

4- CONCLUSIONS

Of the three major energy loads in the plant, the motors used to transport the grain, principally the conveyors and bucket elevators represent the largest share of the usage at approximately 97% of the total, conversely, the lighting load, at 1.2% of the total, represents the smallest portion.

Regrettably, the relative energy usage savings are in inverse proportion to the weights of these two users:

- The motor loads increased by an average of 3.24% when eliminating the premium efficiency motors, and,
- The lighting loads increased by 144% when replacing the planned LED fixtures for traditional HID and fluorescent fixtures.

Likewise, the elimination of the planned routines to turn off equipment and lighting when not in use produced:

- A 13.3% increase in energy consumption for the motors, but,
- A more significant increase of 90.5% for the lighting loads.

The total energy usage changes were +4.9% after equipment exchange and a total of 20.9% after adding the poorer operational methodology.

In facilities where lighting is a more significant portion of the total energy load (EG: warehouses, office buildings, and stadiums) the percentage of energy savings can be significantly higher. This is due to the fact that electric motors are among the most efficient transforming devices in use; even “standard efficiency” motors are more than 90% efficient and, newer, “premium efficiency” motors commonly attain ratings of 95% to 97%.

However, even these modest increases, when taken on a system-wide basis, represent significant amounts of energy savings and are always encouraged by the power producers and distributors.

5- BIBLIOGRAPHY

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