

# Energy Conservation Design in GNWT Buildings

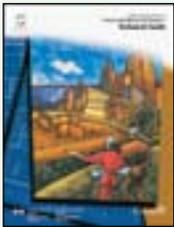
Use CBIP to Reduce Building Energy Consumption,  
and LEED™ for Sustainable High-Performance Buildings

## Energy Conservation in Northern Building Design

### High Performance-Enhanced Buildings



This brochure describes three design tools used to minimize both the total cost of ownership (TCO) and total energy consumption in GNWT buildings. In addition to the Good Building Practice for Northern Facilities (GBP) two more recently available design management tools help the GNWT design higher performance buildings and obtain better long-term value from them – CBIP and LEED™.



The Commercial Building Incentive Program (CBIP) provides federal government financial incentives for buildings designed to achieve superior energy conservation performance, using the Model National Energy Code for Buildings (MNECB) as the performance standard.



Leadership in Energy and Environmental Design (LEED™) uses an extensive project evaluation checklist to audit an integrated design and construction process. Implementing the checklist activities leads to better balance between minimum energy consumption, minimum environmental impact, and operational sustainability over the life of the building, minimizing the total cost of ownership (also called the life-cycle cost).

CBIP and LEED™ may not be appropriate for all buildings. In deciding whether to use CBIP or LEED™, building occupancy, size, building capital budget, user needs and operating requirements, as well as the GNWT's program objectives, are considered. CBIP focuses solely on minimizing the total cost of building ownership through high-performance design, which minimizes energy consumption over the service life of the building.

LEED™ goes further to also minimize the environmental footprint, or impact of the building and extends the project evaluation checklist to include the building site, the community context, the design methodology, and

in some cases, the origin of components and materials used in the total project.

This brochure describes what to consider when deciding to use CBIP or LEED™, or both, on a building project, in addition to the Good Building Practice for Northern Facilities (GBP). It also reviews the GBP, the CBIP subsidy program, and the LEED™ environmental performance criteria protocol, by providing guidelines for appropriate use of each design management tool.

The GNWT has constructed energy-efficient buildings for a number of years, using “Good Building Practice for Northern Facilities” as a best practice standard. Buildings designed and built in accordance with GBP typically use less energy and operate more sustainably than buildings designed only to meet the National Building Code of Canada (NBCC), which is a minimum standard for health, fire and structural safety, and security.

Fuel and electricity costs for northern buildings continue to increase. Increasing operating costs have a greater relative impact in the north than they do in southern Canada, due to the cold climate. Not only do buildings cost more to operate in the north, the operating environment tends to cause earlier deterioration of some building components, reduced building system performance, and shorter building service life. The GBP recommendations provide a comprehensive design tool in response to the cold climate problem. Using the GBP to design a building will obtain higher performance through improved quality management during building development and subsequent more sustainable and energy efficient building operation.

TECHNICAL EXPERTISE NORTH OF 60°

**Technical Support Services**

# Good Building Practice (GBP)



## GBP Standard of Best Practice

### All GNWT Buildings

The GBP Best Practice Standard design protocol applies to all GNWT buildings. The GBP has been used for more than ten years. Its primary objective is to provide a technical reference handbook to help produce the best value in northern buildings. The GBP states that buildings should be designed specifically for the northern climate and for other physical parameters of the site, at the minimum capital cost consistent with lowest life-cycle costs. The objective of the GBP process is to encourage improved building performance over time, based on proven methods and materials, while encouraging improved building performance and new technology.

The scope covered by the GBP includes all aspects of the building site development, structural and weather enclosing shell systems (building envelope), mechanical and electrical systems, and site development for user access and service by vehicles.

Benefits now apparent from using the GBP for a number of years include:

- The GBP has become a known practice for designers, builders and GNWT personnel with the potential to speed up and simplify design decisions by using previously successful preferences.
- A building design is produced through collaborative review by the team of architectural, engineering and specialized consultants and the GNWT project team.
- A building designed using the GBP standards typically meets the energy performance standards of the CBIP program (energy consumption at least 25% lower than the recommended MNECB standard).

The GBP states that wherever alternative designs are considered, the alternative with the lowest life-cycle cost should be preferred. Where alternatives are shown to have the same life-cycle cost, the alternative with the lowest capital cost should be preferred. The life-cycle costing should be based on the expected service life of the building and its systems. For comparative purposes, a minimum twenty-year building service life is used.

