



Just Enough Air

Market Progress Evaluation Report, No. 2

prepared by

Currents Consulting

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NORTHWEST ENERGY EFFICIENCY ALLIANCE

www.nwalliance.org

529 SW Third Avenue, Suite 600
Portland, Oregon 97204
telephone: 503.827.8416
fax: 503.827.8437

JUST ENOUGH AIR: Efficient Pneumatic Conveying

Market Progress Evaluation Report, No. 2

Final Report

Funded By:



NORTHWEST ENERGY EFFICIENCY ALLIANCE
www.nwalliance.org

Prepared For:

David Cohan
The Northwest Energy Efficiency Alliance

Prepared By:

Jennifer Stout



Currents Consulting

3133 Douglas Circle
Lake Oswego, Oregon 97035
jstout@currentsconsulting.com

and

Steven Scott

MetaResource Group

JUST ENOUGH AIR

EXECUTIVE SUMMARY

Introduction

In March 1999, the Northwest Energy Efficiency Alliance (the Alliance) funded an initiative called “Just Enough Air: Efficient Pneumatic Conveying” (JEA). The initiative’s objective was to increase the energy efficiency of industrial low-pressure pneumatic conveying systems (PCS), with an initial focus on the secondary wood products industry. In August 2002, the Alliance contracted with Currents Consulting to prepare this report covering JEA’s accomplishments, market effects, and lessons learned. These are briefly listed below and described in detail in the body of the report.

JEA Accomplishments

- Trained eleven service providers in whole-system PCS optimization and energy efficiency. Including the two implementation contractors, the service provider list consists of thirteen qualified firms located throughout the Northwest.
- Provided evaluations of PCS energy savings potential for 37 facilities in the Northwest.
- Completed nine high-quality case studies that cover a range of PCS improvements and present engineering estimates for costs and savings.
- Prepared and distributed a Best Practices Guide which is being actively used, particularly by utilities. A hard copy of the guide was distributed to 130 companies and organizations and 249 received notification that the guide was available on the Alliance website.
- Demonstrated successful integration of Alliance project efforts with utility efforts.
- Completed these project deliverables 28% (\$233,000) under budget.

Market Effects

A survey of twelve contractor/specifiers, four consulting engineers, and four utility staff was conducted by the evaluators. The consulting engineers and contractor/specifiers surveyed are estimated to represent at least 70 percent of the Northwest PCS services market. The following data support the finding that JEA achieved market effects.

- Thirteen of twenty respondents reported that JEA increased their knowledge and awareness of PCS operating costs, systems sizing, and efficiency opportunities. Among those thirteen, seven said they had enhanced their efficiency services as a result of exposure to JEA (three major contractor/specifiers and four consulting engineers).
- Eight of twenty survey respondents (five contractor/specifiers, one consulting engineer, and two utilities) said they had observed an increase among their customers in awareness of energy efficiency in PCS and attributed that change to their customers’ exposure to JEA’s information and concepts.
- Providers of PCS efficiency services report they have pursued 28 additional projects beyond those completed during the JEA contract period. These include six by EWEB, three by

Snohomish PUD, two by Portland General Electric, two by SBW, one by Baxter Air Engineering, and fourteen by PacifiCorp (beyond the three case studies with PacifiCorp customers completed during JEA, one case study completed before JEA, and one project started before JEA). The fourteen PacifiCorp projects were initiated during or after the JEA contract period and are in various stages of completion as of the publication of this report.

- Four of twenty respondents (two major contractor/specifiers, one consulting engineer, and one utility) said they had noticed changes in PCS energy efficiency services at other service companies and attributed it to JEA. Most comments said the changes resulted from customers' requests for more efficient equipment. Among the remaining sixteen respondents, twelve said they had not noticed a change and four were unsure.

Key Lessons Learned

- The Alliance's and JEA's expectations needed to be more realistic and better aligned regarding expected time requirements for completing whole-system projects, case studies, the Best Practices Guide, and marketing of those resources once developed.
- Although JEA prepared an initial marketing outline, a more fully developed strategic marketing plan that was a "living" document, one used and updated regularly, could have provided valuable ongoing guidance on target market, delivery issues and strategies, project time requirements, and the project exit strategy.
- Important non-energy benefits could have been more strongly highlighted in a number of the case studies, the case study summary table, and the Best Practices Guide.
- A specific plan was needed from the outset for how the adjustable speed drives (ASDs) would be managed after the JEA contract ended. These drives were used in training the service providers, they were used to develop JEA case studies, and they were also made available as rentals for future projects to those service providers who passed the training course. While the Alliance assumes ownership of project assets as a standard part of all contracts, this was the first time physical assets in the form of industrial equipment had been included. The Alliance had no interest in owning the ASDs, and had no way to store or maintain them. There should have been a detailed plan from the beginning for transferring ownership to the project well in advance of the end of the contract.

INTRODUCTION

In March 1999, the Northwest Energy Efficiency Alliance (the Alliance) funded an initiative called “Just Enough Air: Efficient Pneumatic Conveying” (JEA). The initiative’s objective was to increase the energy efficiency of industrial low-pressure pneumatic conveying systems (PCS), with an initial focus on the secondary wood products industry. In these systems, centrifugal fans provide suction to remove wood waste generated in the manufacturing process or to transfer materials from one location to another. Other industries that use PCS include agriculture, food processing, primary metals, and concrete and aggregates. These industries primarily use PCS for dust collection and removal of air-borne pollutants.

In April 1999, PacifiCorp and its two subcontractors, QEI Energy Management, Inc. and Carroll, Hatch & Associates, Inc., began implementation of JEA under a two-year contract. In late 2000, the initiative timeline was extended; it formally concluded in March 2002.

A Market Baseline Evaluation Report (MBER) on the secondary wood products industry was completed in December 1999 by SBW Consulting and Quantum Consulting to help guide strategy and provide a baseline for impacts on industry practices and attitudes. SBW and Quantum also issued other brief evaluation memoranda over the course of the initiative. In August 2002, the Alliance contracted with Currents Consulting to prepare this report covering JEA’s accomplishments, market effects, and lessons learned.

EVALUATION APPROACH

The research for this report included:

- *Review of Alliance documents:* Board meeting documents, staff recommendation, internal memoranda, contractor proposal, and contractor statement of work.
- *Review of Initiative documents:* Marketing materials, case studies and associated documents, Best Practices Guide, and the Initiative website.
- *Review of prior evaluation documents:* SBW report and others.
- *Seven in-person staff interviews:* Four key Alliance staff and three implementation contractor staff.
- *Twenty telephone surveys:* Four utility staff, of which three were qualified as JEA service providers; four consulting engineers of which three were qualified JEA service providers; and twelve contractor/specifiers of which one completed the full service provider training.

