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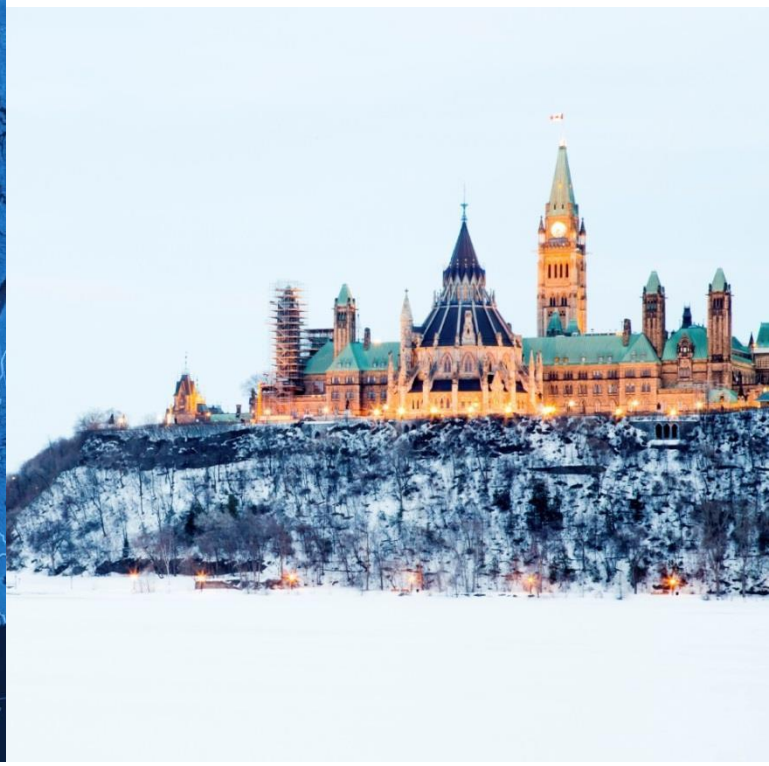


2016 Program Evaluation Report: Toronto Hydro RTU Controls Pilot

Submitted to Independent Electricity System Operator

November 15, 2017

Contents

1 Goals and Objectives

The goals and objectives of the 2016 evaluation of Toronto Hydro's Roof Top Unit (RTU) Controls Pilot (also known as RTUsaver) are to:

- Verify energy and demand savings with a high degree of confidence, taking into account:
  - Mix of measures implemented
  - Spillover savings and pilot-enabled savings
  - Savings from interactive effects within the measures implemented
  - Noted equipment failures
- Review and evaluate key pilot elements.
- Conduct annual cost-effectiveness analyses.
- Report and attribute savings due to the pilot.

To estimate gross verified energy and peak-demand savings, the evaluation team conducted desk reviews of project documentation, followed by an analysis of trended equipment data. Trended equipment data included kWh consumption, runspeed, and damper position. To estimate the direct influence of the pilot in generating energy savings, the evaluation team conducted attribution surveys to calculate the rates of free ridership and spillover. This information was used to calculate the net-to-gross ratio, which was then applied to the gross verified savings to calculate the net savings. This scaling factor was developed using random sampling methods to select and survey projects that were representative of the population at large.

2 Pilot Description

The objective of the RTU controls pilot is to reduce energy consumption by equipping rooftop HVAC systems with the CATALYST RTU Control system. More generally, these are referred to as Advanced Rooftop Controls (ARC). The energy conservation measures tested as part of the ARC package is offered by Transformative Wave technologies and include the following:

- Opti-run fan controls, which adjust fan speeds, based on the space needs.
- Integrated economizer with advanced changeover, which is an outside air economizer controller, to maximize free space-cooling.
- Advance cool, which anticipates the need for cooling and utilizes ventilation pre-cooling to reduce compressor runtime.
- Demand controlled ventilation to limit the amount of outside air, reducing the required cooling and heating of the RTU.

The operation of these features can also be controlled by the Catalyst eIQ Platform, which provides visibility to RTU system operation and allows participants to remotely control the units from a web enabled platform provided by Transformative Wave.

3 Methodology

3.1 Impact Evaluation Methodology

3.1.1 Sampling, Project Reviews and Evaluation

The Nexant team estimated verified savings for each of the four rooftop units at all 13 of the participating facilities, for a total sample of 52 units. The Nexant team's approach utilized hourly interval usage data provided by Toronto Hydro and observed hourly weather conditions obtained through the National Oceanic and Atmospheric Administration (NOAA) to perform a regression analysis to estimate weather normalized annual energy consumption during the standard mode and CATALYST mode control periods. The daily alternating nature of the CATALYST control system allowed for a quasi pre-post analysis, where days in normal operation were assigned as pre (or non-treatment) and days in CATALYST mode operation were assigned as post (or treatment).

The Nexant team used linear regression analysis to establish a relationship between outdoor air temperatures and hourly RTU energy use under normal operation and under CATALYST mode operation. The regression coefficients, which define the observed relationship between weather and energy use, were then applied to typical weather year data (TMY3) for the Toronto weather station in order to estimate annual energy savings for a typical weather year.

The Nexant team used hourly usage data rather than daily or monthly data in order to maximize the level of granularity available in the analysis dataset. In order to estimate savings at the site level, a linear regression model is used on each unit's data separately. The model specification is shown below in Equation 3-1.

