

PURPOSE

The purpose of this document is to provide a description of the program and technical requirements for a Sustainable Communities District Energy Pre-Feasibility Study. The purpose of a Pre-Feasibility Study is to determine if a more detailed Feasibility Study is worthwhile, by taking a high level quantification of the costs and benefits of engineering recommendations.

BACKGROUND

The customer and BC Hydro are evaluating the feasibility of implementing a district energy solution for a specific project development which would reduce electricity and consumption of fossil fuels.

The viability of district energy is related to energy density, scale and rate of development, and the availability of low-cost energy sources.

A Pre-Feasibility study will evaluate the potential for a renewable District Energy System (DES) by assessing the energy density and levelized energy costs of renewable energy alternatives for a specific project at full build out.

ELIGIBILITY

Projects eligible for DE Pre-Feasibility study funding must meet the following eligibility criteria:

- Project size must be at least 750,000 square feet of new high-density, multi-unit residential development within BC Hydro's service territory. Exceptions to this requirement may be granted if the Project is within close proximity to a cost effective, high grade heat source (eg. industrial waste heat).
- Project must have a minimum of three buildings, each with a floor area of at least 20,000 square feet.
- Project must forecast a reduction in annual GHG production as well as a reduction in annual electricity usage compared to business as usual (baseline) at full project build out.

GUIDING PRINCIPLES

The Pre-Feasibility Study shall incorporate the 4R's of Sustainable Community Energy Planning:

- i. Reduce energy demand through efficient building and system design (energy efficiency is the preferred energy source).
- ii. Re-use waste heat if available.
- iii. Use Renewable energy.
- iv. Generate Renewable electricity.

Apply the following guiding principles for the DES (in priority sequence):

- i. Minimize end user energy cost, provide an economic return to the NEU and incorporate a renewable fuel component.
- ii. Minimize the use of fossil fuels and emissions of greenhouse gases.
- iii. Be sufficiently flexible to grow with the community and incorporate new operating strategies, business models, fuels and technologies.
- iv. Maximize energy service quality and minimize energy service interruption.

DISTRICT ENERGY PRE-FEASIBILITY STUDY PROPOSAL REQUIREMENTS

The following items must be included in a proposal to conduct a Pre-Feasibility Study (the requirements for the Study itself are outlined in the next section):

1. Qualifications of the firms involved and the key personnel in performing the assessment of DE opportunities and alternative energy sources in the areas under consideration. Attach corporate profiles and staff resumes as appropriate.
2. Project Background should include:
 - Overview of the project.
 - Description or diagram of the area of the project.

3. Pre-Feasibility Study Objectives:
 - A quantitative and qualitative description of the DE Study area including the core service area and opportunities for connectivity and expansion.
 - A phased service plan for the core area which shall include a renewable energy phase.
 - An economic, environmental and social analysis of the renewable energy alternatives, for the full build-out of the system and comparison to Business as Usual (BAU).
 - A qualitative summary of the benefits of DE.
 - A summary of the key trade-offs between public and private ownership and operations of the Neighbourhood Energy Utility (NEU).
 - An estimate of the GHG and electrical load reduction over BAU.
 - A summary of the major obstacles to successful implementation of DE for the Study area and a recommended mitigation strategy.
4. Definitions
For a list of definitions relevant to DE studies refer to the Power Smart Sustainable Communities Program definitions, located on the Power Smart Alliance extranet.
5. Assumptions & Reference Information
For a list of the assumptions to be considered in the preparation of the DE Pre-Feasibility Study refer to Power Smart Sustainable Communities District Energy Assumptions and the Sustainable Communities District Energy Commodity Prices document, located on the Power Smart Alliance extranet. Assumptions that are at variance with, or not provided in the Sustainable Communities District Energy Assumptions, shall be clearly identified and separately stated in the Study.
6. Total cost of the DE Pre-Feasibility Study. Include a fee schedule for the project team, listing participants, all tasks along with hours and hourly rate. Study costs to be broken out by research, analysis, report preparation, disbursements/expenses, GST/HST and other.
7. Commitment that the District Energy Pre-Feasibility Study will meet the Study Minimum Requirements by signing the declaration and attaching this document as an appendix to the proposal.

DISTRICT ENERGY PRE-FEASIBILITY STUDY MINIMUM REQUIREMENTS

The following minimum requirements for a DE Pre-Feasibility Study are to be viewed as a set of core elements that BC Hydro expects to be addressed by the consultant performing the Study. These should also be included in the customer's Request for Proposal (RFP) if applicable

The following items are to be included in the Pre- Feasibility Study report .

