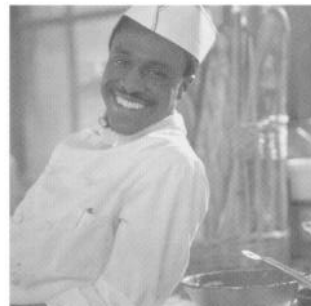
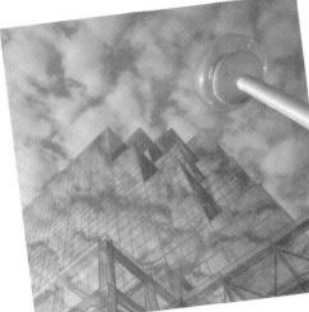
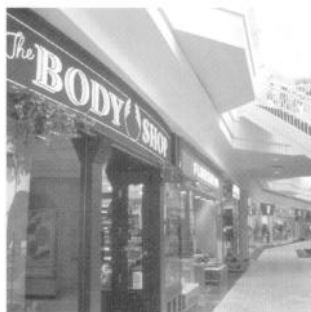




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Office of Energy Efficiency  
Office de l'efficacité énergétique

## MANAGER'S GUIDE TO MAKING TRAINING PART OF YOUR ENERGY EFFICIENCY PROJECT



### Efficiency and Alternative Energy Program

*February 1999*



Natural Resources  
Canada  
Office of Energy  
Efficiency

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énergétique

Canada

**MANAGER'S GUIDE TO**

**Making Training  
Part of Your Energy  
Efficiency Project**

**Efficiency and Alternative Energy Program**

**February 1999**



Office of Energy Efficiency  
Office de l'efficacité énergétique

**Leading Canadians to Energy Efficiency  
at home, at Work and on the Road**

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Catalogue no. M27-01-808E

Copies of this publication may be obtained free of charge from:

Natural Resources Canada

Office of Energy Efficiency

c/o Canada Communication Group

Ottawa, ON K1A 0S9

Phone: (819) 997-1107

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*Cette publication est également disponible en français sous le titre: Guide du gestionnaire sur l'intégration de la formation dans les projets d'efficacité énergétique.*

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## INTRODUCTION TO THE MANAGER'S GUIDE

Congratulations! You're not only taking action to improve the energy efficiency of the facility you manage, you've also shown an interest in energy management training. Put the two together and you're well on the way to a successful project that will save your organization money, improve the workplace and contribute to a cleaner, healthier environment.

Energy management training is critical if you hope to get the most out of your investment in new equipment and systems – and this Manager's Guide can help. Developed by the Office of Energy Efficiency of Natural Resources Canada (NRCan) in collaboration with Seneca College of North York, Ontario, the guide provides a step-by-step process for making comprehensive energy management training part of your upgrade project.

The process explained in this guide makes use of the Building Environmental Systems (BES) program developed by Seneca College (Appendix A). It will help you:

- assess the training needs of individual building operators
- develop a personal training plan for each building operator
- identify a college or other training facility to meet your training needs

Chances are you've already invested a great deal of time and effort in planning your upgrade project. Now, take some time to read this Manager's Guide and to implement this training process. It could make all the difference in the world.

## STEP 1

### Understand the Benefits of Training

Your organization is about to invest in new technology to improve the energy efficiency of one or more of its buildings. New technology requires new skills – and the best way to acquire them is not through costly trial and error, but through formal training by qualified professionals who understand the equipment and its impact on the building. In fact, a complete understanding of how to operate an upgraded facility is every bit as important as the equipment you install.

In other words, don't sell training short. Consider how quickly technology is changing in today's world, and you'll quickly realize that building operators who received training even four or five years ago are probably not up-to-date with the latest developments.

Upgrading the skills of your staff will help them get the most out of new technologies.

Training:

- maximizes savings
- shortens the payback period for investments in upgraded facilities
- ensures employee buy-in
- extends building life
- reduces maintenance cost

Training results in a more competent, knowledgeable, motivated, productive, flexible and creative workforce. And we're not talking about a couple of hours spent with the equipment salesperson or installer. To be truly effective, energy management training must be comprehensive, covering:

- basic mathematics, computer and reading skills (if needed)
- basic energy efficiency techniques and practices related to motors, lighting, heating, ventilating and air conditioning (HVAC) and other building systems
- the specialized skills and knowledge needed to operate specific equipment and maintain the upgraded facility

Generally, the first two types of training can be provided by a community college. More specialized training can be provided by the equipment supplier or an energy management firm.

## STEP 2

### Getting Started – The Training Framework

One of the first things to do is establish a framework for addressing your energy management training needs by:

- defining roles and responsibilities
- establishing a team of individuals to fill these roles
- determining resource requirements and funding sources

#### Contact the Energy Training Office

It's never too early to start thinking about training. Once you've decided to proceed with an energy efficiency project, look into your organization's approach to training. As a manager, do you have a mandate to authorize training, and do you have a budget? Does the organization have a corporate policy on training? Just as important, start thinking about who will need to be trained.

**Before you issue a Request for Proposal or embark on an energy management project, contact the Energy Training Office at Seneca College** (see page 31 for contact information). As the lead agency for the delivery of the training process described in this guide, the Energy Training Office can help ensure that your organization's human resources get the attention and training they need.

#### Roles and Responsibilities

The key players in the training process are:

- the **NRCan program officer**. If your organization is an Energy Innovator or is applying the Federal Buildings Initiative approach to achieving energy savings, the NRCan program officer will explain how to integrate training into your energy efficiency project and will assist you at every step of the process. One of the first things the program officer will do is put you in touch with a college specialist (see below) and a community college that can provide energy management training. Even if NRCan is not directly involved in the project, the Department can offer advice and support materials, as well as a list of qualified college specialists.
- the **client training coordinator (CTC)**. The CTC coordinates the training process, including selecting and working with a college specialist to develop the overall training plan, meeting with trainees to discuss the training plan, participating on the Workplace Training Committee (Step 3), and assessing the overall success of the training exercise (Step 8). Depending on your organization's approach, you or a representative from the human resources department will assume the role of the CTC.
- the **college specialist**. College specialists are energy management trainers who have practical experience in the field of building operations and are affiliated with local colleges. College specialists will conduct the training needs assessment (Steps 4 and 5), develop a personal training plan for each trainee (Step 6), and may deliver the training themselves (Step 7).

- **the trainees.** These are the individuals who will receive energy management training. They are often building operators but may also include supervisors and others.

