THE POTENTIAL FOR WATER EFFICIENCY IMPROVEMENTS IN MULTI-FAMILY RESIDENTIAL BUILDINGS IN CANADA

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Abstract

This report presents a summary of the results of an investigation into the potential for uptake of water efficiency improvements in the multi-family residential (MFR) sector in Canada. The report provides an analysis of trends in the MFR marketplace and the prospects for market penetration of water efficient technologies in multi-family buildings. In addition to defining the problem and identifying the barriers, the report outlines how the barriers are being addressed, particularly by the performance contracting industry. Two case studies are provided in an Appendix to the report which document the actual savings obtained in two highrise buildings in the Greater Toronto Area as well as the financing instruments and installation contracts utilized by the performance contractor.

Executive Summary

Overview

This report presents a summary of the results of an investigation into the potential for uptake of water efficiency improvements in the multi-family residential (MFR) sector in Canada. The report provides an analysis of trends in the MFR marketplace and the prospects for market penetration of water efficient technologies in multi-residential buildings. In addition to defining the problem and identifying the barriers, the report outlines how the barriers are being addressed, particularly by the performance contracting (PC) industry.

The report indicates that the PC industry is beginning to have an impact in the MFR sector within the Greater Toronto Area (GTA) and, to a lesser extent, in the Maritimes. Two case studies are presented documenting the actual experiences of highrise buildings in the GTA which underwent water efficiency upgrades in 1996 using the services of a performance contractor.

The Barriers

The context for this study in Canada is an aging multi-family residential stock where the concern for water costs has only recently begun to surface among residential portfolio managers. Energy costs still dominate as a prime area of concern, averaging three to five times the costs for water and sewer services.

Several barriers exist which are preventing the introduction of water efficiency into the MFR segment of the marketplace. They include: 1) the low cost for water and sewer services relative to other utilities; 2) the availability of suitable, proven low flow fixture technology; 3) certain regulatory barriers such as plumbing codes and rent controls; 4) restrictions on the methods and availability of financing; and, 5) the ability of the performance contracting industry to manage risk in the MFR sector.

The Solutions

The low cost for water and sewer services in general across Canada acts as a major disincentive for water users to invest in water efficiency. Further, about 50% of connections to municipal water systems in Canada remain unmetered. However, the movement to full-cost pricing coupled with the elimination of transfer payments from provincial governments to municipalities is increasing the price for water and sewer services across the country.

Experience with toilet retrofit devices (which retained the toilet and modified the operation of the flush mechanism in the tank) has been mixed. While retrofit devices can work, they do not save as much water as a properly designed Ultra Low Flow (6 Litre per flush or less) toilet. When so-called ULF toilets were first introduced into North America in the 1980's, many proved to be poorly designed, requiring frequent double flushing. However, second and third generation ULF toilet designs are proving to be very effective at reducing total water consumption in the average household by 25 to 35%.

Until 1996, no province or territory in Canada mandated water efficiency in their plumbing codes which made it difficult for municipal building department to require water efficiency in new housing or renovations. However, since January 1996, the Ontario Plumbing Code (OPC) has mandated that all toilet, showerhead and faucet installations be of the "water conserving" type as defined by the regulations. Ontario represents about 40% of the plumbing fixture marketplace in Canada, so it is expected that, within the next five to ten years, other plumbing codes will harmonize with the Ontario example.

Rent controls have been identified as a barrier to the introduction of water and energy improvements in Ontario and Quebec. These controls usually stipulate that savings in utilities obtained by owners of rental properties through efficiency improvements must be passed on to the tenants through lower rents. This compromises the ability of building owners to recover their investment and effectively eliminates any incentive for property owners to invest in building improvements. These controls in Ontario and are likely to be rescinded in the fall of 1997.

With regard to financing barriers, many building owners and managers want relatively quick paybacks and will delay most renovation activity until repairs are absolutely necessary. Their lack of familiarity with the performance contracting industry and such financing instruments as guaranteed savings agreements means that such upgrades as water efficiency improvements receive low priority in the competition for scarce operating and maintenance budgets. In the case of the social housing segment of the MFR sector, many portfolio managers are prohibited from entering into performance contracts under their existing funding formulas with CMHC.

The rise of the performance contracting (PC) industry in recent years has begun to address these financing barriers. For example, the ability of the PC industry to combine financing, design, installation and monitoring services into one complete package — while guaranteeing savings — is offering an attractive alternative to more conventional contracting services. Until recently, performance contracts were only offered to high volume users in the ICI sector. However, the regulatory and technology changes outlined above have lowered the PC industry's perception of risk sufficiently — especially in Ontario — such that the industry has begun to target the MFR segment of the residential sector. Similar inroads are occurring on a smaller scale in the Maritimes.

Conclusions

Based on the results of this research, it would appear that many of the barriers to the entry of the PC industry into the MFR sector, while still a problem in certain regions of Canada, are beginning to disappear. Most of the inroads are occurring in the Southern Ontario market. Despite the higher risk associated with guaranteeing utility savings (water and energy) in the MFR sector, the potential returns are very compelling.

There are significant savings in energy and water to be obtained in the social housing sub-sector, even among low density forms, an attribute many performance contractors are focusing on in their marketing. (Much of the assisted housing built in the 1970's and 1980's had to conform to maximum unit price (MUP) guidelines set by governments. This guaranteed low construction costs at the expense of high operating costs, due to the popularity of cheap to install electric heating systems and poor construction techniques.)

While energy costs in many segments of the MFR sector are disproportionately high, water costs are still low compared to other industrialized countries. Water costs are expected to move upwards as the remaining flat-rate accounts in Canada become metered and municipal water providers utilize other financial instruments to reflect the true costs of providing water service (such as adding sewer surcharges to water bills and implementing conservation-based rate structures). Water's low cost, coupled with the relatively high cost associated with the replacement of plumbing fixtures, translates into payback periods that many building owners and managers will not accept.

The PC industry is responding to this barrier by offering owners of MFR buildings attractive financing and performance guarantees that reduce most of the perceived risks. However, obtaining third party (bank) financing for the MFR sector can be problematic for certain segments of the market. While social housing and condominiums are very attractive to the PC industry (they have either government backing or legally required reserve funds), financing for work involving the private rental market is often much more difficult to obtain. And, as noted above, the residential sector is still largely unfamiliar with what the PC industry is, how it operates and what financing and installation services it offers.

Recommendations

A recent CMHC study on the energy performance contracting industry and the residential marketplace has pointed out that there is a key need to educate the residential portfolio manager about performance contracts. One way to raise the awareness and credibility of performance contracting in the MFR marketplace would be through third-party endorsement involving government/utility partnerships.

The research conducted in this study supports the recommendation that CMHC embark on a development strategy for the performance contracting industry encompassing a combination of marketing, educational and institutional initiatives to accelerate uptake of PC services for both water and energy in the MFR marketplace and to raise awareness among the MFR client base.

The development strategy would include:

- CMHC/Natural Resources Canada consultation to determine interest in development of a government strategy;
- Consultation with the PC industry; and,
- Development of the strategy, based on a series of demonstrations or case studies.

The development of a government/industry strategy is still seen by most stakeholders as a useful endeavour, provided the key market segments identified by the PC industry — high density rental apartments and social housing — are the principal target markets. CMHC has noted[1] these markets represent a potential total investment by the PC industry in the range of $550 to $650 million.

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[1] CMHC, 1996. *Energy Performance Contracting and the Residential Sector,* by Marbek Resource Consultants Ltd., Ottawa.

Case Studies

The development of case studies can present compelling information on the merits and advantages of using the services of performance contractors to introduce water efficiency improvements into the MFR marketplace. Two case studies presented in Appendix 1 to this report document the methods of financing, technologies employed, savings potential and the cost/benefit relationships observed in two highrise buildings in the Greater Toronto Area which underwent water efficiency upgrades in 1996.

The case studies indicate that paybacks of between 14 to 24 months are achievable while maintaining a positive cash flow for the building owner. Actual reductions in water demands of between 35 to 40 percent are being documented with little impact on occupant habits or lifestyles.

RÉSUMÉ

Aperçu

Le présent document résume les résultats d'une enquête portant sur les possibilités d'améliorer l'utilisation efficace de l'eau dans les collectifs d'habitation au Canada. Le rapport contient une analyse des tendances du marché des collectifs d'habitation et les perspectives d'émergence des technologies d'économie d'eau dans ce secteur. En plus de définir la problématique et de déterminer les obstacles actuels, le rapport dresse un profil des méthodes utilisées surtout par les entreprises de services éconergétiques pour aplanir ces obstacles.

Le rapport indique que les entreprises de services éconergétiques influent peu à peu sur le secteur des collectifs d'habitation de l'agglomération de Toronto et, à un degré moindre, sur celui des Maritimes. Les deux études de cas présentées font état des expériences vécues dans les tours d'habitation de l'agglomération de Toronto où des améliorations destinées à économiser l'eau ont été apportées en 1996 grâce au concours d'un entrepreneur de services éconergétiques.

Obstacles

La présente étude effectuée au Canada se déroule dans le contexte d'un vieux parc de collectifs d'habitation où les gestionnaires de portefeuille commencent à peine à se préoccuper des coûts de l'eau. Les coûts énergétiques constituent toujours la principale source de préoccupation puisqu'ils sont en moyenne de trois à cinq fois plus élevés que ceux des services d'alimentation en eau et d'égouts.

Plusieurs obstacles empêchent la mise en oeuvre de moyens pour économiser l'eau dans les collectifs d'habitation : 1) le faible coût des services d'alimentation en eau et d'égouts comparativement aux coûts des autres services publics; 2) la disponibilité des appareils à débit restreint; 3) certains obstacles sur le plan de la réglementation tels les codes de plomberie et le contrôle des loyers; 4) des restrictions relatives aux modes de financement et à sa disponibilité; 5) la capacité des entreprises de services éconergétiques de gérer le risque dans le secteur des collectifs d'habitation.

Solutions

En général, le faible coût des services d'alimentation en eau et d'égouts au Canada est le principal facteur qui dissuade les utilisateurs d'eau d'économiser l'eau. De plus, près de 50 % des branchements aux réseaux municipaux d'alimentation en eau sont, au Canada, dépourvus de compteurs. Toutefois, le mouvement vers la fixation du prix de revient intégral combiné aux coupures de transfert aux municipalités entraîne une augmentation du prix des services d'alimentation en eau et d'égouts dans tout le pays.

L'usage des dispositifs économiseurs d'eau des toilettes (qui permettaient de conserver le même appareil et de ne modifier que le fonctionnement de la chasse d'eau du réservoir) a connu un succès mitigé. Les dispositifs de rattrapage fonctionnent certes, mais ils n'autorisent pas l'économie

d'eau des véritables toilettes à débit d'eau restreint (six litres ou moins par chasse). Lorsque ces modèles sont apparus sur le marché nord-américain dans les années 1980, la conception d'un grand nombre d'entre elles laissait à désirer en ce sens qu'il fallait souvent tirer la chasse d'eau deux fois. Cependant, les deuxième et troisième générations de ces toilettes sont très efficaces et réduisent de 25 à 35 % la consommation d'eau d'un ménage moyen.

Avant 1996, aucune province ou territoire canadien ne stipulait de mesures d'économie de l'eau dans son code de plomberie, d'où la difficulté pour les offices municipaux d'habitation d'imposer des normes correspondantes à l'égard de la construction et la rénovation d'habitations. Cependant, depuis janvier 1996, l'Ontario Plumbing Code (OPC) exige l'installation de toilettes, pommes de douches et robinets économiseurs d'eau, selon la réglementation. Comme l'Ontario représente environ 40 % du marché des accessoires de plomberie au Canada, on prévoit que dans cinq ou dix ans, d'autres provinces suivront son exemple et modifieront leur code de plomberie respectif.

Le contrôle des loyers est l'un des obstacles à l'introduction de mesures d'économie de l'eau et de l'énergie en Ontario et au Québec. La réglementation en ce sens contraint généralement les propriétaires à transmettre aux locataires sous forme de baisse de loyer les économies liées aux services publics qu'ils réalisent. Une telle situation compromet la capacité des propriétaires de récupérer les sommes investies et sape toute motivation à investir dans l'amélioration de leurs collectifs d'habitation. Cette disposition risque d'être révoquée à l'automne 1997.

Pour ce qui est des obstacles financiers, de nombreux propriétaires et gestionnaires de collectifs d'habitation souhaitent une récupération rapide, de sorte qu'ils retarderont la plupart des rénovations jusqu'à ce qu'elles deviennent absolument nécessaires. Leur connaissance limitée des entreprises de services éconergétiques et des instruments financiers tels que les accords de garantie d'économies signifie que les économies d'eau, se retrouvant au bas de la liste des priorités, ont peu de chances de se disputer les maigres ressources prévues dans les budgets de fonctionnement et d'entretien. Dans le cas des logements collectifs sociaux, les modalités du financement actuel par la SCHL interdisent à de nombreux gestionnaires de portefeuille de signer des contrats de performance.

L'essor des entreprises de services éconergétiques ces dernières années commence à aplanir les obstacles financiers. Par exemple, leur capacité d'offrir à la fois les services de financement, de conception, de mise en place et de contrôle - tout en garantissant des économies - offre une solution de rechange intéressante aux contrats de services conventionnels. Dans le passé, on offrait des contrats de performance uniquement aux principaux utilisateurs du secteur des propriétés à revenus, commerciales et industrielles (RCI). Toutefois, les modifications apportées à la réglementation et à la technologie décrites ci-dessus ont suffisamment abaissé la perception des entreprises de services éconergétiques quant aux risques, surtout en Ontario, pour qu'elles se tournent graduellement vers les collectifs d'habitation du secteur résidentiel. La même chose se produit dans les Maritimes, à une échelle moindre.

Conclusions

Selon les résultats de la présente recherche, il semble que bien des obstacles à l'arrivée des entreprises de services éconergétiques dans le secteur des collectifs d'habitation commencent à disparaître, sauf dans certaines régions canadiennes. La plupart des nouvelles avenues s'aménagent au sein du marché du sud de l'Ontario. En dépit des risques plus élevés associés aux économies garanties en matière de services publics (eau et énergie) pour les collectifs d'habitation, les retombées possibles constituent un puissant mobile.

