Market Progress Evaluation Report

Sav-Air Market Transformation Initiative, No. 2

prepared by

Pacific Energy Associates, Inc.

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SAV-AIR MARKET TRANSFORMATION INITIATIVE

MARKET PROGRESS EVALUATION REPORT #2

Final Report

Funded By:

NORTHWEST ENERGY EFFICIENCY ALLIANCE

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Executive Summary

A. Introduction

This *Market Progress Evaluation Report* (MPER) is the second in a series of four reports on the *SAV-AIR Market Transformation Initiative* (SAV-AIR). The work in this report builds upon the work done in the previous report, MPER #1. Some of the background and context presented in the *Executive Summary* and the *Introduction* of MPER #1 are reiterated below for the convenience of the reader.

This report covers the activity of SAV-AIR over the period of January through early August 2000. Although there has been some significant activity in SAV-AIR implementation contracts in the most recent days of this period, in general, there has not been major progress towards the important goals of the Initiative. Thus, the issues and concerns stated in this report remain basically the same as in the first MPER.

Compressed air is often called the "fourth utility" in industrial facilities – after electricity, natural gas, and water. It is used for motive power for machinery, cooling, materials handling, and hand tools. It is a safe, flexible, and powerful resource that is seldom run for low operating costs or best productivity. *Table ES-1* describes the magnitude of the compressed air market in the Northwest.

Table ES - 1: Northwest Region Compressed Air Market Size[1]

MOTOR SIZE	TOTAL AIR COMPRESSOR HORSEPOWER	NUMBER OF AIR COMPRESSORS	ENERGY USAGE, AMW	POTENTIAL SAVINGS, AMW
LESS THAN 200 HP	460,500	14,600		
MORE THAN 200 HP	412,500	600		
TOTAL	873,000	15,200	513	63

[1] *Assessment of Industrial Motor Systems Market Opportunities in the Pacific Northwest*, *Draft Report*, Xenergy and Easton Consultants, October 1999.

The most important issues of industrial compressed air in regards to energy efficiency and management are:

1. Compressed air is a significant industrial end-use in the Northwest region and is an essential utility in these plants;

2. Compressed air is a fundamentally inefficient energy transforma-tion process; and

3. Optimal operation of compressed air systems in industrial plants is seldom a priority and adequate management information is rare, resulting in even less efficiency and impact on production.

The Northwest Energy Efficiency Alliance (the Alliance) is a non-profit group of electric utilities, state governments, public interest groups, and industry representatives committed to bringing affordable, energy-efficient products and services to the marketplace. The *SAV-AIR Market Transformation Initiative* was undertaken by the Alliance to change the way compressed air end-users and service providers view and manage this "fourth utility," and in doing so achieve not only energy efficiency-related benefits, but also non-energy benefits such as increased system reliability. Further, the Alliance and the SAV-AIR team want SAV-AIR to evolve into a self-sustaining business that will continue this work into the future.

B. Evaluation of the SAV-AIR Initiative

Pacific Energy Associates, Inc. (PEA) was hired to assess the market transformation achievements of SAV-AIR, and to assist with "adaptive management" of the SAV-AIR venture. The results of our assessment of this market transformation are contained in four *Market Progress Evaluation Reports.*

The specific objectives of this second MPER (#2) are to:

- Describe how SAV-AIR's approach and services have evolved.
- Review SAV-AIR's current status.
- Report on interviews with industrial compressed air end-users.

- Update information on the compressed air market.
- Make recommendations for revisions to the Alliance's cost effectivity analysis.
- Continue to assess the Alliance-sponsored *Compressed Air Challenge* (CAC) training program.
- Identify key issues and make recommendations to address them.

This MPER#2 builds on market research previously conducted by PEA and Research Into Action, Inc., as well as the research conducted for MPER #1. The new research includes a round of phone interviews with 25 industrial compressed air end-users. PEA also performed an in-depth interview with the plant superintendent of the first SAV-AIR installation.

C. Overview of SAV-AIR's Approach and Services

SAV-AIR provides integrated compressed air management systems and engineering services. The SAV-AIR approach includes remote monitoring and control of compressed air systems involving sensors, computers and software. They have expertise and specialized technology to evaluate existing equipment, engineer upgrades, and provide ongoing monitoring and control of an entire compressed air system. The result is increased compressed air system reliability, decreased compressed air costs, and management information for verification and decision-making.

The current SAV-AIR service approach is comprised of three delivery phases.[2]

- **Phase I – Performance Evaluation**

  The current status of the compressed air system is determined with detailed metering and analysis, and recommendations are made for optimization.

[2] Note that SAV-AIR has condensed to this current three-phase approach from five original steps.

- **Phase II – System Optimization**

  This includes SAV-AIR system installation for monitoring and control along with other recommended system improvements.

- **Phase III – Ongoing Services**

  This includes ongoing monitoring, troubleshooting, and consulting to provide continued system optimization for the maintenance of energy savings and reliability.

D. Assessment of SAV-AIR's Efforts and Market Effects to Date

This section summarizes some of PEA's observations regarding SAV-AIR and then formalizes them in several tables describing early and progressive indicators according to the outline of the *Evaluation Workplan*.

Observations

SAV-AIR has diligently and enthusiastically worked toward meeting the goals of the Alliance as well their own interests in establishing a successful business of managing and optimizing industrial compressed air systems. Despite their best efforts, the length of the sales cycle for SAV-AIR services is still a major concern. As of August, SAV-AIR was still working to bring five of the original six beta demonstration sites beyond the *Phase I – Performance Evaluation* to *Phase II – Implementation of System Optimization*.

"Time-to-market" for the SAV-AIR approach has been long, due to the internal decision processes of initial clients. Budgeting the required expenditures for SAV-AIR, the difficult justification of upgrades to systems currently perceived as adequate, and a focus on production have kept potential customers from moving forward as expected.

Findings at the first SAV-AIR implemented beta project indicate excellent client satisfaction, with energy savings beyond predicted outcomes. SAV-AIR's work at this first demonstration site has led to a flurry of activity within that customer organization, resulting in a commitment for financial support beyond basic sales agreements. SAV-AIR also has a significant commitment from a

major electric utility for financial support to provide their compressed air management services to industrial customers throughout the utility's service territory.

Demonstrated energy benefits at the first beta site exceed initial projections. Although non-energy benefits are undoubtedly real and important, their single current customer is not yet willing to describe them. This may be a result of the particular way that plant staff at that facility view their responsibilities; we believe that non-energy benefits are present, and potentially significant to the firm. Non-energy benefits may be more readily identified, and perhaps even quantified, after additional beta sites have completed a project.

Interest in the SAV-AIR approach has increased dramatically over time, with recent market activity apparently linked to the successful demonstration project. Diffusion of new technology is often exponential. The market activity of SAV-AIR has followed this pattern, with substantial increases in their presentations, proposals, and implementations in the last six months as compared to the previous fifteen.

SAV-AIR's work with their first beta site in the wood products industry has created interest (as expected) from other firms in the same field. As this industry has both cooperative and competitive aspects concurrently, many firms watch each other for new technological approaches to gain small competitive advantages. It is too early to tell what might come of this interest, but early inquiries are at least an indication of increased awareness and potential success.

The completion of the prototype site and implementation of the first beta site have significantly improved SAV-AIR's credibility in the market. Improvements in SAV-AIR's marketing materials and development of an initial case study are also useful to provide impressions of stability and competence.

Market Effect Indicators

This second MPER updates the *early indicators* of market effects. These early indicators primarily concern SAV-AIR's internal progress in developing the prototype (or alpha) test site, delivering the first two phases of their services to pilot or "beta" sites, and customers' expressed intent to implement system changes and ongoing monitoring.

This report also assesses SAV-AIR's status regarding *progressive* indicators. These concern beta site implementation through *Phase III*, development of successful case studies, broader market effects as evidenced by changes in competitor activities, recognition by market actors of the credibility and technical merit of SAV-AIR's services, and successful evolution of SAV-AIR into a viable business.

Tables ES-2, ES-3, and *ES-4* below provide an overview of SAV-AIR's field activities up to early August 2000, and the status regarding both the early and progressive indicators. The tables also describe current concerns the PEA team has and suggested strategies for moving forward. *Table ES-2* also gives an overall picture of SAV-AIR's beta and non-beta activity, with "beta" indicating those projects selected specifically for demonstration under the Alliance initiative and "non-beta" for projects that are not in this group. "In Process" indicates projects that are in negotiation or waiting for a customer decision.

Table ES - 2: Current SAV-AIR Activity

PHASE	BETA		NON-BETA	
	Implemented	In Process	Implemented	In Process
PHASE I – PERFORMANCE EVALUATION	5	1	0	2
PHASE II – SYSTEM OPTIMIZATION	1	2	0	0
PHASE III – ONGOING SERVICES	0	0	0	0

Table ES - 3: Assessment of Early Indicators

PROGRESS INDICATOR GOAL	PROGRESS TO DATE	CONCERNS AND STRATEGY TO ACHIEVE
ONE PROTOTYPE SITE OPERATIONAL BY THE SECOND QUARTER OF 1999	A comprehensive prototype site demonstration was made in April 2000. The prototype site is meeting important needs for SAV-AIR, internally and externally.	This goal has been met.
SIX INDUSTRIAL FACILITY BETA SITES SELECTED BY THE THIRD QUARTER OF 1999	Seven sites have been selected as of August 2000, one has been withdrawn, and five have received *Phase I* evaluations.	One site has implemented *Phase II*. One of the current beta sites is unlikely to move forward. The other four appear to be stalled on making a decision. Additional sites that actually move forward might be considered as alternatives to the stalled four sites.
SUCCESSFUL IMPLEMENTATION OF SAV-AIR'S SERVICES UP THROUGH *PHASE II*	A *Phase II* installation of the SAV-AIR system has been completed at one beta site.	This is a critical-path to financial success. SAV-AIR should continue with additional project implementation as quickly as possible, perhaps with new sites to replace those that have stalled.
BETA SITE CUSTOMERS EXPRESS INTENT TO IMPLEMENT SAV-AIR'S RECOMMENDATIONS AND UNDERTAKE MONITORING	SAV-AIR and the one beta customer have both indicated their intention to implement *Phase III* monitoring. However, there is as yet no contract for services.	SAV-AIR should propose specific actions and a schedule to increase the likelihood that *Phase II* customers contract for *Phase III* monitoring. Interviews with additional *Phase II* sites may provide insights into perceived value and concerns with *Phase III* monitoring.
BETA SITE CUSTOMERS EXPRESS INTEREST IN REPLICATING SAV-AIR SERVICES IN OTHER CORPORATE FACILITIES	Actions and statements of the one *Phase II* site are clear that they are strongly interested in replication.	The actions and statements of this customer are clear; SAV-AIR should focus on following through with this first firm and with others in the same industry.
ABILITY OF SAV-AIR TO STREAMLINE THE SALES AND DELIVERY PROCESS AS THE INITIATIVE PROGRESSES	SAV-AIR updated marketing materials in June 2000, and developed a portable *Survey Kit* for *Phase I* evaluations.	The pipeline for SAV-AIR *Phase I* and *II* services could overfill in the next weeks or months. A plan to deal with concurrent implementation demands should be made before demand peaks.

Table ES - 4: Assessment of Progressive Indicators

PROGRESS INDICATOR GOAL	PROGRESS TO DATE	CONCERNS AND STRATEGY TO ACHIEVE
DEMONSTRATION OF THE BENEFITS OF SAV-AIR SERVICES AT SIX BETA SITES THROUGHOUT THE PACIFIC NORTHWEST THROUGH CASE STUDIES AND OTHER MEANS	Five beta sites have done *Phase I studies*, but not contracted for *Phase II – System Optimization*. A case study has been prepared for the one *Phase II* site. All sites show good potential to serve as case studies for both energy and non-energy benefits.	SAV-AIR should continue to push towards completion of several more beta (or non-beta) sites, so they can demonstrate and document benefits. Case study documentation might follow MPER #1 recommendations and marketing material suggestions in this report.
THE COMPRESSED AIR INDUSTRY AND END-USERS RECOGNIZE SAV-AIR'S PRODUCTS AND SERVICES AS CREDIBLE, UNBIASED, AND TECHNICALLY ACCURATE	Sixty percent of the 24 experts and distributors in the first interview had heard of SAV-AIR. They believe the SAV-AIR approach has value, but withhold judgment about its cost-effectiveness. End-users have uniformly not heard of SAV-AIR.	An end-user survey suggests that there is an actual, but not a perceived need for SAV-AIR's services among most of their potential customers. Education may be a means to overcome this barrier. PEA has scheduled a second survey of experts and distributors to assess opinions of SAV-AIR's services.
NON-ALLIANCE SOURCES PROVIDE AT LEAST 50% IN MATCHING FUNDS FOR BOTH DEVELOPMENT AND IMPLEMENTATION OF THE *SAV-AIR MASTER PLAN*	With limited information, the overall matching ratio currently appears to be about 25%.	Measurement of cost share with beta projects in the pipeline is problematic. Tax credits and utility contributions need definition. This critical issue should be clarified with discussions between SAV-AIR and the Alliance.
SUCCESSFUL LAUNCHING OF SAV-AIR AS A SELF-SUSTAINING BUSINESS	SAV-AIR has created a complete business plan, including a revenue analysis. They are currently seeking major funding to continue their growth pattern.	SAV-AIR is at a critical juncture in their business development. Major funding will accelerate development, delivery and growth; minor funding will put them on a much lower curve. Both can be considered successful for SAV-AIR, but acceleration has more value to the region for energy savings.

Another type of early indicator is the reactions of the beta site customer to SAV-AIR. It is yet too early to tell if the management and data systems will continue to run smoothly, if any problems will be resolved, or if customer

interest will in fact be sustained. However, initial indicators are very positive. The key points of the first beta results are:

- The customer is pleased with data timeliness, finds the data very useful, and is satisfied with the reporting format and overall service.
- The customer is certain that there are major energy benefits, but is not focused on non-energy benefits (as discussed above).
- The customer and corporate management are zealously working to develop additional SAV-AIR projects.
- The customer is using SAV-AIR management information when considering any changes to their compressed air system.
- The customer is using compressed air information and cost data to manage plant air use and is pursing additional compressed air training for staff due to SAV-AIR.

End-use and Compressed Air Challenge Survey

A total of 25 compressed air end-user surveys were conducted in March and April 2000. The overall purpose of this survey was to obtain information on compressed air management practices, what influences changes in compressed air system management, and what barriers there might be to making improvements. There were also questions about training, including the *Compressed Air Challenge* (CAC).

The general indications are that there is an actual, but not a perceived, need for the types of services that SAV-AIR offers among most of their potential customers. Although 96% thought that compressed air was expensive, only 24% had any idea what their compressed air costs were. Few have heard of SAV-AIR, and many were skeptical of the value of the approach. Thirty percent of respondents had some kind of service contract for compressed air, but only one-third of those contracts included efficiency services.

Only facilities with a total plant air compressor capacity of 150 horsepower or more were interviewed. Most of the respondents were in the wood products and pulp & paper, chemicals and aerospace/high technology industries. These industries comprised more than two-thirds of the total survey. About half of the respondents identified themselves with the job title of maintenance supervisor.

Respondents were asked about their top objectives in managing their compressed air system. The top two-thirds of replies included maintaining continuous operation, ensuring adequate supply of air, and maintaining air quality.

The respondents were most influenced to make improvements in their compressed air system by direct experience from within their own company, from a vendor, or by articles or advertisements in a professional publication.

No budget, focus on production, not enough staff time, and lack of training were the top four barriers cited to effective operation of a compressed air system, encompassing 69% of all the responses.

Some insights into the demand-side of compressed air efficiency and optimization services were investigated. Nearly one-third of respondents said that they had been approached by one or more companies offering optimization services.

Additional Information was also gathered on the *Compressed Air Challenge* (CAC). As part of the customer and vendor interviews, we asked follow-up questions about *Compressed Air Challenge* and the *Level I* training program. These questions largely paralleled those asked of experts in MPER #1. Experts and customers who know CAC continue to have a favorable impression towards it, but most customers are unaware of the program. It is most significant to note that several CAC participants are taking major action due to participation. These have included major capital expenditures ($125,000 worth of changes expected to save $54,000 per year), installing blowers for cleaning tools, installing a timed solenoid valve instead of constant drain, and modifications to distribution piping. Additional details are incorporated into the issue discussion below, and also in a later section devoted to a full discussion of the survey results.

E. Issues and Recommendations

Issues and recommendations for both SAV-AIR and *Compressed Air Challenge* are summarized here in approximate order of significance. Those issues that are essentially similar to those made in *MPER #1* are not included. Detailed descriptions of *Issues and Recommendations* are provided in Section V.

SAV-AIR Issues and Recommendations

Issue: Support of SAV-AIR for Alliance Market Transformation

SAV-AIR is at a financial crossroads – their ability to solicit the right type of investment capital and other financial support will allow accelerated growth and fulfillment of the market transformation goals of the Alliance. It is recommended that continued support of SAV-AIR by the Alliance will assist them in pursuing their accelerated growth path rather than a more limited curve.

