

# SBGD - Part D – Consultant Scopes of Work

## 2. Building Energy Consultant Scope of Work

The following scope of work is a list of minimum requirements that shall be included in the scope of the Building Energy Consultant and should not be considered comprehensive. This scope of work document was developed through a collaborative effort between The City of Calgary's Corporate Engineering & Energy Division and Morrison Hershfield

The primary objective of the Building Energy Consultant is to recommend and support design decisions related to building performance through the use of computer simulation and engineering judgement. The Building Energy Consultant will also be required to document compliance with green building certification, such as LEED, and The National Energy Code of Canada for Buildings, as required by the Alberta Building Code.

### Qualifications of the Building Energy Consultant

The building energy consultant team lead must have at least 5 years of experience in energy modeling. The lead Building Energy Consultant shall be a Professional Engineer with APEGA or Registered Architect with AAA as The City may request that modeling reports be sealed by the professional. Other beneficial accreditations include ASHRAE's BEMP credential and being listed on the CaGBC's experienced modeler list.

### Energy Units and Rates

Prior to starting energy related analysis on a project, the Building Energy Consultant must contact The City of Calgary's Energy Management Office (EMO) and request City utility rates that will be used in their assessment. City utility rates provided by the EMO are confidential and are not to be distributed outside the project team. All energy related evaluations shall be reported in the following metric units:

- Electricity: kWh
- Natural Gas: GJ
- Total Energy: ekWh
- Energy Intensity: ekWh/m<sup>2</sup>
- Thermal Energy Demand Intensity (TEDI): ekWh/(m<sup>2</sup>\*year)

### Energy Modelling Software

All energy modeling is to be completed using a capable hourly simulation program, approved for NECB and LEED V4 submissions. EE4 as a stand-alone tool will not be permitted, as it severely limits the type of options that can be directly explored. Note that software selection shall not be a limitation in exploring any measure, system or technology deemed appropriate by The City and design team. The design team should include at a minimum, The City PM, Corporate Engineering & Energy, the architect, structural/building envelope engineer, mechanical engineer and electrical engineer. The consultant shall use whatever tools necessary to provide accurate feedback on building performance as necessary according to the detailed scope identified below.

### Process

Specifically, the Building Energy Consultant will be required to undertake the following tasks. The task list is based on a typical new construction project, and it is noted that the exact scope of work for the Building Energy Consultant may vary from project to project.

### Pre-Design

It is highly recommended that the Building Energy Consultant be onboarded at the same time as the core design team. During the pre-design stage, the project team should discuss and identify energy related goals and targets for the project. These goals and target should be documented in the owner's project requirements.

### Schematic Design

## 1. Massing Analysis

The intent of the Schematic Design phase is to comment on the impact of the proposed architectural layout on indicative building performance metrics. The Building Energy Consultant should assess a minimum of three massing options, presented by the architect, and provide a formal evaluation on the following metrics for each option:

- Relative energy use, broken down by end uses, including but not limited to, heating, cooling, lighting and ventilation,
- Relative peak heating and cooling loads for the building and for the worst performing zones (on a ekW/m<sup>2</sup> basis),
- Daylight potential and excessive illuminance levels (i.e. glare) in zones of interest, as determined by The City and/or Architect,
- Renewable energy potential and
- Alignment of City goals as defined in the RFP, OPR (ex. LEED, energy intensity, or other), and The Sustainable Building Guidance Document.

To reduce the number of variables that differentiate between each iteration in this early model, plug loads, ventilation rates, and schedules (occupancy, lighting, plug, fans, thermostatic set points) are to be kept constant between options and are to be appropriate for the building based on occupancy.

If mechanical systems are known or being evaluated at this stage, they shall be modeled directly. However, the absence of mechanical information shall not delay this evaluation. In lieu of actual HVAC design parameters at schematic design, mechanical systems are to be modeled as heating, cooling, and ventilation delivered directly to the zones (i.e. 100% OA with terminal heating and cooling). The model shall also take into account the daylighting potential of the building by directly modeling the impact of daylight sensors in applicable zones.

Based on the findings from the analysis conducted above, the Building Energy Consultant will work with the architect to recommend strategies around massing, location, orientation, window to wall ratios, window locations, and shading to improve the energy performance based on the metrics identified above. Allow for an additional round of energy modeling to assess the impact of resulting recommendations for the selected massing option.

The Building Energy Consultant shall prepare a report that clearly identifies the energy modeling strategies evaluated, those employed, a summary of key inputs used, a summary of results based on the above metrics and any recommendations.

Include two meetings during this phase; one to identify the energy modeling approach with the project team, and one for the Building Energy Consultant to present the findings in this phase and set direction for the remainder of the design. The findings should be distributed to the project team, including Corporate Engineering & Energy in the form of a report.