Equation 3-1: Regression Model Specification

$$kWh_{it} = \beta_0 + \beta_1(Treat)_{it} + \beta_2(CDH)_{it} + \beta_3(Treat \times CDH)_{it} + \beta_4(HDH)_{it} + \beta_5(Treat \times HDH)_{it}$$

Where:

kWh = average hourly kWh for rooftop unit *i* during time period *t*
CDH = average cooling degree hours
HDH = average heating degree hours
Treat = 0 normal mode, 1 CATALYST mode
$B_{0\text{-}5}$ = regression coefficients

Separate regressions were used to produce kWh savings estimates at the measure level, that is, for each of the units equipped with the RTU control system. At the outset of the pilot, a total of 52 units were equipped with RTU controls at 13 separate locations. Due to equipment failure, eight units from five sites were removed from the analysis, resulting in a final dataset of 44 RTU units.

3.1.2 Net-to-Gross (NTG) Methodology

To calculate net savings, the portion of gross verified savings that were specifically attributable to the pilot were evaluated. Net savings were determined by multiplying the gross verified savings by the net-to-gross (NTG) ratio, as shown in Equation 3-2. This equation and general methodology are the same for estimating energy and demand savings.

Equation 3-2: Net Savings

$$Savings\ \mathrm{net} = Savings\ verified \times NTG$$

Where:

Savings net = Net savings impact (kW or kWh)

Savings verified = Gross verified energy savings (kW or kWh)

NTG = Net-to-gross ratio

To estimate the direct influence of the RTUsaver pilot in generating net energy savings, an attribution survey was implemented to calculate the free ridership (FR) and spillover (SO) rates, assessed as percentages of total reported savings. Free ridership represents pilot savings that would have occurred without pilot services or no-cost upgrades. Spillover refers to savings that occurred because of pilot influence but without pilot services or no-cost upgrades. For any group, the NTG ratio is defined by Equation 3-3, where FR is the free ridership percentage and SO is the spillover percentage:

Equation 3-3: Net-to-Gross Ratio

$$\mathrm{NTG} = 100\% - FR + SO$$

For the RTUsaver pilot, spillover is calculated for a single project for each sampled participant.

3.2 Process Evaluation Methodology

The process evaluation focused on the design, implementation, and delivery of the pilot. Program processes were evaluated through interviews with pertinent program actors including Toronto Hydro staff and participants (Table 3-1). For each population, a unique interview guide was developed to ensure responses produced comparable data and to allow the evaluation team to draw meaningful conclusions.

Table 3-1: Process Evaluation Primary Data Sources

Respondent Type	Methodology	Targeted	Completed
Toronto Hydro Program Staff	Phone	1	1
RTUsaver Participants	Phone	8	8

3.2.1 Program Staff

The evaluation team completed one phone interview with a Toronto Hydro program staff in May 2017. The purpose of the interview was to better understand how the pilot was administered in 2016, and to attain program staff perspectives regarding design and implementation. Topics covered include staff roles, any changes to the pilot, supply channel engagement, barriers to implementation, and perspectives on the success of the pilot. The evaluation team identified the appropriate staff to be interviewed in consultation with the IESO evaluation staff. Toronto Hydro program staff interviewed oversees the planning and implementation strategy. The interview took approximately one half-hour to complete.

3.2.2 Participants

The RTUsaver participant survey asked a series of questions encompassing respondent characteristics, pilot outreach and marketing, participant motives and decision-making, participant satisfaction, free-ridership and spillover, and firm characteristics. Section 6.2 highlights the feedback received from the participant interviews.

Thirteen total buildings participated in the RTUsaver pilot in 2016. Of the 13 sites, two contacts were knowledgeable about two sites (respectively) leaving 11 unique contacts. Of these 11, 8 completed the survey. One contact refused to participate, and another was non-responsive. The remaining survey was not completed largely due to staff turnover resulting in no knowledgeable person available to complete the interview. Table 3-2 below summarizes participant data for the RTUsaver pilot.

Table 3-2 RTUsaver Participant Population Disposition, 2016

Item	Number
Total Projects	13
Unique Participant Addresses	13
Unique Participant Contact Names	11
Phone surveys	8 contacts representing 10 properties

4 Participation

Thirteen participants were enrolled in the pilot and each was provided with four ARC controls for a total of 52 units. Eight units were excluded from the analysis due to equipment failure. All 13 projects in the pilot were reviewed and analyzed, which included all 44 of the rooftop units that did not experience equipment failure.

Toronto Hydro provided IESO with very robust hourly metered data for each rooftop unit, which included kWh consumption, runspeed, and damper position. As mentioned in Section 3.1, the daily alternating nature of the CATALYST control system allowed for the dataset provided by Toronto Hydro to include both pre- and post-retrofit data dovetailed together. Therefore, contacting participants for the purpose of verifying measure implementation was not needed and not performed.

