Espanola community-based energy conservation: Results to date

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1. SYNOPSIS

This paper describes the processes used, the results to date in implementing the Espanola community based conservation project to achieve maximum electricity conservation.

2. ABSTRACT

The Espanola Power Savers Community-Based Conservation Project is a full-scale effort to maximize electricity conservation in a geographically concentrated area, to mobilize community involvement in their energy future, and to research the potential for this type of demand-side management in Ontario. The project was launched in June, 1991 and installation of efficiency measures was completed in March, 1993. Lessons learned have been incorporated into some existing programs. Evaluation and monitoring are expected to be completed by 1994.

The project was positioned to the community as a business proposition. Ontario Hydro purchased kWs at a lower cost than alternative generation sources, thereby reducing the total cost of energy services to the community (and the province), with customers being asked to invest in their energy future. Customer values were incorporated into the project design, such as water conservation and the environmental impact of the project. Two way communication, primarily through a Community Advisory Committee, ensured responsiveness of the project to local needs and built awareness and support throughout the town.

A key aspect is consumer education about energy use so that efficiency built into the community is maintained by encouraging an attitudinal shift toward a conservation ethic. Consequently, project staff incorporated numerous energy-awareness elements in the program, including an ongoing educational effort in the schools.

In both the consumer and business markets of Espanola, the project used saturation marketing, comprehensive energy audits, direct customer contact, measures installation and follow-up inspections. This is a high water mark test so incentives were set at a maximum, which is not a prerequisite of community marketing.

The project has achieved record participation levels in audits with an overall average of 86 percent of eligible customers. Also impressive is the "customer uptake" level, a comparison of measures installed to those measures recommended by the auditors. Seventy-six percent (76%) of the kilowatt value of the energy-efficiency measures recommended were accepted by those customers. This is unprecedented by North American utility standards for DSM programs. In the residential sector, 1.460 homes were retrofitted and completed in December, 1992. In the commercial sector 110 businesses were retrofitted and completed.

The $11,2-million approved project budget represents $7 million for program implementation and incentives (including $ 4,8 million in incentives) and $4,2 million for research and evaluation. As of March 30, 1993, Ontario Hydro had committed $4,2 million for incentives, while the community had committed $2,1 million (a remarkable sum for a small community of approximately 5.500 citizens).

3. INTRODUCTION

There is an increasing trend for power utilities to adopt a mission which aims to provide their customers with energy services at the best possible value. By better serving their customers, it helps them meet the

financial challenges now being faced.

Whatever utility marketing strategies are adopted to provide these services, there is a broad spectrum of utility influence that can be exerted on the customers' decision-making process. This influence can range from a low level-free choice marketing (information programs) to the highest influence with blackouts. Community influenced marketing is more invasive than traditional, broad-based information programs. Yet this "intrusion" is positive and gives customers choices through direct customer contact and a high level of interaction with the community.

Information programmes have been most prevalent in the residential sector. While many different types of programmes have been delivered, it is clear that such programmes have been unsuccessful in increasing energy efficiency (Katzev and Johnson 1987). Also the success of residential incentive programs has been mixed. Penetration rates have tended to be low though some programmes have been more successful than others (International Energy Agency 1987). Conflicting evidence exists though on what factors increase participation (Hartman, R. 1986).

The Hood River Conservation Project, a community based project, achieved unprecedented levels of participation (Hirst, E. 1987). The key factors in the success of this project, which included single family housing and multiple unit rental buildings, seem to have been the offer of free retrofits, the extensive use of word-of-mouth promotion through recruitment of community participants, and a very high level of staff commitment and enthusiasm (Hirst and Goeltz 1986). The general lesson from this and other programmes seems to be that from the perspective of customer participation, it is as important to plan carefully how the programmes will be delivered as it is to decide upon the form and size of the incentive.

The Espanola Community Based Conservation Project (Espanola Power Savers) took into account the "lessons learned" from the Hood river project, and enhanced the project by; including both residential and commercial markets to maximize electricity conservation. Consumer energy education was emphasized to encourage an attitudinal shift towards a conservation ethic, and this extensive retrofit work was undertaken over a short time frame (19 months).

