Ten Years of Market Transformation Programs: From the Home of Power Smart

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ABSTRACT

Market Transformation is a relatively new term, but it is not a new concept. This paper endeavours to provide some learnings from the ten years or more of Power Smart strategic conservation programs at BC Hydro. The paper will review some history, illustrate the rationale for market transformation programs, and then describe the program life cycle concept. We will introduce a new concept, that of a continuum of market influence, stretching from simple resource acquisition efforts to full market transformation initiatives, with programs operating at various points between these poles. The measurement issues for market transformation programs are reviewed, and the results of the Power Smart initiatives are detailed by program.

Market Transformation's Emergence as an Accepted Term

Market transformation is a term that was coined for our industry sometime in 1993 (Prahl and Schlegal 1993), and an EPRI workshop was held in July 1994 to endeavour to bring consistency to the use of the terminology and clarity to the concept. While several utilities had goals to transform markets, most felt that demand-side management was something other than market transformation, and that almost anything that resembled marketing was deserving of this new and popular title, market transformation. The workshop concluded with a basic definition "Market transformation is the continuing effect on the market beyond intervention by a market player. It is a planned objective that may be accomplished by a broad variety of marketing strategies." This built on Ralph Praul's earlier definition, and emphasized two points - the "program" effects continue after the utility intervention stops, and that this effect was planned. The executive summary of that session illustrated some of the confusion of the time, "Market Transformation is not demand-side management (DSM), but shares its focus on end uses of electricity." (Sachs 1993) In fact market transformation was and still is an integral part of what is called DSM, it just wasn't a focus of the investor owned utility (IOU) and U.S. regulatory regime of the time, perhaps due to the quantitative issues in measuring its effects. In a working group at Asilomar later that year, attempts to discover how to merge this "new" approach into the IOU/regulator DSM paradigm failed. In the authors' opinion, too many papers and too little action seem to be the legacy.

Power Smart - The Early Years

In 1975 BC Hydro started the Energy Conservation Division to encourage its customers to utilize energy more efficiently through a systems approach and to purchase more efficient products. In 1977 an engineer was hired specifically to work on an End-Use Industrial Applications Initiative. By the early 1980's BC Hydro had the first electric motors database, highlighting efficiency levels; a traveling

"Energy Bus" which had motors, drive and lighting demonstrations, and supported energy audits in plants; and was running a series of seminars on motors, adjustable speed drives, and motor driven equipment (Nelson 1993). Work was progressing in parallel with residential and commercial customer needs. In the residential sector, an Energy Efficient Home specification was developed and in the commercial sector, more efficient fluorescent lighting systems were developed.

In 1988 pilots were launched to acquire energy savings by providing rebates for high-efficiency motors and refrigerators and by direct installation of water heater blankets. In 1989 the umbrella name of Power Smart was coined, and full scale programs began to roll out. The pilot/program total exceeded 40, and active programs peaked at about 30 in 1993. The move from early energy efficiency efforts (which had focused on investigative activities, setting standards for energy efficient products and education of customers) towards one of providing financial incentives was part of a plan to "flip the market" and facilitate legislation or shift consumer/vendor behaviours. (Nelson & Tiedemann 1995) What was happening in the program design was not so much business driven as it was doing what made sense given the utility's position as a crown corporation owned by the residents of the province. This situation developed after twelve years of groundwork, and the need to deal with the prevailing "market barriers" which blocked the adaptation of the high-efficiency products and processes. Ten years after the start of BC Hydro's $250,000,000 (US) investment in the incentive phase of the programs, over 2,300 GW.h and 310 MW have been "saved", at an average levelized cost of 2.3 cents/kW.h (US), and a great deal has been learned.

Market Barriers

BC Hydro's DSM activities have been focused primarily on finding lasting solutions to market barriers, an approach now referred to as market transformation. (Henriques 1993) Market barriers, as shown in Table 1, are situations which impede the progress of natural conservation through technology improvement. These barriers result in the utility customers not making rational economic decisions regarding the adoption of cost effective, energy efficient technologies. Over time the approach to Power Smart program planning evolved to better integrate planning, operations and evaluation.

