COLLABORATIVE DESIGN OF THE DSM POWER PLANT

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The two year New England experiment in electric utility/intervenor program planning known as the Collaborative has evolved several new approaches to negotiating, designing and delivering programs. Attention in this paper will focus on key elements: the comprehensive treatment and scale of program design; the 100% utility payment for most measures; the commitment to monitoring and evaluation; and the effort to remove internal and external customer barriers to optimal delivery.

The programs which were designed depend upon sophisticated understanding of the efficiency marketplace; the installation of quality materials; internal placement of program delivery in resource allocation departments; and an intervention strategy which distinguishes between market shift and market transformation for particular products.

Concern for maintaining the efficiency gains initially secured prompts an emphasis not only on monitoring, but also on maintenance staff training, effective database management, and resident education and incentives (for multi-family buildings).

INTRODUCTION

The past three years has seen a dramatic change in the electric utility environment in New England as a result of a new rapprochement between utility, consumer and environmental interests through a negotiated settlement of long standing differences. This process has become known as the collaborative design process or simply the Collaborative. The Collaborative broke down barriers and opened new opportunities to secure well designed DSM programs. Despite many shortcomings, the process has demonstrated the need to go beyond regulating conservation in the hearing room.

My role in the collaborative process took three forms. First, as a founder and officer in the New England Energy Policy Council I helped to formulate the *Power To Spare* strategy. Second, I was as an expert witness to the Maine, Vermont, Connecticut and Massachusetts commissions to help present the program design assumptions which formed a basis for *Power To Spare*. Third I was the residential team lead consultant to negotiate the detailed program designs for the residential sector.

This paper will focus on several aspects of the New England Collaborative Design process. First is the organizational steps which led to the Collaborative. Second is the planning design principles. Third is the program design principles which developed from the residential negotiations and finally a description of the residential programs which emerged from the Collaborative. The commercial and industrial programs were built on the same planning principles and incorporate many of the program design principles as the residential programs. My greater familiarity with the residential program and space limitations of this paper restrict the focus to the residential sector.

THE COLLABORATIVE DESIGN PROCESS

The first critical step necessary to create the Collaborative was the establishment of a policy consensus and an a detailed position by the many advocates of conservation. These included a broad array of organizations and interests from across the region. Included were environmental groups such as Conservation Law Foundation (CLF), Massachusetts Audubon Society, Maine Natural Resources Council; consumer advocates such as Mass PIRG, Mass Citizen Action, New England Community Action Directors Association; Connecticut Division of the Consumer Council; and energy conservation groups such as Fair Share Development Corp.; Center for Ecological Technology and many others. In all 26 groups were brought together under the name of the New England Energy Policy Council (NEEPC) to hammer out their various perspectives on energy conservation as a power supply strategy for electric utilities.

The organizations agreed to pool resources and search for foundation support to create a document which would represent a detailed policy paper on the potential for energy efficiency to serve as a power supply source for electric utilities in New England. Joe Chaisson was hired by the Council to coordinate the technical analysis supervised by a technical committee while the drafting of the text was headed by a policy committee headed by Armond Cohen of CLF. Six months of hard work, debates, arguments and resolution of differences resulted in the publication of *Power To Spare* in June 1986. This document represented the most comprehensive consensus building process in support of energy conservation in New England. *Power To Spare* demonstrated that the advocates were willing to invest the time and money necessary to establish specific and detailed proposals which could elicit a response from utilities and regulators.

The next step was to bring the *Power To Spare* message into the regulatory arena in each of the New England States. This began in Connecticut through a case in November 1986 where the Division of the Consumer Council (DCC) was an intervenor. Conservation Law Foundation played a leadership role in coordinating the regulatory and legal strategy throughout New England. This strategy carried out by CLF Attorney Armond Cohen combined with CLF Executive Director Doug Foy's policy initiatives led to significantly increased understanding and support for energy efficiency as a power supply source by the regulatory commissions. The ruling by the Connecticut Public Utility Commission (PUC) in February 1987 clearly endorsed the *Power To Spare* analysis and ordered Connecticut Light and Power, a subsidiary of Northeast Utilities (NU), to revise its plans based on the *Power To Spare* concepts.