To report on NECB and LEED v4 performance (if applicable), a baseline building energy model shall also be completed at this stage. It should be noted that the two baseline models may differ slightly for compliance with the reviewing authority. The City will only accept NECB baselines for LEED v4 projects following the Canadian Alternate Compliance Path guideline. ASHRAE baselines will not be accepted. If the Building Energy Consultant is using a software that auto-generates a baseline, the appropriate modifications must be made to ensure compliance with the NECB versions as they apply to the Alberta Building Code and/or LEED v4.

### Deliverable Summary

- Massing energy analysis of at least three options,
- Simple box energy model that includes space heating & cooling, ventilation, domestic hot water, lighting, specialized equipment, energy generation and any other identified end uses,
- Preliminary energy model summary report, including analysis meeting the above requirements. The energy model summary report shall include the following:
  - Building name and address,

- Occupancy type,
  - Modelling software used,
  - Building floor space,
  - Utility rates used,
  - Energy consumption table for design alternatives that includes electricity and natural gas consumption breakdown,
  - Anticipated onsite renewable energy production potential (energy and dollars),
  - Energy use intensity including a comparison to Canadian National Median EUI for appropriate building type,
  - Peak energy demand,
  - GHG emissions and GHG intensity,
  - TEDI,
  - Window-to-wall ratio information,
  - Lighting power density,
  - All other modelling inputs and assumptions (mechanical, electrical, building envelope and occupancy schedule inputs),
- Provide an evaluation summary of each option and final recommendation. Document any decisions made during the SD stage in this evaluation summary.

## Design Development

### 2. Analysis of Building Systems

For the purposes of the Building Energy Consultant's work, this phase will begin when the final architectural massing and programming is set. At this stage, the Building Energy Consultant will assess the impact of the building systems listed below, in isolation and in combination, on the following metrics:

- Energy use, broken down by end uses (at minimum heating, cooling, lighting, plug loads, fans, and pumps)
- Energy cost, broken down by end uses and utility (using EMO provided utility rates)
- Peak delivered heating and cooling for the building and for the worst performing zones
- Energy Use Intensity
- GHG emissions and GHG intensity
- TEDI
- City compliance metrics and targets (NECB 2011 savings, LEED v4 savings, NECB 2017 compliance)

This phase shall include an energy charrette with the project team led by the Building Energy Consultant. The intent of this meeting will be to explain the schematic design results and design development updates and set direction for the remainder of design.

The inputs to be used for the analysis in this phase shall be considered by the Building Energy Consultant based on previous experience with similar buildings and discussion and coordination with design team members, including the architect, mechanical engineer, electrical engineer and building envelope engineer. The intent of this phase is to inform design. Therefore, this exercise is intended to be an input into developing a detailed design that addresses energy as a parameter in design considerations.

Building systems to be analyzed at this stage shall include at minimum:

- Wall performance based on effective R-values, considering heat loss from not only assemblies, but also interface details. This is referenced in The Building Envelope Thermal Bridging Guide (located at [www.bchydro.com/thermalguide](http://www.bchydro.com/thermalguide))
- Fenestration performance, based on solar heat gain coefficient, visible transmittance, and overall U-value (including framing)

- Roof and floor performance
- Lighting power density ranges, as appropriate, but no less than 2 levels
- A minimum of 2 mechanical system types (ex. air-based heating and cooling with recirculation versus 100% outdoor air with radiant heating)
- Mechanical equipment efficiencies, including boiler efficiency, chiller COP's, heat pump COP's and gas fired equipment COP's, fan and pump static pressures and efficiencies, motor efficiencies, VFD's, the presence of heat recovery and heat recovery efficiency
- Impact of potential renewable energy options
- Building-type specific energy consumption, conservation or generation measures (ex. cogen systems, chiller heat recovery for data centre spaces or specialized refrigeration such as ice rinks or innovative dehumidification and reheat strategies in swimming pools, etc.)

For this phase, the Building Energy Consultant shall prepare a report that clearly identifies the energy modeling strategy employed, a summary of key inputs used, a summary of results based on the above metrics and any recommendations.