4. PROJECT DESIGN

The community-based conservation project had five key features; (1) it was targeted to a specific geographic area; (2) it used the community network to champion the conservation effort; (3) the utility acted as the project manager and catalyst; (4) incentive levels were high; and (5) customers' decision making was facilitated.

The project used a two pronged approach. First an extensive, cost effective list of energy conservation measures and installation specifications was established to maximize energy savings; and second it used a market saturation approach to elicit attitudinal and behavioural change that would optimize energy savings and then maintain the efficiency built into the community, to avoid attrition and the take-back effects following installation of the weatherization measures (Flanigan 1992).

The Project's four main objectives were:

(1) To assess the community-based delivery concept as an additional, aggressive approach to demand management marketing;

(2) To determine the maximum attainable Megawatts (MW) through the installation of cost effective retrofit and replacement measures, in the shortest period of time.

(3) To assess the "transferability" of the community-based delivery concept to the province; and

(4) To collect and evaluate data to augment existing residential and commercial databases.

5. PROJECT IMPLEMENTATION/OPERATIONS

Espanola, with a population of about 6,000, was chosen as the test community for the project. The town is a pulp and paper community situated on the Spanish River in Northeastern Ontario approximately 500 km north of Toronto.

Espanola was chosen because it is geographically delimited, had a stable economy and the proportion of electric heating was representative of a northern community. Also it was evident from the outset that the town officials and the citizens demonstrated civic pride and would be receptive to a community-based conservation program. Representatives from Ontario Hydro, the local distribution utility (Espanola Hydro), and the Town of Espanola took part in a signing ceremony which formalized the responsibilities of these three principal parties.

In the ensuing months, separate tendering documents for the general contractor and the audit/inspection work were prepared. These documents were detailed and represented high expectations to which work was to be performed. A consortium of local contractors in Espanola bid on the contracting portion. While the local contractors were not awarded the general contracting job, most of them ended up working on the project under the general contractor.

The operational phase of the project began on June 1, 1991, with the opening of a field office in Espanola. A community picnic was held which was partially sponsored by various conservation industry suppliers and associations. It was announced the community had until May 31, 1992 to sign up for the project. The project's operations were scheduled to be completed by December 1992 with the completion of the installations. The residential installations were completed by December 31, 1992, with the commercial work completed on March 31, 1993.

5.1 Marketing

A community assessment was carried out in the spring 1991 to obtain a comprehensive understanding of the environment in which the program was to be launched. Besides collecting and analyzing traditional demographic data, the assessment attempted to discover the formal and informal networks/power structure within the community.

A detailed marketing/communication plan (Sharpe and Watts 1992) was developed and implemented. It emphasized cultivation of community interest and support to achieve a maximum participation rate and uptake of recommended measures and to achieve a community "culture shift" to wise electricity use over the long term.

A cornerstone of the plan involved the formation of a Community Advisory Committee at the outset of the project which consisted of over 30 representatives from organizations within the town. The committee had two primary functions; to provide advice and guidance to the project on ways to promote the wise use of electricity and to provide the project direct community feedback on existing and potential project-related issues.

Additional community involvement/communication mechanisms included: Project newsletters, open house/information nights, presentations to community organizations, an energy conservation week, radio/newspaper advertising, municipal council presentations, a curriculum based energy conservation educational package [1], a spring writing contest, high school presentations, Energy Conservation Corner in the Public Library, logo/slogan contest, opening ceremonies picnic and displays, energy saving tips contest, hydro bill inserts, direct mail, and cable T.V. community service announcements.

5.2 The step by step delivery process

From the vantage point of the Espanola home or business owner, the Espanola Power Savers Project involved five main steps:

(1) contact project office to request an audit;

(2) a visit by a qualified energy auditor/contractor team to recommend energy efficient measures to be installed;

(3) approval of work by the home/business owner by signing an agreement with the general contractor;

(4) installation of energy efficient measures by qualified contractors; and

(5) inspection of all major work to ensure energy savings and customer satisfaction.