This could have been the end of the policy process except for one critical decision. Doug Foy and DCC's Jim Meehan proposed to NU Chief Executive Officer Bill Ellis that instead of continuing the battle in the hearing room, that the parties work together to craft programs which met the objectives of both utility and intervenor. This proposal and the enthusiastic acceptance by Bill Ellis paved the way for the negotiation phase of the Collaborative. It is important to note that these and all subsequent negotiations between utilities and intervenors began in the context of a rate case or regulatory hearing with the results entered into the dockets as settlements. Without the context of the commission as the ultimate referee and judge, the parties on both sides would have had much less pressure to achieve an agreement. This pressure to avoid defeat in reaching an agreement was necessary to overcome the institutional obstacles to change in all participating groups.

The detailed negotiation phase began after the CL & P case in February 1987 and has continued unabated over the last three years with utilities in Massachusetts, Connecticut and Vermont. The negotiations are made possible through the willingness of utilities to fund a team of consultants to represent the participating NEEPC members and managed by CLF. The major exception to the design of the negotiating structure was New England Electric System (NEES) which did not participate in the joint utility project in Massachusetts but rather negotiated with CLF individually. The reason for this truncated negotiation process was the desire by NEES to "fast track" their DSM programs which were already well advanced. In the final outcome, the program designs were similar since the consultant teams in most cases were made up of the same individuals.

The role of the non-utility party consultant teams in representing the perspective of the *Power To Spare* analysis and approach and managed by CLF were an important feature of the collaborative process.

Without funding, the non-utility parties would have been unable to establish the level of detail in the negotiation process required to achieve program designs which received consensus support. The consultant team leaders like myself were charged with the task of establishing rapport and trust with utility staff counterparts in spite of maintaining the role of representing historical adversaries.

Many existing utility programs have been criticized as inadequate by intervenors for years and it was difficult to avoid defensiveness and mistrust at the start of the process. The key objective of the teams were to design programs and evaluation procedures which could be supported by both utility staff and intervenor groups. Teams were established for each customer segment, residential, commercial and industrial as well as for design of evaluation procedures. Later, the addition of a resource allocation team to develop cost effectiveness procedures and resource allocation levels addressed perhaps the most difficult area of negotiations.

Negotiations were carried out with CL & P over a four month time frame in an initial phase and continued over the next eight months in a second phase. In Massachusetts, the negotiations stemmed from a generic rule making process at the Department of Public Utilities. The result was a unique negotiating process between six utilities (Commonwealth Electric, Boston Edison, Western Mass Electric Company, Eastern Utilities, Nantucket Electric and Fitchburg Electric) jointly with the intervenor groups coordinated by CLF who become referred to as the non-utility parties (Massachusetts Energy Office, Mass PIRG, Department of the Attorney General and CLF). In Connecticut and Vermont, rate cases were followed by negotiations with Central Vermont Public Service and United Illuminating.

In Massachusetts, the initial Phase I negotiations between the joint committee of utilities and non-utility parties were designed to create program templates with an analysis of technical potential for efficiency investments through these programs. This Phase I process, completed in December 1988, was followed up with Phase II negotiations between the non-utility parties and each utility except Fitchburg Gas and Electric. These individual negotiations were designed to adapt the plans created in Phase I to each utility service territory. These negotiations were paralleled by the individual negotiations with NEES (on behalf of its retail companies Mass. Electric, Naragansett Electric and Granite State Electric) and CLF.

The program designs for a comprehensive Demand Side Management initiative by each Collaborative utility began to emerge initially in Connecticut (1987) and then comprehensively in Massachusetts and Rhode Island in late 1988 and throughout 1989. The last filings were in early 1990. The conclusion of the planning phase of the Collaborative was a massive amount of time, effort and resources put into a unique decision making process. The results were dramatic and in many ways changed the content of the energy debate in New England.

