Collaborative Intervention: Change from the Inside Out

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ABSTRACT

Conventional energy efficiency policy strategies have generally focused on directed actions (e.g., regulations) or persuasive actions (e.g., tax incentives) and often promote the adoption of a particular efficient technology or product (e.g., compact fluorescent lamps; refrigerators; windows). Yet many of the efficiency opportunities now being identified involve the effective application of existing technologies or are related to the design and operation of an entire system.

The authors discuss a model of collaborative intervention based upon a successful project for industrial compressed air systems. The model seeks to effect *institutional and behavioral change*, rather than *technological change*, and involves government and public-interest facilitators bringing key market stakeholders together to develop a common vision for change. Project costs are shared among all stakeholders, as are the project benefits. Stakeholders share decision-making control, thus motivating them to participate actively and contribute beyond their financial support. This approach contrasts with conventional energy efficiency models in which the government or utilities wholly fund and control a project. This approach has a built-in exit strategy, since the project is designed so that the sponsors are encouraged to use the jointly developed products resulting from the collaboration. The commercial HVAC market is used as an example to illustrate the potential for applying this model to the commercial and institutional sectors.

Introduction

Governments use an array of intervention techniques to shape energy efficiency policy in the United States, including both directed actions, such as regulations, and persuasive actions, such as tax incentives. While regulations are a powerful tool for effecting change, they can be difficult and costly to implement, and can result in unintended consequences as markets attempt to respond.

This paper presents a different notion of a persuasive market intervention, one that relies primarily on establishing an environment that encourages the participants in an existing market structure to interact in new ways. We examine how one such intervention is being used to promote energy efficiency in industrial settings, and consider applications to the building sector.

We contend that providing a forum for these interactions will create new business opportunities that will result in a permanent transformation of a market. This type of intervention effects an *institutional and behavioral change*, rather than a *technological change*, more typical of energy efficiency market interventions. It is assumed that the structural shifts resulting from institutional or behavioral change will create an environment for further technological innovation. For lack of a better term, we call this approach *collaborative intervention*.

Collaborative intervention places government in the role of a broker or facilitator, responsible for setting out general goals. Market participants are invited to be champions of these goals. In exchange, government acting as the broker can recognize them for the risks they assume, and help them identify paths for reaching these goals. This approach seeks to exploit the different, and potentially complementary, roles

and competencies of the public, private, and not-for-profit sectors. We have identified four key elements of this strategy:

- broadly defining the goals with no predetermined way of achieving them,
- creating an atmosphere of mutual respect,
- acknowledgment and acceptance that the participants will act in ways that are consistent with their economic and political self-interest, and
- establishing a high tolerance for the ambiguity and tension involved in forming coalitions across typical market structures.

To illustrate this approach, we will present a case study of a collaborative intervention by the federal government, the "Compressed Air Challenge: Resources for System Optimization" (Challenge) that is seeking to transform the customer and supplier relationships for industrial compressed air systems. The Challenge uses a business model to solicit interest and funds for its implementation.

This industry is suited for a collaborative intervention because of characteristics including: market structures, customer interactions, system improvement opportunities, and barriers to achieving those opportunities. Whether this market is capable of transforming itself without intervention will be addressed.

We contend that this model is applicable to other sectors, particularly commercial buildings. Elements of the market-based model developed for industrial compressed air systems will be identified and their transferability to building heating, ventilation and air-conditioning (HVAC) systems operation in commercial buildings will be discussed.

Building HVAC systems are designed to maintain the interior conditions of buildings at acceptable levels of temperature, humidity and air quality. These integrated systems typically consist of chillers, boilers, distribution systems, and controls. These subsystems must all function in harmony if the overall system is to meet its intended purpose. Additionally, the phase-out of CFC refrigerants has created new operational issues for many existing buildings.

Industrial compressed air and commercial HVAC systems share the following common characteristics:

- they have potentially different equipment configurations,
- the output from the system (e.g., compressed air or conditioned air) is defined independently of the system configuration,
- operation is a significant component of the overall system efficiency,
- a variety of groups provide different products and services to the market, and
- these systems are amenable to integrated services and/or operation by a third party.

These market characteristics in large part make these systems attractive candidates for this approach to market transformation. Other markets with similar characteristics may also be candidates for collaborative intervention.