## **Paying for Training**

One of the first questions that needs to be answered is a financial one: How will you pay for the training needs assessment and the training itself?

The cost of a needs assessment and personal training plan for each trainee is about \$150 (some college specialists may also charge a small management fee). This cost is paid by your organization.

Once the personal training plans have been developed, you have two options for delivering the training:

- If you intend to enter into an energy performance contract, you can request that comprehensive energy management training from a recognized community college be part of the overall package of services (some energy management firms may deliver some of the training themselves). In this way, the training can be paid for through energy savings.
- If you are not using an energy performance contract, your organization will have to pay directly for the training costs, which are typically \$2000 per person (\$400 per subject for five subjects).

Before meeting with trainees to explain the process (Step 4), you should decide whether your organization will also cover the cost of upgrading language, mathematics, basic science and computer skills, which may be necessary for some individuals to successfully complete energy management training. The alternative is to require the staff to pay for their own training in these areas.



## STEP 3

### The Workplace Training Committee

A Workplace Training Committee should be convened at the outset of your energy efficiency project. As the facility/project manager, you should sit on and possibly chair this committee. Other members should include the CTC (if this is a different person), the college specialist, representatives of senior management, employees (possibly union stewards), building tenants and the energy management firm that will implement the upgrade project. Typically, the committee will report to senior management through the energy efficiency project manager.

NRCan has produced a presentation that can be used by the CTC to introduce the training process at the committee's first meeting (for a copy, send your request to NRCan at the fax number on page 13). The role of the committee is to help keep employees informed about the training program and to address any issues that may arise.

For example, the committee would respond to the following types of concerns:

- Unions or employees may believe that the needs assessment process (Steps 4 and 5) will threaten their job security. In fact, training will strengthen job security by giving employees the skills they need to contribute to a successful project.
- Management may express concern about both the cost of training and who is paying for it (particularly the upgrading of language, mathematics, basic science and computer skills). The committee's response should be that training is a critical element of the overall upgrade project and an investment in people and the organization.
- The energy management firm may need an explanation of its role in the training process and why its own training services need to be supplemented. The results of the needs assessment should clearly demonstrate the requirement for more comprehensive training than can be provided by the energy management firm.

## STEP 4

# Needs Assessment Questionnaires

## What is a Needs Assessment?

The needs assessment process described here and in step 5 will help you determine the current knowledge level and training needs of each person who will receive energy management training. As noted earlier, trainees are usually building operators.

Arrange a meeting of all the affected building operators and their supervisors. A presentation is available from NRCan (fax a request to the number on page 13) to help the CTC deliver brief messages about:

- the benefits of training to employees and the organization
- the importance of training to the success of the energy management project
- how the training needs assessment works
- who will pay for the training
- college accreditation
- the importance of indicating a language preference (English or French) for the training needs assessment process

The CTC will then provide each building operator with a training kit consisting of an information brochure on building environmental systems and the first two questionnaires described below. The third questionnaire may be given to supervisors under certain circumstances. Trainees are also given the name and address of the college specialist who will undertake the needs assessment and are instructed to return the completed questionnaires directly to this person.

### 1. General Knowledge Questionnaire for Operators

The *General Knowledge Questionnaire for Operators* (Appendix B) is a self-assessment questionnaire intended to establish the individual's knowledge level in language comprehension, mathematics, basic science and computer literacy. Building operators need to have a certain level of ability in each of these areas in order to complete energy management training.

Building operators are instructed to complete the questionnaire at the earliest opportunity. Using the answers provided at the back of the questionnaire, operators are able to establish their basic skill level in each area and determine whether these skills need to be upgraded in preparation for energy management training.

Building operators should be encouraged to return the questionnaire to the college specialist as soon as possible, so that the results can be taken into account when developing a personal training plan.

**All results from the completed questionnaires are held in strict confidence by the college.**

## **2. Energy Management Questionnaire for Operators**

The *Energy Management Questionnaire for Operators* (Appendix C) has two parts.

- a) In the "Staff Profile Section," the building operator is asked to provide information on his or her current job responsibilities, previous training/qualifications and work experience, as well as a preferred mailing address for delivery of the personal training plan. The building operator is also invited to identify any requests for skills upgrading arising from the *General Knowledge Questionnaire for Operators*.
- b) In the "Energy Management Knowledge Section," the building operator is asked to rate his or her abilities in six areas of building operation management: heating, air conditioning and refrigeration, air handling, electricity, controls and water treatment. Within each area, several "categories of performance" are listed, and the operator is asked to rate his or her knowledge as being one of the following:
  - **full** – the operator is able to fully describe the building operation and use this knowledge in the workplace without supervision
  - **basic** – the operator is able to describe basic aspects of the building operation and use that knowledge in the workplace with some supervision
  - **minimum** – the operator has limited or no previous experience with the building operation

**The completed questionnaire is returned directly to the college specialist and is held in strict confidence by the college. Summary information from the completed questionnaires may be provided to the CTC without compromising confidentiality.**

## **3. Operator Assessment Questionnaire for Supervisors (Optional)**

In some cases, building operation supervisors may be asked to complete the *Operator Assessment Questionnaire for Supervisors*. **This can only be done with the approval of both your organization and the union representing the building operators.** This optional questionnaire is identical to the *Energy Management Questionnaire for Operators* (Appendix C), except that building supervisors are being asked to assess the knowledge of individual staff members. The completed questionnaire for each staff member may be used to corroborate the operator's self-assessment and to support the development of a personal training plan.

**Completed questionnaires are returned directly to the college specialist and are held in strict confidence by the college.**

## STEP 5

### Validation Interviews

Validation interviews are private, one-on-one sessions between the college specialist and each building operator, conducted either in person or by telephone, to verify the results of the *Energy Management Questionnaire for Operators*. This is one of the most important steps in the training process. The CTC's role is to put the college specialist in touch with the appropriate supervisor to schedule interviews.

During the interview, the college specialist will explore the individual's responses to the *Energy Management Questionnaire for Operators*. From time to time, operators misjudge their knowledge levels when completing the questionnaire. As someone who has practical experience in the field of building operations, the college specialist can accurately assess knowledge levels.