Table 1: Market Barriers Framework

Market barriers which can be addressed by customer service programs are:

1. Customers' awareness of energy efficiency options.
2. Customers' technical ability to assess the options.
3. Existence of a viable infrastructure of trade allies.
4. Vendor or trade ally awareness of the efficiency options and their understanding of the technical issues.
5. Local or national product availability.
6. Customer transaction costs to assess/implement energy efficiency options.
7. The incremental capital cost of the efficient technology

(Source: Nelson 1996)

Each potential customer service or DSM program must be assessed to determine which of the market barriers are *critical* for that market, which barriers it *might* be able to address, and which it is *expected* to

address. Clear understanding of the market barriers is required to design the appropriate program, to accurately estimate the future activity level and load impact, and to evaluate the overall program impact.

If the effect on the market barriers is expected to last beyond the program's active period, then the program will have transformed the market. This should be a part of the program forecast. Market transformation is fairly complete if the program leads to significant legislated standards or codes, but may be only partial if dependent on reduction of one or more of the first six barriers listed above. Conquering the perceived cost barrier is the most important issue, and failure to adequately reduce costs usually results in purchase behaviours falling back to their original pattern (e.g. water heaters).

Incentive programs address more than just the financial barrier. They serve as signals of utility commitment and garner the co-operation of the trade allies as they affect customer awareness and needs. An effective incentive program by a respected utility can eliminate or at least substantially reduce barriers dealing with customer technical ability and customer transaction costs, and might significantly affect the customer awareness, trade ally awareness and infrastructure, product availability, and incremental cost barriers. Program planning can be usefully based on the "barrier framework", and program evaluation follows it as well.

Program Life Cycle

With many of its initiatives BC Hydro has worked through all five stages of a DSM program as defined below. The phases are best displayed using the example of the High-Efficiency Motors program, as shown in Figure 1.

Program Phases

The individual phases can be described as:

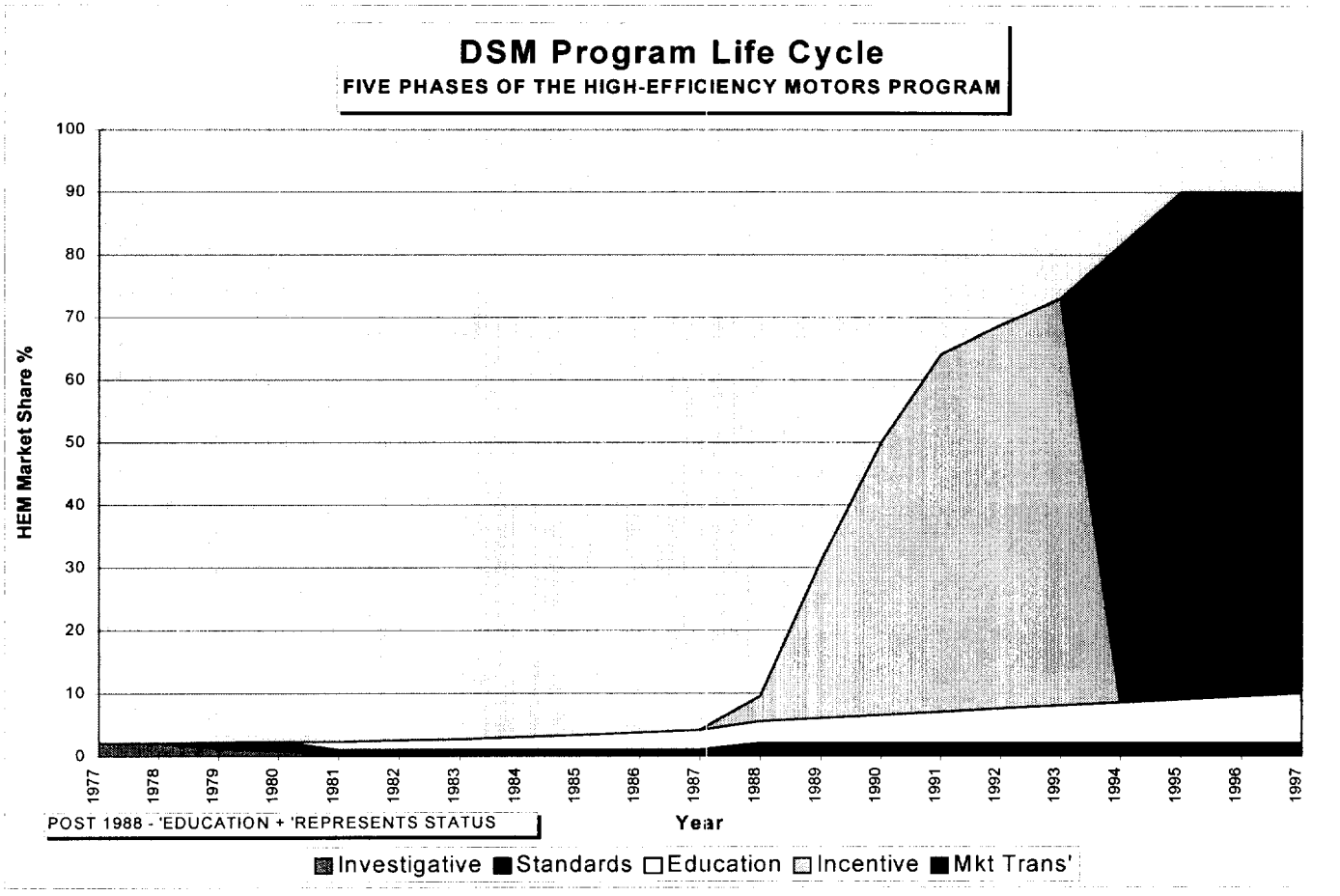
1. **Investigative** - determining what the market is doing, what energy efficiency options are in the market, and then assessing all available products.
2. **Standards** - standards (criteria for acceptable electrical efficiency) are set which would serve as the basis for product recommendations, endorsement for incentives where applicable, as well as the basis for potential regulations or legislated energy codes, thereby specifying what the utility wants to see adopted.
3. **Education** - whatever barriers are in place, the utility staff, trade allies, and key customers need to be educated as to the selected standards and their rationale. For some programs this may just be a stepping stone, and for others it would be the most significant step.
4. **Incentive** - depending on the relevant barriers, the incentive phase may be the key to solving the most significant barrier, or it may be used as a tool to speed up adoption, well beyond the rate expected from the education phase.
5. **Market Transformation** - while this terminology is not quite appropriate in an economics sense, utilities have selected it to describe lasting benefits from the mitigation of various market barriers. DSM activity does not actually transform markets, it merely influences the adoption patterns for cost effective, energy efficient technologies (Nelson 1994a).