5.2.1 The sign-up

The sign-up process started early when interested citizens flooded an ad hoc information booth set up at the local shopping mall days after the project was announced. They requested more information and many were ready to participate. The project team quickly responded by having these "early adopters" sign a log and were advised they would be re-contacted as soon as the project got underway. Later the residents were able to sign-up at the Sportsmen's Show, at the Espanola Hydro office and at the project store front. By the time the project began, almost 50% of the homes and businesses were signed up.

5.2.2 The energy audit

The audit is designed to identify the most complete set of energy conservation measures that will result in the greatest electricity demand and energy savings.

The type of audit conducted depended on the service classification of the customer. The four main classifications were; residential all electric (which had electric space heating and water heating); residential non electric (which had space heating other than electric and optional electric water heater); commercial all electric (same as residential all electric) and commercial non electric (the same as the residential non electric). Each classification had its own audit form.

The all-electric audit was based on the "whole-house approach," which included a full inspection of the building shell inside and out. Particular attention was paid to check for proper ventilation and for moisture problems. Working together, the auditor and contractor's representative measured all windows, doors and areas to be insulated.

The audits were conducted by a two-person team made up of a qualified energy auditor and a representative of the general contractor. The auditor introduced the Espanola Power Savers goals and its potential benefits to the owner.

Because of known potential problems with high radon levels in northern Ontario, radon tests were conducted before and after installations in the electric space heated homes.

5.2.3 Presentation of recommended measures

At the completion of the audit, the auditor presented a set of recommendations to the customer. At this point the contractor's representative took over the meeting and explained the costs of the recommended measures and Hydro's incentives. The customer was also made aware of Hydro's financing plan that allowed the

customer to participate with no upfront costs. The customers usually took at least two weeks or longer to make their decision. When ready to proceed, the home or business owner signed a project application form and contract with the general contractor's representative.

5.2.4 Installation of measures

The general contractor, responsible for handling all the project's installations, was selected by Ontario Hydro through a competitive bidding process which delineated the unit costs of specific retrofit and replacement measures. The general contractor in turn subcontracted to local and regional contractors for the installations. The general contractors tasks included scheduling and coordinating sub-trades and ensuring installations met project specifications.

The installation of energy-efficient measures was conducted by qualified contractors. All trades persons who worked on installations were certified by Ontario Hydro and an association$_2$ to assure proper workmanship. Further on the job training was carried out daily to ensure quality work was being done. Furthermore, all work was covered by a warranty program$_3$.

5.2.5 Inspection of work

Originally all major work was to have had one final inspection after the completion of the installation. Early in the project it was evident that this was not adequate. An interim inspection process was designed to allow up to seven progress inspections for the different types of subtrade work being performed.

A full deficiencies procedure was in place to notify the general contractor when they occurred. They were noted as major or minor deficiencies. Major deficiencies that were expected to result in loss of savings were to be corrected, and re-inspected before the customer signed off the job. Minor deficiencies were more cosmetic in nature, and the contractor had to satisfy the customer before the customer paid their portion of the bill. Minor deficiencies did not hold up the release form for Hydro's payment.

The final inspection continued to be carried out. The inspector checked that each measure had been installed to specifications and reconciled the installed measures to the work order. The inspector also ensured that the owner was satisfied with the contractor's work. The customer then signed a release form that allowed Hydro to pay the utility's incentive money directly to the general contractor.

6. PROJECT MEASURES

Selecting measures and calculating incentives were important tasks of the project design phase. All existing and new technology products were screened using a computerized cost-benefit model, initially without project costs$_3$. The cost effective measures were re-analyzed and incentive levels established at the lesser of the incremental installed cost of the measure or its full system avoided cost.

In total over 100 energy conservation measures were approved. A few measures, when considered on their own, did not pass the test. However when bundled with other measure(s) that were being installed at the same time, they became cost effective. The measures ranged from energy efficient lighting to varying degrees of insulation for the entire thermal envelope, as well as energy efficient windows, doors, plus water and space heating options.