At the outset of the interview, the college specialist will explain that the assessment process is an academic procedure that could lead to formal academic recognition. The college specialist will also confirm the information provided in the "Staff Profile Section" of the completed *Energy Management Questionnaire for Operators* by asking:

- how long the operator has been doing his or her current job at the current facility
- how long he or she has been working in his or her current field
- what formal training has been taken and what certificates and qualifications are held
- whether the operator feels skills upgrading would be helpful, and if so, in what areas

The college specialist will then ask the operator in-depth questions related to each category of performance in the "Energy Management Knowledge Section" of the questionnaire. Based on the operator's responses, the college specialist records his or her own assessment of the operator's knowledge level as being full, basic or minimum. **This may differ from the operator's assessment.**

If the building operator demonstrates strong knowledge and work experience in any of the six areas of building operation management, the college specialist can recommend one of two forms of recognition:

- An **advanced standing credit**, which may be awarded if the operator has extensive work experience and can provide evidence (e.g., a certificate) of having completed a formal training course that is comparable to the training that would be recommended by the college specialist. This qualifies the operator for college accreditation, such as BES program credits.
- A **prior learning assessment** rating, which means that the building operator has sufficient knowledge and work experience to qualify for a BES credit if he or she passes a challenge exam.

Only a college specialist affiliated with one of NRCan's approved network of colleges (Appendix E) can award an advanced standing credit or prior learning assessment rating. Specific questions about the validation process should be addressed to the appropriate college.

## STEP 6

# Developing Personal Training Plans

## Assessing the Results

After completing the validation interviews, the college specialist will assess each operator's training needs (it is during this assessment that the college specialist may decide to recommend an advanced standing credit or prior learning assessment rating). The assessment will include a review of:

- the completed *General Knowledge Questionnaire for Operators*
- the completed *Energy Management Questionnaire for Operators*
- the completed *Operator Assessment Questionnaire for Supervisors* (if available)
- the results of the validation interview

For each category of performance in the *Energy Management Questionnaire for Operators*, the college specialist will record the lowest rating (full, basic or minimum) from either the operator's completed questionnaire or the validation interview. The "Training Assessment Guide" (below) is then used to determine the operator's training needs in each of the six areas of building operations management.

## Training Assessment Guide

Areas of Building Operations Management	Number of "Basic" or "Full" Ratings	Training Recommendations*
Heating	5 or 6	Nil
	4 or less	BES 701 - Heating
Air Conditioning and Refrigeration	5 or 6	Nil
	4 or less	BES 702 - Air Conditioning and Refrigeration
Air Handling	5 or 6	Nil
	4 or less	BES 703 - Air Handling and Preventive Maintenance
Electricity	5 or 6	Nil
	4 or less	BES 704 - Electrical
Controls	5 or 6	Nil
	4 or less	BES 705 - Controls
Water Treatment	5 or 6	Nil
	4 or less	BES 706 - Water Treatment

\* The Southern Alberta Institute of Technology (SAIT) also offers a program of comprehensive energy management training. Contact SAIT for information on courses that are equivalent to BES training. Contact Seneca College to determine the equivalency of courses/programs offered by all other training organizations.

## **Developing the Plan**

Based on the results of the needs assessment process, the college specialist will develop a personal training plan for each building operator. The training plan will contain the following information:

### **Section 1 – Personal Information**

This section of the plan includes the building operator's name, building location, preferred mailing address, telephone and fax numbers and e-mail address, as provided by the operator in the completed *Energy Management Questionnaire for Operators*.

### **Section 2 – Brief Background**

This section provides general background information acquired from the "Staff Profile Section" of the *Energy Management Questionnaire for Operators* and the validation interview. This information supports the training plan recommendations.

### **Section 3 – Energy Management Training Recommendations for College Accreditation**

The college specialist's recommendations for energy management training and college accreditation are set out in this section of the plan.

### **Section 4 – General Knowledge Training Recommendations**

If the building operator has indicated an interest in upgrading his or her language, mathematics, basic science or computers skills, this will be noted in the training plan.

### **Section 5 – Recommended Delivery Options and Order of Training**

This section suggests a local college (Appendix E) or other agent that can deliver the training. If there is no local source of training, the college specialist can advise the building operator to use Seneca College's distance-learning facilities (information is available by calling Seneca College at the number provided on page 30).

This section of the plan also includes the recommended order of training. In all cases, it is recommended that the general knowledge training identified by the operator be completed first, followed by the appropriate college training and then by training from the energy management firm, if applicable.

### **Section 6 – College Specialist's Name and Address**

The college specialist will provide his or her name, address, telephone and fax numbers and e-mail address should the building operator have any questions about the training plan.

### **Registration Form**

If the college specialist is recommending BES courses, a copy of the "BES Training Registration Form" (Appendix D) will be attached to the personal training plan.

This form is to be used by the building operator to:

- request additional information or assistance in registering for classroom learning
- register for distance-learning courses (e.g., via e-mail or the Internet)
- register for the prior learning assessment process

If other courses are recommended, the appropriate application forms will also be attached.

### **Forwarding the Plan**

A "Personal Training Guide" has been developed to explain the various elements of the training plan to building operators (Appendix D). The college specialist will mail the completed training plan and the guide to the individual operators.

Seneca College - on behalf of NRCan - has established a registry to record the names of building operators who receive college credits.

## **STEP 7**

### **Training Delivery**

At this stage of the process, formal arrangements are made for college training. With the agreement of trainees, the CTC should follow up on the personal training plans by contacting the recommended college (usually through the college specialist) and arranging an acceptable training schedule.

A number of factors may influence how the training is delivered, including the number of trainees involved and the type of training recommended. In remote locations or for small groups, the distance-learning option may be the best approach. Larger groups can be accommodated in a classroom setting at a local college or even at your facility.

Arrangements for training on the specific equipment or technology being installed in the building can usually be made through the energy management firm.

**As previously noted, if you are entering into an energy performance contract, you can ask the energy management firm to organize all of the training and you can arrange to pay for it through energy cost savings.**

Additional information on training options is available from NRCan or Seneca College (see page 13 for contact information).

## **STEP 8**

# **Operator Accreditation and Training Evaluation**

## **College Accreditation**

Once the training has been completed, building operators should be encouraged to apply for college accreditation. Records of a building operator's academic qualifications are maintained by the college or colleges where the training was given.

## **Training Evaluation**

This final step in the training process also provides an opportunity for you to assess:

- the level of knowledge and skills acquired through training
- the extent to which the acquired knowledge and skills are being used in the workplace
- the impact training has had on achieving your organization's overall goals and objectives

## **CONCLUSION**

You have an important role to play in helping your staff acquire the skills they need to ensure the success of your organization's energy efficiency project. This will require commitment on your part and a significant investment of time and effort. But the good news is that comprehensive energy management training will pay dividends for years to come through increased energy savings and a more motivated and skilled workforce.