Within BCHydro it was determined that the utility must always have an exit strategy for the programs. The best exit strategy for BC Hydro and BPA has been to lock in the efficiency gains through

regulations or legislated energy codes. The second best strategy is to have affected the marketplace in such a way that a significant change has been made to the expected adoption rates. If that change persists after the program becomes inactive, market transformation has occurred. If the change does not persist the initiative may be described as a resource acquisition program.

In Figure 1 the High-Efficiency Motors program is described graphically, with the market share by year as the top line of the area graph, and the *contributions* of each of the program phases illustrated as a different shade. For example, all of the investigative, standards and education work prior to 1988 was expected to continue to grow the share by .5% per year, and formed the baseline against which to measure the effects of the incentive phase. In this case annual penetration in other jurisdictions was also used as a control. The effectiveness of the incentive phase for this particular technology was in large part dependent upon the earlier standards and education work. In each DSM program the role of incentives, and their impact on market transformation, was different.

Figure 1 Program Life Cycle



(Source: Nelson and Ternes 1993)

Legislation/Regulations

From a utility investment perspective, legislation is often the least expensive means with which to achieve savings and exit from the program. The approach BC Hydro used in closing its initiatives via

regulations evolved over time. After industry/vendors had become accustomed to selling certain types of energy efficient products, and the market penetration had reached 20% say, then legislation was not such a political issue for the government. To gain legislation before the infrastructure was in place and the social costs were proven to be positive would have been impossible. In many cases BC Hydro staff were working with national standards groups to establish future standards, building off the program activities, and often using programs to leverage the standards up one more notch.