The Collaborative process itself is continuing into the oversight of program implementation in a Phase III stage. The utilities are already in the field with the programs which were modified from some of their existing programs and just at the early start-up stage of programs which were newly created by the Collaborative.

THE PLANNING PRINCIPLES

The Collaborative design process used several key principles which were established in *Power To Spare* and refined in the regulatory cases as the underlying concepts in the development of programs. These principles will be reviewed to lead into a description of how the principles were applied in program design.

Lost Opportunities

First is the concept of avoiding lost opportunities in the delivery of conservation programs. Lost opportunities are defined as cost effective efficiency measures which are not identified or secured due to the inadequate scope or quality of program delivery or the failure to provide program assistance during key customer decision making points. These measures are often lost indefinitely due to the high transaction costs or retrofit costs of a follow-up visit. The lost opportunities created by cream skimming or superficial programs are therefore included as societal costs which can be calculated and avoided. The pioneering work to define lost opportunities was carried out at the Northwest Power Planning Council (NPPC) and incorporated into the *Power To Spare* presentation by Tom Foley of the NPPC[1].

The most critical lost opportunities are those which occur in new construction. If a decision is made to install inefficient equipment or features at the time a building is constructed then it is often prohibitively expensive to change or upgrade the building through a retrofit. The collaborative process established as a priority the creation of comprehensive new construction programs to insure that all new buildings are efficient. The commercial and residential new construction programs are either in the street or beginning in the next several months.

Calculation of Full Avoided Cost

In order to establish the value of efficiency investments, the full economic benefits to ratepayers had to be quantified. Without the implementation of this basic principle there is very little ground for negotiation. If the regulatory body itself has not gone beyond the principle of conservation as a buzzword then there can be little progress in either the regulation or negotiation. A precondition to the successful negotiation of conservation programs is the clear definition of the cost-benefit analysis for utility investments.

The accounting for all avoided costs which result from DSM investments, including those which are difficult to quantify, is an important planning principle which continues to be the focus of much debate. The Collaborative achieved sufficient consensus to negotiate effective programs but continues to refine the accounting for more difficult to quantify avoided costs. The avoided costs which are the basis of the Collaborative cost benefit analysis include avoided energy, avoided capacity and avoided transmission and distribution costs all calculated on a time differentiated basis.

1 *For additional documentation see the "Northwest Conservation and Electric Power Plan" (1986), Northwest Power Planning Council.*

The externality benefits of avoided new capacity such as reduced environmental damage and improved economic health are accepted, but are elusive and difficult to quantify. These are only recently beginning to achieve resolution through the regulatory process.

Direct Investment

The third and perhaps most important planning principle which was incorporated into the Collaborative was the agreement that utility investment strategies needed to provide direct funding for efficiency investments up to their full avoided cost value. This principle established the boundaries for efficiency investments which placed DSM on the same footing as power plant investments. In the design of programs the operating investment strategy was to invest up to the full cost of the measure for retrofit programs or up to the full incremental cost of the measure for new construction or point of sale programs.

PROGRAM DESIGN PRINCIPLES

The planning principles established the parameters for investment in efficiency measures and the need to avoid lost opportunities. The negotiating teams of consultants and utility staff applied the planning principles and the experience from utility programs across the country to create new DSM programs or modify existing utility programs. The initial negotiations developed programs somewhat deductively in an attempt to respond to specific target markets or technologies. As negotiations continued, the process developed a set of program design principles which helped frame the design of programs across utilities. The residential design team in conjunction with its utility counterparts, included these program design principles in many of the utility filings.

The three most significant design principles are described here to provide a framework to understand how the collaborative process designed a comprehensive package of interrelated programs to achieve the DSM objectives established in *Power To Spare*.

