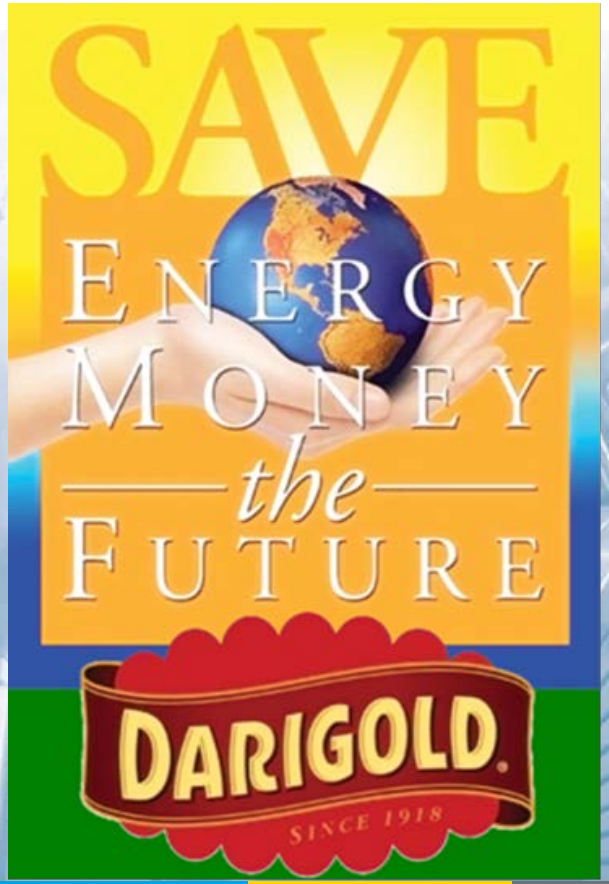
Better Buildings CHALLENGE
U.S. DEPARTMENT OF ENERGY



In-Plant Training

Compressed Air Assessment Basics

March 3 2015

Frank Moskowitz

Draw Professional Services

What is an In-Plant Training?

- In-Plant Trainings (INPLTs) are system-specific workshops led by Better Plants experts that train participants on how to identify, implement, and replicate energy-saving projects.
- Better Plant partners host an on-site, three-day training at one of their facilities, and invite others to attend.
- The training traditionally focus around a topic such as:
  - Compressed air
  - Fans
  - Motor-driven systems.
  - Steam
  - Process heating
  - Pumps
  - Energy Management/ISO 50001

What is an In-Plant Training?

- Technical expertise gained through the INPLTs help companies overcome common, critical barriers to adopting energy management practices and technologies, such as lack of technical expertise and insufficient senior management buy in for implementing energy-saving projects.
- Personnel from other facilities within the company, as well as from other companies in the area and suppliers, may be invited to attend.
- Since April 2011, DOE has conducted 40 INPLTs that have attracted about 765 participants and led to the identification of close to 2.7 TBtu in annual energy savings and more than $14 million in associated cost savings

The Facilitator

- Frank Moskowitz – Draw Professional Services
  - Qualified AIRMaster+ Specialist
    - AIRMaster+ and LogTool Compressed Air Assessment Tools
  - Compressed Air Challenge Instructor for Fundamentals & Advanced Workshop
  - Instructor for AIRMaster+ Qualified Specialist Workshop
  - DOE Compressed Air System Energy Expert
    - In-Plant Training & Save Energy Now Assessments
  - Co-Vice Chair ASME EA-4 Energy Assessment for Compressed Air Systems
  - International Standards Organization Technical Advisory Group Member
    - Air compressors and compressed air systems energy management
  - Contact Information:
    - fmoskowitz@drawproservices.com
    - 602-809-4195

Today's Agenda

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

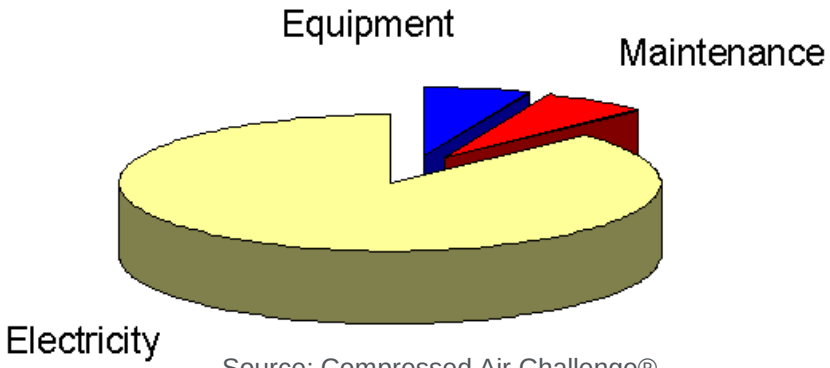
- Overview – Compressed Air System Energy Savings
- Planning for the Assessment
- Baseline Measurement
- Compressed Air Energy Opportunities
- Software Tool – LogTool
- Software Tool – AIRMaster+
- Agenda

Overview

Compressed Air System Energy Savings

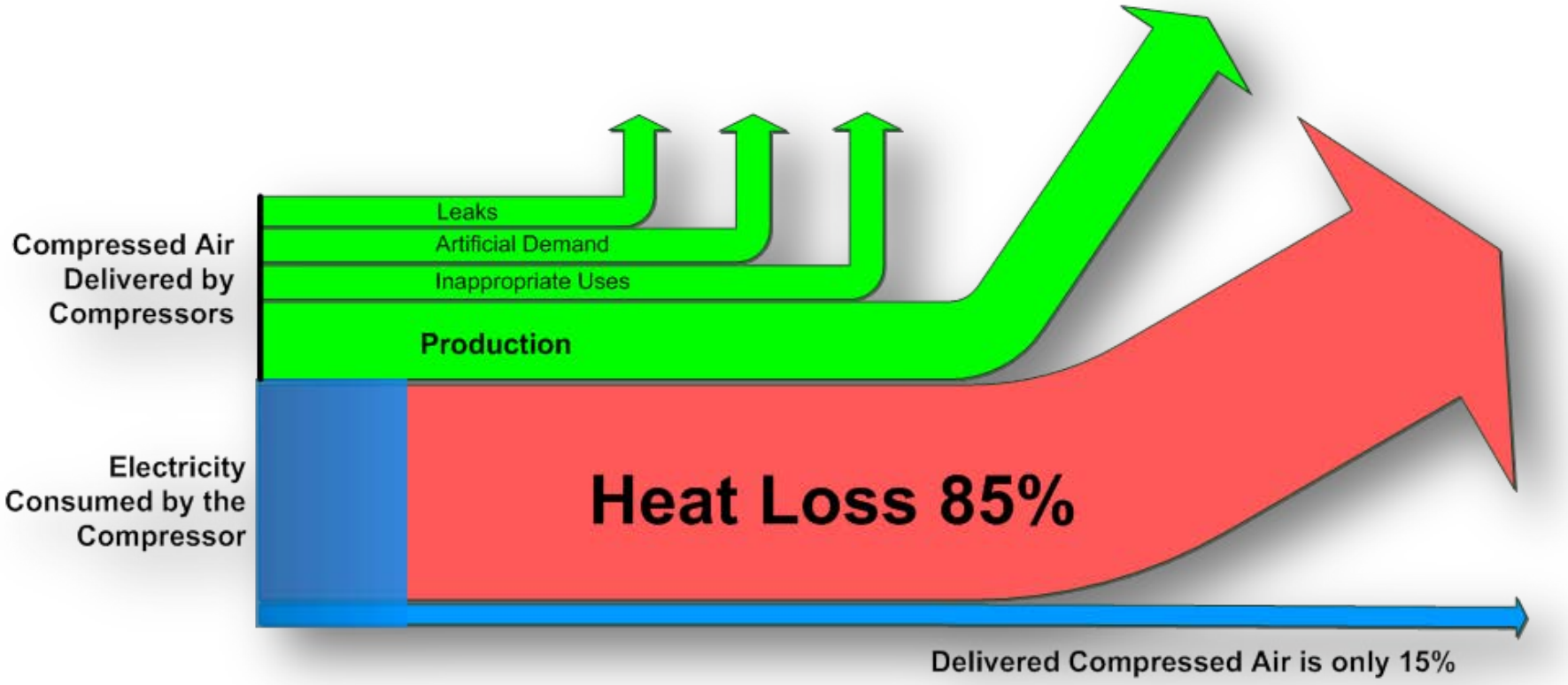
Compressed Air Systems
Total Cost of Ownership

- Equipment cost and maintenance cost represent only a small part of the total cost of operating a compressed air system.
- Electrical cost usually exceeds 75% of the total operating expense.



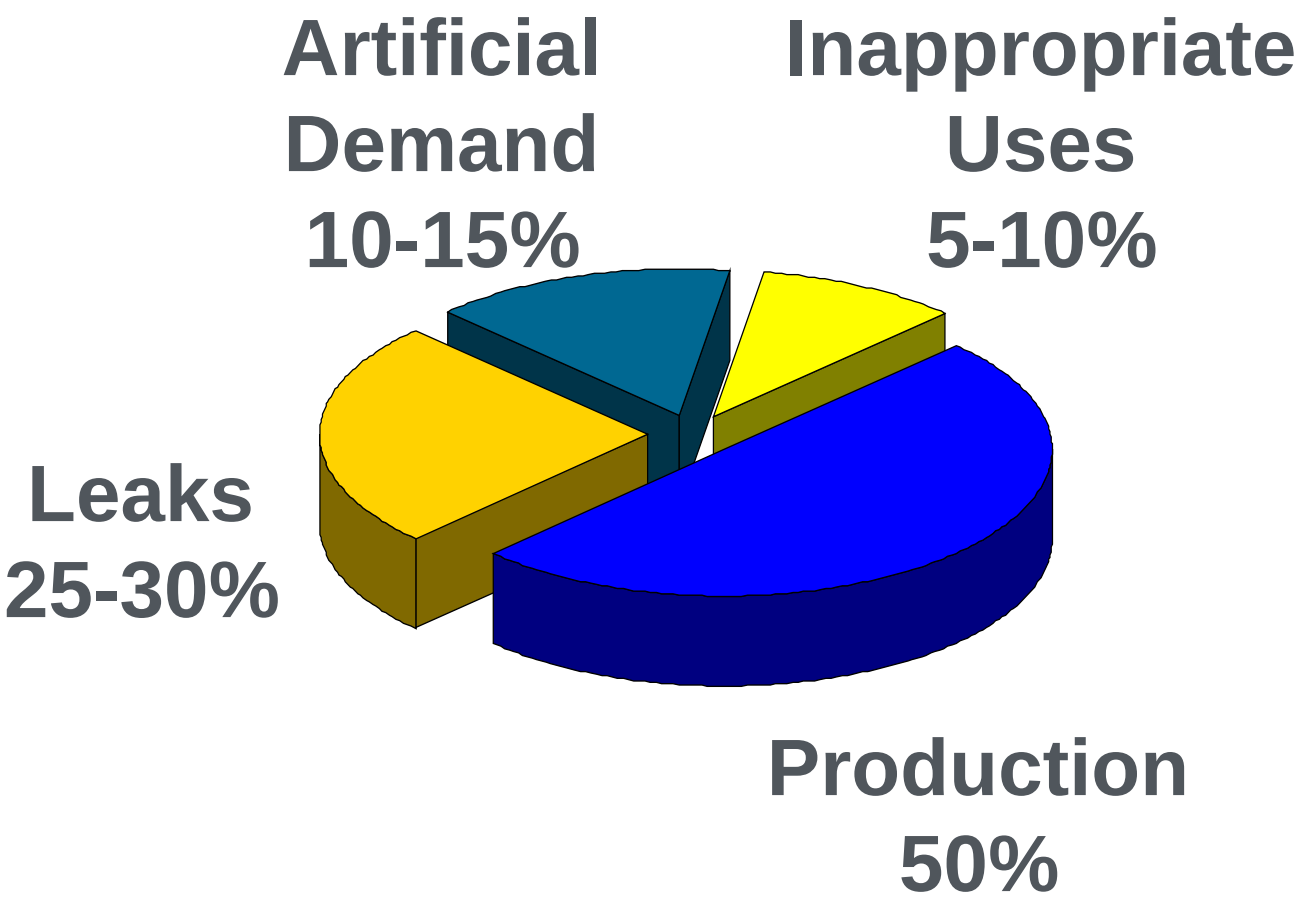
Source: Compressed Air Challenge®

Compressed Air is Inefficient



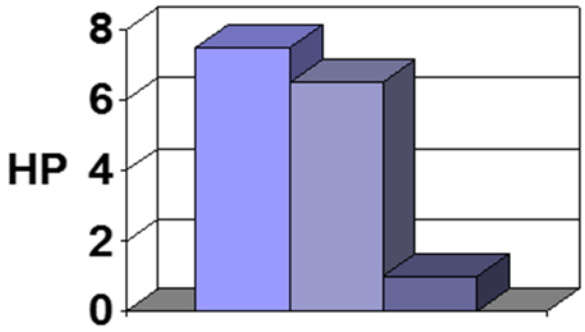
- Compressed Air's Inefficiency:
  - 85% of the power of the prime mover is converted into an unusable form of energy (HEAT)
  - And to a lesser extent, into friction, misuse and noise

Typical Components of Demand



Compressed Air Versus Other Energy Sources

- 1 hp air motor = 7-8 hp of electrical power
  - 30 scfm @ 90 psig is required by the air motor
  - 6 - 7 bhp at compressor shaft required for 30 scfm
  - 7 - 8 hp electrical power required for this
- Annual energy cost for a 1 hp air motor versus a 1 hp electric motor, 5-day per week, 2 shift operation, $0.05/kWh
- **$ 1,164 vs. $ 194**