Listed below are some characteristics of the participating buildings and rooftop units:

- Participant building types varied:
  - Seven shopping centres
  - One grocery
  - One standalone retail (dry-goods)
  - Two fitness/community centres
  - One office space
  - One post office
- Rooftop units:
  - All participating rooftop units were single zone packaged units
  - 51 of the 52 participating RTUs were AC cooling with gas heat, the remaining unit was cooling only
  - Cooling capacity per rooftop unit varied between 7.5 and 30 tons, with an average of 14.3 tons

5 Impact Evaluation Results

5.1 Energy Savings

Measure level estimates were aggregated to produce project (i.e. building) level and full pilot level savings estimates, which are shown in Table 5-1.

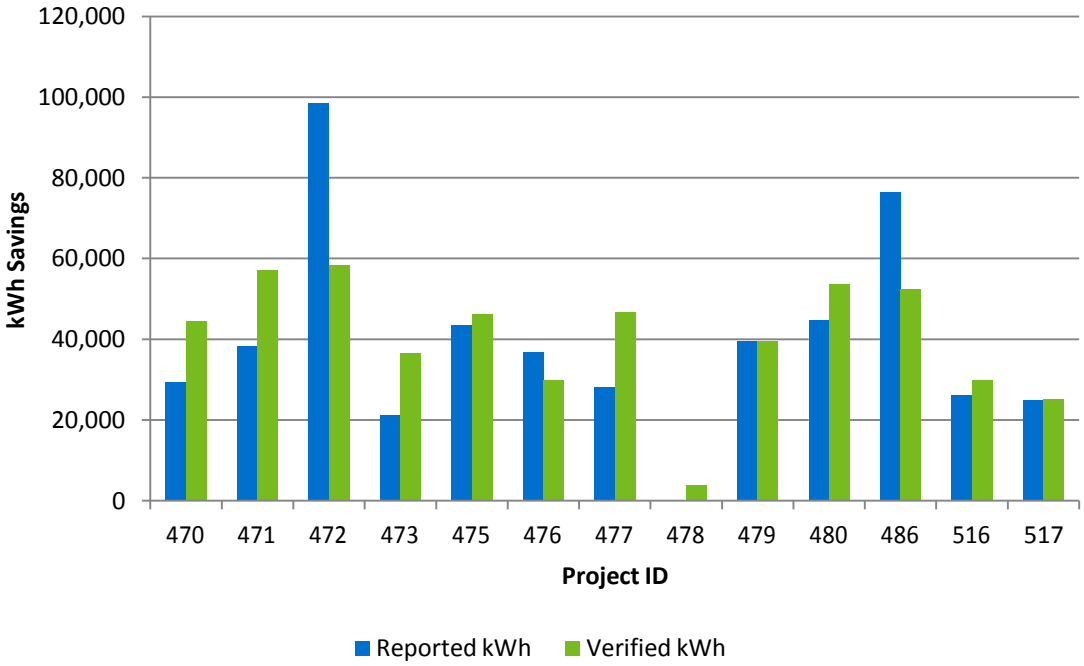
Table 5-1: Estimated Gross Verified kWh Savings by Unit and Site

Site ID	Unit ID	Unit kWh Savings	Site kWh Savings
470	3219	14,390	44,594
	3220	9,007	
	3221	13,642	
	3222	7,555	
471	3223	18,739	57,126
	3225	22,043	
	3226	16,345	
472	3227	19,185	58,411
	3228	4,143	
	3229	8,566	
	3230	26,517	
473	3231	9,207	36,590
	3232	6,147	
	3233	9,853	
	3234	11,382	
475	3240	7,298	46,188
	3241	15,708	
	3242	12,839	
	3243	10,343	
476	3244	6,924	29,822
	3245	13,635	
	3246	9,263	
477	3248	11,463	46,681
	3249	4,087	
	3250	27,817	
	3251	3,313	

Site ID	Unit ID	Unit kWh Savings	Site kWh Savings
478	3255	3,886	3,886
479	3256	6,823	39,476
	3257	15,564	
	3258	8,940	
	3259	8,149	
480	3260	3,159	53,710
	3261	14,983	
	3262	20,080	
	3263	15,489	
486	3311	25,847	52,363
	3312	13,145	
	3313	13,371	
516	3424	10,412	29,963
	3425	5,720	
	3426	5,244	
	3427	8,587	
517	3430	13,076	25,224
	3431	12,148	
Total		524,033	

At the pilot level, gross verified savings were comparable to the pilot's reported savings. On average, the annual verified energy savings were 11,910 kWh at the measure (i.e. RTU) level.

Figure 5-1: Energy Savings by Project



The ratio of gross verified savings, shown in Table 5-1, to the pilot operator's reported savings is the project's "realization rate." The pilot-level realization rate is the weighted average for all projects in the sample. Total pilot-level gross verified savings are the product of the reported savings for the pilot and the pilot's realization rate, and they reflect the direct energy impact attributable to the pilot's operations. Realization rates for each of the 13 participating facilities are shown in Table 5-2. Project level realization rates ranged from 59% to 172% of the reported savings. The pilot level realization was 103%, indicating that the verified savings estimated by the Nexant team generally agreed with the reported savings. There are several possible factors that could contribute to the low/high project-level realization rates, and it is difficult to surmise specific reasons on a case-by-case basis given that the reported savings calculations were not provided as part of this evaluation. Possible factors may include differences in assumptions used between reported and verified savings analyses, such as determining what equipment and time periods yielded erroneous data, which therefore needed to be dropped from the dataset.

