Compressed Air Challenge: Market Change from the Inside Out

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ABSTRACT

Governmental energy efficiency policy strategies generally focus 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). Effective strategies are needed to capture the substantial efficiency opportunities that involve application of existing energy-efficient technologies, particularly within an entire system.

The first author has coordinated an effort to develop one such strategy- a model of collaborative intervention based upon a successful project for industrial compressed air systems. This 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. It is highly cost-effective and engages market forces from the beginning to promote lasting change.

Introduction

Many large opportunities for improving energy efficiency involve entire systems, yet they are often overlooked because they require a shift in thinking by both system users and the businesses that serve them.[1]

As an example, industrial compressed air systems in the US consume nearly 90 billion kWh annually. The efficiency of these systems could be improved by 20-50% through the application of best practices that rely primarily on changes in operation and maintenance procedures. Despite widespread recognition among industry experts, these best practices are not in common use.[2]

This paper describes the results of a four-year effort to develop a model for promoting change in the industrial compressed air systems market by addressing some of the behavior-based barriers to achieving greater system efficiency. Government can be an effective facilitator for this

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1 This paper includes material previously presented in a paper prepared for the ACEEE 1998 Summer Study. New topics addressed here include: project progress, development of a policy model and a market analysis framework, and new applications for the model.

2 The first author started with the estimate of 20-30% published in USDOE's 1996 National Market Transformation Strategies for Industrial Electric Motor Systems and revised it upward based on numerous discussions with experts in the compressed air equipment and consulting businesses. This estimate and the inefficient state of current industrial practices have been consistently supported by compressed air system specialists

type of change, but it requires a different approach than the types of policies currently employed.

In the United States, government (federal, state, and local) uses an array of intervention techniques to shape energy efficiency policy 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.

An alternative type of persuasive market intervention, presented here, relies primarily on establishing an environment that encourages the participants in an existing market structure to interact in new ways. It is our contention that these interactions, by creating new business opportunities, will result in a permanent transformation of a market as well as substantial environmental benefits.

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. Since it engages many aspects of a market, this approach is described as *collaborative intervention.*

Collaborative intervention places government in the role of a broker or facilitator, responsible for setting out initial goals. Market participants are invited to be champions of these goals and collectively determine the best way to achieve these goals. In exchange, government acting as the broker can recognize them for the risks they assume. This approach seeks to exploit the different, and potentially complementary, roles and competencies of the public, private, and not-for-profit sectors. The four key elements of this strategy are:

- 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.

The first application of this approach in the US is the "Compressed Air Challenge: Resources for System Optimization" (Challenge), which seeks to transform the customer and supplier relationships for industrial compressed air systems. This industry is suited for a collaborative intervention because of characteristics including: market structures, market size, pressure to change, system improvement opportunities, and barriers to achieving those opportunities. Whether this market is capable of transforming itself without intervention will be addressed. This will be followed by an example of what one company has already done to implement a systems approach for their compressed air systems.

Finally, we will examine the potential for using the policy model developed for the Compressed Air Challenge in other market interventions. This will include identification of the key elements to consider in selecting a potential target market.

Engaging the Market: A Challenge to Change

Market structures in the US economy generally work well. Products and services are constantly being created to meet perceived customer needs. Whether new products and services are successful and whether they displace existing products and services is driven primarily by how well they find their target market. This process of finding a good fit for new products and services is a function of both product availability and customer interest, yet most policy instruments to promote energy efficiency are directed at either the customer (demand side) or the producer (supply side), but rarely both. Many persuasive actions (rebates, tax incentives) are directed toward changing the demand side. While it is true that the supply side will react to these changes in the demand side, it is our contention that change will happen more quickly and last longer if the supply side can clearly identify a business opportunity independent of any temporary incentive.

We believe that there is a role for the US government to work with existing market structures while acting as a catalyst to achieve changes that a market, particularly a very mature one, may be unable to accomplish on its own. The Compressed Air Challenge is one example of how voluntary participation can be gained by recognizing and engaging private interests to create permanent changes (or transform) markets for the common good.