Transforming Markets from the Inside

A key element of a successful collaborative intervention strategy is acknowledgment and acceptance that the participants will act consistently with their economic and political self-interests. The Challenge provides specific examples of how voluntary participation can be gained by recognizing and engaging private interests to transform a market for the common good.

The Challenge has effected major changes by: 1) carefully selecting a target market in which the government can have a reasonable chance of effecting change, 2) using a business approach in soliciting voluntary participation, and 3) acting as a *catalyst* working with market forces rather than as a regulator trying to control them.

Market transformation for the purposes of this paper, is defined as a permanent change in the way that products or services are purchased or sold.

Why Work Within Market Structures?

The argument that the most effective way for the federal government to voluntarily affect a market is to work within existing market structures is based on a number of assumptions including:

- No one entity has perfect information about a market or cluster of market structures. Market players constantly seek better information to gain a competitive edge. Obtaining information has a cost, which may or may not be correlated to the quality of the information.
- Companies active on the supply side of a market remain in business by making rational decisions in response to market pressures and customer needs.
- Companies active on the demand side of a market seek best value, as defined in context of the buyer's priorities, which may not be immediately obvious.
- Government is typically viewed as an impartial source of consumer information. Voluntary association with the federal government is generally viewed favorably. The potential for brand enhancement and increased market access are important additional considerations.
- Every market has independent experts who are sources of technical knowledge and market information.
- Mature market structures are complex and evolve over time. Government can represent the public interest by acting as a catalyst within existing market structures, shaping the direction and pace of market changes .

The supply side of the market must be effectively engaged. This does not mean that all suppliers will approve of a collaborative intervention. Suppliers that participate will contribute the suppliers' point of view, and help ensure the success of the intervention by becoming "early-adopters." The durability of existing relationships between the supply and demand side, and the potential for enlisting progressive suppliers as champions needs to be recognized. Suppliers (manufacturers, distributors), have important technical and market knowledge and the ability to support (or resist) change in their interactions with customers.

Essential to the success of these voluntary efforts is flexibility and the ability to align the market interests of the various stakeholders to a sufficient degree that a common arena for action can be identified. The challenge is to translate the public goals into private interests so that a market can be transformed through the actions of the market stakeholders.

Identifying a Market

The federal government selected the compressed air industry for a collaborative intervention because of a combination of *opportunity* and *possibility*. The *opportunity* is in the energy savings, coupled with improvements in control and reliability of production. A 20-50% improvement potential exists in many industrial compressed air systems using existing technology.

The *possibility* comes from the current structure of the compressed air systems market and external pressures for change. The sheer size and complexity of existing market structures make a collaborative approach to transforming a market difficult. Although the industrial compressed air systems market is complex, the supply side of the market is highly specialized and relatively compact. Representatives from

all major equipment manufacturers can be seated around an average conference table. A handful of associations represent six hundred of the most influential distributors, and there are less than a dozen prominent compressed air system consultants. The small number of players allows for efficient negotiation, consensus-building, and the rapid exchange of information.

The supply side of the compressed air system market is under pressure both internally from low margins of profitability and the drive for greater economy of production, and externally from globalization of the industry, utilities' entering into providing industrial compressed air services, the displacement of air tools by improved electric tools, and customer dissatisfaction with existing services and equipment performance.

Energy Savings and Environmental Opportunity

Optimization of compressed air systems represents one of the largest non-process industrial energy efficiency opportunities. Manufacturing compressed air systems cost $1.5 billion per year for energy and account for 7 MMTCE in carbon emissions. The Challenge seeks to save $150 million in annual energy costs by the year 2010 . A compressor typically consumes more energy annually than its initial cost of purchase. Although the cost of operation is high, it is a small fraction of the overall cost of production and receives little attention, as long as the air supply is adequate. Compressed air systems are not well understood by the majority of plant operations staff so modifying a system, no matter how poorly it is operating, is perceived as a risk to production (DOE 1998a).

The Industrial Compressed Air System Market

In a paper, Wayne Perry of Quincy Compressor described the existing relationship between equipment buyers and sellers as a mature market –

> *"No truly new compressor technology has been introduced in the past thirty years and there is none on the horizon. Competitive pressures have pushed manufacturers to increase per-employee productivity and implement strict inventory and purchasing procedures to maintain profitability.... it is likely that the number of companies that manufacture industrial compressors will continue to decline. The companies that survive and grow will be the ones that offer solutions instead of just equipment" (Perry 1997).*

This is a market in which equipment distributors are the primary source of information for small to medium size companies. Distributors operate in an intensively competitive market in which: customers typically buy equipment on a first cost basis; sales margins are extremely tight; and long-term equipment service contracts are essential to economic survival.