It became somewhat easier for utilities to gain consensus at the national level in Canada after Power Smart Incorporated (previously a BC Hydro subsidiary) became a national entity in 1994, with revised ownership by seven major Canadian utilities and with over 20 Canadian members, and 10 international members. This provided a coordinated approach to national standards, international energy efficiency labeling, promotions and incentives. A major accomplishment of this member service organization (1990-1997) was its national retail promotions in the residential sector which coordinated manufacturers, retailers and utilities in Power Smart month events. Manufacturers provided promotional pricing and co-op funds, retailers provided end of aisle space and advertising investments, and the utilities provided retail staff training and event coordination. Behind this retail event effort was an ongoing move towards using energy efficiency labeling through the Power Smart Saves "trust mark" as a tool to leverage up product standards for legislation (Nelson 1994a).

Resource Acquisition

If a DSM program was not aimed at lasting effects, or if it failed to achieve lasting effects in the marketplace, then its value was simply one of resource acquisition. Some resource acquisition programs were operated by BC Hydro as a part of the Power Smart product mix. But in the culture which launched Power Smart, even resource acquisition programs, were designed to have some lasting benefits. There is not a clear line between resource acquisition and market transformation. There is a continuum. And perhaps ethic change is one of the initial components of both.

The Program Influence Continuum

As we look back on the more than 30 Power Smart initiatives over the last ten years, more than half were aimed at market transformation, with some clearly planned steps to get there. Others were a mix of market transformation and resource acquisition, with the success of the program becoming part of the determinant of whether transformation had occurred. When with one program (Building Improvements Program) a utility invests over $60,000,000 (US) in energy efficiency retrofits to commercial buildings over a six year period, and their customers invest an additional $80,000,000 - significant changes occur in the inventories of lighting products in the region, the acceptable standards for renovation, the skills of the contractors, and the awareness and education of the buyers. If the program had been only one tenth the size - little effect might have been noticed. So pure size can lead to market effects which would not be initially expected - what would normally have been a resource acquisition program became in fact a program which effected market transformation as well.

With large industrial projects it is fairly clear that turbo generators being added to steam systems to generate electricity would be regarded as pure resource acquisition. On the other hand if a utility supports the installation of a mechanical debarker system, as a replacement for the standard hydraulic

system, the pilot installation of one unit can provide enough experience and information to enable other players in the industry to shift over to the desired technology without financial support. Both projects in this industrial program would be huge, but the first was intended to move just one customer, while the second would be considered market transformation, as it was designed to shift a local market.

As one looks back on the wide menu of programs that operated under the Power Smart umbrella at BC Hydro, it is clear that within a single program there could be both ends of the spectrum, resource acquisition and market transformation, and if a program was very successful in resource acquisition, market transformation could be a somewhat unexpected byproduct. Program evaluation based purely on the resource acquisition effects would understate the total effects of the initiative.

Table 2 details the menu of programs that were offered by BC Hydro, and categorizes them by sector; (residential, commercial and industrial); itemizes which barriers they were intended to address; places them on a continuum between resource acquisition and market transformation; notes their eventual situation/status and shows the dollar investment and the return through kW.h cost and GW.h achieved.

Measurement of Savings

The major challenge with market transformation initiatives is the measurement of impact. Measuring impact is essential for planning, resource optimization and regulatory approval. Because of the need to get programs in the field quickly, the measurement approach for evaluating program savings was established in many cases after the program was launched. By 1992 evaluation plans were established, and studies were underway. All major programs were evaluated by late 1995. Over $5 million (US) has been invested in the evaluation effort, compared to capital costs of $250 million for the Power Smart initiative. Starting with the High-Efficiency Motors program evaluation (completed in December 1992, and results presented at the Sixth National DSM Conference in Miami in March 1993) the methodologies have evolved as more diverse programs came under study. Different programs were based on education seminars, marketing representative induced behavior changes, advertising, and related activities. When spillover (savings beyond those who received direct support/incentives) was a primary goal, traditional evaluation approaches such as billing analysis were generally discarded or used as simply as tools for unit savings estimates.(CPUC 1993) Approaches built off market share assessments became integrated with the technical assessments of unit savings to give an overall perspective on total results.