Minimum Requirements

The Study shall encompass the following elements:

- A. Executive Summary:
The Executive Summary shall include a concise summary of key findings and recommendations for the proposed Neighbourhood Energy Utility (NEU).

Complete and attach as an appendix, the Pre-Feasibility Key Study Outputs, provided by BC Hydro and located on the Power Smart Alliance extranet site for the BAU and renewable energy alternatives for build out of the neighbourhood.

- B. Neighbourhood Overview:
Assess population, population growth and development absorption, land area, current land use and built form (residential, commercial, retail, industrial, mixed), future development areas and proposed land use and density (FAR), land ownership and connectivity of existing buildings and other district energy systems.

Provide mapping to indicate the following:

- Study area boundaries.
- Population density and growth, development absorption.
- Geography.
- Transportation corridors.
- Current land use by archetype and density.

- Future land use by archetype and density.
- Connectivity analysis (high level) – to existing buildings (space heating and domestic hot water) and other district energy systems.

C. Neighbourhood Service Plan

Estimate the new building area (primary market) to be serviced by archetype and the opportunity to service existing buildings (secondary market) both within the study area and within 500 meters from the study area boundary.

Specify a logical phased service plan for the full neighbourhood build out based on market absorption and service costs.

D. Business As Usual

The Sustainable Communities Program business as usual (BAU) scenario for a Multi Unit Residential Building (MURB) is understood to include electric baseboard for suite space heating, natural gas for hallway pressurization make up air and domestic water heating. Estimates are required for both natural gas and electricity consumption for each building archetype (see DE Assumptions document for MURB energy use intensity (EUI) figures). All other building EUIs shall be as provided in the DE Assumptions document or as otherwise agreed to through consultation with the Power Smart Sustainable Communities Program team. Also include an estimate of the GHG emissions.

For each multi-unit residential building (MURB), estimate the annual capital (including reoccurring capital), operating and maintenance costs from the perspective of the building developer and the tenant.

Estimate the levelized unit cost of energy for the BAU.

E. Energy Profile and Load Analysis

Complete a thermal energy load analysis (space heating and domestic hot water) for full build-out of the system based on the energy-use intensities for each archetype and provide a design load duration curve.

F. Analysis of Energy Supply Alternatives

Provide a qualitative and quantitative inventory of current and future renewable energy sources available to the DE system (DES) including, but not limited to, waste heat, geoexchange and bio-energy to supply the base energy load.

Specify a renewable energy base supply and a peaking source to service the design load duration curve. A minimum of one low grade and one high grade temperature renewable energy source shall be analyzed.

Optimize DES design through iteration of the size of the renewable energy source and the peaking energy source to generate the lowest levelized cost of delivered thermal energy. Specify the performance characteristics including the ratio of base load to peak load of the optimal renewable energy system and provide a system schematic.

Note: Some systems may require an interim natural gas phase to postpone the renewable energy phase until the neighbourhood has developed a total energy demand sufficient to justify it. Thereafter, the natural gas system may service a portion of the load for peaking purposes. This is acceptable provided the overall natural gas consumption is equal to or less than BAU.

Complete a quantitative and qualitative triple bottom line analysis of the DES build out, which includes, but not be limited to the following:

- **Economic / Financial**
Estimate the capital costs including land costs for the generation plant and the distribution plant, pollution control equipment to meet regulations, the fuel costs for energy generation and the operating and maintenance (O&M) costs to generate and distribute energy for the renewable energy system(s). Provide a summary of the major cost components, estimate the levelized cost of energy and compare to BAU.

Assume a Class D estimate for costs and electrical energy savings (estimate variance of -25%, +50%)

Provide a high level renewable energy fuel supply assessment to substantiate the fuel cost used in the analysis.

- **Environmental**
Estimate the total electrical energy, natural gas, GHG emissions and renewable energy resulting from the DES at build-out and compare to BAU.

Quantify the impacts on air (common air contaminants; PM10, NOx, CO, SO2, VOC, other), land (ash) and water (local aquifers) for each renewable energy system and compare to BAU. Provide a high level qualitative assessment of these impacts to inform stakeholder engagement.

- Social
Provide a high level assessment of the social impacts including, but not limited to, employment opportunities in the local community, economic development, fuel supply issues, energy security and self sufficiency resulting from a renewable DES and compare to BAU.

G. Combined Heat and Power (CHP)

Incorporate an organic Rankine cycle (ORC) vapour turbine electrical power generation technology top cycled for the base thermal load at system build out for the lowest cost high temperature renewable energy source. Complete a triple bottom line assessment as above. Estimate the marginal revenue from the sale of electrical energy based on BC Hydro's Standing Offer Program and report the revenue as a credit to the levelized cost of delivered thermal energy.

