



focus on energysm

The power is within you.

Performance Verification and Optimization
Compressed Air
Pilot Program
Participant Manual

September, 2009

Table of Contents

Introduction.....	1
Program Overview	1
Eligibility	1
Incentive.....	2
Incentive Estimation Worksheet	2
Process Outline	3
Compressed Air PVO Study Requirements	7
Pre-Study Tasks	7
Study Data Collection	8
Evaluation and Recommendations.....	9
Suggested Report Format.....	9
Tables and Forms.....	10
System Schematic (sketch below)	10
Performance Verification Form Compressor.....	11
Performance Verification Form Air Dryer	12
Performance Verification Sequencer Controls	13
Performance Verification Form Distribution System	14
Leak Assessment Results Form	15
Recommendations (use this table or create your own with same headings).....	16

Introduction

Program Overview

The primary objective of the Focus on Energy Performance Verification and Optimization (PVO) Program is to identify and implement no/low-cost energy efficiency measures within Wisconsin industrial facilities through detailed system studies.

The purpose of a PVO study is to verify that each component of a system is performing as intended and as efficiently as possible. In the process of completing the study the market/service provider may uncover no/low cost repairs that, if completed, will return the system to optimum efficiency.

PVO studies are comprehensive and involve detailed data-logging and analysis to fully understand the dynamics that effect system operation. Unlike a typical audit, a PVO study is not intended to uncover large capital improvement suggestions, although if identified, these suggestions may be included in the final report.

The Focus on Energy PVO program offers \$15 per horsepower (hp) towards the cost of the study (maximum incentive of \$30,000). In return, the customer promises to spend up to \$15/hp implementing any measures identified with a 1.5 year payback or less. If the study can be completed for less than \$15/hp, the customer may use the remaining incentive towards the cost of implementing measures.

This pilot program consists of 10 opportunities. There is a limit of two opportunities per market provider. Opportunities will be distributed on a first-apply, first-serve basis.

Eligibility

Eligible program participants include industrial facility owners who:

- Are customers of a Focus on Energy participating utility see list of participating utilities at focusonenergy.com/Resources/participating_utilities.aspx
- Have demonstrated commitment to spend up to \$15/hp towards implementation of the low/no-cost measures identified in the study with an estimated simple payback of 1.5 years or less
- Have at least 200 connected compressor horsepower
- Have not had a leak audit in the past year
- Do not have any major planned upgrades to their compressed air system.

Incentive

Focus on Energy will provide an incentive of **\$15 per non-back up horsepower** (maximum incentive \$30,000), for a market provider to complete the assessment outline in this manual at the customer site, if the identified measures with a 1.5 year payback or less are implemented or \$15/hp is spent towards those measures before December 31, 2010.

If the participant fails to implement recommended measures within this timeframe, no incentive will be paid and the participant will be responsible for all costs associated with the PVO services provided.

Incentive Estimation Worksheet

A.	Potential Incentive \$15 x _____ (total non-backup hp) =	\$
B	Market Provider's Proposed Cost to Complete PVO Assessment =	\$
C	Incentive Remaining To Apply Towards Implementation (A - B) =	\$

Process Outline

1. **Ensure Customer Eligibility.** Market provider and customer should review eligibility requirements for age of system and total connected horsepower as well as verify that the customer is eligible for Focus on Energy services.
2. **Complete Application.** This should be completed by the vendor and customer together and may require a short walk-through of the facility. The customer must sign the questionnaire. The application and questionnaire are provided in the following pages.
3. **Submit Application for Review and Approval.** Focus on Energy staff will review the yes/no questions in the application to ensure energy savings at customer site and provide pre-approval to move forward with full PVO study. At this time, Focus will also provide incentive amount that will be available to fund study if identified measures are implemented.

Complete applications should be faxed to: Focus on Energy PVO, Attn: Nate Altfeather to 608.277.2947 or scanned and e-mailed to: altfeathern@saic.com. For more information contact Nate Altfeather at 608.277.2949.