On peut réaliser d'importantes économies en matière d'énergie et d'eau dans le sous-secteur du logement social, même dans les aménagements à faible densité d'occupation, un atout utilisé en marketing par de nombreux entrepreneurs de performance. (La plupart des logements aidés construits dans les années 1970 et 1980 devaient respecter les prix maximaux des logements (PML) définis par le gouvernement. On garantissait donc des coûts de construction faibles au détriment de coûts de fonctionnement élevés grâce à l'installation peu coûteuse d'appareils de chauffage à l'électricité et à des techniques de construction laissant à désirer.)

Alors que les coûts énergétiques sont démesurément élevés dans certains segments du secteur des collectifs d'habitation, les coûts de l'eau sont bas comparativement à d'autres pays industrialisés. On s'attend à ce que les coûts de l'eau grimpent lorsque les comptes à taux fixe qui existent encore au Canada seront remplacés par des comptes dont le taux sera établi à l'aide d'un compteur et que les fournisseurs d'eau provinciaux utiliseront d'autres méthodes financières d'établissement du coût réel de l'eau (tels que l'ajout au compte d'eau d'une surprime liée aux égouts et la mise en oeuvre d'une structure des coûts axés sur l'économie de l'eau). Le faible coût de l'eau et les coûts relativement élevés de remplacement des appareils de plomberie se traduisent par une période de récupération qu'un grand nombre de propriétaires et de gestionnaires n'accepteront pas.

Les entreprises de services éconergétiques réagissent en offrant aux propriétaires de collectifs d'habitation des modes de financement alléchants et des garanties de performance qui réduisent la plupart des risques perçus. Cependant, l'obtention de financement d'une tierce partie (banque) pour les collectifs d'habitation peut poser problème dans certains segments du marché. Alors que le logement social et les copropriétés intéressent au plus haut point les entreprises de services éconergétiques (financement garanti par le gouvernement ou fonds de réserve obligatoires de par la loi), il en est autrement pour le marché locatif privé où le financement des travaux est souvent beaucoup plus difficile à obtenir. De plus, comme nous l'avons déjà mentionné, le secteur résidentiel connaît encore très peu les entreprises de services éconergétiques, leur fonctionnement, ainsi que les services de financement et d'installation qu'elles offrent.

Recommandations

Un étude récente sur les services éconergétiques et le secteur résidentiel effectuée par la SCHL démontre qu'il existe un besoin d'éduquer les gestionnaires de portefeuille résidentiel relativement aux contrats de performance. Une façon de sensibiliser le secteur des collectifs d'habitation aux entreprises de services éconergétiques et d'accroître la crédibilité de ces dernières serait d'obtenir une garantie d'une tierce partie au moyen de partenariats avec le gouvernement ou les services publics.

La recherche effectuée dans le cadre de cette étude appuie la recommandation que la SCHL élabore une stratégie de développement pour les marchés de performance qui engloberait le marketing, la formation et des initiatives institutionnelles afin d'accélérer l'utilisation des services de ces marchés pour l'eau et l'énergie dans le secteur des collectifs d'habitation et de sensibiliser leurs clients.

La stratégie de développement engloberait les points suivants :

- Consultation SCHL/Ressources naturelles Canada afin de déterminer s'il existe un intérêt à mettre au point une stratégie gouvernementale.
- Consultation des entreprises de services éconergétiques.
- Élaboration de la stratégie axée sur une série de démonstrations ou d'études de cas.

L'élaboration d'une stratégie par le gouvernement et les entreprises de services éconergétiques est toujours perçue par les intervenants comme une démarche utile en autant que les principaux segments du marché - logements locatifs à forte densité et logements sociaux - soient les principaux marchés cibles. Selon la SCHL[1], ces marchés représentent un investissement total possible de 550 à 650 millions de dollars.

[1] SCHL 1986, Les services éconergétiques et le secteur résidentiel par Marbek Resource Consultants Ltd., Ottawa.

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Canada

The Potential for Water Efficiency in Multi-Family Residential Buildings in Canada

1 Overview

This report presents a summary of the results of an investigation into the potential for uptake of water efficiency improvements in the multi-family residential (MFR) sector in Canada. The report provides an analysis of trends in the MFR marketplace and the prospects for market penetration of water efficient technologies in multi-residential buildings. In addition to defining the problem and identifying the barriers, the report outlines how the barriers are being addressed, particularly by the performance contracting industry.

The report demonstrates that the performance contractors are starting to have an impact in the MFR sector within the Greater Toronto Area (GTA). Two case studies are presented documenting the actual experiences of highrise buildings in the GTA which underwent water efficiency upgrades in 1996 using the services of a performance contractor.

2 Defining the Problem

Building owners and property managers in Canada are increasingly looking for ways to reduce costs associated with the operation and maintenance of their building portfolios. By far the largest utility cost associated with residential high-rise buildings is associated with energy for space heating and water heating. Compared to energy costs, costs for water services[2] are only about one fifth to one-third as much[3].

In the case of energy and water upgrades or repairs, the traditional approach has been for a building owner or manager to retain the services of a building contractor or, in the case of plumbing repairs or renovations, a plumbing contractor, to undertake the work. The owner/manager arranges the financing and pays the equipment and labour costs for the work. Most building owners are, however, not proactive in their building upkeep, preferring to wait until repairs can no longer be delayed.

Over the past 10 years, a new type of contractor industry has appeared on the building renovation scene, offering a wide range of services, contract arrangements and financing instruments. The *performance contracting* (PC) industry focuses on energy retrofit work in the institutional sector and, more recently, has added or piggy-backing water efficiency measures onto the servicing protocols they offer. Performance contractors offer something the traditional building contractor has been unable to provide:

1) securing some or all of the financing for the work;
2) assuming a significant portion of the risk associated with the work; and,
3) in some cases, guaranteeing the project savings.

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[2] Unless otherwise indicated, references to water costs and services in this report include costs of sewage treatment.
[3] Vaccaro, Steve, 1996. CSE Corporation, Toronto, personal communication.

Performance contractors have traditionally focused on the institutional sector (hospitals, schools, nursing homes etc.) where tenure is secure, transferability of experience is assured and the size of the project and magnitude of savings are sufficiently large to justify intervention. As noted in a recent CMHC study[4] and confirmed through the administration of a survey of performance contractors for this research report[5], there has been very little interest shown by the PC industry in targeting the residential marketplace. However, this lack of interest in the residential market is beginning to change in Southern Ontario, as an increasing number of PC's are offering services to the MFR market, in both public and private housing[6].

Several barriers have been identified as possible deterrents to the widespread adoption of water efficiency measures in the MFR sector:

1) The low cost for water and sewer services relative to other utilities[7];
2) The availability of suitable, proven low flow fixture technology;
3) Certain regulatory barriers such as plumbing codes and rent controls;
4) Restrictions on the methods and availability of financing; and,
5) The ability of the performance contracting industry to manage risk in the MFR sector.

Each of these barriers is discussed in more detail in the next section.

3 Assessing the Barriers

3.1 Water and Sewer Costs — The Municipal Context

A recent paper presented at the Canadian Water Resources Association's annual conference has pointed out that Canada's water and sewer infrastructure is in need of major capital re-investment. For example, $4.6 billion per year will be required in order to maintain existing levels of service and water quality, and to meet future needs over the next 10 years[8]. At the same time that Canada's water and sewer infrastructure is falling into disrepair, transfer payments from senior levels of government are diminishing rapidly and have already been withdrawn in many provinces. As a result, municipalities are being forced to rely on user-pay principles to recover the costs associated not only with new or expanded sewer and water infrastructure but also the repair and rehabilitation of existing systems.

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[4] CMHC, 1996. *Ibid.*

[5] see Appendix 2 for list of interviewees and Appendix 3 for a sample of the survey instrument.

[6] It should be noted that there has not been any attempt by the PC industry representatives interviewed in this study to target the single-family market.

[7] This was confirmed in interviews of performance contractors conducted in this study to be a key barrier to the introduction of water efficiency improvements in many building types.

[8] Tate, D.M., 1996. *Resource Valuation and Public Policy: The Case of Water Pricing.* Paper presented at the Canadian Water Resources Association 49th Annual Conference, June 26-28, 1996, Quebec City. Interestingly enough, Tate indicates that the public is willing to pay a higher premium for water and sewer services which could generate about 2/3 of the needed capital reserves to fund the needed infrastructure repairs.

It is indeed ironic that, given the above context, Canadian municipalities continue to charge some of the lowest water and sewer rates in the industrialized world. Canadian households use twice as much water as Europeans (Figure 1) while paying half as much for the service (Table 1)[9]. And, while pricing varies across the country, current prices and rate setting practices act as a disincentive to the uptake of water efficiency practices[10]. Table 2, adapted from Tate and Lacelle (1995), indicates that, although water rates are moving upward, Canadian consumers still have a long way to go to match levels in other similarly developed countries.

Figure 1
Average Daily Domestic Water Use
in Canada Compared to Other Jurisdictions

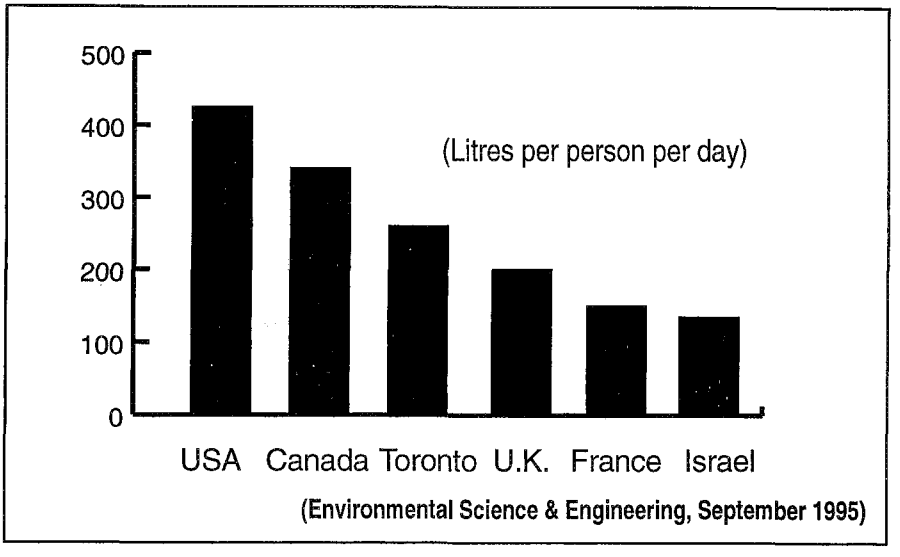


Table 1
International Water Prices*, 1989[11]

Country	Cost (¢/m^3)
Canada	38
United States	42
United Kingdom	61
Sweden	79
France	90
West Germany	135

*Costs do not include wastewater treatment charges

[9] Environment Canada, 1996. *Urban Water Indicator: Metering Residential Water Use,* State of the Environment Reporting Program, Bulletin No. 96-6, Fall 1996.
[10] Tate, D.M., and D. Lacelle, 1995. *Municipal Water Rates in Canada: Current Practices and Prices, 1991.* Environment Canada, Ottawa.
[11] Environment Canada, 1996. Ibid.

Table 2 compares mean monthly residential water prices in 1986 and 1991 for three standard monthly volumes — 10, 25 and 35 m^3 per month. These volumes represent, respectively, a minimum monthly or "lifeline" amount, an average family usage amount and a high family usage amount. The prices include sewer charges where applicable.

Table 2

Comparison of Mean Monthly Residential Water Prices ($/month) for Selected Volumes of Water, by Province and Population Size Group, 1986 and 1991

	Monthly Prices, 1986			Monthly Prices, 1991		
Province	10 m^3	25 m^3	35 m^3	10 m^3	25 m^3	35 m^3
Newfoundland	7.97	7.97	7.97	14.76	14.86	14.94
P.E.I.	11.26	13.46	14.93	19.50	19.50	19.50
Nova Scotia	10.06	11.98	13.26	17.59	20.57	22.57
New Brunswick	14.87	16.57	17.75	19.47	21.32	22.66
Quebec	8.12	8.87	9.54	12.75	13.43	14.00
Ontario	11.49	14.84	17.39	18.63	23.98	27.90
Manitoba	11.76	24.11	31.91	15.60	28.34	36.61
Saskatchewan	12.59	20.47	26.26	18.35	26.71	33.08
Alberta	18.04	24.25	29.86	24.50	32.66	38.97
British Columbia	8.62	9.21	10.09	13.45	14.31	15.70
Territories	19.80	27.50	33.19	35.88	45.99	55.06
Municipal Population Size Groups (000s)						
1 – 5	12.96	15.56	17.62	17.32	20.39	22.75
5 – 10	11.03	14.03	16.40	17.17	21.13	24.13
10 – 50	10.54	13.46	15.82	16.36	20.63	23.79
50 – 100	9.41	11.71	13.57	15.98	20.40	23.52
100+	8.34	12.69	15.91	12.76	19.85	24.77
Canada Total	10.90	13.68	16.08	16.86	20.57	23.36

Source: Tate, D., and Lacelle, D., 1995.

As Table 2 indicates, the highest monthly water and sewer costs are in the prairie provinces and the territories. The lowest costs are in Quebec, British Columbia and the Maritimes. For example, the average monthly water and sewer costs for 25 m^3 in British Columbia was $14.31. Ontario came in at $23.98, while the Northwest Territories averaged $45.99.

Research conducted by the principal investigator for the Municipality of Metropolitan Toronto has documented the wholesale and retail water rates within Metro Toronto (Table 3). Although there is some variation in water pricing within the six municipalities making up Metro Toronto, the average water and sewer costs were $.95/$m^3$ as of December 1996[12]. By comparison, in the City of Edmonton, water costs to the residential consumer were $2.13/$m^3$ in December 1996[13].

[12] REIC Consulting Ltd., and Blease and Associates Consulting Ltd., 1997. *Discussion Paper I: Water Efficiency Plan for Metropolitan Toronto*, MetroWorks Department, Toronto.

[13] Reid, Ed, 1997. Aqualta Corporation, City of Edmonton, personal communication.