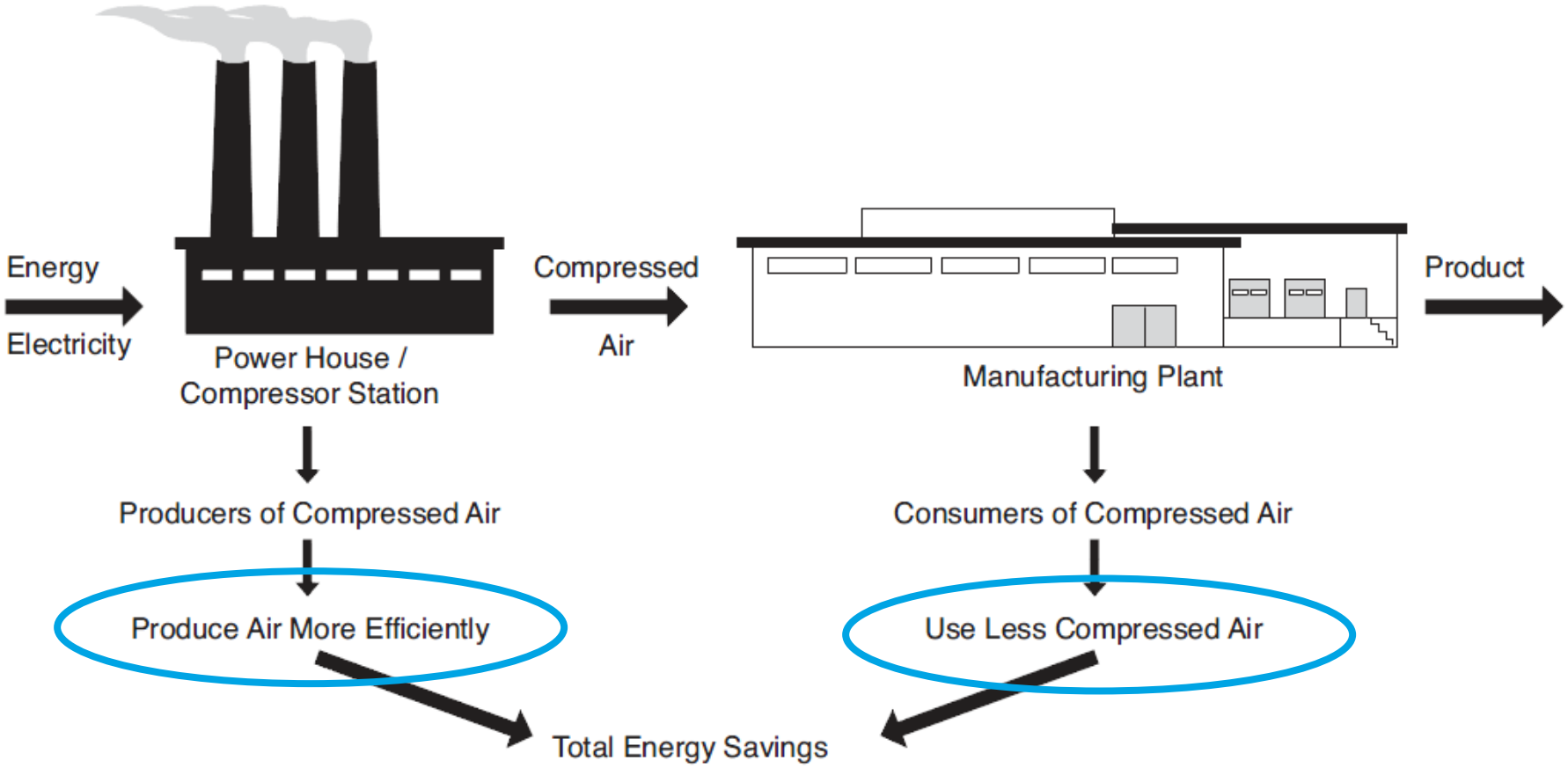
INPLT – Planning for the Training Assessment

Compressed Air System Energy Savings

Compressed Air System Planning for the Assessment

1. System Approach
2. Block Diagrams
3. Key Issues
4. Energy Costs/ Assessment Costs

Compressed Air Systems Approach plant efficiency: energy >> product



There are two basic ways to reduce the energy consumption of a compressed air system: produce compressed air more efficiently; and consume less compressed air.

Look from the System Level Approach

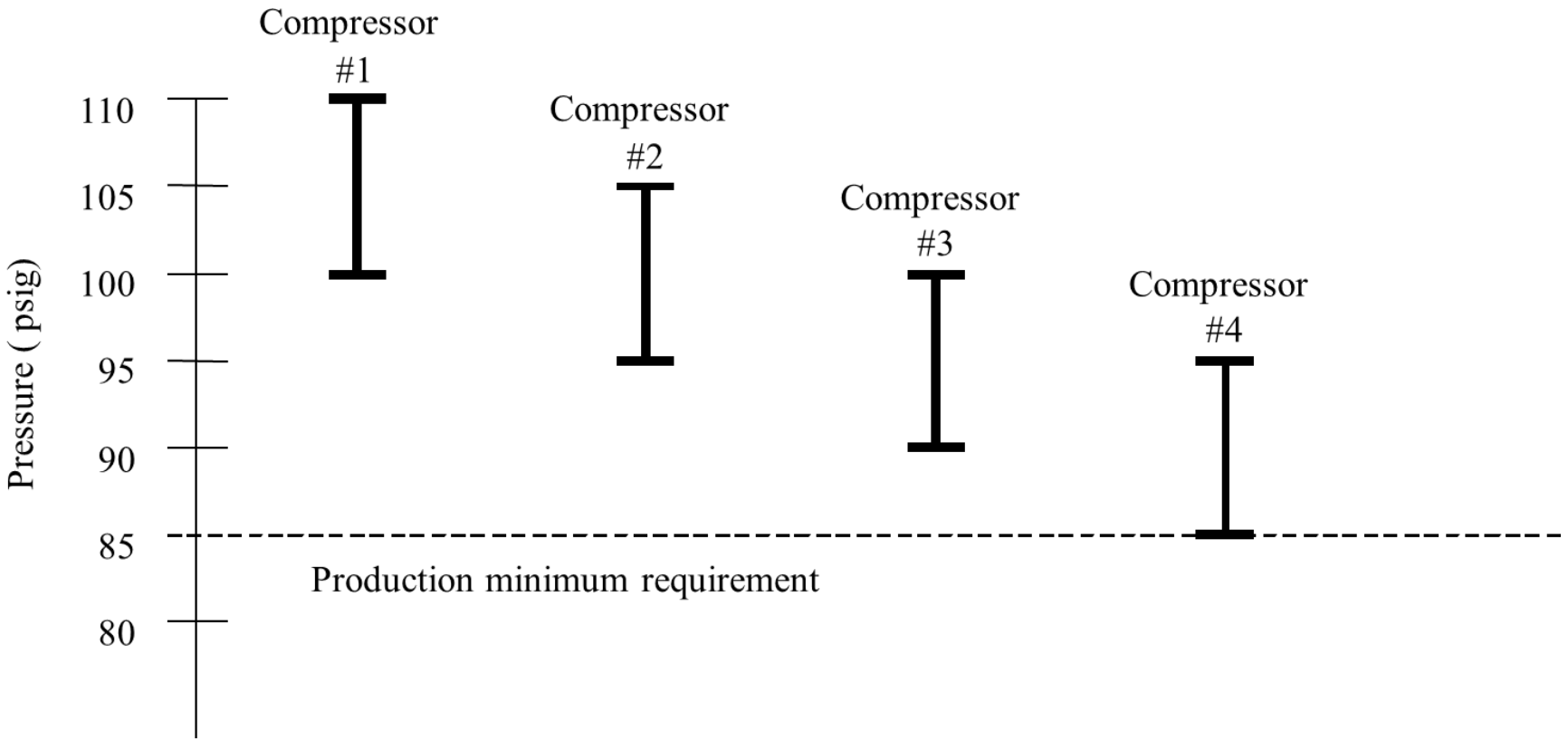
- Improve Compressor Control
- Reduce System Pressure
- Reduce Air Demand

Increase Productivity While Saving Energy

- Compressor manufacturers spend a great deal of money to obtain optimum efficiency of their individual products…….
  - only to see much of the energy savings squandered in a poorly designed and managed system.
- The following information can increase your productivity while Saving Energy

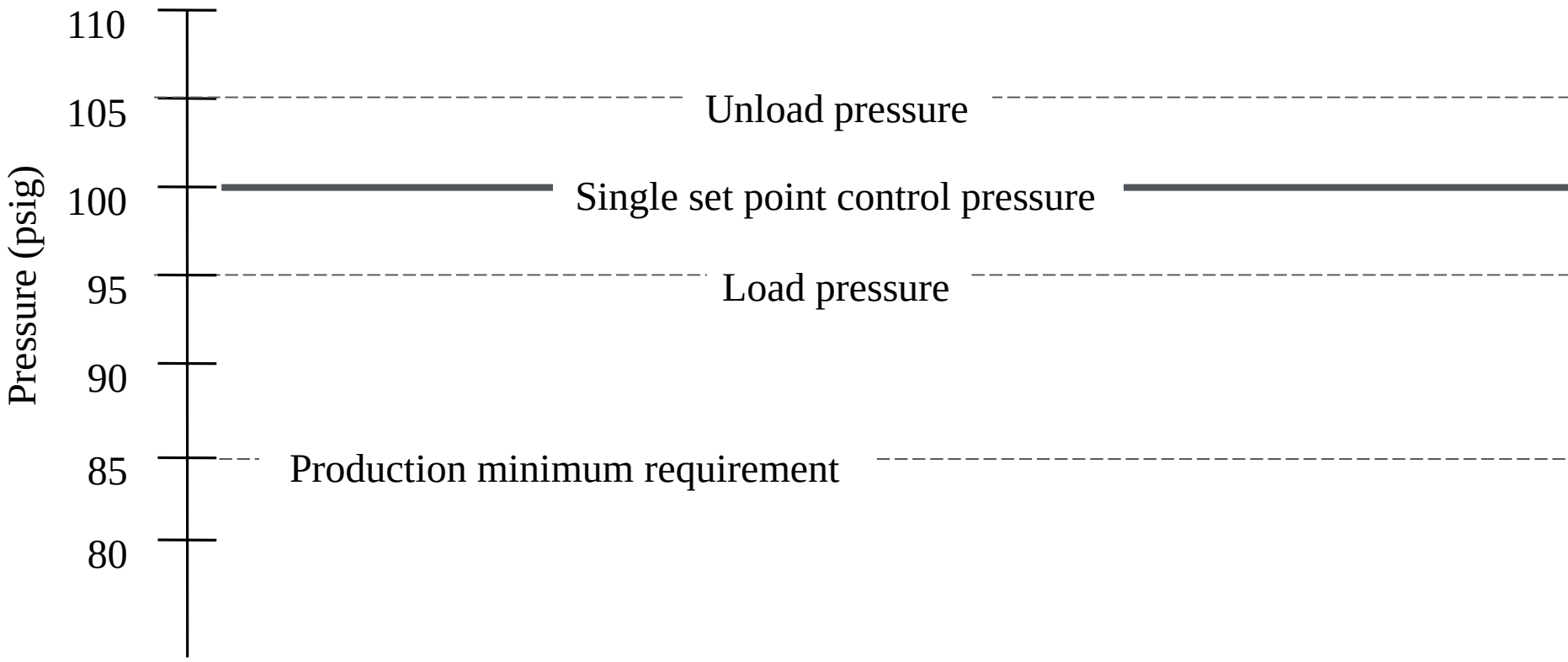
Reduce the number of compressors at reduced capacity

- Base load as many compressors as possible.

