Research & Development Highlights

93-216 Technical Series

Cogeneration Systems in Multi-Unit Residential Structures

Introduction

Cogeneration involves the simultaneous production and utilization of thermal (heat) and electrical energy. Conventional electrical generating systems waste thermal byproducts. Cogeneration can increase useful output to fuel input (efficiency) from a nominal *25%* to *75%,* when compared to traditional thermal-electric generating techniques.

The feasibility of cogeneration depends on:

- the ratio of electrical to fossil fuel costs
- the installation cost
- the building size and occupancy; and
- the design of the domestic hot water heating and electrical power systems.

Research Program

The consultant;

- reviewed cogeneration system products;
- determined the characteristics of the thermal and electrical loads in several multi-unit residential buildings having a range of sizes (# units);
- developed design concepts and cost budgets for four of the buildings; and
- assessed the financial worth of this technology.

Description of Publication

The report is divided into two parts. The initial part provides background information on cogeneration and presents a screening technique to size a system and assess whether a more detailed analysis is warranted. Data for 10 facilities was collected and evaluated. Work sheets are included in the appendices, and can be used by non-technical staff

The second part presents the findings of a technical and economic analysis of cogeneration applicability on 4 benchmark projects ranging in size from 118 to 720 apartments. This “engineering assessment” presents the design criteria, conceptual development, preliminary sizing, capital costs, operating benefits and payback periods for cogeneration systems. This part is intended for engineers and technical practitioners involved in the design, installation, and operating aspects of systems. A detailed description is included in the appendices.

The industry “rule of thumb” for sizing cogeneration systems is to require 9 months full load operation. Residential structures have a summer thermal (domestic hot water) load. A unit sized somewhat greater than this load can be used to offset a portion of the space heating load. The unit(s) selected did not provide more electrical power than was required by the building.

NHA 6330

CMHC SCHL
Helping to house Canadians

Performance outputs for cogeneration units at 40% and 100% of full load are presented. The hourly profiles indicate that cycling may take place between midnight and *5* AM and the proposed units are inadequate to provide for the peak usage between 7 and 11 AM and *5* and & PM.

The total installed costs for the four "benchmark" buildings range from $1,440 per kW (largest at 275 kW) to $2,250 per kW (smallest at 40 kW). Costs for an installation in a new building would be lower than in an existing building.

Cogeneration is presently not economically feasible for units less than 100 kW, or for buildings requiring substantial retrofit expenditures for installation.

The economic feasibility of cogeneration is dependent upon the difference between electrical and fuel costs and therefore varies by region.

Additional work is required to perform a detailed engineering design, and monitor the operation of different systems. A sizing sensitivity analysis and a review of the cogeneration selection procedure should also be performed.

Implications for the Housing Industry

Cogeneration is a new technology for Canadian multi-unit residential buildings. It has the potential to reduce costs, increase energy efficiency, and reduce the greenhouse gases and thermal pollution required to operate these structures.

A cogeneration installation can provide substantial cost savings if a larger electrical service is required due to a renovation or addition. Also, this technology has potential in all large, new high-rise projects.

Project Manager: Wayne Webster
Research Report: Cogeneration Systems in Multi-Unit
Residential Structures
Research Consultant: JJ. Richards & Associates Limited

A full report on this research project is available from the Canadian Housing Information Centre at the address below.

Housing Research at CMHC
Under Part IX of the National Housing Act, the Government of Canada provides funds to CMHC to conduct research into the social, economic and technical aspects of housing and related fields, and to undertake the publishing and distribution of the results of this research. This factsheet is one of a series intended to inform you of the nature and scope of CMHC technical research program.

The ***Research and Development Highlights*** *factsheet is one of a wide variety of housing-related publications produced by CMHC.*

For a complete list of Research and Development Highlights, or for more information on CMHC housing research and information, please contact:

The Canadian Housing Information Centre
Canada Mortgage and Housing Corporation
700 Montreal Road
Ottawa, Ontario
K1A 0P7

Telephone: (613) 748-2367
FAX: (613) 748-2098