RESEARCH HIGHLIGHT

Technical Series 01-114

Peak-Day Irrigation Demand Reduction Monitoring

INTRODUCTION

"Peak-day" is the highest single-day demand on a water-treatment plant in a calendar year. Usually, there are several days a year with similar high demand. This demand, often 150 to 200 per cent greater than an average winter-day demand, can occur on consecutive days or at different times during the year.

Reducing peak-day demand is important to municipal water suppliers for two reasons:

1. The revenue for peak-day demand often accounts for less than five per cent of annual revenue.
2. The infrastructure designed to meet peak-day demand can be scaled back, which significantly reduces capital construction costs.

In addition, programs that reduce average summer-day demand but not peak-day demand can adversely affect municipalities because:

1. The municipality pays to put the program in place.
2. The municipality receives less revenue from reduced water sales.
3. There is no scaling back infrastructure because there is no reduction in peak demand.

This project was jointly undertaken by CMHC and the Canadian Water and Wastewater Association. Irrigation reduction programs target changes in customer habits rather than changes in household fixtures. As such, savings are more difficult to achieve, to maintain, and to quantify than savings related to the installation of new fixtures. The methodology developed for this project was specifically designed to identify and quantify the peak day water savings directly attributable to the individual municipal water efficiency programs.

RESEARCH PROGRAM

Three Ontario municipalities—the Region of Durham, the Region of Halton and the Region of York—participated in the study. Each identified a specific demand-reduction measure to evaluate, and selected a study (where the selected measure was implemented) and a control area.

For each area, the water supply was reduced to one water main. The research consultant, monitored the demand in each area at five-minute intervals, using insertion flow meters and electronic data loggers.

Canada

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HOME TO CANADIANS

The project analyzed water demand between 6 a.m. and midnight and monitored usage from the end of July until mid-October. The researcher collected precipitation and temperature data for each municipality during the monitoring period and reviewed historical data for the entire area.

To quantify the savings related specifically to the measure involved, the research consultants first defined "high" irrigation demands and "low" irrigation demands. The related water savings were then determined to be the difference between these demands in the study area vs. the control area.

Durham

The Region of Durham chose Community-Based Social Marketing (CBSM) as its demand-reduction measure. CBSM, which involves face-to-face contact with homeowners, targeted 400 homes in the Whitby area and an additional 900 homes in the Oshawa area.

The CBSM method employed college summer students to provide lawn and gardening information to residents in the hopes of changing their water-use behaviours. The students visited each household four times. On the first three visits, the students gave residents hose washers, a rain gauge, faucet tags and educational information. On the fourth visit, they gave them a fridge magnet and asked for a written commitment to limit lawn watering to a maximum of 1 in. (2.5 cm) per week. Obtaining this commitment was the chief goal of the intervention.

In a similar program in 1998, students visited approximately 900 households at a cost of $88 per household. The result was an estimated 26 per cent reduction in outdoor water use. One of the goals of the intervention in 2000 was to lower the cost per household of the program. To do this, the students visited twice as many homes, reducing the program cost per household to $44 from $88. Durham estimates the cost per household at $20 if the program were implemented throughout the municipality.

Halton

The Region of Halton also implemented a social marketing program including a letter of introduction, a follow-up survey and a letter of appreciation. The program involved the delivery of educational material and hardware to the households in its study area. The study area included 543 homes, while the control area had 267 homes. The cost of Halton's program was approximately $18 per household but would be expected to reduce to approximately $12 per household if implemented on a Region-wide basis.

York

The Region of York chose to evaluate a public education campaign. Its program involved distributing information and rain gauges to 501 homes in the study area. Nothing was delivered to the control, which included 482 homes. The main messages of the York campaign were as follows:

- Lawns need water only once a week (either by nature or the homeowner).
- Lawns needs only 2.5 cm (1 in.) of water per week.
- Homeowners can measure the watering depth with the rain gauge.
- Homeowners should cut their grass high and leave the clippings on the lawn.

