BC hydro powersmart

Minimum Requirements For A Sustainable Communities District Energy Feasibility Study

PURPOSE

The purpose of this document is to provide a description of the program and technical requirements for a Sustainable Communities District Energy Feasibility Study. The purpose of a Feasibility Study is to build a detailed business case for a potential District Energy system by determining the project's financial, social and environmental viability

BACKGROUND

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

The study will perform further evaluation of the potential for district energy identified in a Pre-Feasibility Study that has met certain economic, environmental and social criteria.

ELIGIBILITY

Projects eligible for District Energy (DE) Feasibility study funding must meet the following eligibility criteria:

A DE Pre-Feasibility Study has been completed which has determined:

i. A viable (financial, social, environmental) DES type has been identified within BC Hydro's service territory.
ii. Project will result in a minimum of 1 GWh/yr of estimated electricity savings versus business as usual (baseline case) at full build out.
iii. Project will result in a reduction in annual GHG production versus business as usual (baseline case) at full build out.
iv. The end-user levelized energy cost shall be within an acceptable range of business as usual, typically within 20%.
v. To be provided with the consultant proposal:
    a. Public consultation plan
    b. An *Executive Summary* and *Pre-Feasibility Study Key Outputs*, in accordance with Sustainable Communities Program Pre-Feasibility Minimum Requirements.

GUIDING PRINCIPLES

The 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 FEASIBILITY STUDY PROPOSAL REQUIREMENTS

The following items must be included in a proposal to conduct a 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. Feasibility Study Objectives:
   The purpose is to investigate the district energy opportunity identified in the Feasibility Study and provide:
   - A phased service plan for the development including an interim natural gas phase (optional) and a required renewable energy phase.
   - An annual life-cycle triple bottom line analysis of Business As Usual (BAU) and of the proposed DES.
   - An ownership and operating model acceptable to the district energy proponent.
   - A stakeholder engagement plan.
   - End user energy rates.
   - Recommendations including regulatory requirements to move to project implementation.
   - Evaluation of the electrical energy efficiency and electrical load reduction compared to BAU.
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 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 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 Feasibility Study will meet the study minimum requirements by signing the declaration and attaching this document as an appendix to the proposal.

DISTRICT ENERGY FEASIBILITY STUDY MINIMUM REQUIREMENTS

The following minimum requirements for a DE 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.

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

Minimum Requirements
The study will assess a minimum of two options from the perspective of the Neighbourhood Energy Utility (NEU) and recommend a preferred District Energy System (DES) option, one including a DES loop connected to a high grade renewable energy source.

The study will encompass the following elements:

A. Executive Summary:
   The following should be included in the Executive Summary:
   - A summary of key findings and recommendations for the proposed DES.
   - Complete and attach as an appendix, the Feasibility Key Study Key Outputs spreadsheet, provided by BC Hydro and located on the Power Smart Alliance extranet site, which will summarize:
     i. The energy, environmental, social and economic performance of the proposed DES.
     ii. A quantitative life cycle cash flow summary of revenues, fixed and variable costs (revenue requirements) and cash reserves for the DES separated into Distribution and Generation plant.
     iii. A quantitative life cycle summary of environmental and social impacts for the DES and comparison to BAU.

B. Neighbourhood Overview:
   Assess population, population growth and development absorption, land area, current land use and built form by archetype (residential, commercial, retail, industrial, mixed), future development areas and proposed land use and density (FAR) and land ownership.

   Survey existing building energy systems and infrastructure, age and life expectancy and review opportunities for connectivity within the neighbourhood boundary or in close proximity thereto.

   Complete a preliminary site investigation or desk study to confirm sub surface characteristics and soil conductivity in the event that geoexchange is a renewable energy option.

C. Neighbourhood Service Plan
Specify a service plan and prepare a preliminary design of a DES for the development indicating the various phases including, but not limited to, an interim natural gas phase, a subsequent renewable energy phase and the DES build out. Include an estimate of the timing of the various phases based on market absorption.

D. Business As Usual (BAU)
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 the 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 building:

i. Estimate the annual consumption of natural gas, electricity and renewable energy for space heating, space cooling and domestic hot water.
ii. Estimate the annual capital (including reoccurring capital), operating (building energy systems only) and fuel costs borne by the building developer and the energy end user and provide a summary of these costs.

E. The DES Connectible Building
Specify the DES connectible (hydronic) building:
Estimate the annual capital (including reoccurring capital), operating (building energy systems only) and fuel costs borne by the building developer and the energy end user and provide a summary of these costs.