The GBP applies to all GNWT buildings. It is written as a standard of practice, suitable even for smaller buildings, including garages and parking enclosures, offices and storage buildings, and residential buildings. It is also applicable to the largest buildings, because it incorporates building design preferences that have been found to work better in the north than the minimum performance requirements of the building and fire codes.

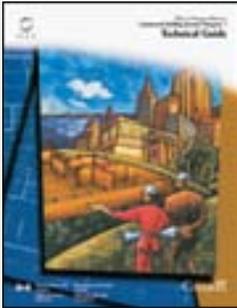
For a complete copy of “Good Building Practice for Northern Facilities” go to:

<http://www.pws.gov.nt.ca/pdf/GBP/GBP%20home.pdf>

More information is available through Public Works and Services, GNWT, Asset Management Division, Technical Support Services.

The GBP Standard of Best Practice improves building energy conservation. Some funding is available from the GNWT through the Department of Environment and Natural Resources (ENR) for renovation projects that incorporate energy saving strategies. For more information contact the Energy Programs Coordinator at 867 873-7654 or fax 867 873-0221.

# Commercial Building Incentive Program (CBIP)



## CBIP Energy Conservation Design

**Where Enhanced Performance Energy Consumption Savings are Significant and Obtainable Through a Modest Additional Time and Budget Investment.**

The Commercial Building Incentive Program (CBIP) helps offset the extra cost of designing energy-efficient buildings. A building that meets CBIP criteria qualifies for a one-time financial subsidy based on the actual annual energy costs saved by the CBIP design, to a maximum of \$60,000 total per building. All new or extensively renovated industrial, commercial or institutional buildings constructed to CBIP program criteria are eligible.

The CBIP process is appropriate for schools, health centres, community activity complexes, service centres, offices, specialized multiple-unit residential facilities like group homes, and similar buildings. Any building expected to operate with high occupant loads, or requiring extensive space heating, ventilation and cooling, should be examined for suitability.

The applicant must use EE4 (Energy Evaluation software Version 4) energy performance simulation software from Natural Resources Canada, NRCAN, to demonstrate a proposed design will reduce energy consumption to 25% below the MNECB performance standard. CBIP funding is limited to six projects per owner, or a maximum subsidy of \$250,000 (whichever comes first).

A central registry to co-ordinate CBIP applications has been established within the Department of Public Works and Services.

CBIP project registration and actual applications are made by contacting, Senior Technical Officer (Mechanical) Technical Support Services (TSS), at 920-6461.

### BENEFITS

- A comprehensive design process incorporates an Energy Modeling Workshop and guarantees the incorporation of the most energy-efficient building components, with acceptable payback times, within the construction budget;
- Additional project funding is provided from NRCAN to the owner, which offsets, at the least, the additional design cost for the CBIP process; and
- Recognition in the industry that the GNWT places high emphasis on energy-efficient buildings, and on continuous reduction of energy costs for building operation.

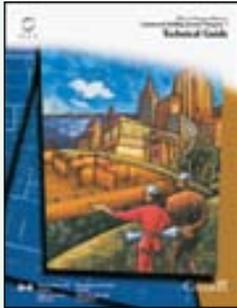
### CONSTRAINTS/COSTS

- Additional funding is required to incorporate the CBIP process into the design process, before it can be offset by the CBIP subsidy; and
- Energy conservation upgrades can result in slightly increased construction costs, but with acceptable payback times through reduced Operation and Maintenance costs for the lifetime of the building.

CBIP certification also enables Natural Resources Canada (NRCAN) funding through the Aboriginal and Northern Community Action Program (ANCAP) of \$10,000 towards the additional design process costs for the required CBIP simulation. A separate fund is available to offset the incremental cost increases for the energy-efficient technologies used in a new building.

For CBIP Submission requirements, see NRCAN website at: <http://oee.nrcan.gc.ca/Publications/infosource/Pub/commercial/new/peterdclark-building.cfm?attr=20>

# CBIP Application Process



**All projects are to be designed to meet the requirements of the Good Building Practice, which automatically meets the requirements for a CBIP application. However, not all projects are suitable applications, so follow these steps:**

## STEP 1

At the Schematic Design Phase, the Project Officer contacts the Senior Technical Officer (Mechanical), Technical Support Services (TSS), at 920-6461. TSS asks you for specific design information enabling them to run a wizard indicating potential energy savings.