Understanding the Marketplace

Market analysis has led to the incorporation of concepts such as *market transformation and market shift.* A MARKET TRANSFORMATION strategy should be utilized when products or methods of doing work are not widely available or understood. For example, compact fluorescent light bulbs are virtually impossible for residential customers to find at conventional lighting retail stores. Instrumented Air Sealing is a weatherization technique understood by only a few insulation contractors. Market transformation strategies such as contractor recruitment and training or additional infrastructure subsidies should create an entirely new decision making environment for the delivery network as well as the consumer before market intervention strategies can have a significant impact. Transformation programs are usually required for immature technologies which have low customer awareness.

A MARKET SHIFT investment strategy attempts to change the choices made by consumers from inefficient to efficient products already available on the market. There are two types of market shift intervention. One is a *Market Push* approach where customers are influenced with information or incentives to purchase high efficiency products already available at the retail level. The other intervention is a *Market Pull* approach where retailers are influenced through program intervention to order and stock high efficiency products from the available models/products at the wholesale level.

Both market transformation and market shift strategies are designed to remove barriers which prevent optimal long-term societal efficiency from being achieved.

Another critical program design issue is where the attempt is made to impact the marketplace. Intervention can occur at the *point of use* which in a residential program is the customer's home. It can also occur at a *point of sale* or distribution such as the retail store a customer purchases light bulbs or appliances. These are the most common points of intervention although two others which are considered include the *point of installation* for products where the trades make many of the key decisions and less often considered is the *point of product research and development* at the manufacturing level.

These concepts require a more sophisticated analysis of long-term net market impact to determine the cost effectiveness of DSM programs. Free riders is the term for customers who receive benefits for measures which would have been carried out in the absence of the program. The evaluation and deduction of free riders is often made in an attempt to calculate the impact of a DSM program for cost effectiveness because it represents a double payment (one the customer's added costs and second the utility's) for the same efficiency improvement.

A better description of free riders is market duplication based on a knowledge of baseline market conditions. The matching term which has never received its appropriate recognition is *free drivers*. This term refers to customers who carry out efficiency investments as an indirect result of a utility program operation but who do not receive financial incentives and are not counted as program participants. In many well designed programs, free drivers overwhelm free riders to create the true picture of a market transformation process.

There are several examples of Free Drivers which can be cited. First is the Boston Edison 'Lite Lights' program. This program has provided aggressive lighting rebates and dealer support which has resulted in rebates on almost 80,000 bulbs. The sales of bulbs in the Boston Edison Territory, however, has been much greater than that as dealers are now stocking more products and sales by the retail lighting store operated by FSDC has documented 30-40% more sales than rebates processed for incentives. In other parts of the state, almost no market for efficient lights exists. Calculation of savings from these unsubsidized market purchases should be accounted as program benefits since they would not have been secured without the utility program. This requires a program evaluation process (control group techniques outside the utility territory provide the best method) which recognizes net market impact as the ultimate test of comprehensive strategies and not simply the count of program participants.

Maintenance and Operations Strategies

Another significant issue that the Collaborative addressed is the recognition that efficiency power plants must be maintained to achieve long-term reliable savings. The need to perform ongoing performance audits, secure maintenance contracts, provide education for maintenance staff and customers and monitor performance is now a feature of most programs.

There is a general recognition that persistence of savings is as important as short term impact. The method of implementation, assignment of costs and responsibilities and role of utility staff and contractors has not yet been placed into operation. The belief that the role of the utility DSM program is complete when a measure is installed has not been fully overcome.

The Customer as Partner: Understanding and Overcoming Market Barriers

In order to achieve the objective of securing the maximum amount of cost effective DSM without lost opportunities, the Collaborative needed to develop a comprehensive analysis of the efficiency marketplace. The traditional technical potential analysis which has been the hallmark of much DSM planning with perhaps the best example being the LBL study of Michigan[2] as well as work done by SRC for Northeast Utilities[3] and others, needed to be expanded.

One such change was to look not only at specific technologies or products but rather at bundles of potential technologies which might exist in target market segments. This involves a customer centered analysis which starts with an understanding of the customers in specific market segments and market barriers associated with these customer segments. Technology investments can only be made if the customer is willing to participate in the program.