In this report, there are several different terms used to describe companies providing services related to pneumatic conveying systems. These terms parallel those used by JEA in their documentation and Best Practices Guide:

- “Consulting engineers”: These companies or individuals provide relatively sophisticated engineering services for PCS and other systems, usually including engineering related to whole-system optimization and energy efficiency.
- “Contractor/specifiers”: Services may include sales, design, specification, manufacture,

installation, repair, and retrofit of PCS. Engineering services are usually limited to the larger contractor/specifiers, and are focused on design and manufacture of equipment rather than on system optimization.

- “Utility staff”: Refers to staff working directly with end-users on energy efficiency and related projects.
- “Service providers”: Any of the above three who have qualified for and completed the JEA training process involving classroom instruction, a written exam, and field training.

In certain sections of the report, the evaluators also use the term “trade allies” to refer to “consulting engineers” and “contractor/specifiers” together to simplify reporting.

Appendix B contains a list of persons and companies interviewed or surveyed. Appendix D contains a copy of the survey instrument. Because sample sizes were small, the data and resulting interpretations should be considered qualitative. However, we believe the findings provide important insights into participant attitudes and the market effects of the JEA Initiative.

INITIATIVE DESCRIPTION

Introduction

As is the case with many of the Alliance’s initiatives, JEA evolved significantly in key areas over the course of its contract including target market and approach, marketing and sales, and exit strategy. Each of the subsections below describes that evolution. To help the reader track the changes, an abbreviated version of each subsection is provided below:

- Target Market and Approach: JEA initially targeted all sizes of end-users (in terms of PCS horsepower) with fan speed reduction through resheaving¹. The Initiative evolved and expanded to target larger customers and include whole-system analysis in addition to fan-speed tuning. It was recognized that with larger savings potential, the larger projects were the best candidates for the service providers for fee-paid work.
- Marketing and Sales: JEA’s goal throughout its contract was to complete 10 case studies and to recruit and train service providers. Initially JEA limited the case studies to only two in each of five territories, and limited the number of trained service providers to five. JEA later removed those geographic limitations, opened the training to anyone who could meet certain criteria, increased their own sales efforts, and offered incentives to trade allies that could provide leads and complete sites by a set deadline (ultimately, no incentives were distributed).
- Exit Strategy: As stated above, JEA initially planned to train five service providers, but later opened up the training. Thirteen service providers were qualified to provide whole-system PCS optimization and energy efficiency services, including the implementation

¹ The terms “adjustable speed drive,” “variable speed drive,” and “variable frequency drive,” are used virtually interchangeably, although variable frequency implies the use of electronic controls. In this report we use the term “adjustable speed drive” because it is used the most in the JEA documents and Best Practices Manual.

contractors. The Alliance and its implementers have reached an agreement with a third party to make the ASDs available for a minimum of three years to service providers on a rental basis for demonstrating fan-speed reduction to customers.

- Discussion: Following these subsections is a discussion of issues raised by the preceding topics, and by the research and document review for this report.

Target Market and Approach

Initial Target Market and Approach

Fan-speed Reduction for All Sizes of End-Users: The implementation contractors' original proposal (submitted May 1998) was to offer fan-speed reduction (and thus achieve energy savings) through resheaving in small, medium, and large (in terms of PCS horsepower) secondary wood products facilities throughout the Northwest region. Diversity of end-user size and geographic distribution, particularly in rural areas, were key arguments made to the Alliance Board for Initiative approval. The JEA implementers estimated total potential savings of 6.6 aMW over 10 years in their original proposal.

Modifications to Target Market and Approach

Whole-System Approach for Large End-Users: In December 1999, SBW Consulting and Quantum Consulting completed their Market Baseline Evaluation Report (MBER). The report estimated total potential savings of 7.8 aMW. A key finding was that 8 percent (about 120) of secondary wood products plants have total PCS horsepower (HP) over 200, and these plants account for 74 percent of regional PCS energy use. If savings are proportional to energy use, energy savings potential for these large end-users was about 5.8 aMW.

The resulting recommendation was that JEA focus on these large end-users and emphasize a whole-system approach to PCS energy efficiency. SBW argued that this approach would better serve larger plants with baghouses, controls, and complex ductwork, and could produce larger benefits. Indeed, early in JEA's recruitment efforts it found that some end-users, both large and small, wanted to make whole-system improvements.

In response to the MBER findings and recommendations, JEA expanded their scope to include whole-system services. This change was also in response to input from the Initiative's Advisory Council of PCS specifiers and installation contractors. The Council was formed in early 2000 at the suggestion of SBW and Quantum Consulting as well as the Alliance. The purpose of the Council was to help develop strong partnerships with trade allies, and help make improvements to the technical and marketing aspects of the Initiative.

Marketing and Sales

Initial Marketing and Sales Strategy

Case Studies: Per its initial scope and contract (April 1999), JEA planned to complete 10 end-user "demonstration sites" by the end of the contract period (March 31, 2001), two in each of

five geographic areas. These sites would demonstrate cost and energy savings from fan-speed reduction through resheaving. From these demonstration sites, case studies would be prepared. In May 2000, in keeping with the inclusion of whole-system analysis, it was decided that the case studies would include both fan-speed reduction and whole-system projects.

Service Provider Training Sites: JEA initially planned to train only four additional service providers beside themselves. The trainees were to complete five training sites, and complete the initial evaluation of another ten. These ten would help jump-start business for the newly trained service providers. These fifteen sites were to be distributed throughout the region, with three in each of five geographic areas. JEA's contract was amended in May 2000, reducing the goal for training to "up to 10" in each of four regions because of the additional anticipated cost of doing whole-system projects.

Adjustable Speed Drives (ASDs) for Demonstration: JEA used ASDs specially configured for temporary installation to convince end-users that fan speeds could be slowed without reducing PCS performance. The implementers estimated that they used the ASDs 20 to 30 times during the project. The Alliance and its implementers have reached an agreement with a third party to make the ASDs available to service providers for a minimum of three years on a rental basis for demonstrating fan-speed reduction to customers.

General Marketing: Over two years, from June 1999 to June 2001, JEA did marketing at eleven conferences and trade shows. A list of dates and events is provided in Appendix C. The marketing included presentations, luncheons to which key end-users, utilities, and service providers were invited, a booth, and a table-top model to demonstrate energy cost savings from fan-speed reduction. Promotional and other information was distributed to 150 to 200 event attendees. In addition, JEA e-mailed utilities on a mass basis and followed up one-on-one with those that expressed interest and/or had many end-users with PCS.