The range of measures offered was determined by the customer's classification. Customers were grouped as either all-electric or non-electric. The all-electric customers were offered more measures, as they had greater potential energy savings. Commercial customers received more extensive lighting measures.

7. PROJECT INFORMATION SYSTEM

To meet the project start-up date, an off-the-shelf computer system was purchased. The purchased software was customized to accommodate the project's needs. The information system helped administer the project in three ways. First it allowed data entry of customer and vendor information, work orders and supplemental data. Second through standard reports and ad hoc reporting capabilities it assisted project management to monitor the status of work performed. Third, it helped to track costs, demand/energy savings and other key parameters.

8. EVALUATION

An integral part of the Espanola Power Savers Project was the desire for an in-depth evaluation encompassing many issues related to the design, implementation, results and transferability of a community-based project. An evaluation plan for the Espanola Power Savers Project was designed to address five major evaluation issues:

(1) development of project's design; (2) efficiency and effectiveness of project design and operations; (3) extent of long-term shifts in attitudes and behaviour; (4) net benefits and costs of the project; and (5) project transferability to other communities.

In developing the evaluation plan, comprehensive logic models were produced, representing the causal relationships between the activities of the project, the outputs, the impacts and the effects of the project as they relate to the overall project goals. These logic models were used to ensure that all major aspects of the project, both planned and unplanned, would be identified and addressed in the evaluation.

To evaluate all aspects of the project operations to determine what worked and what did not, feedback from different perspectives was required. There were numerous stakeholders and players involved who were interested. These groups included residential and commercial customers, auditors, inspectors, contractors, a community advisory group, local schools, the local utility, local community groups and the Town Council.

9. RESEARCH

Research was also conducted into practical problems of the project. Considerable amounts of data were collected and once analyzed, will be reported through the sub-studies. The sub-studies included;

(1) Indoor Air Quality, (2) Air Sealing/Ventilation, (3) Window Performance, (4) Supplementary Heating, (5) Cross (Interactive) Effects, and (6) Net Effects To Distribution Utility.

10. PROJECT MANAGEMENT

When the project became operational in June 1991, managing change became the most important project management task. During this phase eight key elements were followed in completing weekly reports and progress reports to senior management; marketing/communications, conservation measures, audit/inspection, contractors, metering/monitoring, evaluations, information systems and project management. From this process, four different operational project manuals were developed.

11. RESULTS

The data presented in the following tables indicate the level of customer participation and uptake of retrofit activities that occurred over the operational phase of the project.

Table 1 shows the number of eligible sites in Espanola, the number of customers who participated in a level

Table 1. ***Espanola Power Savers - Participation Results (By Building Sites)***

Customer Segment	A Total Eligible Sites	B Total Sites Audited	C Participation Rate (B/A)	D Total Sites Receiving Treatment	E Customer Potential Uptake D/A	F Customer Actual Uptake (D/B)
Residential						
All Electric	726	697	96%	619	85%	89%
Non All Electric	1.081	856	79%	841	78%	98%
Total Residential	1.807	1.553	86%	1.460	81%	94%
Commercial						
All Electric	74	71	96%	44	59%	62%
Non All Electric	130	106	82%	66	51%	62%
Total Commercial	204	177	87%	110	54%	62%
Total Sites	2.011	1.730	86%	1.570	78%	91%

III engineering audit and the number of customers who agreed to receive measures.

An eligible site was defined as any building site that was deemed suitable for possible participation in the project. The criteria used to determine the eligibility included; the individual customer electric energy consumption, the type of heating and size of building and type of end use. Sites that qualified for the program were assigned a site identification number (site id.). Of the total possible sites in the community, four were excluded from the total eligible sites (column A) eg. two radio/telecommunication relay stations.

Utilities measure participation in many ways. The participation results in Table 1 (column C) is defined by the number of audits completed compared to the total eligible sites. It indicates an impressive 86% average participation level. It should be noted that to participate, these customers signed up for an audit at local events, dropping by the field office or in response to a telephone call from the office.

