SMALL GOES BIG:
Large-Scale Savings from Small Commercial Customers

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ABSTRACT

Although small commercial customers are notoriously hard to reach, the experience of "direct install" programs in the U.S. and Canada provides compelling lessons for achieving meaningful participation and energy savings from this customer segment.

This paper begins with the results of a comparative review and assessment of leading small commercial direct install programs. The comparison includes each program's key components such as eligibility criteria, delivery model, eligible measures, incentive levels and quality control. It also presents some of the more innovative design features, and compares metrics like budgets, participants and, most tellingly, achieved energy savings. The paper also provides a deeper assessment of appropriate incentives and/or financing and the impact of both on project uptake rates in a number of additional programs. The paper highlights the most significant lessons learned from experience to date; lessons that the authors used to design what is soon likely to become the single largest "direct install" program in North America.

Based on this review of lessons learned, the paper proceeds to describe the choices made for a new, large-scale program. The program, designed by Dunsky Energy Consulting and set to be launched later this year by Hydro-Quebec, the continent's leading electric utility, is expected to generate annual savings of nearly 600 GWh/year by its fifth year, arising from nearly 60,000 participating customers.

While one-size-fits-all solutions remain inappropriate, the paper should provides guidance to those interested in designing (or redesigning) effective large-scale programs for the underserved, small commercial market segment.

Background

Hydro-Quebec's Challenge

Hydro-Québec, a state-owned utility servicing the Canadian province of 7 million people, is by many measures North America's largest electric utility[1], with an installed capacity in excess of 40,000 MW, annual revenues of $12 billion (including $3 billion in export revenues), nearly 150,000 kilometers of transmission and distribution lines, and a staff of over 23,000 people.[2]

In 2007, the utility's sole shareholder, the government of Quebec, adopted a new energy policy, including a requirement that the utility significantly increase its energy savings goal to

[1] Depending on the measure, Hydro-Quebec and California's Pacific Gas & Electric vie for first or second place. Hydro-Quebec's assets are worth nearly twice as much; its generating capacity is seven times greater; and its customers consume two and a half times more electric power. PG&E, on the other hand, has a longer electric T&D system, and a natural gas distribution network. The two corporations have similar staff and gross revenue.

[2] Throughout this paper, dollar values are quoted in Canadian currency. As of April 5, 2010, the two currencies were at par (0.9967 USD / CAD).

achieve 11 TWh/year – or roughly 6.5% of domestic sales – by 2015. Seen through the lens of standard industry rules of thumb, this is less ambitious than other targets (at roughly 0.8% annual incremental savings, it falls short of the increasingly commonplace 1-2% goals). However, Hydro-Quebec's unique characteristics make achieving this goal more difficult than it may be elsewhere, because:

- Its customer base includes an unusually large number of modern, energy-intensive industries (40% of energy use comes primarily from aluminum smelters and other large industrial customers, where baseline consumption is generally more efficient than in other sectors);
- Electric space heating, for which energy savings opportunities are more difficult to achieve, accounts for over half of total residential electric consumption (the majority of residential customers heat with baseboard electric heaters); and
- The omnipresence of electric heat in a cold climate means that other electric savings – such as from lighting and appliances – typically create energy penalties, as the reduced heat loss results in increased (electric) heating loads, hampering cost-effectiveness for both the utility and its customers.[3]

As a result, the 11 TWh goal represents a reasonably ambitious savings target, and required Hydro-Québec to rethink its programs and strategies. This strategic review led the utility to consider a new approach for its small commercial market and ultimately to hire Dunsky Energy Consulting to design what is slated to become its single biggest energy efficiency program to date.

The Small Commercial Market

Hydro-Québec chose to define its target "small commercial" market as customers who:

- Have annual electric bills of less than $50,000[4]; and
- Are not public schools, arenas, or chains and franchises for which equipment purchase decisions are centralized.[5]

As a result, the target market covers a broad and extremely heterogeneous group of over 180,000 facilities (and some 10 TWh of annual power consumption), including those with:

- A vast array of purposes and operating patterns (from retail clothing stores to restaurants, offices to gas stations, groceries to warehouses to small manufacturing facilities and others);
- A similar diversity of building types and equipment (and energy savings opportunities);
- A combination of both renters and owners; and
- For renters, a combination of customers who pay their energy bills directly, indirectly (as flow-throughs to rent), or not at all (fully embedded in rents).