Modifications to Marketing and Sales Strategy

Case study development proceeded more slowly than expected. In the face of slow progress and in response to its Advisory Council and the SBW report, JEA made a number of changes to its approach and scope.

Increased JEA Sales Efforts, Removed Boundaries: The limitation of only two case studies in each of five geographic areas was removed. The implementers increased their sales efforts and pursued leads without territorial limitations.

Expanded Service Provider Training: In a rigorous recruiting and training effort, JEA ultimately qualified eleven service providers to offer PCS energy efficiency services, resulting in a total of thirteen service providers including the JEA implementers themselves. (More detail on the training is provided in the section below on exit strategy and in Appendix A.)

Offered Financial Incentives: JEA also decided to offer a \$500 incentive to contractors who provided leads for companies that became demonstration sites and \$2,500 to service providers-in-training who completed field training sites by March 31, 2001. No incentives were ever distributed because none of the projects ultimately met the completion deadline.

Even with these changes, by November 2000 twenty-nine site visits had yielded seven demonstration site sign-ups and two completed case studies. As JEA's contract was to end in March 2001 the project was given an extension through February 2002, and ultimately, JEA provided PCS evaluations of energy savings potential for 37 facilities in the Northwest. Those 37 evaluations resulted in four fan-speed reduction case studies and five whole-system case studies. Total documented savings were 0.2 aMW for the nine case studies. These case studies are summarized in Table A-1 in Appendix A. (A tenth project already completed by PacifiCorp and Carroll, Hatch, & Associates before the Initiative started was also included in the Best Practices Guide, with estimated savings for this project alone of 0.21 aMW.²)

JEA provided and paid for the energy engineering for the case study sites, while the sites paid for and were responsible for all of the implementation of JEA recommendations. JEA worked with local utility and other programs where available to take advantage of incentives and tax credits. The projects involved different combinations of partners/participants including four contractor/specifiers, a consulting engineering firm qualified as a JEA service provider, four utilities (including two qualified as service providers), and the Oregon Office of Energy.³

The evaluators have the following observations about the case studies:

- In general, the case studies are thorough and well-written, and present solid data on cost and savings estimates for small, medium and large wood products facilities. Several service providers and utility respondents we surveyed specifically mentioned that the case studies were useful for convincing end-users of the value of PCS efficiency projects.
- The level of technical detail provided in the case studies is necessary for convincing trade allies of the value of the JEA approach. They are a tough audience because they sell/design/service and work with PCS systems on a daily basis. Convincing them is critical to getting through to their customers. At the same time, creating shorter, less technical versions of a few of the whole-system case studies could be useful for management at PCS facilities; they are often involved in decisions involving capital expenditures but lack time.
- It is notable that the paybacks, even with incentives, are well over three years on three of the case studies. It would be helpful if the summary table in the guide included a brief description of non-energy benefits (see Table A-1 in Appendix A). This might help strengthen potential clients' perception of the viability of such projects from a business perspective.

² The Best Practices Guide is available in hard copy from the Alliance or electronically at <http://www.nwalliance.org/projects/projectdetail.asp?PID=26>. This website also provides access to the project case studies, evaluations, and other documents.

³ Among the case studies, three were service provider field training sites. There were six other service provider field training sites as well, although none resulted in published case studies during the term of the JEA contract.

Exit Strategy

Initial Exit Strategy

Below are the key elements of JEA's initial exit strategy:

Train Five Service Providers: A total of five JEA-qualified firms, one in each of five regions, providing the market structure for ongoing PCS efficiency work after the initiative ended.

Evaluate Ten Sites to Jump-Start Marketing Efforts: Ten sites were to receive an initial evaluation as part of the training, and so be primed for trainees' marketing efforts.

Provide ASDs for Loan: Four ASDs (two 100 HP, one 150 HP, and one 250 HP) specially configured for temporary installation were to be available on loan to the trained service providers for demonstration purposes after the Initiative ended.

Modifications to Exit Strategy

Expanded Service Provider Training: Based on further evaluation and input from the advisory council, JEA opened up the service provider training program by issuing an RFQ to over 100 people to assess their background and interest.⁴ Twenty-two people applied and were accepted. After pre-qualification, the training consisted of three phases: classroom instruction, a written test, and field training. These training phases are described in more detail in Appendix A.

Eleven companies completed the full training, creating a total of thirteen qualified service providers including QEI Energy Management and Carroll, Hatch & Associates. These service providers are located throughout the Northwest. In addition, nine individuals completed the classroom training for professional development purposes only without intending to complete the service provider program. Service providers surveyed were complimentary of the training even if it was a review for them. Verbatim quotes are provided in Appendix A.

The thirteen qualified service providers include the implementation contractors and consist of:

- Four utilities with six qualified staff;
- Eight consulting engineering firms with nine qualified staff, and;
- One contractor/specifier firm with four qualified staff. Contractor/specifiers turned out to be generally uninterested in becoming qualified service providers because they did not consider engineering part of their core business. However, as described in the market effects section below, this does not mean that they were not influenced by JEA.

Continued to Develop a Plan for ASDs for Loan: The Alliance and its implementers have reached an agreement with a third party to make the ASDs available to service providers for a minimum of three years on a rental basis for demonstrating fan-speed reduction to customers.

⁴ To keep the project within the original budget, JEA and the Alliance agreed JEA would complete up to ten PCS performance evaluations jointly with the service providers as part of their field training, instead of the original plan to have each service provider in training conduct two evaluations and also complete one project.

Created Best Practices Guide: As a result of experience working with small PCS end-users, JEA decided a Best Practices Guide was the most appropriate way to support utilities and others in reaching small end-users who could not necessarily afford to hire a service provider. The guide is also relevant for medium and large PCS users.

The guide contains technical information to educate end-users and service providers on how blower systems operate, how to evaluate system performance, and best practices to reduce operating costs. JEA developed energy use indices to provide end-users with performance data they could use to compare vendor proposals from an energy and operating cost perspective. This type of data is not published in manufacturer's literature. The guide also contains the case studies, specific technical tools, extensive industry contact lists, and a resource list. A hard copy of the guide was distributed to 130 different companies and organizations. These 130 and about 120 more were also notified of the guide's availability on the Alliance website.