Table 3
Rates and Billing Practices in Metropolitan Toronto

Municipality	% Metered	Billing Period		1996 Water & Sewer Rate	Comments
		Residential	ICI	per m3	
East York	100	4 months	1 month	$1.01	single price for residential and ICI customers - sewer costs recovered through water bill
Etobicoke	>90	3 months for residential & commercial	1 month for high use accounts	$0.95	single price for residential and ICI customers, but high volume users (>23 ML/month) use rate of $0.90/m3 - sewer costs recovered through water bill
North York	100	4 months	2 months	$0.93	single price for residential and ICI customers - sewer costs recovered through water bill
Scarborough	100	2 months	1 month	$0.78	single price for residential and ICI customers, but high volume users (>23 ML/month) use rate of $0.71/m3 - sewer costs recovered through water bill (formerly recovered through property taxes
Toronto	33	2 months	1 month	$1.05	rate is $6/month for flat rate residential customers (all residential customers are to be metered within 25 years) - single price for residential and ICI customers - sewer costs recovered through water bill
York	100	2 months	2 months	$1.00	single price for residential and ICI customers, but high volume users (>4.5 ML/month) use rate of $0.76/m3 - sewer costs recovered through property taxes

Source: REIC Ltd. and Blease & Associates, 1997.

What Tables 1, 2 and 3 indicate is that the cost of water service in Canada generally, and in Metro Toronto specifically, are still very low by western industrial standards. This low cost acts as a major disincentive for water users in both the residential and industrial, commercial and institutional (ICI) sectors to invest in demand-side management (DSM).

Interviews conducted by the principal investigator with key representatives of the PC industry in Canada tend to confirm that the low costs currently charged by most Canadian municipalities for water and sewer services is a barrier to the introduction of water efficiency into the residential highrise marketplace in Canada[14].

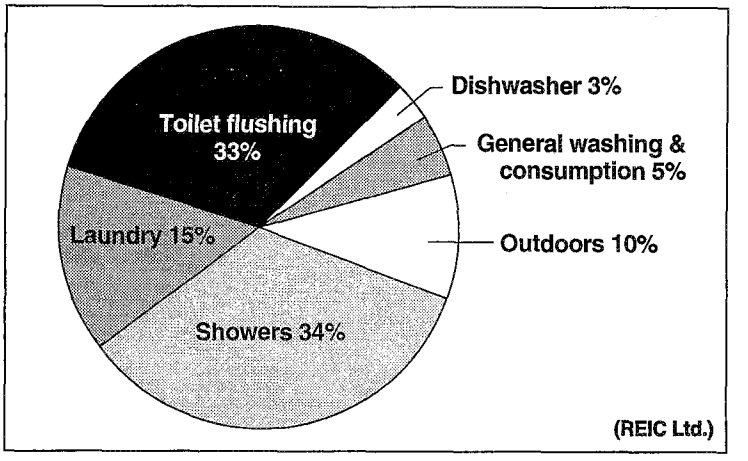
[14] For example, the two case studies in Appendix 1 reveal water and sewer costs are about $0.30/capita/day in highrise buildings in the GTA.

It is interesting to note that the low cost for water is a barrier for water efficiency improvements even for high volume users (HVU's) in the ICI sector. For example, in Metropolitan Toronto, research has shown that 300 HVU's are responsible for nearly 20 percent of Metro Toronto's total average day water demands[15]. However, the HVU's within the ICI sector have shown traditional caution about retrofitting their high water use production processes because of fears about loss of production capacity during the extended shutdown periods required to retrofit the facility.

3.2 Concerns About Low Flow Fixture Technology

The common flush toilet is responsible for about 30 to 40 percent of the water consumption in a typical household. When the showerhead is included, the bathroom is responsible for about 2/3 of the water use in a typical household. Figure 2 presents a disaggregation of a typical Canadian household's water use into its component end-uses.

Figure 2
Residential Water Use in a Typical Household



CMHC has already documented the range of water efficient technology currently available in the residential marketplace[16]. Despite a proven track record throughout the United States and in Europe, there is still skepticism in many market sectors about the performance of water efficient plumbing fixtures and their ability to deliver sustained water reductions, in spite of the fact that in the largest market in Canada — Ontario — the Plumbing Code now mandates low flow fixtures.

A survey of performance contractors conducted by the principal investigator for this project has indicated that toilets and showerheads are the primary end uses targeted by the PC industry in Canada to reduce household water demands in MFR buildings. The showerhead is usually replaced if, for example, the flow rates are in excess of about 11 to 13 litres per minute (L/m). While low flow showerheads do save water, the value of their energy savings — especially in the case of electric resistance heating — is much greater.

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[15] REIC Consulting Ltd. and Blease & Associates, 1997. *Discussion Paper I: Water Efficiency Plan for Metropolitan Toronto*, prepared for Metro Works Department, Toronto.

[16] CMHC, 1991. *Residential Water Conservation: A Review of Products, Processes and Practices,* by REIC Consulting Ltd., Toronto.

Treatments for the toilet can involve either *retrofitting* the existing toilet, or *replacing* it with a new, ultra low flush (ULF) fixture[17].

Toilet Retrofitting

Retrofitting existing toilets involves retaining the existing bowl and tank but modifying the flush sequence or process to use less water. Retrofitting can be accomplished by installing a wide range of after-market devices. These devices fall into three main categories:[18]

1) Water Displacement Devices;
2) Water Retention Devices; and,
3) Early Closure Devices.

Water displacement devices include water-filled bags and bottles which displace their equivalent volume of water with each flush. These low-cost devices are easy to install but do not save much water, averaging a reduction of about 1 to 2 litres per flush. They are also low maintenance, unlike the other devices and, once set in place, perform as designed without needing adjustment.

Water retention devices include tank dams which hold back up to 4 litres per flush and extension collars which fit into the flapper valve seat and project above the seat, saving about 3 to 4 litres per flush. In the case of toilet dams, problems have been encountered by both water utility sponsors[19] and performance contractors[20] with these devices. They often slip out of place and can interfere with the proper operation of the flush sequence, causing leakage and toilet run-on. There have also been reports of tampering with these devices by tenants in rental apartments[21].

Early closure devices were, until recently, the retrofit device of choice used by most performance contractors in Canada and the United States in MFR applications[22]. The flush valve or flapper, which closes the opening at the bottom of the toilet tank, is usually replaced with a flapper which interrupts the flush sequence after the toilet tank is only partially emptied, saving up to 5 or 6 L/f.

With the introduction of a wider range of CSA-approved 6 litre ULF toilets into the Canadian marketplace — brought about largely by the changes to legislation in Ontario — the number of toilet retrofit devices installed by PC companies in the multi-residential sector is being rapidly overtaken by ULF toilets. All of the PC companies in the Southern Ontario marketplace who indicated they were offering services to the MFR sector have switched to ULF toilet replacements. Although this is a more costly measure to finance, ULF toilets offer much more sustainable, predictable and — most important for the PC company — "tenant-proof" water reductions. They minimize risk while maximizing savings.

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[17] The term ULF in the context of this report refers to toilets using no more than 6 litres per flush (L/f). Some manufacturers have models using less than 6 L/f (from 0.5 L/f to 3 L/f). Models in the range of 3 L/f to 6 L/f have been in common use in North America for about 15 years (see footnote 23).

[18] Gates, C., 1993. *The Potential for Improving Water Efficiency in Existing Housing: Implications for Municipal DSM Programming,* in Every Drop Counts, D. Shrubsole and D. Tate, CWRA, Cambridge, Ont.

[19] Walker, Deborah., 1997. Region of Waterloo Water Efficiency Manager, personal communication.

[20] Kalifon, Philip., 1997. CFCI Corporation, Toronto, personal communication.

[21] Region of Waterloo, 1993. *Kitchener Pilot Project Water Efficient Homes Final Report,* Region of Waterloo Utilities Division, Waterloo, Ontario.

[22] Horner, Russell, 1996. Water Management Inc., Virginia, personal communication.

Toilet Replacements

ULF toilets, some with flush volumes as low as 3 L/f, have been common in the US for more than 10 years. The US federal government mandated 6 litre ULF toilets, as well as 9.5 L/m showerheads and 8.35 L/m faucets in 1993. The legislation controls not only the installation but also the sale of plumbing fixtures. It also sets water efficiency requirements for clothes washers and dishwashers. This US legislation has been instrumental in making ULF toilets the option of choice for performance contractors in the US and, more recently, in Canada.

However, municipal toilet replacement programs have reported wide fluctuations in ULF toilet performance[23] as well as reporting that pricing is no guarantee of quality or performance. Before the passage of the Ontario legislation, Canadian toilet manufacturers were taking an incremental approach to the problem of using less water per flush, simply by retaining their existing bowl designs and delivering a smaller flush volume through retrofitted tanks. Some earlier makes and models were prone to bowl clearing and trap seal problems and required unacceptable incidents of double flushing[24] plus more frequent cleaning. These problems have also been documented in recent issues of consumer publications[25].

The imposition of low flow requirements in the Ontario Plumbing Code (OPC) has prompted Canadian toilet manufacturers to develop real innovation by redesigning the toilet bowl. For example, trap diameters are being increased from 1.5 inches to 2 inches and an increasing number of traps are being glazed to improve hydraulic performance. This has significantly improved the bowl clearing and cleaning effectiveness of each flush, reducing incidences of double flushing[26].

The improvement in ULF toilet performance — along with the changes to the OPC — have been key factors in the PC industry's adoption of toilet *replacements* in MFR contract work in Ontario. High incidences of double flushing erode the payback and benefit/cost relationships many performance contractors establish with their building clients. If the contractor has entered into a guaranteed savings type of agreement, double flushing can increase their financial exposure and risk.

ULF toilets offer other advantages to the performance contractor and the building client over toilet retrofits:

1) CSA or equivalent test laboratory approval;
2) Tamper-proof by the tenant/occupant; and,
3) Municipally and utility supported due to predictable infrastructure benefits.

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[23] Scott, R., C. Gates et al., 1996. *Canadian Municipal Water Conservation Initiatives,* Technical University of Nova Scotia, Halifax, NS.

[24] Anderson, D.L., and R.L. Siegrist, 1989. *The Performance of Ultra-Low-Volume Flush Toilets in Phoenix,* AWWA Journal, March 1989, Denver.

[25] Consumers Reports Magazine, 1995. *Low Flow Toilets,* February 1995.

[26] Mills, Peter., Strategic Utilities Management Inc., Toronto, personal communication.

3.3 Regulatory Barriers

Two regulatory instruments are often cited as impediments to the introduction of water efficiency (and other) improvements in the MFR sector:

1) plumbing codes; and,
2) rent controls

Plumbing Codes

Currently, only one province in Canada — Ontario — has mandated low flow fixtures in new construction and renovations. Since January 1996, the OPC has mandated that all toilet, showerhead and faucet installations had to be of the "water conserving" type as defined by the regulations. Toilets must use no more than 6 litres per flush (L/f), showerheads 9.5 litres per minute (L/m) and faucets 8.35 L/m[27]. With the exception of British Columbia, all other provinces use the National Building Code, which sets no limits on water consumption in plumbing fixtures[28].

The mandation of ULF fixtures in Ontario has been instrumental in removing a key barrier to the introduction of water efficient fixtures in the marketplace. However, elsewhere in the country, it has been reported[29] that ULF toilets represent only about 2.5% of total fixture sales Canada-wide (excluding sales in Ontario). In the City of Edmonton, where water costs are over twice the average in Ontario, ULF toilets represent about 8% of total fixture sales[30]. Alberta has not mandated 6 litre ULF toilets or other low flow fixtures in its plumbing code.

Rent Controls

At present, only Ontario and Quebec have rent controls in place. However, it has been reported elsewhere that 75% of all apartments in Canada are located in these 2 provinces[31]. Bill 121 in Ontario had a major impact on the PC industry in the early 1990's. One of its provisions is that savings in utilities obtained by owners of rental properties through efficiency improvements must be passed on to the tenants through lower rents. This compromises the ability of building owners to recover their investment and effectively eliminates any incentive for property owners to invest in building improvements.

As a result of the introduction of rent controls in Ontario, most of the performance contractor customer base in the MFR sector disappeared in Ontario in the early 1990's[32]. It has only recently returned as a result of the promise from the new government in Ontario to rescind this legislation (expected in the fall of 1997). In addition, the PC industry can offer off-balance sheet financing, which can enable the MFR building owner to "get around" the legislation.

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[27] Rogers, Joe., 1997. Ontario Buildings Branch Plumbing Code Advisor, Toronto, personal communication.
[28] British Columbia mandated 13.25 L/f toilets in 1996 (Joe Rogers, personal communication).
[29] Reid, Al., 1997. Aqualta Corporation, City of Edmonton, personal communication.
[30] Reid, Al., *ibid.*
[31] CMHC, 1996. Ibid.
[32] Mills, Peter, 1997. Strategic Utilities Management Inc., Toronto, personal communication.

Other landlords are more transparent. If they have good relations with their respective tenants' associations, they are successful at fixture replacement by positioning the work as "plumbing upgrades" or "bathroom renovations". It was pointed out by one performance contractor that most tenants are happy to receive a new toilet but tend not to care whether it flushes 6 litres or 16 litres[33]. Most residential landlords who have taken advantage of services offered by the PC industry in Ontario have tended to identify ULF toilet replacements as "bathroom upgrades". Seen in this light, tenants tend not to press for lower rents because they recognize that the owner has the option to apply for rent increases to offset the investment in plumbing upgrades.

In addition, the PC industry is moving more aggressively to service the MFR sector — especially in Ontario — offering financing, servicing and installation contracts which effectively eliminate the fiscal, monetary and regulatory barriers discussed thus far (see Section 4.2).

3.4 Limitations on Financing

Traditionally, a building owner/manager has had several financial instruments available to underwrite the costs of construction or renovation work. These are:

1) self-financing through internal operating or capital funds;
2) bank loans; and,
3) leasing arrangements.

The costs of major retrofits for space and domestic hot water (DHW) heating, for building envelope improvements and for major plumbing retrofits are often sufficiently prohibitive that most building owners and managers will not consider these types of building improvements. They tend to want relatively quick paybacks and will delay most renovation activity until repairs are absolutely necessary. This incremental approach to building maintenance on the part of many owners and managers of MFR properties is not helped by rent controls and other restrictions on building maintenance (see Section 3.3).