Issue: Maintaining Financial Momentum

SAV-AIR still has a need to demonstrate their technology, gain experience and credibility, and generate revenues. The original goals for SAV-AIR might now be supplanted by the immediate need of closing sales. SAV-AIR should pursue the most direct course that allows them immediate opportunities to demonstrate their technology. That is, implementation of *Phase II – System Optimization* and *Phase III – Ongoing Monitoring* where savings are accrued and can be documented.

Issue: Conversion of System Optimization to Ongoing Monitoring

It is not yet clear that all customers that eventually purchase the *Phase II* services of *System Optimization* will also eventually contract for *Phase III – Ongoing Monitoring*. Sales of ongoing services are critical to the goals of the Alliance for savings persistence, and are an important revenue source for SAV-AIR. SAV-AIR should consider contract structures that make it more likely that ongoing monitoring is part of each system installation.

Issue: SAV-AIR Marketing Contacts

SAV-AIR has made numerous contacts and a number of *Phase I* and *Phase II* sales outside of their original beta commitments to the Alliance. SAV-AIR has relied to date primarily on high-level corporate contacts and introductions for their services. Although it may not appear absolutely necessary in the short run, it will eventually be valuable to close sales based on inquiries originating at various levels within an organization.

Issue: Non-energy Benefit Documentation

Documentation of non-energy benefits are essential for cost-effectivity, both for the Alliance, SAV-AIR's sales, and perhaps more importantly, for the customer themselves. Although most customers are likely to justify capital investments like SAV-AIR based on the energy cost savings alone, it may often be the non-energy benefits that engender real support from hands-on staff in maintenance and operations. Although no strong conclusions can be made yet about non-energy benefits, we believe that they are significant and can be described eventually.

Issue: Marketing Materials Development

The SAV-AIR marketing materials provide good basic communication about the tool, but their sales approach needs to better articulate bottom-line results. Excessively technical material is for engineering staff and should be directed only at that audience. It is recommended that SAV-AIR improve the case study to address potential customers at different organizational levels and consider working with a marketing consultant to give their sales materials a professional polish and depth of content appropriate to the target audience.

Issue: Compressed Air Economic Analysis Tool (Airmonics)

SAV-AIR has developed a simple tool for compressed air economic analysis called *Airmonics*. SAV-AIR should consider calculating energy cost savings by using coincident demand savings, total energy savings, and incremental rates for both demand and energy.

Compressed Air Challenge Issues and Recommendations

Issue: Lack of information about CAC on the Energy Ideas Clearinghouse Web Site

The *Energy Ideas Clearinghouse* (EIC) is also an Alliance program. However, links between the CAC and EIC web site should be improved, and the event calendar for the EIC doesn't list all scheduled classes.

Issue: Supporting Implementation of the CAC System Approach at the Plant Level

The CAC *Level I* class conveys fundamental compressed air information and sound compressed air management practices. It provides students with application tools such as a seven-step action plan for implementing the systems-approach in their plants. Yet some survey respondents expressed concerns about information learned in the classroom ever getting implemented at the plant. To help solve this problem, the classes should also include an action plan and materials for selling the systems-approach to management.

I. SAV-AIR Effort and Status

A. Overview

The Northwest Energy Efficiency Alliance (the Alliance) is a non-profit group of electric utilities, state governments, public interest groups, and industry representatives committed to bringing affordable, energy-efficient products and services to the marketplace. The *SAV-AIR Market Transformation Initiative* was undertaken by the Alliance to change the way compressed air end-users and service providers view and manage their systems, and in doing so achieve not only energy efficiency-related benefits, but also non-energy benefits such as increased system reliability. The Alliance and the SAV-AIR team want SAV-AIR to evolve into a self-sustaining business that will continue this work into the future. SAV-AIR, LLC was formed in 1997, and was selected by the Alliance in December 1998, as one of its ventures. SAV-AIR's formal contract with the Alliance began in December 1998, and will continue through December 2000, with ongoing commitments by SAV-AIR for demonstration of their approach through December 2001.

SAV-AIR provides integrated compressed air management systems and engineering services. The SAV-AIR approach includes remote monitoring and control of compressed air systems involving sensors, computers and software. They have expertise and specialized technology to evaluate existing equipment, engineer upgrades, and provide ongoing monitoring and control of an entire compressed air system. The result is increased compressed air system reliability, decreased compressed air costs, and management information for verification and decision-making.

The current SAV-AIR service approach is comprised of three delivery phases.[3]

- **Phase I – Performance Evaluation**

  The current status of the compressed air system is determined with detailed metering and analysis, and recommendations are made for optimization.

[3] Note that SAV-AIR has condensed to this current three-phase approach from five original steps.

- **Phase II – System Optimization**

  This includes SAV-AIR system installation for monitoring and control along with other recommended system improvements.

- **Phase III – Ongoing Services**

  This includes ongoing monitoring, troubleshooting, and consulting to provide continued system optimization for the maintenance of energy savings and reliability.

Over the period of January to August 2000 covered in this report, SAV-AIR has diligently and enthusiastically worked toward meeting the goals of the Alliance and establishing a successful business of managing and optimizing industrial compressed air systems. Despite their best efforts, the length of the sales cycle for SAV-AIR services remains a major concern. SAV-AIR is still working to bring five of the original six beta demonstration sites past the *Phase I – Performance Evaluation* to implementation of *Phase II – System Optimization*.

Major milestones achieved by SAV-AIR during this period are the first completed installation of the SAV-AIR system at a beta site; the SAV-AIR demonstration site is operational and contributing to product development and marketing; portable *Survey Kits* have been developed and deployed to facilitate *Phase I* assessments; and capabilities are being added to the SAV-AIR software, including control of centrifugal air compressors.

SAV-AIR has completed a successful demonstration project at one of their beta sites, with energy savings beyond predicted outcomes and with very high customer satisfaction. SAV-AIR's work at this first demonstration site has lead to a flurry of activity within that organization, with a commitment for financial support beyond the basic sales agreements. They also have a significant commitment from a major electric utility for financial support to provide their compressed air management services to industrial customers throughout the utility's service territory. Although each plant must buy into this project individually, there is support from the corporate energy manager, the engineering manager, the purchasing manager, and the manufacturing manager.

It is expected that a commitment from a major Northwest electric utility to work with SAV-AIR on energy efficiency for the utility's customers will benefit SAV-AIR in this market. The initial focus will be on a wood products firm with eight

facilities. This came out of a three-way understanding (not a contract) between the utility, the wood products firm, and SAV-AIR. If the projects are implemented before August 2001, there is also an approximate 50% grant available to support implementation costs. The volume of work that SAV-AIR will be able to do under this utility agreement is limited only to the number of the utility's customers that SAV-AIR can bring to the table – it could include many other projects.

SAV-AIR currently has the software and systems in place to control any type of positive-displacement compressor, including reciprocating and screw machines. They are now working to add control of centrifugal compressors to their capability, to encompass all types of air compressors used in industry.

In order to support the current and expected increase in services, SAV-AIR has contracted with a number of local consultants with particular expertise in industrial compressed air and efficiency improvements. They will use the prototype site for training, and the *Survey Kits* as necessary for a cost-effective and uniform approach to data collection and analysis.

The SAV-AIR approach has demonstrated energy benefits at the first beta site. Although non-energy benefits are undoubtedly real and important, plant personnel at their single current customer do not appear to attach significance to them. At this particular plant, personnel are predominantly interested in quantifiable energy benefits and not in hard-to-quantify non-energy benefits that may be present.

SAV-AIR's work with their first beta site in the wood products industry has created interest from other firms in the same field (reported by SAV-AIR). As this industry has both cooperative and competitive aspects concurrently, many firms watch each other for new technological approaches to gain small competitive advantages. It is too early to tell what might come of this interest, but early inquiries are still an indication of awareness and potential success.

The completion of the prototype site and implementation of the first beta site have improved SAV-AIR's credibility in the market. Improvements in SAV-AIR's marketing materials and development of an initial case study are also useful in providing impressions of stability and competence.

B. SAV-AIR Market Activity

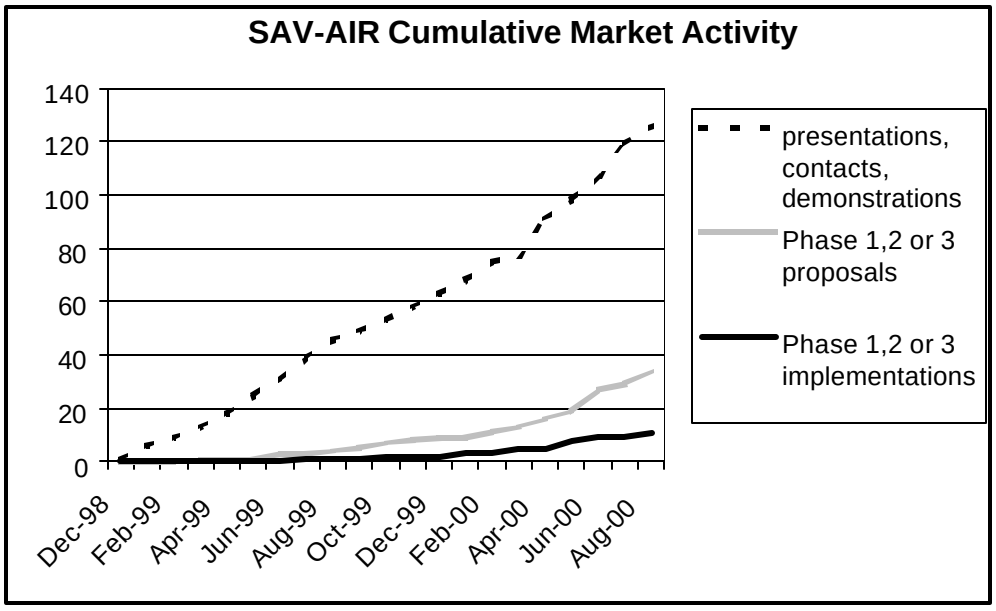
Interest in the SAV-AIR approach is increasing dramatically over time, with recent activity linked to their successful demonstration project. Diffusion of new technology is often exponential once there is concrete action, and SAV-AIR appears to fit this pattern. There have been substantial increases in the number of presentations, proposals, and implementations by SAV-AIR in the last six months, as compared to the previous fifteen. *Table 1* below gives an overall picture of SAV-AIR's beta and non-beta activity by *Activity Phase*. The table gives an overall picture of SAV-AIR's beta and non-beta activities, with "beta" indicating those projects selected specifically for demonstration under the Alliance initiative and "non-beta" those projects which are not in this group. "In Process" indicates projects that are in negotiation or waiting for a customer decision.

Table - 1: Current SAV-AIR Activity

PHASE	BETA		NON-BETA	
	Implemented	In Process	Implemented	In Process
PHASE I – PERFORMANCE EVALUATION	5	1	0	2
PHASE II – SYSTEM OPTIMIZATION	1	2	0	0
PHASE III – ONGOING SERVICES	0	0	0	0

SAV-AIR provided a document that described the tracking of all their marketing activities since the beginning of their contract with the Alliance. Their marketing contacts, presentations, and demonstrations were totaled over time, as were their proposals and implementations for *Phases I* through *III* of the SAV-AIR approach. Each of these values was totaled in a cumulative sum over the entire twenty-month period. These were graphed, as shown in *Figure 1*, and also analyzed for overall activity rate.

Figure - 1: SAV-AIR Cumulative Market Activity



March 2000 was chosen to represent an inflection point, as this is when the first beta installation of the *Phase II – System Optimization* occurred. The average monthly rate of market activity in each of the categories described above was determined for the first fifteen months and for the most recent six.

In each of the market activity categories, the rate has increased substantially, up markedly for presentations, proposals, and implementations. The results are shown in *Table 2*. As for many businesses, it appears that numerous presentations are needed to feed the pipeline of projects.

Table - 2: SAV-AIR Market Activity Trend

MARKET ACTIVITY	MONTHLY AVERAGE FIRST 15 MONTHS	MONTHLY AVERAGE LAST 6 MONTHS
PRESENTATIONS, CONTACTS, DEMONSTRATIONS	5.0	8.5
PHASE I, II OR II PROPOSALS	0.7	3.8

PHASE I, II OR III IMPLEMENTATIONS	0.2	1.3

C. Updated Status of Beta Sites

As described in MPER #1, the intention for SAV-AIR and the Alliance is for the beta projects to formally demonstrate the capability of the SAV-AIR approach and for SAV-AIR to gain market experience and credibility. Implementation at the beta sites is partially supported by Alliance funding (cost share is described below).

The initial considerations for beta site selection were to have leveraging capability, to demonstrable non-energy benefits, and to have industry and geographic diversity to meet the interests of the Alliance.

"Time-to-market" for the SAV-AIR approach has been long, due to the internal decision processes of initial clients. Budgeting the required expenditures for SAV-AIR, the difficult justification of upgrades to systems currently perceived as adequate, and a focus on production have kept potential customers from moving forward as expected.

The desire for market leverage is for each beta project to translate to broader interest and more projects, both within a corporate organization and to other firms in the same industry. Each of these leveraging paths has already been demonstrated in the case of the wood products industry.

The intention for demonstrable non-energy benefits is met in a variety of ways, typically differently for each particular potential beta site. Some beta sites may have equipment problems with their compressed air, so that the upgrades associated with a SAV-AIR project and the engineering skills inherit in the SAV-AIR team are attractive. For others, operational or management difficulties may be remedied by implementation of the *SAV-AIR System Optimization*.

The Alliance and SAV-AIR selected six beta sites as potential demonstration projects. *Table 3* below summarizes the status of each of these.

Table - 3: Status of Beta Sites

BETA SITE	SITE DESCRIPTION	STATUS
1	Wood Products	*Phase II* implemented *Phase III* in negotiation
2	Mineral Mill	*Phase I* implemented *Phase II* in negotiation
3	Hard Rock Mine	*Phase I* implemented (may not proceed)
4	Transportation Equipment	*Phase I* implemented *Phase II* in negotiation
5	Food Processor	*Phase I* implemented *Phase II* in negotiation
6	Wood Products B (Replaced Semiconductor)	*Phase I* agreement in negotiation

One project has had a full implementation of *Phase II – System Optimization*. For this site, *Phase III* for *Ongoing Monitoring* is being negotiated. Four sites have had a detailed *Phase I* evaluation and three of these have outstanding proposals under consideration for *Phase II*. One of the earlier selected sites, Beta 2, the Hard Rock Mine, may not proceed, due to limitations in capital and the length of time they may remain in business. Another, Beta 6, the Semiconductor Plant, has been withdrawn and replaced with another wood products manufacturer. This site is currently considering a proposal for SAV-AIR to perform a *Phase I* evaluation at their plant.

Of the fifteen active prospects (including these beta sites), ten are in the wood products industry and five are with one particular wood products firm. Although this may not be aligned with the industry and geographic diversity interests of either SAV-AIR or the Alliance, they are "live" prospects – they are asking for proposals and responding. While SAV-AIR's initial agreement with the Alliance called for projects in several industries, SAV-AIR does not have any internal concerns about working in a single industry, especially at this point in their growth. The wood products industry has terrific potential and is close at hand throughout the region. They feel that establishing a beachhead in

this industry will make a major contribution to the success of SAV-AIR in the long run.

It is not unusual for a new technology to initially focus on one or a handful of industries, to learn the language and develop a prominent market position. It may take significant additional effort to break into each industry, and at this point, SAV-AIR must concern themselves with establishing financial viability.

Beta 1: Wood Products Manufacturer

SAV-AIR has completed *Phase II – System Optimization* with excellent results (described in detail below) and is currently negotiating to go ahead with *Phase III* monitoring. Both the client and SAV-AIR want to structure the monitoring cost so that it is related to savings. Recent discussions about the monitoring contract focus on the length of the contract and service frequency. There has been a detailed case study prepared for this project, which is being used for marketing.

Although the plant superintendent does not feel that there are important non-energy benefits, the SAV-AIR team believes that already the plant has experienced some decrease in air system component maintenance costs and maintenance attention.

From their experience of working with this client on *Phase III*, SAV-AIR has developed approaches to sell monitoring services that they believe will make it more valuable and palatable to customers. They have also determined some possible pricing structures that relate the cost of *Phase III* monitoring to potential additional savings, perhaps by identifying and correcting leaks, or for modifying end-uses. Remote diagnosis, problem correction before process impacts, and customized data management would be additional advantages to the monitoring.

Beta 2: Mineral Mill

A *Phase I* evaluation has been performed for this site and a proposal for implementing *Phase II* has been presented. Although their current compressed air system has substantial costs and problems, this customer is progressing slowly on decisions for a major system upgrade. This could be a problem, as

the summer construction window closed for the substantial outdoor work required for this project. Management changes are delaying decisions on this project, and the sales activity of various compressor manufacturers may also be contributing to indecision on the part of the customer.

Beta 3: Hard Rock Mine

A *Phase I* evaluation has been performed for this site and a proposal for implementing *Phase II* has been presented. Although this project has very significant benefits from installing the SAV-AIR system, the customer does not have the capital for even this highly leveraged project (four parts incentive to one part customer contribution). Additionally confounding the situation is the fact that there may be only two more years of cost-effective extraction left in the ore body at this location. This means that investments into plant systems are not being considered unless absolutely necessary.