### **Deliverable Summary**

- Provide an evaluation summary and final recommendation/decision justification in the DD report,
- Preliminary energy model summary report, including analysis meeting the above requirements. The energy model summary report shall include the following:
  - Building name and address,
  - Occupancy type,
  - Modelling software used,
  - Building floor space,
  - Utility rates used,
  - Energy comparison table that includes electricity and natural gas consumption breakdown (both energy and dollars) between the proposed building and the reference building,
  - Overall savings (total energy, total dollars, percent energy and percent dollars),
  - Anticipated onsite renewable energy production (energy, dollars and percentage),
  - Anticipated LEED points earned under Optimize Energy Performance and Renewable Energy Production (if applicable),
  - Energy use intensity including a comparison to Canadian National Median EUI for appropriate building type,
  - Peak energy demand,
  - GHG emissions and GHG intensity,
  - TEDI,
  - Window-to-wall ratios or fenestration-and-door-to-wall ratio,
  - A breakdown of lighting power densities by room/area and overall lighting power density,
  - A clear list of Energy Conservation Measures (ECM's) evaluated and their potential impact if quantifiable (energy and dollars),
  - When the value of ECM's warrants further investigation, conduct a full life cycle cost assessment evaluating capital cost and corresponding operational and maintenance savings. Discuss the option of onboarding a cost consultant or utilizing an existing cost consultant to provide a class 3 estimate for ECM's deemed to be of high importance with the project team.
  - All other modelling inputs (mechanical, electrical, building envelope and occupancy schedule inputs) for both the proposed building and reference building and any referenced appendices,
  - Energy consumption breakdown comparison by end use. Include energy and dollar comparison.
- Provide an evaluation summary of each option and final recommendation/decision justification in the design development report.

## Contract Documents

### 3. Energy Performance Update

During the contract documents phase, the Building Energy Consultant should review the drawings and specifications at a minimum of two major milestones (approximately 60% package and Issued for Building Permit) and provide an update on energy performance. Exact review stages will be project specific.

The Building Energy Consultant shall prepare an updated energy model summary report for the project team reporting back on the findings of this phase.

For Building Permit, the Building Energy Consultant shall provide all documentation required by The City of Calgary's, Planning & Development group, including section 5 of the NECB.

Include one meeting during this phase to explain updated energy results and answer any questions from the project team.

#### Deliverables Summary

- Energy model summary report update as per above. The energy model summary report shall include the following:
  - Building name and address,
  - Modelling software used,
  - Building floor space,
  - Utility rates used,
  - Energy comparison table that includes electricity and natural gas consumption breakdown (both energy and dollars) between the proposed building and the reference building,
  - Overall annual savings (total energy, total dollars, percent energy and percent dollars),
  - Anticipated onsite renewable energy production (energy, dollars and percent),
  - Anticipated LEED points earned under Optimize Energy Performance and Renewable Energy Production (if applicable),
  - Energy use intensity including a comparison to Canadian National Median EUI for appropriate building type,
  - Peak energy demand,
  - GHG emissions and GHG intensity,
  - TEDI,
  - Window-to-wall ratios,
  - A breakdown of lighting power densities by room/area and overall lighting power density,
  - A clear list of Energy Conservation Measures (ECM's) evaluated and their potential impact if quantifiable (energy and dollars),
  - When the value of ECM's warrants further investigation, conduct a full life cycle cost assessment evaluating capital cost and corresponding operational and maintenance savings. Discuss the option of onboarding a cost consultant or utilizing an existing cost consultant to provide a class 3 estimate for ECM's deemed to be of high importance with the project team.
  - Collaborate with the design team and confirm, document and identify opportunities to improve set points, setbacks, occupancy schedules and sequences of operation,
  - All other modelling inputs (mechanical, electrical, and building envelope inputs) for both the proposed building and reference building and any referenced appendices,
  - Energy consumption breakdown comparison by end use. Include energy and dollar comparison.

### 4. Final Model

Upon completion of the final construction documents (i.e. tender drawings and specifications), the Building Energy Consultant shall prepare one final energy model for the purposes of the LEED submission and all supporting documentation as required by the governing authority of the LEED program. The Building Energy

Consultant will also respond to review comments by the governing authority to ensure successful achievement of the Energy and Atmosphere pre-requisite: Minimum Energy Performance and credit: Optimize Energy Performance.

#### **Deliverables Summary**

- Final energy model (model and summary report) for LEED Design Application submission, or any alternative green building rating system used.
- In compliance with the City of Calgary's Master Consulting Terms & Conditions, all reports, discussion summaries, meeting minutes, and modeling files will be provided to The City of Calgary's Project Manager, and Corporate Engineering & Energy in electronic format.

#### **5. NECB Submittals (if required)**

If NECB compliance is required per the Alberta Building Code, the building energy consultant shall prepare all documentation necessary to demonstrate NECB compliance for the building permit submission.

#### **Deliverables Summary**

- All documentation necessary for NECB submission for building permit.