## FOR MORE INFORMATION

The Office of Energy Efficiency of NRCan and the Energy Training Office at Seneca College can help you make training part of your energy efficiency project. We've contributed to the implementation of many energy management training plans in the past, and we're ready to put our experience and expertise to work for your organization.

Don't hesitate to contact us if you have any questions:

- Fax your name, phone number and the name of your organization to the Office of Energy Efficiency at (613) 947-4121 for information on how you can improve the energy efficiency of your facilities through programs such as the Federal Buildings Initiative or Energy Innovators. You can also visit our web site at <http://oe.e.nrcan.gc.ca>.
- Seneca College has established a special toll-free help-line to address your training questions and concerns. Call 1-800-572-0712. You can also write to:

Sheila Hirsch  
Energy Training Office  
Seneca College  
Centre for the Built Environment  
1750 Finch Ave. East  
North York, ON M2J 2X5  
E-mail: [sheila.hirsch@senecac.on.ca](mailto:sheila.hirsch@senecac.on.ca)  
Web site: <http://www.senecac.on.ca/~eto>

## APPENDIX A

### Sources of Training and Recognition

A wide variety of energy management training materials and trainers are available to help your staff upgrade their skills. This appendix outlines some of your main options.

#### NRCan Workshops

NRCan workshops are intended to serve as refresher courses or to help fill gaps in the knowledge of building operators. The following workshops are available through private training organizations and some community colleges:

- Electrical Energy Management Opportunities
- Thermal Energy Management Opportunities
- Industrial Energy Management Opportunities
- Energy Auditing

Contact NRCan at the fax number on page 13 for a list of training delivery agents.

#### Building Environmental Systems Training and Accreditation

The Building Environmental Systems (BES) program developed by Seneca College is used as the core curriculum for energy management training by a network of approximately 20 colleges across Canada. Building operators can take the BES program either on campus or through distance education (i.e., by e-mail or hard copy correspondence). Some colleges also deliver their own energy management courses. For a full list of colleges that offer energy management training, see Appendix E.

The BES program offers two levels of accreditation, as explained below.

A **BES Class II Certificate** requires completion of the following courses:

**1. BES 700 – BUILDING SYSTEMS: A PRACTICAL OVERVIEW**

An introductory overview of today's complex building systems. Includes site visits and demonstrations of actual equipment and machinery (e.g., boilers, chillers, air-handling units, fire protection systems and electrical equipment).

**2. BES 701 – HEATING**

An introduction to the operation and maintenance of boilers, burners, heating pipe systems and plumbing.

**3. BES 702 – AIR CONDITIONING AND REFRIGERATION**

Understand the function of air conditioning and refrigeration, with respect to equipment and design, as well as that of ozone-depleting substances.

**4. BES 703 – AIR HANDLING AND PREVENTIVE MAINTENANCE**

An introduction to air-handling systems and their component parts, including preventive maintenance programs, as well as air quality and waste management issues.

**5. BES 704 – ELECTRICAL**

A study of electrical systems, motor controls and wiring diagrams. Includes calculation of loads and charges.

**6. BES 705 – CONTROLS**

Basic training on automatic controls, including how they work and how they are applied and interconnected.

**7. BES 706 – WATER TREATMENT**

Understand water treatment and the application of a water treatment system to industrial and commercial properties. Also addresses issues related to the efficient use of water.

A **BES Class I Certificate** requires completion of the seven subjects listed above, plus:

**1. BES 710 – ENERGY MANAGEMENT IN LARGE BUILDINGS**

Covers energy efficiency issues in relation to building management and application, heating and cooling, air handling, lighting and electrical systems, and building control systems.

**2. BES 711 – Training provided by an energy management firm or one of the following courses:**

**2a. BES 707 – PIPE SYSTEM DESIGN**

A study of the design, application and operating characteristics of pipe system equipment.

**2b. BES 708 – AIR SYSTEM DESIGN**

A study of the design, application and operating characteristics of air system equipment. a Prerequisite: BES 707.

Seneca College may recognize work experience and previous academic training as credits toward either of its BES certificates.

Graduates of Seneca College’s BES program generate impressive energy savings for their organizations, as illustrated below:

**Annual Energy Savings Generated by One Group of BES 710 Graduates**

• Apartment buildings	\$104 000
• Office buildings	\$270 500
• Industrial buildings (with office space)	\$25 400
• Schools	\$4 000
• Hotels	\$22 000
• Shopping malls	\$10 000
• Churches	\$15 000
<b>TOTAL</b>	<b>\$450 900</b>

Seneca College and the Southern Alberta Institute of Technology (SAIT) are currently leading an effort to establish a national, academically validated accreditation program for building operators in the area of energy efficiency. This accreditation will eventually be recognized by training institutions and employers across Canada.

## **Southern Alberta Institute of Technology's Building Operator Training Program**

SAIT's Building Operator Training Program is an introduction to energy management, providing training in the areas of personal skills development, applied science, plant auxiliaries, heat-transfer equipment, microcomputers, refrigeration and air conditioning, heating systems, electricity, introductory AutoCAD, energy auditing, boiler systems, electrical systems and HVAC systems. The program includes hands-on laboratory work.

## **Training by an Energy Management Firm**

Training may also be provided by an energy management firm as part of an energy performance contract. This training tends to be system- and project-specific and is generally not based on a formal needs assessment. It should be viewed as a valuable supplement to – but not a replacement for – college-based training, where a needs assessment has indicated that the latter is necessary.

## APPENDIX B

# General Knowledge Questionnaire for Operators

*(Client training coordinator provides a copy to each building operator.)*

This self-assessment questionnaire was prepared to help you evaluate your general knowledge and readiness for building operator training.

The questionnaire is not intended to test your basic skills, but rather to help you recognize areas where you may want additional training. Answers to all questions are provided so you can mark your own questionnaire.

The questionnaire is divided into four sections:

- language skills
- mathematical skills
- science skills
- computer skills

Check off your answer beside each question. When you're finished, compare your responses to the answers provided on the last page.

If after completing the questionnaire you wish to take a basic course in math, language, science or computer skills, please indicate so when completing the "Staff Profile Section" of the *Energy Management Questionnaire for Operators*. Information on how to take this training will be included in your personal training plan, which will be given to you by the college.