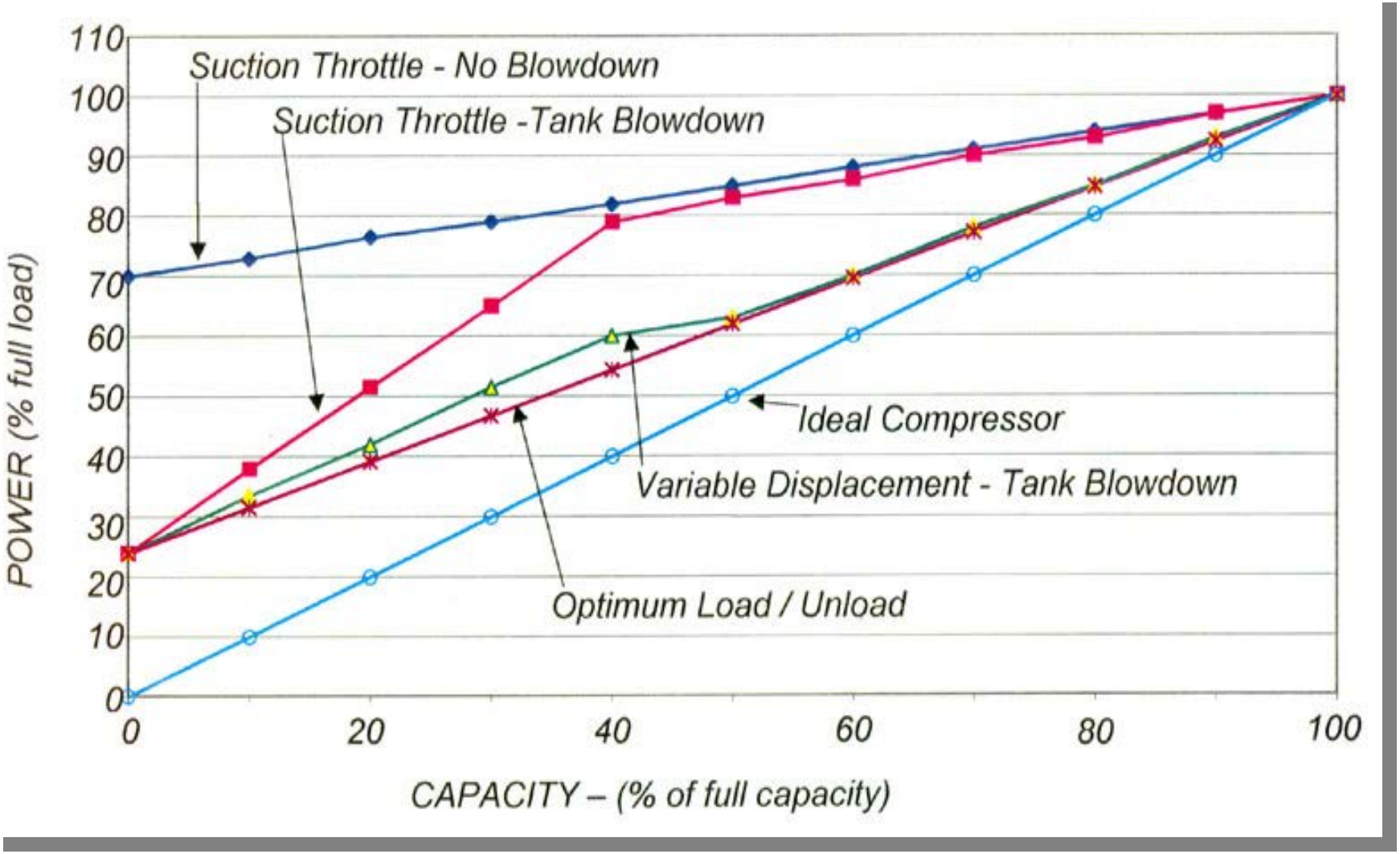


Reduce the number of compressors at reduced capacity

- Use Automation with single setpoint control scheme



Baseline Energy Opportunities
Control Strategies



Source: Compressed Air Challenge®

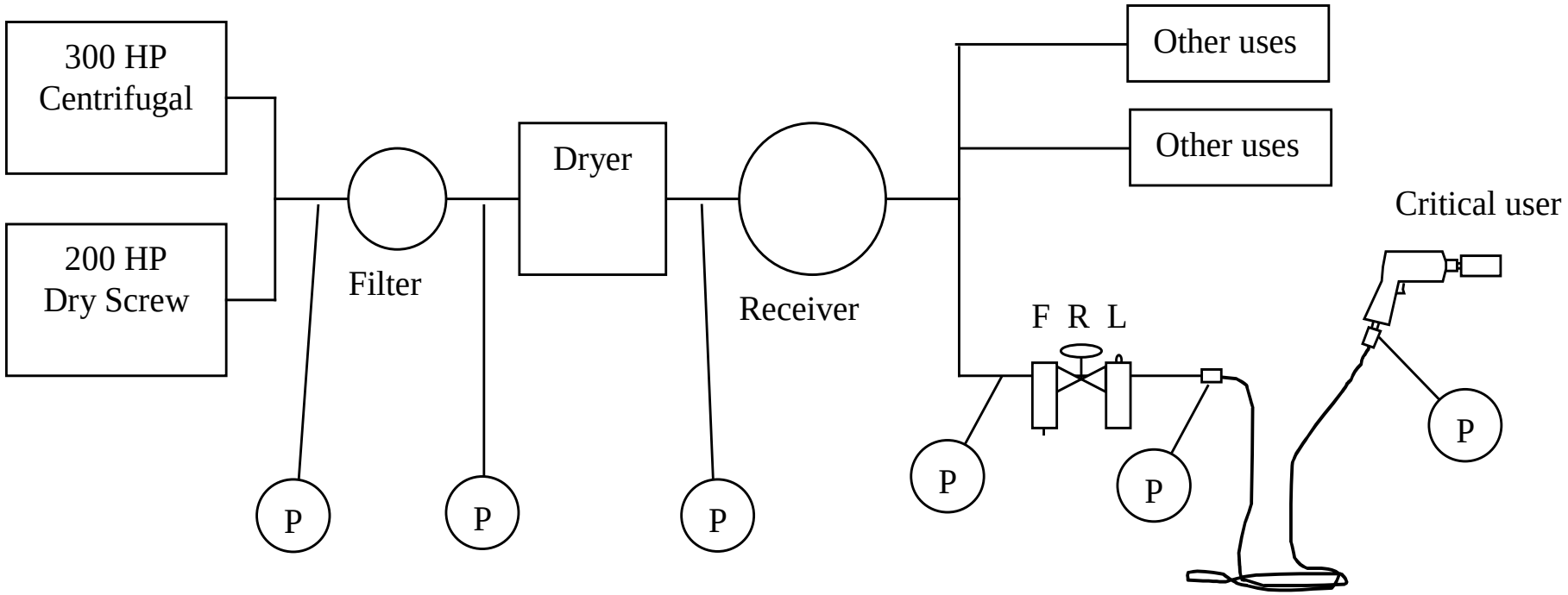
Reduce pressure at points of use

- The total system may be running at a higher pressure to satisfy the needs of only one point of use.
  - If the high pressure application can be modified to operate at lower pressure, make the fix.
  - If the high pressure application is valid, find a better way to serve it.
  - The single higher pressure point of use can be met with an amplifier or booster.
  - The remainder of the system can operate at a lower pressure, reducing leakage and usage rates and at reduced energy consumption.

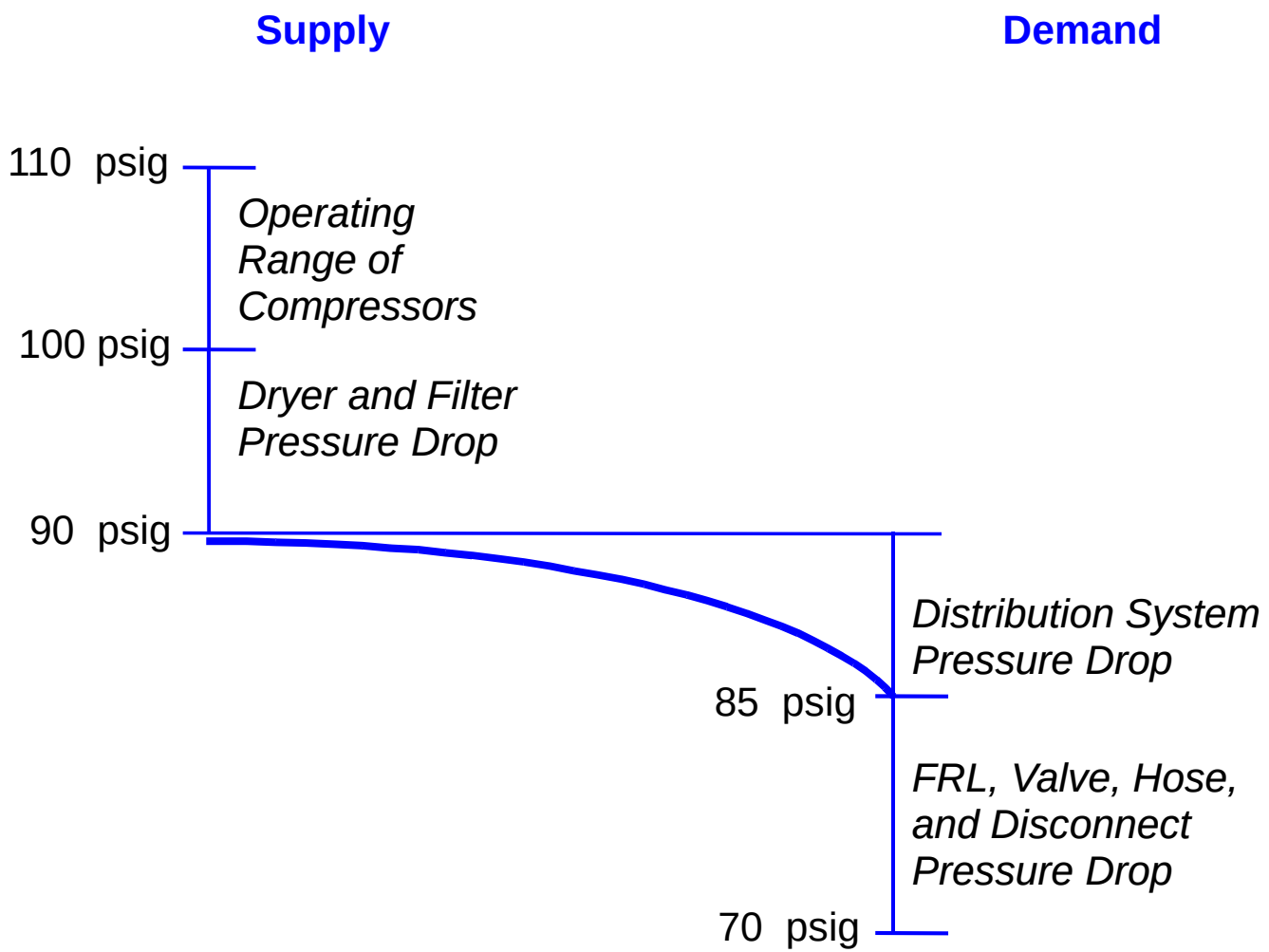
Reduce pressure at points of use

Review Air Usage Patterns Regularly

- Understand Your Pressure Profile

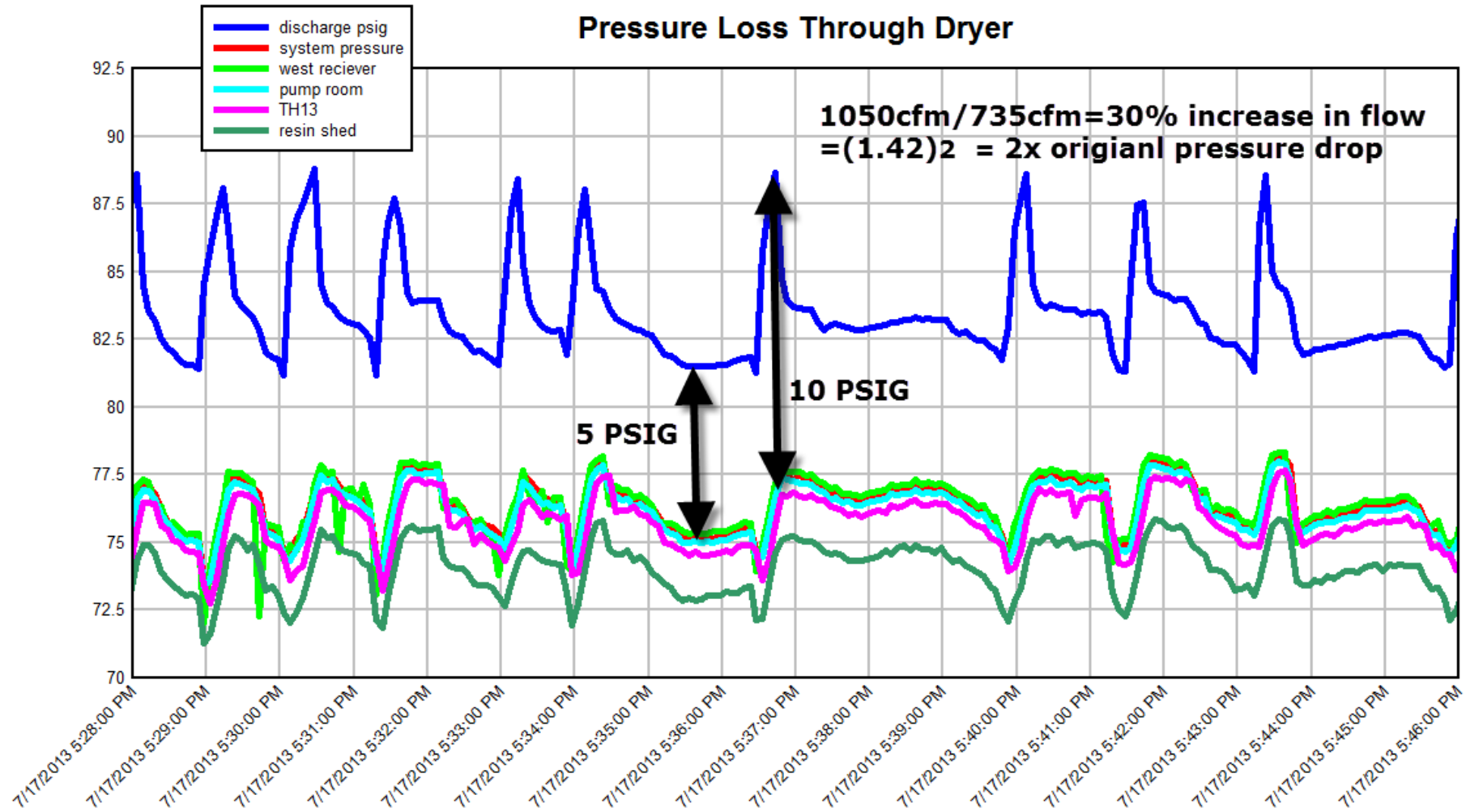


Review Air Usage Patterns Regularly



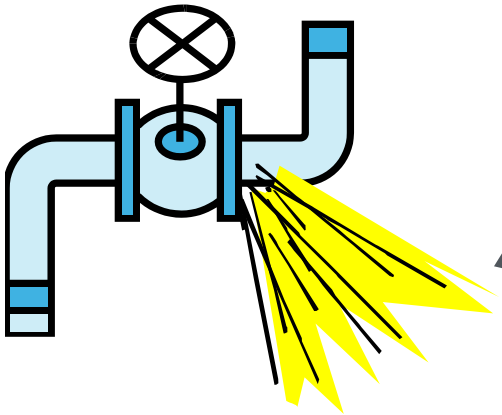
Pressure Profile

- Understand Your Pressure Profile
  - Pressure drop increase with the square of the flow increase



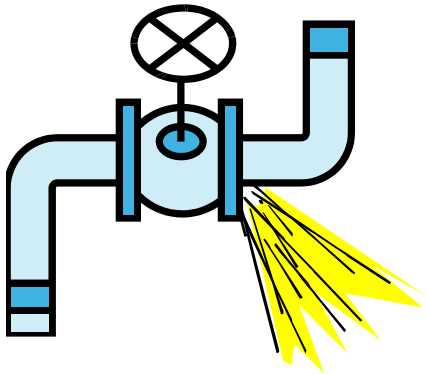
A 1/16 inch equivalent diameter leak

At 120PSIG



7.62 scfm FLOW

At 80PSIG



5.36 scfm FLOW

A leak consumes 42% more air at 120 psig than at 80 psig adding to the artificial demand on the system.

Leaks & How Demand is Affected by Pressure

Discharge of air through an orifice (SCFM)

	1/64”	1/32”	1/16”	1/8”	¼”	3/8”
70 psi	.300	1.20	4.79	19.2	76.7	173
80 psi	.335	1.34	5.36	21.4	85.7	193
90 psi	.370	1.48	5.92	23.8	94.8	213
100 psi	.406	1.62	6.49	26.0	104	234
125 psi	.494	1.98	7.90	31.6	126	284