Currents Consulting reviewed the guide and thought it was an excellent resource, although it could have benefited by including a section that was less engineering-oriented. Survey respondents reported that they actively use the guide and were very positive about it. Some specific comments about the guide from the phone survey included:

- *“The information provided by JEA in the guide makes [energy efficiency] projects more justifiable because it provides specific information and case studies on cost savings.” (Contractor/specifier)*
- *“[The guide] opened up a whole new avenue where no corporate knowledge existed [previously] among vendors or utilities. [Before the guide] the feeling was ‘I don’t know where to start or who to start with.’ [The guide] gives vendors an independent and unbiased tool for how to calculate savings and payback.” (Utility)*
- *“We use it as a resource, particularly when deploying junior engineers. It is a good approach for assessing system opportunities.” (Consulting engineer)*
- *“Well thought out and presented.” “Valuable and accurate.” “I am very enthusiastic.”*

The utility staff spoke particularly highly of the Best Practices Guide being a valuable resource that they actively use in working with customers. In general, the utilities were complimentary of the JEA program. The following additional comments from utilities were particularly noteworthy:

- *“JEA was one of NEEA's best projects. Before Just Enough Air, John Shinn had been out doing this work but not as a program. Under JEA, the guide was produced and that provided a specific tool to assess energy saving opportunities. At least it had tangible output in the form of a book, with minimal expenditure. The book was a physical product unlike the other NEEA projects.”*
- *“One of the best NEEA programs I've participated in... [before JEA] I tried to do PCS projects with [three customers] but did not have information to be successful.”*

More detail on the Best Practices Guide is provided in Appendix A.

The evaluators also noted that the project deliverables were completed 28% under budget (\$233,000) despite changes in approach and scope, such as deciding to create the Best Practices Guide.

Discussion of Issues

The following is a discussion of questions the evaluators believe are raised by the foregoing description of JEA's efforts and evolution, and by the research and document review for this report. These questions include:

- Why did JEA have an initially slow start in completing case studies?
- “How big is big enough?” in terms of energy savings potential and numbers of end-users, to warrant pursuing a market transformation effort.
- How important is it that the ASDs be available to service providers?
- Was JEA best cast as a market transformation initiative, a utility-based program...or both?

Why Did JEA Have a Slow Start?

A number of factors appear to have contributed to JEA's slow initial start in completing demonstration sites, a common occurrence among Alliance initiatives. Some factors were internal to JEA while some were related to the market. These factors are described below.

Factors internal to the initiative:

- JEA's initial decision to spread the case studies among five geographic areas with only five service providers proved too limiting to meet the initiative's goals and timelines. JEA and the Alliance recognized this and made changes as described earlier in the report.
- The decision to expand the scope to include whole system projects impacted the selection and completion times for case studies, as well as marketing, and service provider training. In retrospect, a significant contract extension should have accompanied the scope change at the time it was made.

In general, more explicit communication was needed between JEA and the Alliance regarding project timelines and resource requirements. A strategic marketing plan including expected timelines and staffing requirements, and the team's combined marketing and sales strength would have been a helpful tool in this communication process.

- The JEA engineers could have benefited from third-party training and coaching in strategic marketing and sales, an issue for many technical initiatives.
- Further emphasizing, and if possible quantifying, non-energy benefits might have helped motivate end-users, particularly on projects with longer paybacks.

Market factors:

- Whole-system modifications are usually undertaken when other changes are planned, and new construction is limited even in good economic times. Thus sales opportunities in PCS beyond natural market “turnover” and industry growth have to be created through savvy and persistent sales efforts if projects are to be identified and completed in a reasonable amount of time. The relative scarcity of opportunities was echoed by the service providers surveyed for this report.
- Even when an end-user made an initial commitment to a project, the full process through case study publication took longer than anticipated, involved extensive support to keep sites on the path to completion, and required working with many sites to complete nine studies. JEA may have been overly optimistic partly because they originally planned to focus on the simpler fan reduction projects which can be approved and completed in a relatively short amount of time compared to capital-intensive whole-system projects. In addition, preparation and publication of case studies as detailed as those created by JEA is time-intensive.
- There are substantial end-user barriers. For example, the SBW baseline report found that eighty-six percent of end-users felt that their systems are sized “about right” when in fact there is no easy way to tell if a system is oversized (an undersized system is more obvious).
- The secondary wood products industry is contracting, especially with recent economic trends, making it hard for end-users to justify capital expenditures even if they will help control operating costs.
- Some utilities were very helpful and supportive while others were slow or perhaps reluctant to provide customer leads. This is to be expected given the many priorities utilities manage.

Given the Alliance staff's high regard for the technical knowledge and skills of JEA staff, it may be that JEA and the Alliance project coordinator could have “sold” the project to the Alliance more effectively, and have been more realistic and explicit about project timelines. Regular meetings with between the Initiative team and other Alliance staff besides the project coordinator, as well as consistent delivery of monthly reports, might also have been helpful for making sure all parties were on track.

“How Big Is Big Enough?”

The research done for this report indicates that JEA was on par with several other Alliance initiatives in terms of magnitude of projected and achieved savings.

The documented savings of 0.2 aMW from JEA’s nine wood products case studies are on par with, or greater than, the savings reported through December 2001 for three of ten Alliance industrial initiatives. JEA also completed a tenth project with savings of 0.21 aMW before the JEA contract began. While the ten-year estimate of energy savings potential for JEA of 7.8 aMW is relatively small compared to all but one other industrial initiative, this estimate would likely be substantially higher were savings potential considered for other industries besides secondary wood products, such as agriculture, food processing, primary metals, and concrete and aggregates.

Market Transformation Initiative, Utility-Based Program...or Both?

As far back as the first presentation of the JEA initiative to the Alliance board, there was debate about whether JEA was a market transformation initiative or if it was better suited to be a utility-based program. Early in the debate, some Alliance staff suggested it would make a better utility-based program.

The evaluators believe it was well-suited to a combined approach, which ultimately is what JEA did. The JEA program provided significant resources, in particular, the service provider trainings and the Best Practices Guide, to support both utility-based programs as well as service providers who work directly for end-users on a fee-paid basis. However, in the case of the Best Practices Guide it would have been beneficial for the Alliance and JEA to come up with a more in-depth strategy for marketing and distributing the guide to make it an even more effective tool.

How Important are Loaner ASDs?

Sixteen of twenty respondents were asked if they thought having access to adjustable speed drives for testing and demonstration purposes was important. Twelve of these sixteen indicated strong interest in having access to loaner ASDs. Eight of the twelve specifically said they thought the ASDs were important for promoting and selling PCS efficiency services⁵ (all eight had participated in the training). Among the remaining four, three did not think they were important (none of these had completed the training), and the fourth said he was not sure how the approach would work technically. QEI Energy Management and Carroll, Hatch, & Associates report that they have received five to ten calls from service providers regarding the ASD status, and they have been loaned out on two occasions to utilities since the initiative ended.