## STEP 2

TSS reports back to the Project Officer, enters the project on their central register, and submits an *Expression of Interest* (EOI) to NRCAN. TSS receives back a file number, and sends it to the Project Officer.

## STEP 3

Project Officer informs the Consultants if the project has been deemed suitable for a CBIP application. If it is, he or she tells the Consultant to proceed with planning an Energy Modeling Workshop, using EE4 simulation software to meet the prerequisite for CBIP funding and to maximize the energy savings aspect of the building design. The workshop should be scheduled to be performed concurrent with the finalization of the Design Development Report, which includes the modeling workshop report, together with all the requirements of the CBIP Application Checklist (Appendix A).

## STEP 4

Once design is completed and the drawings are sealed, Consultants provide all necessary documentation to TSS via the Project Officer so that TSS can submit to NRCAN.

## STEP 5

NRCAN verifies that the design meets the technical requirements of the program, and, if successful, sends a Contribution Agreement back to TSS, who passes it on to the building owner via the Project Officer.

## STEP 6

The Project Officer completes the *Initial Payment Request Form* and sends to TSS, who passes it on to NRCAN. This will usually be done once a building permit is in place for the project, as NRCAN deems a copy of the permit proof of project initiation. NRCAN will send a cheque covering 80% of the awarded funding to TSS, who will forward it to Project Officer to present to the building owner.

## STEP 7

Repeat Step 6 for the *Final Payment Request Form* at project substantial completion, together with a photograph of the building and proof that it has been constructed in accordance with the design specifications. At this point the remaining 20% of the funding is paid out.

# Appendix A - CBIP Submission Checklist

(Items listed below are mandatory requirements of a CBIP submission and must be included in the submission package)

Item Required (see attached instructions for details)		Location in Submission Pg#	For NRCAN Use Only
1	CBIP Submission Checklist	1	
2	Submission Overview		
3	Performance Path Worksheet		
4	Building Permit		
5	MNECB Mandatory Requirement Checklist	EE4-CBIP: list should be checked by hand	
		and attached in paper format	
		EE Wizard: List is included in the Compliance Report, Item 6 (except for arenas and retail food stores)	
6	EE4-CBIP or EE Wizard Compliance Report		
7	Explanation of Errors and Warnings		
8	Outdoor Air Calculation Spreadsheet		
9	Relevant Calculations		
10	Calculations for Renewable Energies (if applicable)		
11	Mechanical Zoning Diagram		
12	Electronic Simulation Files	EE4-CBIP	
		EE Wizard	
13	Stamped Drawings	A	
		M	
		E	
		R	
14	Principal Building Systems	Heat Recovery Ventilation	
		Space Heating and Cooling Equipment	
		Boilers	
		Heat Pumps	
		Air Handling Units	
		Pumps	
		Chillers (where applicable)	
		Cooling Towers (where applicable)	
		Unit Heaters	
		Other, Specify: _____	
		Service Hot Water Heating Equipment	
		Envelope Construction	
		Window and Glazing Thermal Performance	
		Panelized Wall Systems, Curtain Wall Systems	
		Interior Lighting	
		Refrigeration Systems	
		Display Cases	
		Walk-in Freezers/Coolers (where applicable)	
		Controls for Display Case & Walk-in Coolers/Freezers	
		Compressors (where applicable)	
Heat Recovery Coils (where applicable)			
Mechanical Sub-cooling (where applicable)			
Floating Head Pressure (where applicable)			
Renewable Energy Features (if applicable)			
Special Energy Conserving Features (if applicable)			
15	Arch/Mech/Electrical/Refrigeration Specs (Tender Documents)		
16	Energy Prices		

# Leadership in Energy and Environmental Design (LEED™)



## New Buildings

LEED™ Canada-NC 1.0 for new buildings and LEED™-EB for renovation and additions, consist of an explicit set of environmental performance criteria, organized within five key performance categories: Sustainable Sites; Water Efficiency; Energy and Atmosphere; Materials and Resources, and Indoor Environmental Quality. A sixth category, Innovation and Design Process, rewards exceptional environmental performance or innovation over and above that explicitly covered in the basic LEED™ credits. Building design and performance is certified (based on the number of points earned of a possible 70 point total by a project) with either a Certified, Silver, Gold, or Platinum rating.

The performance criteria are contained in a checklist, (see <http://www.cagbc.org/> and Appendix B).