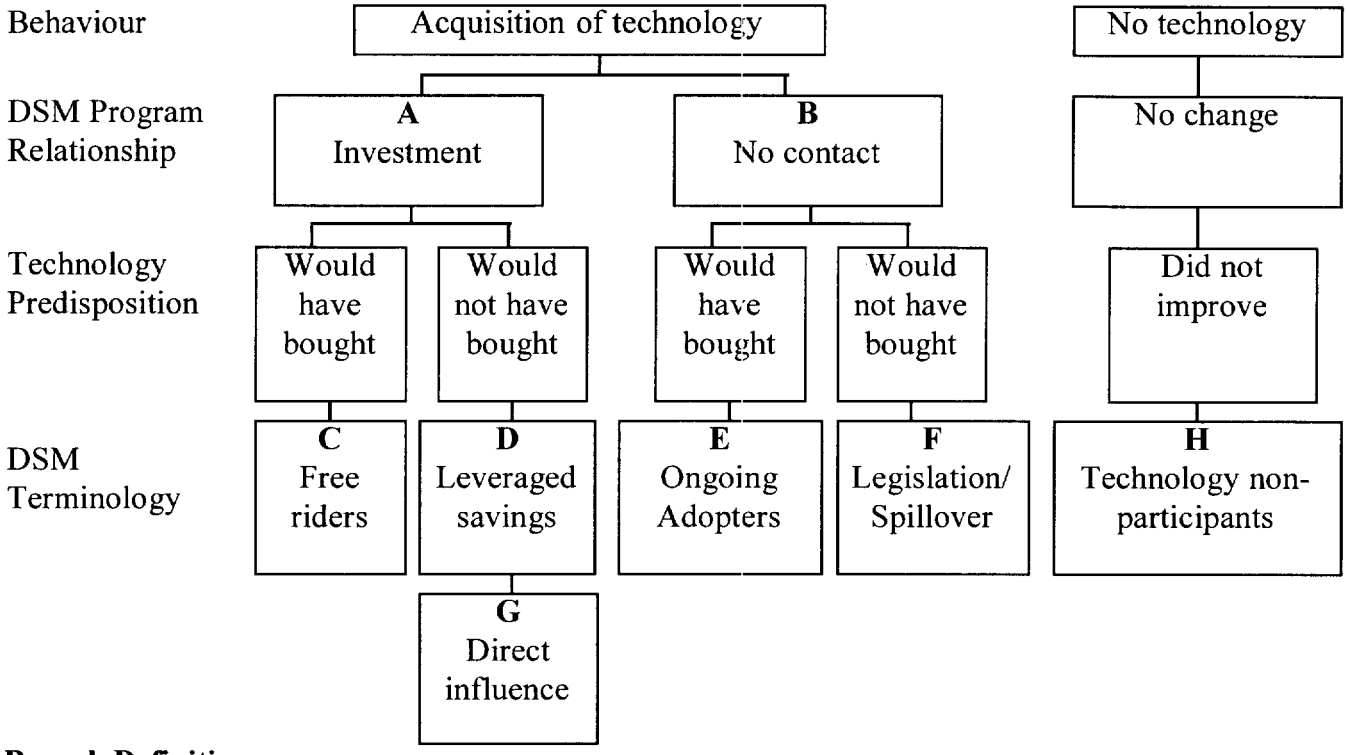
Long before the terms "market transformation" and "spillover" came into common usage, a tool was developed to explain the market options, and to help to plan the measurement of them. This tool was the "technology tree". The original perspective on the tree, the "financial" approach, was described in earlier works (Nelson 1992), and the current version (Table 3) which focuses on attribution, has been used in BC Hydro since 1994 (Nelson 1994b). This new approach was essential as under the financial perspective the direct influence (induced) savings would have come under the term spillover. The 1994 approach attempted to show why direct influence savings should be viewed as normal energy savings achieved through participants, rather than being classified as spillover or free drivers. And lastly, the term free