Customer actual uptake (column F) is defined as the number of customers that accepted at least one measure from the list of total measures recommended by the auditor compared to the total number of customers audited. The real measure of success though is not the uptake as shown in Table 1, but is the amount of energy saved through the acceptance of the multiple measures offered ie. the Table 2 data.

The resulting electrical energy savings from the installed measures compared to the recommended measures represented an impressive overall 71%, especially that both residential and commercial markets were included and that it was delivered over a short period of time.

For the energy efficient (ee) measures alone, they represented an even higher overall estimated energy saving uptake of 80%. For the fuel switching measures the overall lower uptake of 24% was due to; the dropping off of responses in the commercial market compared to the residential market due to the deepening

Table 2. *Espanola Power Savers - Estimated Energy Savings (kW.h)*

Customer Segment	A Estimated kW.h Savings for Eligible Sites	B Estimated kW.h Savings for Audited Sites	C Estimated kW.h Savings for Accepted Measures	D % of Uptake (C/A)	E % of Uptake (C/B)
ee Measures					
Residential	7.472.514	6.770.987	5.552.411	74%	82%
Commercial	5.793.142	3.212.886	2.417.958	42%	75%
Subtotal ee Measures	13.265.656	9.983.873	7.970.369	60%	80%
Fuel Switching Measures					
Residential	177.970	177.970	177.970	100%	100%
Commercial	1.817.926	1.817.926	308.551	17%	17%
Subtotal Fuel Switching	1.995.896	1.995.896	486.521	24%	24%
Total Customers	15.261.552	11.979.769	8.456.890	55%	71%

recession (may be relevant to the ee measures as well), commercial customers had less decision making time (57 customers, 32% of total were cut-off due to the need to end the project retrofit work prior to the heating season for metered data), and a greater emphasis on ee measures throughout the project as a result of accepting our partners wishes to downplay the communications on fuel switching, and the decision making process complicated much of the fuel switching in the town's only retail mall despite the tenants interest, 79% of total fuel switching potential.

The total system net savings are based on engineering estimates which have been adjusted for cross effects.

In a recent study of American utilities it concluded that participation for energy efficiency measures could be expected at a level of between 7 per cent and 20 per cent for the residential sector. This U.S. study said that even if the utility picks up 100 per cent of the measure's cost, some customers will still not participate (Chamberlin and Faruqui 1991)

The Hood River Conservation Project, a community based project, achieved unprecedented levels of participation over the years 1983 to 1985, 91% of eligible households had elected to have an audit and 85% had installed at least one major retrofit measure (Hirst 1986). The project compares well as it included both residential and commercial customers while Hood River included only all-electric residential customers.

Table 3 represents average costs per site and average capacity reduction and electrical energy savings.

For the project's average total installed cost of almost 2.400 ecu the customer paid on average 791 ecu which represents 33% of the total installed cost. Also the average capacity reduction was 1,2 kW with the corresponding average annual energy reduction of 4.873 kW.h.

Table 3. ***Espanola Power Savers - Project Average Costs (in ECU's) and Energy Savings*** *

Customer Segment	Average Customer Contribution Per Site	Average Hydro Incentive Per Site	Average Total Cost Per Site	Average kW Reduction Per Site	Average kW.h Savings Per Site
Residential All Electric	1.716	2.685	4.581	1,87	6.832
Residential Non Electric	11	124	134	0,12	1.071
Commercial All Electric	2.124	5.377	7.501	6,99	24.904
Commercial Non Electric	353	2.778	3.130	2,21	11.911
Community Total	791	1.569	2.360	1,20	4.873

* 1 ECU = 1.5643 Cdn dollars (1992)

These results are very favourable when compared to the Hood River Community Based Project. For example in their project the utility's incentives covered the full cost of the installed measures. Further their average installed cost was similar at 2.420 ecu. Their resulting average capacity reduction was 1,76 kW and average annual energy reduction of 2.600 kW.h in the first year after retrofit (Flannigan 1992). From an Ontario Hydro study (Ontario Hydro 1990) on 1000 electrically heated homes across the province, it assessed the technical/economic potential for the housing stock in the Province of Ontario. The results showed; the average electrically heated house in the sample used about 28.000 kW.h of electricity a year, the savings for each house was about 3,4 kW, the average degree days was 4.000 C and the average size of the house was 111 square metres. From the project estimated electrical energy savings for the residential all electric of 6.832, the savings represent 24% of the homeowners electrical energy from the study. At the utility rate of 0.047 ecu per kW.h the average customer could expect to save annually 332 ecu.