However, it appears that there was some confusion on the part of service providers regarding the availability of the ASDs. For example, two survey respondents wondered what their current status was. Another said he would have used an ASD to convince a customer to move on a large dust collection efficiency project in a grain storage facility, but he did not think the ASDs were available. A fourth also said he had wanted to use them on two projects and was frustrated that that were not available. JEA said they thought they had communicated to the service providers that JEA staff would work with anyone who was ready to use the ASDs and make them available even without an explicit loan arrangement. Service providers should be notified once the plan for ASDs is in place.

More detail on the phone survey results regarding ASDs is provided in Appendix A.

MARKET EFFECTS

The following is a more detailed discussion of the findings on JEA's market effects. To recap our approach, twenty telephone surveys were conducted. The surveys were conducted with four consulting engineers, of which three were qualified as JEA service providers, twelve contractor/specifiers, one of which completed the full service provider training, and four utilities,

⁵ Not all were asked because the question was added after several surveys had been completed.

one of which was qualified as a JEA service provider. Based on discussions with John Vranizan of Carroll, Hatch & Associates and the responses of several survey respondents, the consulting engineers and contractor/specifiers interviewed are estimated to represent at least 70 percent of the Northwest PCS services market. Appendix B contains a list of the individuals surveyed. In this section the term “trade ally” is used to refer to both consulting engineers and contractor/specifiers.

Respondents were asked questions in the following categories to gain an impression of JEA’s market effects. The utility survey included additional questions appropriate to these respondents.

PCS energy efficiency services or awareness before JEA, and service or awareness change resulting from JEA.

- Perception of whether other service companies or consultants have changed their services or awareness because of JEA.
- Perception of change in customers’ awareness attributable to JEA.

Respondents’ spontaneous comments also were a source of information on market effects.

Services or Awareness Before JEA and Change Resulting from JEA

All twelve contractor/specifiers and two of the four consulting engineers said they offered services to customers to help them improve the energy efficiency of their PCS before JEA although three of the contractor/specifiers’ service descriptions indicated they only nominally addressed energy efficiency. Among utility staff, all four said they were aware of energy efficiency opportunities in PCS before JEA.

Among the twenty respondents, thirteen reported that JEA had increased their knowledge and awareness of PCS operating costs, system sizing, and efficiency opportunities. Seven of those thirteen said they had enhanced their efficiency services as a result of exposure to JEA.

Table 1 below shows these results. It should be noted that the three contractor/specifiers who said they made changes to their services as a result of JEA are major providers of PCS services in the Pacific Northwest. One is located in Everett, Washington, one in Tacoma, Washington, and the third in Eugene, Oregon.

Table 1: Changes Resulting from JEA

Business Type	Total Interviewed	JEA Increased Their Knowledge/Awareness	They Changed or Enhanced Their PCS Efficiency Services As Result of JEA
Contractor/ Specifiers	12	5	3
Consulting Engineers	4	4	4
Utilities	4	3	N/A
TOTAL	20	13	7

Below are some key verbatim remarks by respondents:

- *“Before JEA [energy savings] was a side consideration, not a key component. JEA gave us the tools to evaluate systems...we can apply the JEA concepts. JEA made us more aware. We used to use biggest size instead of looking at optimal size from an energy savings perspective.”(Consulting engineer)*
- *“We’re re-sizing duct work to maximize air flow and...save energy. As a result of JEA we enter into all new contracts with an emphasis on energy efficiency.”(Large contractor/specifier)*

Other Companies’ Service Change Resulting from JEA

Four of twenty respondents said they had noticed changes in PCS energy efficiency services at other service companies and attributed it to JEA. Most comments said the changes resulted from customers’ requests for more efficient equipment. The rest of the trade allies said they had not noticed change. Observations of change included:

- *“Customers are hearing more and more about total horsepower consumption and are asking service providers. Suppliers have to deal with premium efficiency motors. Customers want [them] and are willing to pay for them so suppliers have to have them in stock.”*
- *“Fan suppliers and industrial dust collector [suppliers] are aware of it and are quoting more efficient fans...I believe this is from the JEA Initiative's influence.”*
- *“I’ve only noticed minor instances in dealing with vendors. When we are working with the vendors, the vendors bring up optimization more than they used to.”*

One utility respondent who had noticed greater awareness among vendors said that two had contacted him regarding projects that had never contacted him before. But another utility said there was “not much change in the engineering and design world.”

Change in End-Users’ Practices and/or Awareness Attributable to JEA

Eight of twenty survey respondents (five contractor/specifiers, one consulting engineer, and two utilities) said they had noticed changes on the part of their customers in terms of awareness of energy efficiency in PCS and attributed that change to their direct exposure to JEA’s information and concepts. Most described the change as customers asking vendors and suppliers more often about energy-efficient equipment. One trade ally also said customers are more actively pursuing utility rebates. These findings echo the anecdotal examples described by John Shinn of end-users starting to think about operational costs, not just first cost, and about system sizing.

Additional Projects Beyond the JEA Contract Period

As part of the evaluation, service providers and other market players who participated in JEA were queried via e-mail on whether they had pursued additional PCS efficiency projects that went beyond the JEA contract period. The following information was collected:

- EWEB reported initiating six PCS efficiency projects since the conclusion of JEA in March 2002 and described them as “influenced by JEA.” For one of the projects they used the ASD available from the program, and said they may use it on another four.
- Baxter Air Engineering reported installing a large project with a wood products plant in 2002 in Tacoma, Washington and reported it was influenced by the JEA materials.
- Snohomish PUD reported initiating three additional projects with wood products plants and said they “evaluated the systems using the skills learned from the JEA program.”
- SBW Consulting was involved in two projects influenced by JEA in addition to their service provider field training projects. Both were with PacifiCorp. One customer implemented the project (installed the measures). The other has not.
- PGE reported it was not doing pneumatic conveying projects before JEA and now it is. At least two project leads from Air Tek NW, a pneumatic conveying contractor, were referred to PGE during and after JEA.

In addition, PacifiCorp also reported as of October 2002 it had fourteen projects in process in Oregon and Washington (beyond the three case studies with PacifiCorp customers completed during JEA, one case study completed before JEA, and one project started before JEA). These fourteen projects were initiated during or after the JEA contract period and are in various stages of completion as of the publication of this report. Of the fourteen, four were in construction as of April 2003. Also, as of October 2002 PacifiCorp had two projects in progress in Utah.