Table 2: The Program Influence Continuum

Programs	Timing	Barriers							Continuum	Status	$ mm	c/kWh	GW.h
	Pilot/ Program	1	2	3	4	5	6	7	Resource Market Trans				
Q Plus	89	x	x	x	x	x	x	x	X	high cost	1.4	high	.3
New Home	93 94	x	x	x	x	x	x		X	ongoing	3.1	2.5	40.2
Home Improvements	90	x	x	x	x	x	x	x	X	commercial	24.2	20.4	40.8
Non-Integrated	89	x	x	x			x	x	X	ongoing	2.6	15.7	5.4
Water Heater Blanket	88 89	x					x	x	X	complete	3.4	3.3	12.9
Hot Water Saver	90 91	x					x	x	X	complete	2.4	2.3	28.5
Refrigerator Efficiency	88 89	x	x	x	x	x	x	x	X	legislation	10.4	.3	165.7
Refrigerator Recovery	90 91	x						x	X	ongoing	17.8	2.3	108.7
Elec to Gas W. Heaters	89	x			x			x	X	ended	2.5	4.8	101.3
Water Heater Efficiency	89 91	x	x	x	x	x	x	x	X	legislation	1.4	2.6	10.0
Residential Lighting	90	x	x	x	x	x	x	x	X	high cost	1.7	4.5	3.1
Res. Fuel of Choice	90								X	TRC rose	.6	n/a	.5
BC21 & Special Projects	94								X	complete	4.3	n/a	40.1
Retail Promotions	91	x	x	x	x	x	x	x	X	ongoing	2.7	8.8	5.2
Residential Legislation	96	x	x	x	x				X	ongoing	n/a	n/a	35.0
Education Programs	89	x	x	x					X	ongoing	2.6	n/a	
Misc. Programs	87								X	complete	1.5	n/a	
Residential Total											**82.6**	**4.3**	**599.9**
New Building Design	90	x	x	x	x	x	x	x	X	legislation	28.6	1.5	353.6
Building Check-up	96 97								X	ongoing fees	1.1	n/a	30.0
PS Green Hotel	97								X	ongoing	.1	n/a	.1
Gas Fuel of Choice	91								X	closed	1.7	3.3	.5
Building Improvements	90	x	x	x	x		x	x	X	closed	93.8	3.6	580.4
- Lighting	89	x	x	x	x	x	x	x	X	legislation	BIP	n/a	151.5
- Municipal Efficiency	89								X	complete	BIP	.8	10.8
- EMCS	90								X	closed	.2	.8	.4
- Economizers	90								X	closed	.1	.8	.4
- In-house	90								X	complete	1.5	.8	7.8
Comm Water Heater Con	90	x	x	x	x	x	x	x	X	TRC rose	.2	.8	6.7
Misc. Programs									X	complete	1.5	.8	12.4
Commercial Total											**128.8**	**2.9**	**1181.8**
Consolidated Ind Prog	97								X	closed	4.9	n/a	below
Process Improvements	90	x	x		x		x	x	X-------X	ended	4.9	1.2	228.1
Power Play	91	x	x				x		X	closed	n/a	n/a	1.5
Compressed Air	89	x	x	x	x	x	x	x	X	closed	4.4	1.4	69.9
Efficient Fans	90	x	x	x	x	x	x	x	X	closed	3.2	1.9	50.0
Efficient Pumps	90	x	x	x	x	x	x	x	X	closed	2.4	3.1	167.0
High Efficiency Motors	88	x	x	x	x	x	x	x	X	legislation	11.1	1.3	41.7
New Plant Design	89	x	x		x		x		X	by program	n/a	n/a	n/a
Roadway Lighting	90	x	x				x	x	X	complete	3.1	2.8	59.1
Industrial Total											**34.0**	**1.9**	**617.3**
Administration, etc.	88										86.0		
Total Power Smart											**331.4**	**2.94**	**2399.0**

- Financial data is from a variety of sources, with most $ data in current dollars (except individual industrial programs), but cents/kW.h (Total Resource Cost) are in constant 1995$s. Overheads vary in application.
- Administration etc. = Planning, Evaluation, Information, Education, misc Legislation work, Admin. and Overheads.
- "x" in a barrier column indicates that the program attacked that barrier
- All dollars on this page are in Canadian currency which had an average exchange rate of 1.3:1 against the US$.

Table 3 The Current Technology Tree



Branch Definitions:

A Specific Customers where the utility has made a financial or time investment: can be measured by incentive forms, or induced savings reporting approaches.

B Customers who acquired the technology but who received no direct utility influence: can be measured by broad based market surveys.

C Customers who would have bought the technology without an incentive in a relevant timespan, given program duration and savings life, but who received a utility incentive: can be measured by market survey, and if possible it is best to determine from adoption rate information. Equal to or less than the adoption rate (natural conservation).

D Customers who were influenced by the program, and received a utility incentive: measured from program records.

E Customers who would have acquired the technology without the program, and who did not receive an incentive: can be measured by broad based surveys.

F Customers who acquired the technology without an incentive, but as a result of program influence, via legislation or program spillover effects: can be measured through broad based market surveys.