Some of the market segments identified as requiring program design to respond to technology opportunities or market barriers include the following:

Multi-Family. Multi-family housing requires unique targeting for both technical and market reasons. First, the packages of technical opportunities have unique characteristics which have been well documented in ACEEE papers for years. Second, the most difficult barrier to comprehensive and reliable resource acquisition from this market is the need to secure participation from both the owner and occupant. In most cases the benefits are split between these parties which reduces the self interest to invest in and maintain DSM measures by either owner or occupant. The marketing and participation barriers became the over-riding need to unify multi-family programs into one program design.

Single Family Electric Heat. This market is isolated because of the need to conduct a comprehensive technical assessment of a broad range of efficiency measures. The technical assessment must be simple enough to avoid the administrative costs of serving a widely distributed market.

Public Housing. The unique financial and administrative requirements of public housing necessitate the specialized delivery of services. The rules and regulations which govern the procurement and decision making process as well as the capturing of savings, require a special programmatic focus.

General Use Customers. The modest levels of electric saving opportunities require the delivery of services to the home through low cost door to door "blitz" or Energy Fitness strategies. These were developed to reduce transaction costs in the investment in lighting and hot water heating measures.

Hot Water Heating. Service territories with significant concentrations of electric hot water heating without electric heat can benefit from targeted service delivery to this group.

Appliance Efficiency. There is a dual challenge to program design of first, small short-term savings opportunities resulting from the combined effects of appliance efficiency standards and CFC reductions and second, the low turnover of appliances in the home. This led to the decision to adapt the point of sale program designed by Bonneville Power Administration to New England.

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2 *"Analysis of Michigan's Demand-Side Electricity Resources in the Residential Sector" Florentin Krause, Lawrence Berkeley Laboratory (1987).*

3 *See NU Energy Alliance documents filed as part of Docket No. 87-07-01: Application of Connecticut Light and Power Company in 1987.*

Lighting. The challenge in the lighting market is to achieve a market transformation from inefficient to efficient given the level of entrenched infrastructure for product distribution. The result was a two part strategy to complement the point of use programs. This included a catalogue distribution to circumvent the market in the short-term and rebates to stimulate traditional market participation over the long-term.

New Construction. The market challenge in New England to an efficient new construction program is the goal of achieving efficiency improvements in all homes regardless of fuel since electric heat is a minority of new homes. This led to the development of a fuel neutral program which invested in electric efficiency in homes which meet the standard regardless of fuel source.

THE COLLABORATIVE DSM PROGRAMS: THE RESIDENTIAL SECTOR

With the help of the planning and program design framework outlined in this paper, the Collaborative Design Process developed a residential efficiency plan for utilities in New England. The eight program designs are summarized here as follows:

Program 1 Electric Space Heat Retrofit

Target Market:	Electric Space Heating Customers
Investment Levels:	$1,000 per Household Average
Technical Measures:	Instrumented Air Sealing Lighting Retrofit Attic Insulation Upgrade to R-38 Basement Insulation Hot Water Measures Setback Thermostats Window Treatments Energy Management Training
Delivery Mechanism:	Technical Assessment Hot Water/Lighting Measures Contractor Follow-up Quality Control Inspection Monitoring and Evaluation
Savings:	1,900-2,200 kWh/yr 1.5 kW

Program 2 Hot Water Efficiency

Target Market:	Hot Water Heating Customers No Electric Heat
Investment Levels:	$80-$100 per Household
Technical Measures:	Tank Wraps/Pipe Insulation Low Flow Showerheads Faucet Aerators 3 Efficient Light Bulbs Installed Energy Management Training
Delivery Mechanism:	Telemarketing Customer Lists Direct Installation
Savings:	400-700 kWh per year