In the e-mail from the Snohomish PUD engineer regarding JEA’s continuing influence he remarked:

- *“I think JEA is a very successful program. I was aware of the energy waste in dust collection systems before the program but I lacked the experience in working with those systems. JEA provided just that. After participating in three projects, I feel very confident technically in evaluating this type of projects. The case studies are great and they provide convincing stories to motivate customers to look at their systems. I believe we have a lot of opportunities in our service territory. ...Other engineers [at Snohomish PUD] may or may not be aware of the opportunities. So I tried to educate or share my experience with other engineers here. One thing I think will be helpful is for NEEA to organize another training for utility engineers or other engineers in the field.”*

In an e-mail from PacifiCorp regarding their ongoing projects beyond JEA, the program manager remarked:

- *“We would have continued to focus on fan speed reduction [without JEA] and would have figured out whole system analysis eventually, but JEA got us there more quickly with a focus and with solid work products. We credit JEA for the projects in our pipeline because we are doing projects now in a more thorough way and with more*

confidence as a result of JEA. We are also more effective at finding PCS opportunities, screening them, and obtaining customer buy-in to proceed on projects as a result of JEA. We use the case studies, we use the trade ally and service provider lists, and we use the Best Practices Guide.”

General Market Findings

Despite clear market effects, it remains the case that the market is relatively small in terms of numbers of customers, and that opportunities to upgrade efficiency occur only occasionally, particularly in the secondary wood products industry. Both of the consulting engineers surveyed said PCS work is scarce, and only by doing whole-system work can one achieve sufficient profit margins. One remarked “The hardest part is that after the [training] process you have to find a job to do. It is more by accident. Opportunities are there but financial margins are not that high – at least on the resheaving stuff. But if doing complete system re-do, there is a lot more engineering work.” A third trade ally remarked that with energy prices going down again, he has seen two clients walk away from potential PCS projects. A utility contact remarked that, “The opportunities are ‘one in a million’ for cost-effective projects on existing systems. But maybe finding out that paybacks were long was valuable in and of itself.” The conclusion is that whole system retrofit projects often need incentives to buy down the payback. This is common to other industrial systems.

LESSONS LEARNED

- **The Alliance and JEA’s expectations needed to be more realistic and better aligned regarding expected time requirements for completing whole-system projects and case studies.** More explicit communication was needed between JEA and the Alliance regarding the implications of the mid-course decision to expand the scope to include a whole system approach. This decision impacted the selection and completion times for case studies, as well as marketing and service provider training. In retrospect, a significant contract extension and attention to marketing implications should have accompanied the scope change at the time it was made. Regular meetings with Alliance staff in addition to the project coordinator might also have been helpful for making sure all parties were on track.
- **The initiative could have benefited from a strategic marketing plan and a more clearly articulated business case.** Although JEA prepared a marketing outline, a more fully developed strategic marketing plan that was a “living” document, one used and updated regularly, could have provided valuable ongoing guidance on (1) the intended target market and the rationale behind its selection (including consideration of the SBW report findings); (2) the planned marketing and sales approach given the target market selected and its characteristics; (3) expected project timelines and staffing requirements; (4) the business case from the perspective of both end-users and service providers; and (5) an assessment of the team’s combined marketing and sales strengths. Given the implementation contractor’s considerable experience in developing and delivery PCS projects, the evaluators believe this plan could have been developed before the case studies were completed. Involving a third-party expert in preparing the plan and providing other marketing and sales support could have also been beneficial.

- **Non-energy benefits could have been more strongly highlighted.** Several of the case studies could have been strengthened by the inclusion of more detailed descriptions of non-energy benefits and/or quantification of non-energy benefits in dollars where possible⁶, particularly on case studies with long paybacks. The summary table of case studies also needed to include mention of non-energy benefits. The Best Practices Guide could benefit as well from information on how to more formally identify, describe, and quantify non-energy benefits (with dollar values, if possible).
- **A specific plan was needed from the outset for how the ASDs would be managed after the JEA contract ended.** While the Alliance assumes ownership of project assets as a standard part of all contracts, this was the first time physical assets in the form of industrial equipment had been included. There should have been a detailed plan from the beginning for transferring ownership to the project well in advance of the end of the contract. While a general idea existed to transfer the ASDs to another party after the initiative's conclusion, no specific arrangements were made until very recently, a situation that resulted in uncertainty for service providers and unnecessary tension between the Alliance and JEA. The Alliance and JEA have now arranged for transfer of ASD ownership to a third party who has agreed to make them available to qualified service providers for a minimum of three years.

⁶ For example, the non-energy benefits described for Wood Castle, Wallace Millworks, and Timber Products Co. could have been further quantified.

APPENDIX A: FURTHER DETAIL ON FINAL JEA DELIVERABLES

CASE STUDIES

Table A-1 below provides a summary of the nine case studies. Total documented savings are 0.2 aMW. The Best Practices Guide contains a more detailed table and hard copies of the studies.⁷

Table A-1: Case Study Summary

Business Type	State / Plant Size	Energy Efficiency Measures	kWh/year savings / % of PCS energy saved	Simple payback in years based on <u>total and net cost</u>		Non-energy benefits
Woodtape	WA Medium	Fan speed reduction	217,525 39%	0.5	0.0	Noise reduction, less indoor dust in winter.
Log homes	ID Large	Fan speed reduction	26,400 23%	2.4	0.2	Minimized vibration that was problematic for years.
Display partitions	WA Medium	Fan speed reduction	243,000 36%	0.1	0.0	Better matching of airflow to production needs.
Wood cabinets	WA Medium	Permanent VFD used manually	312,468 38%	0.9	0.3	Better matching of airflow to production needs.
High-end kiln-dried furniture	OR Medium	System replacement	129,000 46%	11.0	4.1	Noise and emissions reduction; flexibility in scheduling.
Millwork	MT Small	System replacement	27,900 50%	1.3	0.0	Improved product quality and productivity.
Furniture	OR Medium	System replacement	218,250 34%	18.1	6.9	Emissions reduction, capability for expansion.
Dimension lumber	OR Large	System replacement with controls	403,645 44%	5.9	5.9	Noise and emissions reduction
Decorative overlays	OR Medium	New system for 24 hr part of operation	188,099 18%	7.6	0.6	Decreased maint. and longer equip. life on blower.
TOTAL			0.2 aMW			

⁷ The JEA Best Practices Manual is available in hard copy from the Alliance or electronically at <http://www.nwalliance.org/projects/projectdetail.asp?PID=26>. This website also provides access to the project case studies, evaluations, and other documents.

SERVICE PROVIDER TRAINING

JEA conducted a rigorous training effort for service providers wishing to be “qualified” by JEA. After pre-qualification of applicants, the training consisted of three phases: classroom instruction, a written test, and field training.

Pre-qualification

JEA first sent out a Request for Qualifications to over 100 people to assess the background and interest of applicants. It was important to the initiative that those intending to become qualified be in a position to apply their newly-gained knowledge. Twenty-two people applied and were accepted.