Leaks are a function of the supply pressure in an uncontrolled system

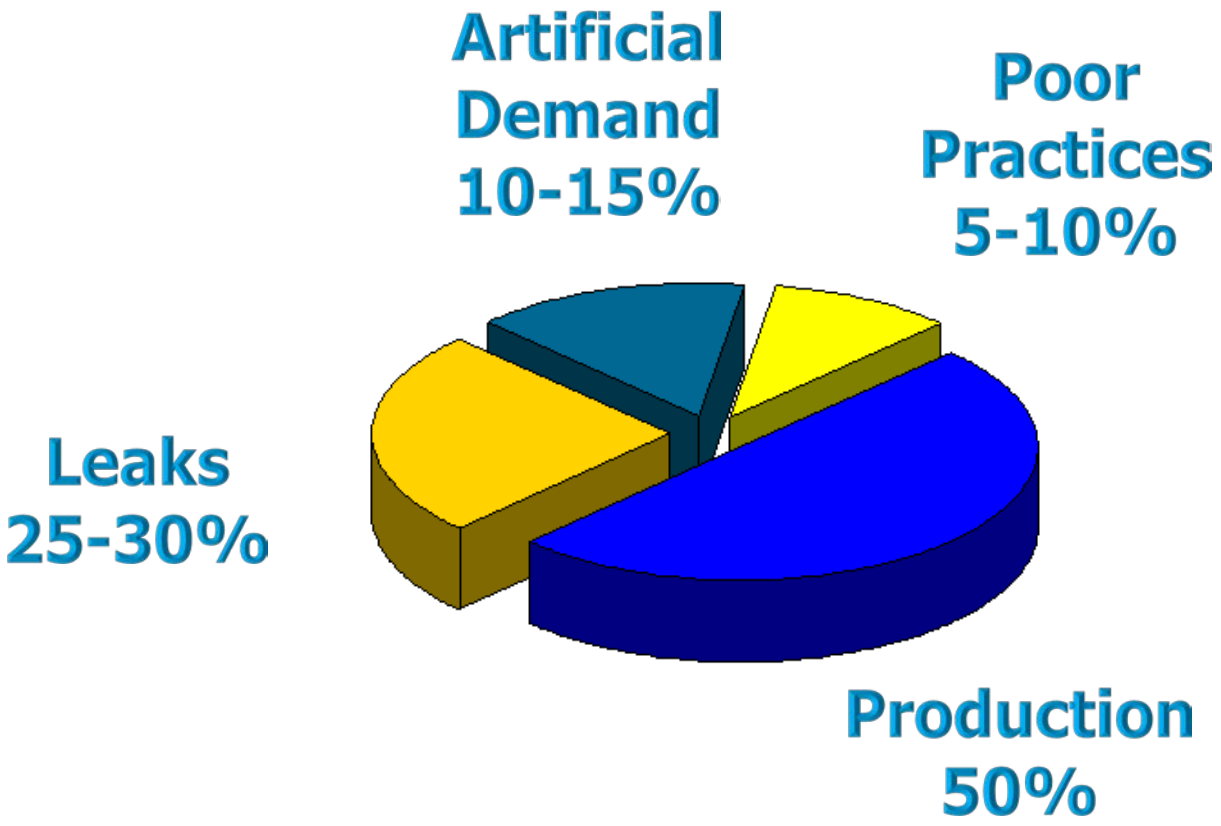
Higher pressure = greater flow

Lower pressure = less leak flow

Remove Inappropriate Applications

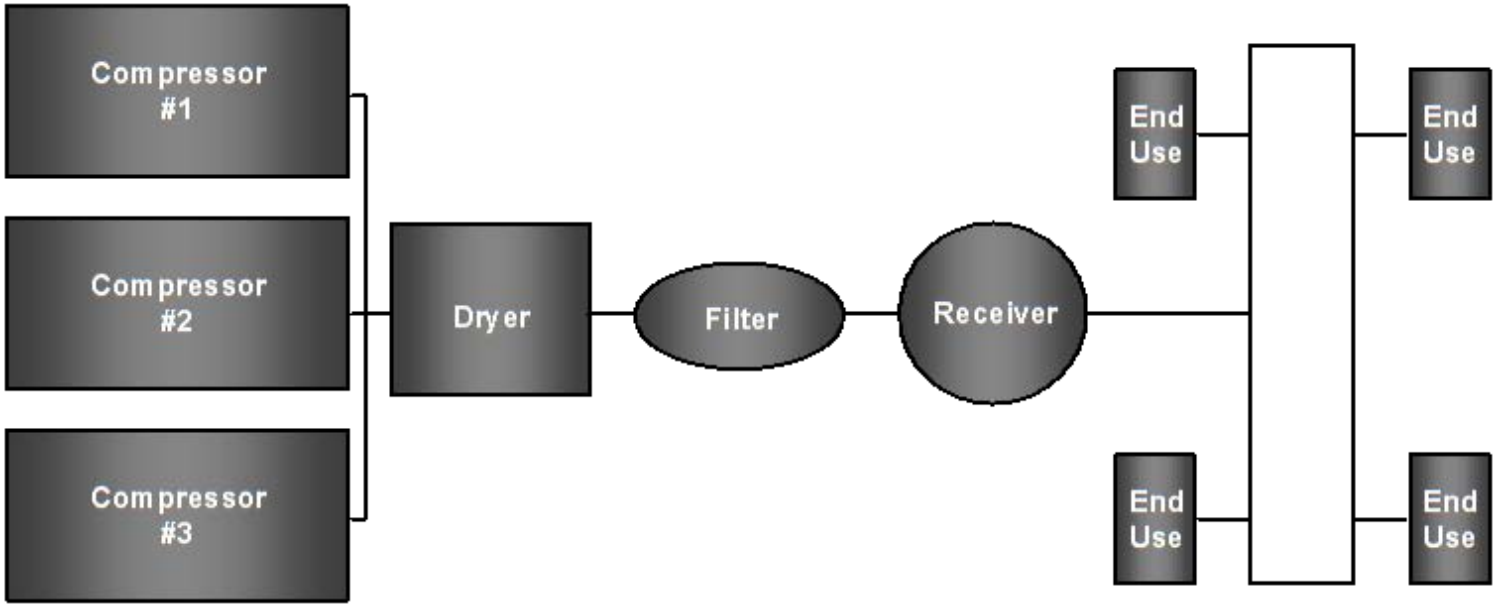
- Many applications can be served more efficiently by: low pressure air from a fan, a blower; or by a vacuum pump, rather than by compressed air.
- Examples of Inappropriate Uses:
  - Cabinet cooling
  - Liquid agitation or stirring
  - Vacuum generation
  - Unregulated Open Blowing
  - Air Motors
  - Atomizing

Where is my air going?



Compressed Air System Block Diagram

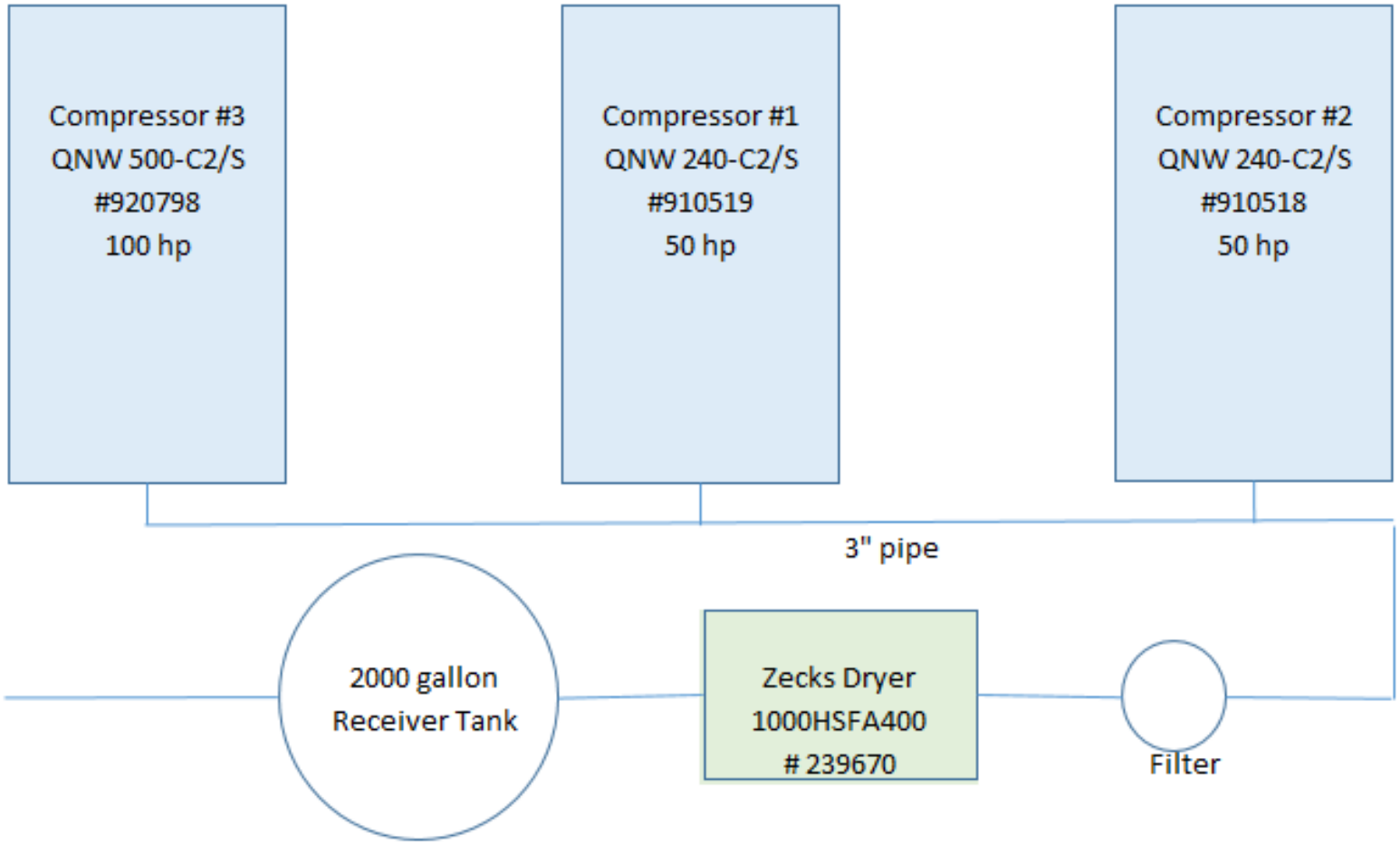
- Graphic representation of compressed air system and the relationship of individual components