A key element of working within market structures is acknowledgment and acceptance that participants will act in ways that are consist with their economic and political self-interests. As mentioned before, the supply side of the market must be effectively engaged. Not all suppliers will approve of a collaborative intervention. Suppliers who self-select to participate will contribute the suppliers' point of view and help ensure the success of the intervention by becoming "early-adopters". This recognizes both the durability of existing relationships between the supply and demand side as well as the potential for enlisting progressive suppliers as effective champions for change. Suppliers (manufacturers, distributors) have unique technical and market knowledge and the ability to support (or resist) change in their interactions with customers.

The success of these voluntary efforts depends on 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.

Selecting a Market

A combination of *opportunity* and *possibility* are the reasons why the US government selected the compressed air industry for a collaborative intervention. The *opportunity* is in the energy savings potential and corresponding improvements in quality control and production reliability. Industrial compressed air systems represent a rare example of an untapped cherry-picking opportunity- that is, a large potential for energy savings (20-50%) from a relatively small effort. The

fact that these improvements frequently result in measurable productivity improvements and reductions in polluting waste creates an "everybody wins" appeal[3]

Compressed air is industry's "fourth utility"; it is central to production for many industries. Compressed air is typically the most expensive utility; a single compressor delivering 500 standard cubic feet per minute (scfm) 24-hrs per day can cost $100,000 year to operate. If the company using the compressor has a 5% net profit ratio, the cost of operating the compressor will be the equivalent of $2,000,000 in production (Foss 1994, 71). In spite of its cost, a high level of waste in a manufacturing facility is not uncommon, due to poor system operation coupled with a perception by production staff that compressed air is free. Compressed air systems are modified over time and frequently suffer from some or all of the following: improperly installed and/or leaking distribution lines; outdated or inadequate controls; poor maintenance of filters and other accessories; mismatch of compressors to load; excess compressor capacity; higher than necessary system pressure, and inappropriate applications.

Optimization of compressed air systems represents one of the largest non-process, industrial energy efficiency opportunities, with improvements of 20-50% readily achievable through the introduction of a best practices approach. Compressed air systems in U.S. manufacturing account for 90 billion kWh/yr of electricity (USDOE1998) or $4.5 billion per year of energy costs and 21 MMTCE of total U.S. carbon emissions (1-½ percent of total U.S. emissions). The Compressed Air Challenge seeks to save $150 million in annual energy costs by the year 2010 (USDOE, 1998 Compressed Air Challenge Kickoff).[4]

The *possibility for change* arises from current market structures combined with internal and external pressures. Internal supply side pressures include low margins of profitability and the drive for greater economy of production. Externally, the market is being pressured from several sources: globalization, utilities entering the business of providing industrial customers with compressed air, the increased use of improved electric tools instead of air tools, and customer dissatisfaction with existing services and equipment performance.

The sheer size and complexity of existing market structures can make a collaborative intervention difficult. Although the industrial compressed air systems market is complex, the supply side of the market is highly specialized and has a limited number of participants.

The Industrial Compressed Air System Market

In a paper, Wayne Perry of Quincy Compressor described the existing compressed air equipment market and the relationship between equipment buyers and sellers. The major points made in this paper have been subsequently reaffirmed through several other sources and will be referenced several times in this section. Perry describes the industrial compressor industry as follows:

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3 Although formal documentation of the linkage between increased productivity and reliability is still underway, there are is analytical information on these linkages being shared among compressed air system specialists. Examples include: increased throughput and better quality control in glass manufacturing, reduced overspray in paint booth applications, and reduced wastage in container manufacturing. Most benefits derive from stabilization of system pressure and flow.

4 Usage figures have been revised upward since the Compressed Air Challenge Kickoff based on findings in the USDOE *United States Industrial Motor System Market Assessment*, December 1998.

> 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....When inflation... is factored in, industrial compressor prices have held steady or fallen in each of the past five years. With these market conditions, 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 1998, 71).

This is a market in which equipment distributors are the primary source of information for small to medium size companies. Large companies will usually rely on in-house staff or distributors, hiring an outside consultant only to justify a large purchase or if a system has chronic problems maintaining pressure. Distributors operate in an intensively competitive market in which customers typically buy substantial pieces of equipment (purchase prices can range from $50,000 to a million or more for a major new system) on a lowest first cost basis, margins for equipment sales are extremely tight, and long-term equipment service contracts are essential to economic survival.