Summarize the difference in costs between the BAU and the DES connectible building.

F. Energy Profile and Load Analysis:
Complete a thermal energy load analysis (space heating, space cooling and domestic hot water) and load duration curve for each building.

Prepare an energy load duration curve for the DES to service the full build out of the neighbourhood. Estimate the reduction (%) in total energy load resulting from DES load diversification.

G. DE System Design
Prepare a phased schematic design to service the energy load for both a DES coupled to a high grade energy source and a DES coupled to a low grade energy source.

Optimize DES design through iteration of the renewable energy component 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 capital cost of 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 and to provide system redundancy. This is acceptable provided the total annual natural gas consumption at full build out is equal to or less than the total annual gas consumption of BAU at full build out. Alternatively, the proponent may elect to proceed directly to the renewable energy phase.

Qualify additional sources of supplemental renewable energy in addition to the base load source.

Assess additional DES optimization opportunities:

i. Distributed electrical generation including, but not limited to vapour turbine technology.
ii. Supplemental energy strategies including thermal storage, building scale heat pumps and solar thermal.
iii. District cooling opportunities utilizing absorption chillers; compare point of use economics to in-building electric chillers.
iv. Reusing waste heat from building cooling and equipment.

Specify the base load renewable technology and the natural gas peaking component (%) for both system types. Provide a summary in graph format.

H. DES Performance

Evaluate and estimate the performance characteristics of the DES based on:

i. For the generation plant; combustion and thermal efficiencies, plant and parasitic losses and auxiliary electrical load.
ii. For the distribution plant; coincident heating and cooling, distribution plant losses to distribute the energy to the building Energy Transfer Station (ETS) and auxiliary pumping energy.
iii. Based on the above, estimate the DES efficiencies and DES losses to supply thermal energy to the building ETS. For the low grade DES estimate the COP (electrical) and for the high grade DES estimate the net DES efficiency.

Based on the above performance characteristics of the DES:

i. Estimate the annual consumption of natural gas, electricity and renewable energy for space heating, space cooling and domestic hot water for each building connected to the DES.
ii. Specify the annual consumption of natural gas, electricity and renewable energy for space heating, space cooling and domestic hot water for the DES.
iii. Estimate the difference in annual energy consumption of natural gas, electricity and renewable energy for space heating, space cooling and domestic hot water between BAU and the DES.

I. Cost Analysis

Stipulate the point of separation of DES generation and distribution and the building ETS.

Estimate the annual life cycle capital costs including soft costs of the generation plant, the distribution plant and the building ETS.

Assume a Class C estimate for costs and electrical energy savings (estimate variance of -15%, +25%).

Estimate the annual O&M costs of the generation plant, the distribution plant and the building ETS, including but not limited to, system maintenance, management and staff, insurance (property and liability), property taxes, municipal fees, customer service costs, land rent, overheads and fuel costs.
Separate into fixed and variable costs.

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

J. Sources and Uses of Funds

Prepare a sources and uses of funds analysis and summarize the financing opportunities available for the DES ownership model to finance the capital costs, the O&M costs and the financing costs.

K. Revenue Requirements

Estimate the annual financial charges including, but not limited to, financing fees, depreciation, income taxes, debt interest and repayment, dividends payable and return on equity for both a private and public ownership model. Adhere to generally accepted accounting principles. For accelerated capital cost allowance for clean energy generation equipment refer to changes announced in the 2010 federal government budget.

Estimate the revenues from carbon credits and energy sales to provide an operating reserve and to pay the capital costs, the O&M costs and the financial charges. State the levelized energy ($/MWh) price and express it as a % of BAU.

L. Sensitivity analysis

Undertake and report the results of a sensitivity analysis of the cash flow summary and impact on end user rates:

i. From a 25% reduction in energy load due to energy conservation measures.
ii. From a 25% decrease in rate of development.
iii. From a change in natural gas rates to the high / low case scenario.
iv. From an increase in electrical rates of 5% over the base case rates.
v. From a +/- 25% change in biomass fuel costs.
vi. From a 25% increase in total capital costs.
vii. From +/- 25% change in COP.

The above scenarios are for guidance and the consultant is encouraged to extend the sensitivity analysis to other scenarios that may occur over the life cycle of the DES.

In the event that the lowest cost alternative is not economically viable, estimate the capital incentive necessary to make it so.

M. Environmental Analysis

Estimate the annual GHG emissions resulting from BAU and the DES. Assume indirect (upstream) emissions from biomass are nil.

