Archived Content

Information identified as archived is provided for reference, research or recordkeeping purposes. It is not subject to the Government of Canada Web Standards and has not been altered or updated since it was archived. Some of this archived content is available only in one official language. Translation by CMHC can be requested and will be provided if demand is sufficient.

Contenu archivé

Le contenu identifié comme archivé est fourni à des fins de référence, de recherche ou de tenue des dossiers; il n'est pas assujetti aux normes Web du gouvernement du Canada. Aucune modification ou mise à jour n'y a été apportée depuis son archivage. Une partie du contenu archivé n'existe que dans une seule des langues officielles. La SCHL en fera la traduction dans l'autre langue officielle si la demande est suffisante.

CANADA MORTGAGE AND HOUSING CORPORATION

Better Buildings

Issue 3

OPERATING • MANAGING • REPAIR • RETROFIT • RENOVATION

Heating and hot water retrofit: Gas conversion and replacement of boilers, tank and valves

Summary

Residents of a 36-unit housing cooperative complained about erratic hot water temperatures and suites that were either too hot or too cold. The property manager felt energy costs were too high, and that repairs to the heating and hot water systems were too frequent, and caused major disruptions.

Building exterior

In Victoria, natural gas distribution began in 1987. The gas utility offered incentives to convert heating and hot water to natural gas. The Cooperative board analysed its entire heating and hot water system. The board documented complaints, listed the maintenance problems, and determined costs. Using the Board's information, a heating contractor designed and built a natural gas system for the Cooperative.

The project cost $38,000 was completed without seriously inconveniencing residents. As a result of the work, resident complaints about heat and hot water have disappeared, maintenance problems have been reduced and operating costs have gone down about $6,000 a year.

The Building

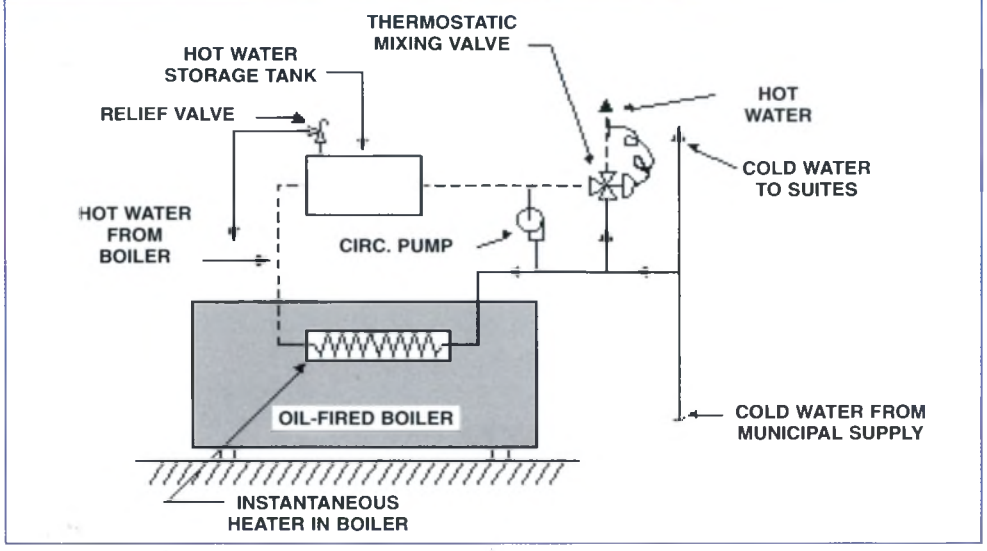
Built in 1965 for the 1678 Fort Street Housing Cooperative, the 2,230 m² (24,000 sq.ft) four storey wood frame apartment building has 36 suites, all occupied by seniors. The residents run the building through a board of directors that employs a resident manager and a property management company.

The building was originally heated with hot water radiators, served through a central boiler fueled by oil from a buried tank. Thermostatic radiator valves controlled heat in each suite.

An instantaneous heater inside the central boiler provided domestic hot water. Hot water was stored in a separate tank. A circulating pump between the tank and the heater kept the water hot. As the water

CMHC SCHL
Canada

Figure 1: Original Domestic hot water and heating installation



could become very hot—85°C (185°F), a mixing valve regulated temperature by adding cold water.