**Return the questionnaire to the college specialist identified in your training kit.**

# General Knowledge Assessment

## A. Language Skills

Please read the following paragraph carefully.

There are several types of condensers used to convert refrigerant vapour to liquid refrigerant. Air-cooled condensers, which are generally used in small air conditioners, transfer heat to the outdoors through a coil of finned tubing. In water-cooled condensers, water flows through tubing within a refrigerant chamber to pick up and convey heat outdoors. The water may be cooled in a device that resembles an automobile radiator, or it may be cooled by evaporation. In evaporative cooling, water is pumped to a high, narrow outdoor structure called a cooling tower. These towers are frequently seen atop large factories and office buildings. The water is released from the top of the tower in a fine spray. Air blown through the spray causes some evaporation. The water is cooled in the process, and fresh water is added to the tower to replace the small amount lost by evaporation.

Please answer the following questions by checking what you think is the most correct answer based on the above paragraph:

1. To condense means to change from
  - a) liquid to solid
  - b) solid to liquid
  - c) liquid to gas
  - d) gas to liquid
  - e) gas to solid
  
2. A water-cooled condenser
  - a) heats up refrigerant
  - b) absorbs heat from the water
  - c) carries heat out of the building
  - d) involves evaporative cooling
  - e) converts steam to liquid water
  
3. A tower is
  - a) a tall structure
  - b) an elevator shaft
  - c) a type of fan
  - d) an ice-making machine
  - e) a form of ventilator

4. What do you often find on the roof of office buildings?
- a) fans
  - b) elevator shafts
  - c) water-cooled condensers
  - d) cooling towers
  - e) large factories
5. What cools down when air is blown through a fine spray of water?
- a) the air
  - b) the water
  - c) the elevator shaft
  - d) the condenser
  - e) the cooling tower

## B. Mathematics Skills

1. Express 0.875 as a fraction.
- a)  $1/8$
  - b)  $1/4$
  - c)  $2/3$
  - d)  $3/4$
  - e)  $7/8$
2. What is the total of  $(3/8) + (4/8)$ ?
- a)  $12/8$
  - b)  $12/64$
  - c)  $7/64$
  - d)  $7/8$
  - e)  $1\ 1/2$
3. Calculate  $(1+3) + (7+5)/4$ .
- a) 2
  - b) 3
  - c) 4
  - d) 7
  - e) 12

4. 16 is 20% of what number?
- a) 5.2
  - b) 8
  - c) 32
  - d) 80
  - e) 125
5. If  $2(x + 4) = 18$ , what is the value of  $x$ ?
- a) 1
  - b) 3
  - c) 5
  - d) 7
  - e) 9

### C. Science Skills

1. The following formula converts temperature from degrees Celsius to degrees Fahrenheit:  $^{\circ}\text{F} = 32 + ^{\circ}\text{C} (9/5)$ . What is the Fahrenheit equivalent for  $85^{\circ}\text{C}$ ?
- a)  $95.4^{\circ}\text{F}$
  - b)  $121^{\circ}\text{F}$
  - c)  $185^{\circ}\text{F}$
  - d)  $210.6^{\circ}\text{F}$
  - e)  $212^{\circ}\text{F}$
2. If you increase the voltage in an electric circuit, what change would you expect to occur in the current?
- a) it would increase
  - b) it would decrease
3. The North poles of two bar magnets
- a) attract each other
  - b) repel each other
4. What happens to the boiling point of water as you go higher up a mountain?
- a) it becomes higher
  - b) it stays the same
  - c) it becomes lower



5. Of the following three components of atoms, which are the lightest?

- a) electrons
- b) neutrons
- c) protons

## D. Computer Skills

1. A floppy disk drive would be classified as

- a) hardware
- b) software

2. ROM stands for

- a) Random Order Macro
- b) Repeat Old Messages
- c) Read Only Memory
- d) Reset Operating Memory
- e) Recognition of Optical Mouse

3. Which definition best describes a macro?

- a) A set of keystrokes that can be carried out by typing the name of the macro.
- b) A peripheral that can be added to increase the memory of the computer.
- c) A program larger than 10 megabytes.
- d) A program designed to interface with the World Wide Web.
- e) Computer slang for a major disaster such as blowing out your hard drive.

4. Which of the following is not likely to be a key on a computer keyboard?

- a) Tab
- b) Ctrl
- c) Alt
- d) Rem
- e) Shift

5. A modem is

- a) a built-in teaching device about a computer
- b) a computer store demonstration model
- c) a Multiple Operating Device Employing Macros
- d) a cross-linked monitor
- e) a device that helps your computer talk to other computers

# Answers to General Knowledge Assessment

## A. Language Skills

1. d    2. c    3. a    4. d    5. b

## B. Mathematics Skills

1. e    2. d    3. d    4. d    5. c

## C. Science Skills

1. c    2. a    3. b    4. c    5. a

## D. Computer Skills

1. a    2. c    3. a    4. d    5. e

## APPENDIX C

# Energy Management Questionnaire for Operators

*(Client training coordinator provides a copy to each building operator.)*

Please complete this questionnaire and return it to the college specialist identified in your training kit.

## Staff Profile Section

### 1. Personal Information

Name: \_\_\_\_\_

Building Location: \_\_\_\_\_

Preferred Mailing Address: \_\_\_\_\_

Telephone: (    ) \_\_\_\_\_ Fax: (    ) \_\_\_\_\_

E-mail Address: \_\_\_\_\_

### 2. Brief Background

Describe your job. \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Describe your qualifications. \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

How long have you worked in this field? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

How long have you worked in this building? \_\_\_\_\_

\_\_\_\_\_

Is your job best described as specialized or generalized?

- Specialized                       Generalized

How do you feel about the general physical conditions in your workplace?

- Very good                       Satisfactory                       In need of improvement  
 In poor condition and in serious need of improvement

### 3. Individual Training Preferences

Check the basic skills training you require as determined from your *General Knowledge Questionnaire for Operators*.

- Language                       Science  
 Mathematics                 Computer

When would you prefer to take training?

- During working hours       Evenings                       Weekends

In which format would you prefer to take training?

- In a classroom                 By correspondence  
 By electronic communications (e-mail, etc.)

### Energy Management Knowledge Section

For each category of performance in the following tables, rate your abilities as being one of the following:

**MIN:** Minimum knowledge. Very limited or no previous experience.

**BASIC:** Basic knowledge. Able to describe basic aspects of the building operation and use that knowledge in the workplace with some supervision.