H. DES Governance

Summarize the key trade offs and cost / benefit of public versus private (regulated) ownership of the generation and distribution assets of the DES including, but not limited to: regulatory issues, rates of return on debt and equity, risk, income taxes, operations, future expansion and impact on end user costs.

Estimate the total required rate of return for a municipal ownership model with 100% debt financing and a private regulated utility model with 60% debt financing and the maximum return on equity (ROE) permitted by the regulator (refer to Assumptions).

I. Sensitivity analysis

Undertake and report the results of a sensitivity analysis of the levelized cost:

- Estimate the discount rate at which the levelized energy cost of the renewable alternative is equal to the levelized cost of BAU.
- Estimate the levelized energy cost based on the Weighted Average Cost of Capital (WACC) for the municipal ownership model as above.
- Estimate the levelized energy cost based on the WACC for the private regulated utility ownership model as above.
- Estimate the impact on rate of return in the event of a 25% reduction in total energy load as a result of energy efficiency measures.

J. Recommendations / Next Steps

Provide recommendations for further study including, but not limited to:

- Selection and specification of the preferred renewable DES.
- Regulatory changes including land use policy changes necessary for DES implementation and connectivity.
- A preferred governance model for the NEU.

K. Timing, Phases & Milestones

The draft Pre-Feasibility Study should be submitted to BC Hydro within 120 days from the date of the signed Pre-Feasibility Agreement, and the final Pre-Feasibility Study should be submitted to BC Hydro within 180 days from the date of the signed Pre-Feasibility Agreement, and should incorporate the following milestones:

- Kickoff meeting with consultant, customer and key stakeholders, including BC Hydro, to confirm:
 - Scope of work.
 - Study area.
 - Objectives and measures of triple bottom line analysis.
 - Acceptable levelized fuel cost premium for DES over BAU.
- Update meeting with consultant, customer and project sponsors to confirm:
 - Preliminary load analysis.
 - Business As Usual.
 - Renewable energy fuel options.
- Draft report to review key findings and assumptions and opportunity for project sponsors to review and comment on draft report.
- Submit the Final report and complete the Pre-feasibility Study Key Outputs spreadsheet which are mandatory submissions. Additionally, a read/write working model spreadsheet of the background calculations is desired. Refer to Power Smart Alliance extranet for the Pre-feasibility Study Key Outputs template.

Compare the proposed rate structure (Levelized) to BAU and existing regulated and non-regulated district energy utilities in BC. Refer to the Sustainable Communities District Energy Commodity Prices Assumptions Document.

- Payment - BC Hydro will pay 50% of the study cost to a maximum BC Hydro contribution of \$20,000. Payment will be made upon delivery and approval of the invoices and Final Report.

L. Work Excluded

The following work is not included in the Pre-Feasibility Study:

- i. Building energy modeling.
- ii. A Comprehensive risk analysis.
- iii. NEU end user rates and pricing.
- iv. Project definition phase
- v. Permitting and regulatory requirements.

LEAD CONSULTANT'S DECLARATION	
<p>I, the undersigned, declare:</p> <ul style="list-style-type: none"> • that we are an approved BC Hydro Power Smart Alliance consultant to do a pre-feasibility study (If more than one consultant is used, the consultant named below will assume the lead role for the Pre-Feasibility Study and incorporate all information into one report), • that I have read and complied with the DE Pre-Feasibility Study Minimum Requirements, and the Terms and Conditions that are contained in this document. • I also understand that the Pre-Feasibility Study and accompanying documents will be reviewed by BC Hydro engineers and consultants. • I also understand that the Pre-Feasibility Study Minimum Requirements is included in the Customer's Request for Proposal (RFP). 	
Company Name:	
Authorized signature:	Date:
Print Name:	
Mailing Address (Street):	Phone:
City:	Fax:
Postal Code:	Email:

BCH-QMS-9462-C-075-Rev 000 Prefeasibility Minimum Requirements. The data and information provided in this document was compiled solely for BC Hydro purposes in relation to the Power Smart Sustainability Communities Program. BC Hydro expressly disclaims any warranties or representations, either expressed or implied, with respect to the accuracy, reliability, usefulness, completeness, non-infringement of intellectual property rights, or quality of data and information contained herein. BC Hydro, its employees, servants and agents do not accept any liability of any kind arising in any way out of the use of or reliance on this data and information by any person. Any person using or relying on this data and information does so at their own risk.