The comfort, operating and maintenance issues of the original heat and hot water system, shown in Figure 1, were identified as the following:

1. Energy costs were high because the large central boiler ran year-round to provide domestic hot water. As it produced more heat than was needed to supply hot water, there was considerable energy wastage in warm weather. More heat loss was caused by poor insulation of the equipment.

2. Space heating temperature was inadequately regulated. Some suites would overheat and residents would open windows. At the same time, other suites would be cold. There were two causes for this: the thermostatic radiator valves were wearing out and could no longer control heat distribution efficiently, and the single boiler couldn't meet the demand for both heat and hot water.

3. Uneven hot water temperature and insufficient supply. The original design used a central thermostatic mixing valve which could not respond to rapid changes in water demand, causing temperature fluctuations—and discomfort for people showering. Because the storage tank was too small for a 36-unit building, hot water would run out at peak times.

4. Heating system maintenance costs were high. When a thermostatic radiator valve needed repair or replacement, the whole system had to be drained because there was no way to isolate the individual control valves. This was expensive, time consuming and inconvenient. Because of this frequent draining chemical treatment could not be used to deal with rust and deposits, making poor system performance worse.

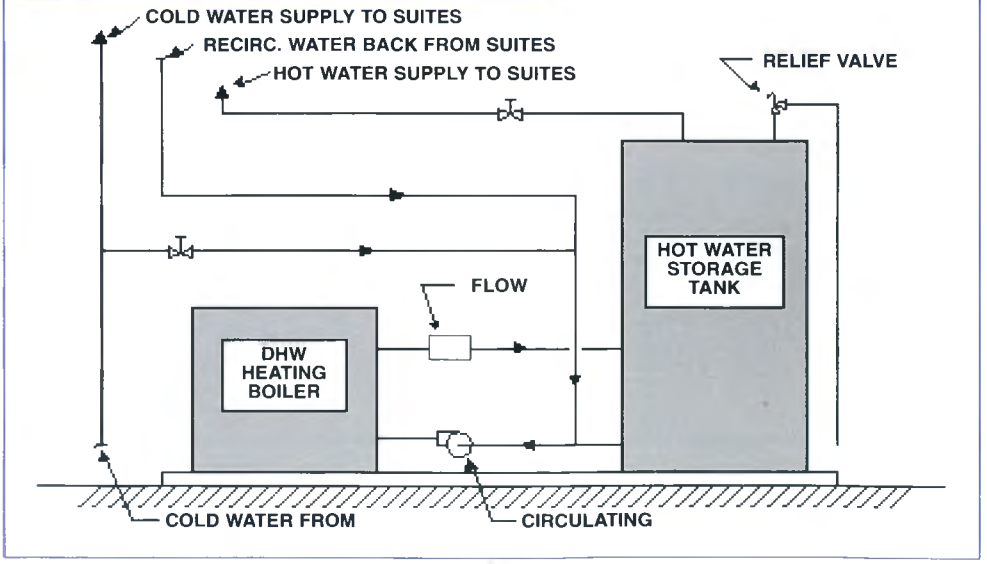
The Project

The Cooperative outlined the problems to a service contractor who also designs and installs. The contractor proposed solutions using standard equipment that is easy to understand and operate.

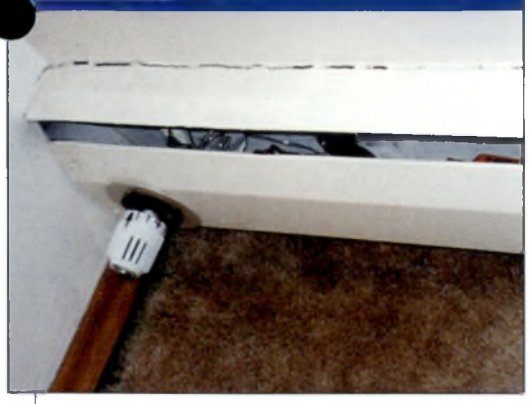
The contractor installed separate boilers for heat and hot water to reduce energy costs and improve space heating, hot water supply and water temperature. The separate boilers can respond to demand.

To reduce maintenance costs the contractor replaced the thermostatic radiator valves. New isolation valves were installed on either side of the new valves. Now, each thermostatic radiator valve can be isolated for servicing, and the heating system does not have to be drained every time there is a problem.