The results from this mining-related project support previous research indicating that mining is an exceedingly difficult industry in which to achieve long-term investments in efficiency. [4]

Beta 4: Transportation Equipment Manufacturer

A *Phase I* evaluation has been performed for this site and a proposal for implementing *Phase II* has been presented. Although the decision-making on this project on the part of the customer was extremely slow, and perhaps even suspended for a time, very recently this customer has shown renewed interest by asking for recalculated savings values. This may indicate that they are reconsidering the project and that they may eventually move forward. This project is particularly attractive as the customer is interested in SAV-AIR for monitoring and control of system pressure for manufacturing quality (ISO 9000).

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[4] Pacific Energy Associates, Inc., *Drive Power Initiative – Market Progress Evaluation Report #1*, for The Northwest Energy Efficiency Alliance. Portland, OR, November 30, 1999.

Beta 5: Food Processing Facility

For this major food processor, the *Phase I – Performance Evaluation* has been completed and *Phase II* is in negotiation. The evaluation showed substantial benefits to the customer for implementing *Phase II*. Consultants retained by corporate headquarters reviewed the SAV-AIR proposal and highly recommended implementing the project; management has supported it. There have yet been no positive decisions for going ahead with this project because the plant has been purchased and all capital improvements are on hold.

Beta 6: Wood Products Manufacturer B (was Semiconductor Plant)

Beta 6 was originally a semiconductor plant (it was described in detail in MPER #1). This potential customer had such a focus on their core business that they felt improving the management of the in-house compressed air utility and reducing the costs associated with that utility were unimportant. An alternative wood products manufacturer was selected to replace this potential beta. This wood products company has been recently distracted by other major plant projects and it is not clear when they may move forward. This beta, if they do not move forward, may again be replaced by one of the currently non-beta sites, noted below, that are more progressive.

A *Phase I* agreement is in negotiation with this Oregon wood products manufacturer. This firm has made an internal and external commitment to sustainability in its operations and it was felt that they would quickly embrace the SAV-AIR advantage of improving management of their compressed air system. The leveraging capability of an additional wood products manufacturer for SAV-AIR is not particularly significant, but the non-energy benefits potential of being a part of this firm's sustainability commitment could be attractive.

D. Other Selected Non-Beta Achievements to Date

Oregon Cable Manufacturer

This customer has successfully applied for an *Oregon Business Energy Tax Credit* for implementation of SAV-AIR *Phase II* at their facility. Their plant

consists of about 350 horsepower of air compressors. The serving utility has made a contribution to the *Phase I* evaluation and analysis costs, and the customer has just agreed to move forward on *Phase II*.

Oregon Wood Products Manufacturer C

This potential customer is currently distracted by major regulatory issues and is not expected to make a decision on the SAV-AIR system anytime soon.

Oregon Wood Products Manufacturer D

This wood products firm operates a very large multi-product plant with an old and difficult-to-manage compressed air system of 1,725 horsepower. They have been considering an upgrade to their system for two years and so are very ready to move forward. The serving utility has just provided funding for SAV-AIR to go ahead with a *Phase I* evaluation.

Oregon Wood Products Manufacturer, E, F & G Plants

These three large wood products manufacturing plants, located in Oregon (one with installed air compressor capacity of 1,550 horsepower), have just received *Phase I* funding authorization from the serving electric utility.

E. Impact of the Addition of Compressed Air System Control

SAV-AIR was initially conceived primarily as a management information tool, working with existing controls and air system managers to improve overall efficiency. However, their initial customers insisted that SAV-AIR take full control of their compressed air system, and completely integrating those features to their software and hardware took several months.

It appears that many customers take substantial time to separate the functions of an internal utility like compressed air from their process. They often ask for the SAV-AIR system to be compatible with their existing process control systems. Once they understand that they have always expected compressed air to be

constantly available and managed to support their production, they then often relax requirements for control compatibility.

Of course, the customer needs to have ultimate control over the SAV-AIR automated controls. Most of the time, this is provided by a *manual/auto/ off* setting on the SAV-AIR control panel. Manual reversion to an existing electromechanical control system is usually the backup control means provided. Customers also need to have independent control for maintenance purposes. Many industrial plants have existing automated controls for their process and use them for supervision, control, and monitoring. Eventually SAV-AIR software will allow customers to pull compressed air performance data into their own computerized process control systems, but this is months away.

F. Updated Status of Prototype Site

SAV-AIR has made their prototype site a flexible test bed for their internal needs, and is beginning to exploit its use as a demonstration and marketing tool. The prototype test site remains a valuable test bed for both hardware and software systems. It has been used for marketing to potential investors and customers.

There are a few other examples of concrete advantages of the prototype site: SAV-AIR's new survey kits have had extensive testing and refinement at the site (the survey kits are described below). A potential consulting partner came on board because of impressions made by demonstration at the site, and he provided introductions to a customer and their serving utility. The ability to demonstrate a real product, working in real time, to utilities or others gives SAV-AIR significant credibility.

The importance of a flexible, independent testing facility for the SAV-AIR hardware and software should be emphasized. A physical test bed is necessary to field proof these complex systems and ancillary equipment. With the prototype, no customer needs to be the guinea pig for a new flow sensor, nor would a compressor run to meet a testing need for SAV-AIR.

G. Status of Survey Kit

SAV-AIR has developed portable survey kits to be used for their *Phase I* data collection and *Performance Evaluation*. The portable survey kits collect real-time compressed air operation and use data essential for evaluating system performance and the potential savings from the SAV-AIR *Phase II – System Optimization*. The survey kits collect and record air pressure and flow rates, and document compressor energy use. SAV-AIR currently has four kits with a single data-logger, and one of the most recent versions that contains three data-loggers. These kits have significant advantages over the piecemeal assembly of data recording equipment used to gather information from their first customers, and also will eventually be used by compressed air auditors working with SAV-AIR. As the time of this writing, all the survey kits are being used in the field on potential projects.

H. First Installed Beta Results

The Plant Superintendent for a wood products plant in Oregon was interviewed in person at the end of June 2000, regarding the recent implementation of a SAV-AIR *Phase II* project for *System Optimization*. At the time of the interview, the SAV-AIR system had been operating for several months. The interview results below are summarized from the survey instrument (included as *Appendix B*).

The plant maintenance supervisor was also briefly interviewed by telephone in August 2000. That interview was intended to gather information on his impression of non-energy benefits. A summary of his comments is included at the end of the superintendent's remarks.

Plant Description

The three air compressors in this large veneer plant and lumber mill are oil-flooded screw machines of 150, 200, and 300 horsepower. All three machines are run as needed to meet plant air needs, with only two machines typically needed at one time. The plant currently runs two to three shifts a day, seven days a week.

The plant superintendent for many years has regarded compressed air as the most expensive energy source in their plant. They have known the approximate cost since 1985, due to testing by their electric utility and through other surveys on the compressed air system.

Compressed Air System Management and Maintenance

The corporate purchasing manager's recommendation was the main reason the plant superintendent decided to work with SAV-AIR.

Before working with SAV-AIR, their management approach for the compressed air system was described by the plant superintendent as chaotic. They basically tried to listen for leaks and close them down. They also have tried to use hydraulics in lieu of compressed air as much as possible and to get maintenance staff to shut down unused compressed air systems.

Before working with SAV-AIR, their primary objective in managing their compressed air system was to control costs. However, their system was always operated manually, and this approach was inadequate for both cost control and in meeting plant air needs. Other management objectives for their system included maintaining continuous operation and ensuring adequate supply of air to end-uses.

The SAV-AIR monitoring system reports on leaks and system status – why each compressor is running (or not running) at any particular time. The system has been tuned to run efficiently and provide plant air at the right pressure and volume.

Probably the most significant finding during this interview was regarding changes to their practices for managing their compressed air system since they started working with SAV-AIR, as well as their use of the SAV-AIR control system. The plant superintendent said: *"Yes [there have been changes]. We don't worry about it at all. Do the maintenance and the system operation takes care of itself. The system is self-sufficient. It has relieved staff of some duties."* This can be contrasted with the statements of the plant maintenance supervisor at the end of this summary.

For this customer, the change in practices is related to working with SAV-AIR. Because of SAV-AIR, they no longer need to give the same level of attention to operating their compressed air system.

A number of compressed air management approaches and tools were described to the beta customer to find out if they were already doing them before working with SAV-AIR, if they planned to start doing them in the future, and whether these decisions were a result of working with SAV-AIR.

Some compressed air management approaches are viewed as essentially the same as before SAV-AIR was involved in their plant. For example, they did both long- and short-term monitoring of air compressor energy use (or current draw), working often with their serving utility. They also did some estimation of their compressed air costs, which due to SAV-AIR, they can now monitor much more accurately.

Other compressed air management approaches have changed in the plant since working with SAV-AIR. This includes leak detection, tracking compressed air costs, improvements in control strategies, and analysis and decision-making.

SAV-AIR has introduced this customer to using ultrasonic leak detection sensors. Previously, they were limited to finding larger leaks by simply listening for them when the plant was shut down. Now they can find smaller leaks, even when the plant is running at capacity (these plants are very noisy and generally require hearing protection). They can also now more reasonably prioritize leak repair for those that are quickest to fix.

As mentioned, before SAV-AIR, they were able to do rough estimates of compressed air costs, often with the help of their serving utility. This has been substantially improved in accuracy and is consistently available. The additional flow metering now allows them to assign compressed air usage and costs to individual plant demands and operational practices. For example, they were able to identify that some areas and shifts were using compressed air for plant cleanup. The plant supervisor then reminded personnel to use the backpack blowers (the same as those used for garden sweeping) that were acquired for this purpose some time before.

Prior to SAV-AIR, the manual control of their compressed air system was inadequate on many occasions. Compressors that needed to be on when the plant restarted were sometimes forgotten, and thus production was halted while

compressors were started and the system came up to pressure. Air compressors that should have been turned off during weekends were often inadvertently left on. System pressure variations regularly required maintenance attention. None of this manual control or maintenance attention is required any longer.

Analysis to justify improving compressed air operations and maintenance was performed before, but it was mostly based on experience and rule-of-thumb, whereas now the analysis can be more formal and precise. In fact, the improved data sometimes allows the plant personnel to take no action because they have firmer knowledge that the compressed air system can adequately meet demands.

The plant staff performed some simple compressed air monitoring before working with SAV-AIR and also worked with their serving electric utility to determine air and the electric usage. They are now considering trying the SAV-AIR long-term monitoring and management services, perhaps for a trial period of six months to a year.

Interestingly, besides their serving utility, there is no other resource, such as case studies, consultants, vendors, or peer groups that influences them to adopt new compressed air management tools or approaches. Now, of course, SAV-AIR is such an influence.

If a compressed air improvement works well for this plant, the superintendent said it was very likely that their company would implement it in other plants.

Before working with SAV-AIR, the barriers faced in getting the plant's compressed air system to run more efficiently included not having a complete understanding of the system's operation. With the manual controls that were used before SAV-AIR was in place, they found it nearly impossible to implement any operations plan for their system.

The plant superintendent cited that there are a number of barriers to more effective operation of their compressed air system. He feels that working with SAV-AIR has, or will help address all of these barriers. Their serving utility is also being very helpful. The barriers mentioned are listed below (the three most significant are listed first):

- Lack of information about the performance of the system

- Lack of technical expertise
- Lack of accountability for the compressed air systems or costs
- Efficiency measures are too expensive
- Focus is on production
- Lack of management buy-in.

The main recommendations for system improvement and optimization that SAV-AIR has made include installing receivers in the right places, using ultrasound for leaks, and most importantly, an air dryer upgrade. The dryer is important as their modern processing equipment needs dry air year around; with the limited capability of their current dryers, their air lines occasionally freeze or cause moisture damage. They have installed the receivers and use the ultrasonic leak detection, and will eventually implement the air dryer recommendation.

Besides what was recommended and implemented by SAV-AIR, other changes are being made to achieve system optimization, including training staff on the SAV-AIR system so that they can monitor and manipulate the controls on their own. This familiarity will also help them assign compressed air costs.

The plant superintendent was satisfied with the SAV-AIR control panel and software, and did not suggest any changes.

In addition to providing compressed air management information and energy cost savings, the SAV-AIR system has some other benefits to the beta customer's plant and production. According to the plant superintendent, these benefits include safety in fire system sprinklers, pressure charging, and keeping even air pressure in the plant so that variations won't affect production. Previously there was too much air pressure at times and seals would blow on some production equipment. He felt that there were two equal benefits – cost control and exactly enough air [volume and pressure] is produced. The non-energy benefit that the superintendent notes as most significant is that they can now have some complacency or a more relaxed state of concern regarding their compressed air system.

So far, SAV-AIR has given the customer useful information about system function, system efficiency, and opportunities for improvement. SAV-AIR's

periodic reports on the compressed air system are useful and appropriate for plant needs.

The plant superintendent felt that the SAV-AIR team was generally easy to work with.

He also felt that the SAV-AIR team has the skills and knowledge to meet their needs for compressed air system management.

Although the SAV-AIR team has provided estimates of the energy benefits of their *Phase II – System Optimization*, the plant manager is withholding final judgment about the savings. They are still monitoring the savings by working with both SAV-AIR and their utility, as well as checking on their own.

The plant superintendent said that he was satisfied with SAV-AIR and would recommend their services without hesitation to other plants in his organization, as well as to colleagues at other companies.

So far, the plant superintendent liked the cost savings best about SAV-AIR's services and he has no particular concerns or questions about SAV-AIR.

Training

Training for plant maintenance and operations staff on compressed air systems is usually accomplished in-house and through vendor training courses. Regarding training, the plant superintendent feels that some classes are pretty good, while some do not provide enough material, and others too much. Because training needs to be at the right level and often isn't, he has become gun-shy about training classes. The superintendent has not heard of the *Compressed Air Challenge*.

Other Issues

Other comments made by the plant superintendent were that the SAV-AIR system took a little longer to install than expected; it is their first wood products plant and they are learning. There is some comfort that SAV-AIR left their manual controls in place so they can revert to manual operation if needed.

He also said that their serving utility has transmission and distribution savings as a benefit from this project. Reducing the load at this large wood products plant is an advantage to them in postponing needed line expansions. Their utility is still watching the savings to justify the utility's planned credit toward the SAV-AIR system costs.

Maintenance Supervisor Interview

As mentioned earlier, the plant maintenance supervisor was also interviewed briefly by telephone in August 2000. That interview was intended to gather information on his impression of non-energy benefits. A summary of his comments is provided below.

When asked about his general impressions of the SAV-AIR system, he said that SAV-AIR is still working on the software program for their system to make it completely automated. At this point, when there is a power blip, their entire system goes back to manual mode. (It is likely that the incidents are actually caused by a compressor problem alarm rather than a power-quality event.) *"When there is a power blip all three [compressors] come on in manual, and when this happens there can be moisture problems."* (The moisture problems may be exacerbated by inappropriate valve settings. A new version of the SAV-AIR software will soon be installed to overcome this, and SAV-AIR has recommended automatic valving to help.)

Regarding operational benefits of the SAV-AIR system, the maintenance supervisor said, *"Can't say there is a difference. You can see where it's going to work real good in the end, once they get the program perfected. What it truly does for us, when there is not a demand for air, it turns the air compressors off. Now there is definitely more pressure variation [at the compressors, as they charge the receivers] between 75 to 90 psig. [There is] no maintenance cost difference and there is no difference in the [metered run hours on the compressors] due to running seven days a week."* (Note that the metered analysis by SAV-AIR suggests that for two compressors, the runtime is significantly reduced.)

Regarding maintenance costs, the maintenance supervisor said: *"No less attention is required by maintenance with SAV-AIR in place. We are getting [to] where we rely on that SAV-AIR thing; we use it to indicate air leaks. SAV-AIR has brought in airless blow down and has helped in sizing*

a replacement oil cooler for one compressor. Now [there is] less seal blowing [in actuators] with this lower pressures and more constant air pressure. Couldn't say a number right now [on reduction of blown seals]. The SAV-AIR system has picked out some of the problems with their air system, now have those problems cured. [There is a] more continuous load on the compressors with the new receivers. The units do shut off."

I. Summary of First Beta Savings

The three air compressors in this large veneer plant and lumber mill total 550 horsepower. All three machines are run as required to meet plant air needs, with only two machines typically necessary to meet plant air requirements. The plant currently runs two to three shifts a day, seven days a week.

The air distribution system is complex, with a bi-directional airline joining the two facilities. The three air compressors are in two different locations in the plant. Problems with the air system included large random fluctuations in pressure, poor air dryer performance, and no system operating information. The compressors used throttling to meet varying air loads.

The SAV-AIR system included airflow, power and pressure sensors, and a new intermediate controller managed by the SAV-AIR system directly. Their recommendations for installing new air receivers and correcting a variety of other problems throughout the plant were followed.

The actual measured power cost of the compressed air system before installing SAV-AIR's system was $175,000 annually. With the *SAV-AIR System Optimization* in place, the actual measured power cost is $120,000 annually, a savings of $55,000.

According to the plant superintendent and the maintenance supervisor, there have been no significant changes in maintenance costs. However, there has been a substantial reduction in operating hours for the compressors. During an eight-day (192 hour) trial in April, the operating hours of each compressor were monitored. During the eight-day period without the SAV-AIR system operating, each of the machines ran almost constantly. After the SAV-AIR system was in use, operating hours for two of the machines were reduced 35% and 90%, as shown in *Table 4*. Depending on the type of maintenance

required for each air compressor, this reduction in hours should translate directly to reduced maintenance costs.