[3] Hot climates benefit from the opposite effect: savings from lighting, appliances and other electric loads tend to *also* reduce air conditioning loads.
[4] With low retail rates (in the range of 8¢/kWh), the $50,000/year threshold is equivalent to roughly 600 MWh/year.
[5] The utility has other strategies to address these customers.

Yet in another important way, these customers are strikingly similar: by and large, they do not participate in energy efficiency programs. In fact, after five years of efficient products programs, less than 1% of this customer base had taken advantage of incentives (nearly 20% of larger commercial customers had participated). Two fundamental reasons explain this discrepancy:

- **Lack of Time/Interest**: Small commercial customers have little or no spare time to identify opportunities, study their costs and benefits, work through the "hoops" and paperwork of energy efficiency program requirements, find contractors, and oversee projects. Since energy efficiency is by no means a priority, they are unwilling to expend limited discretionary budgets on hiring experts to perform these tasks. And the absence of initiative is not compensated by contractors, who rarely "cold-call" or otherwise market their services toward these customers, since sales transaction costs are too high given the small project sizes, and conversion rates too low.
- **Poor/non-existent returns on investment**: Because electric costs are often embedded directly in rents (commonly referred to as the "split incentive" barrier), many small commercial customers have no real opportunity to recover their investment in energy efficiency measures. For the remainder – those who either pay their bills directly or own their facilities –, many have such little certainty about their own future that they heavily discount the value of future savings. Further uncertainty around actual energy savings – most are not equipped to assess or judge the bill reductions that would ensue from a given project or product – only add to the severe implicit discounting of future benefits.

Among the vast array of market barriers that impede commercial sector energy efficiency, these are particularly significant for smaller customers, and must be overcome to achieve real energy savings.

Strategies: Direct Install

These barriers need not seal the non-participatory fate of small commercial customers. Rather, they point to the tremendous challenge in overcoming barriers with conventional strategies designed with larger customers in mind. As a result, an increasing number of energy efficiency programs are turning to "direct install" strategies as critical to achieving success in this market.

Direct install strategies are, in a sense, a blunt instrument. Whereas other strategies focus on overcoming complex barriers through awareness, information, and training, and then top it off with calculated incentives aimed at "buying down" payback periods (or even more sophisticated approaches aimed at meeting customer investment criteria), direct install programs are the efficiency equivalent of Nike's "Just Do It!™". Indeed, under direct install, the program does it all (see Figure 1):

1) **Outreach**. Program representatives (including their contractors) conduct outreach activities, including direct mailings, bill inserts, cold calls and door-to-door, to convince customers to receive a (typically free) audit.
2) **Audit**. The program sends trained staff to conduct a simple audit of the customer's facility and equipment, aimed primarily at finding simple opportunities for energy

savings and, using (typically) pre-defined unit prices, determine project-level costs and savings.

3) **Proposal**. The program (often through an automated tool) generates a project proposal, which the contractor "sells" to the customer (strong incentives are required to this end – see discussion below). The proposal indicates the project specifications, the share of project cost (if any) the customer is being asked to take on, and the economic and other benefits the project has to offer.

4) **Measure installation.** Once the customer has agreed, the program takes on responsibility for doing the project itself and ensuring proper installation of energy-saving equipment. While some programs limit measures to lighting replacements, others (including Hydro-Québec's) aim to be more comprehensive, including lighting and HVAC controls, refrigeration, air sealing, and hot water insulation.

5) **Quality control.** Program staff or contractors ensure quality control through spot inspections (both of audits and of jobs), and also conduct satisfaction surveys.

Figure 1. A Typical Five-Step, Turnkey "Direct Install" Model

Source: Dunsky Energy Consulting

As the reader can see, the turnkey approach is designed to spare the customer the very transaction costs – the time to find and assess the opportunities, and to select and oversee contractors – that often constitute an insurmountable barrier (see previous discussion). Furthermore, while each program may vary in its incentive levels, direct install programs typically aim to overcome the perceived lack of return on investment by a very generous set of incentives. As we will see, some programs ask the customer to pay a fraction of the total cost (and offer attractive financing for the remainder); in others, the project is offered entirely free of charge.