Figure 2: Retrofit domestic hot water installaton



Typical baseboard heater with thermostatic radiator valve



When the work was completed, the contractor flushed and cleaned the heating water pipes and added a chemical treatment designed to inhibit rust and deposits. This improved heat transfer and prolongs the system's life.

The project included removing the existing boiler and underground oil tank, and backfilling the hole. The oil tank had not leaked and there was no contamination of the surrounding soil. The new gas service was installed by the local utility.

New Eqoipment

For heating, a gas fired boiler with an output capacity of 134 kW (456,500 Btu/h) and an automatic vent damper was installed and connected to the heat distribution pipes. An outside temperature control regulates the space heating boiler. The domestic hot water boiler has an output capacity of 90 kW (304,000 Btu/h), while the new storage tank holds 454 L (100 gallons). A circulating pump and flow switch are on the pipes connecting the boiler and tank. The flow switch ensures that water is circulating through the boiler before it fires. A new gas vent was installed inside the existing masonry chimney, with the breaching between the boilers and the vent insulated to keep the boiler room as cool as possible.

The Process

Because the building receives a subsidy from Canada Mortgage and Housing Corporation (CMHC), the Cooperative had to get three bids for the project. They were evaluated on the basis of 'best value', which resulted in the selection of the second lowest bidder.

Careful planning and scheduling ensured that work would be done during three weeks in the summer. A temporary water heater provided domestic hot water service during the work, except for short periods to connect and disconnect the temporary service. This meant little disruption and inconvenience for the residents.

New space heating boiler. Note the motorized insulated flue damper.

New hot water storage tank and boiler (right). Note the circulating pump in bottom pipe, flow switch in top pipe.

Costs

The total cost was $41,100. A Conversion Grant paid for $3,000 of the work; the rest came from the cooperative's replacement reserve fund. Project costs:

Boiler replacement, including boiler and oil tank removal, new boilers, pumps, tank, , etc.	$30,500
Control Valve, thermostat replacements	$10,600
Less Gas Conversion Grant	-$ 3,000
Net Total Cost	**$38,100**

Savings

Energy costs were reduced by $64 a unit a year, a saving of 34.6 per cent, Repair costs were reduced by $66 a unit a year , a saving of 68.6 per cent. The total energy and maintenance cost savings are approximately $6,000 per year. The table below shows this in detail. Note that even though 1996 was colder than 1994, energy costs were significantly lower.

The savings result in a simple payback of the cost in 6.25 years. The improved resident comfort and operating costs enhance the market appeal of the building.

Resident and Manager Response

Resident discomfort and complaints regarding both heat and hot water have virtually disappeared. The resident manager is very satisfied with the results: fewer maintenance problems, fewer complaints and ease of operation.

Lessons Learned

An important lesson is owners and managers should analyse all aspects of the heating and hot water system when considering replacement of major mechanical equipment, converting to another fuel. If this project had involved only replacement of the existing boiler with a unit of similar design, resident complaints and maintenance problems would not have been resolved, and cost savings would not have been as significant. Another building in the same area, with a similar system, converted to gas. That building continues to have a number of problems. Identifying and evaluating comfort, energy and maintenance issues simultaneously is the first step toward a comprehensive, effective and economical solution.

COST CATEGORY	1994 Actual	1996 Actual	% Saving	1994 Cost per Unit	1996 Cost per Unit
Energy Costs	10650	6970	34.6%	258	194
Plumbing and Heating Repairs	3500	1100	68.6%	97	31
Degree-Days	2761	3104			

Contacts

Owner:
1678 Fort Street Housing Cooperative, Jim Brown, Chairman; Fred Munn, Resident Manager; Hugh Creighton, Creighton Property Management

Designer & Contractor:
Dean Houston, Mac's Heating, Victoria, B.C.

Equipment:
Space Heating: Veissmann boilers, Tour & Andersson Radiator Control Grundfos circulating pump
Domestic Hot Water: Ray-Pak boiler, Tam stainless steel tank, Grundfos circulating pumps

For more information about building envelope solutions and best practices, visit the Canada Mortgage and Housing (CMHC) web site at www.cmhc-schl.gc.ca and visit the Highrise and Multiples site at www.cmhc-schl.gc.ca/research/highrise/

NHA 2240