Table 5-2: Pilot Realization Rate

Site ID	Number of RTU Units	Reported kWh Savings	Verified kWh Savings	Realization Rate
470	4	29,437	44,594	151%
471	3	38,412	57,126	149%
472	4	98,495	58,411	59%
473	4	21,243	36,590	172%
475	4	43,365	46,188	107%
476	3	36,824	29,822	81%
477	4	28,088	46,681	166%
478	1	n/a	3,886	n/a
479	4	39,626	39,476	100%
480	4	44,784	53,710	120%
486	3	76,499	52,363	68%
516	4	26,236	29,963	114%
517	2	25,000	25,224	101%
Pilot Level	**44**	**508,009**	**524,033**	**103%**

5.2 Peak Demand Savings

The Nexant team also used the regression model to estimate peak demand savings for the pilot. The Nexant team calculated a peak summer demand savings of 37.1 kW and a demand realization rate of 147% when verified savings were compared to reported savings. The primary driver for this high realization rate appears to be due to the implementer's different definition of peak demand than the one employed by IESO. In the final pilot report, the implementer defines peak demand by stating, "days were chosen having the highest demand power in each of the Standard and CATALYST modes." It appears that the reported peak demand savings is simply the difference in demand values between these two days.

The Nexant team estimated hourly kW demand using the coefficients output from the regression specified in Equation 3-1. Hourly demand was estimated for a typical weather year in both Standard and CATALYST modes. Peak demand savings were calculated as the difference in these two demand values during the same IESO-defined peak hours.

5.3 Lifetime Savings

The same measure (VFD on supply air fan with advanced controls) was implemented in each project of the pilot. Therefore, the same effective useful life was used for all pilot savings based

on the Measures and Assumptions List's deemed value for VFDs - 15 years. This means that the savings first observed in 2016 will be expected to last through 2030 on average. Therefore, the net 2020 annual savings is expected to be identical to the net verified savings listed in Table 5-2.

5.4 Net-to-Gross

5.4.1 Free Ridership

The participant survey asked respondents when they had learned about the no-cost upgrades offered by Toronto Hydro's RTUsaver pilot. Eight respondents stated they learned about the pilot *before they started planning their upgrade.* Two respondents stated they learned about the pilot *after they completed the project.*

Respondents were also asked what they would have done had they not learned about the pilot. Seven respondents indicated they would have gone ahead with the same upgrade. One respondent said they would have delayed the upgrade by at least one year. One respondent would have cancelled the upgrade altogether. One respondent would have done the upgrade, but would have scaled back by a moderate amount (Table 5-3).

Table 5-3: Actions in the Absence of the Pilot (n=10)

If you had never learned you could get no-cost upgrades from Toronto Hydro, which of the following best describes what your business would have done?	Respondents
Put off doing the upgrade for a least one year	1
Cancelled the upgrade altogether	1
Done the upgrade, but scaled back the size or extent of the upgrade	1
Done the exact same upgrade anyway	7

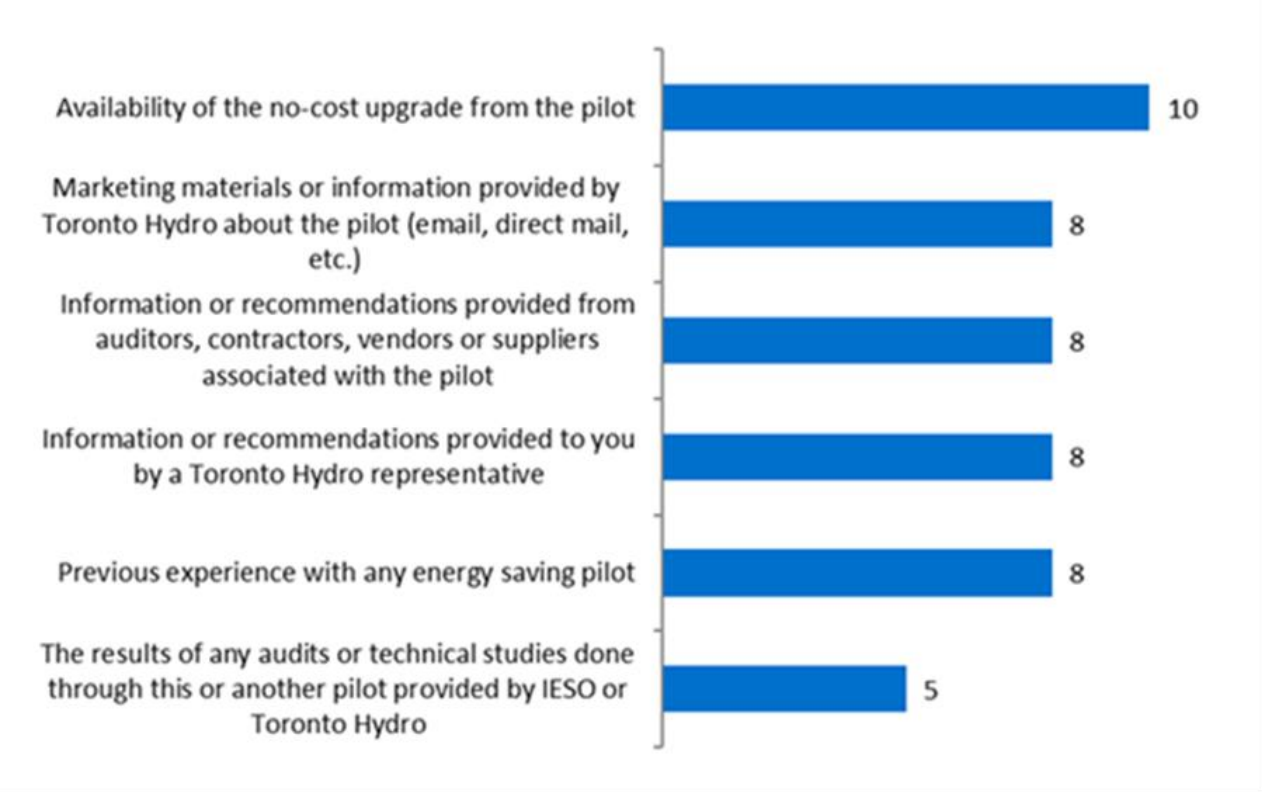
The participants who reported they would have *done the exact same upgrade anyway* were asked about their ability to fund the project on their own. Four participants stated they *definitely would have* had the funds to cover the entire cost of the project, and three participants said they *might have* had the funds to cover the full cost.

