

**QUANTIFICATION PROTOCOL FOR
COMMERCIAL AND INSTITUTIONAL GREEN BUILDING PROJECTS**

ABRIDGED

Submitted to:

Alberta Environment

January 2008

Disclaimer

The following document presents an abridged version of the Commercial and Institutional Green Building Projects protocol prepared for Alberta Environment which has completed an initial round of technical review. This document has been prepared as a means of supporting a broader stakeholder consultation process. As such, this document should not be used as a quantification protocol.

DRAFT

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1.0 Project and Methodology Scope and Description

The opportunity for generating carbon offsets with this protocol arises from the direct and indirect reductions of greenhouse gas (GHG) emissions resulting from the implementation of new building methods, and facility retrofits that result in overall efficiencies in energy use per unit of productivity. Process changes may include the mechanical, biological and/or chemical components of the operation and may impact upon on-site heat, electrical and power requirements. This quantification protocol is written for those familiar with building construction and retrofit projects. Some familiarity with, or general understanding of, the operation of these practices and processes is expected.

This quantification protocol is applicable to the quantification of direct reductions of greenhouse gas (GHG) emissions resulting from overall energy efficiencies in new commercial and institutional (CI) buildings or the retrofit of existing CI buildings. It includes reductions in GHG emissions due to any heat/power savings and/or production, and electricity generation related to the process.

This protocol does not prescribe the configuration or nature of the processes that result in energy efficiencies. Rather, this protocol serves as a generic ‘recipe’ for project proponents to follow in order to meet the measurement, monitoring and GHG quantification requirements. **FIGURE 1.1** offers a typical element life cycle chart for a typical project as defined in this protocol.

There are separate baseline conditions for new buildings and retrofits of existing buildings. The baseline for new buildings is based on the emission levels for the building based on the ASHRAE 90.1¹ standard. To assess to what emission savings the building has achieved, upon completion of the construction of the new building energy audits will need to be conducted in each of the first two years before offset credits can be applied for.

The baseline condition for the retrofits of existing buildings in this protocol is defined as the average building emissions from the 3 years prior to any retrofits and/or improvements. The energy and emissions footprint, per square meter, of the baseline configuration is established as part of an energy audit or similar action that is completed before any changes have been made to the building.

FIGURE 1.2 offers an element life cycle chart for the typical baseline configuration.

To demonstrate that a project meets the requirements under this protocol, the project proponent must supply sufficient evidence to demonstrate that:

1. New buildings must exceed the ASHRAE 90.1 standard;
2. Retrofits to existing buildings must improve emission performance as established by the difference between pre- and post-retrofit energy audit;