4. **If Application is Approved, Complete the PVO Study and Deliver Report.** Market provider must complete PVO activities described in the attached study guidelines and delivers report to both Focus on Energy and to customer within four weeks of conclusion of audit.
5. **Implement Identified Measures.** Customer must implement all measures that are identified as having a simple energy payback of less than 1.5 years or invest up to a total of \$15 per connected horsepower towards those projects, whichever is less, **before December 31, 2010.** Customers will have the opportunity to make a case that a given project is unreasonable. If a project is deemed unreasonable by Focus on Energy, implementation of that project will not be required.
6. **Receive Incentive.** Upon receipt of implementation notice that measures are completed, customer will receive incentive payment of \$15 per connected horsepower, not to exceed the cost of the PVO study.

Industrial Compressed Air PVO Application

Customer Information		
Company Name		
Primary Contact Name	Primary Contact Phone	Primary Contact Email
Facility Address		
City	State	Zip
Market Provider Information		
Market Provider Company Name		
Market Provider Contact Name	Contact Phone	Contact Email
Payment Information		
Company or Corporate Tax ID of Payee (Must be 9 digits, do not list tax exempt number)		
Name Check Should be Written To (Company/Corporate/Owner's Legal Name)		
Attention		
Mailing Address		
City	State	Zip Code
Business Classification (Please Select One) <input type="checkbox"/> Corporation <input type="checkbox"/> Partnership <input type="checkbox"/> Sole Proprietorship <input type="checkbox"/> Other <input type="checkbox"/> LLC (please write tax classification D,C,P)		
Customer Acceptance of Application Terms		
By signing below I certify that:		
1) The information contained in this application and associated questionnaire is accurate and complete to the best of my knowledge, and I will make my best effort provide additional information if requested.;		
2) I have read and understood the obligations of PVO incentive participants, including the commitment to spend up to \$15 per connected hp to implement identified energy conservation measures by December 31, 2010 and agree to make a good faith effort to comply with all requirements if selected for participation in the program.		
Company:		
Printed Name of Signee:		Signee Title:
Signature:		Date
Market Provider Acceptance of Application Terms		
By signing below I certify that:		
1) The information contained in this application and associated questionnaire is accurate and complete to the best of my knowledge, and I will make my best effort provide additional information if requested.		
2) I understand that contractual agreements for payment of services are strictly between customer and market provider. If customer fails to meet requirements for award of incentive market provider is responsible for collecting payment from customer for services rendered.		
Company:		
Printed Name of Signee:		Signee Title:
Signature:		Date

Industrial Compressed Air PVO Application

Site Information	
Company Name:	
Facility:	
Date:	
Market Provider Company:	Contact Name:
Eligibility	
Does customer have at least a 200 connected compressor hp not including backup?	yes / no
Does the customer purchase electricity from a Focus on Energy participating utility?	yes / no
Industrial Compressed Air PVO Pre-Qualification Questionnaire	
<i>Please indicate if the customer's system has opportunities for low/no-cost efficiency improvement in the following areas by circling yes or no. If yes, please explain your reasoning in the space provided. Areas where "yes" is indicated should have a resolution stated in the final report if application is approved.</i>	
Optimizing system pressure	yes / no
Reducing temperature of intake air to compressor	yes / no
Reducing air use at end use	yes / no
Reducing pressure required at end use	yes / no
Recovering heat of compression	yes / no
Addition of compressor sequence controls	yes / no
Adjustment of existing controls to optimize system	yes / no
Install/repair dew-point control for regenerative dryers	yes / no
Eliminate high-pressure loss piping	yes / no

Compressed Air PVO Study Requirements

The following requirements are based on those in the Compressed Air Challenge Best Practices Second Edition Appendix 6.B.1

WARNING BEFORE PROCEEDING! *You must have an approved application form signed by Focus on Energy before proceeding with PVO audit. Studies that proceed without pre-approval will NOT receive an incentive.*

The objective is a proper alignment of the supply side and the demand side for optimum efficiency, energy savings and reliability. A baseline will be established against which the results of any proposed changes are measured.