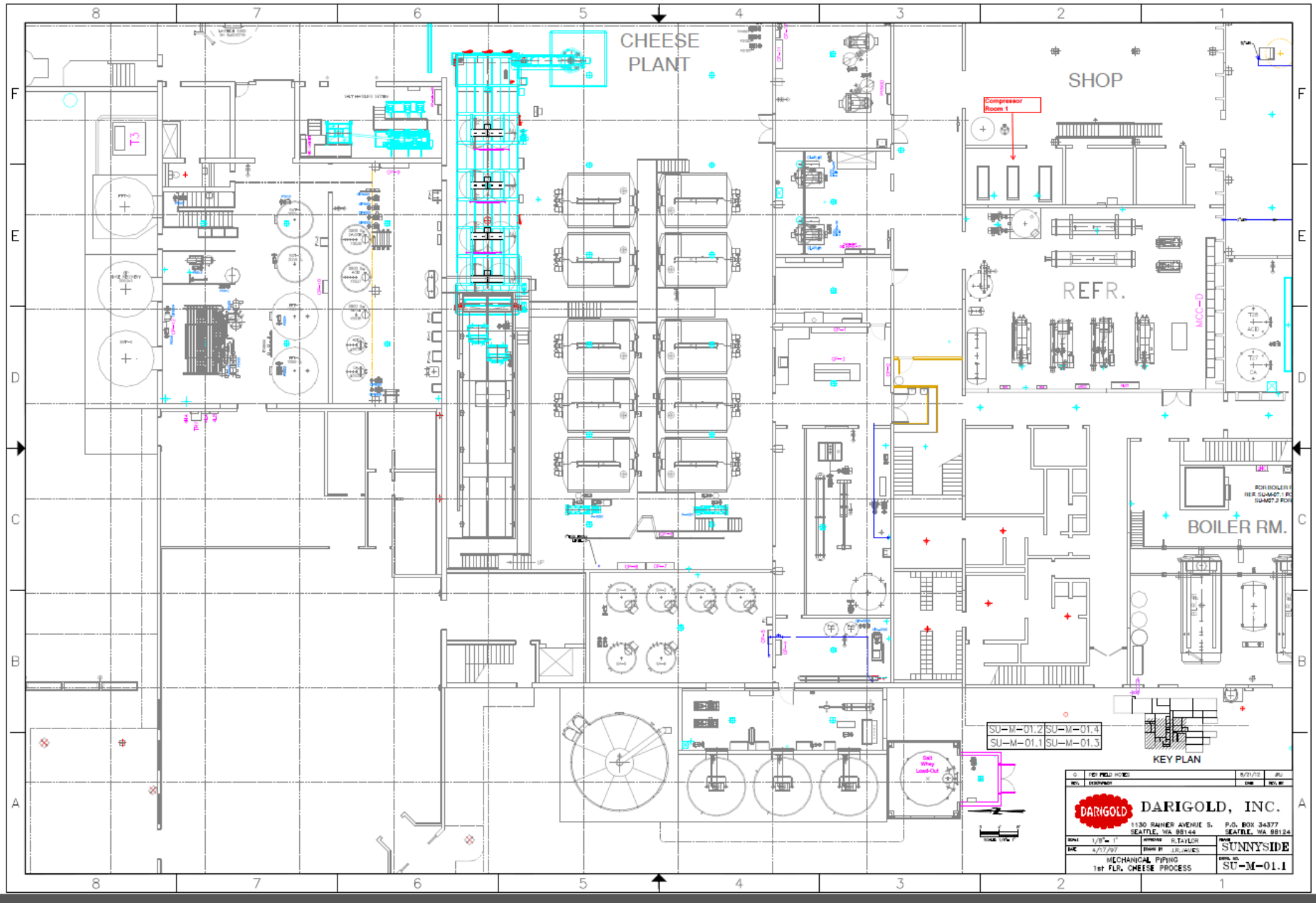
Compressor Room 1

Darigold Sunnyside

Compressor Room 1



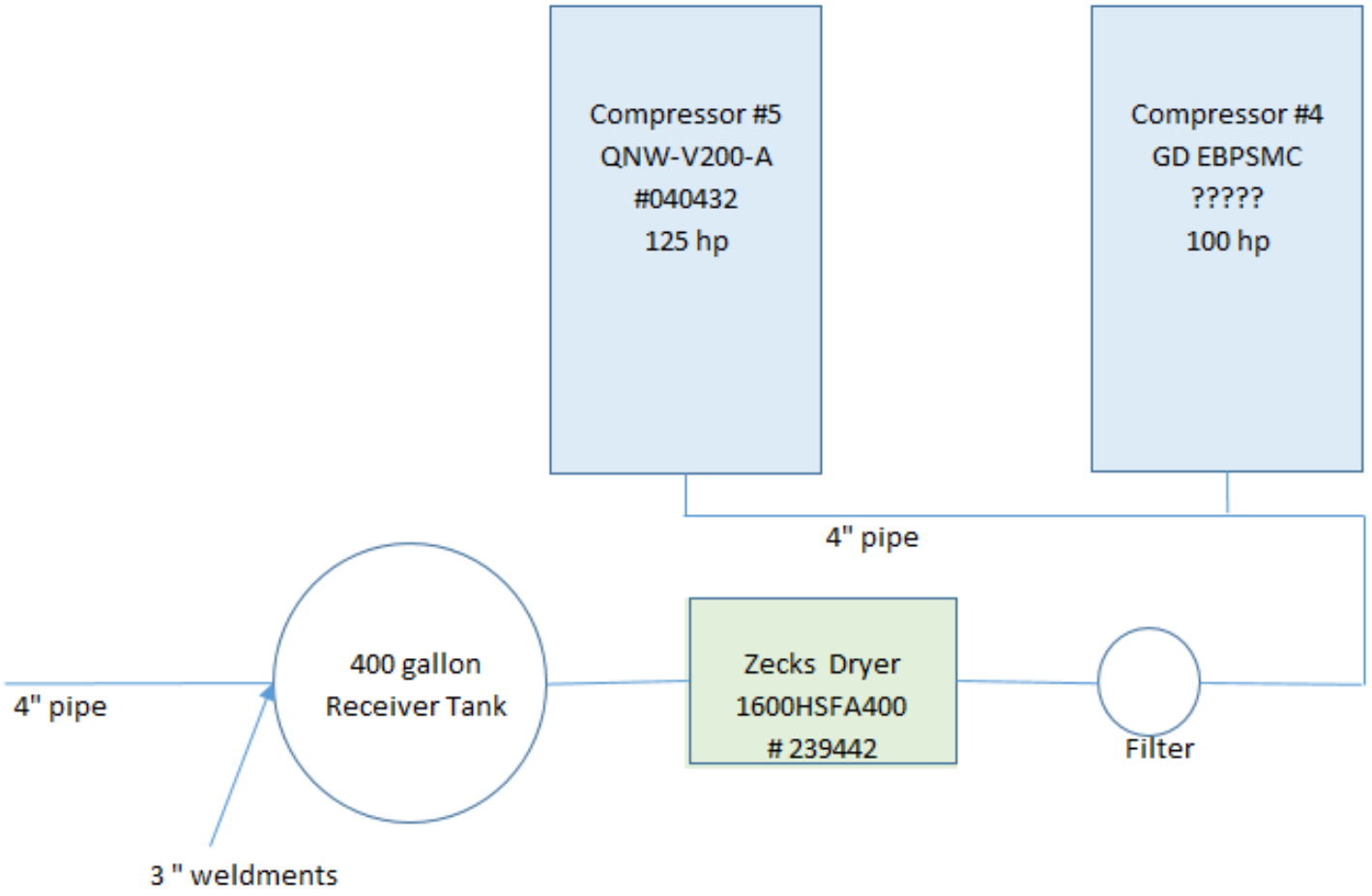
Compressor Room 1



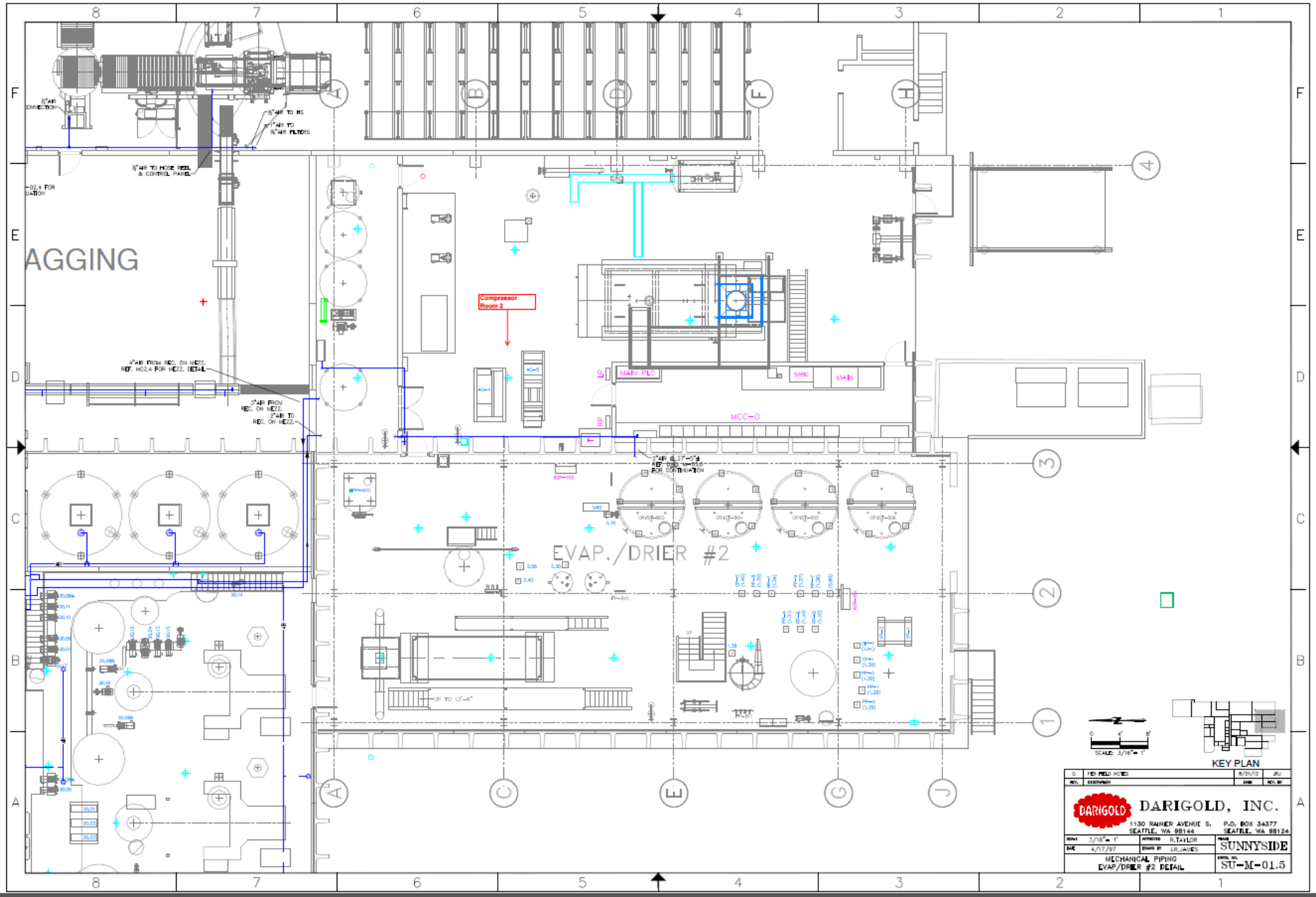
Compressor Room 2

Darigold Sunnyside

Compressor Room 2



Compressor Room 2

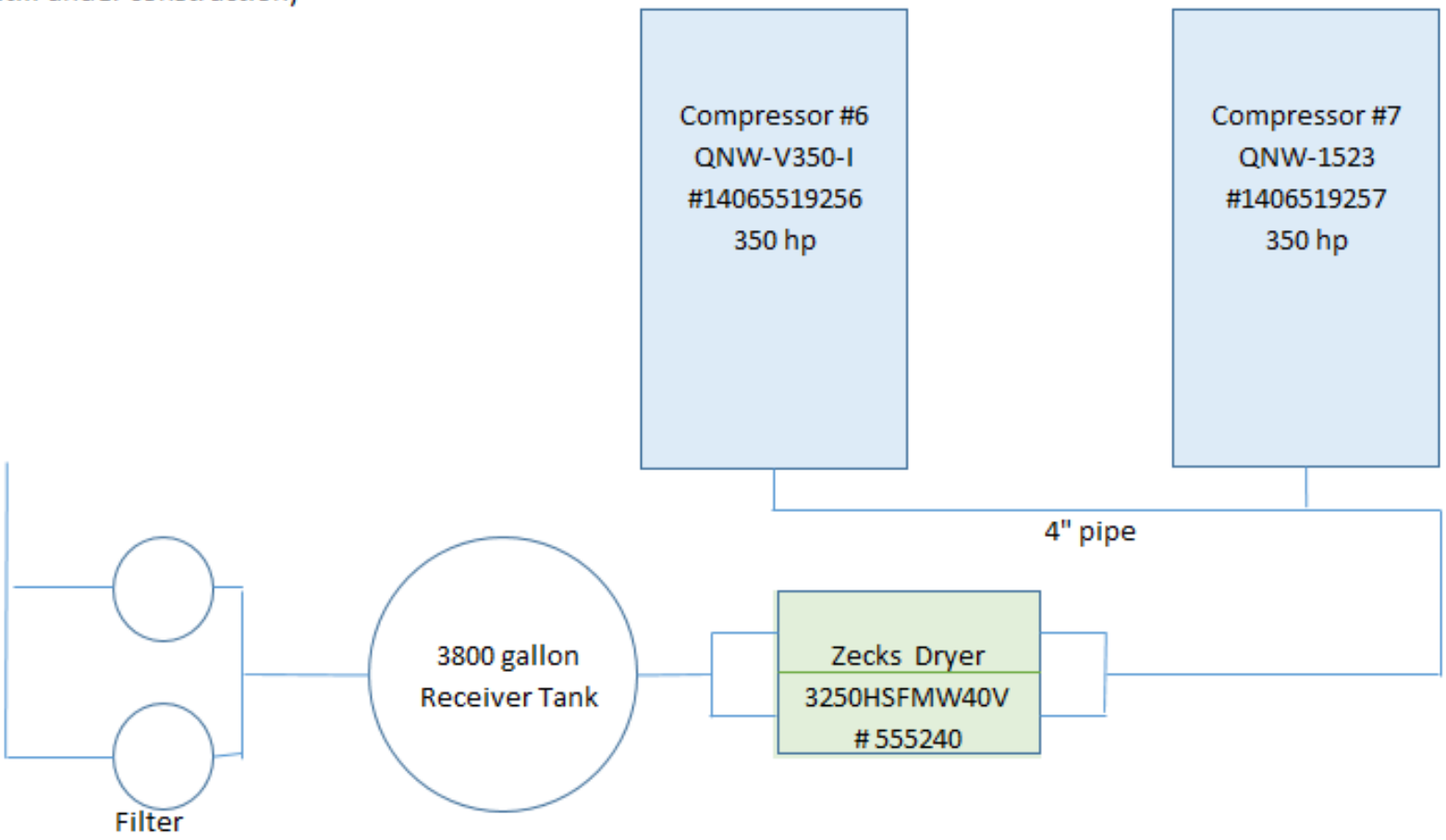


Compressor Room 3

Darigold Sunnyside

Compressor Room 3

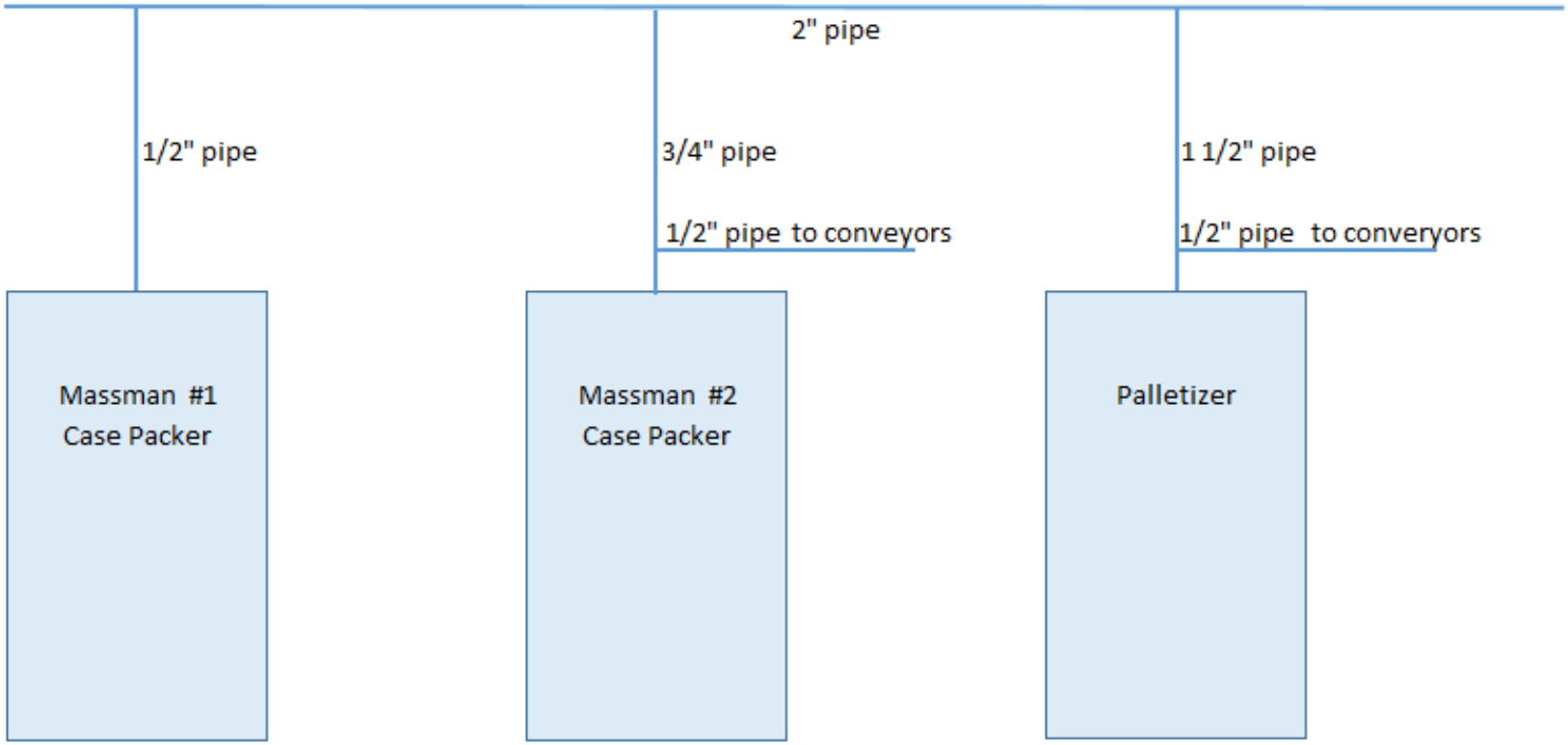
(still under construction)