Table - 4: Beta 1 Compressor Operating Hours

COMPRESSOR	BEFORE SAV-AIR HOURS	DUTY CYCLE	AFTER SAV-AIR HOURS	DUTY CYCLE	PERCENT REDUCTION
150 HP	190	99%	19	10%	-90%
200 HP	192	100%	190	99%	-1%
300 HP	192	100%	124	65%	-35%

J. SAV-AIR Funding Sources and Matching Funds

The contract between the Alliance and SAV-AIR calls for cost sharing of *development costs* and *implementation costs.* The apparent intention of cost sharing for implementation costs is to ensure that on average, beta site customers pay for at least one-half of the cost of installing SAV-AIR in their facilities. The apparent intention of cost sharing for *development costs* is for SAV-AIR (essentially its stockholding owners) to furnish no less than one-half of the costs for developing the SAV-AIR technology and products.

Thus, the overall result of cost sharing appears to mean that up to one-half of all development and implementation costs are to be financially supported by the Alliance.

Some of the customer contributions toward one-half of the implementation costs have been made through in-kind means, which could be maintenance labor, management labor, equipment, or other direct costs. Some of the contributions that SAV-AIR is including as a customer contribution include the *Oregon Business Energy Tax Credit* and incentive payments by the serving utility.

For cost sharing of implementation costs, there is only one fully implemented beta project to consider. The information available to PEA shows that for this

one project with a total implementation cost of $100,000, the customer contribution was $57,450, or 57%. In this case, the customer contribution included maintenance labor, management labor, equipment, other direct costs, and a substantial incentive payment by the serving utility.

For cost sharing of development costs, the information available to PEA provided only an overall picture of implementation and development costs together. To date, SAV-AIR has billed the Alliance for $1.589 million, while showing total *implementation cost* contributions of $108,275 and total *development cost* contributions of $414,570. The implementation costs include two projects that are not beta sites. As only one has been fully implemented, no customer cash payments are included. The contributions included besides those from the customer are maintenance labor, management labor, equipment, other direct costs, and incentive payments by the serving utilities.

This information is incomplete and it also attempts to track a moving target with several beta and non-beta customers in the pipeline and implementation costs not yet determined. The inclusion of utility incentive payments and potential *Business Energy Tax Credits* also is not formally described in the contract as a customer contribution. Still, at this point in time, the overall cost share is one-for-three (or 25%) rather than one-for-one (or 50%) as per the contract as interpreted by PEA.

It is important to note that, if SAV-AIR develops a number of non-beta, non-subsidized sites in the next few months, the Alliance portion of costs is likely to diminish significantly. At least four such projects have just recently received the go-ahead for *Phase I*.

K. Review of Marketing Materials

PEA reviewed SAV-AIR's marketing materials, including the marketing brochure, a one-page marketing flyer, the SAV-AIR web site, several SAV-AIR customer proposals, and relevant content of the revised business plan. As with any small organization in new product development, these materials are being revised constantly in order to keep up with SAV-AIR's concept of their products and services, and an evolving understanding of who their customers are. This review is thus a snapshot and is intended to bring to bear our

suggestions on concepts and approaches rather than to criticize. Details of this review are included in *Appendix C*, an overview is provided here.

Marketing Brochure

SAV-AIR might consider further refining the marketing brochure, working with a marketing consultant and graphic designer. We envision that the marketing consultant would work with the team on all their marketing materials and coordinate with both the graphic and website designers. The brochure, as well as other marketing materials, needs to speak to the perspective and concerns of staff at multiple organizational levels.

Customer Proposals

We reviewed one of the SAV-AIR marketing proposals to get a sense of the tone and approach they are taking. The particular proposal we read is now a year old and obviously they have been refined since that time. Nevertheless, some of the general observations about this proposal might still apply. We saw significant opportunities to sharpen the sales approach and provide clearer and easier-to-assimilate information on bottom-line benefits. These are detailed in *Appendix C*.

Business Plan

The review of the business plan concerned the sections and elements that address the SAV-AIR marketing strategy and approach. Details of this review are in *Appendix C*, with a brief summary of the critical points below:

- The number of customers within the SAV-AIR target market could be more refined.
- SAV-AIR might consider offering some form of sponsorship or support to CAC.
- SAV-AIR might consider carefully how to use utilities for funding, given the nature of deregulation.

- The business plan might more clearly describe plans to have other companies and service providers use SAV-AIR tools and offer SAV-AIR services.

- The business plan should include a strategy to prevail over potential competitors.

II. SAV-AIR Cost Effectivity Update

A. Introduction

As part of the review of SAV-AIR in its business trajectory and the potential impact of the program in the market, this evaluation also revisits the assumptions upon which the program's cost-effectiveness is based.[5] This is a joint effort undertaken by SAV-AIR and PEA in that both entities provided data to help gauge the energy savings potential of compressed air optimization, the total potential market, and the likelihood of this market to adopt the service. Primarily relying on the *SAV-AIR Business Plan Draft Document*, dated July 12, 2000, recommendations were developed for revising the program assumptions to reflect actual conditions and projections of market share and energy savings impacts through the year 2010.

The adoption of any recommendations to revise cost-effectivity calculations should be the result of collective decision-making by the Alliance, SAV-AIR, and PEA.

B. Cost-Effectiveness Assumptions

Cost-effectiveness assumptions refer to those assumptions that directly impact the overall estimates of program viability. The initial inputs shown in *Table 5* relate to the total size of the market

[5] The initial assumptions and cost-effectiveness estimates are based on work by the Alliance and the original proposal for the *SAV-AIR Master Plan*.

Table - 5: Total Market Cost-Effectiveness Inputs

COST-EFFECTIVENESS INPUTS	
UNIT	Medium Compressed Air System Optimization
TOTAL NUMBER OF UNITS	938
MEASURE LIFETIME YEARS	10 years
NON-ENERGY BENEFITS SAVINGS/YEAR	$0 (assumed, although clearly non-zero)
COMPRESSED AIR EFFICIENCY IMPROVEMENT	25%
COMPRESSED AIR EFFICIENCY SAVINGS/FACILITY/ YEAR (KWH/YEAR)	918,979
ONGOING SERVICES COST/FACILITY/YEAR	$14,400
CAPITAL COSTS	$36,200

Program expenditures are also included in cost-effectiveness assumptions and are presented below in *Table 6* for each of the years of the venture. These are approximate values based on the best information available. The costs should be revised to reflect actual invoiced amounts.

Table - 6: Program Cost Inputs

INPUT CATEGORY	1999	2000	2001
TOTAL ALLIANCE PROJECT COSTS	$943,200	$851,600	Not yet determined
ALLIANCE EVALUATION	$46,700	$78,100	$75,000

Impact Estimates

At the time of proposal adoption, it was assumed that of the proposed 938 total potential facilities, 381 would be appropriate candidates for *SAV-AIR System Optimization*, which would result in 40 average megawatts (AMW) of savings during the period through 2010.

Baseline

The original cost-effectivity analysis assumed that there were 938 medium-sized industrial compressed air facilities in the Northwest, each with an average of 750 horsepower installed capacity. It was assumed that each had the potential for efficiency improvement of 25%. The total annual electricity use for compressed air in the Northwest was estimated to be 3,400 million kWh. As mentioned above, the proposal estimated that 381 sites would encompass the total market penetration through 2010 for SAV-AIR.

Recommendations for Changes to Assumptions

Based on this analysis by PEA and the *Business Plan by SAV-AIR*, this section presents recommendations for changes to be made to the baseline and to the original cost-effectiveness assumptions presented in *Table 6*. All recommendations are presented in *Table 7* below.

Table - 7: Summary of Recommendations for Changes to Assumptions

INPUT	ORIGINAL ASSUMPTION	RECOMMENDATION
UNIT	One Industrial Air Compressor System *(average of medium facility, 750 HP)*	One Industrial Air Compressor System *(average of market-size facility, 870 HP)*
ESTIMATED TOTAL NUMBER OF UNITS	938	800
MEASURE LIFETIME, YEARS	10	10
NON-ENERGY BENEFITS	None considered	None yet quantified
ANNUAL O&M COST	$14,400	$16,800
CAPITAL COST	$36,200	$119,234
MEASURE SAVINGS, KWH/YEAR	918,979	1,015,600
TREATED UNITS, 1999-2000	6	2
TREATED UNITS, 2001-2010	375	565

Note that the business plan describes six distinct revenue stream units. These are *Performance Evaluation, System Optimization, Ongoing Services, Training, Related Engineering,* and *Related Equipment*. The two units of interest for this cost-effectivity work are *System Optimization*, as it relates capital cost and annual savings, and *Ongoing Services*, as it relates to maintenance costs.

From work by Xenergy on the Northwest electric motor market,[6] it was estimated that there are a total of about 800 industrial compressed air plants with over 400 installed horsepower in the Northwest. It was also estimated from US DOE data that the average size of the compressed air plant in these facilities was 870 horsepower and that their average efficiency improvement was equivalent to the savings obtained at the first demonstration project. The savings there were 32% of compressed air energy, or 1,299,792 kWh/year for 600 total horsepower of air compressors. Under these assumptions, the total annual market savings applicable in the Northwest was estimated to be approximately 172 average MW. Measure life in the original cost-effectivity analysis was confirmed against a number of measure life studies.

The *Draft Business Plan* assumes that SAV-AIR is financed or otherwise financially supported to pursue the higher of two potential growth trajectories that allows sales of 567 units in the Northwest.

Market Size

A task for the evaluation team was to develop an estimate of the market size for *SAV-AIR System Optimization* services. This was adapted from several sources, notably the *SAV-AIR Business Plan* and the Xenergy motor study for the Northwest region.

[6] Xenergy and Easton Consultants, *Assessment of Industrial Motor Systems Market Opportunities in the Pacific Northwest*, for The Northwest Energy Efficiency Alliance. Portland, OR, November 2, 1999.

Average Facility

The original cost-effectivity assumption was that the market unit was an industrial compressed air system that was the "average of medium facilities." SAV-AIR, according to their *Business Plan*, applies more appropriately to larger facilities with multiple compressors of greater than 500 total horsepower. Although the "average medium" facility was assumed by the Alliance to be 750 HP, it may be a point of confusion. Given this, it is recommended that the description of *unit* be changed to the "average of market-size facility."

Number of Technically Appropriate Facilities

As previously stated, the number of technically appropriate facilities was reduced to 800, rather than the originally proposed number of 938, as a result of additional market analysis and due to refinement of the market unit.

Costs

Capital Costs

The capital cost presented in *Table 7* is from an estimate made for SAV-AIR monitoring equipment and some compressed air system improvements. Experience with the first beta site indicates that this equipment may not always be sufficient. The costs for *System Optimization* in this facility were approximately $100,000. The SAV-AIR business plan uses an average cost for all facilities of $119,234. This average is the current recommended value.

Operations and Maintenance Costs

Operations and maintenance costs are to be paid by the facilities for keeping equipment up to date, in tune with current compressed air costs, and to ensure savings persistence. The estimated costs of the ongoing monitoring services are estimated in the *Business Plan* as an average value of $16,800, rather than $14,400 as previously used.

Lifetime of Measure

The lifetime of the measure is still assumed to be ten years.

Savings

The savings from the pilot project have been estimated at 32% of compressed air costs of 1,299,972 kWh annually. If the original savings figure of 25% were to be used as a conservative value, a revised annual savings value of 1,015,600 kWh could be seen.

Non-Energy Benefits

It may be difficult to quantify non-energy benefits for this venture. It is recommended that non-energy benefits continue to be monitored at the pilot project and other sites where *SAV-AIR System Optimization* is implemented.

Market Baseline

The market characterization conducted in MPER #1 and in this report suggested that there is no significant competition to the unique *SAV-AIR System Optimization* product in the Northwest region at this time. Should either real or perceived competition begin operating in the region, the share of the market for SAV-AIR will be diminished. In this case, the penetration for SAV-AIR will be smaller, and thus the energy savings reduced as well. However, if competing products also have similar energy benefits, the overall savings accrued in the region will be similar. Note that market entry by competitors is considered a sign of market transformation and should be regarded as positive.

III. Market Information Update

A. Introduction

A number of different elements make up this section, which updates information on the compressed air market. First and foremost is a summary of 25 compressed air end-user interviews prepared for this evaluation. Also included is a summary of a Xenergy *Compressed Air Market Assessment* performed for the *Compressed Air Challenge* and a brief description of a compressed air persistence study being carried out in California. The last element is a brief description of potential and perceived competitors to SAV-AIR.

Our primary conclusions from these new materials are that:

> Awareness and action to address compressed air efficiency among customers are relatively rare.

> In prioritizing action for their plants, personnel are not necessarily focused on the issues that can provide the most energy savings.

> There is a real, if not perceived, need for the type of services that SAV-AIR provides.

> The persistence study indicates that customers value metered information, and there are problems with efficiency efforts that don't provide measurement.

> As expected, awareness levels for SAV-AIR are very low, or at least were early in the year.

> Compressed air system problems lead to significant and frequent production interruptions, a potentially lucrative target for SAV-AIR.

B. Summary of 25 Compressed Air End-User Interviews

A total of 25 compressed air end-user surveys were conducted in March and April 2000. The original contact list came from a variety of sources including: customers previously contacted for other surveys, a list from BPA of very large

customers, information from Mark Kendall of Oregon Office of Energy, and referrals from earlier SAV-AIR expert interview subjects. As described in the *Compressed Air Challenge* results, this list was appended with attendees of the *CAC Level I* training to ensure that the needs of that portion of the survey instrument were also met. Note that the CAC survey included 27 total respondents, as several did not meet the screening requirements for the end-user survey. By chance, one of the respondents was a SAV-AIR beta site. This sample of 25 is a reasonable size for this qualitative summary but no particular statistically significant conclusions can be drawn from this data.

The overall purpose of this survey was to obtain information on compressed air management practices, what influences changes in compressed air system management, and what barriers there might be to making improvements. There were also questions about training, including the *Compressed Air Challenge*, that are covered in a later section of this report. This survey is also a baseline (actually, the first survey) to determine if compressed air end-users recognize SAV-AIR's products and services – and if so, if they see them as credible, unbiased, and technically accurate.

The general indications are that there is an actual, but not a perceived, need for the types of services that SAV-AIR offers among most of their potential customers. Although 96% thought that compressed air was expensive, only 24% had any idea what their compressed air costs were. Few had heard of SAV-AIR, and many were skeptical of the value of the approach.

The telephone survey used contact names when they were available and otherwise asked for the person responsible for operation of the plant's compressed air system. The respondents were assured of confidentiality except for reporting in summary fashion to the Alliance. *Tables 8* through *10* describe the distribution of the respondents according to geographic location (state), industry, and job title. The contact list appears to have provided a very reasonable distribution of each of these variables.

Table - 8: Geographic Distribution

OREGON	IDAHO	MONTANA	WASHINGTON
8	5	3	9

Table - 9: Industry Distribution

AERO-SPACE/ HIGH-TECH	CHEMI-CAL	FOOD	GLASS	MINER-ALS/ MINING	PAPER	STEEL	WOOD PROD-UCTS
3	4	2	2	2	5	1	6

Table - 10: Job Title Distribution

ENGINEER	MAINTENANCE SUPERVISOR	MILLWRIGHT	PLANT OPERATOR	PRODUCTION MANAGER
6	13	2	3	1

Only personnel in facilities with a total plant air compressor capacity of 150 horsepower or more were interviewed, with the largest plant having a total of 11,000 horsepower in four compressors. The average air compressor total plant capacity was just over 1,800 horsepower (1,823 HP). Nine of the plants had total capacity of less than 1,000 horsepower, and six facilities had 2,000 or more horsepower of air compression.

The average number of air compressors in the respondents' facilities was just over five (5.4), with a minimum of two compressors and a maximum of twelve compressors per plant.

Respondents were asked three questions about compressed air costs in their plant: *"Do you regard compressed air as an expensive part of your operations?" "Do you have a rough idea of how much of your electric bill comes from compressed air?"* and *"Would it be useful to your company to know your compressed air costs?"* Although 96% agreed that compressed air was expensive, only 24% had any idea what the costs were as a portion of their bill. And of those that answered the third question, only 62% thought it would be useful. Reasons were given such as:

> *Probably – not sure anyone would really care other than the engineers.*

> *The plant engineer knows these numbers.*

> *So management would see what it is costing.*

> *I know they (compressors) waste energy because they run all the time. It's useful to know, good information.*

> *He thinks the company knows this because it is useful to understand all expenses.*

> *It would help justify attention being paid to it.*

> *Probably – I don't get into the monetary.*

> *Shows how much is spent. Gets someone's attention.*

> *The company knows the percent of the electric bill but he doesn't know off hand.*

> *To some degree. It would help increase output.*

> *Would help justify cost savings projects.*

And for the question regarding knowledge compressed air costs, when reasons why it would not be useful were provided:

> *It is a very small part of the overall costs.*

> *It is not useful to me personally.*

> *Insignificant portion of electric costs.*

> *Not useful for me but for others in the company.*

> *Doesn't make any difference how much it costs.*

> *Don't know – there is not a lot of waste.*

> *Just take care of the system.*

Respondents were asked: *"What would you say are the objectives in managing your compressed air system?"* and were read a list of potential objectives. They were then asked to pick the top two objectives. *Table 11* below describes their responses.

