Notebook

Notebook provides data not easily found elsewhere and background descriptions of important aspects of the energy system. Contributions are invited.

This note provides additional information to follow up the feature on cogeneration in the pulp and paper industry and a paper on district energy systems in Volume 5, Number 2.

Major Cogeneration Projects in Canada

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There are a growing number of cogeneration projects in operation in Canada for the combined production of power and heat, the latter normally recovered in the form of steam for both industrial and heating purposes. Most of these facilities are fueled with natural gas although some derive their energy from biomass sources. Proposals to build such installations have generally exceeded previous estimates and limits have had to be placed on the quantity of electricity purchased by utilities in some provinces. It is noteworthy that sizable installations are now being proposed in Québec with its substantial economic hydraulic generation. Two facilities are planned in that province near Ottawa: (1) a $160-million unit by the Indeck Company in Hull opposite the Parliament Buildings, approved by the Provincial Government, will generate 142 MW, with the steam going to the adjoining E.B. Eddy Company and Scott Paper plants; and (2) a somewhat similar facility planned at another nearby paper mill

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Table of Major Cogeneration Projects in Canada

MW	Company	Location	System Description
112	Howe Sound Pulp and Paper	Port Melon, BC	Hog-and black liquor-fuelled boilers with condensing/extraction steam turbines. Surplus electricity to BC Hydro.
110	TransAlta Energy	Mississauga, Ont.	Gas-fired combined cycle. Steam to McDonnell Douglas aircraft plant. Electricity to Ontario Hydro.
101	Northland Power	Kirkland Lake, Ont.	Gas and wood waste combined cycle. Electricity sold to Ontario Hydro.
107	Centra Gas	Fort Frances, Ont.	Gas-fired combined cycle. Steam to Boise Cascade mill. Surplus electricity to Ontario Hydro.
92	Westcoast Energy and CU Power	Taylor, BC	Gas-fired combustion turbines. Steam and electricity to adjacent gas-processing plant. Surplus electricity to BC Hydro.
68	TransAlta Energy	Ottawa, Ont.	Gas-fired combined cycle. Steam, hot and chilled water sold to adjacent hospitals. Electricity to Ontario Hydro. (See ESR 4:2:181-82)
60	NW Energy	Williams Lake, BC	Wood waste fuelled boilers with condensing turbine. Electricity and steam to mill. Surplus electricity to BC Hydro.
39	Northland Power	Cochrane, Ont.	Gas and wood waste combined cycle. Electricity to Ontario Hydro.
39	Dupont Canada	Maitland, Ont.	Gas-fired combustion turbine. Electricity and steam used in plant. Surplus to Ontario Hydro.
16	Cascades Inc.	Kingsley Falls, Que.	Gas-fired combustion turbine. Electricity and steam used in plant.

Note: One of the major combined power and heat projects in Canada is operated in conjunction with the generation of nuclear energy. Most nuclear plants operate in base load mode and thus can be a steady source of thermal energy to near-by industries. At the Bruce Generating Station of Ontario Hydro there are eight CANDU reactors in operation with a total capacity of 7000 MW, although four of these reactors are presently operating under reduced power. The Bruce Bulk Steam System can provide 5350 MW of medium pressure steam from the nuclear generating facilities, which is used mainly to supply energy for the one heavy water plant still in operation. This steam is also used for station heating requirements and to supply an adjacent industrial park, which includes greenhouses primarily used for the growing of tomatoes.

in Gatineau. Such facilities can be commissioned typically in two or three years, a notably shorter period than for large centralized coal or nuclear generating stations. The investment required is usually between $1000-1200/kWe depending on the specific requirements of individual sites. These installations may qualify as investments in energy conservation equipment and so be eligible for Capital Cost Allowance under Class 34 of the federal Income Tax Act. If so, three year, 25-50-25%

straight line depreciation may be applicable. Up to 80% of the total capital invested may qualify in a typical case, but to take full advantage of this tax concession, the company must have income from other energy-related activities against which to apply this depreciation.