The focus on lowest first cost persists despite the fact that many large compressors cost more to operate in the first year than initial purchase price (Kemp 1998). Often, significant savings can be obtained from relatively low-cost changes in the way that compressed air is used, stored, or supplied (Howe and Scales 1995) (Van Ormer 1997)(Foss 1997). However, since capital budgets and operating budgets are separate, there is little incentive to spend limited funds on efficient equipment or a comprehensive system approach to reduce operating expense. End user companies frequently will not pay for quality services because they do not understand what they need.

Perry indicates that lack of complete information from manufacturers on equipment performance adds to purchaser confusion. This is further complicated by the fact that a compressed air system is 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 1998, 72). One equipment distributor described the situation as "providing pre-packaged solutions to an undefined problem on a lowest first-cost basis" (McMorrow 1998).

This is a chicken or egg dilemma. Until end 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.

Why Doesn't the Market "Transform" Itself?

The average US corporate customer is unaware of the possible benefits from improving the operation of their compressed air system. 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. It is an atmosphere where an outside intervention is helpful so that no single stakeholder has to be the one who blinks first. Changing the situation requires the creation of a new market, a 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.

Creating a Collaborative Model: The Compressed Air Challenge

The Compressed Air Challenge is outgrowth of work on Industry Partnerships for the USDOE Motor Challenge Program. The themes which ultimately led to this project were first identified in the April 1995 Roundtable on Market Transformation Strategies for Industrial Motor Systems. A general point of consensus established at the Roundtable was that the major improvement opportunities are in the compressed air system, not the individual components.

The first author, acting as a facilitator, worked with the Compressed Air and Gas Institute (CAGI) to identify cooperative projects that addressed some of the key needs in the compressed air market CAGI proposed two major activities:

- develop data sheets standardized 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 (Correspondence with CAGI Energy Awareness Committee 1996).

Work on a standardized format for reporting equipment performance is well underway, although there is still a need for independent verification of performance data. The idea of a training and certification program on compressed air system best practices led to the Compressed Air Challenge.

An initial proposal for a training and certification program was developed by the first author, Neal Elliott of ACEEE , Mark Hanson and later Ron Wroblewski of the Energy Center of Wisconsin. The proposal was refined and reshaped over eight months through a series of meetings with CAGI, state and utility representatives, and other interested parties.

From its inception, the project model was to solicit multiple sponsors from market stakeholders with the objective of pooling funds and stakeholder technical knowledge 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 critically important to build ownership and a new network of relationships during the development phase of the project. Since the ultimate goal of the Challenge is to change market interactions and stakeholder behavior, those stakeholders (manufacturers, consultants, end users, distributors, state organizations, utilities) needed to become part of the process early on so that they didn't become unwilling recipients of someone else's idea of what is "good for them."

A business prospectus was developed because we were seeking a combination of private, public, and not-for-profit sponsorship. This required that the solicitation clearly and succinctly address the key question "what's in it for me?" The prospectus approach has been very well-received and greatly assisted in defining the project (McKane, Elliott, Wroblewski 1997).

One final stakeholders meeting was held in May 1997 to review the draft prospectus and try to reach consensus on a fundable project. Meeting attendees included: 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. End user companies were purposely excluded from the meeting so that the other stakeholders would not be distracted by key customer relationships.

The group reached a consensus on the formation of a national collaborative to bring together the best information on compressed air system design, operation and maintenance, and assessment to:

- increase the reliability and quality of industrial production processes,
- reduce plant operating costs,
- expand the market for high quality compressed air system services, and
- save energy- projecting annual savings of more than 3 billion kWh of electricity nationwide

The collaboration has three primary elements:

- a *customer awareness campaign* on the benefits of effective and efficient industrial compressed air systems;
- 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.

The group also decided that the project sponsors would each be asked to contribute $30,000 for each of the two project years and would comprise an Advisory Board with final decisions for the project. Another body, the Project Development Committee, represents a cross-section of stakeholders, whether or not they are 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. Several working groups were also formed to address topic areas (promotion, technical issues, training, and certification). Decisions are made by consensus to preserve stakeholder balance.