Table - 11: Compressed Air System Management Objectives

POTENTIAL OBJECTIVE	NUMBER	PERCENT
MAINTAIN CONTINUOUS OPERATION	14	29%
ENSURE ADEQUATE SUPPLY OF AIR TO END-USES	12	24%
MAINTAIN QUALITY OF AIR SUPPLIED (CLEAN AND DRY AIR)	7	14%
ENSURE SYSTEM RELIABILITY	4	8%
IMPROVE SAFETY	4	8%
REDUCE MAINTENANCE AND REPAIR FOR PROCESS MACHINERY	4	8%
CONTROL OR REDUCE ENERGY COSTS/ENERGY USE	3	6%
REDUCE MAINTENANCE AND REPAIR OF THE COMPRESSED AIR SYSTEM	1	2%
IMPROVED OR INCREASED PRODUCTION (FEWER REJECTS)	0	0%
REDUCE CAPITAL COSTS (FEWER COMPRESSORS REQUIRED)	0	0%
MEET PROCESS QUALITY STANDARDS	0	0%

In response to: *"Do you use any long-term or short-term monitoring to help you manage your compressed air system?"* 68% of those we contacted have some sort of monitoring program. The respondents provided descriptions of a wide a range of monitoring activities, many involved with preventive maintenance:

> *Continuously monitor air pressure and dew point.*

> *Regular oil samples, monitor air quality of instrument air, and regular vibration analysis.*

> *System gauges are read. Monitor motor power, air temp, oil, and flow.*

> *Record gauge readings regularly (logged manually).* He alluded to their supplier gathering information to review and evaluate also.

> *Record gauge readings hourly (three of them).*

> *Because they can't have any large fluctuations and must deliver the air at 84 +/- 1/2 psig, they monitor closely using a combination of Intellution (monitoring software) and ConservAIR (intermediate controller). They monitor temperature, pressure, and current throughout the system.*

> *They monitor 10 points: 6 points for pressure and 4 points for flow. Done in-house.*

> *Monitor with gauges on the system and do oil analysis routinely.*

> *Oil analysis, vibration analysis, and regular preventive maintenance.*

> *Periodically monitor air pressure and flows to look for variations in usage. No disciplined program.*

> *Vibration analysis by a contractor, dew point and other parameters internally.*

> *Continuous vibration monitoring; monitor system pressures, temperatures and water flow every eight hours in house, contractor does quarterly vibration analysis.*

> *Monitoring by SAV-AIR (actually only a Phase I evaluation).*

> *Monitor readings daily and record them.*

> *Charts and gauges and pressure switches. Done in house.*

> *Check plant meters daily to make sure the plant is not using more than it should.*

> *He takes readings off of the pressure chart.*

When asked: *"Do you have a regular leak detection routine or program in place at your facility?"* 48% responded "yes." Their comments about their leak detection program were:

> *Listen for leaks when plant is shut down on Saturday.*

> *Once a year Rogers comes in.*

> *They do since CAC.*

> *The compressors are big and old and so they work on leaks all the time.*

> *Leak detection is just listening for air leaks when the mill has shut down for the day.*

> *Ultrasound.*

> *When the mill shuts down they listen for leaks and use ultrasonic listening devices.*

> *Twice a year a firm comes in to check for leaks.*

As leak repair does not always follow from detecting air leaks, the respondents were also asked: *"If at anytime leaks are detected, is there a leak repair routine or program?"* To this 80% answered "yes." Their additional comments on leak repair included:

> *Fix them as soon as I find them.*

> *But it could be six months down stream before we are allowed to fix the leak. Systems usually can't be down.*

> *Process safety management must repair with in five days or if not critical it is put in place to fix in 15 days.*

> *They fix to the degree it affects production.*

> *We repair them when they are found.*

> *Identify the leaks when found and incorporate fix with maintenance down days. One day once per week they are down for maintenance.*

> *Repair small ones when found and write a work order for the large ones for later repair.*

> *They either repair them immediately, if possible or mark them for a later repair and write a work order.*

> *They fix right away when found or schedule for later.*

> *They repair as found.*

> *When leaks are identified they write up a work order to have them repaired.*

> *Write up work order if can't be fixed on the spot.*

> *Yes a work order system is in place to replace or fix the equipment or hose.*

> *Leaks are repaired when practical.*

Table 12 below is a ranked list of the respondents reply to: *"What activities do you think would most help to improve the overall operation of your compressed air system?"* The respondents selected the top two from the list. Newer compressors and improving control strategies were seen as the most attractive improvements to their systems, while leak detection, maintenance, and distribution piping improvements take the next three spots. These five operation improvements included 80% of all responses.

Table - 12: Operation Improvement Responses

OPERATION IMPROVEMENT	NUMBER	PERCENT
BUY NEW, BETTER, MORE RELIABLE AND EFFICIENT COMPRESSORS	6	20%
IMPROVING CONTROL STRATEGIES	6	20%
DETECTING LEAKS	4	13%
PERFORMING REGULARLY SCHEDULED MAINTENANCE	4	13%
IMPROVING DISTRIBUTION PIPING	4	13%
TESTING AND REPLACING WATER TRAPS	2	7%
REPLACING AIR FILTERS	1	3%
REPAIRING LEAKS	1	3%
MONITORING COMPRESSOR MOTOR LOAD OR CURRENT	1	3%
REPAIRING FAILED EQUIPMENT	1	3%

The respondents were most influenced by direct experience from within their own company or from a vendor. The question asked was: *"What influences you the most in terms of adopting a new compressed air strategy?"* Also important were articles or ads in professional publications. The Internet was not an important source of information, and case studies were ranked only about half as influential as the first three. *(See Table 13.)*

Comments received regarding respondents' influences on their compressed air strategy included:

> *They tend to use all of the above.*

> *He doesn't get involved in it and is satisfied with the way it is. Not looking for new strategies.*

> *They are greatly influenced when they get the savings promised, also by utility incentive programs, and corporate support.*

Table - 13: Compressed Air Strategy Influences

INFLUENCE	NUMBER	PERCENT
EXPERIENCE FROM WITHIN YOUR COMPANY THROUGH A PILOT PROJECT	10	21%
VENDOR'S RECOMMENDATIONS	10	21%
ARTICLES OR ADVERTISEMENTS IN A PROFESSIONAL PUBLICATION	10	21%
HEARING ABOUT ANOTHER COMPANIES SUCCESS THROUGH CASE STUDIES	5	10%
CONSULTANT RECOMMENDATIONS	5	10%
OTHER SOURCES	5	10%
WEB SITES	2	4%
BOOKS	1	2%

The influence that they might have on the compressed air strategy of others in their company was also assessed by asking: *"If a compressed air improvement that works well for you, how likely is it that your company would implement it in other plants?" (See Table 14.)*

Table - 14: Likelihood of CA Strategy Referral

RESPONSE	NUMBER	PERCENT
VERY LIKELY	8	40%
SOMEWHAT LIKELY	7	35%
NOT AT ALL LIKELY	3	15%
DON'T KNOW	2	10%

Comments that go along with the *"Somewhat likely"* and *"Not at all likely"* responses include:

> *Plants are pretty independent.*

> *Depends on the plant needs.*

> *Every one does things their own way. Philosophy is changing however.*

> *Plants are independent from one another.*

> *Plants are independent.*

A list of barriers was read to the respondents with the question: *"What barriers do you face in getting your compressed air system to run more effectively?"* The respondents were asked to select the top two barriers to effective operation. *Table 15* shows their responses.

No budget, focus on production, not enough staff time, and lack of training, as the top four barriers, cover 69% of all the responses. Although *"Efficiency measures are too expensive"* and *"payback restrictions are too short"* were examples read to the respondents, these were not chosen. In fact, *"None"* was selected by several respondents.

Table - 15: Barriers to Effective CA System Operation

BARRIER	NUMBER	PERCENT
NO BUDGET FOR ACTIVITIES RELATED TO IMPROVED EFFICIENCY	11	29%
FOCUS IS ON PRODUCTION	7	18%
NOT ENOUGH STAFF TIME	4	11%
LACK OF TRAINING	4	11%
NONE	4	11%
LACK OF MANAGEMENT BUY-IN	3	8%
LACK OF TECHNICAL EXPERTISE	3	8%
LACK OF ACCOUNTABILITY FOR THE COMPRESSED AIR SYSTEMS OR COSTS	2	5%

C. Efficiency and Optimization Services

Some insights into the demand-side of compressed air efficiency and optimization services were investigated in the next few questions. The respondents were asked: *"In the last year, have any vendors approached your company to sell services to optimize or reduce energy costs in your compressed air systems?"* Of all respondents, 29% said that one or more companies had approached them. Of those responding positively, they were also asked the kinds of companies that approached them. *Table 16* summarizes those results.

Table - 16: Type of Company Offering Efficiency

TYPE OF COMPANY	NUMBER	PERCENT
INDEPENDENT CONSULTANT OR CONTRACTOR	6	33%
COMPRESSED AIR EQUIPMENT VENDOR	5	28%
ENERGY SERVICE COMPANY	4	22%
OEM EQUIPMENT VENDOR	2	11%
CONTROLS COMPANY	1	6%

Note: This table tallies multiple responses.

Two of the seven, or 28%, that had been approached did purchase the service. One did this because they needed the equipment and the other did it for energy savings and because they had capital to buy a new compressor but wanted to make a smart choice with their money. They wanted to improve control strategies and not just buy the biggest compressor money could buy.

When asked if they had heard about SAV-AIR before this survey, only two of the 25 had heard about SAV-AIR. (Note that, by chance, one of the respondents was a SAV-AIR beta site).

The respondents were read a very brief and generic description of the SAV-AIR compressed air management services. They were then asked if the SAV-AIR approach sounded like it might be useful for their facility. Replying "yes" were 54% of respondents, "don't know" 3 %, and "no" 15%. The remaining

28% didn't feel that SAV-AIR would be useful. Some of the comments for the "no" responses included:

> *Other than leak detection, they already do what they need to do with monitoring. But this would be more useful after we implement our new improvements.*

> *They don't buy outside services for something they already do.*

Comments for the "don't know" responses included:

> *Could be. It depends on hearing more and management buy-in.*

> *Maybe, Compressed air is a minor part of our bill with steam the other big expense.*

> *Don't know. It depends. Need to know more.*

Comments for the "yes" responses included:

> *Lower manufacturing costs and improve operation.*

> *Send information on the approach.*

> *Save money and save down time.*

> *Would need to get more information. Convert use into power consumption.*

> *The plant engineer would be the person making this decision.*

D. Summary of Xenergy CAC Market Assessment

A recent study (April 13, 2000) that was performed by Xenergy for the *Compressed Air Challenge* has many results of interest to the SAV-AIR evaluation. In particular, the *"Assessment of the Market for Compressed Air Efficiency Services"* describes demand-side and supply-side efficiency. A copy of the report was provided to PEA by the Alliance. Some highlights from the demand-side findings of this study were:

- Customer awareness of, and concern for compressed air efficiency is low, with only 17% mentioning efficiency as a management objective.

- Maintenance of consistent, reliable compressed air supply is the principal objective of system management for 71% of respondents.

- A large portion of customers report serious problems in compressed air system operation and maintenance, including 35% that reported they had experienced unscheduled compressed air system shutdowns during the previous year. For 60% of these, the shut down lasted for two days or more. This is a very significant level of plant problems and a potentially lucrative target for SAV-AIR.

- Thirty percent of respondents have service contracts for compressed air, but only one-third of those contracts included efficiency.

- Only 35% of customers say that they have leak prevention programs.

Some highlights from the supply-side findings of the study were:

- Over three-quarters of distributors offer some compressed air efficiency services, but these services contribute a minor 4% of total revenues from these sectors.

- Over one-half of respondents feel that the demand for compressed air efficiency services has increased over the past year.

- Most distributors (45%) identified customers' lack of understanding of compressed air efficiency as a major barrier to increased sales of these services.

E. Summary of a Compressed Air Persistence Study

Two interviews were conducted in March and July 2000 with Proctor Engineering regarding an ongoing industrial compressed air monitoring project. This work has some interesting parallels to the SAV-AIR concept. It also provides a "management tool" by communicating actual monitored compressed cost and operational information to plant staff and management along with

recommendations for improvements. These improvements include changes to setpoints or operational parameters that offer savings potential. Subsequent cost and operation information, provided approximately monthly, will give plant staff direct feedback on their actions.

Summary

A report to be completed in late Fall 2000 will describe an industrial compressed air monitoring project as a follow-up to implementation of efficiency measures funded by utilities. Five sites have successful monitoring with complete instrumentation.

The study found that none of the compressed air systems were operating at or near the level that was indicated by previous evaluations, nor were they achieving the full savings expected of the implemented measures. There are large opportunities for savings in both energy use and demand. It appears that savings degradation also occurs due to reintroduction of standard inefficient practices, staff turnover, increased leakage, and equipment disrepair. These findings would appear to re-enforce the value of a permanent monitoring, diagnostic, and control system like SAV-AIR.

Research questions of interest include obtaining an understanding of the relationship between management knowledge and commitment to an air management program and other measures of persistence for industrial compressed air efficiency.

Details

Six industrial sites have had monitoring equipment installed on their compressed air systems. Monitored values include airflow and compressor energy use and operation settings (no pressure was monitored). Five sites are working well and one has had some problems in data collection. Initially the study wanted to understand from the monitoring if savings were being achieved from the utility-financed projects. However, no baseline for comparison was available, and so the project will use their initial monitored data as a baseline and compare it to changes that occur from now on.

The data is summarized using proprietary software; particular days are selected to show good examples of what needs correction. For all cases, they provide standard operation flow and kW demand and leakage, as well as CFM per kW. They also provide an operating cost estimate for each compressor.

All plants had utility-funded compressed air measures installed and none were performing as expected. When the project was begun, complete pre-data, retrofit, and post-data were thought to be available. But in actuality, it turned out that no pre/post data had been recorded. The retrofits implemented in the plants were thought to be in the best interest of the system, but it appears no one really knows what the effects were. In some cases, it is clear that the measures are not working well, while in other cases it is only believed that the measure is working – there is no actual information. Most of the end-users agree that they don't really know the retrofit that was installed. New estimates for each plant suggest that significant additional savings are available – 15% to 20% in compressed air energy costs

The engineering behind the retrofits seemed to be well intended and competent, but there was no feedback in measurement and operation, so the retrofits often missed the mark in terms of particular need, operation style, or usage in the plant. One of the most common problems was that the engineering was done for a static flow, but for the most part, these plants have a highly dynamic flow that the systems are not flexible in dealing with.

Other issues that have impacted savings are staff changes that effect leakage and leak repair, and compressed air system maintenance. Turnover has lead to neglect of existing programs. Also, each facility has a different problem and requires a different approach to management and improvement in their compressed air system.

When sufficient baseline data is gathered, the monitoring contractor will show plant personnel the baseline operation and observe if the management makes changes. They will provide leakage rates, kW demand (some plants have peaking problems), kWh energy usage, and recommend changes to control strategies. The monitoring also determines the efficiency of compressor systems in terms of kW per CFM. The data will be presented approximately monthly by mail with the initial presentation done in person. There will be enough detail (through the use of fifteen-minute interval data) to show some production

interaction problems. Calibration of sensors was performed before installation, but no ongoing calibration will be done.

Only two of the plants had a basic idea of how their compressor systems were operating. Five of the six have already made a capital equipment decision based on the data provided by this effort. For example, the flow capacity of a new a dryer has been sized, based on monitored data. One of the plants has used the data to remove a compressor from service and another has used data to add a compressor. Although the plant managers can look at the data directly, none of the plant staff have opted for that. They want the results summarized and they want to know what to do. They now can make decisions based on facts rather than estimates; they want a tool rather than the data itself. Formerly, they just guessed.

Monitored data on compressed air leakage has shown that two plants were very tight – below 10% leakage – and they knew it prior to monitoring. Two other plants had leakage rates of 50%, and they did not know it. The two remaining plants had moderate leakage rates, but also didn't realize that they were losing air and capacity. One of the plants with large leaks has already instituted a leakage reduction plan and reduced their rate down to 25% in only one month. The monitored data will allow them to correlate hours spent on leakage reduction to reduced costs.

None of the plants were under capacity in terms of air compressors. The recommendations under consideration now are changes in controls. Most of the fixes were very inexpensive. Only one plant has a major capital improvement in the works. One has electric demand peaks, so taking a peak reduction approach with their three compressors is a possibility.

Not all plants have the training and ability to fully implement the changes that were recommended. Everyone in management can understand the data and make decisions using it, but getting the changes actually implemented on the plant floor is another question. Most plants can't handle general instructions, especially when it requires a carefully made adjustment. The attitude, *"I'm not going to screw with it unless I'm ordered to,"* is common.

Of particular interest to SAV-AIR might be that all of the plants said that they are very interested in buying the monitoring equipment being used (it is now being leased for the project). Whereas formerly these companies did not pay

attention to compressed air, they do not want to lose the monitoring capability they have gained. When times are good they worry about production and staffing. When times are tough, they will know how to control one of their significant variable costs – compressed air. They expressed a desire to buy equipment because they can get data when they need it.