G Direct influence savings gained through marketing representative or contractor specific education.

H Customers who did not upgrade their technology (the sum of all customers in the applicable class minus those who acquired the technology of concern): can be determined with market surveys.

Some Useful Equations:

C + E = Natural Conservation or the forecasted technology adoption level in lieu of a program.

D + G + F = Total Program Savings

C + D = Total rebate/incentive activity.

D + G = Direct influence in the broader sense.

drivers (spillover) was replaced with more specific terminology, legislation and spillover, both of which may lead to market transformation.

The attribution perspective was designed to clarify the point that the utility should focus on savings which have been directly influenced, whether they were financially leveraged through incentives, or were a result of other ongoing utility investments[1] in the DSM area. The term spillover (or free drivers) should only refer to the area of non-incented savings which is categorised as indirect influence (see Figure 2). The program evaluation would then look at two clusters of savings documents, the rebate/incentive records, and the induced savings forms completed by their sales representatives, or energy advisors covering the non-incented savings. The savings which could not be documented on a customer specific basis were still to be referred to as spillover, and would require market transformation approaches to assess. And in reality, if the direct influence savings could not be documented they would still show up eventually as spillover through market studies, but would likely carry an inherent higher level of uncertainty.

Measurement of market transformation programs has proved to be complex. BC Hydro did a good job of planning its initial programs, but for the later programs the approach improved significantly, with planning and evaluation becoming even more aligned. "To justify the launch of DSM programs and to evaluate their impact, estimates must be made of the expected penetration of the technology in question, by year, into the marketplace. Prior to the launch of a program the plans would detail what the expected natural adoption rate would be for the technology if there was no program. That natural adoption rate becomes free riders and on-going adopters when the program operates. The utility needs to understand how the program has changed its customers' energy requirements in comparison to the base load forecast in order to cleanly add DSM into the integrated resource plan, as well as to conduct proper cost effectiveness assessments." (Nelson 1994b, pp. 143)

Conclusion

Much of the analysis in the area of market transformation focuses on product life cycles and how the utility is attempting to shift the adoption (or diffusion) curve forward, and move the final adoption rate to a higher level. Product life cycles also include the concepts of maturity and decline. As one looks back on ten years of Power Smart at BC Hydro the same paradigm can be used. The early need for energy conservation in this region was fueled by the expected high costs of construction and the associated environmental impacts of additional generation. With high "future avoided costs" most programs were found to be cost effective, and the "ready, fire aim" approach to product launches was used extensively.

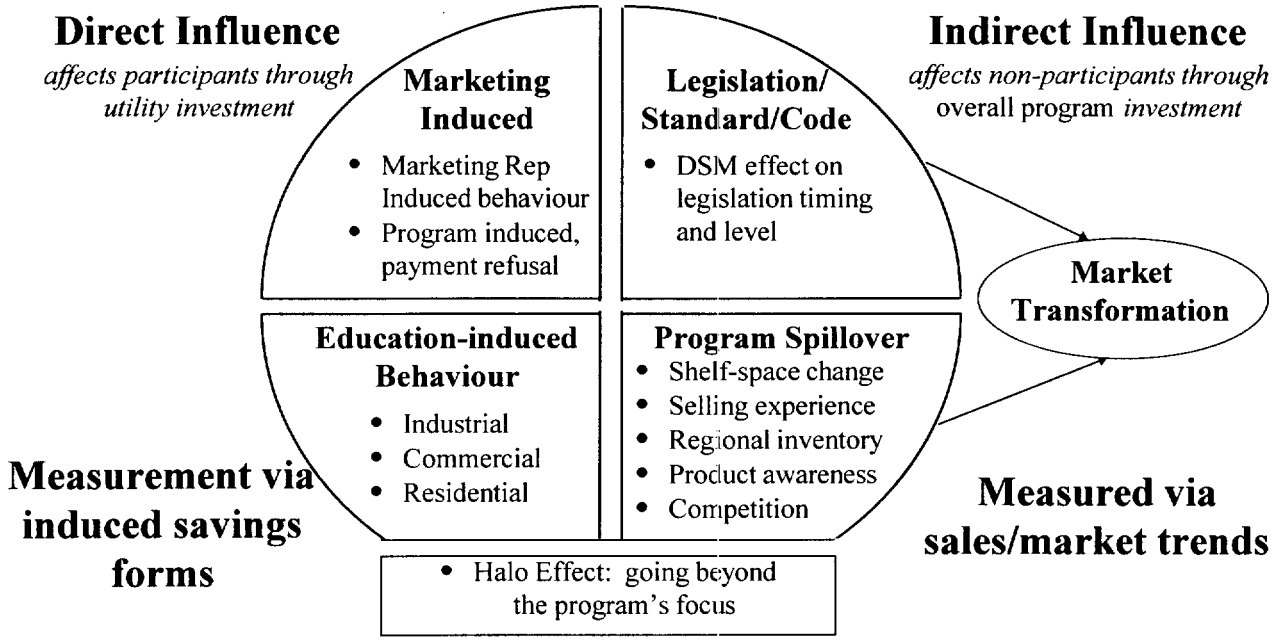
Over time the achievements of many of the programs were close to the original predictions, and several programs came to natural ends when legislation was enacted or markets were sufficiently changed. Other programs failed to make a significant impact early in their lives and were closed quickly. With the changing of the future avoided costs[2] from those based on the traditional IRP planning approach