This basic model has been proven to succeed in a number of regions.[6] Yet the model also offers significant room for customized choices, including on key issues such as the share of project costs that customers are asked to take on. To build on the lessons of previous efforts, Hydro-Québec asked us to review best practices and design a custom solution for the province's context and needs.

Experience and Lessons Learned

Review

Before designing the model for Hydro-Quebec, we reviewed some of the better small commercial direct install programs. We began by identifying 14 programs in place, and of these, chose three for closer examination, namely:[7,8]

- *National Grid (NGrid).* With 1.6 million customers spanning three New England states, NGrid's *Small Business Energy Services* program services customers with demand of less than 200 kW and energy use of less than 483 MWh/yr. The program covers 70-75% of project costs (in addition to 100% of audit and other costs), and typically achieves savings of 15 MWh per project, at an average cost of around $5,500. NGrid's approach is typical of many direct install programs.
- *Southern California Edison (SCE).* With some 5 million customers in the southern California area, SCE's *Non-Residential Direct Install* program provides small customers (less than 100 kW) a turnkey solution at no charge, achieving some 5 MWh/year of savings per project, at an average cost of $1,500. SCE's approach is typical of a number of programs that focus more on volume (number of customers) than on depth of savings.
- *United Illuminating and Connecticut Light & Power ("UL/CLP").* With a combined 1.4 million customers, Connecticut's two main electric utilities' *Small Business Energy Advantage* program is closer to the National Grid approach, but aims for deeper savings (25 MWh and $10,000 per project on average), despite lower incentive levels (30-40%). The UL/CLP program approach is atypical, although abnormally low incentives may be explained in part through the fact that the state has the highest electric rates in the region.

For each program, we reviewed the following key characteristics:

- Basic approach
- Incentive levels and financing (where applicable)

[6] Variations on this theme have been tried, but to little success. For example, a recent Commonwealth Edison program aimed at the small commercial market tried to minimize program costs (avoid labor costs altogether) by simply mailing compact fluorescents to small commercial customers, free of charge. The company soon found that the majority of CFLs never ended up in a socket, and of the minority that were, most were installed in homes, not businesses (lower operating hours). All told, evaluators determined a net-to-gross ratio of only 0.13, meaning that every bulb mailed generated 1/8th the expected savings.

[7] While other programs were also of interest, we chose these three because (a) they had each been previously recognized as best practices by independent organizations like ACEEE, and (b) they represented a cross-section – though unrepresentative – of different incentive levels, a key issue Hydro-Quebec had to grapple with.

[8] To ensure Canadian representation, we also examined pilot projects in Nova Scotia and British Columbia, as well as a full-scale program in the province of Ontario.

- Eligibility thresholds
- Basic delivery model
- Types of measures installed
- Quality control
- Innovative / Unique characteristics
- Program budgets
- Results, including Total annual savings, Number of projects, Cost per project and Savings per project

Table 1 summarizes the results of this review.

Key Issue: Incentive Levels

While direct install models involve a number of key design issues, chief among them is the level of "incentives" or, inversely, the share of project costs required of participants. Given the importance of this issue, we took a deeper look at experience from other programs.[9]

Of the 13 programs which were first identified, nine required either no contribution at all, or what we characterize as a "symbolic" contribution (for example, Sacramento Municipal Utility District requests variable contribution rates, typically on the order of 10-15%). Indeed, "free" or nearly free seems to characterize a strong majority of direct install programs.

Of the remaining 4 programs that require a significant contribution (20% or more of project costs), we note that:

- Each offers on-bill financing for the customer's contribution (and typically aim at Providing positive cash flow from year one), a component often considered a key to success by program managers we interviewed;
- They generally take place in high-rate regions (rates are typically two or three times higher than those at Hydro-Quebec), increasing customer openness to paying *something*; and
- Despite these conditions, required contributions remain relatively low (20-30% in most cases, Connecticut notwithstanding).

[9] Programs we reviewed include those at: Southern California Edison, Efficiency Vermont, B.C. Hydro, Los Angeles Department of Water and Power, San Diego Gas and Electric, Ontario Power Authority, California's statewide B.E.S.T. program, Consolidated Edison (New York), National Grid, Connecticut Light and Power, United Illuminating, Sacramento Municipal Utility District, Nova Scotia Power and NStar.