Within the public housing field, an additional barrier relates to how operation and maintenance (O&M) costs are financed and subsidized. For example, CMHC provides subsidies to social housing under a number of different programs and funding formulas. Some subsidies cover the difference between revenues (from rental income) and operating expenses (for maintenance, repairs, improvements, taxes and utilities) in designated public housing buildings[34]. In some cases, CMHC may have title to the buildings, in others, an agency such as the Ontario Housing Corporation (OHC) may have title. Even if CMHC doesn't have title, they may still play a role in reaching decisions about maintenance and upgrade decisions affecting public housing.

In certain programs, the subsidy transfers go into replacement reserve funds for each building controlled by a board of directors elected by building occupants. Current funding formulas do not allow any expenditures which come out of these reserve funds, and which involve transactions with third parties, without approval from CMHC. If the financing proposed is in any way

[33] Mills, Peter, 1997. Strategic Utilities Management Inc., Toronto, personal communication.
[34] Carleson, Marjory, 1997. CMHC Ontario Regional Office, personal communication.

unorthodox (such as a performance contract), approvals may also be needed by head office in Ottawa. In fact, performance contracts are not allowed under existing funding formulas[35]. The primary concern here relates to dilution of CMHC's interest.

In addition, many building managers in the MFR and ICI sectors who are responsible for financing their own building improvements will only implement efficiency upgrades that can be paid back in one year through their O&M budgets. This approach has limited the list of improvements which building owners and managers might be prepared to invest in to upgrade buildings[36].

For example, high efficiency lighting conversions have paybacks as low as three to six months[37] and are historically financed through O&M budgets which are set yearly. However, virtually all of the performance contractors interviewed while conducting this research indicated that water efficiency improvements such as ultra low flush (ULF) toilets typically have paybacks of 2 to 3 years in the MFR sector and between 3 to 5 years in the single-family sector.

3. 5 Perception of Risk

The management of risk involves several issues relating to the residential market sector:

1) The dispersed nature of the market, especially low rise developments;
2) Difficulty in controlling/influencing tenant/occupant energy and water using habits;
3) Gaining access to the key decision-makers; and,
4) Lack of familiarity on the part of building owners with new PC contract structures.

The Nature of the Residential Market

As noted above, the PC industry prefers those market sectors where risk can be minimized. Risk is associated with the size of the project, the end-uses being targeted, the characteristics of the end-users and the past experiences of the industry with the particular market sector being targeted. For example, in the case of schools and hospitals, there is a certain degree of homogeneity such that experiences in one context have a reasonable chance of being replicated in other locations[38]. This predictability minimizes the risks for both the building owner/manager and well as the performance contractor.

However, in the case of the MFR sector, no such homogeneity exists. This sector displays a significant amount of heterogeneity which can increase the exposure of the PC company. However, the PC industry is responding to this problem by segmenting the multi-family sector into discrete sub-sectors (private market rentals, condominiums, social housing) to facilitate this needed replicability[39].

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[35] Lahtinen, Lief, CMHC Toronto Branch Office, personal communication.

[36] If the O&M savings could be used to finance further improvements in efficiency in subsequent years, then this would act as an incentive to invest in such improvements, while stabilizing and eventually reducing O&M subsidies.

[37] Energy, Mines and Resources Canada, 1989. *The Economics of Energy Efficient Lighting,* prepared for the CREO Office, prepared by REIC Consulting Ltd., Toronto.

[38] Brown and Caldwell Consulting Engineers, 1989. *Water Auditing Protocols for Public Buildings,* Denver.

[39] CMHC, 1996. Ibid.

Controlling Tenant Water and Energy Use

In the case of MFR buildings (both high rise private sector rental and social housing types), the PC industry in Canada is only now developing a track record of MFR experience, based in part on experiences in the United States[40]. The PC industry's main concerns relate to the unpredictability of the behaviors of tenants in market rental and social housing buildings and their inability to control both water using and energy using behaviors of individual households. If there is no buy-in from building occupants, performance contractors are often reluctant to proceed.

The control of occupant behavior is compromised in most cases by low costs for water services, which generates little motivation on the part of tenants to change water-using practices. Added to this problem is the fact that most MFR buildings are bulk metered such that water costs are included in the rent (or maintenance fees, in the case condominiums). So, even if ULF fixtures are installed, the occupants may still have no incentive to modify their water-using behaviors. Until building occupants can see a direct incentive to reducing water (or energy) usage, by being responsible directly for their own water and energy charges, this barrier is unlikely to disappear.

Gaining Access to Key Decision-Makers

Several of the performance contractors interviewed for this research project expressed frustration with the dispersed and at times convoluted decision-making which characterizes the MFR market[41]. For every building candidate, the PC company must be able to identify:

1) who the key decision-makers are;
2) how they reach their decision; and,
3) whether or not they will be prepared to bring their own financing to the table.

In ascending order of difficulty in accessing the decision-makers and understanding the decision-making process in the MFR sector, the 3 sub-markets are:

1) private market rental accommodation;
2) condominiums; and,
3) social housing complexes.

In the case of private market rentals, the decision to renovate may be the responsibility of a single individual, especially if the building is managed by the owner. If the building is managed by a property management company, the decision can involve up to 3 individuals: the owner, the on-site manager and the company manager. While this is a fairly straightforward decision-making stream, the downside, as noted earlier, is that this sub-sector is not known for its proactiveness in building renovation, preferring to do only the minimum in maintenance and repairs to meet local property standards by-laws. This is particularly a problem in Ontario under current rent control legislation.

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[40] Home Energy Magazine, 1994. *The Rise of Water Service Companies,* July/August 1994 and Kalifon, Philip, 1997. CMCI Inc., Toronto, personal communication.

[41] Vaccaro, Steve, 1997. CSE Corporation, Toronto, personal communication; Kalifon, Philip, 1997. CFCI Corporation, Toronto, personal communication.

In the case of condominiums, all decisions regarding property maintenance, upkeep and renovations are made by a board of directors who are themselves, either owners or tenants. Because condominiums are required by legislation to maintain reserve funds for property maintenance, condominium board members tend to see the reserve fund as the only way to finance renovations to the common element. Because the board members are not professional property managers[42], they are usually not well versed in the issues of conventional contract arranging, let alone dealing with an emerging performance contracting industry. For this reason, the condominium market has not been actively pursued by the PC industry[43].

The social housing sub-sector is the least homogeneous of the three sub-sectors, involving a wide range of building types and tenure arrangements. An added dimension which tends to muddy the waters is the number of stakeholders which are involved in the financing, operation and maintenance of these building portfolios. All three levels of government — federal, provincial and municipal — may have a stake in the decision-making, along with a mixed group of tenants associations, non-profit housing groups and housing co-ops. So, there are many institutional and regulatory barriers still in the way.

The PC industry has found this to be a major barrier to accessing this market segment[44]. However, the reductions in operating subsidies most social assisted housing organizations are experiencing is forcing them to seek innovative ways to finance needed renovations. Most interviewees for this study from the PC industry operating in Ontario see this trend as an opportunity to gain further access to this segment of the MFR market, once the client base is better educated about what the range of services are which the PC industry can bring to the table.

Educating the Client About Performance Contracts

Entering into a performance contract requires something of a leap of faith for building owners and managers who are more familiar with the conventional paradigm for arranging contracting work for their buildings. As was discovered by the principal investigator during the preparatory work for Part 1 of this research program, many MFR owners and managers see performance contracts which guarantee savings while requiring no up-front financing on their part as simply "too good to be true" (see footnote 42).

For the performance contractor, offering a shared savings agreement or guaranteeing savings carries with it the need to ensure that all the players — building owners, managers, superintendents as well as the building occupants — buy-in to the proposal and have a clear understanding as to the expected results. This means making the transaction process as transparent as possible and often requires a level of client preparation and education at the front end which some PC companies appear unwilling to invest.

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[42] Most condominium boards contract out property management responsibilities to professional property management firms.

[43] CMHC, 1996. Ibid. However, several respondents to this research project's telephone survey did indicate they were targeting this sub-sector of the MFR market.

[44] CMHC, 1996. Ibid.

4 Overcoming the Barriers

Most of the barriers identified in Section 3 can and are being overcome in the MFR marketplace. There is every reason to believe that, given the right set of circumstances, most of these barriers will be overcome within the next few years, as discussed below.

4.1 Low Costs for Water and Sewer Services

The low costs for water and sewer services documented in Section 3.1 of this report reflect a uniquely regional problem in Canada. As noted, some of the lowest water costs in the country are in British Columbia and the Maritimes. These are, coincidentally, regions of the country where a significant percentage of the urban population is not served by any type of municipal sewage treatment or, where sewage treatment is provided, the costs are "recovered" through mill rates.

For example, neither the Halifax/Dartmouth area of Nova Scotia nor Victoria, BC treat sewage before releasing it into receiving waters. Beyond the obvious environmental impacts this practice creates, it also sends a false price signal to consumers about the true cost of providing municipal water service. Those jurisdictions which recover the costs of sewage treatment through property taxes are also sending false price signals to water consumers because the customer does not see sewage treatment costs reflected in their actual user fees for water use.

A related problem is the lack of water metering in many Canadian municipalities. A recent federal study has reported that in 1990, only about 50% of connections to municipal water systems were metered[45]. In City of Toronto, only about 35% of residential water customers are metered. Without water meters, it is impossible to develop a benchmark of water use in the community and it is equally impossible to monitor savings. Metered households typically use 20% less water per capita than unmetered households[46].

The tightening of sewage effluent requirements and the high capital costs associated with the expansion of water supply infrastructure are prompting municipalities such as Victoria and Halifax/Dartmouth to reassess their wastewater treatment policies[47]. It is anticipated that within the next few years, water costs in those Canadian municipalities which currently do not treat sewage will rise significantly as the true costs of water supply, including sewage treatment, are factored into water billing practices. This will effectively reduce one of the key barriers to the wider penetration of water efficiency practices in the residential marketplace.

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[45] Environment Canada, 1990. *Water Demand Management in Canada: A State-of-the-Art Review,* by D.M. Tate, Ottawa.

[46] Blease, Kingsley, 1995. *Water Efficiency and Metering,* in Ontario Pipeline, Volume 12, No. 2, Ontario Water Works Association.

[47] Perry, D., 1996. *Report of the Special Commission on the Greater Victoria Water Supply,* Vol. Two, Background Reports, Victoria.

4.2 Technology Considerations

The decision by the Province of Ontario to mandate 6 litre per flush ULF toilets has generated one additional benefit which will accelerate the introduction of these low flow fixtures into the MFR sector. Before the mandation of ULF toilets in January 1996, virtually all players in the PC industry favoured retrofitting toilets with low-flow devices such as early closure flappers.

While cheap to purchase and install, these devices are often prone to tampering by tenants and can malfunction over time, a situation which has plagued many performance contractors who derive their principal sources of revenue from water savings[48], and which explains the PC industry's reluctance outside Ontario to offer water efficiency upgrades to the MFR sector.

As noted in Section 3.4, the requirement for 6 litre toilets in Ontario has provided the impetus for manufacturers to develop "made in Canada" ULF designs which work consistently with high levels of consumer satisfaction. What is most important is that all of the more popular 6 litre ULF designs are CSA or equivalent testing agency approved. This gives both the PC company and the building owner/manager the assurance they need to adopt these new toilets in whole-building changeouts.

As a result, virtually all of the PC companies who reported in this survey doing water efficiency work in Ontario for the MFR sector are choosing ULF toilets over toilet retrofits[49]. Although the costs are higher — a per suite treatment offering a ULF toilet, showerhead and kitchen and bathroom faucets may cost between $180 to $220[50] compared to about $50 for an early closure flapper, modified ballcock assembly and low flow showerhead and faucets — the savings are also much higher and, more important, sustainable over the long term. The per building water savings reported average between 30% and 40%, with simple payback periods averaging 1 to 3 years.

CSA certification notwithstanding, many of the more successful PC firms in the US — and a few in Canada — regularly test ULF toilets and low flow showerheads in independent labs to compare and contrast performance levels. While most $300 ULF toilets tend to perform better than units priced at $100, there are many ULF toilets in the $150 to $200 range that perform as well or better than much more expensive units[51]. This third party testing is simply good business practice. It helps the PC's weed out faulty or inefficient products and devices thus reducing their risk while, at the same time, sending a clear signal to prospective clients that the savings projections which form the basis of the performance contract will be sustained after the terms of the contract have expired.

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[48] Home Energy Magazine, 1994. Ibid.

[49] The only other region in the country reporting water efficiency work in the multi-family residential sector was the Maritimes, where only about 30% of toilet treatments involve actual replacement of the toilet with a ULF model (Bavis, Kirk, 1997. EnerPlan/Rose Engineering Ltd., Moncton, personal communication).

[50] Vaccaro, Steve, 1997. CSE Corporation, Toronto, personal communication.

[51] Horner, Russell, 1996. Water Management Inc., Virginia, personal communication.

4.3 Regulatory Barriers

With regard to plumbing code issues, the recent mandation of 6 litre ULF toilets, 9.5 L/m showerheads and 8.35 L/m faucets in Ontario is starting to influence the marketplace in other regions of the country. Larger manufacturers such as Crane and American Standard are moving to standardize their product lines based on the Ontario requirements. The reason for this is simple economics: Ontario represents about half of the market for toilets in Canada[52].

In terms of rent controls, the only provinces where this is an issue are Ontario and Quebec. The legislation is planned to be rescinded in Ontario in the fall of 1997. This will remove one of the last principle barriers to the introduction of water — and energy — efficiency improvements to the MFR sector.

The recent trend by senior levels of government to reduce or eliminate operating subsidies for social housing represents both a constraint and an opportunity for the social housing sector. The elimination of these subsidies has left many of the organizations who manage these portfolios with little alternative but to reduce maintenance and related service levels over the short term. However, over the long term, it has been noted that reductions in operating grants will provide the stimulus for these agencies to seek out the types of services offered by the PC industry[53]. In fact, this has already happened in many jurisdictions in Ontario, including the City of Barrie[54] and in Metro Toronto[55].

4.4 Contract Financing

The performance contracting industry is beginning to offer a wider range of contract types and financing packages to the residential marketplace targeting, in particular, the high rise rental and social housing segments.