Accomplishments

For a project of this type, progress has been rapid. Since the first Advisory Board meeting in September 1997, the Compressed Air Challenge has accomplished the following:

- in cooperation with USDOE, prepared, published, and sold 1200 copies of *Improving Compressed Air System Performance: A Sourcebook for Industry*
- participated in kickoff press event in Washington, DC in January 1998
- developed through a consensus process and tested a one-day training program for plant engineers *Fundamentals of Compressed Air Systems*
- selected and trained the first group of 13 instructors to give the training
- developed a "train the trainer" program to qualify an additional 15 instructors
- conducted the first 5 one-day training sessions
- coordinated an ambitious roll-out of 50 training sessions during the second quarter of 1999
- begun a national advertising campaign with full-page ads in *Plant Engineering* and *Plant Services* magazines and a national mailing to 5,000 plant engineers
- created a web site *http://www.knowpressure.org*
- begun work on a 2-1/2 day advanced training session to be offered in late 1999

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- total sponsorship over two years is $840,000 from 14 sponsors. 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 was developing the framework for Working Groups and trying to accommodate participation by all interested stakeholders. This has been difficult- but largely successful.

A baseline for evaluating the program will stem from two primary sources: a 1998 brief market survey of approximately 300 plant operating and supervising technical staff conducted by the Energy Center of Wisconsin on behalf of the Challenge and a recently completed study of industrial motor systems applications conducted by XENERGY and ORNL for Motor Challenge. Strategies for assessing program impact include: training evaluation forms, post-training follow-up surveys, and feedback from consultants, distributors, and end users.

Factors Contributing to Success

If 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 keep the participants' focus on, and to continually refine a shared vision, the collective commitment of so many important market shareholders has created its own forward momentum.

The first author recently had the privilege of witnessing the shift in the actions of industry suppliers. At a distributors' association meeting, two members spent several hours describing to fellow members their success in developing a new business component that takes a systems approach with customers. After less than two years in the business, they characterized their results as highly successful, both in terms of new customer generation as well as increased revenue for their existing business activities. It was clear from their discussion that without the Challenge, they either would not have undertaken the new business component at all or would have done so much more slowly.

Another distributor relayed the following story to describe the change in his customer interactions:

> I got a phone call from a new customer requesting a third bid on a large compressor. Before, I would have sharpened my pencil and tried to come in with a competitive bid. This time, I asked the caller if they were sure that they needed the machine. Would they mind if I came out to their plant and looked at their system first? They didn't need it, but they needed a lot of other equipment (smaller compressor, storage, controls). So I got a good sale, the customer's system works better than it ever has, and he thinks that I'm a hero.

As work progresses and the potential for change becomes evident, individuals with differing points of view have become more engaged and active. The level of volunteerism has been astonishingly high- thousands of hours and considerable travel. 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 are able to participate in development without an overbearing time commitment;
- there is already a strong base of quality technical information from which to draw, and
- working through representative associations allowed input from the universe of interested parties to be effectively 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.

Cutting the Cost of Compressed Air at Ford Motor Company

Ford Motor Land Services is an example of a what can be accomplished when a company starts to comprehensively address compressed air system improvement possibilities on a plant-by-plant basis. What is notable about Ford's actions is that they are relative simple, require incremental and fairly modest capital investments, and depend on teamwork to be effective. Through the efforts of corporate energy management, led by the second author, there is an effort to apply lessons learned in one plant to similar opportunities elsewhere in the company. This is a "best practices" approach practiced at the corporate level. It should also be noted that this corporate energy manager is a

member of the Challenge Project Development Committee and a qualified instructor for the *Fundamentals* training.

The Woodhaven Stamping Plant in Woodhaven, Michigan provides one example of how a systems approach can begin to cut costs. The 2.7 million square foot Woodhaven Plant processes approximately 1600 tons of steel per day into body panels for Ford vehicles. Through a partnership with Detroit Edison, Ford undertook a project to: build awareness of the cost of air, reduce leak losses, reduce header pressure, and more closely match the supply of compressed air to actual demand.

A project team included the second author, Gordon Nader of Detroit Edison, two Woodhaven machine repairman, and plant management. They designed and implemented a plan to reduce the plant's high leakage rate and $1.8 million in electricity costs attributable to the compressed air system.

After initial implementation of its improvement plan, the plant reduced the cubic foot per minute flow by 18% (from 25,000 scfm to 20,500 scfm) and cut electricity costs by $400,000. One 800 hp compressor was taken completely offline and the remaining in-service compressors are consuming less energy. These results occurred from June to December 1998, with continued improvements expected.