Cheese Packaging

Darigold Sunnyside

Cheese Packaging



Compressed Air System Issues and Opportunities

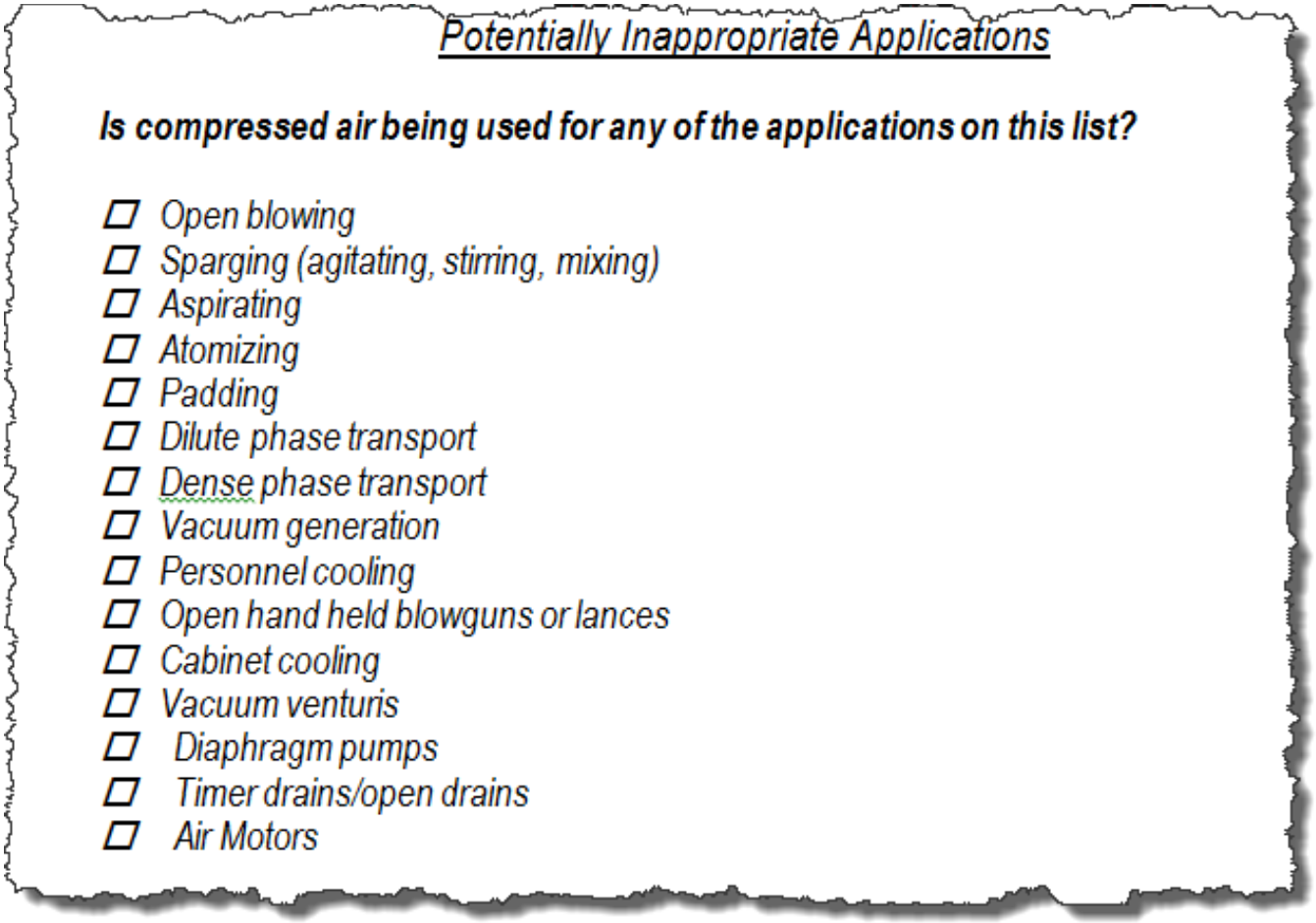
- Gather pre-assessment information

Primary Audit Objectives

- ☐ We need to improve the reliabilty of the compressed air system in supporting manufacturing operations.
- ☐ Production interruptions occur which are a result of poor compressed air system performance; we need to minimize production downtime.
- ☐ Product qualitiy is being affected by poor compressed air system performance; we need to reduce our scrap rate.
- ☐ Our automated equipment which is operated by compressed air will not achieve its full capacity throughput: we need to know if this is a compressed air related issue.
- ☐ We are expanding our production facility and consequently need to expand our existing compressed air system to accomodate the new flows; we want to know if our existing compressors can handle it.
- ☒ We need to reduce air demand and lower energy costs of operating our compressed air system.
- ☐ We are replacing older air compressors and want to investigate new more efficient type compressors; we want to improve system efficiency and reduce energy costs.
- ☐ We have recently eliminated production equipment which used compressed air but the compressors are still using the same energy as before: we need to reduce the compressed air demand.
- ☐ Low pressure occurs on a system wide basis and occasionally impacts production.

Compressed Air System Issues and Opportunities

- Gather pre-assessment information



Potentially Inappropriate Applications

Is compressed air being used for any of the applications on this list?

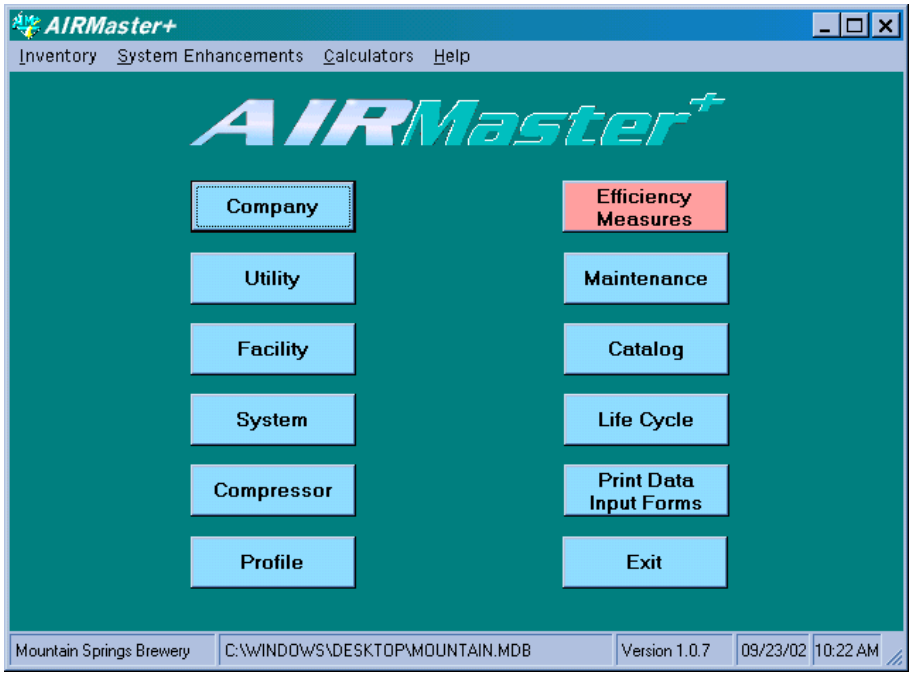
- ☐ *Open blowing*
- ☐ *Sparging (agitating, stirring, mixing)*
- ☐ *Aspirating*
- ☐ *Atomizing*
- ☐ *Padding*
- ☐ *Dilute phase transport*
- ☐ *Dense phase transport*
- ☐ *Vacuum generation*
- ☐ *Personnel cooling*
- ☐ *Open hand held blowguns or lances*
- ☐ *Cabinet cooling*
- ☐ *Vacuum venturis*
- ☐ *Diaphragm pumps*
- ☐ *Timer drains/open drains*
- ☐ *Air Motors*

INPLT – Baseline Measurement Using: Software Tools; AIRMaster+ and LogTool

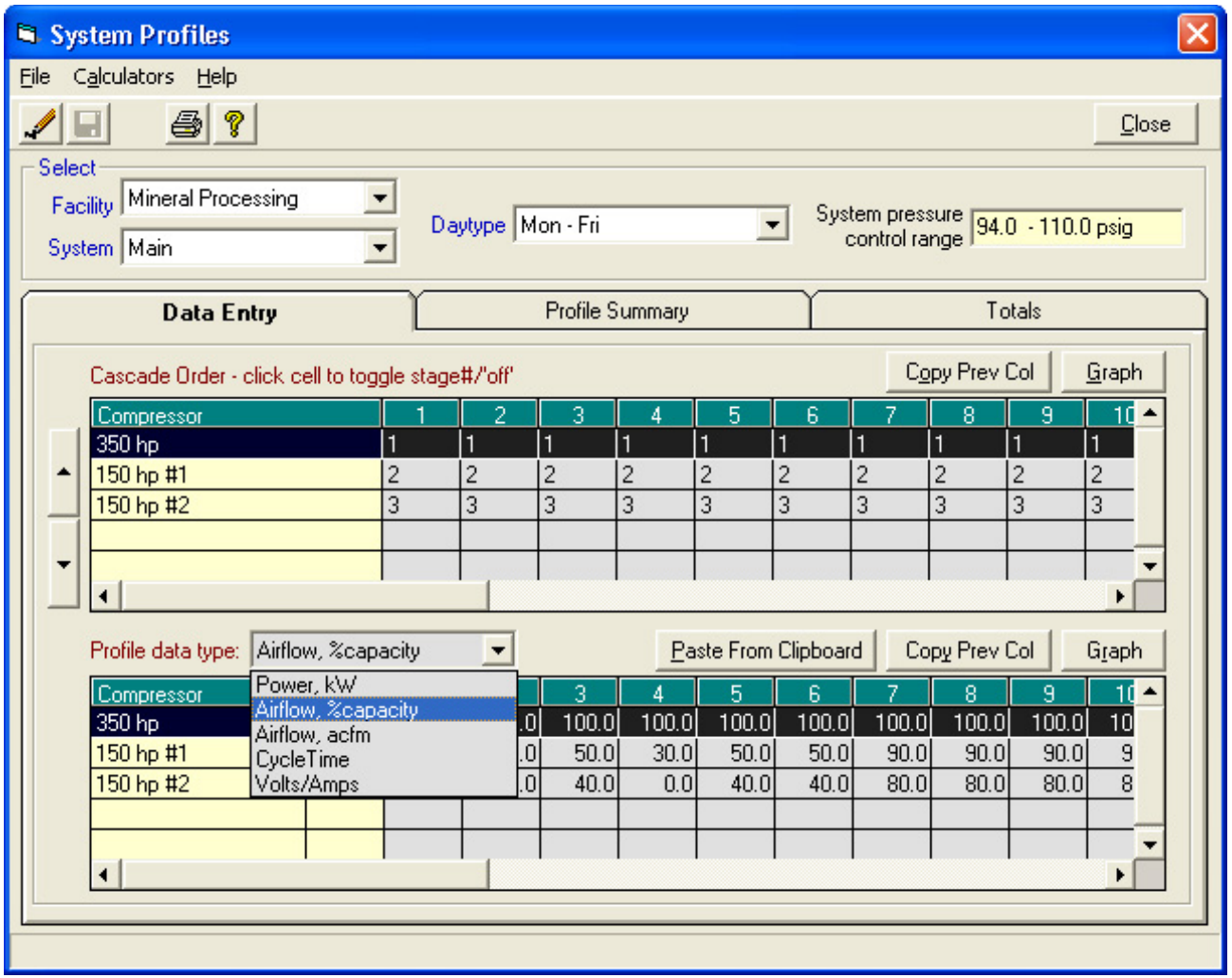
AIRMaster+

AIRMaster+ a Windows based software tool used to model and analyze industrial compressed air systems:

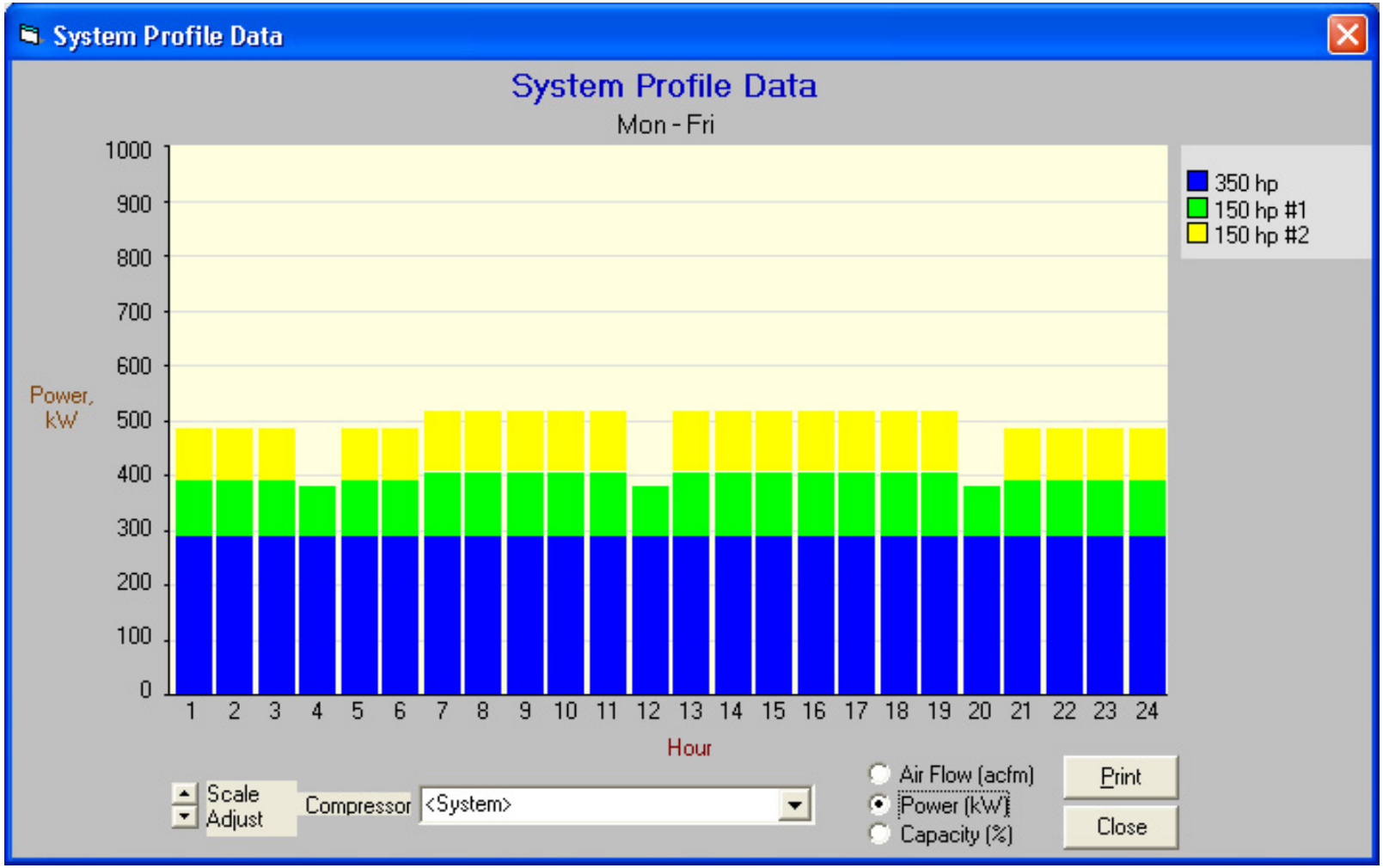
- Measure / Calculate Annual Baseline Energy & Cost
- Input 24-hour metered airflow or power data
- Assign electrical utility energy schedules
- Simulate compressed air system operation
- Model system operation at various loads
- Estimate Savings of Energy Efficiency Measures
- Is not a substitute for an experienced auditor!