FIGURE 1.1: Project Element Life Cycle Chart

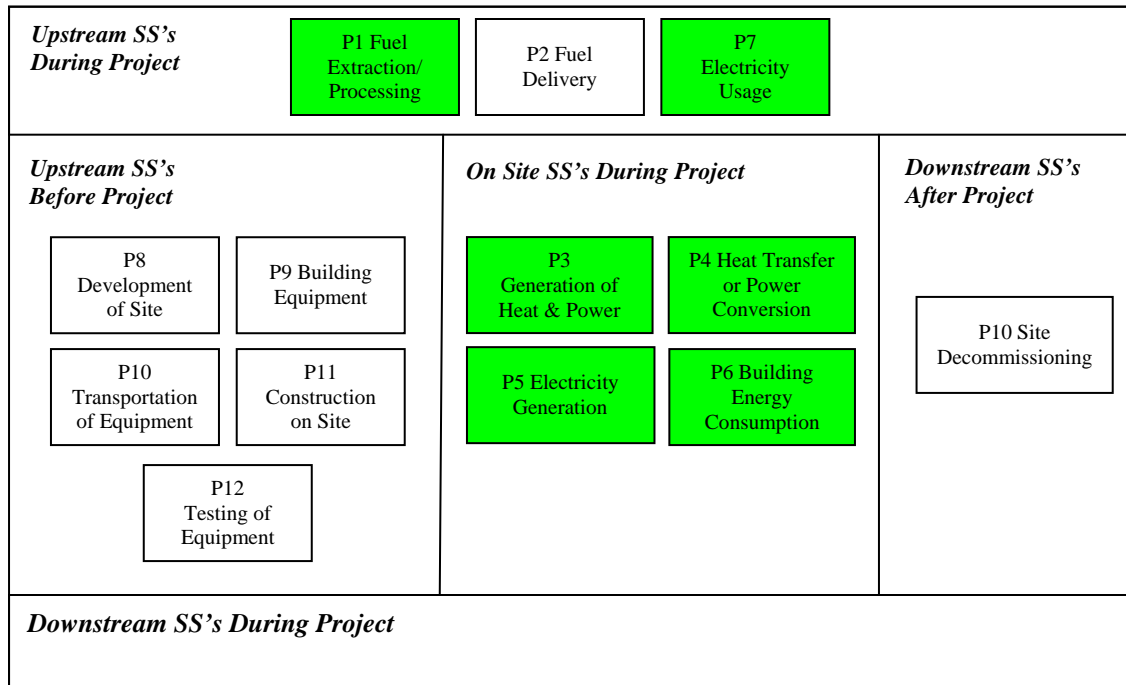
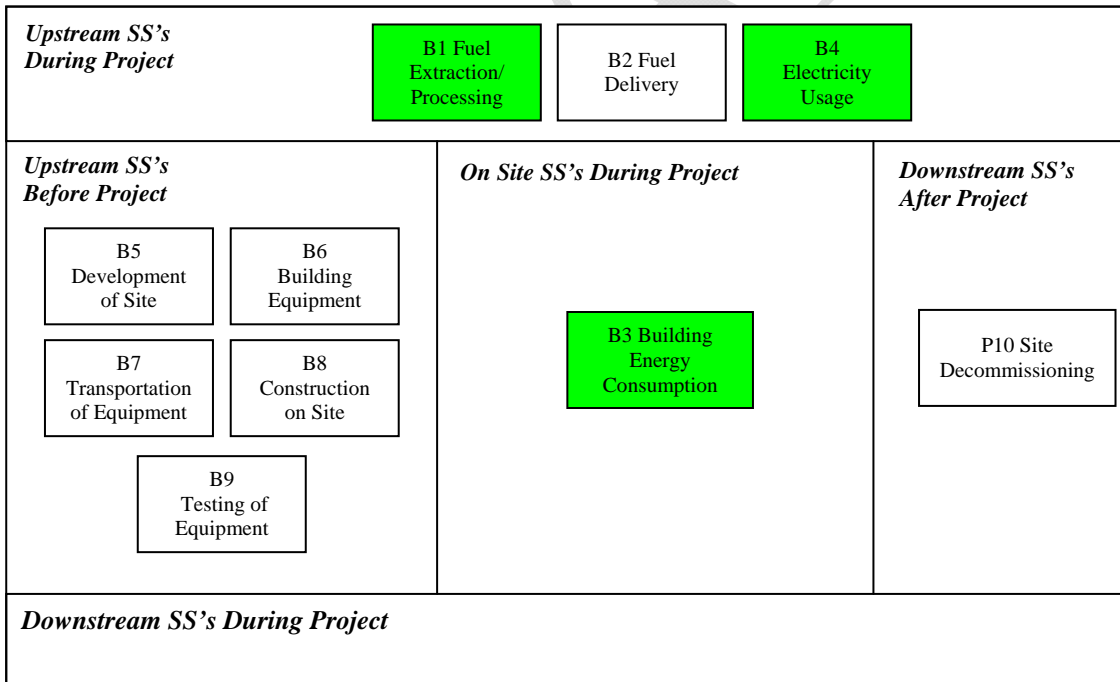


FIGURE 1.2: Baseline Element Life Cycle Chart



*(Sources, sinks and reservoirs selected for measurement and monitoring under this protocol are highlighted)

3. The quantification of reductions achieved by the project is based on actual measurement conducted in energy audits. For existing buildings this will include both a pre-project and post-project energy audit. New buildings reductions will be established based on a post-project energy audit and compared to the established baseline for new buildings of the energy consumption levels for the ASHRAE 90.1 standard;
4. The quantification of reductions achieved by the project is based on actual measurement and monitoring (except where indicated in this protocol) as indicated by the proper application of this protocol; and
5. The project must meet the requirements for offset eligibility as specified in the applicable regulation and guidance documents for the Alberta Offset System.

Flexibility in applying the quantification protocol is provided to project developers in the following ways.