Table 1. Review of Three Leading Direct-Install Programs

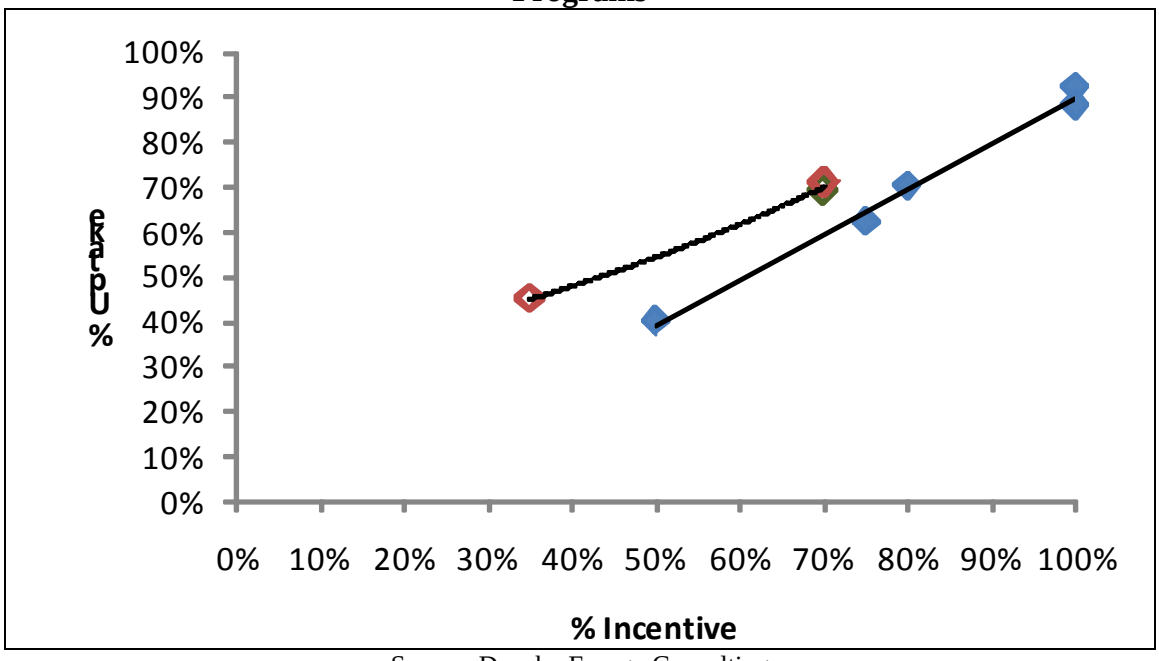
	NATIONAL GRID	CONNECTICUT LIGHT & POWER and UNITED ILLUMINATED	SOUTHERN CALIFORNIA EDISON
CUSTOMER BASE	1.6 million customers in New England (MA, RI, NH)	1.4 million customers in Connecticut	~5 million customers in southern California
PROGRAM	Small Business Energy Services	Small Business Energy Advantage	Non Residential Direct Install
APPROACH	Turnkey, free audit, incentives, on-bill financing for remainder	Turnkey, free audit, incentives, on-bill financing for remainder	Turnkey, free audit, 100% incentives
INCENTIVE LEVELS	**~70 - 75% of project cost**	**30% for lighting 40% for other measures**	**100% of total project cost**
FINANCING	On-bill for remainder – goal of positive cash flow from year 1	On-bill for remainder – goal of positive cash flow from year 1	Not applicable
ELIGIBILITY THRESHOLD	< 200 kW or <483 000 kWh	< 200 kW for CL&P <150 kW for UI	< 100 kW
DELIVERY MODEL	Territories assigned to individual contractors (4)	No assigned territories; contractors (10/utility) compete for customers (at least in theory)	Territories assigned to individual contractors (3)
MEASURES	90% lighting, 10% HVAC, refrigeration, others	~70% lighting, ~20% refrigeration, ~10% HVAC/others. *CT places strong emphasis on comprehensiveness.*	95% lighting
QUALITY CONTROL	Random check on ~25% of projects; add'l checks on audits	*Non-refrig.*: 35% random checks *Refrig.*: CL&P ~50%; UI 100%	Random check on ~25% of projects
INNOVATIVE/UNIQUE CHARACTERISTICS	Distinct contract to supply equipment	Audit/management tool allows for real-time, on-site assessments, proposals	Unit prices adjusted for distance; Priority contracting with community organizations
PROGRAM BUDGET	~$8M USD (2006)	~$9M USD (2006)	~$25M USD
PROGRAM SAVINGS	23 GWh/yr (2006)	38 GWh/yr (2006)	~90 GWh/yr
PROJECTS / YEAR	**1,600 (2006)**	**1,522 (2006)**	**17,000**
AVG. PROJECT COST	**$5,500 USD**	**$10,000 USD**	**$1,500 USD**
AVG. SAVINGS	**~15,000 kWh/yr**	**~25,000 kWh/yr**	**5,300 kWh/yr**