Classroom Training

Altogether, thirty-one individuals representing 19 organizations attended the classroom trainings. The trainings were held in Tacoma, Eugene, and Spokane in October and November of 2000 and a follow-up class was held in Portland in October 2001. The 19 attending organizations consisted of: nine engineering consulting firms, two contractor/specifiers, seven utilities, and one other organization. Nine individuals attended classroom training for professional development purposes only without intending to complete the service provider program.

Written Test and Field Training

To advance to the field training phase, prospective service providers were required to pass a written test. Twenty-two individuals took the test and 20 passed. Eleven of those passing went on to complete field training at a site with JEA’s assistance and became qualified service providers.

The eleven individuals who completed the full training are listed in the JEA Best Practices Guide along with QEI Energy Management, Inc. and Carroll, Hatch & Associates and another five individuals who passed the written exam and either expect to complete field training in the future or are from the same firm as a person who completed the field training.

So altogether, the list of Service Providers in the Best Practices Guide contains eighteen individuals from 13 organizations.⁸ Tables A-2 and A-3 below summarize the types of service providers and their locations in the Northwest.

Table A-2: Service Provider Organizations

Engineering Consulting Firms	Contractors/ Specifiers	Utilities
8	1	4

⁸ In addition to the list of qualified service providers, the Best Practices Manual also contains a list of 35 “Dust Collection/Blower System Contractors” described as “a sampling of the companies who install and/or sell equipment and services to users of low pressure dust collection/blower systems.”

Table A-3: Locations of Service Provider Firms

Western Oregon	Western Washington	Eastern Oregon/ Washington	Idaho	Montana
7	3	1	1	1

Service providers surveyed were complimentary of the training even if it was a review for them:

- *“Good training. It was a refresher for me but it was the right length and good technically.”*
- *“We were familiar with affinity laws, but this gave us the design parameters to use when assessing systems.”*
- *“Great training. We learned a lot of new things.”*

BEST PRACTICES GUIDE

Table A-4 below shows how many organizations have received a copy of the Best Practices Guide, and how many have been notified by e-mail that the guide is available electronically on the Alliance web site.

Table A-4: Distribution of Just Enough Air Best Practices Guide

Method of Distribution	Types of Organizations Receiving Guide					TOTAL
	Service Providers	Utilities	PCS End-Users	Contractors/Engineers	Other	
Hard Copy	18	10	37+	53	12	130
Notification of Availability on Alliance Website	18	178		53		249

It might be of use to the Alliance to track how many Best Practices Guides are downloaded from the website. While there is no reliable statistical relationship between such data and the level of interest, it is still a relative indicator. Setting up a system to track general and specific web site hits is fairly easy with available software, and might be of benefit to the Alliance in other ways as well.

The following are detailed findings from the service provider surveys regarding their use of the guide:

- Sixteen respondents were asked if they had used the guide.⁹ Eleven said yes. A twelfth was very positive about it but said he was already familiar with the contents. The four that had not used it were contractor/specifiers. This is not surprising since they did not attend the training and their businesses are more focused on installations than

⁹Two respondents were not asked this question because they said they did not receive the manual, and two were not asked because the question was added after several surveys had been completed.

engineering.

- Uses of the Best Practices Guide mentioned by respondents included: as a reference for specifying systems; for calculating project costs and savings using the tools; to calculate the power to air ratio; to assess system opportunities; to train staff; and as an educational resource for customers and for the respondent (a utility).

SERVICE PROVIDER OPINION OF IMPORTANCE OF LOANER ASDs

Sixteen respondents were asked if they thought having access to adjustable speed drives for testing and demonstration purposes was important.¹⁰ Below are examples of responses from the twelve survey respondents who thought loaner ASDs are important. As mentioned in the body of the report, all eight with positive responses had participated in the training:

- The one contractor/specifier qualified as a JEA service provider said *“ASDs are key to our involvement on an ongoing basis. Other people are in the same situation. We need to be able to demonstrate to the client that lower RPM works...it gives us another inroad.”* This same respondent said this tool was particularly important in the industries they serve including steel, lime, and aluminum manufacturing where end-users tend to oversize fans and run them at higher speeds than necessary because dust collection and conveying is critical to pollution control.
- One qualified consulting engineering firm remarked: *“We ran into a few situations where we could have used the ASD to demonstrate to the customer the 'sweet spot' in terms of fan speed but we didn't have [access to] the [loaner] ASDs so the projects just died. One was a grain storage facility with 12 different dust collection systems totaling 1,000 HP that were inefficient. So there was significant savings potential. The client wanted to see proof [that the slower fan speeds would work and save energy] but we didn't have the ASDs. We did do other energy savings work at the plant, but none on the dust collection system.”* (This firm also mentioned that they have had several other inquiries from customers to use the ASDs to test their PCS.)
- Another contractor/specifier also mentioned that he would have used them on two projects but was frustrated to find they were not available. He thinks they are a “great idea.”
- Two utility respondents, both qualified service providers, said they had successfully used ASDs to demonstrate reduced fan speeds and convince customers to pursue projects.

As mentioned above, three of the four neutral or negative responses about the loaner ASDs were from respondents who had not completed the training:

- One contractor/specifier said an educated guess for resheaving gets you close enough.
- Another contractor/specifier said in one case he might have used an ASD to demonstrate but did not because it was a new system and the installation would have interrupted the flow of work.

¹⁰ Only sixteen were asked because the question was added after four surveys had already been completed.

- A third contractor/specifier had attended the training but said “I’m not sure how that would work” and added that his company uses what he described as an “infinite speed drive” from Inertia Controls.
- One utility respondent said that ultimately service providers and consultants will “do their own thing” and that a formal loan program would not work. He also said he had never used an ASD as a demonstration tool with a customer.

The twelve service providers with positive views on ASDs were also asked if they believe they could be useful for demonstration in other industrial systems. All but one said they believed they could be used in other applications, although two expressed reservations about using them for pumping. One utility respondent specifically mentioned induced draft fans on hog fuel boilers as a potential application.