Respondents to the performance contractor telephone survey undertaken in this research have indicated preference for three types of financing agreements which offer an attractive alternative to the more conventional approaches outlined in Section 3.2. They are:

1) first out agreements;
2) shared savings agreements; and,
3) guaranteed savings agreements.

Under the *first out* arrangement, the performance contractor retains all of the savings obtained through the upgrade until the investment debt has been recovered or a specified time period has elapsed, whichever comes first.

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[52] Lennox, Graham, 1996. Marketing Manager, American Standard (Canada) Ltd., Toronto, personal communication.
[53] CMHC, 1996. Ibid.
[54] Thompson, Barry, 1996. City of Barrie Water Efficiency Coordinator, personal communication.
[55] Burns, Peter, 1997. Ontario Ministry of Housing, Toronto, personal communication.

Under the *shared savings* arrangement, as the name implies, the performance contractor and the building client share the savings obtained through the upgrade. This type of contract is terminated at the end of a specified contract period or at the time the project investment has been recovered, whichever comes first[56].

For a premium, the performance contractor can enter into a *guaranteed savings* agreement in which it guarantees the facility owner's utility savings, in effect, by assuming the responsibility for paying the monthly utility costs. This is usually accomplished by obtaining third party (bank or insurance company) underwriting of the risk.

These contract instruments have been popular with the PC industry for the institutional sector for several years. The reason for this is relatively straightforward. The institutional sector — made up of hospitals, schools and nursing homes — is fairly homogeneous, tenure is secure and the value of individual initiatives is at a threshold level which is viable for the performance contractor.

However, these contract instruments are only now being offered to the residential marketplace and only in very limited market segments and parts of the country. For example, virtually all of the Ontario-based PC firms interviewed for this research are targeting high rise rental buildings and government-assisted social housing with plumbing fixture replacement programs, usually piggybacked with energy efficiency upgrades such as insulation upgrades, space and DHW heating system conversions, as well as air sealing and ventilation improvements. They offer all 3 of the financing agreement options discussed above.

None of the performance contractors interviewed for this research outside Southern Ontario are targeting the residential marketplace. This is true in British Columbia[57] and in the prairie provinces[58]. In the Maritimes, the PC industry is beginning to offer services to highrise building types in the condominium, private rental and social housing tenure classifications[59]. There is virtually no interest from the PC industry anywhere in Canada in the low rise, owner-occupied housing sector[60].

4.5 Managing Risk

Section 3.5 has identified the key areas of concern for the PC industry in terms of introducing water efficiency into the MFR sector. The key objective for performance contractors is to provide a useful service to its client base while obtaining an acceptable rate of return on their investment in the project.

Based on its experiences in delivering energy efficiency and related building renovations to the institutional sector, the PC industry is transferring some of the lessons learned from this sector to the MFR sector, enabling the industry to respond to the 4 key risk factors identified in Section 3.5.

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[56] CMHC, 1996. Ibid.

[57] Smith, Victoria, 1997. Honeywell Ltd., Victoria, personal communication.

[58] Hounjet, Marvin, 1997. Johnson Controls Ltd., Calgary, personal communication.

[59] Bavis, Kirk, 1997. Enerplan/Rose Engineering, Moncton, personal communication.

[60] One interviewee from Ontario did indicate that their company was developing a servicing division to aggressively recruit this segment of the residential marketplace.

Dealing with a Dispersed, Non-Homogeneous Market

Performance contractors are dealing with the dispersed nature of the MFR market in a number of ways. Economies of scale favour larger projects where better financing and carry costs can be negotiated and larger savings streams can be assured. CMHC[61] has reported that there is considerable flexibility within the industry in terms of threshold limits on the value of a project before a PC firm will agree to proceed. Some larger firms require a project valuation at least $1 million in size, while others often require utility costs in excess of $100,000/yr before proceeding.

The survey conducted for this research project tends to support the earlier finds of CMHC. Perhaps as a reflection of the growing competitiveness in the marketplace, performance contractors are demonstrating a wide range of "viability thresholds". One contractor noted that they spend the same amount of up front preparatory work for a 25 unit building as they would for a 300 unit building but will do both[62].

As noted earlier, most PC firms are piggybacking water efficiency measures onto energy retrofit work in the proposals they submit to residential property owners. Because smaller buildings have higher per unit transaction costs, the PC industry prefers bundling together a number of buildings within a given owner's or manager's portfolio, which increases the value of the contract. However, size of building is no real indicator of potential. A 50 unit building with old plumbing and electric resistance space and domestic water heating, which is also in need of air sealing and thermal envelope upgrading, may be a more viable candidate than a 300 unit building with newer plumbing fixtures and natural gas heating.

The PC industry is also learning to segment the MFR marketplace, paying particular attention to the high rise rental and social housing segments. Within these segments, one PC firm noted that a certain amount of homogeneity is beginning to appear[63]. They are also developing better, more systematic ways of categorizing candidate buildings by age, type of construction, type of heating system, plumbing system characteristics, as well as occupant demographics.

As the industry's track record and pool of experience increases in this sector, chances for transferability will increase while the perceived degree of volatility and risk will decrease. There are signs that this is already happening in the Southern Ontario marketplace.

Controlling Tenant Utility Use

The PC industry has recognized that, in the case of the residential sector, the key to success is to obtain buy-in from the building tenants and occupants. The problem of split incentives is always an issue in rental accommodation. Tenants see no reason to save water or energy if the only beneficiary from this action is the landlord. Individual metering of each suite for electricity use is becoming very common in new construction. However, individual metering of each suite for water use is still relatively uncommon, due to the high cost of meters and the relatively low cost for water[64]. This may change as water costs continue to escalate in the future.

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[61] CMHC, 1996. Ibid.

[62] Mills, Peter, 1997. Strategic Utilities Management Inc., personal communication.

[63] Vaccaro, Steve, 1997. CSE Corporation, Toronto, personal communication

[64] Bednar, Teresa, 1997. Scarborough Pubilc Utilities Commission, personal communication.

As far as social housing portfolios are concerned, as operating subsidies from senior levels of government continue to be eliminated, the pressure on municipal housing authorities to seek ways to reduce operating costs is unlikely to prompt a rapid retrofit of buildings to individual water metering. The costs are still very high for the savings that may be achieved, because low-income families typically have little in the way of discretionary water use to cut back on in the first place.

Most PC firms doing work in the rental sub-market rely more on a technical fix rather than behavior modification to minimize their exposure. The increased availability of 6 litre ULF toilets, especially in the Ontario marketplace, is a key factor in the industry's ability to make inroads in this segment of the MFR market. Working with the building owner and superintendent, they obtain tenant buy-in by positioning the new toilet as part of a "bathroom upgrade" or the new windows as an opportunity to improve comfort levels within suites.

In the case of ULF toilets, a common practice is to install units in superintendent and custodian suites in advance of converting the whole building. This brings the building maintenance staff on-side so that they can become knowledgeable about the new products and how to deal with any problems that may arise[65].

In terms of the social housing segment of the MFR market, the same issues apply. However, in the case of housing co-ops, renovation proposals involving energy and water efficiency renovation work are easier to sell to occupants who share in any reductions in utility costs.

Gaining Access to Decision-Makers

Two key segments of the MFR which the PC industry is targeting, at least in Ontario, are the private market high rise rental buildings and social housing. As noted in Section 3.5, the level of effort in gaining access to decision-makers is much higher for both these market segments, compared to the institutional and industrial sectors. The barriers are particularly onerous in the social housing segment of the market[66]. The government bureaucracy has been described as "impenetrable"[67], however, the potential for returns on investment are sufficiently attractive enough that, as one PC interviewee pointed out, "it's worth the effort and sacrifice"[68].

The fact that several PC contractors in Ontario are making inroads in these segments of the MFR marketplace is an indication that they are finding ways to access the key decision-makers. The social housing field has the greatest potential because many renovation (as well as basic maintenance and upkeep) decisions have been put on hold due to reductions in operating subsidies. In addition, as noted above, the percentage of apartments heated with electricity is very high in both Ontario and Quebec[69]. Therefore, the potential savings stream from both energy and water retrofitting is very high, which explains why the PC industry, particularly in Ontario, is making the effort to sort out the jurisdictional and bureaucratic hierarchies.

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[65] Gates, C., et al, 1996. *An Evaluation of the Effectiveness of a Municipal Toilet Replacement Program,* presented at the AWWA Annual Conference, June 1996, Toronto.

[66] Owens, Philip, 1997. Johnson Controls Ltd., personal communication.

[67] CMHC, 1996. Ibid.

[68] Vaccaro, Steve, 1997. CSE Corporation, Toronto, personal communication.

[69] CMHC (1996) notes that about 35% of apartments in Ontario are electrically heated while the figure is closer to 45% in Quebec.

The key initial effort is to find the right point of entry into the decision-making bureaucracy. Initially, this can be a hit-or-miss proposition. For example, social housing portfolio managers can act as key "gatekeepers" providing a key entry point into the decision-making bureaucracy. They can bring the right stakeholders to the table in the form of property managers, asset managers and site managers to review PC proposals and make decisions.

However, as one PC contractor pointed out during the interviews for this research, there are additional barriers which still need to be overcome. For example, government and social housing financing and purchasing policies often do not accommodate the types of performance contracts offered by the industry. This is generally perceived as more a learning curve problem than an unsolvable bureaucratic one. Once social housing agencies and their funders see the results of a few pilots or case studies — several of which are currently underway — and develop a better understanding of what performance contracting is and how it can help to manage building portfolios, this barrier will begin to disappear. As noted earlier, there is evidence in the Ontario market, due to the ongoing subsidy squeeze, that this barrier is diminishing.

Educating Residential Clients About Performance Contracts

It has been reported that one way to raise the awareness and credibility of performance contracting in the MFR marketplace would be through third-party endorsement involving government/utility partnerships. Involving the banks as more visible providers of a pool of capital and the insurance industry as underwriters of the risk has also been proposed.

However, in the case of government and utility programs, a certain degree of ambiguity is evident in the PC industry. For example, CMHC has noted that the PC industry is quick to point the finger at government-funded and utility-sponsored DSM programs in the 1980's (the Canada Home Insulation Program - or CHIP - is most often mentioned) which effectively distorted the marketplace. On the other hand, the PC industry has identified the need for government and utility marketing to assist in legitimizing and promoting the services offered by the PC industry.

Although definitions of what constitutes an acceptable threshold for a viable performance contract vary considerably within the PC industry, the project does have to be large enough to justify the higher transaction costs and levels of risk associated with this market sector. Although the utility savings from the water and energy efficiency improvements are higher, so also are the capital costs which leads inevitably to extended repayment periods. Therefore, clients must be able to accept longer payback scenarios. They typically prefer paybacks of less than 3 years, however, some contracts have been reported to extend up to 10 years or longer[70].

It has been recommended that CMHC embark on a development strategy for the performance contracting industry encompassing a combination of marketing, educational and institutional initiatives to accelerate uptake of PC services for both water and energy in the MFR marketplace and to raise awareness among the MFR client base[71].

The development strategy would include:

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[70] CMHC, 1996. Ibid.
[71] CMHC, 1996. Ibid.

- CMHC/Natural Resources Canada consultation to determine interest in development of a government strategy;
- Consultation with the PC industry; and,
- Development of the strategy, based on a series of demonstrations or case studies.

The development of a government/industry strategy is still seen by most stakeholders as a useful endeavour, provided the key market segments identified by the PC industry — high density rental apartments and social housing — are the principal target markets. CMHC has noted these markets represent a potential total investment by the PC industry in the range of $550 to $650 million[72].

5 Conclusions

This research set out to assess what are the market barriers to the introduction of water efficiency measures into the multi-family residential sector in Canada and what the role of the performance contracting industry should be as a delivery agent for water DSM to this segment of the marketplace. Based on the results of this brief survey of the PC industry, it would appear that many of the barriers to the entry of the industry into the MFR sector, while still a problem in certain regions of Canada, are beginning to disappear. Most of the inroads are occurring in the Southern Ontario market.

Despite the higher risk associated with guaranteeing utility savings (water and energy) in the MFR sector, the potential returns are very compelling. There are significant savings in energy and water to be obtained in the social housing sub-sector, even among low density forms. Much of the assisted housing built in the 1970's and 1980's had to conform to maximum unit price (MUP) guidelines set by governments. This guaranteed low construction costs at the expense of high operating costs, due to the popularity of cheap to install electric heating systems and poor construction techniques.

While energy costs in many segments of the MFR sector are disproportionately high, water costs are still low compared to other industrialized countries. Water costs are expected to move upwards as the remaining flat-rate accounts in Canada become metered and municipal water providers utilize other financial instruments to reflect the true costs of providing water service (such as adding sewer surcharges to water bills and implementing conservation-based rate structures). Water's low cost, coupled with the relatively high cost associated with the replacement of plumbing fixtures, translates into payback periods which many building owners and managers are not prepared to accept.

The PC industry is responding to this barrier by offering owners of MFR buildings attractive financing and performance guarantees that reduce most of the perceived risks. However, obtaining third party (bank) financing for the MFR sector can be problematic for certain segments of the market. While social housing and condominiums are "very financable"[73] (they have either government backing or legally required reserve funds), financing for work involving the private rental market is often much more difficult to obtain.

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[72] CMHC, 1996. Ibid.

[73] Vaccaro, Steve, 1997. CSE Corporation, personal communication.

For example, in Ontario rental properties tend to be written off as tax losses by owners who claim they are losing money under rent controls. Needed repairs and renovations are postponed leading to further depreciation in property values and, in many case, to the withdrawal of the property from the rental market. As a result, banks and related financial institutions are reluctant to provide the financing for performance contracts in this segment of the MFR sector. However, key players in the PC sector in Ontario are working with gas utilities to address this barrier. For example, Consumers Gas is working with several performance contractors in the Toronto area, offering on-bill financing for both energy and water efficiency upgrades[74].

Most PC firms need a project to be of sufficient size, in either monthly utility bills or in the value of the renovations proposed, to justify the investment. For this reason, where water efficiency is being offered in performance contracts — primarily in the Ontario marketplace — it tends to be bundled with energy efficiency improvements which themselves tend to be piggy-backed onto other renovation work being planned for the building. However, water efficiency measures cannot always be piggybacked onto energy efficiency proposals. Condominiums have presented problems for some PC contractors.