To further examine the importance of incentives, we compiled data (in some cases estimates from program managers) comparing incentive levels and project "uptake" rates, i.e. the rate of completed project over initial audits. Because of the difficulty in obtaining uptake data, this was conducted for a subset of eight programs, of which three offered on-bill financing for participants' contributions, and three did not (financing does not apply in two cases, where participant contributions are not required).[10]

As can be seen in **Figure 2**, the data suggest a *nearly* linear link between incentives and uptake rates. Also of interest (although with a small sample), the data seems to support expectations that on-bill financing, represented in the chart by empty lozenges, helps to maintain uptake rates as incentives drop. Indeed, the ratio of uptake over incentive rates – a measure of the impact of incentives on program success – is 1.10 for the programs *with* on-bill financing, while only 0.83 for those without. This is an important consideration for Hydro-Quebec (and indeed all program administrators), where on-bill financing was not considered a viable option.

Taking into account Quebec's unique context, including most notably electricity rates significantly lower than those in our sample regions and a decision not to pursue on-bill financing, we then generated an estimated curve for the province's own direct install program (not included in the chart). This estimate was later used to conduct sensitivity analyses on the expected impacts of various incentive levels.

Figure 2. Relationship Between Incentives and Project Uptake at Eight "Small Comm." Programs



Source: Dunsky Energy Consulting

[10] These data were compiled by colleagues at Optimal Energy Inc. They include a subset of our initial 13 programs, in addition to data from three other programs. Some rates are program managers' estimates rather than verified ex-post.

Findings

Our review of previous program experience led to several key findings. Chief among these, we emphasize three findings:

- *Turnkey is critical* to achieving significant savings in the small commercial customer market. Other approaches – whether conventional per-product or custom incentives that focus primarily on reducing payback periods, or alternate strategies such as give-aways that stop just short of a turnkey solution – have not proven their ability to generate actual participation. By and large, energy savings simply are not sufficient to overcome small commercial customers' time, hassle and uncertainty barriers.
- *Incentive levels and financing both matter*. Conversion from audits to completed projects appears to be strongly linked to incentive levels, and on-bill financing seems to improve those ratios considerably.
- *Comprehensiveness matters*. Programs varied considerably in their approach to comprehensiveness and, as a result, in their per-project savings. Indeed, programs that focus almost exclusively on lighting (e.g. SCE with 5 MWh/project) appear to achieve savings significantly lower than those with a strong focus on comprehensiveness (CLP/UI, with 25 MWh/project).

Ultimately, there is no single "one-size-fits-all" optimal design for direct install programs – incentives and other key components must be adjusted according to local context (electricity rates, predominance of certain types of small businesses, health/professionalism of the local contractor market, and program objectives, among others). Still, the experience of other programs can help in determining optimal incentives and other design components, and was particularly valuable in designing the Hydro-Quebec program.

Hydro-Quebec's Plan

Program Design

As indicated earlier, while in some respects less aggressive than other North American efficiency targets, Hydro-Quebec's goals – equivalent to 0.8% average annual incremental savings – are nonetheless challenging in an environment of very low rates, unusually strong electric baseboard heating, net heating penalties from efficient lighting, appliances and motors, and very significant large industrial loads.

Given these challenges, Hydro-Québec opted for a very aggressive small commercial customer program, characterized by the following key components:

- **Turnkey**: As with other such efforts, the program will offer a turnkey service including outreach, audit, proposal, measure installation and quality control.
- **Free**: The program will require no contribution of participants, either for audits or for measure implementation. This was decided after sensitivity analyses suggested that the

utility's increased incentive costs would to a certain extent be offset by a lower percentage of unproductive outreach and audit costs (due to higher uptake rates).