Respondents were also asked how pilot features, such as the availability of no-cost upgrades, information provided by representatives and contractors, and marketing, influenced their decision to make upgrades. They responded with ratings on a scale of 1 to 5, where 1=played no role and 5=played a great role. Respondents indicated that several of these pilot features influenced (4 or 5 rating) their decision to pursue energy-efficient upgrades. These features included the availability of the no-cost upgrade from the pilot (10 respondents); marketing

materials from Toronto Hydro (8 respondents); information or recommendations from auditors, contractors, and vendors (8 respondents); information or recommendations from a Toronto Hydro representative (8 respondents); and previous energy efficiency pilot experience (8 respondents).

Five respondents indicated audits or technical studies played a role in their decision to do the energy efficient upgrades (Figure 5-2).

Figure 5-2: Influence on Upgrade Decision (n=10)
(Rating of 4 or 5 on a scale of 1 to 5)



When asked whether there was anything else that played a great role in influencing their decision to do the upgrades, one respondent said saving energy and reducing energy bills. Another respondent also said reducing energy costs played a great role.

5.4.2 Spillover

Respondents were asked whether they installed additional equipment for which they did not receive no-cost upgrades or other types of incentives, after participating in the pilot. Two of ten respondents installed or upgraded energy-consuming equipment for which they did not receive an incentive after they had participated in the pilot. Respondents installed the following HVAC and motor/pump upgrades:

- HVAC - Premium efficiency HVAC weighing between 5.4 and 11.4 tons
- Motor/pump upgrades - Premium efficiency motor with 5.1 to 15.0 horsepower for an HVAC fan.

The participant survey asked respondents how much of a role their prior experience with the pilot played in the decision to do the upgrades. They responded using a scale of 1 to 5, where 1=played no role and 5=played a great role. Both respondents said their participation played a role (4 rating) in their decision to do the upgrade (Table 5-4).

Table 5-4: Pilot-Influenced Non-Incentivized Upgrades Installed (Participant Spillover)

What type of energy efficient improvements, products, or equipment did you install?	Respondents (n=2)	Influence from Earlier Pilot Involvement[1]
HVAC – Air conditioner replacement, above code minimum	1	4
Motor/Pump Upgrade	1	4

[1] Rating from 1 to 5, where 1 = played no role at all and 5 = played a great role.

5.4.3 Net Savings

There were 10 responses received for the net-to-gross (NTG) survey. The results from these surveys are presented in Table 5-5 below.

Table 5-5: Net-to-Gross Survey Results

Savings Type	Freeridership	Spillover	NTG Ratio	Relative Precision at 90% Confidence Level
Energy	29.4%	0.1%	70.3%	11.6%
Demand	29.4%	3.1%	73.7%	22.9%

5.5 Cost Effectiveness

The evaluation team conducted a cost effectiveness analysis for the RTUSaver pilot. This analysis was completed in accordance with the IESO requirements as set forth in the IESO CDM Cost Effectiveness Test Guide and using IESO's CDM Energy Efficiency Cost Effectiveness Tool. The energy and demand savings results from the impact evaluation were

inputs into the IESO Cost Effectiveness Tool as well as budget information supplied by the IESO.

Cost effectiveness results are presented in Table 5-6. The pilot did not pass the Total Resource Cost (TRC) and Program Administrator Cost test with both benefits less than their respective costs.

A key contributor to the low cost-effectiveness ratios was the relatively frequent equipment failure – 8 of 52 units. The failed rooftop units incurred the costs to the pilot without delivering any savings. Supporting this observation is the ratio of incentive money paid per annual verified kWh savings, which was $0.49/kWh.