Estimate the annual emissions of common air contaminants (PM10, NOx, CO, SO2, VOC, other) resulting from BAU and the DES.

In the case of biomass, estimate the annual ash produced from combustion and provide a disposition option.

In the case of geoexchange, quantify and qualify the impacts on the energy source aquifer.

N. Social Analysis

Estimate the local annual employment opportunities and energy source diversity resulting from BAU and the DES.

Provide a qualitative assessment of other opportunities for economic development resulting from the DES.

O. Risk Analysis & Management

Complete a risk analysis and make recommendations for risk mitigation and management of:

i. Project risks (including revenues and costs).
ii. Energy supply risks.
iii. Environmental risks.
iv. Health and safety risks.
v. Stakeholder risks.
vi. Public acceptance risks.

Extend the sensitivity analysis to cover the likelihood and impact of significant identified risks.

P. Combined Heat and Power (CHP)

Estimate the marginal rate of return for the DES owner in the case of the addition of distributed power generation. In the event that the marginal rate of return is greater than the Weighted Average Cost of Capital (WACC) provide the following:

i. Cost per energy unit for renewable energy supplied to the distributed generator.
ii. Capital cost of the electrical generation equipment and other changes to DES equipment.
iii. Operating costs for the electrical generation component.
iv. Annual power production and associated revenues based on BC Hydro's Standing Offer Program, Feed-in Tariff or other Distributed Generation (DG) programs.

Q. Recommendations for Implementation

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

i. List of regulatory and other approvals required.
ii. A preliminary schedule including milestone dates.

R. Stakeholder Engagement

Provide a stakeholder engagement plan which indentifies the stakeholders, why they are important, whether they have been contacted and their feedback or position on the proposed DES.

S. Timing, Phases & Milestones

The draft report is to be received by BC Hydro 180 days from the date of the signed Feasibility Study Agreement, and the final report must be received 240 days from the date of the signed Feasibility Study Agreement, and should incorporate the following milestones:

i. Kick-off meeting with customer, consultant, key stakeholders, including to confirm:
    - Scope of work;
    - Assumptions;
    - Data sources;
    - Contacts;
    - Work plan.
ii. Technical meeting 1 – review energy demand and load forecast, development phasing, BAU costs and high level DES concepts and fuel types for further study.
iii. Technical meeting 2 – review work to date, DES design and triple bottom line proforma development.
iv. Draft report.
v. Meeting to review draft report and discuss revisions.
vi. Consultant presentation to customer of the Study report.
vii. Submit the Final report and complete the Feasibility Study Key Outputs spreadsheet which are mandatory submissions. Additionally, a read/write working model spreadsheet of the background calculations is desired. Refer to the Power Smart Alliance extranet for the Feasibility Study Key Outputs template.
viii. Other interaction as necessary to ensure the study assumptions and objectives will be met.

ix. Payment – BC Hydro will pay 50% of the study cost to a maximum BC Hydro contribution of $75,000. Payment will be made upon delivery and BC Hydro's approval of the invoices and final report.

Work Excluded

The following work is not included in the Feasibility Study:

i. A detailed schedule including permitting and regulatory requirements.
ii. DE system modeling except as necessary to provide the information requested herein.
iii. Building energy modeling.
iv. A measurement and and verification plan.

Additional Considerations

These Minimum Requirements may be revised to include the following additional work which will be confirmed with the customer:

A. DE Ownership & Operations

Summarize the cost / benefit (i.e. trade offs) of the prescribed ownership model for the NEU.

Summarize the cost / benefit of a hybrid ownership model where the generation assets are owned by a private regulated utility and the distribution assets are municipally owned.

Make recommendations on a preferred model for operating the DES.

B. Rates & Pricing

Based on the revenues required from energy sales, prepare a preliminary rates and pricing structure for DES end users incorporating the following:

i. A connection fee,
ii. A delivery charge related to the cost of energy distribution,
iii. A commodity charge per energy unit related to the cost of fuel and generation assets.

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.

LEAD CONSULTANT'S DECLARATION
I, the undersigned, declare: • that we are an approved BC Hydro Power Smart Alliance consultant to do a District Energy Feasibility Study (If more than one consultant is used, the consultant named below will assume the lead role for the Feasibility Study and incorporate all information into one report), • that I have read and complied with the DE Feasibility Study Proposal Requirements, Minimum Requirements, and the Terms and Conditions that are contained in this document. • I also understand that the Feasibility Study and accompanying documents will be reviewed by BC Hydro engineers and consultants. • I also understand that the 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:**

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