**FULL:** Full knowledge. Able to fully describe the building operation and use that knowledge in the workplace without supervision.

## Heating

CATEGORIES OF PERFORMANCE	FULL	BASIC	MINIMUM
1 I am able to define the terms involved and capable of performing simple calculations involving temperature, heat and changes of state.			
2 I am able to draw a schematic of the basic refrigeration cycle, labelling all necessary components. I can use this sketch to explain to others the principles involved.			
3 I am able to explain heat exchange in both air- and water-cooled condensers and evaporators, and I can describe the efficient and safe operation of each.			
4 I am able to describe the purpose of metering devices in refrigeration and identify the advantages and disadvantages of the different types of devices in common use.			
5 I am able to use a psychometric chart and perform simple calculations regarding absolute humidity, enthalpy, dew point, relative humidity, wet bulb and dry bulb temperature readings.			
6 I am able to demonstrate a sound knowledge of the proper techniques for the safe and environmentally acceptable handling of refrigerants, including charging and removal procedures.			

## Air Conditioning and Refrigeration

CATEGORIES OF PERFORMANCE	FULL	BASIC	MINIMUM
1 I am able to identify the major means of heat distribution in any building, develop solutions to overcome localized problems, and initiate changes that will prevent energy waste.			
2 I am able to perform maintenance and operation procedures on gas and oil burners and can describe the proper storage and piping of gas and oil.			
3 I am able to explain to others the dangers of incomplete combustion. I feel confident recommending procedures to ensure complete combustion leading to safe, energy-efficient and environmentally responsible operation.			
4 I am comfortable reading heating drawings and can draw a basic hydronic heating circuit with all necessary valves, pumps and safety equipment.			
5 I am able to describe the fundamentals of both a hot water and steam heating system, detailing boiler operation and piping systems.			
6 I am able to describe in detail heating control systems and perform proper adjustments and maintenance of control equipment. I can also maintain heating units within a building.			

## Air Handling

CATEGORIES OF PERFORMANCE	FULL	BASIC	MINIMUM
1 I am able to identify the causes of poor indoor air quality in buildings and can undertake steps to reduce or eliminate the problems.			
2 I am able to describe several ways to detect undesirable gases in a building's air supply system and can initiate steps to eliminate them.			
3 I am able to analyse the air-handling system in a building and can determine if it is providing a safe and comfortable working environment.			
4 I am fully aware of construction and maintenance procedures for air distribution systems and their related components.			
5 I am able to describe the different types of air-filtering systems in use and can operate and maintain each type.			
6 I am able to describe the importance of humidification and dehumidification and the methods used to control and measure humidity levels.			

## Electricity

CATEGORIES OF PERFORMANCE	FULL	BASIC	MINIMUM
1 I am able to calculate volts, amps and ohms when any two are given in simple series, parallel or series-parallel circuits.			
2 I am able to draw diagrams to demonstrate how the principles of magnetism and electromagnetism are applied in generators, electric motors and transformers.			
3 I am able to describe three-phase power and can perform simple calculations related to it.			
4 I am able to describe how hydro-utility companies invoice for peak demand, power factor penalties, time-of-use billing and consumption charges, and how to keep these costs to a minimum.			
5 I am able to describe in detail all safety procedures that must be followed when working on electrical equipment. I am comfortable using meters and testing equipment associated with preventive maintenance on all types of electrical equipment.			
6 I am able to describe the operation of most electronic devices and give examples of the use of electronic equipment in building operations.			

## Controls

CATEGORIES OF PERFORMANCE		FULL	BASIC	MINIMUM
1	I am able to describe the differences between open- and closed-loop control systems and can explain this to others.			
2	I am able to describe a variety of different measuring devices (sensors) used by the control industry and can explain in basic terms how they operate.			
3	I am able to identify all components in a pneumatic control system and make appropriate adjustments.			
4	I am able to list the procedures that must be undertaken to maintain pneumatic and electronic control systems, detailing preventive measures on a daily to yearly basis.			
5	I am able to identify all equipment in a building that must be controlled by an automatic temperature control system and the criteria for safe and efficient operation of such equipment.			
6	I am able to describe the operation of master/submaster control sequencing and safety issues, including sewage discharge.			

## Water Treatment

CATEGORIES OF PERFORMANCE		FULL	BASIC	MINIMUM
1	I am able to identify the principal contaminants of untreated water and can explain how they can be removed.			
2	I am familiar with and can describe test procedures associated with water treatment.			
3	I am able to describe the principal methods used in external water treatment and can evaluate them on the basis of energy and water conservation.			
4	I am able to describe the principal methods used in internal water treatment and can evaluate them on the basis of energy and water conservation.			
5	I am able to explain the importance of water treatment in all types of systems and why different systems require different methods of water treatment.			
6	I am able to explain the relationship between water treatment and health and safety issues, including sewage discharge.			

## APPENDIX D

# Personal Training Guide, Plan and Registration Form

*(This is a sample of the personal training plan and guide that will be sent to each operator by the college specialist.)*

This personal training plan is the result of a comprehensive needs assessment process that included your own assessment of your basic skills and energy management knowledge and your interview with a training professional. Completing the recommended training will give you credits toward Seneca College's Building Environmental Systems program.

This plan is your personal record and has not been shared with your employer. However, the organization you work for has demonstrated a commitment to energy efficiency, and we encourage you to discuss this plan with your supervisor so that you can complete the recommended training.

### **How to Read and Use the Plan**

Sections 1 and 2 of the plan provide personal information and details of your existing job, experience level, etc. The objectives of the remaining sections of the plan are as follows:

### ***Energy Management Training Recommendations for College Accreditation***

#### ***Courses Recommended***

This section lists the recommended courses by category of learning.

#### ***Advanced Standing Credit***

Your work experience and prior training may qualify you for college accreditation. If so, you will need to provide the college specialist with documentation of your training in the subjects identified in this section.

#### ***Prior Learning Assessment***

Your work experience and current knowledge may qualify you for college accreditation if you pass a challenge exam in the subject areas listed in this section. If you qualify, a registration form is attached.

### ***General Knowledge Training Recommendations***

This section lists areas in which you identified a need to upgrade your skills after completing the *General Knowledge Questionnaire for Operators*.

### ***Recommended Delivery Agent and Order of Training***

A local delivery agent (usually a college) for the recommended training is identified in this section. The suggested order in which you should complete the training is also provided.

A form is included with your training plan to allow you to register for correspondence courses or other methods of individualized learning. For courses in a classroom setting, please apply directly to the local delivery agent.