Table 5-6: Cost Effectiveness Results

Cost Effectiveness Test	Value
Total Resource Cost (TRC)	
TRC Costs ($)	448,902
TRC Benefits ($)	188,514
TRC Net Benefits ($)	-260,388
TRC Net Benefit (Ratio)	0.42
Program Administrator Cost (PAC)	
PAC Costs ($)	523,071
PAC Benefits ($)	163,925
PAC Net Benefits ($)	-359,146
PAC Net Benefit (Ratio)	0.31
Levelized Delivery Cost	
$/kWh	0.18
$/kW-yr	2,442.42

6 Process Evaluation Results

The sections below provide the process evaluation results.

6.1 Program Staff Perspectives

The evaluation team interviewed the Toronto Hydro program staff to better understand how the program was administered in 2016 and to attain program staff perspectives regarding design and implementation. Feedback from the interview is summarized below.

6.1.1 Barriers to Implementation

The program staff discussed some of the barriers to pilot implementation. In general, program staff felt that the program has been successful in terms of saving energy, but it turned out to be more costly and challenging to manage than anticipated. One of the main barriers mentioned was the challenge of managing the service providers who expected larger payments than agreed to by Toronto Hydro, which affected the performance of the service providers. Program staff also noted that many equipment operators provided resistance in having a service provider working on their equipment. Logistically the time frame to recruit participants was very short and made it challenging to recruit the expected number of participation. Two technology based barriers were identified as: (1) existing equipment was not suitable or required repairs to enable new technology to function properly; and (2) connectivity via internet posed a barrier in many instances due to participants' security requirements, which required installation of dedicated cellular lines.

6.1.2 Success of the Program to Date

Program staff was asked for their perspectives on the success of the program to date and they viewed the pilot successful in attaining energy savings. However, changes to the pilot is proposed when developing it into a local program. One of the proposed change include, conducting an initial assessment to ensure existing units function properly and considering alternative technology that is less costly.

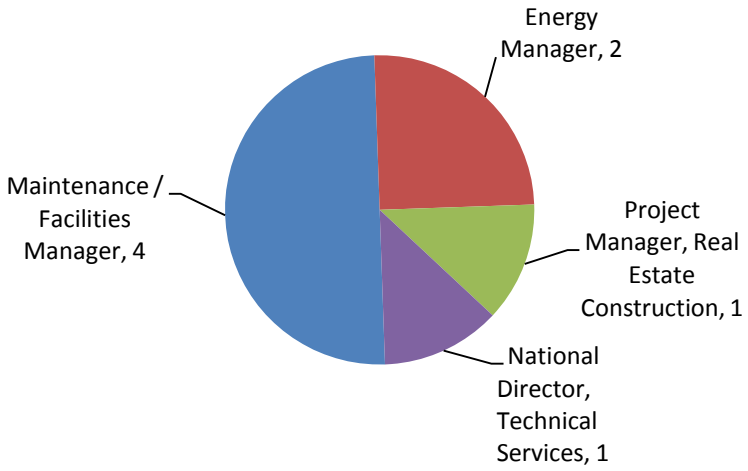
6.2 Participant Perspectives

The evaluation completed 8 telephone interviews with RTUsaver participants to better understand participant perspectives related to pilot delivery. Feedback from these interviews is summarized below.

6.2.1 Firmographics

Respondents were asked about their position in the company. Four respondents were maintenance or facilities managers, two were energy managers, and one was a project manager for real estate construction and the last a national director of technical services.

Figure 6-1: Title of Respondent



6.2.2 Program Outreach and Marketing

Participants were asked how they first heard about the RTUsaver pilot to assess sources of awareness. Participants heard about the RTUsaver pilot from a variety of sources, including a representative from Toronto Hydro, from a contractor or equipment vendor, the City of Toronto, word of mouth, and from IESO. Specific responses and counts are summarized below in Table 6-1. The three respondents that initially heard about the pilot from Toronto Hydro stated the utility contacted them to inform them about the pilot offerings, as opposed to the customer contacting Toronto Hydro.

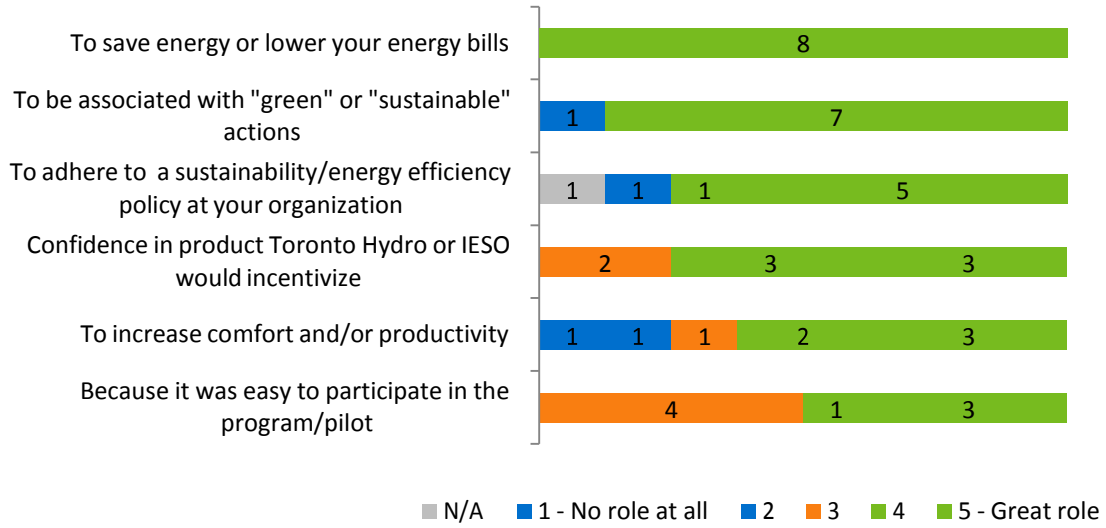
Table 6-1 Program Outreach and Marketing