Perry indicates that purchaser confusion results from a lack of complete information from manufacturers on equipment performance. Further, compressed air systems are dynamic and "most manufacturers cannot be of much help when predicting the behavior of their products in dynamic systems" – mainly due to lack of available training and experience (Perry 1997).

Customer purchasing decisions may be made entirely with in-house advice plus distributor input. An outside consultant may used to evaluate the system for a large company or a large purchase. Often, significant savings can be obtained from relatively low-cost changes in the way that compressed air is used, stored, or supplied (Howe & Scales 1995)(Van Ormer 1997)(Foss 1997). Other independent sources of

information are extremely limited and compressed air system performance training is virtually non-existent.

Since capital budgets and operating budgets are separate, there is little incentive to spend any extra capital on either efficient equipment or a comprehensive systems approach to reduce operating expenses. End users of compressed air frequently will not pay for quality services because they do not understand what they need.

Oversized systems are frequently the result of these problems. Once mistakes involving unnecessary capital expense are made, too much is at stake for an end user to readily correct the situation. The result is a system that is not understood, continues to operate poorly, wastes energy, and cuts into profitability. It is only when a new facilities person takes over or management begins to question overall costs that the cycle can be broken.

This is a chicken or egg dilemma. Until users ask for a different approach, manufacturers and distributors cannot afford to concentrate on one or they will go out of business before they have a market. Lacking information, users do not know what they need nor how to manage any perceived increase in risk from taking a non-traditional approach.

Why Doesn't the Market "Transform" Itself?

A deep lack of trust among the stakeholders has made it extremely difficult for manufacturers and distributors to change the way that they interact with customers for fear of being undercut. Changing the situation requires the creation of a new distributor/manufacturer focus on system opportunities rather than equipment solutions. It is a high-risk change that requires a complete re-evaluation of what constitutes a successful customer relationship coupled with an intensive re-education of consumers on the value of this approach. Providing an independent source of consumer information is an essential element of this change.

Collaborative Model Case Study: The Compressed Air Challenge

In the Challenge, the government is acting as a *catalyst* working with market forces rather than as a regulator trying to control them.

Evolution of a Project Model

The Compressed Air Challenge grew out of the Industry Partnerships for the U.S. Department of Energy's (DOE) Motor Challenge Program. The themes were first identified in the April 1995 Roundtable on Market Transformation Strategies for Industrial Motor Systems where it was established that the major improvement opportunities are in the compressed air system, not the individual components.

The Industry Partnership worked with the Compressed Air and Gas Institute (CAGI) to identify cooperative projects. Two major activities include:

- develop data sheets that standardize reporting of performance for rotary screw compressors and two types of compressed air dryers; and
- develop a training and certification program on compressed air system best practices (CAGI 1996).

Work on a standardized format for reporting equipment performance is well underway. The goal to develop a training and certification program on compressed air system best practices led to the Compressed Air Challenge. The proposal to develop a training and certification program led to discussions with CAGI and other stakeholders to determine how to launch such an effort. A series of stakeholder meetings were held over a period eight months to refine the scope and the approach for the

project. During this period, the project description evolved from a concept document to a business-oriented prospectus. These meetings also served to build ownership and laid the groundwork for subsequent activities.

The project model was to pool funds from multiple market stakeholders to complete project deliverables. This approach was taken for two reasons: cost and developing ownership for implementation. The project was too extensive and costly for a single sponsor (or CAGI and DOE together) to undertake. Given the level of conflict and distrust in the industry, it was also important to build ownership and networks of relationships during the development phase of the project. These networks of relationships are at least as important an outcome as the materials and training produced by the Challenge. Since a primary goal of the Challenge is to change market interactions and stakeholder behavior, those stakeholders (manufacturers, consultants, end users, distributors, state organizations, utilities) needed to engage the process early so that they did not become unwilling recipients of someone else's ideas. The project objectives needed to be clearly stated, openly arrived at, and customer-tested to achieve maximum effectiveness.