Pre-Study Tasks

- 1) **Hold a pre-study meeting with plant personnel**
 - a. Record compressed air concerns from each department
 - b. Brainstorm potential uses for compressor waste heat utilization
 - c. Record existing compressed air management initiatives
 - d. Document compressed air quality requirements
 - e. At this time also decide on a cost per unit of energy based on utility billing history to be used for system study cost analysis

- 2) **Draw a block diagram of the compressed air system**
 - a. Include relative locations of separate supply points, and the various production areas (buildings, departments, business units, etc.) as well as conditioning equipment
 - b. Identify any high-air use equipment in the process and/or production areas
 - c. Identify all electronic control valves/main charging valves on the diagram
 - d. Identify on the diagram what components are integrated into the system controller (if controller exists) include valves controlled by controller

- 3) **Attain compressor and treatment equipment performance data**
 - a. Include CAGI Compressor Data Sheets or Engineering Data Sheets
 - b. Include CAGI Equipment Data Sheets or Engineering Data Sheets for auxiliary conditioning equipment
 - c. Document nameplate data if above are unavailable

- 4) **Document existing system controls and performance monitoring equipment**
 - a. Identify individual compressor controls (i.e. mod, load/unload, VFD, etc.) list control strategies available on each compressor as well as control currently being used
 - b. If compressors are currently sequenced describe the sequence order and parameters or describe sequence controls if program unknown
 - c. If treatment equipment is incorporated into control system please describe how
 - d. Describe all existing electronically controlled valves including location performance rating and function

- 5) **Identify and document customer pressure requirements**
 - a. Document current compressor pressure set point and end use pressure required
 - b. Note high/low-pressure end-uses that deserve further investigation
 - c. Validate end-use pressure and quality requirements from end-use manufacturer specs to ensure customer isn't over-treating or over-pressurizing air

Study Data Collection

1) Determine supply side efficiency

For the same one-week period the following must be logged using no longer than a 15-second sample interval.

- a. kW (not amps) at the following points
 1. each compressor
- b. SCFM at the following points
 1. downstream from all supply equipment
- c. Pressure at the following points
 1. Before or after treatment equipment
 2. Before and after flow controller (if applicable)
 3. Distribution point furthest from supply
 4. Other critical areas of customer concern
- d. Determine Compressed Air Supply Efficiency (CASE) Index.
CASE Index is average scf/kWh for one week where scf is measured downstream of all supply side equipment, and kWh includes energy consumption of all supply side equipment (compressors, dryers, flow controllers, etc.) estimate auxiliary equipment energy consumption from nameplate if unable to measure real data

2) Verify performance of individual system components and uncover deficiencies

Complete the attached performance verification forms for the following

- i. Compressor(s)
- ii. Treatment equipment
- iii. Distribution system
- iv. Controls

3) Measure/quantify air consumed by leakage and inappropriate uses of compressed air

Use one of the following methods to estimate leakage rate:

- a. Compare system/sector air consumption during production and non-production periods
- b. Perform a system bleed down test during a non production time
- c. Complete an ultra-sonic leak survey for entire system

4) Document actual end use pressure requirements

Document actual end-use pressure requirements using name plate data or original specification for point of use equipment.

Evaluation and Recommendations

Report Findings

A comprehensive written report of all findings, recommendations and results must be submitted within four weeks to both Focus on Energy and the customer. Findings may be displayed as graphs, tables or diagrams, as needed to clearly convey these findings. Photographs of identified problems areas also may be helpful. Solution and product neutrality should be maintained with any recommendations. Report at a minimum must contain the following.

The recommendations MUST be listed along with estimated reduction in air consumption, power (kW), energy (kWh), utility costs savings, estimated implementation costs, and anticipated payback period for each recommendation and displayed in a table at the end of the report.

Suggested Report Format

- Executive summary
- Facility profile
- Summary of customer pre-study meeting
 - Record compressed air concerns from each department
 - Results of brainstorming for uses of compressor waste heat
 - Explain customers current compressed air requirements
 - Pressure
 - Air quality
- Describe data logging activities
 - Types of loggers and monitoring equipment used
 - Describe locations in the system where metering was performed
- Attach completed data logging results
- Attach completed performance verification forms
- Attach list of recommended measures

Tables and Forms

System Schematic (sketch below)