APPENDIX B: IN-PERSON INTERVIEWS

Implementers:

- John Vranizan, Carroll, Hatch & Associates, Inc.
- John Shinn, QEI Energy Management, Inc.
- Nancy Goddard, PacifiCorp

Alliance staff:

- David Cohan, Evaluation Coordinator
- Michael Ponder, Project Coordinator
- Susan Hermenet, Director of Planning and Implementation
- Jeff Harris, Manager, Development

Phone Surveys

Consulting Engineers:

- Dan Parker, Parker, Messina, & Associates, Inc. (JEA qualified service provider)
- Richard Kartchner, Kartchner Engineering (JEA qualified service provider)
- Bing Tso, SBW Consulting (JEA qualified service provider)
- Rob Morton, Cascade Energy Engineering

Contractor/specifiers:

- Warren Phillips, Serbaco, Inc. (JEA qualified service provider)
- Michael Wyre, Schneider Simpson
- Bruce Livesay, Western Pneumatics
- Pete Newman, H&R Mechanical
- Dave Setera, Argo Blower & Manufacturing Co.
- Dennis Gibson, Commercial Metal Products
- Mark Wolfe, Superior Systems
- Randy Heijden, US Metal Works
- David Spencer, Willow Creek Tool
- Pat Hagel, Hagel & Associates
- Wally Carothers, Carothers & Son
- Troy Sheperd, B&R Sheet Metal, Inc.

Utilities:

- Rob Gray, Avista (JEA qualified service provider)
- Alan Fraser, EWEB (JEA qualified service provider)
- Chao Chen, Snohomish PUD (JEA qualified service provider)
- Doug Findlay, PGE

APPENDIX C: CONFERENCE AND TRADE SHOW MARKETING

JEA did marketing at eleven conferences and trade shows over two years. A list of those dates and events is shown below.

- Presented at the Western Dry Kiln Club in Portland, OR in 1999
- Presented at the Washington State Plant Engineering & Maintenance show in Tacoma, WA in Fall 1999
- Presented and exhibited at the Wood Technology Clinic & Show in March, 2000 in Portland, OR
- Presented at the Earth Day 2000 Utility Roundtable in Newport, OR in April 2000
- Presented at the Northwest Plant Engineering & Maintenance Show and Conference in Portland, OR in May 2000
- Planned and presented at two end-user seminars in Montana in June 2000, jointly with the Electric League Drive Power project
- Presented and exhibited at the Central Oregon Industrial Expo in September, 2000 in Redmond, OR. JEA mailed announcements to large and medium end user sites in Oregon and Washington to encourage them to see JEA at the show, and then followed up the mailing with phone calls.
- Presented jointly with Roger Hunter, Woodtape, Inc., at the Washington State Plant Engineering & Maintenance show in October, 2000 in Seattle, WA
- Wood Technology Clinic & Show in March 2001 in Portland, OR. Hosted a luncheon attended by 44 individuals. Event was put on jointly with Oregon Office of Energy, the Alliance, five utilities and the JEA service providers. Dick Watson from NWPPC was the keynote speaker on the current energy situation and tie to energy efficiency. JEA presented dust collection system energy efficiency opportunities.
- Presented and exhibited at Snohomish County PUD trade show/seminar in June 2001

APPENDIX D: SERVICE PROVIDER/CONTRACTOR SERVEY

Note: The utility survey had a few additional questions appropriate to those respondents.

**JUST ENOUGH AIR
SERVICE PROVIDER/CONTRACTOR SURVEY**

Company name: _____

Contact person: _____

Date: _____

(Ask for specific contact person listed in the list of service providers.)

My name is Jennifer Stout. I'm calling on behalf of the Northwest Energy Efficiency Alliance. I'm with a research firm called Currents Consulting. We're doing a very brief follow-up survey on the Alliance's Just Enough Air Initiative. Would you have 15 minutes to answer a few questions? (RESCHEDULE AS NECESSARY.) Your responses are confidential – your name will not be associated with any of your comments.

1. First I'm going to read you a list of ways you may have been involved the Just Enough Air Initiative. For each, please answer yes or no or don't remember.

Y	N	DK	1A. You were contacted by one of the Just Enough Air consultants.
Y	N	DK	1B. You were invited to a technical training session.
Y	N	DK	1C. You participated in a technical training session.
Y	N	DK	1D. You were certified as a service provider.
Y	N	DK	1E. You received the Just Enough Air Best Practices Manual.
Y	N	DK	1F. You provided a lead for a company to become a project demonstration site.
Y	N	DK	1G. You were involved in a demonstration project.

2. Before being exposed to the Just Enough Air Initiative, did you offer any services to customers to help them improve the energy efficiency of their pneumatic conveying systems?

Y N DK

3. IF YES: Can you briefly describe the services you provided? (PROBE: Did you recommend and/or offer fan speed reduction through resheaving or permanent VFDs before being exposed to Just Enough Air?)

3. Describe:									
3A. Resheaving:	Recommend	Y	N	DK	Offer	Y	N	DK	
3B. Permanent VFDs:	Recommend	Y	N	DK	Offer	Y	N	DK	

4. As a result of being exposed to the Just Enough Air Initiative, have you made any changes to the services you offer to customers to help them improve the energy efficiency of their pneumatic conveying systems?

Y N DK

5. IF YES: What changes have you made? (PROBE: Do you now recommend and/or offer resheaving or permanent VFDs to reduce fan speed?)

5. Describe:									
5A. Resheaving:	Recommend	Y	N	DK	Offer	Y	N	DK	
5B. Permanent VFDs:	Recommend	Y	N	DK	Offer	Y	N	DK	

6. IF DOES NOT RECOMMEND OR OFFER THESE IN Qs 3 OR 5: Even though you don't recommend or offer resheaving to reduce fan speed, do you still think resheaving would work at wood processing facilities? Do you think the permanent VSD approach would work?

6A. Resheaving:	Y	N	DK
6B. Permanent VFD:	Y	N	DK

7. Are you aware of any other service companies or consultants who have changed their services over the past year or so as a result of being exposed to the Just Enough Air Initiative?

Y N DK

7A/B. IF YES: What changes have you seen, and who is doing things differently?

7A. What changes?
7B. Who?

8. Over the past year or so have you noticed any changes on the part of your customers in terms of their awareness of energy efficiency in pneumatic conveying systems?

Y N DK

9. IF YES: What have you noticed?

--

10. IF RECEIVED MANUAL IN QUESTION 1 ABOVE: Have you used the Just Enough Air Best Practices manual?

Y N DK

10A. IF YES: How have you used it? (PROBE: Was it useful? What's your opinion?)

--

11. IF ATTENDED TRAINING IN QUESTIONS 1: What was your opinion of the training?
Was it useful? How?

12. As you may know, the original plan was to have ASDs available to loan to service providers to demonstrate optimal fan speeds for customers. How important would you say it is to have these ASDs available for loan?

13. Do you feel that loaner ASDs are useful for testing in other industrial systems, such as pumping or drying systems?

14. Do you have any other comments on the Just Enough Air Initiative or on energy efficiency in pneumatic conveying systems in general?

Thank you very much for your time.