The concept model included pooling of sponsor funds and stakeholder technical knowledge for basic materials development and then making these materials available to each sponsor to deliver to their customers either individually or in partnership with others. In this way, the facilitators also hoped to make the project more appealing to newly-competitive utilities seeking market differentiation.

After stakeholder meetings, the concept piece was revised and recast as a prospectus for potential sponsors (McKane, Elliott & Wroblewski 1997). This instrument was used to seek a combination of private, public, and not-for-profit sponsorship and because of the need to clearly and succinctly address the key question "what's in it for me?" The prospectus approach has been very well-received, and has greatly assisted in defining the project.

Project Formation, Goals and Objectives, Target Market

A final stakeholders meeting was held in May 1997, bringing together representative from representatives from equipment manufacturers and distributors, compressed air system consultants, state and federal government, utilities, energy efficiency organizations, state research and development organizations, and a utility ESCO, to review the draft prospectus and try to reach consensus on the project. End use companies were purposely excluded from the meeting so that the other stakeholders would not be distracted by key customer relationships.

The project that emerged focused on the creation of a national collaborative to assemble state of the art information on compressed air systems design, performance, and assessment procedures. This collaborative will use education, training, recognition, and awareness-building to:

- Increase the reliability and quality of industrial production processes,
- Reduce plant operating costs,
- Expand the market for high quality compressed air services, and
- Save energy; a 10% improvement over current usage would result in annual savings of more than 3 billion kWh of electricity nationwide.

The project includes three primary elements:

- a *customer awareness campaign* on the benefits of effective and efficient industrial compressed air systems. This campaign will target both management and plant operating personnel;

- a nationally recognized *professional development program* to train plant operating personnel on compressed air system best practices, and
- a *certification program* for plant operating personnel who apply these best practices (McKane, Elliott & Wroblewski 1997).

The group also decided that project sponsors would each be asked to contribute $30,000 and comprise an Advisory Board with final decisions for the project. The Board now includes: three state research and development organizations, four utilities/utility consortia, three equipment manufacturers and distributors' associations, an individual company that markets controls and system audits, a utility ESCO, and DOE. Another body, the Project Development Committee, represents a cross-section of stakeholders, whether or not they were sponsors. This permits participation and critical technical input by key stakeholders, such as the compressed air system consultants, who would be unlikely to commit $30,000 of their own funds. The Committee is responsible for the overall operation of the project, in cooperation with the Project Manager.

Progress to Date

The Compressed Air Challenge has made significant progress since its formation in September 1997. The first few months of the Challenge were dedicated to creating a workable organizational structure – which is still evolving and refining itself. While the technical work of the Challenge was beginning, the partners felt it was important to provide a tangible product at the DOE-hosted project kickoff press event in January 1998. So, with DOE's Motor Challenge, the Challenge co-published "Improving Compressed Air System Performance: A Source Book for Industry" (DOE 1998b).

Future program deliverables will include a one-day training workshop for plant operating personnel, multi-day in-depth training for distributors, manufacturers' representatives, and utility representatives, and a customer awareness campaign to promote compressed air efficiency. The products will be pilot tested during 1998, with a full-scale deployment planned for calendar year 1999.

Potential Obstacles

The potential obstacles to the continued success of the Challenge are significant and should not be underestimated. They include:

- tension during project development between the need to assemble small groups empowered to draft materials so that the project can proceed and the need to keep the process open so that everyone who wants to participate gets the opportunity;
- dealing with individuals and companies who are attracted to the Challenge for the benefits that they want rather than what they can contribute. During the development phase of the project, it is important to protect end users and consultants (who often bring in their most valued end use customers) from unwanted solicitations for products and services;
- the program message concerning oversized systems. If the Challenge message successfully reaches its target audience, there will be a shift away from large equipment purchases and toward smaller equipment coupled with comprehensive services. This will require some major changes in the way that manufacturers and distributors interact with their customers;
- volunteerism exhaustion before the project has reached its stated objectives; and
- working the difficult politics of conflicting agendas.