Because of the non standard nature of the commercial buildings a standard upon which to base average percentages is not useful.

It should also be mentioned that the total customer contribution of 1,34 M ecu from all sectors over 19 months is a substantive indication of their commitment to energy efficiency.

Also noted is that there is a much smaller level of involvement in the work from the gas heated homes. This is not unsurprising, as it also had a detrimental impact on the overall community perception of the project.

Once work had been completed in customers' homes, they were sent a survey to ascertain their level of satisfaction with key project elements. Hence, assessments were made just after the peak work level for each customer and were sent out over a six-month period. Of the total 1.074 surveys sent out, 411 were returned. Satisfaction with the project overall showed 88% of the respondents categorizing it as somewhat to very satisfactory. The highest satisfaction ratings were 94% for inspection and 90% for the audit process, with the lowest showing 84% favourable towards the general contractor and 80% for the sub-contractors. The strong positive response could be attributed to factors (Sharpe and Watts 1992) such as; the importance of the education component, the importance of the advisory committee, and the importance of beautification (ie. non ee related decisions).

Table 4. ***Comparison Residential Customers' Project Satisfaction Ratings "Operational" and Mid-Point Surveys***

Survey Description	Project Operational Questionnaire		Project Mid-Point Survey		
Date	April - December 1992		July - August 1993		
Projected Overall Rating	(%)		Telephone (%)	Personal (%)	
Good/Satisfied					
Extremely	35		46	47	
Somewhat	53		21	13	
	88		67	60	
Poor/Not Satisfied					
Extremely	7		13	16	
Somewhat	5		8	13	
	12		21	29	
Don't Know/Not Stated			12	11	
Total	100		100	100	
Sample Size	n=402	100%	n=295	n=295	100%
	All Electric=249	62%		All Electric=139	54%
	Non Electric=153	38%		Non Electric=136	46%

In comparing the operational questionnaire to the evaluation's mid-point survey, conducted in July/August 1992, satisfaction with the project overall showed as 60% to 67% of the respondents were somewhat or very satisfied with the project overall. Comparing the two surveys, 47% of respondents in the midpoint survey were very satisfied with the project compared to 35% in the operational questionnaire. It should be noted that the mid-point survey had a larger percentage (46%) of non electric (gas heated) respondents vs (38%) for the operational questionnaire. Dissatisfaction occurred due to; the gas heated customers who despite project communications on the business nature of the project (ie. utility funding commensurate with level of ee savings) felt left out of the major project benefits, and the length of time between sign up and work completion. This tended to occur in the easy work homes where scheduling of work was lacking. Over the life of the project, the completion time dropped from a worst case of six months to two weeks.

In the current utility environment, these levels of satisfaction are impressive. From other similar utility satisfaction surveys conducted, they showed a province wide reduction in utility image ratings of 13 points over a one year period compared to no decrease in the Espanola ratings.

12. CONCLUSIONS

This research project has provided the opportunity to test innovative marketing approaches and the best available technologies to secure the maximum megawatts in a way that pleases the customer. These results show unprecedented levels of customer participation. Customer acceptance of the conservation ethic in Espanola is beyond the levels observed in more standard DSM programs. The town of Espanola offered itself as a test bed and its citizens gave the project their time and attention, along with a considerable amount of financial support. This partnership approach, incorporating a spectrum of customer interest including electricity savings, provides a framework for a sustainable future.

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ENDNOTES

1. Developed by the Society for Environment and Energy Development Studies (SEEDS).

2. The accrediting of contractors was conducted by the National energy conservation association. (NECA)

3. The Home owners warranty as set up by the Energy conservation contractors warranty corporation.

4. Barakat & Chamberlain designed the DSStrategist for Ontario Hydro's needs.

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