AIRMaster+
System Profile – Data

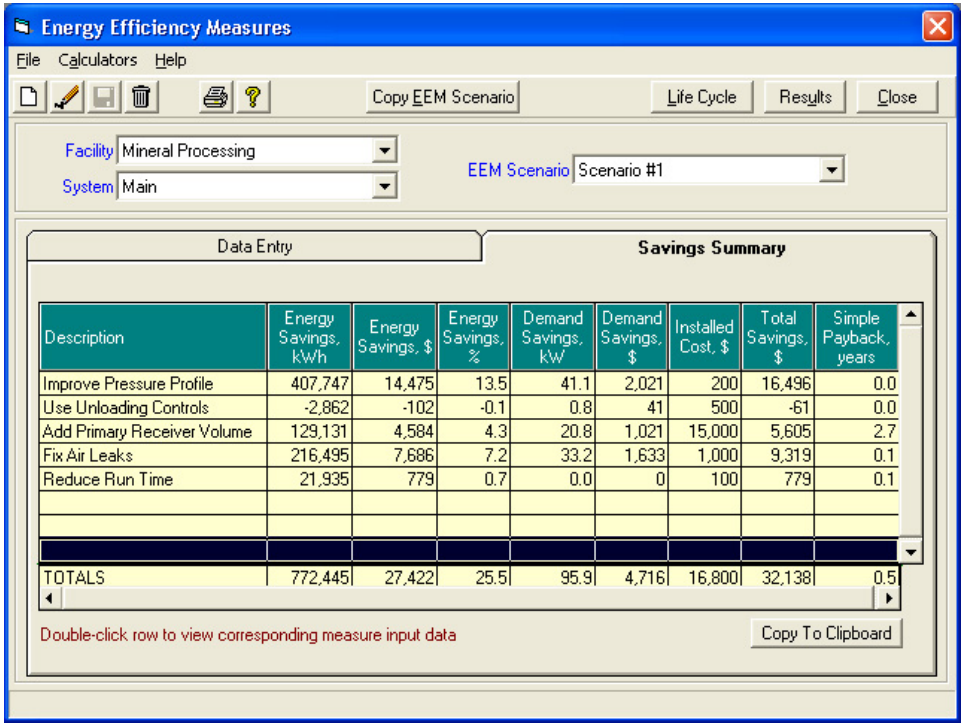


AIRMaster+
System Profile – Power (kW)



AIRMaster+ Energy Efficiency Measures

1. Reduce Air Leaks
2. Improve End Use Efficiency
3. Reduce System Air Pressure
4. Use Unloading ControlsAdjust Cascading Set Points
5. Use Automatic Sequencer
6. Reduce Run Time
7. Add Primary Receiver Volume




LogTool v2
Version 2.0.80
LogTool is a public domain tool available from SBW Consulting, Inc. and the Compressed Air Challenge (CAC). LogTool was developed in part with funding from CAC. It is designed to assist in the analysis of compressed air system performance measurements. It is a companion tool for AIRMaster+, also available from the CAC.
Continue

LogTool v2

- LogTool is a public domain tool available from SBW Consulting, Inc.
  - Import data from different types of data loggers
  - Display trend plots with one or two Y axes
  - Assist in the analysis of compressed system performance measurements
  - Display DayType plots
  - a companion tool for AIRMaster+, also available from the Compressed Air Challenge

LogTool v2 – Import Data

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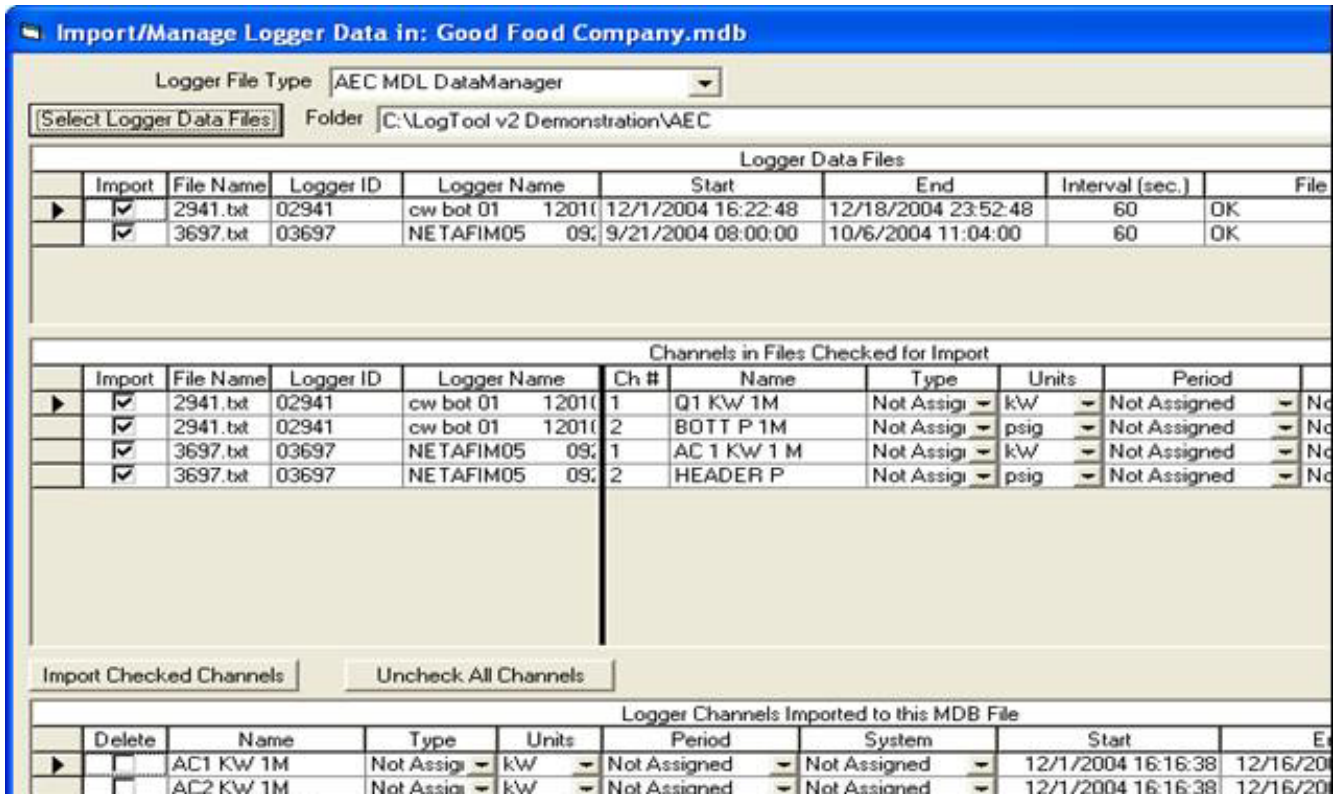
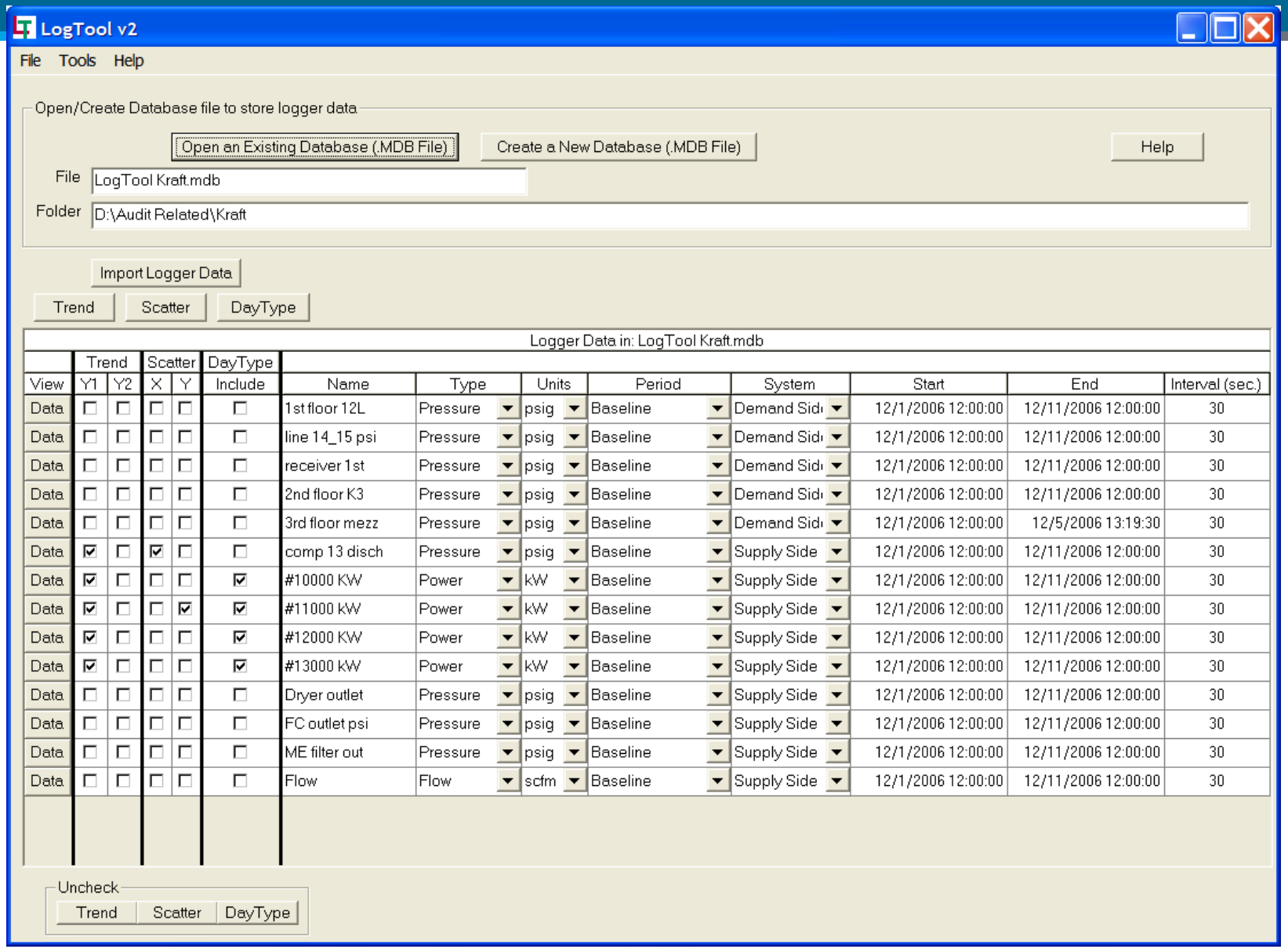
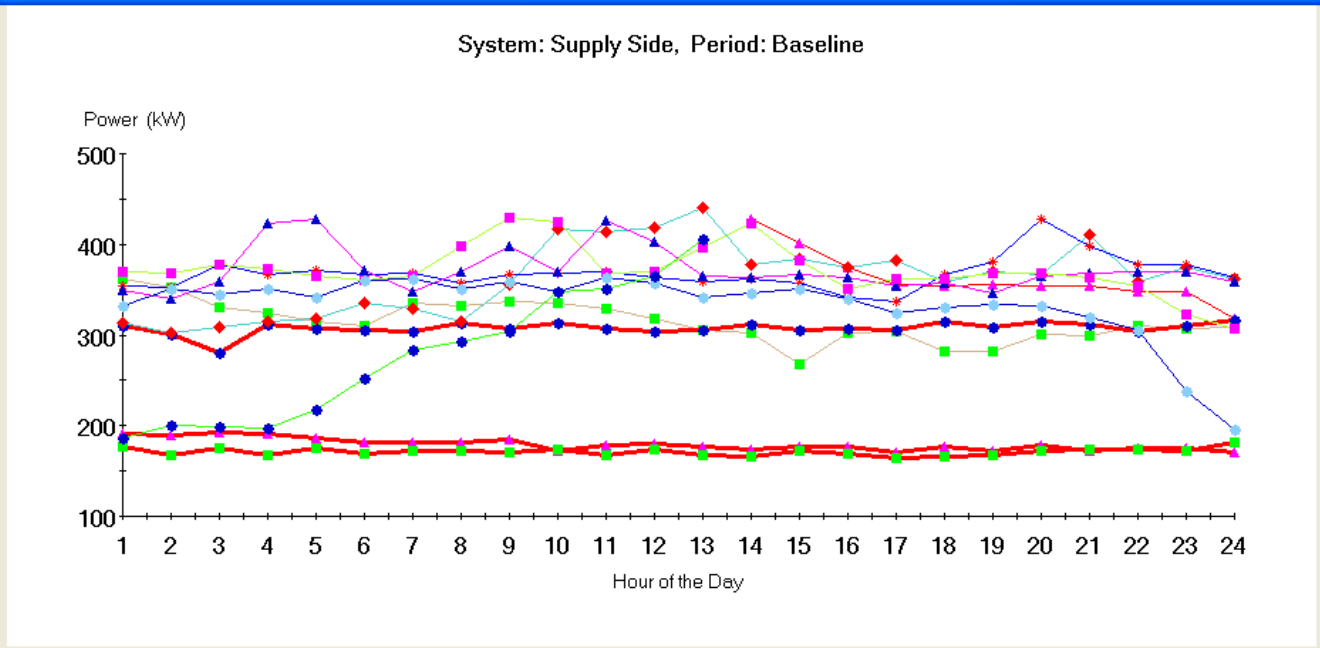
- The import screen gives you tools to import data from different types of data loggers





	Trend		Scatter		DayType								
View	Y1	Y2	X	Y	Include	Name	Type	Units	Period	System	Start	End	Interval (sec.)
Data	☐	☐	☐	☐	☐	1st floor 12L	Pressure	psig	Baseline	Demand Sid	12/1/2006 12:00:00	12/11/2006 12:00:00	30
Data	☐	☐	☐	☐	☐	line 14_15 psi	Pressure	psig	Baseline	Demand Sid	12/1/2006 12:00:00	12/11/2006 12:00:00	30
Data	☐	☐	☐	☐	☐	receiver 1st	Pressure	psig	Baseline	Demand Sid	12/1/2006 12:00:00	12/11/2006 12:00:00	30
Data	☐	☐	☐	☐	☐	2nd floor K3	Pressure	psig	Baseline	Demand Sid	12/1/2006 12:00:00	12/11/2006 12:00:00	30
Data	☐	☐	☐	☐	☐	3rd floor mezz	Pressure	psig	Baseline	Demand Sid	12/1/2006 12:00:00	12/5/2006 13:19:30	30
Data	☑	☐	☑	☐	☐	comp 13 disch	Pressure	psig	Baseline	Supply Side	12/1/2006 12:00:00	12/11/2006 12:00:00	30
Data	☑	☐	☐	☐	☑	#10000 KW	Power	kW	Baseline	Supply Side	12/1/2006 12:00:00	12/11/2006 12:00:00	30
Data	☑	☐	☐	☑	☑	#11000 kW	Power	kW	Baseline	Supply Side	12/1/2006 12:00:00	12/11/2006 12:00:00	30
Data	☑	☐	☐	☐	☑	#12000 KW	Power	kW	Baseline	Supply Side	12/1/2006 12:00:00	12/11/2006 12:00:00	30
Data	☑	☐	☐	☐	☑	#13000 kW	Power	kW	Baseline	Supply Side	12/1/2006 12:00:00	12/11/2006 12:00:00	30
Data	☐	☐	☐	☐	☐	Dryer outlet	Pressure	psig	Baseline	Supply Side	12/1/2006 12:00:00	12/11/2006 12:00:00	30
Data	☐	☐	☐	☐	☐	FC outlet psi	Pressure	psig	Baseline	Supply Side	12/1/2006 12:00:00	12/11/2006 12:00:00	30
Data	☐	☐	☐	☐	☐	ME filter out	Pressure	psig	Baseline	Supply Side	12/1/2006 12:00:00	12/11/2006 12:00:00	30
Data	☐	☐	☐	☐	☐	Flow	Flow	scfm	Baseline	Supply Side	12/1/2006 12:00:00	12/11/2006 12:00:00	30

DayType Analysis



Right click on data points to select day type. Left click to highlight the trace.

Click a date to highlight profile in graph.