The actions implemented during the first six months include:

- Assembled an Air Leak Detection/Correction Team. Two machine repairmen were assigned to identify and correct significant leaks. Management support was gained for this activity by presenting a cost-benefit analysis. Leak correction activities occur primarily during the July and December plant shutdown time, during lunch breaks and unscheduled downtime. The effort is credited with reducing air requirements by approximately 2,500 scfm , cutting electricity consumption by 2,000,000 kWh;[5]
- Replaced leaking seals on stamping press die automation valve, reducing air requirements by 1000 scfm and electricity consumption by 1,600,000 kWh;
- Lowered header pressure by approximately 5 psig, resulting in electrical savings of 2,300,000 kWh;
- Replaced existing flow measuring orifice plates with low loss venturis to measure discharge flow from two of the largest compressors. Replaced orifice plate in the main system with an averaging pitot tube.
- Developed posters and banners to publicize the leak detection/correction effort with the production staff. This year's budget includes funding to train the production staff on the cost of air and continue building awareness.
- Began shutdown of small (30hp each) satellite air compressors. These satellite compressors were supplying 110 psig to some of the stamping press robots. After testing, the team was able to demonstrate that five out of seven of these compressors could be shut down. Supply air for the robots was returned to the plant's lower pressure (70 psig) main air header. The need for the two remaining satellite compressors is still under evaluation. The projected energy and maintenance savings for this measure is $55,000 annually.

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[5] Based on 12 months of operation; compressor hp average= 4.25 scfm (kW=5.4 scfm); electrical power cost= $0.0435/kWh

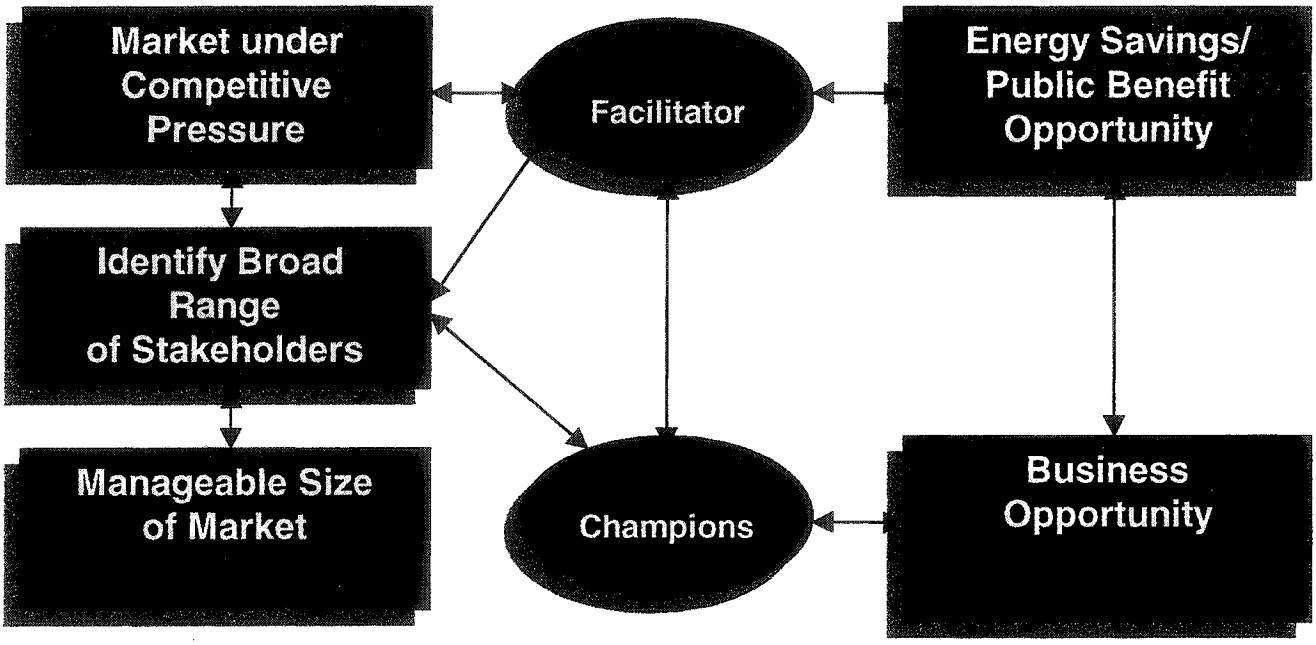
Other actions for 1999 include:

- refurbishing blanker die automation valves;
- replacing leaking counter balance pressure regulating valves;
- replacing air driven vacuum pumps with electric vacuum pumps;
- correcting improper use of compressed air;
- departmental billing for electricity and compressed air;
- adding a part-time electrician to the Air Leak Detection Team,
- and installing energy-efficient compressed air dryers and motors.