### ***College Specialist's Name and Address***

The name, address and other contact information for the college specialist who prepared your plan is provided here. This is the person to contact if you have any questions or require additional information about the training plan.



# Building Operations Training Plan

*(The college specialist is to complete a plan for each operator. The plan is sent directly to the operator by the college.)*

## 1. Personal Information

Name: \_\_\_\_\_

Building Location: \_\_\_\_\_

Preferred Mailing Address: \_\_\_\_\_

Telephone: (    ) \_\_\_\_\_ Fax: (    ) \_\_\_\_\_

E-mail Address: \_\_\_\_\_

*Please call Seneca College at 1-800-572-0712 if any of this information changes.*

## 2. Brief Background

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## 3. Energy Management Training Recommendations for College Accreditation

Courses Recommended: \_\_\_\_\_

Advanced Standing Credit: \_\_\_\_\_

Prior Learning Assessment: \_\_\_\_\_

## 4. General Knowledge Training Recommendations Identified

- Language       Science  
 Mathematics       Computer

## 5. Recommended Delivery Agent and Order of Training

Local Delivery Agent: \_\_\_\_\_

We recommend that you take training in this order:

1. General knowledge training
2. College training
3. Training from the energy management firm (if applicable)

## 6. College Specialist's Name and Address

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone: (    ) \_\_\_\_\_ Fax: (    ) \_\_\_\_\_

# BES Training Registration Form

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone: (     ) \_\_\_\_\_ Fax: (     ) \_\_\_\_\_

E-mail Address: \_\_\_\_\_

## A. Classroom Learning

Section 5 of your training plan lists a local delivery agent, if one is available. Please indicate if you are interested in this option (Seneca College can assist you in registering).

I am interested in classroom learning.

## B. Individualized Learning (through distance education)

In areas where classroom learning is not available or if you prefer to pursue training through individualized learning, you can register directly with Seneca College and begin your training immediately.

List the subjects in which you wish to register for individualized learning.

\_\_\_\_\_  
\_\_\_\_\_

Fee: \$395 per subject (x number of subjects = \$\_\_\_\_\_)

*Note: Discounts may be available for corporate groups of 10 or more.*

Identify your preferred method of individualized learning (mark a 1 beside your first choice, 2 beside your second choice, etc.).

\_\_\_ Correspondence (by postal system to the address provided above)

\_\_\_ E-mail (make sure your address is provided above)

\_\_\_ First Class Computer Conferencing

## C. Prior Learning Assessment

List the subjects for which you are eligible to complete the prior learning assessment process.

\_\_\_\_\_  
\_\_\_\_\_

Fee: \$75 per subject (x number of subjects = \$\_\_\_\_\_)

## D. Workplace Supervisor

When taking individualized learning or participating in the prior learning assessment process, the final exam must be completed in the presence of a workplace supervisor. Please identify this individual: \_\_\_\_\_

## Submitting Your Registration Form

Complete and return this form to:

Energy Training Office  
Seneca College  
Centre for the Built Environment  
1750 Finch Ave. East  
North York, ON M2J 2X5

## APPENDIX E

### College Listing

All of the colleges (and other organizations) listed in this appendix offer energy management training. However, as noted earlier, the Energy Training Office at Seneca College is the lead agency for delivery of the training process described in this guide. This office should be your first point of contact for incorporating energy management training into an energy efficiency project:

Energy Training Office  
Seneca College  
Centre for the Built Environment  
1750 Finch Ave. East  
North York, ON M2J 2X5  
Phone: (416) 494-4392 or 1-800-572-0712  
Fax: (416) 494-9178  
E-mail: sheila.hirsch@senecac.on.ca  
Web site: <http://www.senecac.on.ca/~eto>

- ⊕ Colleges identified with this symbol are actively delivering the Building Environmental Systems (BES) comprehensive training program in their regions.
- ✦ Colleges identified with this symbol have access to the BES program and the needs assessment process described in this guide.

**Algonquin College ✦**  
1385 Woodroffe Ave.  
Nepean, ON K2G 1V8  
Phone: (613) 727-4723 ext. 5105  
Fax: (613) 727-7771  
Tim Breton

**British Columbia Institute of Technology ⊕**  
3700 Willingdon Ave.  
Burnaby, BC V5G 3H2  
Phone: (604) 432-8558  
Fax: (604) 439-0426  
Garry White

**Cambrian College ⊕**  
1400 Barrydowne Road  
Sudbury, ON P3A 3V8  
Phone: (705) 566-8101  
Fax: (705) 524-7327  
Laura Broderick

**Canadore College ✦**  
P.O. Box 5001  
North Bay, ON P1B 8K9  
Phone: (705) 474-7600 ext. 6555  
Fax: (705) 472-7169  
Peter Sheppard  
[sheppard@ccourt.canadorec.on.ca](mailto:sheppard@ccourt.canadorec.on.ca)

**College of the North Atlantic Seal Cove Campus ✦**  
P.O. Box 10  
Conception Bay South, NF A0A 3T0  
Phone: (709) 744-1935  
Fax: (709) 744-3541  
Bill Haynes  
[bhaynes@northatlantic.ca](mailto:bhaynes@northatlantic.ca)

**Conestoga College ✦**  
299 Doon Valley Drive  
Kitchener, ON N2G 4M4  
Phone: (519) 748-5220 ext. 406  
Fax: (519) 748-3521  
Mike Harttrup  
[mharttrup@cs7.conestogac.on.ca](mailto:mharttrup@cs7.conestogac.on.ca)

**Confederation College ✦**

P.O. Box 398  
Thunder Bay, ON P7C 4W1  
Phone: (807) 475-6296  
Fax: (807) 623-3175  
Sally Jackson

**Durham College ✦**

Skills Training Centre  
1610 Champlain Avenue  
Whitby, ON L1H 6A7  
Phone: (905) 721-3309  
Fax: (905) 721-3338  
Esther Patterson  
susy-taylor@mail.durhamc.on.ca

**École des métiers et occupations de l'industrie de la construction ☉**

1060, rue Borne  
Québec City, QC G1N 1L9  
Phone: (418) 681-3512  
Fax: (418) 681-2410  
Carole Gingues

**Fanshawe College ✦**

1460 Oxford Street East  
London, ON N5V 1W2  
Phone: (519) 452-4436  
Fax: (519) 452-1343  
Mike Westmorland  
westmorland@fanshawec.on.ca