Program 3 Energy Fitness

Target Market:	General Service Customers Urban Neighborhoods
Investment Levels:	$100-$120 per Household
Technical Measures:	Efficient Lighting Installation of 4-7 Bulbs Hot Water Measures (Electric) Energy Management Training
Delivery Mechanism:	Neighborhood "Blitz" Canvassing Door to Door Installations
Savings:	350-450 kWh per Household/yr

Program 4 Multi-Family Efficiency

Target Market:	Multi-Family Buildings 5+ Units

Investment Levels:	$600 for Electric Heat Units
	$100 for Non-Heating Units
Technical Measures:	Electric Heat Measures
	Attic Insulation
	Window Repair/Replacement
	Air Sealing
	Thermostat Setbacks
	Ventilation Systems
	Lighting/Hot Water Measures
	Hall Lighting Retrofit
	Exit Sign Changeouts
	Security Lighting
	Interior Lighting Retrofit
	Hot Water Measures
Delivery Mechanism:	Technical Assessment
	Direct Installation
	Contractor Follow-up
	Quality Control Inspections
	Fixture Rebate
	Monitoring and Evaluation
Savings:	1400-1800 kWh per Unit/yr (Electric Heat)
	250-300 kWh per Unit/yr (General Service)

Program 5 Public Housing Efficiency

Target Market:	Public Housing Units
Investment Levels:	$600 Electric Heat Units
	$100 Lighting/Hot Water
Technical Measures:	Same as Multi-Family
Delivery Mechanism:	Marketing to PHA
	Financial Packaging Assistance
	Procurement Packaging
	Maintenance Staff Training
	Evaluation and Monitoring
Savings:	1,500 kWh/Unit/yr (Electric Heat)
	350 kWh/Unit/yr (Lighting/Water)

Program 6 Lighting Efficiency

Target Market:	All Customers
Investment Levels:	$5-$10 Rebates for Bulbs
	$30 Fixture Rebate
	Free Bulbs Installed
Technical Measures:	Compact Fluorescent Bulbs
	Component Fluorescent
	Fluorescent/HID and Halogen Fixtures
Delivery Mechanism:	Free Installations (Audits,WAP etc.)
	Catalogue Sales
	Market Rebates
Savings:	30%-75% per Bulb
	150-250 kWh/yr per Participant

Program 7 Appliance Labeling

Target Market:	Customers Purchasing Appliances
Investment Levels:	Education and Marketing
Technical Measures:	Identification of Top 15% of Models in Efficiency
	Refrigerators
	Freezers
	Room Air Conditioners
Delivery Mechanism:	Appliance Dealers
	Model Labeling
	Customer Education
Savings:	100 kWh/yr (Refrigerators and Freezers)
	40 kWh/yr Room A/C

Program 8 New Construction

Target Market:	New Single and Multi-Family Housing
Investment Levels:	$500-$2000 per New Unit
Technical Measures:	Increased Insulation
	Air Tightness
	Passive Solar
	Mechanical Ventilation
	Efficient Windows
	Efficient Lighting
	Improved Equipment and Installation
Delivery Mechanism:	Builder Training
	New Home Plans Review
	Home Certification/Testing
	Incentives
	Marketing

Savings: 5,000-6,000 kWh/yr per Unit (Single)
1,500-2,500 kWh/yr per Unit (Multi)

CONCLUSION

The collaborative design process which has occurred over the past three years represents one of the most ambitious attempts to secure a comprehensive shift in energy policy through voluntary negotiations. The result was some dramatic benefits and a few disadvantages.

On the benefits side of the ledger, the collaborative put both institutional commitment and a public policy consensus behind the use of Demand Side Management to secure electric power resources. The programs which resulted were both comprehensive and broad based. The level of investment made by New England Electric Utilities will increase from under 100 million dollars per year in 1987 to over 300 million dollars per year in 1990 and more in later years.

The only significant disadvantage has been the time required to negotiate the agreements and secure the consensus from such a broad range of interests. The process has required a much greater level of detail in program planning and regulatory filings than has been previously carried out. The overall results to date, however, more than outweigh the disadvantages in the eyes of most participants and observers of electric utility policy in New England.