Administered by the Canadian Green Building Council (CaGBC), the LEED™ Canada Rating System recognizes leading edge new buildings that incorporate design, construction and operational practices that combine healthy, high-quality and high-performance advantages with reduced environmental impacts. It should be noted that conforming to CBIP performance verification energy consumption procedures is required for LEED™ Canada.

One significant mandatory requirement is EA 1: “Fundamental Building Systems Commissioning”, defined as independent, third-party commissioning. The industry practice rule of thumb for third-party commissioning cost ranges from 0.5 to 1% of project construction costs, possibly higher in northern locations.

Another factor to consider is the additional cost required for preparing the application. Historically, this has been in the \$60,000 to \$80,000 range.

- There is **no financial incentive offered to pursue LEED™**. The major benefit of LEED™ certification, is seen as a public leadership statement from the owner, avowing their intention to provide healthy, energy-efficient buildings while reducing greenhouse gas

emissions and minimizing the building’s impact on its environment.

### LEED™ SELECTION CRITERIA:

- Is the project scope of such magnitude that the budget can accommodate the extra costs of commissioning and LEED™ application requirements?
- Is independent, third-party commissioning a justifiable added expense to the project?
- Is the client department willing to expend these extra costs to attain LEED™ certified status?

### BENEFITS

- LEED™ involves an integrated design process (IDP), which includes all interested stakeholders in regular design workshops, resulting in decisions agreed to by all parties, and potential energy consumption savings up to 45% greater than the MNECB recommendations;
- Recognition that the GNWT places high emphasis on healthy, energy-efficient, environmentally friendly buildings.

### CONSTRAINTS

- Need for additional funding upfront;
- No financial incentives to pursue LEED™ certification;
- Can result in increased construction costs.

### SUITABLE BUILDINGS FOR LEED™

Larger, more complicated or specialized buildings, for which third-party commissioning is required, or buildings for which the client department wishes to achieve LEED™ rating, and can justify the additional associated costs should be considered for LEED™. The proposed building should have a large enough annual energy consumption budget to obtain a favorable cost-benefit analysis and payback, or cost recovery period.

# Appendix B - LEED™ Canada NC 1.0

## Preliminary Project Rating Checklist

(LEED™ Canada NC-1.0 Project Check Sheet for Project Rating)