1. The requirement for an energy audit may be waived in situations where the baseline emissions per square meter can be justified using available records;
2. Reductions in onsite electricity or fuel use would be dealt with outside the scope of the protocol as part of the energy efficiency protocol and renewable energy protocols. The benefit of including onsite energy production (i.e. solar, small hydro, wind, biomass, etc) would be dealt with under appropriate protocols. However, the project developer must justify the separation of this component of the project to ensure that the emission reductions are properly quantified between the two projects and that double counting does not occur;
3. For the purpose of this protocol, the unit of production will be square meters. Another suitable unit of production can be defined for incorporating functional equivalence within the calculation methodology as indicated by reasoned qualitative and quantitative analysis; and
4. Site specific emission factors may be substituted for the generic emission factors indicated in this protocol document. The methodology for generation of these emission factors must be sufficiently robust as to ensure reasonable accuracy..

If applicable, the proponent must indicate and justify why flexibility provisions have been used.

Considering the changes that are occurring in this sector around energy management, a review of the protocol's baseline and rating system selection will be part of each periodic review and update of the protocol. The review is meant as opportunity to maintain the environmental integrity of the protocol and as such, any changes will reflect a higher standard of measurement.

2.0 Quantification of Identified Sources, Sinks and Reservoirs

These calculation methodologies serve to complete the following three equations for calculating the emission reductions from the comparison of the baseline and project conditions.

$$\text{Emission Reduction} = \text{Emissions}_{\text{Baseline}} - \text{Emissions}_{\text{Project}}$$

$$\text{Emissions}_{\text{Baseline}} = \text{Emissions}_{\text{Fuel Extraction / Processing}} + \text{Emissions}_{\text{Electricity Usage}} + \text{Emissions}_{\text{Building Energy Consumption}}$$

$$\text{Emissions}_{\text{Project}} = \text{Emissions}_{\text{Fuel Extraction / Processing}} + \text{Emissions}_{\text{Total Onsite Energy Use}} + \text{Emissions}_{\text{Net Net Electricity Usage}}$$

Where:

$\text{Emissions}_{\text{Baseline}}$ = sum of the emissions under the baseline condition.

$\text{Emissions}_{\text{Fuel Extraction / Processing}}$ = emissions under SSR B1 Fuel Extraction and Processing

$\text{Emissions}_{\text{Building Energy Consumption}}$ = emissions under SSR B3 Building Energy Consumption

$\text{Emissions}_{\text{Electricity Usage}}$ = emissions under SSR B4 Electricity Usage

$\text{Emissions}_{\text{Project}}$ = sum of the emissions under the project condition.

$\text{Emissions}_{\text{Fuel Extraction / Processing}}$ = emissions under SSR P1 Fuel Extraction and Processing

$\text{Emissions}_{\text{Total Onsite Energy Use}}$ = emissions under SSR P3 Generation of Heat and Power; P4 Heat Transfer or Power Conversion; P5 Electricity Generation; and P6 Building Energy Consumption

$\text{Emissions}_{\text{Net Electricity Usage}}$ = emissions under SSR P7 Electricity Usage