Some of the principal failures to managing compressed air in these plants have included:

- A new, efficient 300 HP compressor was run lead-lag with an older, inefficient compressor. It was done that way on a two-week cycle to give maintenance plenty of opportunity to change the oil and filters in each unit. The monitoring has showed the costs of doing this.

- The question of, *"Why is plant pressure set the way it is?"* is often answered with, *"A really smart guy sixteen years ago set pressure and everything has worked fine since."*

- One plant has five manually controlled 125 HP compressors feeding a common header from multiple locations. It was typical to find all or most of the machines running at times, even when only one or two was needed. Note that this plant was not monitored because of perceived difficulty in using the Interlane monitoring system for multiple compressor locations.

- One plant is running a late night shift for four hours a day with very low airflows. To meet airflow requirements, they have a 75 HP compressor running at very poor efficiency. At their costs they are spending $15,000 per year for compressed air for that shift. Managers may be reluctant to shift production schedules because of compressed air costs – this may be an opportunity once information on compressed air management is provided.

- Eventually one of the plants may put in blowers instead of using compressed air for one end-use. Another may use a "backup" 40 HP compressor instead of a newer, more efficient 75 HP unit because they don't need all the air and costs are lower when supply and demand are better matched.

- Another plant may install a recommended retrofit of undersized compressed air lines for a grinder operation. This would reduce a requirement for a higher plant pressure, and obtain significant savings.

- It is also interesting to note that although three of the plants have ultrasonic leak detectors, the staff at two of the plants don't know how to use them.

F. Competition Summary

The market for SAV-AIR's services is significant and large, with no major competitors working in the regional market. *Table 17* below is a summary of competitors to SAV-AIR. In general, all of them market to the same type of customers: industrial facilities that have significant use of compressed air. Depending on the firm, there appears to be some segmentation according to industry group, and also some focus on particular geographic areas.

None of these firms appear to offer exactly the services, technology, and capability that SAV-AIR does. The closest appears to be Bay Controls. A number of firms offer demand expanders or some type of intermediate pressure controller.

Some of the firms concentrate on offering to particular industries and geographic regions. Bay Controls appears to sell primarily to the automotive industry that is located near its Ohio location. Sarlin is the only firm that clearly has been active in the pulp & paper and wood products industry where SAV-AIR is concentrating their first efforts.

Table - 17: Regional, Perceived, and Actual Competitors to SAV-AIR 04-19-00

FIRM	PRODUCT/SERVICE	COMMENT	COMPETITIVE
BAY CONTROLS – MAUMEE, OH	*BayWatch* remote monitoring, monitoring systems, compressor controls	Wide range of comprehen-sive products/services, heavy in the automotive industry	Regional-N Perceived-N Actual-Y
SARLIN – MARIETTA, GA & FINLAND	Sarlin Balance	Demand expander, measurements, system audits. Active in pulp & paper, wood products	Regional-Y Perceived-Y Actual-Y
HONEYWELL – VARIOUS, U.S.	*XCEED*, system audits, system surveys	Demand expander & controls *(see APT)*	Regional-Y Perceived-Y Actual-Y
APT – ANNAPOLIS JUNCTION, MD	Compressor controls, system controls, system audits	Owned by Honeywell	Regional-N Perceived-N Actual-N
AIROMETRIX MANUFACTURING – DENVER, CO	Airometrix	One-time detailed measurement for compressor performance and leak measurement	Regional-Y Perceived-Y Actual-N
INGERSOLL RAND	SCADA and Internet monitoring	Monitoring is focused on predictive maintenance	Regional-Y Perceived-N Actual-N
CONSERV AIR – KENOSHA, WI	ConservAIR	Pressure/flow controller (may also be developing compressor controls)	Regional-Y Perceived-Y Actual-N
ZEKS – WEST CHESTER, PA	XpandAIR and TargetAir	Demand expander & controls	Regional-N Perceived-N Actual-N
AUDITAIR – MARKHAM, ON	AuditAir	One-time measurements and detailed system audit	Regional-N Perceived-N Actual-N
AIR TECHNOLOGIES – COLUMBUS, OH	MonitAIR, ManagAIR, and DirectAIR	Software and guarantee service, compressed air surveys	Regional-N Perceived-N Actual-N
COMPRESSOR CONTROLS CORPORATION – DES MOINES, IA	Turbomachinery control packages – worldwide market	Focus on large centrifugal machines but do have some positive displacement controls	Regional-N Perceived-N Actual-N

Airometrix has created a program (sponsored by utilities) using their patented metering device and the Internet. A compressed air user would get the meter free if they keep checking their equipment for three years and entering periodic data into the Airometrix web site.

The last column of *Table 17* summarizes PEA's opinions about the competitive nature of each firm. The column indicates an opinion about three competition areas: if the firm is competitive in the Northwest region (Oregon, Washington, Idaho, and Montana); if the firm might be perceived by compressed air end-users to be offering a similar product; and finally, if we believe that they are an actually competitor to SAV-AIR. These opinions were not determined through end-user or market actor interviews and so may not accurately reflect competitive stance.

III. Market Information Update

IV. Compressed Air Challenge Update

A. Introduction

PEA performed a related, but independent study assessing the training programs of the *Compressed Air Challenge* (CAC), a national effort to encourage compressed air system optimization through promotion, training, certification, and improved information on equipment efficiency. A complete description of CAC is provided in *Appendix D* of the first MPER. As part of PEA's interviews for the SAV-AIR evaluation, we asked questions focusing on the CAC training.

PEA considered whether the *Compressed Air Challenge* is affecting how industrial customers with large compressed air systems think about and manage their compressed air systems. It is important to examine CAC's effect on large industrial customers because SAV-AIR targets this market sector. It is necessary to understand how the impact of CAC may in turn affect perceptions of SAV-AIR. This second MPER includes results of 27 end-user telephone surveys on their opinion of the CAC training. These surveys were a portion of the end-user surveys also described in this report.

Ninety-two percent of the class participants interviewed responded positively regarding their *Level I* class experience. No outstanding criticisms were made about the class content. Although there were a few negative comments (such as needing to hold the class in a nicer location), there were no repeated concerns or issues that would indicate problems. The interviews also revealed that the *Level I* class raised the awareness of the majority of the participants regarding the cost of compressed air and the importance of fixing leaks. Evidence that the class motivates participants to act is probably the most important success indicator for market transformation. Seventy-five percent of those attending the class said that they made, or are in the process of making, improvements to their compressed air system because of what they learned in the class.

B. CAC Evaluation Approach and Methodology

PEA's evaluation of the CAC for the second MPER includes gathering, reporting, and synthesizing information, and making observations based on the following activities:

- Conducting telephone interviews with 27 compressed air end-users throughout the Northwest region
- Reviewing the CAC web site
- Reviewing the current state of CAC class offerings in the Northwest.

PEA's survey inquiries for CAC consisted of seven questions within the larger SAV-AIR market study survey instrument. The questions were specifically developed to evaluate the CAC's *Level I* training program in the Northwest region, as well as to ascertain participant expectations for a more advanced class. A copy of the survey instrument is provided in *Appendix A*.

C. Key Findings from CAC Surveys

The following highlights the findings from the survey of 27 compressed air end-users. The highlights are divided into the following categories:

- Awareness of the Program and Training Courses
- Suggested Improvements for the *Level I Training Course*
- Impact of the *Level I Training Course*
- Expectations for the *Level II Training Class*

Awareness of Program and *Level I Training Course* Among End-users

As the interviewing process for gathering information from major compressed air end-users progressed, it became apparent that few of the selected population of end-users were aware of the CAC program and the *Level I* training course. Only one individual had heard of CAC and, although he did not participate in a class, someone else in his company had attended. In order to ensure that we obtained adequate feedback on the CAC program, we added twelve class participant names to the list of interviewees. Thus of the 27 end users surveyed, 13 had heard of CAC and 12 had participated in a class.

Improvements for the *Level I Training Course*

All twelve of the class participants answered the question on how the CAC training could be improved. Six of the respondents felt the class was good as it stands and did not need improvements. The following lists the suggested improvements provided by the other six respondents:

> *Pre-work needs to arrive earlier.*

> *Needs a nicer location (this person attended the Seattle class.)*

> *Need more specific examples of equipment and systems and what equipment is efficient.*

> *The class should be held at a plant so attendees could see how CA is actually used.*

> *It took too long.*

> *Maybe make it two days.*

Impact of the *Level I Training Course*

The respondents were asked what the most important thing was that they learned from the training. The majority, nine of the twelve respondents, indicated an increased awareness about how much compressed air costs. Two people mentioned that they had learned about the importance of fixing air leaks. Only one person claimed they learned nothing new and it was just review.

Respondents were also asked what they liked best about the *Level I* class. The following comments are notable:

> *Learned a lot. The atmosphere was good and relaxed.*

> *The one-on-one work groups.*

> *Combination of instructors and their diversity of background. Source book good.*

> *Interaction with other people from other plants.*

> *Getting the knowledge and information to help find problems in the plant.*

> *One day. Manuals are good. Good reference materials. Lots of practice exercises. Several instructors. Small group (class had 35). Pre-work with own plant information made it realistic and able to accomplish actual work even when in class.*

> *Information to save money on bottom line.*

> *It was not boring. Thinking about how expensive compressed air is and how to approach management with this information.*

One person said that nothing stood out. This was the same individual that felt they had learned nothing new.

Respondents were also asked if they had implemented any improvements in their plant because of the CAC training. Of the three questions related to impact, this question reveals the most regarding the success of the training. Nine of the twelve answered yes and explained what they did. The following answers are of particular interest:

> *Yes, fixed leaks and make sure that compressed air is used correctly.*

> *Yes, $125,000 worth of changes. Expect to save $54,000/year. Working with PUD to put in a 10" closed loop, air header, new water drains, and relocate air compressors.*

> *Yes, Installing blowers for cleaning tools and looking into intermittent uses of compressed air.*

> *Yes, installed a timed solenoid valve, instead of constant drain. Other ideas are in the works.*

> *Yes, changed plumbing. Getting the plumbing to where there are the least restrictions. Better quality air by relocating filters further down the line. We have a fairly new system but I'm still finding leaks.*

> *Yes, audit and plan to implement design changes and purchase equipment.*

> *Yes, beginning to redo the fittings in the system. Changing them over to swage-lock fittings.*

> *Yes, leak detection.*

> *Yes, Put regulators, valves, and timers on blowdown nozzles.*

The individual who felt that he had learned nothing new said that his plant was already doing everything that the class teaches.

Expectations for *Level II Training Class*

Eight of the twelve class participants have specific expectations for an advanced class. Two indicated interest in having a more hands-on type class. One person wants the class to focus more specifically on their own plant with details on how to evaluate their own plant. Two people want to see more information on how to calculate and account efficiency gains and energy costs. The following comments are interesting:

> *More detail on working with utilities regarding opportunities to fit into programs.*

> *Advanced maintenance techniques on compressors, like how to tear apart a loader.*

> *Monitoring techniques like SAV-AIR.*

> *I'd just like to do Level I over again.*

One person felt that he'd gotten enough with *Level I* and was unsure how beneficial learning calculations would be for him since he is a hands-on type person.

D. *Compressed Air Challenge* Web Site

The CAC website is now easily and quickly accessible via a link from the Alliance website. This linkage was not present earlier. Easy access to the site using a search engine requires typing in the full phase, not just the CAC initials. Accessing the CAC web site from the Energy Ideas Clearinghouse (EIC) website is not straightforward, as there does not appear to be a direct link to the CAC website from the EIC website. Also, the events calendar for the EIC does not list the scheduled CAC *Level I* classes for Fall 2000.

E. State of Class Offerings in the Northwest

The information presented in this section comes from attending CAC Advisory Board meetings, discussions, and communications with Blair Collins (CAC Project Coordinator at the Alliance) and the Northwest Energy Education Institute (NEEI) at Lane Community College. Helen Vidahl at NEEI coordinates and tracks the registration, bookkeeping, and data gathering processes for the classes. She also assists the co-hosts during the class.

Five CAC *Level I* classes were offered in the Pacific Northwest in different locations in June 2000. *Table 18* shows the total number of attendees for each class and the number of end users per class.

The registration and class evaluation forms were not available for analysis in this report. However, a preliminary look at the attendance database provided by NEEI revealed that out of the 111 attendees, 33 are not direct end-users of compressed air. Instead, they are vendors, consultants, and utility staff members. A more thorough look at the data from these forms will be presented in the third MPER.

Table - 18: CAC Level I Classes in the Northwest – June 2000

LOCATION	NUMBER ATTENDING	NUMBER OF END USERS PER CLASS
SPOKANE, WA	22	16 (72%)
SEATTLE, WA	42	28 (67%)

PORTLAND, OR	20	18 (90%)
MEDFORD, OR	12	8 (67%)
MISSOULA, MT	15	8 (53%)
TOTAL	111	78 (70%)

For the year 2000, CAC intends to offer a total of eleven *Level I* classes. This is a substantial increase over the six classes offered in 1999. Six *Level I* classes are scheduled for Fall 2000, and four of the six have definite dates scheduled. Dates and locations for the six classes are shown in *Table 19*:

Table - 19: Scheduled CAC Classes for Fall 2000

LOCATION	DATE
YAKIMA, WA	9/7/2000
BEND, OR	9/12/2000
BOISE, ID	9/27/2000
LONGVIEW, WA	10/11/2000
TACOMA/SEATTLE, WA	Sept./Oct. 2000
BILLINGS, MT	Sept./Oct. 2000

The marketing effort for a CAC *Level II* is tentatively scheduled to begin in November 2000. Planning for the marketing effort is currently underway. These will be the first *Level II* class held in the Pacific Northwest (others have been held in other parts of the country). Seattle WA is the selected location, but the exact site, sponsor, and date have not been determined.

The main concerns that the CAC Advisory Board continues to work on are reducing costs, generating income while keeping reasonable tuition, successfully marketing to end users, and maintaining vendor neutrality.

IV. Compressed Air Challenge Update

V. Issues and Recommendations

These issues and recommendations for both SAV-AIR and *Compressed Air Challenge* are presented in approximate order of significance.

A. SAV-AIR Issues and Recommendations

Issue: Support of SAV-AIR for Alliance Market Transformation

SAV-AIR is at a financial crossroads – their ability to solicit the right type of investment capital and other financial support will allow accelerated growth and fulfillment of the market transformation goals of the Alliance. Interest in the SAV-AIR approach is increasing dramatically over time, with recent activity linked to their successful demonstration project. The SAV-AIR team currently assembled has "the right stuff" for carrying on their mission of permanently changing the way compressed air is managed.

Recommendation

Continued support of SAV-AIR by the Alliance will assist them in pursuing their accelerated growth path rather than a more limited curve. Although SAV-AIR has not been able to bring all six beta-demonstration sites past the *Phase I – Performance Evaluation* assessment, some of these original contacts will likely soon implement *Phase II – System Optimization*. In addition, SAV-AIR is on the cusp of making significant inroads in one firm in the wood products industry. This particular industry has strong tendencies toward technology replication, both within each company and across the industry. It appears SAV-AIR is on the edge of making this happen.

The Alliance may wish to have some commitment or milestones from SAV-AIR for its continued financial support. A "pay for performance" scheme where delivered implementation or evaluated savings would be the criteria for Alliance payments would be one way. An alternative would be for the Alliance to match funding that SAV-AIR obtains through other parties.

Issue: Maintaining Financial Momentum

SAV-AIR still has a need to demonstrate their technology, gain experience and credibility, and generate revenues. These needs are acute, and SAV-AIR is certainly aware of them. The original goals for SAV-AIR included demonstrations across a diverse set of industries and in all areas of the Northwest region. These goals were, and still are, reasonable and well considered, but they might now be supplanted by the immediate need of closing sales.

Recommendation

Even if it does not meet their own or the Alliance's originally stated goals, SAV-AIR should pursue the most direct course that allows them immediate opportunities to demonstrate their technology: that is, implementation of *Phase II – System Optimization* and *Phase III – Ongoing Service* (including monitoring) where savings are accrued and can be documented. These immediate opportunities may have sales focused in the single industry of wood products, or even with just one wood products firm, however it's SAV-AIR's best bet to demonstrate success, enhance their reputation, and assure financial survival. This may require that the Alliance revise its goals or timetable for beta sites in other industries.

Issue: Conversion of System Optimization to Ongoing Monitoring

It is not yet clear that all customers that eventually purchase the *Phase II* services of *System Optimization* will also eventually contract for *Phase III – Ongoing Service* (including monitoring). Sales of ongoing services are critical to the goals of the Alliance for savings persistence, and are an important revenue source for SAV-AIR. Finding a way to ensure that customers who install the *SAV-AIR Phase II – System Optimization* also use *Phase III*, which includes system monitoring, is essential.

Recommendation

SAV-AIR should consider contract structures that make it more likely that ongoing monitoring is part of each system installation. A sale of equipment and ongoing services set up as an installment sale, bundling the SAV-AIR hardware and compressed air system upgrades, along with ongoing monitoring, may be considered as an approach.