				City, Province							City, Province					
				<b>Sustainable Sites</b>			<b>14 Points</b>									
Yes	?	No		Prereq 1	Erosion & Sedimentation Control	Required										
				Credit 1	Site Selection	1										
				Credit 2	Development Density	1										
				Credit 3	Redevelopment of Contaminated Site	1										
				Credit 4.1	Alternative Transportation, Public Transportation Access	1										
				Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms	1										
				Credit 4.3	Alternative Transportation, Alternative Fuel Vehicles	1										
				Credit 4.4	Alternative Transportation, Parking Capacity	1										
				Credit 5.1	Reduced Site Disturbance, Protect or Restore Open Space	1										
				Credit 5.2	Reduced Site Disturbance, Development Footprint	1										
				Credit 6.1	Stormwater Management, Rate and Quantity	1										
				Credit 6.2	Stormwater Management, Treatment	1										
				Credit 7.1	Heat Island Effect, Non-Roof	1										
				Credit 7.2	Heat Island Effect, Roof	1										
				Credit 8	Light Pollution Reduction	1										
				<b>Water Efficiency</b>			<b>5 Points</b>									
Yes	?	No		Credit 1.1	Water Efficient Landscaping, Reduce by 50%	1										
				Credit 1.2	Water Efficient Landscaping, No Potable Use or No Irrigation	1										
				Credit 2	Innovative Wastewater Technologies	1										
				Credit 3.1	Water Use Reduction, 20% Reduction	1										
				Credit 3.2	Water Use Reduction, 30% Reduction	1										
				<b>Energy &amp; Atmosphere</b>			<b>17 Points</b>									
Yes	?	No		Prereq 1	Fundamental Building Systems Commissioning	Required										
Y				Prereq 2	Minimum Energy Performance	Required										
Y				Prereq 3	CFC Reduction in HVAC&R Equipment	Required										
				Credit 1	Optimize Energy Performance	1 to 10										
				Credit 2.1	Renewable Energy, 5%	1										
				Credit 2.2	Renewable Energy, 10%	1										
				Credit 2.3	Renewable Energy, 20%	1										
				Credit 3	Best Practice Commissioning	1										
				Credit 4	Ozone Protection	1										
				Credit 5	Measurement & Verification	1										
				Credit 6	Green Power	1										
				<b>Materials &amp; Resources</b>			<b>14 Points</b>									
Yes	?	No		Prereq 1	Storage & Collection of Recyclables	Required										
				Credit 1.1	Building Reuse: Maintain 75% of Existing Walls, Floors, and Roof	1										
				Credit 1.2	Building Reuse: Maintain 95% of Existing Walls, Floors, and Roof	1										
				Credit 1.3	Building Reuse: Maintain 50% of Interior Non-Structural Elements	1										
				<b>Materials &amp; Resources</b>			<b>14 Points</b>									
Yes	?	No		Credit 2.1	Construction Waste Management: Divert 50% from Landfill	1										
				Credit 2.2	Construction Waste Management: Divert 75% from Landfill	1										
				Credit 3.1	Resource Reuse: 5%	1										
				Credit 3.2	Resource Reuse: 10%	1										
				Credit 4.1	Recycled Content: 7.5% (post-consumer + 1/2 post-industrial)	1										
				Credit 4.2	Recycled Content: 15% (post-consumer + 1/2 post-industrial)	1										
				Credit 5.1	Regional Materials: 10% Extracted and Manufactured Regionally	1										
				Credit 5.2	Regional Materials: 20% Extracted and Manufactured Regionally	1										
				Credit 6	Rapidly Renewable Materials	1										
				Credit 7	Certified Wood	1										
				Credit 8	Durable Building	1										
				<b>Indoor Environmental Quality</b>			<b>15 Points</b>									
Yes	?	No		Prereq 1	Minimum IAQ Performance	Required										
Y				Prereq 2	Environmental Tobacco Smoke (ETS) Control	Required										
				Credit 1	Carbon Dioxide (CO <sub>2</sub> ) Monitoring	1										
				Credit 2	Ventilation Effectiveness	1										
				Credit 3.1	Construction IAQ Management Plan: During Construction	1										
				Credit 3.2	Construction IAQ Management Plan: Testing Before Occupancy	1										
				Credit 4.1	Low-Emitting Materials: Adhesives & Sealants	1										
				Credit 4.2	Low-Emitting Materials: Paints and Coating	1										
				Credit 4.3	Low-Emitting Materials: Carpet	1										
				Credit 4.4	Low-Emitting Materials: Composite Wood and Laminate Adhesives	1										
				Credit 5	Indoor Chemical & Pollutant Source Control	1										
				Credit 6.1	Controllability of Systems: Perimeter Spaces	1										
				Credit 6.2	Controllability of Systems: Non-Perimeter Spaces	1										
				Credit 7.1	Thermal Comfort: Compliance	1										
				Credit 7.2	Thermal Comfort: Monitoring	1										
				Credit 8.1	Daylight & Views: Daylight 75% of Spaces	1										
				Credit 8.2	Daylight & Views: Views 90% of Spaces	1										
				<b>Innovation &amp; Design Process</b>			<b>5 Points</b>									
				Credit 1.1	Innovation in Design	1										
				Credit 1.2	Innovation in Design	1										
				Credit 1.3	Innovation in Design	1										
				Credit 1.4	Innovation in Design	1										
				Credit 2	LEED® Accredited Professional	1										
											<b>Project Totals (pre-certification estimates)</b>			<b>70 Points</b>		
											<b>Certified</b>			26-32 points		
											<b>Silver</b>			33-38 points		
											<b>Gold</b>			39-51 points		
											<b>Platinum</b>			52-70 points		

# Summary

Good Building Practice for Northern Facilities (GBP) continues to serve as an effective design standard for energy conservation in northern buildings when it is fully followed. Additional energy conservation benefits and optimized service life can be determined following the building energy utilization simulation protocols found in CBIP, using Natural Resources Canada financial incentives, after which energy savings recovery is cost neutral. Exceptional buildings that occasionally provide very specialized design challenges for energy utilization, environmental impact, and very long service life, can benefit from undergoing the design, construction and commissioning requirements of LEED™ Canada NC 1.0.

## Saving ENERGY SAVES Money



### For further information, please contact:

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*“Our mission is to deliver quality services to satisfy the need of our customers, while achieving the best value for government, communities and residents.”*

Mike Aumond,  
Deputy Minister