Measuring Effectiveness

The first measure of success was whether enough sponsors would agree to contribute $30,000 apiece for the first year to develop a functional budget of $300,000. This goal has been exceeded-sponsorship currently stands at $390,000. The second measure of success was whether a Project Development Committee and Board of Directors successfully formed and met. Again, this has been achieved. A third measure of success will be whether a framework is developed for establishing Working Groups and whether all interested stakeholders are able to find a voice in the Groups. Work on this is progressing. A baseline for evaluating the program will stem from two primary sources: a 1998 market research study conducted of approximately 300 plant operating and supervising technical staff conducted by the Energy Center of Wisconsin on behalf of the Compressed Air Challenge and a recently completed study of industrial motor systems applications conducted by XENERGY and ORNL for Motor Challenge. Strategies are still being developed for assessing program impact, but will most likely include: training evaluation forms, post-training follow-up surveys, and feedback from consultants, distributors, and end users.

Factors Contributing to Success

If early indications hold true, the Compressed Air Challenge is likely to obtain its stated goals for market change and resulting energy savings. While constant maintenance will be needed to maintain the participants' focus on, and continued refinement of a shared vision, the collective commitment of so many important market shareholders has created its own forward momentum.

As work progresses and the potential for change becomes evident, individuals with differing points of view have become more engaged and active. Simultaneously, mutual respect has developed. Participants are willing to compromise, even over hotly-contested issues and closely-guarded positions of genuine disagreement, in the interest of project progress. A sense of shared purpose has superseded personal agendas, however temporarily. The biggest challenge will continue to be maintaining a balance between developing an independent body of information for the public good and the commercial interests of those involved in its development and delivery. Government can be an effective moderator.

Factors contributing to the success of the Challenge include:

- Market influencers such as the investor-owned utilities and the compressed air controls industry are looking for business opportunities and threatening the status quo. The Challenge offers an opportunity for equipment manufacturers and distributors to look like good corporate citizens while keeping abreast of and influencing new market developments;
- utilities and utility consortia are looking for market transformation projects of manageable length and investment. The Challenge gives them a quality product for their critically important industrial customers at a highly leveraged bargain rate.
- the Challenge itself is structured so that the sponsors can share rights, form partnerships of their choice to deliver the resulting products and materials, and take credit for sponsorship;
- all non-governmental sponsors have indicated that association with the DOE is a critically important public relations and marketing factor;
- the compressed air user is invited to participate in development as well as delivery of the resulting training and materials in a way that it is compatible with the demands of their work environment;

- there is already a strong base of quality technical information from which to draw; it requires consolidation and re-packaging; and
- by working through representative associations, input from the universe of interested parties can be managed.

The Importance of Champions

In the compressed air industry, which is small and highly specialized, many of the equipment manufacturers' personnel and consultants have worked for more than one company. As a result, today's protégé or mentor may become tomorrow's fiercest competitor or critic. For an outside party to be an effective facilitator in such a charged environment, they must first be accepted by the industry. There is no substitute for personal interaction in building that trust- logging the miles, visiting plants, appearing at association meetings, and the like.

A major result of this work was the identification of champions – representatives from each stakeholder group who were really willing to take risks to support and persuade others to support the Challenge. These representatives included: manufacturers, consultants, distributors, directors of state R&D organizations and a facilities engineering association, and representatives from national energy efficiency organizations. Without them and the influence that they wield among their peers, the project would not have come to fruition. Many of them have also already invested huge amounts of their personal time and company resources in attending meetings, reviewing information, and drafting materials for the Challenge.

In recognition of the importance of the "people side" of the equation, one of the first public actions of the Compressed Air Challenge was a DOE – hosted event to celebrate the project kickoff and the people who made it possible. The prospect of early and regular recognition by DOE was an important selling point in fund raising efforts.

How to Apply the Collaborative Model

To successfully apply the collaborative intervention model requires that the target market be thoroughly understood, and be in a condition amenable to change. If these key market characteristics are met, then government can play a facilitating role in the development of the activity. However, government must allow market players to define the direction of the activities so that they retain ownership.

Key Characteristics of a Successful Collaborative Intervention

Careful selection of a target market is imperative to the success of a collaborative intervention. Elements of a suitable target market include:

- a significant savings opportunity – either directly from the energy savings or with related benefits such as increased productivity, cost savings, enhanced safety or health benefits, commercial viability, improved comfort, or other desirable traits;
- the potential for a commercial party to assist customers in taking advantage of the opportunity, through the provision of goods and services;
- a market of manageable size – as mentioned previously, it is important that key stakeholders or their representatives can meet to exchange ideas;
- the ability to identify a broad range of market stakeholders, some with potentially competing interests;
- a market that is either under pressure to change or just beginning to change;

- the presence of potential champions – people who are dissatisfied with the status quo; and
- the availability of an effective facilitator to act on behalf of the government.