How did you first hear about the RTU Saver pilot?	Count of Responses
A representative from your utility	3
A contractor or equipment vendor	2
The City of Toronto	1
A colleague or competitor	1
A representative from IESO	1

6.2.3 Participation Motives and Decision Making

Nexant also gauged respondent motivations to participate in the pilot by asking how much of a role certain factors played in their decision to implement the upgrades. Respondents were given a 5-point scale where 1 indicates “no role at all” and 5 indicates a “great role”. Responses are summarized below in Figure 6-2. The primary motivational factor was to save energy or lower energy bills, followed by “to be associated with “green” or “sustainable” actions, then to adhere to a sustainability or energy efficiency policy at their organization.

Figure 6-2 Motives for Participating in the RTUsaver pilot



When asked to expand upon requirements of a corporate sustainability or energy efficiency policy, the following responses were received:

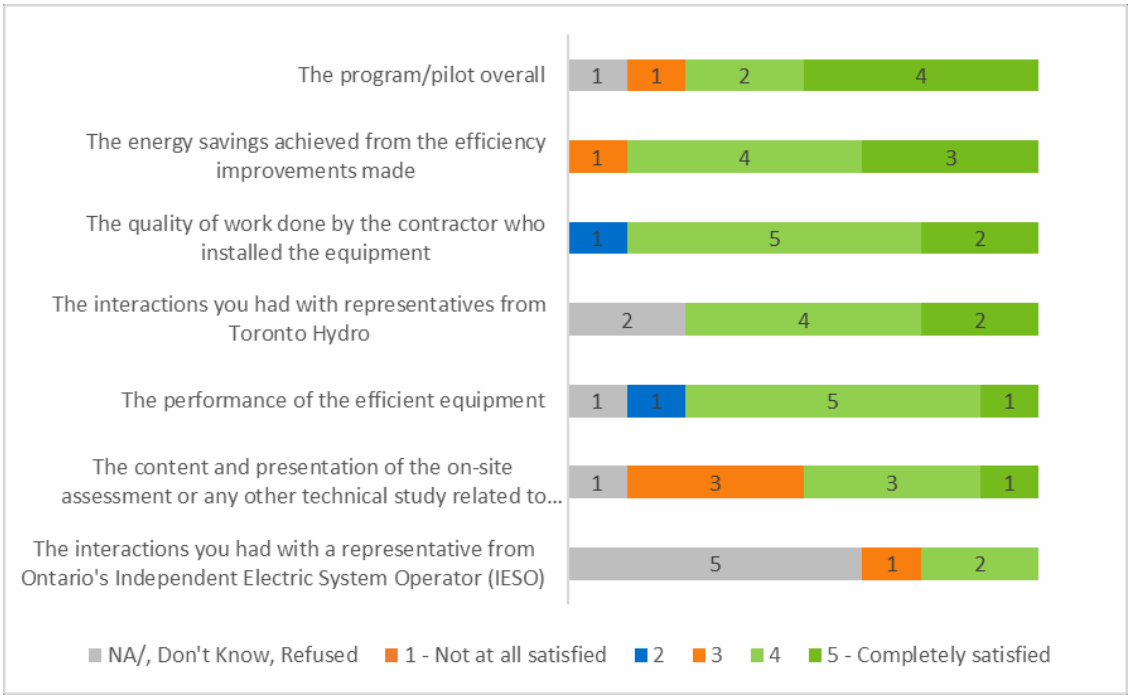
- “We don’t have targets per se, but always trying to reduce operating costs. We’re installing LED lights, now we got into the 8 foot and 4 foot bulbs.”

- "We're currently part of the Toronto Hydro EEM program. Targets of 2GW for 2016 and 2017 in the 416 region, and a 25% reduction target for GTA. 40% GHG reduction target in 2010 for 2020 that has since been surpassed."
- "We have a set of targets, not an official policy. These targets are set each year for value and energy usage."
- "We do things like for Easter long weekend - planning of not having lights on and set back of HVAC, the key is to save on billing."
- "There are targets, a percentage reduction year over year. Some properties have different reductions so can't really give you a number."
- "[We're] in the midst of creating an energy management plan, trying to improve our energy efficiency."

6.2.4 Participant Satisfaction

Respondents were asked to rate their satisfaction with the pilot on a scale of 1 to 5, with 1 being not at all satisfied and 5 being completely satisfied. Six of the eight responding participants were satisfied with the pilot overall, with one respondent reporting a 3, or neutral satisfaction rating as shown in Figure 6-3. Pilot satisfaction rates were highest for the energy savings achieved from the efficiency improvements made, and the quality of work done by the contractor who installed the equipment. The most neutral responses were related to the content and presentation of the onsite assessment.