The average cost per household was $22.22 and anticipated to reduce to approximately $4.60 per household if implemented on a Region-wide basis.

FINDINGS

A surprising conclusion from the research is the relationship between rainfall and irrigation. Although the information the municipalities gave to householders explained that lawns do not need more than 2.5 cm of water a week, the data indicated that irrigation demands often rose dramatically after significant rainfall events.

The average household irrigation demand on peak-demand days ranged from 257 L (68 gal.) in the York study area to 671 L (177.2 gal.) in the Durham control area.

The results also indicated that weekday irrigation demands peak around 8 p.m. while weekend irrigation occurs throughout the day. Weekend water demands are greater and more evenly distributed than weekday demands.

Durham

In both Whitby and Oshawa, homeowner commitment to changing water-use behaviours was consistent with previous programs. The support levels were:

- Limiting lawn irrigation and rainfall watering to a maximum 2.5 cm (1 in.) a week: 94 per cent.
- Leaving grass longer: 82 per cent.
- Grass-cycling: 85 per cent.
- Not watering paved areas: 93 per cent.
- Watering either early or late in the day: 91 per cent.

Analysis of Durham's results revealed that during irrigation days water demand increased more in the control area than in the study area. This indicates that the social marketing program worked.

The water-reduction program saved about 215 LHd (litres per household per day—47.3 gal. per house per day) on high-irrigation days—about 32 per cent.

Halton

Halton's results show that, as in Durham, water demands increased more in the control area than in the study area, again indicating that the social marketing campaign strategy worked.

Halton's program saved about 220 LHd (48.4 gal. per household per day) on high-irrigation days—savings of about 45 per cent.

York

The data analysis for York revealed that household demands for both the control and the study areas were similar on both irrigation and non-irrigation days. York's program saved only about 3 LHd (0.7 gal. per household per day).

Moreover, the households in both the study and the control areas performed only minimal irrigation. This may have been the result of significant public education previously undertaken by the Region. It may also indicate that there is a practical lower limit to potential savings available from irrigation reduction measures (excluding restriction).

COMPARISON WITH COST OF SUPPLY

Comparison of the cost of implementing a measure to the cost of not implementing a measure determines if a water demand-reduction measure is cost-effective. The researchers calculate cost-effectiveness by comparing the cost of implementing a measure with the current cost of constructing water supply infrastructure.

The calculation shows that the current cost of constructing water supply infrastructure is $0.40 per L/d ($0.09 per gal. per day). To be cost-effective, the unit cost of implementing water-demand reduction must be less than $0.40 per L/d. However, to apply this economic-value calculation, it is critical that water savings be maintained over time.

COST-EFFECTIVENESS OF REDUCTION MEASURES

Table 1 shows the approximate unit costs (that is, cost per household) of implementing the water-use reduction measures. The unit costs on a region-wide basis are assumed to be significantly less.

The table shows that Halton's program was the most cost-effective, followed by Durham's, then York's. When evaluating these findings, it is important to remember that the savings achieved must be maintained over time, and that the unit cost of implementing the measures on a region-wide basis must be used.

The report emphasizes that maintaining the program savings is critical. One study, referred to in *The Guide to Data and Methods for Cost-Effective Analysis of Urban Water Conservation Best Management Practices,* found that savings drop off quickly after the program's first year. Continued monitoring of this project is expected to continue in 2001 to evaluate the sustainability of these measures.

Table 1 Cost-effectiveness of reduction measures

Municipality	Unit Cost of Measure	LHd Savings	Unit Cost of Savings, $ per L/d	Unit Cost of Supply, $ per L/d	C/B Ratio
Durham	$20.00	215	$0.093	$0.40	0.23
Halton	$12.00	220	$0.055	$0.40	0.14
York	$22.22	3	$1.53	$0.40	3.8

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Housing Research at CMHC

Under Part IX of the ***National Housing Act***, the Government of Canada provides funds to CMHC to conduct research into the social, economic and technical aspects of housing and related fields, and to undertake the publishing and distribution of the results of this research.

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