[1] Utilities often have energy advisors or marketing reps working with the customers on how to use the product more efficiently, and these efforts often lead to significant energy savings.

[2] Programs were justifiable financially if they "produced" energy at a lower total resource cost that other, more traditional potential sources of energy and capacity.

(akin to pretending one lived on an island and all generation had to be built by the utility) to costs based on the expected price of natural gas to a modern generator 1000 miles away in another country, the goalposts were moved - by the cost of gas, the technology shifts in generation, and the wiring of the continent. Suddenly newly designed programs which were cost effective in one planning paradigm, were no longer going to be cost effective, causing the next generation of programs to be short-lived. A government owner which strongly supported the DSM initiatives became concerned over giving large financial incentives to commercial and industrial customers, leading to significant changes to the structure and contents of programs and often total re-design. The long term strategy of having a broad mix of programs along the continuum, with resource acquisition savings supporting market transformation efforts, and market transformation creating the brand awareness needed for resource acquisition to be effective, was no longer viable.

Figure 2 Non-Incented Program Effects; and Their Relationship to Market Transformation



Power Smart with its broad mix of programs has changed the ethic for energy use in the province, and with 90% aided recognition, is still a highly recognized brand name. BC Hydro has run a strong strategic conservation program for most of the decade. Despite the loss of some tools (incentives), the raising of the goalposts for cost effectiveness, and the changes inherent in moving from a somewhat reactive to a sales focused organization, Power Smart is still strong, and is taking a new approach. It is focusing on education and information and the delivery of energy-efficiency services that customers want and are prepared to pay for. The term "energy management" sums up the tack now taken by this utility and is one aimed at building loyalty and growing the business.

Endnotes

Thanks to Dr. Kenneth Keating and Dr. Ben Bronfman for their efforts in the early 1990s in training and coaching BC Hydro staff in traditional evaluation techniques. Thanks also to Kirsten Cameron for

her assistance in assembling the technology tree, and initiating much of the research work on free riders in BC Hydro.

Derek Henriques started with BC Hydro in 1977 as an engineer working in the industrial area, and served in a variety of design, program management, and technology management positions, including serving as Acting VP Power Smart, and as VP Technology for Power Smart Inc.. Derek is now Manager of Power Smart and Delivery where he is responsible for delivery of existing and new energy efficiency program and other BC Hydro customer services. Dennis Nelson started with BC Hydro in 1991 as the first employee in the evaluation area, and has served in a variety of managerial positions including Acting President of Power Smart Inc. He is now Manager of Market Analysis and Information, developing the marketing information systems for the company. Ken Tiedemann started with BC Hydro in 1992 in the evaluation area and has managed that function for a number of years and published energy related research findings extensively. Ken is now Manager of Market Research and Forecast, and still holds responsibility for the evaluation function.

Power Smart Inc. operated from 1990 to 1997. In the end the fact that it was owned by six Canadian utilities, and serviced the changing agendas of over 20 member utilities in North America as well as international members, meant that the political pressures of the impending competitive market were immense. The company was dissolved by its shareholders in 1997, and the national standards and successful labeling program were returned to BC Hydro..

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