Issue: SAV-AIR Marketing Contacts

SAV-AIR has made numerous contacts and a number of *Phase I* and *Phase II* sales outside of their original beta commitments to the Alliance. SAV-AIR has relied to date primarily on high-level corporate contacts and introductions for their services. This is an effective approach, but limited to firms where they have high-level contacts. Sales without these introductions will likely be more difficult.

Recommendation

Although it may not appear absolutely necessary in the short run, it will eventually be valuable to close sales based on inquiries originating at various levels within an organization. Plant operation and maintenance personnel are (unfortunately) somewhat complacent about the state of the compressed air system, and skeptical of the need or value of improvements. A means to reach O&M staff through this veil should eventually become part of the SAV-AIR repertoire of marketing materials. SAV-AIR may inevitably be a high-level sale, but they should consider developing a sufficiently persuasive case regarding energy and non-energy benefits to interest every level in an organization.

Issue: Non-energy Benefit Documentation

Documentation of non-energy benefits are essential for cost-effectivity, both for the Alliance, SAV-AIR's sales, and perhaps more importantly, for the customer themselves. Although most customers are likely to justify capital investments like SAV-AIR based on the energy cost savings alone, it may often be the non-energy benefits of improved reliability, reduced pressure variations, or eliminated operational hassles that engender real support from hands-on staff in

maintenance and operations. These personnel are the ones that can make a SAV-AIR installation a clear success.

Recommendation

Although no strong conclusions can be made yet about non-energy benefits, we believe that they are significant and can be described eventually. Once more plants are using *SAV-AIR System Optimization (Phase II)* other data points for non-energy benefits will be gathered. SAV-AIR should investigate any indications from customers about non-energy benefits, noting anecdotes or real numbers in terms of reduced plant shut downs, improvements in product throughput, or decreased maintenance.

Issue: Marketing Materials Development

The SAV-AIR marketing materials provide good basic communication about the tool, but the sales approach needs to better articulate bottom-line results. Excessively technical material is for engineering staff and should be directed only at that audience.

Recommendation

Improve the case study to address potential customers at different organizational levels. SAV-AIR should invest in working with a marketing consultant to give their sales materials a professional polish and depth of content appropriate to the target audience. Some of the content could also be drawn from the business plan. Additionally, SAV-AIR needs a fully functional website. While SAV-AIR may not need this to recruit additional prospects at this time, it may help customers already interested in SAV-AIR understand this complicated product.

Issue: Compressed Air Economic Analysis Tool (Airmonics)

SAV-AIR has developed a simple tool for compressed air economic analysis called *Airmonics*. The tool currently appears to use gross average rates, including service charges, demand charge, energy charge, and power factor.

Although the gross average will usually provide a reasonable estimate of costs, more accurate rates should be used. In addition, demand charges can be significant for some utilities and peak demand savings might be gained from judicious control of air compressors.

Recommendation

Consider calculating energy cost savings by using coincident demand savings, total energy savings, and incremental rates for both demand and energy. For example, rather than using a kWh rate that averages all charges, use the last block energy charge and demand charge, times the savings for each.

Actual industrial rate schedules of the serving electric utility should be used whenever possible. Rates are usually available from the utility, if not from the customer.

B. *Compressed Air Challenge* Issues and Recommendations

Issue: Vendor Neutrality

Vendor neutrality is a clearly stated goal for the CAC program. The first MPER pointed out that some of the experts and vendors surveyed repeatedly expressed concerns that the course is biased. Some perceive a vested interest on the part of the instructors, in that particular compressors are represented more often and as better than others. They felt that because the instructors are from one manufacturer, they appear to dominate the program, thus giving them an unfair sales advantage. It is interesting that in revisiting this issue with the end-users, not one mentioned any concerns regarding bias. (It should be noted that there are no direct questions on the vendor neutrality issue in either survey. Instead, the respondents were asked open-ended questions that allowed them to express any issues, including any bias concerns.)

Recommendation

Maintaining vendor neutrality should continue to be a critical element for the credibility and success of the CAC program. Although, the end-

users didn't express any concerns regarding this issue, vigilance should be maintained regarding instructor selection and course content to ensure neutrality. It is recognized that some of the best instructors available in the region are associated with vendors, so perfect neutrality may be an unattainable goal. The recommendations of the first MPER may be considered in light of this additional information.

Issue: Low Attendance by End-Users (Customers)

The first MPER stated that PEA's review of class attendance records for the Northwest indicated that end-users comprised a majority of participants, but only marginally so at 57%. PEA's preliminary analysis of the class records for 2000 indicates a 13% improvement in this area. For all classes, end-users comprised 70% of the attendees. If attendance by end-users continues to increase, this issue should become less of a concern as a market transformation barrier.

Recommendation

We recommend continuing to examine and adjust the strategy for promoting CAC classes to end-users. Although Portland's class did not reach the goal of 24 attendees needed for the class to break even, 90% of the attendees were end-users. Obtaining this high percentage of end-users is most likely due to the marketing strategy used in the Portland area. Large end-users (200 HP and over) were targeted and follow up calls were made. Large end-users are thought to have more dollars available for training and they may perceive a more serious need for better compressed air management strategies than smaller end-users. This strategy is worth considering for other densely populated areas such as Seattle. In all cases, doing follow up calls to the mailings are strongly encouraged.

Issue: Low Awareness of the Program and Training Courses

As PEA progressed through the interview process it became apparent that of the initially selected population of compressed air end-users, most were not aware of the CAC program and the *Level I* training course. Only one

individual had heard of CAC but had not participated in the class. This is an indication that broader awareness of CAC should be promoted.

Recommendation

Ten respondents indicted that they were influenced by trade or professional publications; that would suggest that advertising and articles might increase interest in CAC. Eleven said they were influenced by case studies that could be presented in a newsletter. Although newsletters are expensive, this may be a onetime investment, making it more palatable.

Issue: Lack of information about CAC on the Energy Ideas Clearinghouse Website

The *Energy Ideas Clearinghouse* is also an Alliance program. However, accessing the CAC website from the *Energy Ideas Clearinghouse* (EIC) website is not straightforward. There does not appear to be a direct link to the CAC website from the EIC website. Also, the events calendar for the EIC doesn't list the scheduled CAC *Level I* classes for Fall 2000.

Recommendation

Have the EIC provide a direct link to the CAC website and place the current CAC class schedule on the EIC event calendar.

Issue: Supporting Implementation of the CAC System Approach at the Plant Level

The CAC *Level I* class conveys fundamental compressed air information and sound compressed air management practices. It provides students with application tools such as a seven-step action plan for implementing the systems-approach in their plants. Yet some survey respondents expressed concerns about information learned in the classroom ever getting implemented at the plant. One vendor is concerned that unless there is follow up with each end-user, the information learned will never be put into practice. In part, this happens because managers are not well informed about the CAC efforts and the importance of taking a systems-approach to managing their compressed air.

Thus, managers are often not supportive of their staff spending time or money putting into practice what they have learned in a class.

Recommendation

To help solve this problem, the classes should also include an action plan and materials for selling the systems-approach to management. Attendees need to define what barriers they might see to "making it happen" in their plant and develop some strategies for overcoming the barriers. When they leave the class, they should have a clear understanding of what they need to do first to begin to make what they have learned standard practice for their plant. We understand that this type of material is included in the *Phase II* CAC class. We recommend that if that module proves to be effective, it should be considered also for *Phase I*.

Appendices

Appendix A: **SAV-AIR Evaluation End-User Survey (Including CAC questions)**

Appendix B: **SAV-AIR Beta Survey**

Appendix C: **Detailed Review of Marketing Materials**

Appendices

Appendix A

SAV-AIR Evaluation End-user Survey 3-9-00

Introduction: I am _____ of Pacific Energy Associates, a research firm in Portland. We are conducting a research project for the Northwest Energy Efficiency Alliance, a consortium of Northwest utilities and public energy agencies. We are asking operators of large compressed air systems questions about their systems. Your individual responses will be kept confidential. Summary reports on this evaluation may be made available on the Alliance web site. The questions take about 15-20 minutes. Is now a good time to talk?

By participating in this survey end-users like you will help to influence new approaches and training for improved management of compressed air systems. There are potential energy cost savings and also the possibility of improving overall productivity through new approaches to compressed air system operation.

1. What is the <u>total</u> horsepower of all air compressors in your system?
   - ____ Hp (Exact or Approximated?)
   -
   - *[If less than 150 Hp, skip to 29.]*

Throughout this survey we will talk about "compressed air system optimization." By this we mean detailed evaluation, analysis, and changes to the entire compressed air system - compressors, auxiliaries (air dryers, filters), controls, distribution, leaks, and end-uses. Does this definition work for you?

General Interviewee Information

Contact Name:	
Title:	
Company:	
City and State:	
Telephone:	
Email:	
Industry:	
Serving Utility:	

Compressed Air System Description

2. How many air compressors do you have on line in your plant?
_____ number (Do not count back up units.)

3. Do you regard compressed air as an expensive part of your operations?
- ❑ Yes
- ❑ No
- ❑ Couldn't say

4. Do you have a rough idea of how much of your electric bill comes from compressed air?

Yes – What is it?		*[Skip to 6.]*
No		

5. Would it be useful to your company to know your compressed air costs?

Yes – Why?	
No – Why not?	

Compressed Air System Management and Maintenance

6. Could you please describe the management approach for your compressed air system?

7. What would you say are the objectives in managing your compressed air system?

8. Are any of the following also objectives for managing your compressed air system? *[Read from list.]*
- ❑ Maintain continuous operation
- ❑ Insure system reliability
- ❑ Ensure adequate supply of air to end-uses
- ❑ Improved or increased production (fewer rejects)

- ❑ Maintain quality of air supplied (clean and dry air)
- ❑ Control or reduce energy costs/energy use
- ❑ Reduce capital costs (fewer compressors required)
- ❑ Meet process quality standards
- ❑ Improve safety
- ❑ Reduce maintenance and repair for process machinery
- ❑ Reduce maintenance and repair of the compressed air system

9. Among the items you've mentioned, what would you say are the top two objectives for managing your compressed air system?

10. Do you use any long-term or short-term monitoring to help you manage your compressed air system?

- ❑ Yes
- ❑ No *[Skip to 12.]*

11. Please describe the type of monitoring that you do.
(Probe: by yourself? By outside contractors?)

12. Do you have a regular leak detection routine or program in place at your facility?

- ❑ Yes
- ❑ No
- ❑ Couldn't say

13. If at anytime leaks are detected, is there a leak repair routine or program?

- ❑ Yes
- ❑ No
- ❑ Couldn't say

14. What activities do you think would most help to improve the <u>overall</u> operation of your compressed air system?

15. Would any of the following also improve the overall operation of your compressed air system? *[Read from list.]*

- ❑ Buy new, better, more reliable and efficient compressors
- ❑ Replacing air filters
- ❑ Improving control strategies
- ❑ Detecting leaks
- ❑ Repairing leaks
- ❑ Performing regularly scheduled maintenance
- ❑ Monitoring compressor motor load or current
- ❑ Testing and replacing water traps
- ❑ Re-assessing needs for pneumatic equipment vs. electric
- ❑ Repairing failed equipment

16. Among the items you've mentioned, what would you say are the top two potential improvements for your compressed air system?

17. What influences you the most in terms of adopting a new compressed air strategy?

- ❑ books
- ❑ web sites
- ❑ Hearing about another companies success through case studies
- ❑ Experience from within your company through a pilot project
- ❑ Consultant recommendations
- ❑ Vendor's recommendations
- ❑ Articles or advertisements in a professional publication
- ❑ Other _____

18. If a compressed air improvement that works well for you, how likely is it that your company would implement it in other plants? Would you say… (READ LIST)

- ❑ Very likely
- ❑ Somewhat likely
- ❑ Not at all likely IF NOT AT ALL: Why not? _____

19. What barriers do you face in getting your compressed air system to run more effectively?

20. Would you consider any of the following also as barriers to more effective operation of your compressed air system? *[Read from list.]*

- ❑ Not enough staff time
- ❑ No budget for activities related to improved efficiency
- ❑ Efficiency measures are too expensive
- ❑ Payback restrictions are too short
- ❑ Focus is on production (keeping things running by any means necessary)
- ❑ Lack of accountability for the compressed air systems or costs
- ❑ Lack of management buy-in
- ❑ Lack of technical expertise
- ❑ Lack of training
- ❑ Other _____

21. Among the items you've mentioned, what would you say are the top two barriers to effective operation of your compressed air system?

Efficiency / Optimization Services

22. In the last year, have any vendors approached your company to sell services to optimize or reduce energy costs in your compressed air systems?

- ❑ Yes
- ❑ No *[Skip to 27.]*
- ❑ Couldn't say *[Skip to 27.]*

23. What kinds of companies were these?

- ❑ Compressed air equipment vendor
- ❑ Independent consultant or contractor
- ❑ Energy service company
- ❑ OEM (Original Equipment Manufacturer) equipment vendor
- ❑ Other _____

24. Did you purchase this service?

- ❑ Yes
- ❑ No *[Skip to 27.]*
- ❑ Couldn't say *[Skip to 27.]*

25. Why did you purchase the service?
[Prompt from list as necessary. Skip to 27.]

- ❑ Energy savings
- ❑ Improve control over production
- ❑ Improve efficiency in production
- ❑ Improve safety
- ❑ Increase reliability
- ❑ Increase compressed air quality
- ❑ Insure adequate supply of air to end uses
- ❑ Improve company's environmental practice
- ❑ Improve maintenance
- ❑ Control or reduce energy costs
- ❑ Reduce capital costs
- ❑ Meet plant quality standards
- ❑ Other _____

26. Why didn't you purchase this service?

- ❑ Too expensive
- ❑ No budget
- ❑ Skeptical of energy savings estimates
- ❑ Can do it ourselves, in-house
- ❑ Presented to management; management did not approve
- ❑ Still considering
- ❑ Other _____

The Northwest Energy Efficiency Alliance, for whom this survey is being performed, is supporting a long-term compressed air monitoring and optimization service called SAV-AIR. SAV-AIR will implement a comprehensive monitoring program and provide real-time information and control capabilities to their customers. They will monitor leakage rates, compressor operation, and provide ongoing recommendations for the optimization of their customer's compressed air system.

27. Had you heard about SAV-AIR before this survey?
- ❑ Yes
- ❑ No [Skip to 29.]

28. Does this SAV-AIR approach sound like it might be useful for your facility?

Yes – Why?	
No – Why not?	

Training

29. How do you usually accomplish training for your staff on compressed air systems?
- ❑ In-house
- ❑ Vendor training courses
- ❑ Utility training courses
- ❑ Colleges/vocational schools
- ❑ Professional associations
- ❑ Don't provide compressed air operation training
- ❑ Other: _____

30. Have you heard of the Compressed Air Challenge? *[We will have a "blurb" to explain what CAC is if they ask.]*
- ❑ Yes
- ❑ No *[Skip to 37.]*

31. Have you participated in a CAC training?
- ❑ Yes
- ❑ No

32. In what way did the CAC class influence you the most? Or, What was the most important thing that you learned from taking the class?

33. In your opinion, how could the CAC training be improved?

34. What did you like best about the CAC training?

35. What might you expect to gain from a more advanced CAC training course (Level II)?

- ❑ Nothing

36. Were any improvements implemented in your plant because of the CAC training?

Yes – What were they?	
No – Why not?	

37. May we contact you periodically so we can learn more about your continued observations and opinions of compressed air services?

- ❑ Yes
- ❑ No

Thank you for spending time talking with me. This information is important to promoting effective and efficient compressed air operation in the region.

Appendix B

SAV-AIR Evaluation Beta Survey **5-16-00**

Planned for in-person interviews.

Introduction: I am _____ of Pacific Energy Associates, a research firm in Portland. We are calling on behalf of the Northwest Energy Efficiency Alliance, a consortium of Northwest utilities. The Alliance is currently sponsoring a number of customer services, one of which is SAV-AIR. Because you're a SAV-AIR customer, we'd like to talk to you and get your feedback on the services. Would it be possible to arrange an in-person interview sometime in the next few weeks? It will take about 45 minutes. ARRANGE APPOINTMENT. Just to let you know, your individual responses will be kept confidential from other companies and SAV-AIR. Summary reports on this evaluation may be made available on the Alliance web site. Thank you and I look forward to meeting with you.

General Interviewee Information

Contact Name:	
Title:	
Company:	
City and State:	
Telephone:	
Email:	
Industry:	
Serving Utility:	

WHEN ON SITE, DO USUAL INTRODUCTIONS AND ALSO SAY THE FOLLOWING.

As I mentioned when I called you, your individual responses will be kept confidential from other companies and SAV-AIR. Summary reports on this evaluation may be made available on the Alliance web site.

Throughout this survey we will talk about "compressed air system optimization." By this we mean detailed evaluation, analysis, and changes to the entire compressed air system - compressors, auxiliaries (air dryers, filters), controls, distribution, leaks, and end-uses. Does this definition work for you?

Compressed Air System Description

1. Can you confirm the air compressors used in your facility?

Compressor ID	Compressor HP/status

2. Do you regard compressed air as an expensive part of your operations?
   - ❑ Yes
   - ❑ No
   - ❑ Couldn't say

3. Before starting your work with SAV-AIR, did you have a rough idea of how much of your electric bill came from compressed air?