- **Comprehensive**: The program is aiming at comprehensive measures: beyond one-for-one lighting change-outs, the program will encourage other measures, including lighting and temperature controls; high-efficiency motors, pumps and fans; economizers; vestibules; and a variety of heat recovery devices, among others.
- **Delivery**: The program will, on a turnkey basis, attribute between one and three territories to individual contractors, to be selected through an RFP launched in the spring of 2010. The contractor(s) will be responsible for program management, outreach, audits and installations. It is noteworthy that Hydro-Quebec's territory spans 1.5 million square kilometers, or more than 3.5 times the area of the State of California.

Hydro-Quebec also chose to develop an audit/program management tool that it will require all contractor(s) to use. This is meant to ensure both auditing and reporting consistency across assigned territories, to facilitate oversight, and to maximize Hydro-Quebec's control and ability to effect program changes (e.g. measure additions) smoothly over time.

Forecast Results

We conducted a detailed, measure-level analysis to determine the total expected costs, savings and cost-effectiveness of the program. The analysis began with 672 "measures types", comprised of 54 distinct measures (e.g. replacing T12s with HPT8 lights, replacing bi-metallic thermostats with electronic ones, adding automated controls to lighting on refrigeration units, etc.) applied to up to 32 distinct building types (e.g. small fast-food restaurant, large family restaurant, small retail store with non-electric heat, etc.).[11] Each "measure-type" was attributed costs, savings, measure lives and other characteristics to determine which measures could apply to which market segments. The analysis also included a series of filters to reduce or eliminate the likelihood of a given measure being considered acceptable to participating customers (adjustments reduced expected penetration rates by anywhere from 17% to 100%, depending on the measure-type).

Combined with direct program costs, expected participation rates and expected conversion ("uptake") rates, we developed a robust forecast of costs and savings.[12] In particular, the program is expected to:

- Conduct energy savings projects in some 54,000 customer facilities (of which 60% are expected to come from three segments – restaurants/hotels, retail stores, and offices);
- Scale up to incremental annual savings of 158 GWh/yr by year 3;
- Generate cumulative net annual savings of nearly 600 GWh/year by the end of year 5, or an average of more than 10 MWh/year per participant;[13]

[11] Note that not all distinct measures apply to all building types. For this reason, the number of applicable "measure types" (672) is less than the sum of the distinct measures (54) multiplied by the building types (32).

[12] At the time of writing, the bidding period on Hydro-Québec's RFP for program delivery had not yet closed. As a result, we are unable to share more detailed cost and savings estimates at this time.

- Ensure comprehensiveness, such that only 60% of savings are derived from lighting, with an additional 24% from controls (primarily thermostats) and 16% from a broad array of other measures (including new measures that may be added overtime); and
- Be cost-effective from a Total Resource Cost (TRC) test perspective.

The contractor(s) will be held responsible for achieving these goals. Compensation will also hinge on respect of other criteria, including those related to timing (maximum time from customer approval to the beginning of work, and from the beginning of work to project completion), and customer satisfaction.

Next Steps

At the time of writing, Hydro-Quebec had released its request for proposals, and was awaiting bids. The program is expected to be launched and fully available throughout the province by the end of August, 2010, and will run through the end of 2014.

One of the lesser-known benefits of direct install programs is the ability of program administrators to easily ramp up or ramp down spending and associated savings. This flexibility is a valuable component of a broad DSM portfolio – one that most programs are not able to offer to the same degree. As a result, Hydro-Quebec will closely monitor results, and may adjust savings goals as the program's success – and the utility's own DSM goals – evolve in the future.

References

Hydro-Québec, 2010. *Document d'appel de propositions – 13383784 – Avis aux intéressés à soumissionner*. Montreal, Quebec : Hydro-Québec.

[13] Adjusted for climate (heating penalties from interactive effects, as opposed to cooling bonuses in other regions), this amounts to relative savings somewhat higher than those of National Grid's program, and about three times higher than those of Southern California Edison. Expected relative, climate-adjusted savings remain approximately one-third lower than those of the Connecticut programs we reviewed.