Many cogeneration facilities are in operation or planned in the US. In fact, a significant fraction of the recent expansion of Canadian natural gas exports is directed towards new such installations in that country. Part of the reason may be the foreclosing of the nuclear option. Despite aggressive Demand Side Management efforts in recent years, additional electrical supply may be needed, but the increased demand could easily occur at a time when little additional output from nuclear facilities will be coming on stream. Although no new nuclear facilities have been ordered in the US for over 20 years, the supply of nuclear-generated electricity had been steadily increasing, by some 5%/year, as the reactors under construction were finally commissioned and as the performance of operating reactors improved. In 1992, however, the increase of electricity from this source was only 1%. From now on, even in the unlikely event that new reactors were to be ordered soon, nuclear generation will not increase substantially in the coming decade. To meet a modestly growing but still uncertain demand, and given the environmental obstacles to the expansion of coal-based generation and the relatively low price of natural gas in recent years, it is not surprising that a large number of cogeneration projects based upon gas are in operation or planned in the US. The recent fall in the price of oil raises the question as to whether some light distillates might also be used as fuel in some cases.

The technical limits on the cogeneration option in Canada depend upon the number of locations where a sizable but steady and reliable outlet exists for the steam. Generally, the conditions are favourable in the pulp and paper industry, and also in situations where there may be a concentrated heating or cooling load, such as that involved in the supply of steam for a central heating/cooling system serving a number of nearby buildings. From an institutional viewpoint, the cogeneration facility is frequently owned and operated by a separate company, which may specialize in the operation of several of these units in different locations. This company contracts to supply the power to the local utility (either the surplus not needed by the industry served or the entire output) and the steam to the local user.

In the above table the projects are listed in order of size of electrical capacity. The list is not necessarily complete and does not include turbines located in oil refineries or major chemical plants where internal generation is a practice of long standing. It is also noteworthy that a large amount of cogeneration actually occurs in the conventional steam cycle of fossil fuel-fired generating stations. In this case the same principle is used to increase thermal efficiency in the generation of electricity: the pressurized boiler feed water is preheated by extracting steam from the turbine at several locations of increasing pressure.

District Heating and Cooling Systems in Canada

Most Canadian district heating installations operate without the cogeneration of electricity but this situation may change over the years as it has in some Scandinavian countries. In some cases, the district heating systems take advantage of an existing thermal power plant. Some of these systems have operated for many years, including the original Winnipeg installation.

The major operating systems at present are:

1. Corporation de Chauffage Urbain de Montréal (CCUM): This is a large steam heating system which currently serves about 10 large commercial buildings in the heart of the city. It is based upon a system operated for many years by Canadian National.
2. Toronto District Heating Corporation: This heating system with a load of over 200 MW(thermal) is thought to be the third largest district heating system in North America.
3. London District Heating and Cooling: There has long been a central system for heating and cooling in this city. Currently the system is owned by TRIGEN Inc., the US subsidiary of the French company which also owns CCUM

in Montréal.

4. Ottawa Public Works Systems: Public Works Canada (PWC) operates several systems in Ottawa. Altogether there are about eight systems in the city, including those operated by the University of Ottawa and Carleton University. The Cliff Street plant operated by PWC is one of the largest cooling systems in Canada.
5. Central Heat Distribution Limited: This company operates a well-regarded system in Vancouver.

In addition to these selected major examples, there are about 150 smaller systems operated by universities, other levels of government and by the Department of Defence. A number of other systems are now at the advanced planning stage and include:

- Metropolitan Toronto District Energy System
- Lakeview/Mississauga District Energy System
- Kingston District Energy System
- Geraldton District Heating System
- Grassy Narrows District Heating System
- Regina District Heating System
- Moose Jaw District Heating System
- Halifax/Dartmouth District Heating and Cooling Project and associated Department of Defence Project
- Prince Edward Island System in Charlottetown
- Cornwall District Heating Limited
- Deep Lake Water Cooling Project in Toronto.

This list indicates that district heating will become more important in the future in Canada.