Missing from this list is something that government frequently seeks – a market that is initially receptive to partnership or already known to the government in some way. This characteristic is of limited value. It would have been difficult to identify a market that was initially less known to, or perceived as more resistant to partnership with government than the compressed air industry. The industry is a tightly-held, highly competitive industry with virtually no experience working with the public sector except for the Internal Revenue Service and the occasional antitrust threat. A compelling characteristic of the market was pervasive mistrust among all parties including manufacturers, distributors, consultants, and the customers that they all served. It is important to recognize that initial conflict among participants often means an opportunity for transformation exists when something of value is at stake.

The Challenge began from a position of mutual suspicion, but with considerable curiosity. After an initial period of building trust, the lack of experience became an asset for the collaborative intervention. The market had few preconceived notions of what was possible, so the ideas and solutions were more forthcoming and creative than they might otherwise have been.

Creating an Effective Government Role

This approach requires a different way of doing business for governmental entities. The role of the federal government has been critically important to the Challenge's progress to date. The federal government is in a unique position to encourage champions for change across the entire stakeholder spectrum, thus accelerating this transition while still working within market structures. Government can publicly recognize suppliers and end users as forward-thinking, empower would-be champions to build their own position within their organizations, and offer the market the prosect of avoiding future regulation. To realize this opportunity, a governmental entity must make three changes:

- First, the government entity must tolerate ambiguity and loss of control. A failure to listen and attempt to accommodate the desires, interests, ideas, and agendas of the other market stakeholders is the kiss of death for a collaborative approach. Acknowledging publicly the skills, knowledge, and talent of people who have spent their entire careers in a specialized field is critically important. Ideally, the government facilitator will undertake a mutual exploration of the market with the stakeholders, each getting to know the other at different levels, and stakeholders educating the government facilitator on how the market works. No one, including government, should bring out their wallet until the project has been adequately defined, and the parties should invest equally. Personal presence and attention to details matter.
- Second, the government must empower a representative to facilitate the initiative who is free to act, within preestablished boundaries, without needing additional approval. This is an activity that requires the facilitator to work "outside the box" to develop an understanding of the other stakeholders and to build their trust. Failure to do this will result in either project failure, as participants learn that the facilitator lacks the authority to negotiate, or in confrontation.
- Third, government must be patient. For the Compressed Air Challenge, it will be nearly four years from the first exploratory discussions before the primary "product" (training of plant operating personnel) really gets underway. While this type of time line is acceptable for funding of technical research, it is not typical of so-called "applied program" activities in the energy efficiency field. A single budget cycle is not enough time to develop a

meaningful collaborative intervention. The government facilitator must spend at least a year becoming known and trusted with the market(s) that he/she is attempting to influence before any tangible product can even be planned.

This type of activity can be characterized as "organizational or behavioral market research" that creates an environment for an applied program activity to take place. It has all the hallmarks of research – a stated problem, many possible solutions, and the need for substantial analysis to test and determine what will be effective. The difference is that the issues relate to desired changes in human and organizational behavior rather than new technologies. What is being created as the result of the Compressed Air Challenge is a new virtual organization that did not exist before – a forum for information exchange, and the creation of joint products and materials that support an emerging market for services. Stakeholders are being asked to take real business risks and need corresponding assurances from government that they are not going to be abandoned mid-change due to some institutional or political whim.

In summary, collaborative intervention requires a respect from government for a businesslike approach. This respect needs to be reflected in the language used; the way that the project is organized; the time commitment; the conduct of meetings (focused, substantive, and start and end on time); the responsiveness, authority, and professionalism of the facilitator . For the Challenge, this approach also helped establish a "we mean business" appearance by clearly outlining the goals, value and opportunity for prospective participants.

Applying the Model in the Commercial Building Sector

While the model presented is in the industrial sector, this collaborative arrangement is applicable to many areas within the commercial and institutional sectors. One potential area for application of this model is in the operation of commercial buildings HVAC systems.