Applying the Collaborative Model

The essential elements of the Collaborative Model are illustrated in Figure 1: market under pressure for change, a broad range of stakeholders, a market of manageable size, a public benefit opportunity (e.g.-energy savings, environmental benefit), a business opportunity, the presence of champions, and a facilitator. To be effective, the potential facilitator should understand why the situation hasn't already changed.

Figure 1
Elements of a Collaborative Intervention



In order to effectively build a collaboration, a facilitator should first identify the following for each key stakeholder group:

- what is their potential contribution to the collaboration (why are they desirable participants)?
- what is their initial motivation to join the collaboration?
- what are their primary drivers– what do they hope to gain from their participation? An analysis of the compressed air systems market participants is provided in Chart 1.

Taking the time to conduct this analysis during project formation can really help structure a collaboration that is appealing to a broad base of stakeholders.

Chart 1: Compressed Air Systems Market

Participant	Potential Contribution	Initial Motivation	Primary Drivers
Equipment Manufacturers & Distributors	Detailed technical & market information, customer influence	Brand enhancement Perceived threat to business	Sustain sales Customer retention Increased profits
Specialized Consultants	System engineering Broad knowledge of Applications/ problems	Increased visibility Legacy- impart knowledge	Increased billable hours Recognition
End Users of Compressed Air Systems	Knowledge of specific applications & Organizational dynamics	Alignment w/ green image May fix problem	Reliability Profitability Efficiency Recognition
Influencers: Utilities Energy-efficiency organizations Government	Market credibility Outreach mechanisms Perceived neutrality	Meets mission Highly leveraged Politically beneficial	Customer education Customer retention Energy savings Recognition

It is not necessary to select a market that is initially receptive to partnership or already known to the government in some way. 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. 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 can be an indicator of a market transformation opportunity because something of value is at stake.

Creating an Effective Government Role

The role of the US government has been critically important to the Challenge's progress to date. The US 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 prospect of avoiding future regulation. To realize this opportunity, a governmental entity must take the following into consideration:

- First, ambiguity and loss of control. An essential ingredient of a successful collaborative is the ability to listen and to accommodate the desires, interests, ideas, and agendas of the other market stakeholders. This requires the government to relinquish "control" and allow market players to collectively direct the effort. Acknowledging publicly the skills, knowledge, and talent of people who have spent their entire careers in a specialized field is critically important.
- Second, need to empower a representative to facilitate. 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, time. For the Compressed Air Challenge, it was nearly four years from the first exploratory discussions until the primary "product" (training of plant operating personnel) really got underway. 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. Stakeholders need assurance that the business risks that they are being asked to take will be paralleled by government commitment.

While the investment of time and money will decline in the outlying years, the continued presence of the US government in some type of facilitating role will likely be needed for about five more years before market transformation can be assured. Permanent change on this scale takes time.

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.

Conclusion

Collaborative intervention is difficult but rewarding; it can be an attractive alternative to conventional prescriptive market intervention approaches. Each collaboration will have its own characteristics but the framework described in this paper can be applied to any market that meets the basic criteria for size, existing pressure to change, business opportunity, and public benefit opportunity. If these conditions are met and the facilitator is able to engage the support of champions, a collaborative intervention should be possible.

This collaboration model is currently being applied in the pumping industry. The initial focus is on promoting a life-cycle cost approach to the procurement of pumping systems. This activity is likely to

be accomplished through work with key end use associations, including agencies responsible for government purchasing.

Collaboration requires skills and expectations different from more conventional technology deployment programs. These projects require longer development time and greater flexibility to accommodate the goals of market stakeholders. Because collaboration depends on building consensus, good communication skills are needed.

The rewards are several: a highly leveraged project, widespread and lasting market change, and a built-in exit strategy. If the collaboration is successful, a new market structure will be created which will perpetuate the project goals, even after government participation has ceased.

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