Office of Energy Efficiency
Energy Innovators Initiative

Technical Fact Sheet

The Future is Free

Association of Canadian Community Colleges

Renewable Energy

Energy Use and Emerging Renewable Energy

Energy-efficient practices are becoming more necessary as energy prices continue to rise and the impacts of climate change emerge. Institutions that adopt measures to reduce energy and the associated greenhouse gas emissions will reap financial, environmental and social benefits. One way to ease the financial burden of increasing energy price volatility is to reduce dependence on electricity, propane, oil and natural gas by switching to emerging renewable energy sources, including solar energy (direct, passive and active), wind, biomass, micro-hydro and geothermal (heat from the ground). Renewable energy is readily available and, once capital costs are incurred, it is virtually free. Systems may stand alone, i.e., off the utility grid, or be inter-tied (connected) to the grid. In Canada, large-scale hydro-electricity constitutes the bulk of the renewable energy supply. However, significant opportunities exist by using emerging renewable energy technologies.

Solar – Direct, Passive and Active

Direct solar energy can be converted to electrical energy through the technology of photovoltaic (PV) panels. These panels, much like the ones found on solar-powered calculators and watches, consist of solar cells that trap energy from flowing electrons to produce electricity. An inverter converts the DC (direct current) energy to AC (alternating current) energy, which is then used for immediate electrical needs or stored in battery banks. PV panels can be mounted on south-facing rooftops or be integrated into building façades.

Passive solar energy is generally considered the easiest and most cost-effective way to provide heat in new building construction, where factors such as orientation, size, position, glazed area and materials can be controlled to maximize solar absorption. Instead of mechanical equipment, building elements such as walls, windows, floors and roofs control heat generated by solar radiation. The heat gains are then distributed by pumps or fans to regulate temperature.

Active solar energy is used to heat water and/or air via solar collectors. Unlike PV panels, which generate electricity, active solar energy panels convert sunlight into heat for water and space heating. Active solar energy systems are very efficient for heating hot water for swimming pools or general use, as well as for warming liquid for radiant floor heating.

Natural Resources Canada
Office of Energy Efficiency
Ressources naturelles Canada
Office de l'efficacité énergétique
Canada

The British Columbia Institute of Technology

CASE STUDY

The British Columbia Institute of Technology has installed 1 kW of AC photovoltaic modules as part of the building façade. The electricity produced is transferred to the utility grid. This experimental system is a project of the Institute's Photovoltaic Energy Applied Research Lab (PEARL).

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The Toronto District School Board

CASE STUDY

The SOLARWALL® is a unique building façade system employing active passive solar technology coupled with PV panels to power the fans. This system has been successfully installed in a high-rise seniors' residence as well as the Toronto District School Board and several schools in Canada, including one in Yellowknife, Northwest Territories. It is effective for both heating and cooling purposes and can be applied to any building that uses ventilation air.

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Wind

Wind turbines are a highly effective mechanism for generating energy, as wind is in relatively constant supply. Furthermore, modern turbines can generate electricity efficiently at low wind speeds, thereby increasing the return on investment. The efficacy of wind-derived energy depends on wind speed, which is determined by geographic qualities such as proximity to large lakes and oceans, land elevation (e.g., mountains) and landscape features such as tall trees and buildings.

Yukon College

CASE STUDY

Yukon College has installed a hybrid renewable energy system consisting of a 1.5-kW wind generator and 40 50-kW solar PV panels. This system is currently being used as a demonstration facility and supplies part of the energy needs for its building. While the efficacy of the project has yet to be analysed, the college will begin energy tracking shortly, when the power produced can be transferred back to the grid.

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Biomass

Biomass energy is derived from organic matter, which releases energy through digestion, decomposition or combustion. Sources are generally region-specific and may include wood, wood residues, crop wastes and refuse. Combustion of crop wastes produces heat that can be captured to heat buildings, whereas gasification (decomposition) converts solid fuel into combustible gases that can be burned like natural gas to generate electricity.

Agricultural University of Norway

CASE STUDY

The Energy Centre at the Agricultural University of Norway uses biopellets made from wood pulp as an alternative to oil for its heating system. A biofuel plant was constructed on campus and integrated into the existing district heating system. The system replaces an estimated 1.1 million litres of oil a year and meets 90 percent of the energy demand of the heating system. Under the current energy pricing regime, the system should pay for itself in 15 years; however, an expected carbon dioxide tax will effectively reduce this time period.

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Geothermal

Ground-source heat pump systems employ heat from the ground (geothermal energy) or water and operate with a heat exchanger and heat pumps within either open- or closed-loop designs. This type of system is most often used for space heating and cooling requirements, and can also supply hot water for commercial or domestic use and radiant floor heating. It has been estimated that geothermal energy can meet 67 percent of total commercial energy demand. Although capital costs are generally higher than for conventional systems, geothermal systems have the lowest lifecycle costs, and payback is accomplished within a relatively short period of time.

Lady Meredith House, McGill University

CASE STUDY

A geothermal system was installed in 1991 at this architectural landmark to replace the conventional heating and cooling equipment. The system comprises a closed vertical loop energy source and a basic mechanical room interfaced with digital controls and monitoring equipment. This highly successful pilot project had a payback period of 5.7 years.

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Micro-Hydro

Micro-hydro systems, also referred to as run-of-river systems, can readily supply AC electrical and space heating demands. Systems consist of turbines powered by pressurized water acquired via gravity-operated pipelines. The energy produced can be used immediately or stored in batteries, depending on flow rates and energy output. Micro-hydro systems are site-specific and generally small in scale, thereby mitigating environmental impacts.

For More Information

A variety of reliable and effective emerging renewable energy systems can be applied in energy efficiency programs to reduce dependence on traditional energy sources. Implementing these "inflation-proof" technologies will alleviate the financial burden associated with continuing price fluctuations, improving the bottom line as well as the learning environment. To help you in your decisions, Natural Resources Canada has established the Renewable Energy Deployment Initiative (REDI), a program that provides assistance in implementing active solar air-heating systems, solar hot water systems, ground-source heat pumps and high-efficiency/low-emissions biomass combustion systems. Find out more by visiting the REDI Web site at http://www.nrcan.gc.ca/redi or by calling 1 877 722-6600 toll-free. To obtain more information on how renewable energy technologies can help you, visit the Canadian Renewable Energy Web site at http://www.canren.gc.ca.

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OEE

Office of Energy Efficiency
Office de l'efficacité énergétique

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

The Office of Energy Efficiency of Natural Resources Canada is a dynamic organization with a mandate to renew, strengthen and expand Canada's commitment to energy efficiency in order to help address the challenges of climate change.

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