For example, one of the more active performance contractors in the Southern Ontario market has pointed out that the condominium market in Ontario has become much more accessible within the past year[75] — but only for energy retrofit work. Several condominium projects the company has completed performance contracts for have "burst through the membrane", setting an example for other condominium boards and demonstrating the efficacy of performance contracting. Apparently, the biggest attraction for condominium boards has been the realization that reserve funds do not have to be depleted to finance the work.

While this has improved the energy efficiency of these condominiums, the contractor has found water efficiency upgrading to be a hard sell in condominiums. The reason for this is due to the need to access individual suites. Energy upgrades typically target heating system conversions and efficient lighting upgrades, which usually involve obtaining access to common areas only. Gaining access to individual suites for toilet and showerhead replacements carries with it much higher transaction costs due to the need to match toilet footprints, colours and showerhead preferences. In some cases, individual suite owners may refuse access or decline the offer for toilet and showerhead replacements, thus eroding the potential savings stream needed by the PC firm.

Market rental and social housing properties, as distinct segments in the MFR marketplace in Ontario, present their own unique set of opportunities and constraints for the PC industry. High vacancy rates in many social assisted housing complexes are often a function of the high rental costs for tenants associated with the operation of these primarily electrically heated buildings. The PC industry maintains that converting these buildings to natural gas through performance contracts would not only reduce operating costs but also improve occupancy rates by lowering rents and attracting more tenants back to these buildings.

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[74] Lee, Randall, 1997. Consumer Gas Ltd., personal communication and Steve Vaccaro, 1997. CSE Corporation, personal communication.

[75] Vaccaro, Steve, 1997. CSE Corporation, personal communication.

Rent controls have long presented a major barrier to the introduction of water and energy improvements into the rental segment of the MFR sector. In Quebec, even though rent controls are in place, landlords continue to invest in renovation[76]. It is not clear why landlords have been able to navigate through rent controls in Quebec but it would appear that there is greater trust of the system in that province.

Rent controls are under review in Ontario and are expected to be substantially revised in the fall of 1997. The requirement for landlords to pass on to tenants savings associated with energy and water efficiency improvements will be removed. The PC industry is poised to capitalize on this change in rent controls in Ontario and can be expected to increase its penetration into this segment of the MFR market.

Another factor that is likely to accelerate the introduction of water efficiency into the MFR sector is the mandation of water efficient plumbing fixtures in Ontario. The requirement for CSA-approved 6 litre ULF toilets, 9.5 L/m showerheads and 8.35 L/m faucets in Ontario as of January 1996 is influencing the marketplace across Canada.

This research was also designed to identify the role that CMHC could play in accelerating the introduction of water efficiency measures into the MFR sector. As reported, there is a considerable amount of ambiguity in the PC industry over the role of government and, to a lesser extent, utilities, in the MFR marketplace. However, there is general agreement that government can best play a facilitation role by educating the key target market segments, particularly in the rental and social housing areas.

How can this best be accomplished? One way would be to document case studies of MFR buildings which have undergone energy and water efficiency upgrades through the performance contracting process. Part 1 of this research, scheduled for completion later in the summer of 1997, will help to provide valuable intelligence in this area. Developing a series of case studies documenting the industry's experiences in other regions of Canada could be problematic, given the current lack of interest on the part of the PC industry in Canada towards the MFR sector outside Ontario and parts of the Maritimes.

Ontario seems to be the key to demonstrating on a significant scale, the potential for the PC industry in the MFR market in Canada. The industry is very mature and active in Ontario and, given the right stimulus, should be able to respond to a marketplace which seems ready for the service. CMHC has noted the preference of the PC industry for bundling similar buildings together. This achieves economies of scale, reduces risk and provides more attractive financing.

In view of the fact that CMHC's Assisted Housing Division is in the process of transferring the responsibility for its social housing portfolios to the provinces[77], perhaps the timing is right in Ontario for the Ontario Ministry of Municipal Affairs and Housing (MMAH) and the Ontario Housing Corporation (OHC) to initiate a large-scale demonstration, involving at least 100,000 social housing units, through the competitive bidding process, targeted to the PC industry.

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[76] Burke, Stephen, 1997. Quebec Housing Corporation, personal communication.
[77] Carleson, Marjory, 1997. CMHC Ontario Regional Office, personal communication.

However, there is considerable uncertainty about the future administrative and jurisdictional responsibilities for social housing in Ontario — uncertainty which may continue to impede the large-scale uptake of performance contracting in the social housing segment of the MFR market. The negotiation of agreements between CMHC and the individual provinces on the transfer of responsibilities for social housing continues. Until these jurisdictional and ownership issues have been dealt with, the government and the private sector will likely remain cautious about new relationships and contractual arrangements.

References Cited

Anderson, D.L., and R.L. Siegrist, 1989. *The Performance of Ultra-Low-Volume Flush Toilets in Phoenix,* AWWA Journal, March 1989, Denver.

Blease, Kingsley, 1995. *Water Efficiency and Metering,* in Ontario Pipeline, Volume 12, No. 2, Ontario Water Works Association.

Brown and Caldwell Consulting Engineers, 1989. *Water Auditing Protocols for Public Buildings,* Denver.

CMHC, 1991. *Residential Water Conservation: A Review of Products, Processes and Practices,* by REIC Consulting Ltd., Toronto.

CMHC, 1996. *Energy Performance Contracting and the Residential Sector,* by Marbek Resource Consultants Ltd., Ottawa.

Consumers Reports Magazine, 1995. *Low Flow Toilets,* February 1995.

Energy, Mines and Resources Canada, 1989. *The Economics of Energy Efficient Lighting,* prepared for the CREO Office, prepared by REIC Consulting Ltd., Toronto.

Environment Canada, 1990. *Water Demand Management in Canada: A State-of-the-Art Review,* by D.M. Tate, Ottawa.

Environment Canada, 1996. *Urban Water Indicator: Metering Residential Water Use,* State of the Environment Reporting Program, Bulletin No. 96-6, Fall 1996.

Gates, C., 1993. *The Potential for Improving Water Efficiency in Existing Housing: Implications for Municipal DSM Programming,* in Every Drop Counts, D. Shrubsole and D. Tate, CWRA, Cambridge, Ont.

Gates, C., et al, 1996. *An Evaluation of the Effectiveness of a Municipal Toilet Replacement Program,* presented at the AWWA Annual Conference, June 1996, Toronto.

Home Energy Magazine, 1994. *The Rise of Water Service Companies,* July/August 1994

Perry, D., 1996. *Report of the Special Commission on the Greater Victoria Water Supply,* Vol. Two, Background Reports, Victoria.

Region of Waterloo, 1993. *Kitchener Pilot Project Water Efficient Homes Final Report,* Region of Waterloo Utilities Division, Waterloo, Ontario.

REIC Consulting Ltd., and Blease and Associates Consulting Ltd., 1997. *Discussion Paper I: Water Efficiency Plan for Metropolitan Toronto*, MetroWorks Department, Toronto.

Scott, R., C. Gates et al., 1996. *Canadian Municipal Water Conservation Initiatives,* Technical University of Nova Scotia, Halifax, NS.

Tate, D.M., 1996. *Resource Valuation and Public Policy: The Case of Water Pricing.* Paper Presented at the Canadian Water Resources Association 49th Annual Conference, June 26-28, 1996, Quebec City.

Tate, D.M., and D. Lacelle, 1995. *Municipal Water Rates in Canada: Current Practices and Prices, 1991.* Environment Canada, Ottawa.

The Potential for Water Efficiency in Multi-Family Residential Buildings in Canada

Appendix 1
Two Case Studies

Case Study 1
50 Trudelle St.,
Scarborough, Ontario

Case Study 2
1177 Bloor St.,
Mississauga, Ontario

Acknowledgment

The two case studies presented in this appendix were prepared by REIC Consulting Ltd., based on file information and interviews obtained from CSE Energy Services Inc. in Concord, Ontario. REIC gratefully acknowledges the cooperation and support of Mr. Steve Vaccaro at CSE in the production of these case studies.

Appendix 1:
Two Case Studies

1 Introduction

These case studies document the water savings achieved in two highrise apartment buildings in the Greater Toronto Area brought about through performance contracts. As noted in the main text of the report, the performance contracting industry in the GTA has begun to move more aggressively to target the highrise marketplace, offering water efficiency upgrade services, either stand-alone, or offering them piggy-backed onto energy efficiency retrofit work.

As an outcome of the research and interviewing conducted in the preparation of the report, one performance contractor active in the GTA agreed to work with the principal investigator and provide file information on two recent water efficiency projects involving highrise apartments. Both buildings are documented in the two case studies which follw. Case Study 1 deals with a highrise building constructed in the mid-60's and located in the City of Scarborough within Metropolitan Toronto. Case Study 2 documents a similar aged building located in the City of Mississauga in the Region of Peel, just west of Toronto.

2 Discussion of the Two Case Studies

A review of the two case studies offers interesting comparisons and contrasts, as summarized in Table 1 below. In Case Study 1 (Scarborough), the performance contractor was able to convince the building owner/manager that fixture treatments focusing on toilet replacements was the most viable option. This was accomplished in a municipality with one of the lowest water and sewer charges per cubic metre in Southern Ontario. The contract did offer longer paybacks than Case Study 2 (Mississauga) but it also offered larger savings. Coupled with a performance contract which guaranteed the savings while providing positive cash flow — in spite of relatively high monthly payments to the performance contractor — the arrangement was suitable for both parties.

In the Mississauga case study, the performance contractor was unable to convince the building owner/manager that toilet replacements were the best option, even though the toilets consumed more water than in the Scarborough example (27 L/f vs. 21 L/f). Instead, the client opted for toilet retrofits (retaining the existing toilet bowl but replacing the working mechanisms inside the toilet tank). This was cheaper than toilet replacements, with more attractive paybacks. The building owner was not prepared to accept the high interest rate associated with the cost of borrowing money for a 30 month term[78]. In this particular case, the up-front cost was low enough and the expected payback quick enough that the building owner/manager did not require financing from the performance contractor.

[78] The high carrying costs associated with interest charges in the typical performance contract under $500,000 (where the contractor provides the financing) is a major barrier to the more widespread introduction of water efficiency improvements in the MFR sector, as discussed below.

Table 1 — Case Study Comparison

Item	Case Study 1	Case Study 2
Municipality	Scarborough	Mississauga
Demographic Make-up	Family Building	Adult Building
# of Suites	137	169
Toilets	163	170
Showers	137	169
Occupants	438	256
Occs/Suite	3.2	1.5
Toilet Treatment	Replace	Retrofit
Toilets/Suite	1.2	1.0
L/c/d Before	391	373
Water Cost/Capita Before	$.307/day	$.306/day
L/c/d After	238	226
Water Cost/Capita After	$.186/day	$.185/day
Water Costs/m^3	$.785	$.82
Contract Costs	$48,619	$15,662
Costs/Suite	$355	$93
Costs/Capita	$111	$62
Projected Water Savings %	35.8	29.5
Actual Water Savings %	39	39.5
Savings $/yr (Water & Gas)	$21,900	$13,200
Actual Payback (yrs)	2.2	1.2

It is interesting to note that the Mississauga building saved, on a percentage basis, about the same as the Scarborough building, even though the owners chose to retrofit the toilets rather than replace them with 6 Litre per flush toilets, as was done in Scarborough. On paper, the toilet retrofits only reduced flush volumes by 36% compared to toilet replacements, which should have reduced flush volumes by 71% — nearly twice as much.

However, the existing toilets in the Mississauga building were much larger water users than their counterparts in Scarborough, so the potential savings were also greater. Another explanation for this discrepancy could be very high rates of leakage in the Mississauga toilets which were corrected during the rebuild of each toilet.

In addition, the Mississauga building, although it had the higher flush volume toilets, displayed lower daily per capita consumption (373 L/c/d vs. 391 L/c/d). The explanation for this is a demographic one. The building in Case Study 2 had half the per suite occupancy compared to Case Study 1 and was an adult building. While the "other" use category in Case Study 1 represented 30% of total use (common uses associated with laundry and irrigation), it represented only 15% of total use in Case Study 2.

It can be surmised that more frequent laundry use associated with a family building and, possibly, greater site irrigation, are responsible for this difference between the two buildings[79].

On the subject of interest charges, the performance contractor reported that this element of performance contracting is the hardest sell in reaching an agreement with a building owner or manager concerning water efficiency upgrades. When all is said and done, many clients complain that they could have done the work at less cost themselves out of operating budgets with a local plumbing contractor or custodial staff[80].

The barrier of interest costs and carrying charges results in long lead times between first contacting the client and getting approvals to proceed. The performance contractor in these two case studies reported it often takes *up to 2 years* before a prospective client accepts a proposal.

High carrying costs (due to high borrowing costs associated with contracts worth less than $500,000) mitigate against participation, especially if the client can get financing at one or two points above prime on their own. This is why performance contractors prefer larger buildings in which both energy and water retrofit work is needed. The ideal candidate building is one with older plumbing fixtures and electric space and domestic water heating. The potential savings are very high in these buildings and the value of the work performed is such that a more attractive interest rate can be obtained from lenders.

Another barrier is a simple monetary one: water costs just under $0.31/occupant/day in both case study buildings. At such low costs, it is difficult enough to sell toilet retrofits let alone toilet replacements. However, toilet retrofits are prone to tampering by tenants and, in most cases, the devices have a much shorter performance life compared to ULF toilets. In addition, toilet retrofit devices do not save as much water as ULF toilets.

At the same time, more municipal water utilities in Canada are targeting the toilet in residential and commercial water demand management programs. They remain skeptical of the long-term performance and water saving potential of toilet retrofit devices such as dams, displacement bags and some types of early closure flappers. They prefer ULF toilets designed to flush with 6 litres which have CSA or related testing lab certification[81].

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[79] This information also highlights the importance of targeting washing machines in DSM programming. A recent Metropolitan Toronto discussion paper (see References Cited) has noted that high use machines such as those in apartments and some condominiums may be cost-justified for a rebate program to replace conventional vertical axis (V-axis) machines — which use between 150 to 300 litres per cycle — with more water efficient horizontal axis (H-axis) machines — which use 40% less water and half the heating energy of V-axis machines. The PC industry could play a lead role in the future delivering H-axis machines to such high volume users as highrises, condominiums and laundromats.