**Georgian College ✦**

1 Georgian Drive  
Barrie, ON L4M 3X9  
Phone: (705) 728-1968 ext. 1625  
Fax: (705) 722-5180  
Tom Morrisey  
tmorrisey@central.georcoll.on.ca

**Holland College ✦**

Royalty Centre  
40 Enman Crescent  
Charlottetown, PE C1E 1E6  
Phone: (902) 566-9335  
Fax: (902) 566-9321  
David Webster  
dwebster@hollandc.pe.ca

**La Cité Collégiale ☉**

2645 boulevard Saint-Laurent  
Ottawa, ON K1G 5H8  
Phone: (613) 783-2483 or 1-800-267-2483

**La Commission Scolaire Sainte-Croix ☉**

Le service de l'éducation des adultes et  
de la formation professionnelle (SEAFP)  
1450 rue Filion  
Saint-Laurent, QC H4L 4E8  
Phone: (514) 747-8606  
Fax: (514) 748-0961  
Wojtek Winnicki

**Lambton College ☉**

P.O. Box 969  
Sarnia, ON N7T 7K4  
Phone: (519) 542-7751

**Loyalist College ☉**

Wallbridge-Loyalist Road  
P.O. Box 4200  
Belleville, ON K8N 5B9  
Phone: (613) 969-1913

**Malaspina University – College ✦**

900-5th Street  
Nanaimo, BC V9R 5S5  
Phone: (250) 753-3245  
Fax: (250) 741-2459  
Dan Wood  
woodd@mala.bc.ca

**Mohawk College ✦**

Fennell Avenue & West 5th  
Hamilton, ON L8N 3T2  
Phone: (905) 575-2203  
Fax: (905) 575-2292  
Michelle Chamberland

**New Brunswick Community  
College St. Andrews ✦**

P.O. Box 427  
St. Andrews, NB E0G 2X0  
Phone: (506) 529-5026  
Fax: (506) 529-5216

Terry Dempsey  
td5026@gov.nb.ca **Niagara College ✦**

P.O. Box 1005  
Welland, ON L3B 5S2  
Phone: (905) 735-2211 ext. 7516  
Fax: (905) 735-2286

Sue Tallon

**Northern Alberta Institute of Technology ☉**

11762-106 Street  
Edmonton, AB T5G 2R1  
Phone: (403) 471-7584  
Fax: (403) 471-8993  
Harold Hayter

**Northern College ☉**

Highway 101 East  
South Porcupine, ON PON 1H0  
Phone (705) 235-7230  
Fax: (705) 235-7279  
Maurice Routhier

**Nova Scotia Community College ✦**

1825 Bell Road  
Halifax, NS B3H 2Z4  
Phone: (902) 424-7981 ext. 7981  
Fax: (902) 424-0553  
Phil Davison

**Red River Community College ☉**

2055 Notre Dame Avenue  
Room A125  
Winnipeg, MB R3H 0J9  
Phone: (204) 632-2156  
Fax: (204) 633-6075

**St. Clair College ✦**

2000 Talbot Road West  
Windsor, ON N9A 6S4  
Phone: (519) 945-4007 ext. 238  
Fax: (519) 945-7674  
William VanderStelt

**St. Lawrence College ☉**

King Street & Portsmouth Avenue  
Kingston, ON K7L 5A6  
Phone: (613) 544-5400 ext. 1238  
Fax: (613) 545-3915  
Barry Keefe

**Sault College ☉**

443 Northern Avenue  
Sault Ste. Marie, ON P6A 5L3  
Phone: (705) 759-6700 or 1-800-461-2260

**Seneca College ✦**

Energy Training Office  
Newnham Campus  
1750 Finch Avenue East  
North York, ON M2J 2X5  
Phone: (416) 494-4392 or 1-800-572-0712  
Fax: (416) 494-9178  
Sheila Hirsch  
sheila.hirsch@senecac.on.ca

**Sheridan College ✦**

407 Iroquois Shore Road  
Oakville, ON L6H 1M3  
Phone: (905) 845-9430 ext. 8039  
Fax: (905) 815-4101  
Dan Piedra  
dan.piedra@sheridanc.on.ca

**Sir Sandford Fleming College ☉**

Sutherland Campus  
Brealey Drive  
Peterborough, ON K9J 7B1  
Phone: (705) 749-5530 or 1-800-461-6423  
Alan Bird

**Saskatchewan Institute of Applied Science &  
Technology SIAST – Kelsey Institute ☉**

Idylwyld & 33rd Street  
Saskatoon, SK S7K 3R5  
Phone: (306) 933-8057  
Fax: (306) 933-5309  
Gord Vaxvick  
vaxvickg@siast.sk.ca

**SIAST – Wascana Institute ☉**

P.O. Box 556  
Regina, SK S4P 3A3  
Phone: (306) 787-8045  
Fax: (306) 787-4278  
Bill Senft  
senft@siast.sk.ca

**Southern Alberta  
Institute of Technology SAIT** ☉  
1301-16 Avenue NW  
Calgary, AB T2M 0L4  
Phone: (403) 284-8290  
Fax: (403) 284-8262  
Larry Sever  
larry.sever@sait.ab.ca

**University College of the Caribou** ☉  
P.O. Box 3010  
Kamloops, BC V2C 5N3  
Phone: (250) 828-5725  
Fax: (250) 828-5492  
Ralph R. Finch

**DBSF** ✦  
7333 rue Saint-Denis  
Montréal, QC H2R 2E5  
Phone: (514) 278-3273  
Fax: (514) 278-7224  
Jean-Marc Chouinard  
jmchouinard@dbsf.pixelweb.net

**Collège Ahuntsic** ☉  
c/o DBSF  
7333 rue Saint-Denis  
Montréal, QC H2R 2E5  
Phone: (514) 278-3273  
Fax: (514) 278-7224  
Bob Venafro  
rvenafro@dbsf.pixelweb.net

**College Boreal** ☉  
21 boulevard Lasalle  
Sudbury, ON P3A 6B1  
Phone: (705) 521-6026  
Fax: (705) 560-7641  
Michelle C. Mailloux  
www.borealc.on.ca

**Manitoba Energy Management Task Force** ☉  
c/o Lisbeth Liebgott  
Pollution Prevention  
Manitoba Environment  
123 Main Street, Suite 160  
Winnipeg, MB R3C 1A5  
Phone: (204) 945-8980  
Fax: (204) 945-1211  
lliebgott@env.gov.mb.ca