Commercial Building HVAC Systems

Commercial HVAC systems present both the *opportunity* and the *possibility* for collaborative intervention. The opportunity is the energy savings potential, as with compressed air systems. HVAC systems account for more than 29% of the total commercial building energy consumption, and there are large opportunities for efficiency gains. The possibility comes from the increasing awareness of energy efficiency opportunities among building owners, technological improvements, and the increasing prevalence of energy service companies and third party HVAC operation arrangements. Additionally, increased competition is being seen among commercial building owners to retain tenants, with enhanced indoor air quality and improved individual conditioned air control becoming increasingly important incentives for tenants.

The commercial HVAC market possesses several of the key characteristics thought to be required of a market suitable for collaborative intervention, based on the industrial compressed air systems model. There is a range of stake holders, including manufacturers, end users, engineers and architects, technical and trade associations, utilities, energy service companies, and advocacy organizations. The market is of manageable size in that there is a finite number of manufacturers of chillers, boilers, fans, controls, and other primary equipment, and the manufacturers, suppliers, and end-users each have established professional associations.

As with industrial compressed air systems, commercial HVAC systems represent a small part of the cost of owning and operating a building. Hence, while routine maintenance may be part of a building's operation, modifying the HVAC system is left until there is a problem. While engineering/architectural firms are increasingly conscious of energy efficiency in the design of new HVAC systems, the suppliers and service organizations working with existing systems often focus on individual HVAC components and pay less attention to systems opportunities. Equipment is frequently purchased based on lowest first cost. HVAC systems are modified over time and suffer from:

- improper and leaking distribution systems,
- outdated and inadequate controls,
- poor maintenance,
- mismatch of HVAC to load, and
- excess capacity.

These typical conditions lead to many opportunities to improve the efficiency of commercial HVAC systems. Unlike the compressed air market however, both the public and private sectors have been heavily involved in improving the efficiency of HVAC systems for many years, though primarily focused on component improvements. There has been substantial research and development supporting improvements, including state of the art chillers and advanced controls, increased proficiency in commissioning of newly installed systems, and training for operation and maintenance staff are all currently underway.

Financing is more readily available for HVAC systems than for compressed air systems. Many performance contacting firms are capitalizing on the savings potential by improving the efficiency of outdated HVAC equipment and controls, and many building owners have taken advantage of utility incentive programs to upgrade their HVAC systems. There is also discussion of a new way of doing business with a third party taking control of the systems with owners/ managers paying for conditioned space rather than energy and O&M bills. Another substantial difference is that established federal efforts work with allies to bring this information to end users (Energy Star Buildings and Rebuild America).

While significant, these recent efficiency improvements have not been universal and have not focused on "systems" efficiency savings opportunities (with the exception of the small minority of building owners using performance contracting arrangements). The collaborative approach does offer the opportunity to package these diverse efforts and to bring together both the supply and demand side in a comprehensive way. The fragmented approach of addressing the development, design, financing and acquisition and operation and maintenance of these systems has resulted in gaps in expertise, imperfect information to the supplier and the ultimate user and lost opportunities for energy savings and improved indoor air quality. Because of the ongoing efficiency work, there are established networks and viable programs and companies providing part of an integrating function. The need is for rethinking with industry on how to package, revise and present these services and information to motivate end users to take advantage of the savings potential through an integrated systems approach to energy efficiency. How the model might be best applied and how to most effectively use the existing infrastructure needs further investigation.

Conclusion

Collaborative initiatives offer governments an attractive alternative to conventional prescriptive market intervention approaches. Collaborative approaches are particularly appropriate for systems in which the application of technology, rather than technology itself is the determinant of efficiency and other benefits.

Not all systems markets are appropriate for the collaborative approach. The market must possess the structures and characteristics described in this paper if it is to be a candidate. Additionally, the authors feel the market needs to be in a state of change due to external market influences if an initiative is to be successful. A stable market without preexisting pressure for change will be difficult to influence.

A collaborative intervention will require skills and expectations different from more conventional technology deployment programs. The project will require longer development time, and a greater degree of flexibility to make the initiative's goals congruent with the goals of market stakeholders. In addition, the government initiators must cede the control of the initiative to a consensus of all stakeholders.

The reward for this tradeoff in initiative control is a clear exit strategy. If the initiative is successful, a new market structure will be created which will perpetuate the goals of the government-facilitated initiative, even after the government participation has ceased.

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