[80] Although, performance contractors counter that they can offer quicker turnaround times, less disruption to building occupants and greater depth of experience in water audit assessment and building retrofits — experience which is value added to the project.

[81] Currently, no Canadian certification authority has tested or approved any toilet retrofit devices.

Increasingly, municipal water authorities are taking the position that the only toilet treatment that will guarantee long-term sustainable reductions in water demand are those in which existing toilets are replaced with 6 litre ULF designs. For this reason, more performance contractors are promoting ULF toilets with their clients. As water and sewer costs continue to climb, the cost/benefit relationship for ULF toilets will become even more compelling for the average residential portfolio manager.

3 Next Steps

CMHC should consider documenting a series of multi-family residential case studies on water and energy retrofits carried out either by the performance contracting industry or through convention contracting firms. Building on the two case studies presented in this research, the information should be made available to municipal water utilities, public utilities commissions, wastewater treatment authorities and public housing authorities to heighten their awareness about the potential for water efficiency (and energy efficiency) improvements in this sector of the housing market.

The financing instruments which performance contractors can bring to the table, coupled with the advertising, marketing and promotional support that large water purveyors in the major metropolitan areas of Canada can also bring to the table, could rapidly accelerate the penetration of water efficiency into the multi-family residential sector. The presence of Canada's national housing agency as the publisher of the case studies, plus the support of municipal water and wastewater utilities (potentially in a role of funding for fixture rebates, for example) would provide the much needed third party "sanctioning" which the performance contracting industry needs to legitimize the concept of performance contracts in the marketplace.

In municipalities such as Metropolitan Toronto, where 50% of the existing 920,000 housing units are classified as multi-family, the conversion of this category of housing could lead to significant reductions in water demands and wastewater flows, thus easing the burden on water and wastewater infrastructure. An effort at promoting and implementing water efficiency could also help to defer the need for costly expansions to this infrastructure.

CMHC Case Study No. 1

Name of Case Study

San Marino Apartments Ltd.,
c/o Brown Management Services
38 Berwick Ave.,
Toronto, Ontario
M5P 1H1

Street Address of Case Study Building

50 Trudelle St.,
Scarborough, Ontario
M1J 1Z3

Building Owner Contact Name

Mel Brown
416-487-5122

Performance Contractor

Steve Vaccaro
CSE Corporation
467 Edgeley Blvd., Unit 4,
Concord, Ontario
L4K 4E9
(905) 660-1339

Type of Contract

Guaranteed Savings Agreement: In this case study, the performance contractor provided all the labour, financing and materials to changeout all toilets, showerheads and kitchen and bathroom aerators with low flow fixtures. The performance contractor used their own plumbing installers and supervisors to ensure acceptable installation procedures and speedy installation.

Costs of the project, the interest rate and the term of the contract were all negotiated with the building client as part of the performance contract service. A 30-month term was negotiated at an interest rate of 9.5%, for a total contract cost of $48,619 ($41,728 for materials and labour, $2,921 in taxes and $3,970 in interest charges). The fixture changeouts occurred over the period from October 12 to October 17, 1996.

This contract stipulated that the client would be responsible for continuing to pay the water utility (Scarborough Public Utilities Commission) on a monthly basis, as well as a monthly invoice to the performance contractor guaranteed to be less than or equal to the value of the monthly water and energy savings realized by the client. In essence, this guaranteed positive monthly cash flow for the client.

Description of Building

This is a 137 unit, 12 storey apartment building constructed in the mid-1960's. Before the fixture changeouts, it had high volume use toilets and showerheads. There is one showerhead per unit (137 showerheads) and an average of 1.2 toilets per unit (163 toilets).

Site characteristics are summarized in Table 1.

Table 1 — Site Characteristics

Number of Units	137
Number of Occupants	438
Average Occupancy/Unit	3.2
Number of Toilets	163
Number of Showers	137
Number of Bathroom Faucets	163
Number of Kitchen Faucets	137

Plumbing Fixture Characteristics

During a field audit, the performance contractor measured the flush volumes of the existing toilets and the flow rates for the existing showerheads and kitchen and bathroom faucets in about 5% of the units. The toilets averaged 21 litres per flush (L/f) while the showerheads demonstrated flow rates of 21 litres per minute (L/m). The Ontario Plumbing Code mandated in August 1993 that showerheads use no more than 9.5 L/m and, in January 1996, that toilets use no more than 6 L/f.

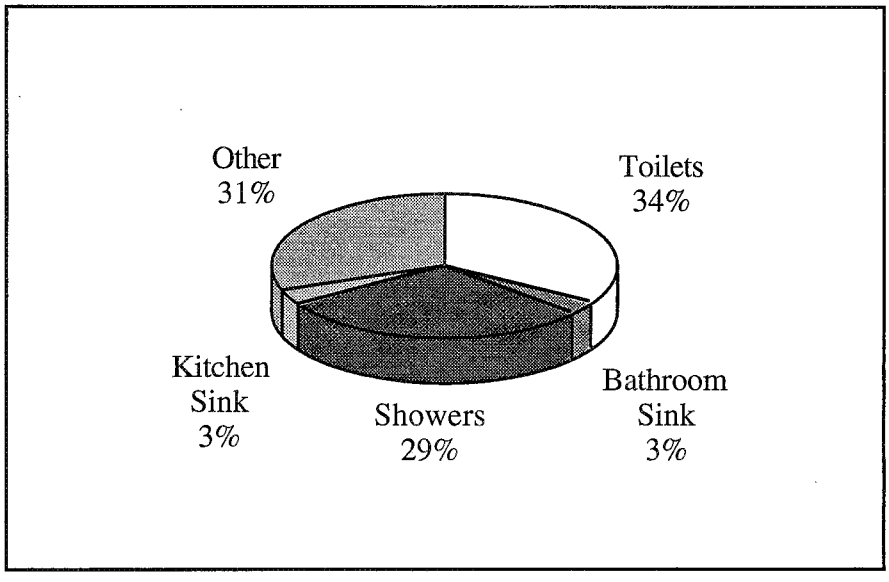
It was determined that the toilets and showerheads were responsible for 63% of total metered consumption and 91% of in-suite water consumption (refer to Table 2 and Chart 1). Table 2 and the chart reveal a category referred to as "other", representing common element uses (laundry and site irrigation).

Table 2 — Existing End Use Consumption

Fixture	Consumption Gallons	Percent Use
Toilets	4,704,470	34.0%
Showers	4,000,400	29.0%
Bathroom Sink	400,040	2.9%
Kitchen Sink	480,048	3.5%
Other	4,227,855	30.6%
Total	**13,812,813**	**100.0%**

% Use = Consumption/Total Existing Consumption

Chart 1 — Water End Use Consumption



Water Consumption History

The performance contractor analysed water consumption billing records for the building covering the period from December 1994 to December 1995. As shown in Table 3, water consumption averaged 13.8 million gallons per year or 62,650 m^3/year. This represented about $49,200 in yearly water costs and does not include natural gas costs to heat domestic water.

Table 3 — Historical Water Consumption

Month	Days per Period	Gallons	CM	Adjusted Gallons	Avg. Gallons per Day	Avg. Gal/ Person/Day
12/94 to 1/95	32	1,155,636	5,263	1,155,636	36,114	82.4
1/95 to 2/95	28	1,009,609	4,598	1,009,609	36,057	82.2
2/95 to 3/95	31	1,141,165	5,197	1,141,165	36,812	84.0
3/95 to 4/95	28	1,040,857	4,740	1,040,857	37,173	84.8
4/95 to 5/95	29	1,088,947	4,959	1,088,947	37,550	85.7
5/95 to 6/95	30	1,075,793	4,899	1,075,793	35,860	81.8
6/95 to 7/95	34	1,239,695	5,646	1,239,695	36,462	83.2
7/95 to 8/95	33	1,257,263	5,726	1,257,263	38,099	86.9
8/95 to 9/95	30	1,248,720	5,687	1,248,720	41,624	94.9
9/95 to 10/95	30	1,236,753	5,632	1,236,753	41,225	94.0
10/95 to11/95	27	1,082,315	4,929	1,082,315	40,086	91.4
11/95 to 12/95	29	1,084,687	4,940	1,084,687	37,403	85.3
Average	**30**	**1,138,453**	**5,184**	**1,138,453**	**37,843**	**86.3**
Total	**361**	**13,661,441**	**62,213**	**13,812,814**	**454,465**	

Summary of Work Completed

The performance contractor selected 6 litre ULF toilets manufactured by Western Pottery and EMCO low flow showerheads rated at 9.5 L/m and faucet aerators rated at 8.5 L/m. Table 4 summarizes before and after fixture characteristics.

Table 4 — Before and After Flow Rates of Fixtures

Fixture	Before	After
Toilets	21 L/fl	6.0 L/fl
Showers	21 L/m	9.5 L/m
Faucets	15 L/m	8.5 L/m

Projected Water Savings

The performance contractor had estimated savings would be 51.7% of in-suite use and 35.8% of total metered use. These savings were guaranteed as part of the performance contract. As Table 5 reveals, water reductions were projected to amount to 4.95 million gallons per year (22,500 m^3/year). At the City of Scarborough's combined water and sewer rate of \$0.785/m^3, the yearly dollar savings for water were estimated to be about \$17,650.

Table 5 — Projected Water Savings

Fixture	# of Occs.	# of Fixtures	Exist. Use Gal p/d	Exist. Use Gal p/Yr	Prop. Use Gal p/d	Prop. Use Gal p/Yr	Gal Saved/Yr	ML* Saved/Yr
Toilets	438	163	29	4,704,000	11	1,792,000	2,912,000	13.22
Showers	438	137	25	4,000,000	14	2,200,000	1,800,000	8.17
Bath. Basin	438	163	3	400,000	2	240,000	160,000	0.73
Kitchen Sink	438	137	3	480,000	3	400,000	80,000	0.36
Total				**9,584,000**		**4,632,000**	**4,952,000**	**22.48**

Total Proj. Water Savings = 4,952,000 Gal/Yr (22.48 ML/Yr) = 51.7% of In-Suite Consumption and 35.8% of Total Metered Consumption. (* ML = Megalitre = 1 Million Litres)

Projected Energy Savings

Projected energy savings were based on reductions in domestic hot water (DHW) use anticipated from the more efficient use of water in showers, bathroom basins and kitchen sinks. Table 6 shows that about 550 MMBtu's were expected to be saved which, at \$5.00/MMBtu, represents about \$2,750 per year.

Table 6 — Projected Energy Savings

Fixture	Water Saved (Gal)	% of Hot Water	Water Temp.	Supply Temp.	MMBtus Saved
Showers	1,800,180	40%	120 °F	55 °F	486
Bath. Basin	160,016	40%	120 °F	55 °F	43
Kitchen Sink	80,008	40%	120 °F	55 °F	22
Total					**550**

There may also be energy savings associated with less heat loss from draining a smaller volume of water during each 6 Litre flush. For example, in this case study, about 3 million gallons of water are saved each year due to the installation of ULF toilets. Natural gas cost savings of about $850/year are assumed to be obtained from the installation of ULF toilets, based on the following assumptions and calculations:

Assume:

- water supply temperature is 55 degrees F
- indoor temperature is 70 degrees F
- flush temperature is 62.5 degrees F ($\Delta T = 7.5$)
- water heated with gas @ $0.04/kWh equivalent
- 4 month core heating season

Cost savings per year:

$$\frac{A \times B \times C}{D} \times E \times F$$

where: A = ΔT, B = lbs/gal, C = gal/yr, D = BTU/kWh,
E = heating months, F = energy price in $/kWh

$$\frac{7.5 \times 10 \times 3 \times 10^6}{3440} \times \frac{4}{12} \times 0.04$$

= $860

Total Projected Water and Energy Savings

Total projected water and energy savings were estimated to be $21,243. Based on the $48,619 cost of the performance contract, this generates a simple payback of 2.3 years (Table 7). It is interesting to note that if this building had been located in the City of Toronto, with a combined water and sewer rate of $1.05/m^3, the yearly savings would have been $26,377, generating a simple payback of 1.8 years.

Table 7 — Projected Cost Savings

	Savings	Cost/Unit	Total $ Saved
Water (1000 Gal.)	4,953	$3.56	$17,633
Thermal* (MMBtu)	550	$5.00	$2,750
Thermal** (MMBtu)	172	$5.00	$860
Total Yearly Savings			$21,243
Materials & Labour			$41,728
Taxes			$2,921
Carrying Charges			$3,970
Total Cost			$48,619
Simple Payback			2.3 Years

*** Gas savings from low flow showerheads**

**** Gas savings from less heat loss in each smaller flush volume**

Actual Savings

A review of billing records since the fixture changeouts indicates that the water efficiency improvements are generating yearly savings of 39% in total metered consumption, exceeding the estimated 35.8% reduction in total metered consumption by about 9%.

As interpreted from Tables 3, 5, 6 and 7, the average water cost savings are about $1,595/month, while energy cost savings are estimated at $300/month, for a combined saving of just under $1,900/month. Under the terms of the performance contract, the monthly invoice from the performance contractor is fixed at $1,620. In other words, the client is experiencing positive cash flow in the amount of about $275/month. After the 30-month life of the contract expires, the client saves the full amount.

CMHC Case Study No. 2

Name of Case Study

Applewood on the Park Apartments Ltd.,
c/o Lehndorff-Tandem Management Ltd.
390 Bay St.,
Toronto, Ontario
M5J 2S8

Street Address of Case Study Building

1177 Bloor St.,
Mississauga, Ontario
L4Y 2N9

Property Management Contact Name

Roger Palmer
Lehndorff-Tandem Management Ltd.
416-869-7800

Performance Contractor

Steve Vaccaro
CSE Corporation
467 Edgeley Blvd., Unit 4,
Concord, Ontario
L4K 4E9
(905) 660-1339

Type of Contract

Guaranteed Savings Agreement: In this case study, the performance contractor provided all the labour, financing and materials to retrofit all existing toilets and replace all showerheads with low flow units and all kitchen and bathroom aerators with low flow aerators. The performance contractor used their own plumbing installers and supervisors to ensure acceptable installation procedures and speedy installation. Installations were completed over a 5 day period in late November, 1996.

