

Region of Waterloo
Stage 1 Light Rail Transit Project

Design and Construction Performance Output Specifications
Article 7
Energy Management Plan

Table of Contents

- 7.1 Energy Management Plan 7-1
 - (a) Goals 7-1
 - (b) Design for Energy Efficiency..... 7-1
 - (c) Energy Surveillance 7-1
 - (d) Regeneration 7-2
 - (e) Utility Billing Arrangements..... 7-2
 - (f) Base Case for Comparison 7-2
 - (g) Project Co Reference Document 7-3

ARTICLE 7 ENERGY MANAGEMENT PLAN

7.1 Energy Management Plan

(a) Goals

- (i) The goal of the Energy Management Plan shall be to minimize energy costs by control of the consumption of energy consistent with the requirements of the Operations Plan. The Plan will allow Project Co to select energy-efficient equipment and provide the means to monitor energy usage on a continuous basis. This will allow the Region to intelligently monitor and control energy consumption and power demand by utilizing a demand related power supply control system to shift load peaks whenever possible.
- (ii) Project Co shall provide a Draft Energy Management Plan as part of the Phase 1 submission and the final Energy Management Plan within one hundred twenty (120) calendar days after the issuance of Phase 1 for the power supply systems for traction power and other facilities to minimize power usage, reduce the maximum power demand and maintain the power factor at a level acceptable to the utility. Project Co shall provide trade-off information on LRV's and equipment in order to advise the Region on equipment options which may promote energy savings. In addition, Project Co shall provide operating recommendations which shall reduce the maximum power demand on the utility system.
- (iii) The Energy Management Plan shall address the following issues:
 - A. Design for energy efficiency in passenger facilities and maintenance facilities
 - B. Energy surveillance: monitoring and automatic control
 - C. Regeneration
 - D. Utility billing arrangements.

(b) Design for Energy Efficiency

- (i) In developing an energy-efficient design, Project Co shall identify the major energy use centers in order that conservation efforts can be consistently applied in terms of design effort and specificity of detail.
- (ii) Traction Power is the major energy use. Vehicle operating voltage, substation power factor, vehicle acceleration, vehicle speed, propulsion control system, and vehicle weight will impact energy use. Vehicle design coupled with the needs of the Operations Plan and load management monitoring for "catch up" operations shall be important determining factors of the final design of the power distribution system.
- (iii) Project Co's design shall be developed for all LRT Stops and the OMSF, for HVAC and lighting, along with other energy uses, to minimize energy consumption. The design shall address heating, cooling, and lighting thresholds, insulation values, energy-efficient equipment, and the use of automatic sensors, motion detectors, thermostats and similar devices with programmable computer override. Power demand loads at all fixed facilities by location, time of day and time of year will be provided by Project Co to the Region.

(c) Energy Surveillance

- (i) Project Co shall develop an Energy Management System (EMS) for monitoring energy use using computer control. The EMS will be a computer-based usage monitor, display, alarm, recording and reporting system on a real time basis. It shall have the capability of on-line,

time synchronized monitoring, display, alarm and recording. The system shall be described in the Energy Management Plan.

- (ii) The Energy Management Plan shall describe the sources of electrical power and the means of load control. The EMS shall monitor electrical load at all delivery points where load control capability exists. The EMS will annunciate whenever the power demand at any delivery point or group of delivery points (conjunctive demand) is at 85% of the targeted peak demand, and a load control operating procedure will be required to manage the condition.
 - (iii) When incidents occur that impact normal operations, it is possible that excessive power demand will result in the recovery operation subsequent to the incident.
 - (iv) Recovery Operating procedures shall be developed to effectively control power demand during catch-up, and the EMS shall be designed to meet the needs of such operations. The EMS shall not curtail or delay scheduled service through system consumption refinement, whether directly or indirectly, unless supervised by Central Control.
 - (v) Information relating to the nature of each incident shall be recorded by the EMS to enable review of recovery operations by monitoring data including energy consumption, delivery point, "train" locations, time of day, etc. Such information shall include eyewitness accounts of such incidents and the planned recovery operation, against which actual performance can be compared in order to possibly institute new recovery operation procedures.
- (d) **Regeneration**
- (i) The Energy Management Plan shall describe the anticipated level of traction power regeneration.
- (e) **Utility Billing Arrangements**
- (i) The total cost of the energy supplied is typically based on three elements: the "energy charge", the "demand charge" and the "facilities charge". The "energy charge" is the total electrical energy used (measured in kilowatt hours) multiplied by the respective price per kilowatt hour. The "demand charge" is determined from the maximum energy demand over one or several demand periods, and the "facilities charge" is a monthly charge for each point of supply. Power factor may also affect the "demand charge." As part of the Phase 1 submission, Project Co shall investigate the utility billing arrangements and propose changes to the design or operation of the LRT Project that, if accepted by the Region, would reduce the cost of power on the Stage 1 LRT Project.
- (f) **Base Case for Comparison**
- (i) To allow comparisons to be made of energy savings methods the following shall be used as a base case.
 - (ii) The total power consumed and maximum power demand over a 24 hour period, 15 and 30 minute periods, respectively, utilizing:
 - A. Normal weekday schedule for vehicles.
 - B. No regeneration.
 - C. No coordination of traction power and facility power usage.
 - D. No special power reduction features on vehicles or equipment.

- E. Utility supply for all power required.
- F. Power Factor of 0.85.
- (g) Project Co Reference Documents
 - (i) All reference documents such as power system studies, equipment analysis reports and operating plans used to support the energy management plan shall be included as appendices to the Plan.