### **Contract Administration**

It is not an expectation from The City that the Building Energy Consultant will review and monitor Shop Drawings during construction. The Prime Consultant and/or The City Project Manager will notify the Building Energy Consultant of any changes to the energy related systems within the building that occur after compliance documentation has been submitted and may require additional services to assess the impact of these changes at that time. This will be completed on a Time and Materials basis.

### **Close Out**

#### **6. NECB Submittals (if required)**

If NECB compliance is required per the Alberta Building Code, the building energy consultant shall prepare all documentation necessary to demonstrate NECB compliance for the occupancy submission. Confirm with the coordinating professional of record if the existing energy model requires updating.

#### **Deliverables Summary**

- Documentation necessary for NECB submission for occupancy.

### **Prior to Warranty Expiration**

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### **Annually**

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## Appendix – Sample RFP

### 4.2 Building Energy Optimization

The following scope of work is a list of minimum requirements that shall be included in the scope of the Building Energy Consultant. The primary objective of the Building Energy Consultant will be to recommend and support design decisions related to building performance through the use of computer simulation and engineering judgement. The Building Energy Consultant will also be required to document compliance for LEED v4 certification and The National Energy Code of Canada for Building, as required under the Alberta Building Code.

The building energy consultant lead peer reviewer must hold the designation of Professional Engineer with APEGA or be a Registered Architect in Alberta. All energy modeling is to be completed using a capable hourly simulation program approved for NECB and LEED V4 (if applicable) submissions.

Utility rates to be used in this scope of work will be provided by The City's Energy Management Office. All units are to be in metric (kWh for electricity and GJ for natural gas).

Table 1 below is a summary of anticipated deliverables from the Building Energy Consultant Team:

*Table 1: Building Energy Consultant Deliverables*

Project Milestone	Deliverable	Description
Pre-Design & Schematic Design	Massing Analysis	The intent of the Schematic Design phase is to comment on the impact of the proposed architectural layout on indicative building performance metrics. The Building Energy Consultant should assess a minimum of three massing options, presented by the architect. Further guidance is available from the City on the exact metrics to be evaluated, but will include energy use, heat gain/loss, peak heating and cooling loads, daylight potential and renewable energy generation potential.
	Preliminary Energy Performance Optimization Workshop	Based on the findings from the analysis conducted above, the Building Energy Consultant will work with the architect to recommend strategies around massing, location, orientation, heat loss/gain, window to wall ratios, window locations, shading, lighting packages, and preliminary HVAC design options to improve the energy performance based on the metrics identified above. This workshop will be an opportunity to work with The City and the Architect to finalize a path forward on potential design options. Provide a report or memo on the energy workshop findings.
	Simple Box Energy Model and Report	The Building Energy Consultant shall prepare a report that clearly identifies the energy modeling strategies evaluated, those

		employed, a summary of key inputs used, a summary of results based on the above metrics and any recommendations.
	Baseline Development	To report on LEED v4/ NECB performance, baseline building energy models shall be completed at this stage. The City will only accept NECB baselines for LEED v4 following the Canadian Alternate Compliance Path guideline. ASHRAE 90.1 baselines will not be accepted. If the Building Energy Consultant is using a software that auto-generates a baseline, the appropriate modifications must be made to ensure compliance with the NECB 2011 as it applies to the Alberta Building Code and/or LEED v4. Further guidance is available from The City on expectations of each building system which is to be analyzed at this stage.
	Preliminary Energy Model Summary Report	At the completion of Schematic Design produce an energy model summary report that summarizes the analysis and decision made during pre-design and schematic design phases of the project.
Design Development	Energy Optimization Charette	This phase shall include an energy charrette with the project team led by the Building Energy Consultant building off of the work done during schematic design. The intent of this meeting will be to explain the schematic design results, refine the models with design development updates and set direction for the remainder of design.
	Energy Model Report	At the completion of design development, provide a summary report identifying energy targets, agreed upon sustainability strategies, and modeling inputs and outputs.
Contract Documents	Design Review	During the contract documents phase, the Building Energy Consultant will review the drawings and specifications at a minimum of two major milestones (approximately 60% package and Issued for Building Permit) and provide an update on energy performance. Prepare an updated energy model summary report for the project team that includes any updates from this phase of the project.
	Final Model	Upon completion of the final construction documents (i.e. tender drawings and specifications), the Building Energy Consultant shall prepare one final energy model for the purposes of a LEED submission and the ongoing energy performance benchmarking exercises.



		Respond to LEED reviewer comments accordingly.
	NECB Compliance	The building energy consultant shall update models and prepare all documentation necessary to demonstrate NECB compliance for the building permit and occupancy permit submissions to the Authority Having Jurisdiction. Confirm with the coordinating professional of record if any changes affecting the energy use occurred and update existing energy models accordingly.
Post Construction Services		