Unlike Case Study 1, this project involved retaining the existing toilets and retrofitting the tanks with new supply lines, early closure flappers and modified refill tubes. In addition, this contract involved no interest charges or monthly payments. Instead, the client made an upfront payment to cover materials and labour with the understanding that if, at the end of the first year, savings were less than projected, then CSE would refund the difference.

Total costs of the project, including parts, materials, labour and taxes was $15,622. The fixture retrofits and changeouts occurred over the period from November 10 to November 15, 1996.

Description of Building

This is a 169 unit, high rise apartment building constructed in the mid-1960's. Before the fixture changeouts, it had very high volume use toilets and moderately high use showerheads. There is one showerhead per unit (169 showerheads) and one toilet per unit (170 toilets — 169 in-suite toilets plus one toilet in the laundry room).

Site characteristics are summarized in Table 1.

Table 1 — Site Characteristics

Number of Units	169
Number of Occupants	256
Average Occupancy/Unit	1.5
Number of Toilets	170
Number of Showers	169
Number of Bathroom Faucets	170
Number of Kitchen Faucets	169

Plumbing Fixture Characteristics

During a field audit, the performance contractor measured the flush volumes of the existing toilets and the flow rates for the existing showerheads and kitchen and bathroom faucets in about 5% of the units. The toilets averaged just over 21 litres per flush (L/f) while the showerheads demonstrated flow rates of just over 19 litres per minute (L/m). The Ontario Plumbing Code mandated in August 1993 that showerheads use no more than 9.5 L/m and, in January 1996, that toilets use no more than 6 L/f.

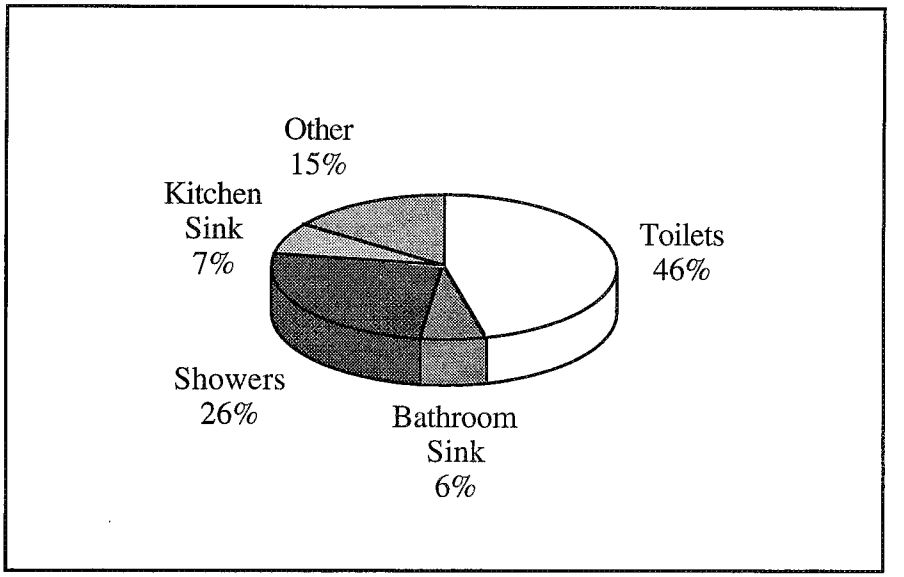
It was determined that the toilets and showerheads were responsible for 72% of total metered consumption and 84% of in-suite water consumption (refer to Table 2 and Chart 1). Table 2 and the chart reveal a category referred to as "other", representing common element uses (laundry and site irrigation).

Table 2 — Existing End Use Consumption

Fixture	Consumption Gallons	Percent Use
Toilets	3,597,440	46.3%
Showers	1,985,600	25.5%
Bathroom Sink	467,200	6.0%
Kitchen Sink	560,640	7.2%
Other	1,166,927	15.0%
Total	**7,777,807**	**100.0%**

% Use = Consumption/Total Existing Consumption

Chart 1 — Water End Use Consumption



Water Consumption History

The performance contractor analysed water consumption billing records for the building covering the period from mid-June 1996 to mid-November 1996 (Table 3). As shown in Table 2, in suite water consumption averaged 6.6 million gallons per year while total metered use was 7.7 million gallons (34,870 m^3/year). This represented just over $28,590 in yearly (1996) water costs, excluding natural gas costs to heat domestic water.

Table 3 — Historical Water Consumption

Month	Days per Period	Gallons	CM	Avg. Gal. / Day	Avg. Gal. Per/Day
6/17/96	27	575,326	2,620	21,308	83.2
7/17/96	31	669,750	3,050	21,605	84.4
8/19/96	31	680,729	3,100	21,959	85.8
9/17/96	29	687,317	3,130	23,701	92.6
10/17/96	30	645,595	2,940	21,520	84.1
11/19/96	32	581,914	2,650	18,185	71.0
12/10/96	21	283,271	1,290	13,489	52.7
1/21/97	42	537,996	2,450	12,809	50.0
2/17/97	27	373,303	1,700	13,826	54.0
4/16/97	28	404,046	1,840	14,430	56.4
Average	**29.8**	**543924.7**	**2477**	**18283.2**	
Total	**298**	**5,439,247**	**24,770**	**182,832**	

Summary of Work Completed

The performance contractor installed new supply lines, refill tubes and early closure flappers in the existing toilet tanks and low flow showerheads rated at 9.5 L/m and faucet aerators rated at 8.5 L/m. Table 4 summarizes before and after fixture characteristics.

Table 4 — Before and After Flow Rates of Fixtures

Fixture	Before	After
Toilets	27 L/fl	17.5 L/fl
Showers	19 L/m	9.5 L/m
Faucets	16 L/m	8.5 L/m

Projected Water Savings

The performance contractor had estimated savings would be 34.6% of in-suite use and 29.5% of total metered use. These savings were guaranteed as part of the performance contract. As Table 5 reveals, water reductions were projected to amount to 2.289 million gallons per year (10,440 m^3/year). At the Region of Peel's 1996 water and sewer rate for apartment buildings of \$.82/m^3, the yearly dollar savings for water were estimated to be about \$8,560[82].

Table 5 — Projected Water Savings

Fixture	# of Occs.	# of Fixtures	Exist. Use Gal/p/d	Existing Use (Gal/Yr)	Prop. Use Gal/p/d	Proposed Use (Gal/Yr)	Gal. Saved/Yr	ML* Saved/Yr
Toilets	256	170	39	3,597,000	25	2,289,000	1,308,000	5.94
Showers	256	169	21	1,986,000	14	1,285,000	701,000	3.18
Bath. Basin	256	170	5	467,000	3	280,000	187,000	0.85
Kitchen Sink	256	169	6	561,000	5	467,000	94,000	0.43
Total				**6,611,000**		**4,321,000**	**2,290,000**	**10.40**

Total Projected Water Savings = 2,290,000 Gallons/Yr = 34.6% of In-Suite Consumption and 29.4% of Total Metered Consumption (*ML = Megalitre = 1 Million Litres)

Projected Energy Savings

Projected energy savings were based on reductions in domestic hot water (DHW) use anticipated from the more efficient use of water in showers, bathroom basins and kitchen sinks. Table 6 shows that about 185 MMBtu's were expected to be saved which, at \$5.00/MMBtu, represents about \$925 per year.

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[82] Interestingly enough, the client was offered a toilet *replacement* option which would have reduced in-suite use by over 53.4% and total metered use by 45.4%. This option was rejected due to the higher capital and financing costs which would have been incurred and the desire on the part of the client to obtain a quicker payback.

Table 6 — Projected Energy Savings

Fixture	Water Saved (Gal)	% of Hot Water	Water Temp.	Supply Temp.	MMBtus Saved
Showers	700,800	35%	120 °F	55 °F	132
Bath. Basin	186,880	35%	120 °F	55 °F	35
Kitchen Sink	93,440	35%	120 °F	55 °F	18
Total					**185**

There may also be energy savings associated with less heat loss from draining a smaller volume of water during each 6 Litre flush. For example, in this case study, about 1.3 million gallons of water are saved each year due to the installation of early closure flappers in the existing toilet tanks. Natural gas cost savings of about $375/year are assumed to be obtained from the smaller flush volumes, based on the following assumptions and calculations:

Assume:

- water supply temperature is 55 degrees F
- indoor temperature is 70 degrees F
- flush temperature is 62.5 degrees F ($\Delta T = 7.5$)
- water heated with gas @ $0.04/kWh equivalent
- 4 month core heating season

Cost savings per year:

$$\frac{A \times B \times C}{D} \times E \times F$$

where: A = ΔT, B = lbs/gal, C = gal/yr, D = BTU/kWh,
E = heating months, F = energy price in $/kWh

$$\frac{7.5 \times 10 \times 1.3 \times 10^6}{3440} \times \frac{4}{12} \times 0.04$$

= $375

Total Projected Water and Energy Savings

Total projected water and energy savings were estimated to be $9,860, or about $820 per month. Based on the $15,662 cost of the performance contract, this generated a simple payback of 1.6 years (Table 7).

Table 7 — Projected Cost Savings

	Savings	Cost/Unit	Total $ Saved
Water (1000 Gal)	2,289	$3.74	$8,562
Thermal* (MMBtu)	185	$5.00	$925
Thermal** (MMBtu)	75	$5.00	$375
Total Yearly Savings			$9,862
Materials & Labour			$14,637
Taxes			$1,025
Total Cost			$15,662
Simple Payback (yrs)			1.59

*** Gas savings from low flow showerheads**

**** Gas savings from less heat loss in smaller flush volume**

Actual Savings

A review of billing records since the fixture changeouts (refer to the December 10, 1996 to April 16, 1997 billing period at the bottom of Table 3) indicates that the water efficiency improvements are generating yearly savings of 39.5% in total metered consumption, exceeding the estimated 29.5% reduction in total metered consumption by 34%.

As interpreted from Tables 3, 5, 6 and 7, the average water cost savings are about $1,020/month, while energy costs are estimated at about $110/month, for a combined saving of just under $1,130/month. In other words, instead of taking just under 20 months to payback the building owners investment, the actual savings will allow the investment to be recoved in just under 14 months.

Appendix 2

List of Contacts

Contact	Affiliation	Location	Phone
Bavis, Kirk	EnerPlan/Rose Engineering	Moncton	506-858-1300
Bednar, Teresa	Scarborough Public Utilities Com.	Scarborough	416-292-1530
Blease, Kingsley	Blease & Associates	Toronto	416-499-1777
Brennan, Lane	Schlumberger Industries	Mississauga	905-858-4211
Burns, Peter	Ministry of Housing	Toronto	416-585-7562
Carleson, Marjory	CMHC Ontario Regional Office	Toronto	416-218-3358
Horner, Russell	Water Management Inc.	Virginia	703-658-4300
Hounjet, Marvin	Johnson Controls Ltd.	Calgary	403-469-6700
Kalifon, Philip	CMCI Inc.	Toronto	416-781-8556
Lahtinen, Leif	CMHC Toronto Branch Office	Toronto	416-789-8742
Lee, Randall	Consumers Gas Ltd.	Toronto	416-496-7157
Lennox, Graham	American Standard	Toronto	416-536-1078
Levy, Allan	CAESCO	Toronto	905-294-3366
Martin, Mike	Honeywell Ltd.	Toronto	416-502-4245
McCoombes, Lynn	Water Matrix	Concord	800-668-4420
Mills, Peter	Strategic Utilities Mgmt.	Toronto	416-493-2480
Owens, Philip	Johnson Controls Ltd.	Markham	905-474-5359
Reid, Ed	Aqualta Corporation	Edmonton	403-944-7757
Rogers, Joe	Ministry of Housing	Toronto	416-585-6666
Smith, Victoria	Honeywell Ltd.	Vancouver	604-654-5606
Thompson, Barry	City of Barrie	Barrie	705-726-4242
Vaccaro, Steve	CSE Corporation	Toronto	905-660-1339
Walker, Deborah	Region of Waterloo	Kitchener	519-575-4503

Appendix 3

Telephone Survey for Performance Contractors

Name:_____ **Company:**_____

Phone:_____ **Fax:**_____

1) Does your firm offer water efficiency contract work in the multi-res sector?

2) What tenure types do you service?

Condominiums and equity co-ops	❑
Non-equity co-ops	❑
Private market rental housing	❑
Public housing	❑
Sponsored non-profit housing	❑

3) What products/fixtures are targeted?

Toilets	❑
Showerheads	❑
Kitchen Faucets	❑
Bathroom Faucets	❑
Landscape Irrigation	❑
Other (specify)_____	❑

4) Do you focus on toilet *retrofits* (early closure flappers, etc.) or *replacements*?

Retrofits	❑
Replacements	❑

5) How do you choose manufacturers/suppliers?

Price	❑
Product performance	❑
Both	❑

6) Do you target energy efficiency upgrades in multi-residential buildings?

Yes	❑
No	❑

7) If yes to Question 6, in what areas do you offer services?

Space heating equipment	❑
DHW equipment	❑
Lighting	❑
Building envelope upgrades	❑
Other (specify)_____	❑

8) When you assess a potential candidate building, do you:

Audit units/measure fixture flows?	❑
Analyse billing histories?	❑
Both?	❑

9) What barriers must be overcome to convince building owners to participate?

10) What effects do rent controls have on your projects?

11) What is the typical size of a building project?

Number of Units:_____

Capital Cost of Work:_____

12) What type of contractual arrangement do you typically offer a client?

Guaranteed savings	❑
Lease arrangement	❑
Both	❑

13) What is a typical payback period for water efficiency upgrading?

1 to 2 years	❑
2 to 3 years	❑
3 to 5 years	❑

14) What benefits does a turnkey approach offer for the client?

15) What magnitude of water savings are obtained in a typical project?

1 to 10%	❑
11 to 20%	❑
21 to 30%	❑
31 to 40%	❑
41 to 50%	❑
>50%	❑

16) What magnitude of energy savings are obtained in a typical project?

1 to 10%	❑
11 to 20%	❑
21 to 30%	❑
31 to 40%	❑
41 to 50%	❑
>50%	❑

17) Do you offer services in the ICI sector? If yes, in what end-use categories:

Domestic uses	❑
Process water uses	❑
Cooling water uses	❑
Other (specify)_____	❑