TABLE 1.1: Quantification Procedures

1. Project / Baseline SSR	2. Parameter / Variable	3. Unit
Project SSRs		
P1 Fuel Extraction and Processing	Emissions Fuel Extraction / Processing = $\sum (\text{Vol. Fuel}_i * \text{EF Fuel}_{i\text{CO}_2}) ; \sum (\text{Vol. Fuel}_i * \text{EF Fuel}_{i\text{CH}_4}) ; \sum (\text{Vol. Fuel}_i * \text{EF Fuel}_{i\text{N}_2\text{O}})$	
	Emissions Fuel Extraction / Processing	kg of CO ₂ e
	Volume of Each type of Fuel Combusted for P4 and P6 / Vol. Fuel	L, m ³ or other
	CO ₂ Emissions Factor for Each Fuel Including Production and Processing / EF Fuel _{CO₂}	kg CO ₂ per L, m ³ or other
	CH ₄ Emissions Factor for Each Fuel Including Production and Processing / EF Fuel _{CH₄}	kg CH ₄ per L, m ³ or other
	N ₂ O Emissions Factor for Each Fuel Including Production and Processing / EF Fuel _{N₂O}	kg N ₂ O per L, m ³ or other
P3 Generation of Heat and Power, P4 Heat Transfer or Power Conversion, P5 Electricity Generation, and P6 Building Energy Consumption	Emissions Total Onsite Energy Use = $\sum (\text{Vol. Fuel}_i * \text{EF Fuel}_{i\text{CO}_2}) ; \sum (\text{Vol. Fuel}_i * \text{EF Fuel}_{i\text{CH}_4}) ; \sum (\text{Vol. Fuel}_i * \text{EF Fuel}_{i\text{N}_2\text{O}})$	
	Emissions Total Onsite Energy Use	kg of CO ₂ ; CH ₄ ; N ₂ O
	Volume of Each Type of Fuel Consumed to Generate Heat and Power / Vol. Fuel _i	L, m ³ or other
	CO ₂ Emissions Factor for Combustion of Each Type of Fuel / EF Fuel _{iCO₂}	kg CO ₂ per L, m ³ or other
	CH ₄ Emissions Factor for Combustion of Each Type of Fuel / EF Fuel _{iCH₄}	kg CH ₄ per L, m ³ or other
	N ₂ O Emissions Factor for Combustion of Each Type of Fuel / EF Fuel _{iN₂O}	kg N ₂ O per L, m ³ or other
P7 Net Electricity Usage	Emissions Electricity = Electricity * EF _{Elec}	
	Emissions Electricity	kg of CO ₂ e
	Incremental Electricity Used at the Site for Unit Operation / Electricity	kWh
	Emissions Factor for Electricity / EF _{Elec}	kg of CO ₂ e per kWh
Baseline SSRs		
B1 Fuel Extraction and Processing	Emissions Fuel Extraction / Processing = $\sum (\text{Vol. Fuel}_i * \text{EF Fuel}_{i\text{CO}_2}) ; \sum (\text{Vol. Fuel}_i * \text{EF Fuel}_{i\text{CH}_4}) ; \sum (\text{Vol. Fuel}_i * \text{EF Fuel}_{i\text{N}_2\text{O}})$	
	Emissions Fuel Extraction / Processing	kg of CO ₂ e
	Volume of Each type of Fuel Combusted for P4 and P6 / Vol. Fuel	L, m ³ or other
	CO ₂ Emissions Factor for Each Fuel Including Production and Processing / EF Fuel _{CO₂}	kg CO ₂ per L, m ³ or other
	CH ₄ Emissions Factor for Each Fuel Including Production and Processing / EF Fuel _{CH₄}	kg CH ₄ per L, m ³ or other
	N ₂ O Emissions Factor for Each Fuel Including Production and Processing / EF Fuel _{N₂O}	kg N ₂ O per L, m ³ or other
B3 Building Energy Consumption	Emissions Unit Operation = $\sum (\text{Vol. Fuel}_i * \text{EF Fuel}_{i\text{CO}_2}) ; \sum (\text{Vol. Fuel}_i * \text{EF Fuel}_{i\text{CH}_4}) ; \sum (\text{Vol. Fuel}_i * \text{EF Fuel}_{i\text{N}_2\text{O}})$	
	Emissions Unit Operation	kg of CO ₂ ; CH ₄ ; N ₂ O
	Volume of Each Type of Fuel for Unit Operation / Vol. Fuel _i	L, m ³ or other
	CO ₂ Emissions Factor for Combustion of Each Type of Fuel / EF Fuel _{iCO₂}	kg CO ₂ per L, m ³ or other
	CH ₄ Emissions Factor for Combustion of Each Type of Fuel / EF Fuel _{iCH₄}	kg CH ₄ per L, m ³ or other
	N ₂ O Emissions Factor for Combustion of Each Type of Fuel / EF Fuel _{iN₂O}	kg N ₂ O per L, m ³ or other
B4 Electricity Usage	Emissions Electricity = Electricity * EF _{Elec}	
	Emissions Electricity	kg of CO ₂ e
	Incremental Electricity Exported from the Site / Electricity	kWh
	Emissions Factor for Electricity / EF _{Elec}	kg of CO ₂ e per kWh

APPENDIX A: Glossary of New Terms

Energy Audit:	Is an assessment of how much energy a building consumes and includes details on efficiency of the building's insulation, heating and cooling systems, and can include recommendations on ways to make the building more energy-efficient
ASHRAE 90.1:	The purpose of this standard is to provide requirements for the energy efficient design and construction of buildings. It is to be used in the implementation of this protocol as the way to develop a baseline for a new building.
Green Building:	Are buildings that incorporate practices that increase the efficiency of buildings and their use of energy, water, and materials, and reduce building impacts on human health and the environment, through better siting, design, construction, operation, maintenance, and removal.
Unit of Production:	For the purpose of this protocol, the unit of production will be square meters. As mentioned in the flexibility provisions, with thorough justification the project proponent may change the unit of production to a more appropriate unit.