Figure 6-3 RTU Saver Participant Satisfaction (n=8)



6.2.5 Suggestions for Pilot Improvement

When asked how likely they would be to recommend the pilot to others, 7 of the 8 respondents indicated that they would be very likely to do so (4 or 5 rating). One rated the likelihood of recommending the pilot as neutral (3 rating). This indicates most respondents appreciate the pilot opportunity. When asked if they had any suggestions to improve the pilot, the following two constructive responses were received.

- "The follow up was really not very good. Left a bad taste in my mouth. The company [Transformative Wave] was very keen to carry out the pilot until we didn't want to buy anything from them. The equipment that was modified had missing parts. I had to spend $12,000 to get back online. Then the company offered extended service for a hefty fee." (Rated 3 overall satisfaction).
- "Maybe a bit more transparency. It wasn't clear that they would be cycling the fans on and off to show the savings. It would be good to know that ahead of time. More clarity that at the end of the pilot, you're basically forced to renew your contract with the third party for the controllers on the rooftop. Normally with most pilots it would be paid to have the equipment removed." (Rated 4 overall satisfaction).

According to the LDC, the pilot:

- Provided new technology and did not modify existing equipment.
- Communicated that the participant was to keep the equipment upon completion of the pilot.
- Communicated up front the contract renewal for the subscription based option. The pilot covered the cost for the 1st year.

These comments indicate that there is an opportunity to increase customer understanding regarding the technical details of the Advanced Rooftop Controls put in place and the options for a continuing relationship with Transformative Wave after implementation of the pilot

7 Key Findings and Recommendations

7.1 Impact Key Findings

7.1.1 Impact Key Findings

Key findings and recommendations from the 2016 pilot impact evaluation include:

- Pilot level energy realization rate was 103%, indicating that verified savings generally agreed with the reported savings.

  Recommendation: *The large amount and granularity of unit-level data available to both the implementer and evaluator enabled both analyses to use their own robust approaches on the same dataset. If possible, it is recommended to maintain this approach to minimize any deviances between reported and verified savings approaches due to assumptions made from lack of data.*

- Peak demand savings realization rate was 147%. The primary driver for this high realization rate appears to be due to the pilot implementer's different definition of peak demand than IESO's definition.

  Recommendation: *It is strongly recommended that all program implementers present peak demand savings using IESO's definition.*

- One project had three of its four rooftop units needing replacement during the pilot. While the cost of implementing measures on all four rooftop units was incurred, only one unit was able to produce savings, contributing to a less cost-efficient pilot. Similarly, eight of the 52 rooftop units appeared to experience failure during the time period of data collection. There are a number of reasons for the rooftop units needing replacement, and according to the LDC some participants did not share their equipment replacement plans during the recruitment and installation phase and some refused to allow contractor to reconnect the technology to the new units, siting warranty issues.

  Recommendation: *To ensure savings persistence in the future, the program should consider requiring participants to provide equipment replacement plans during recruitment, address any warranty concerns upfront, have a documented maintenance protocol and log in place (if done in-house) or a maintenance agreement in place with a service company (if hired out).*

7.1.2 Net-to-Gross Key Findings

The key findings from the 2016 pilot impact evaluation pertaining to net-to-gross include:

- The 10 surveyed participants displayed a range of free ridership behavior. If they had not learned about the no-cost upgrades, one respondent would have delayed the project by at least a year, another would have cancelled it, and a third would done the upgrade, but scaled back by a moderate amount. Seven respondents would have done the same upgrade, four would have had the funds to cover the full cost of the project, and three might have had the funds.
- Most respondents rated many pilot-related factors, such availability of the no-cost upgrade, and marketing materials from Toronto Hydro, as influential in their decision to participate in the pilot.
- Spillover savings associated with two respondent projects (HVAC and a motor). Both respondents said their participation to the pilot played a great role in their decision to do the upgrade.

7.2 Process Key Findings

The key findings and recommendations from the 2016 pilot process evaluation include:

- In general, program staff felt that the program has been successful in terms of saving energy, but it turned out to be more costly and challenging to manage than anticipated.

  Recommendation: *Assess and determine the items that resulted in increasing management effort and associated cost, to assist in determine strategies to address and minimize the impact of these items on the implementation and delivery cost.*
- Representative and marketing outreach from Toronto Hydro and contractors were participants' primary source of information.
- Respondents were satisfied overall with the pilot, the energy savings achieved and quality of work from affiliated contractors, and interaction with Toronto Hydro representatives.
- While Toronto Hydro intends to explain pilot specifications prior to participating in the pilot, and contract renewal options upon completion of the pilot, one participant stated a desire for more clarity regarding equipment cycling during the pilot, and contract renewal options after the pilot. Ensuring consistent communication of these facts may improve customer satisfaction.

  Recommendation: *Continue to build on the marketing and outreach strategy and messaging, to ensure customer participation and customer expectations are met in terms of energy savings and quality of work.*

  One option to do this is to provide a fact sheet ahead of pilot implementation that summarizes key aspects of the pilot. Concerns over contract renewal may be assuaged by the provision of additional program educational material that provides

case studies comparing the annual cost savings due to the installation compared to the contract continuation fee.

- The desire to save or reduce energy bills, to be associated with “green” or “sustainable” actions, and to adhere to the organization’s sustainability / energy efficiency policy were the major influences in the participation of the program.

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