Performance Verification Form Compressor

Compressor Name:	Location:	
Name Plate Hp:	Full Load CFM:	
Control Type (Mod, On/Off, Var Dis, VFD, etc.)		
Performance Criteria		
Customer Required Performance. List the critical performance parameters that the customer requires from this compressor.	Max CFM	
	Min CFM	
	Avg CFM	
	Pressure Range	
	Other:	
	Other:	
Manufacturer's Specified Performance. List the manufacturer's specifications for the same parameters above.	kW @ Customer Max CFM	KW
	kW @ Customer Min CFM	KW
	KW @ Customer Avg CFM	KW
Actual Measured Performance. List the actual performance of the compressor based on data gathered during the study. Is the compressor delivering required performance? Is the control mechanism functioning properly at light loads?	kW @ Customer Max CFM	
	kW @ Customer Min CFM	
	kW @ Customer Avg CFM	
	CFM/KW	
	Capacity Control Working	Yes / No
	Other:	
Recommendations. List low/no-cost measures that the customer should consider to optimize the compressor's performance while meeting the customer's needs.		

Performance Verification Form Air Dryer

Dryer Name:		Location:	
Name Plate Capacity (CFM):		Minimum Dew Point:	
Dryer Type (Refrigerated, Cycling, Purge Air etc)			
Performance Criteria			
Customer Required Performance. List the critical performance parameters that the customer requires of the dryer	Required Dew Point		
	Max Dryer CFM Capacity Required		
Manufacturer's Specified Performance. List the manufacturer's specifications for the following parameters	Minimum Dew Point		
	Max CFM Treatment Capacity		
	CFM Consumed for Media Regeneration		
	Expected Regeneration Cycles per Hour		
	KW Draw		
Actual Measured Performance. List the actual performance of the compressor based on data gathered during the study.	Dew Point of Delivered Air		
	CFM Consumed for Media Regeneration		
	kW Draw (can be estimated from amps)		
	Actual Regeneration Cycles per Hour		
Recommendations. List low/no-cost measures that the customer should consider to optimize the dryer's performance while meeting the customer's needs.			

Performance Verification Sequencer Controls

Performance Criteria										
<p>In the chart below indicate with an 'x' the system CFM demand when each compressor should be on-line. Then after the investigation use 'x' to indicate which flow range each compressor was actually on-line and review for optimum efficiency based on individual compressor characteristics. Only use the number of CFM ranges necessary.</p>	Compressors Controlled by Sequencer (Write names in boxes below)									
	Trim		Base Load 1		Base Load 2		Base Load 3		Base Load 4	
	Expected	Actual	Expected	Actual	Expected	Actual	Expected	Actual	Expected	Actual
1 CFM to _____ CFM										
_____ CFM to _____ CFM										
_____ CFM to _____ CFM										
_____ CFM to _____ CFM										
_____ CFM to _____ CFM										
_____ CFM to _____ CFM										
_____ CFM to _____ CFM										
_____ CFM to _____ CFM										
_____ CFM to _____ CFM										
_____ CFM to _____ CFM										
_____ CFM to _____ CFM										
_____ CFM to _____ CFM										
_____ CFM to System Max CFM										
<p>Recommendations. List low/no-cost measures that the customer should consider to optimize the system's performance while meeting the customer's needs.</p>										

Performance Verification Form Distribution System

Performance Criteria				
Customer Required Performance		Customer Required Pressure (PSI)	% of end use equipment requiring this pressure	
	Lowest End Use Pressure Required			
	Critical Point 1:			
	Critical Point 2:			
	Critical Point 3:			
	Highest End Use Pressure Required			
Actual Measured Performance	Location		Average Pressure (PSI)	Fluctuation +/-%
	Immediately After Treatment Equipment			
	Critical Point 1:			
	Critical Point 2:			
	Critical Point 2:			
	Farthest point from supply			
<p>Recommendations. List low/no-cost measures that the customer should consider for improving the distribution system's efficiency and reducing unnecessary pressure loss.</p>				

Leak Assessment Results Form

Fill out the information for one of the following methods:				
Leak Down Test				
Estimated System Volume	Starting Pressure	Elapsed Time	Final Pressure	Estimated Leak Rate (CFM)
Ultrasonic Leak Detection (include leak survey log) with the following categories for each leak:				
<ul style="list-style-type: none"> -Tag Number -Location -Description -Leak Severity (severe, moderate, small) -Estimated Cost of Leak (\$/year) 				
Total Number of Leaks	Estimated Total Leak Rate (CFM)		Survey Log Attached? (y/n)	