Yes		
No		

4. IF NO: As a result of working with SAV-AIR, do you now have an idea?

Yes		
No		

5. Do you find it useful to your company to know your compressed air costs?

Yes		
No		

Compressed Air System Management and Maintenance

6. Could you please describe what the management approach was for your compressed air system before you started working with SAV-AIR?

7. Before working with SAV-AIR, what would you say were your objectives in managing your compressed air system?

8. Before working with SAV-AIR were any of the following also objectives for managing your compressed air system?

- ❑ Maintain continuous operation
- ❑ Ensure adequate supply of air to end-uses
- ❑ Improved or increased production (fewer rejects)
- ❑ Maintain quality of air supplied (clean and dry air)
- ❑ Control or reduce energy costs/energy use
- ❑ Reduce capital costs (fewer compressors required)
- ❑ Meet process quality standards
- ❑ Improve safety
- ❑ Reduce maintenance and repair for process machinery
- ❑ Reduce maintenance and repair of the compressed air system

9. Have your objectives for managing your compressed air system changed at all since you started working with SAV-AIR? IF YES: In what way?

10. So would you say the change in objectives is related to working with SAV-AIR? IF YES: In what way?

11. Now I'd like to describe a number of compressed air management approaches and tools. First, I'd like to know if you were already doing them before starting to work with SAV-AIR. Then I'm going to ask you if you plan to start doing them in the future, and whether that decision is a result of working with SAV-AIR.

Approach/Tool	**Already doing before SAV-AIR?**	**Now doing or plan to do?**	**IF YES: Result of work w/ SAV-AIR?**
Short-term monitoring of load or current	Y N DK	Y N DK	Y N DK
Long-term monitoring of load or current	Y N DK	Y N DK	Y N DK
Leak detection	Y N DK	Y N DK	Y N DK
Leak repair	Y N DK	Y N DK	Y N DK
Tracking compressed air costs	Y N DK	Y N DK	Y N DK
Improving system control strategies	Y N DK	Y N DK	Y N DK
Assigning CA costs to cost centers	Y N DK	Y N DK	Y N DK
Using formal analysis to justify improved operation and maintenance rather than buying additional compressors.	Y N DK	Y N DK	Y N DK

12. IF USED MONITORING: Could you describe the type of monitoring you did before working with SAV-AIR? (PROBE: By yourself? By outside contractors?)

13. Do you plan to make any changes to your monitoring approach as a result of working with SAV-AIR?

Yes	
No	

14. IF YES: What types of changes?

15. IF DIDN'T DO MONITORING BEFORE, BUT NOW PLAN TO: What type of monitoring do you plan to do?

16. Do you plan to enter into a contract with SAV-AIR for long-term monitoring and management services? IF YES: What will it involve? IF NO: Why not?

17. What influences you the most in terms of adopting new compressed air management tools or approaches?

- ❑ books
- ❑ web sites
- ❑ peers/peer groups/organizations
- ❑ CAC or other CA classes
- ❑ Hearing about another companies success through case studies
- ❑ Experience from within your company through a pilot project
- ❑ Consultant recommendations
- ❑ SAV-AIR's recommendations
- ❑ Vendor's recommendations
- ❑ Articles or advertisements in a professional publication
- ❑ Other _____

18. If a compressed air improvement that works well for you, how likely is it that your company would implement it in other plants? Would you say… (READ LIST)

- ❑ Very likely
- ❑ Somewhat likely
- ❑ Not at all likely IF NOT AT ALL: Why not? _____

19. Before working with SAV-AIR, what barriers did you face in getting your compressed air system to run more efficiently?

20. Were any of the following barriers to more effective operation of your compressed air system? *[Read from list.]*

- ❑ Not enough staff time
- ❑ No budget for activities related to improved efficiency
- ❑ Efficiency measures are too expensive
- ❑ Payback restrictions are too short
- ❑ Focus is on production (keeping things running by any means necessary)
- ❑ Lack of accountability for the compressed air systems or costs
- ❑ Lack of information about the performance of the system
- ❑ Lack of management buy-in
- ❑ Lack of technical expertise
- ❑ Lack of training
- ❑ Other _____

21. What were the top two barriers to effective operation of your compressed air system?

22. Do you think working with SAV-AIR has or will help you overcome any of these barriers? IF YES: In what way?

23. What have been SAV-AIR's main recommendations for system improvement and optimization?

24. Do you plan to implement any additional SAV-AIR recommendations? IF YES: Which ones? How soon? IF NO: Which ones? Why not?

25. Besides what was recommended and implemented by SAV-AIR, are you making other changes to achieve system optimization? (PROBE: Staff with appropriate

decision making responsibilities are communicated with and involved; work orders, purchase orders, contracts, etc. drawn up as necessary for system changes.).

26. What features would you like to the see in the compressed air control panel and software used by SAV-AIR?

27. In addition to providing compressed air management information and energy cost savings, the SAV-AIR system may have other benefits to your plant and production. What do you see as other benefits? [PROBE: reduced production downtime, reduced production waste, predictable CA system maintenance, ability to focus on core business, etc.]

28. IF ANY BENEFITS: Can you provide any anecdotes or assign a value to these additional benefits?

SAV-AIR Satisfaction

The next series of questions deals with your experiences with SAV-AIR and your satisfaction so far with their services. I'm going to read you a series of statements. Please respond to each statement with "no" if you disagree and "yes" if you agree. You may also respond with "don't know." (FOR EACH 'No" RESPONSE, ASK WHY)

29. So far SAV-AIR has delivered useful information about system function, system efficiency, and opportunities for improvement. ☐ Yes ☐ No

IF ANSWERED NO, ASK WHY:

30. SAV-AIR's periodic reports on my compressed air are useful and appropriate for my needs. ☐ Yes ☐ No

IF ANSWERED NO, ASK WHY:

31. The SAV-AIR team is easy to work with. ☐ Yes ☐ No

IF ANSWERED NO, ASK WHY:

32. The SAV-AIR team has the skills and knowledge to meet our needs for compressed air system management. ☐ Yes ☐ No

IF ANSWERED NO, ASK WHY:

33. The SAV-AIR team has clearly explained and quantified the potential energy benefits of the recommended system improvements versus the costs.
☐ Yes ☐ No

IF ANSWERED NO, ASK WHY:

34. SAV-AIR has identified potential non-energy benefits that are important to our plant. ☐ Yes ☐ No

IF ANSWERED NO, ASK WHY:

35. So far I am satisfied with SAV-AIR's services. ☐ Yes ☐ No

IF ANSWERED NO, ASK WHY:

36. I would recommend SAV-AIR's services to other plants in my company without hesitation. ☐ Yes ☐ No

IF ANSWERED NO, ASK WHY:

37. I would recommend SAV-AIR's services to colleagues at other companies without hesitation. ☐ Yes ☐ No

IF ANSWERED NO, ASK WHY:

38. What's the main reason you decided to work with SAV-AIR?

39. So far, what do you like best about SAV-AIR's services?

40. Do you have any concerns or questions about SAV-AIR? IF YES: What?

Training

41. How do you usually accomplish training for your staff on compressed air systems?

- ❑ In-house

- ❑ Vendor training courses
- ❑ Utility training courses
- ❑ Colleges/vocational schools
- ❑ Professional associations
- ❑ Don't provide compressed air operation training
- ❑ Other: _____

42. Have you heard of the Compressed Air Challenge?
- ❑ Yes
- ❑ No *[Skip to 37.]*

43. Have you participated in CAC training?
- ❑ Yes
- ❑ No

44. In what way did the CAC class influence you the most? Or, What was the most important thing that you learned from taking the class?

45. In your opinion, how could the CAC training be improved?

46. What did you like best about the CAC training?

47. What might you expect to gain from a more advanced CAC training course (Level II)?

- ❑ Nothing

48. Were any improvements implemented in your plant because of the CAC training?

Yes – What were they?	
No – Why not?	

49. May we contact you periodically so we can learn more about your continued observations and opinions of compressed air services and your experience with SAV-AIR?

- ❑ Yes
- ❑ No

Thank you for spending time talking with me. This information is important to promoting effective and efficient compressed air operation in the region.

Appendix B

Appendix C

Detailed Review of Marketing Materials

Marketing Brochure

The brochure reviewed for this report was written and laid out by the SAV-AIR team and included in its most recent business plan dated July 12, 2000. Our understanding is that it was prepared without outside assistance.

The brochure is a good start as a portable "calling card." It has been much improved since the first draft was produced in the early spring. The content is more robust and the layout and graphics more deliberate. SAV-AIR might consider further refining it, utilizing a marketing consultant and graphic designer. We envision that the consultant would work with the team on all their marketing materials and coordinate with both the graphic and web site designers. These would probably be two different people, but they would need to work together to design a consistent look.

Below are some specific aspects of the brochure that we believe need further enhancement. Many of the suggestions below would also apply to the web site.

Overall Look and Feel

Currently the brochure has a "home spun" look. A graphic designer could help bring a more professional polish to it.

Customer/Audience Targeting

The team should think further about whether the brochure powerfully describes how SAV-AIR can address their target customer/audience's key needs and concerns. Ideally, the brochure should speak to staff at multiple levels of the organization – from air compressor operator to CFO – as multi-level marketing is necessary for SAV-AIR's integrated approach. The sections *"Why Is SAV-AIR Compelling?"* and *"SAV-AIR can…"* provide a good start at defining and answering those concerns. We recommend combining these two sections (as there is a fair bit of repetition) and making them a centerpiece, rather than placing them on a back flap.

Content

The brochure's content and language could be more punchy and powerful. The description of benefits needs to be more pointed, vivid, and results-oriented. Again, a marketing consultant could be helpful here. For example, perhaps instead of SAV-AIR can *"Increase compressed air reliability,"* say: *"Increase compressed air reliability to stabilize production processes and reduce down time."* If you state, *"Defines compressed air system costs as a production cost,"* it does not directly say how that addresses a need and provides a specific bottom-line benefit. Similarly, "*Supports facility maintenance and engineering services."* How? The question to ask about each point made is whether it clearly explains to the reader the distinct ways that SAV-AIR can address key customer needs/concerns.

The section titled *"SAV-AIR Services"* might be combined with *"The SAV-AIR Difference"* and have the latter title. The current services description needs to grab the reader's attention and make SAV-AIR stand out. Also, the theme on the front of the brochure emphasizes energy efficiency, which may not be the best way to capture the attention of potential customers. Finally, when results are available for the beta sites, the key bottom line energy and non-energy benefits of these projects should be described, assuming customers give permission. Pithy customer quotes should be included.

As mentioned above, the brochure and other marketing materials need to speak to the perspective and concerns of staff at multiple organizational levels. Staff at the operations and maintenance level will probably be most concerned with how SAV-AIR can increase system reliability, reduce maintenance costs over time, and keep production lines running. CFOs will be more concerned with stable and increased productivity, and reduction of both operational and capital costs. A particularly effective way to convincingly convey this information would be through the beta site descriptions emphasizing bottom line savings and other tangible benefits. The "before and after" overview of the Willamette Industries project is a good example, if permission can be obtained to use this information.

One-Page Marketing Flyer

Many of the comments about the brochure apply to this flyer. The flyer should cut to the chase with results and benefits that grab the reader's attention and

resonate with their needs and concerns; use punchy, powerful sales-oriented language and describe success stories.

Web Site

SAV-AIR has established a web site address, but at this point it is under construction. So far, it contains only a general one-paragraph introduction, contact information, and a ten-item bullet list of services.

While we realize that SAV-AIR's current primary marketing approach is to cultivate their high-level personal contacts at target companies, their web site can still play a key marketing function. As noted in their June 2000 *Summary Report*, they are continuing to make contacts with new customers as well as other market players such as utilities and agencies. Since SAV-AIR's services are comprehensive, as well as somewhat complex, a strong web site can play a critical role in conveying image, message, and service content.

The Internet has become integral to doing business. These days having an effective and well-organized web site conveys to customers that the company itself has these qualities. In short, rightly or wrongly, customers are increasingly regarding web sites as indicative of the value and competence of companies.

SAV-AIR should invest in working with a marketing consultant and web site developer/designer to develop their web site to give it professional polish and depth of content appropriate to their target audience. Some of the content could be drawn from the *Business Plan*, although there are obviously issues of confidentiality to consider. Another important outcome will be that the web site content and "look" can be leveraged to other marketing materials, proposals, presentations, and meetings. So while it will take hard work and thought to carefully craft how SAV-AIR's services and benefits are described and conveyed, this work will pay off many times over.

Customer Proposals

General Tone and Focus

The proposal contained a lot of good information. It is very careful to explain the process, methodology, and results in detail, much as a straightforward

report might. The technical and analytical capabilities of the team are clear. But the report needs to get to the bottom line much earlier and have a confident marketing tone, rather than a more academic one.

Sales Pitch

It should take any reader, whether a CFO or a plant-level person, five to ten minutes maximum to understand the bottom line project results and how they will solve their problems and meet their needs. The compelling reasons to keep them reading for those five minutes should be obvious within the first fifteen seconds of looking at the proposal. It needs to speak directly to the perspective of the decision-maker. This information should be contained in a one-page or shorter *Executive Summary*. Otherwise, particularly with a CFO, you may lose their attention. SAV-AIR needs to flex its selling muscles. While the proposal we reviewed did not seem to do this, these goals are met effectively in the *Business Plan*, whose language could be used for future proposals.

Indeed, in SAV-AIR's *Business Plan* it states that: *"We believe that our products and services are best delivered initially at 'higher' levels in industrial corporations using a 'top down' approach."* To take such a top down approach, materials must be targeted appropriately.

Technical Information

The detailed methodology and analysis information can be put in an appendix, although even this information, as we reviewed it, would benefit from some simplification. Only provide what is absolutely necessary to back up the statements in the executive summary.

The explanation of the costs versus savings and the resulting payback period could be clearer. This information needs to be laid out all together, clearly showing the precise payback and how it was calculated.

Finally, the proposal contains a fair amount of discussion on the funding arrangement with the Alliance and the fact that the customer is a beta site. While acknowledging the Alliance's support is appropriate, particularly since it relates directly to project funding and payback, SAV-AIR should not focus too

much on the fact that the customer is a beta site. Whatever is said about this should be more positive. Otherwise, a CFO or other decision-maker might perceive purchase of the services as unusually risky or be concerned about the company being around in the future.

Business Plan

Description of Target Market

The *Business Plan* clearly describes the SAV-AIR target market. What needs a little more refining is the number of customers within their target market. The plan also says the wood products industry is a specific initial target, but does not estimate the size of this market in terms of numbers of potential customers. Having these more refined numbers would help in assessing their business planning strategies and spreadsheets.

Marketing Strategy

SAV-AIR's marketing strategy could be sharper and more finely drawn. One of the central strategies is to form strategic alliances with other service providers and utilities. We have several questions and concerns about this approach:

- Should SAV-AIR look to utilities for significant funding, given the uncertain and evolving nature of deregulation? Is there going to be enough funding to be of real use? As we have seen in Oregon, in some situations over the near term, the public purpose pie has been sliced fairly finely, leaving a relatively small amount for industrial program development and implementation. Also, can SAV-AIR avoid the potential to get pulled in different directions by utility requests, program requirements, and politics? This last issue has been the bane of many efficiency providers and energy services companies nationwide.

- There appears to be no description of if and how SAV-AIR plans to either support *Compressed Air Challenge* or tap into its participants as potential customers. The work of this report shows that there appears to be a relationship between knowledge of compressed air issues and an interest in improving efficiency. SAV-AIR might consider offering some form of sponsorship or support to CAC.

- While SAV-AIR needs to develop its delivery infrastructure, it also needs to be more specific about exactly how it plans to have other companies and service providers use SAV-AIR tools and offer SAV-AIR services. They need to more clearly describe who they plan to approach, how they will approach them, and what the specific financial and legal agreements will be. They also need to explicitly incorporate the financial results of those agreements into their business plan. If they use this approach, SAV-AIR needs to think carefully about how it can do this to its advantage in terms of protecting and promoting its services and reputation, and being successful in the market. While a goal and indicator of market transformation from the Alliance perspective is to have the broader market respond with similar services, SAV-AIR needs to protect its interests first.

- In refining the strategy described above, SAV-AIR needs to make clearer distinctions among the "stakeholders" they envision working with. For example: utilities, the unregulated energy service company subsidiaries of utilities, other types of energy service companies including those providing compressed air services like SAV-AIR's, independent consultants and "air auditors", engineering service companies, etc. If the best type of partners is not yet clear, SAV-AIR needs a strategy to quickly apply triage, lest they be pulled in too many directions.

- SAV-AIR should consider whether potential funders might be concerned about the approach of relying on utilities and on building business using other companies as vehicles. If they anticipate any concerns, they should address those in the business plan.

Description of Competitors

Competitor description is well organized and clear. They have a good amount of detail on each of their key competitors' services.

What appears to be missing is any detailed description of a strategic plan to prevail over the competitors that present the greatest immediate or potential threat. Even if SAV-AIR's services are unique and better, competitors may have other significant advantages in how they are perceived by customers, including being first-to-market, having a large a skilled sales force, lower prices,

and having name recognition. SAV-AIR needs a clear strategy for how they will address these potential competitive advantages both in terms of their marketing strategy and their sales approach.

Appendix C