Date	Day	Day Type
Dec-01-2006	Fri	Excluded Days
Dec-02-2006	Sat	Weekend running
Dec-03-2006	Sun	Weekend running
Dec-04-2006	Mon	Excluded Days
Dec-05-2006	Tue	Excluded Days
Dec-06-2006	Wed	Weekday
Dec-07-2006	Thu	Weekday
Dec-08-2006	Fri	Excluded Days
Dec-09-2006	Sat	Weekend not running
Dec-10-2006	Sun	Weekend not running
Dec-11-2006	Mon	Excluded Days

Plot Day Type ... All Days

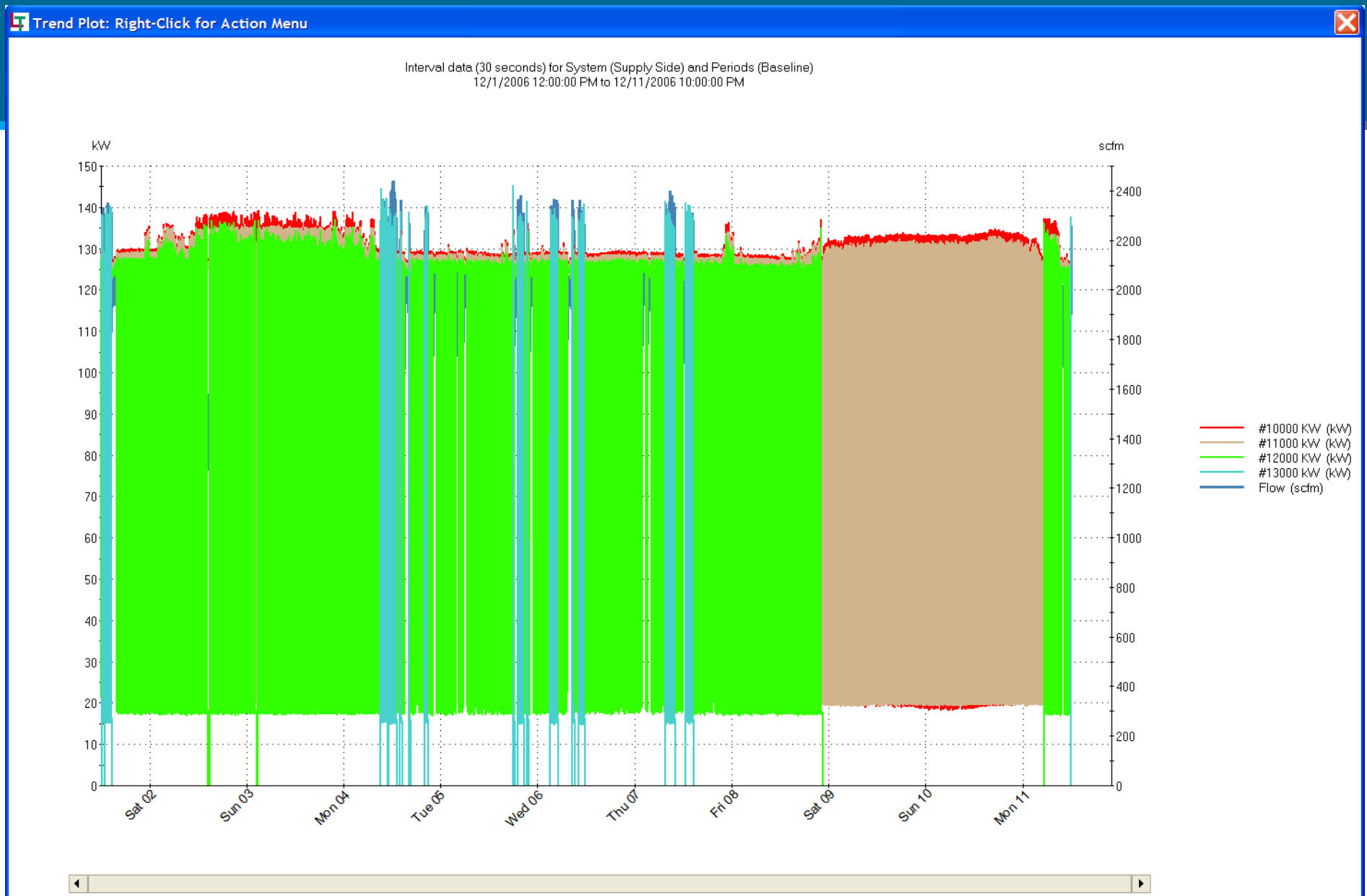
Remove Day Type...

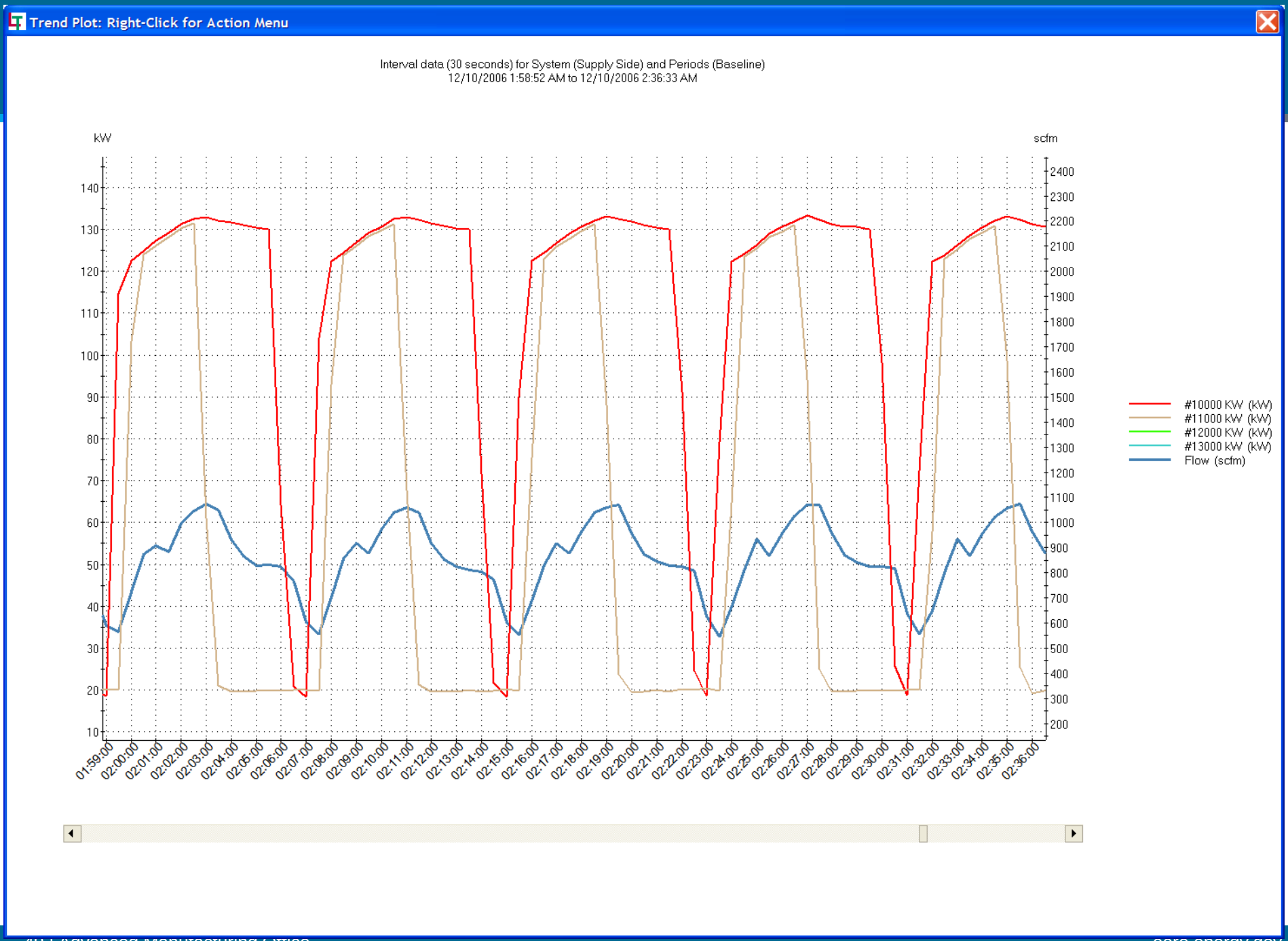
Caution: Day profiles can be similar even though different equipment, e.g., compressors, is operating. Use Trend Plots to examine the details of equipment operation before determining whether days should be assigned to the same daytype.

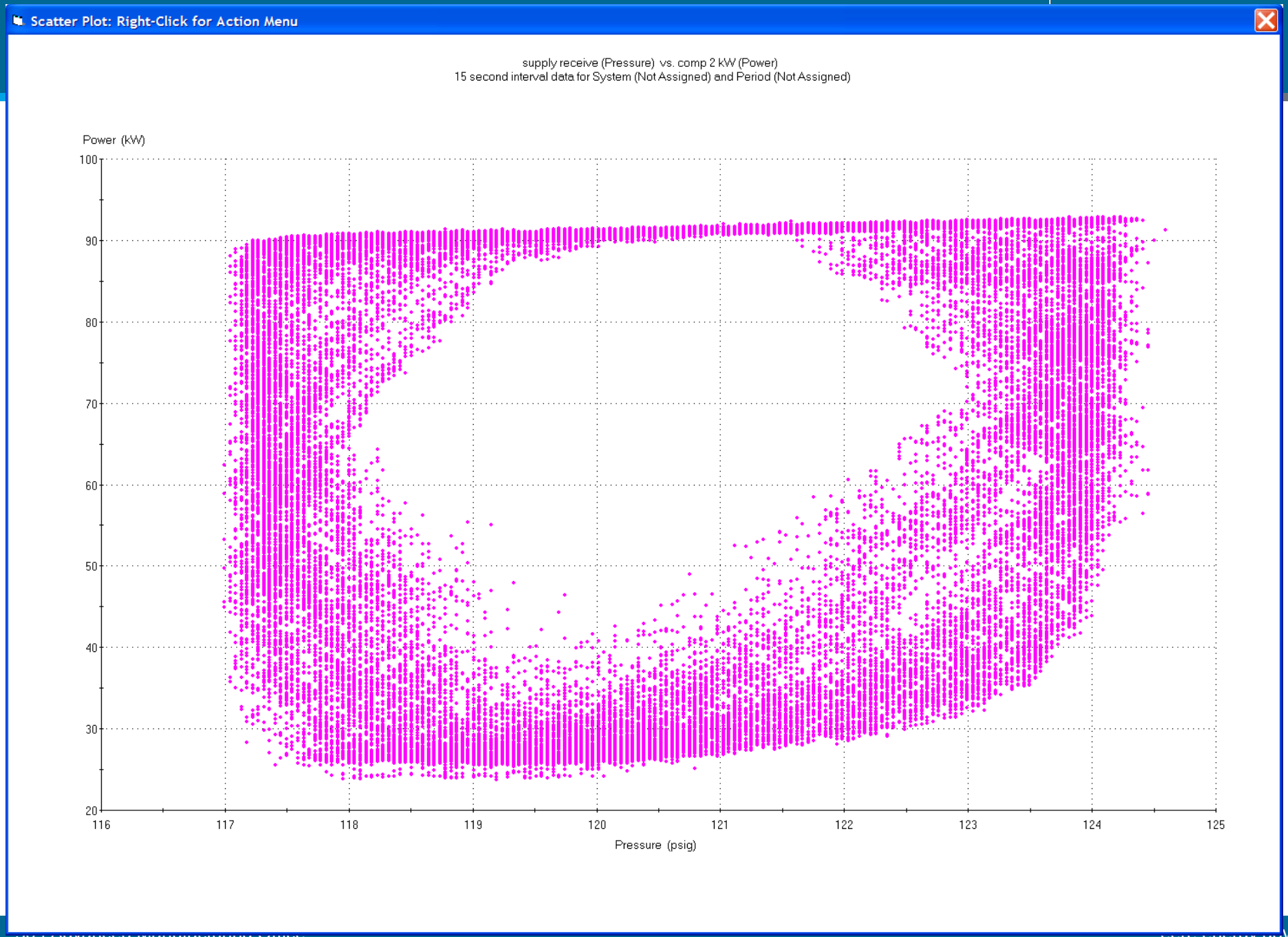
Create System DayType Profiles | Copy Plot to ClipBoard | Copy Profiles to ClipBoard | Help

System	Type	Period	DayTypeName	ChannelName	Hr_01	Hr_02	Hr_03	Hr_04	Hr_05	Hr_06	Hr_07	Hr_08	Hr_09	Hr_10	Hr_11	Hr
Supply Side	Power	Baseline	**Weekday**	#10000 KW	126.8	126.9	127.0	127.6	127.7	127.0	126.9	127.1	128.0	127.1	127.1	
Supply Side	Power	Baseline	**Weekday**	#11000 kW	126.2	126.2	126.4	126.9	127.0	126.4	126.2	126.4	127.3	126.4	126.4	
Supply Side	Power	Baseline	**Weekday**	#12000 KW	106.8	101.6	114.5	118.9	115.0	112.0	103.2	118.3	119.2	119.5	116.6	
Supply Side	Power	Baseline	**Weekday**	#13000 kW	0.0	0.0	0.0	24.8	26.3	1.1	0.0	12.5	38.9	24.8	27.0	
Supply Side	Power	Baseline	**Weekend not running**	#10000 KW	120.2	118.2	119.5	118.4	119.7	117.1	116.2	117.7	114.7	112.1	112.0	
Supply Side	Power	Baseline	**Weekend not running**	#11000 kW	64.2	60.3	64.6	61.0	61.1	58.4	60.5	59.3	62.4	60.4	61.5	
Supply Side	Power	Baseline	**Weekend not running**	#12000 KW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Supply Side	Power	Baseline	**Weekend not running**	#13000 kW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Supply Side	Power	Baseline	**Weekend running**	#10000 KW	129.4	129.7	129.3	130.3	130.6	131.0	130.2	129.9	129.7	129.4	129.8	
Supply Side	Power	Baseline	**Weekend running**	#11000 kW	122.9	119.0	120.1	123.1	120.9	118.6	120.6	123.3	123.0	123.9	121.5	
Supply Side	Power	Baseline	**Weekend running**	#12000 KW	84.0	78.2	56.5	65.0	59.3	58.3	69.0	69.1	68.7	71.5	66.6	
Supply Side	Power	Baseline	**Weekend running**	#13000 kW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
			Weekday	Flow	1885.87	1861.73	1938.515	2063.188	2042.347	1917.98	1871.879	2004.384	2123.58	2054.267	2036.333	
			Weekend not running	Flow	947.2361	922.6665	944.0294	939.7109	913.2008	904.8779	895.8726	910.1708	893.2721	871.2878	877.7692	
			Weekend running	Flow	1764.013	1723.066	1603.593	1662.083	1640.152	1623.76	1686.323	1689.084	1699.662	1698.266	1670.245	

Period	DayTypeName	ChannelName	Hr_01	Hr_02	Hr_03	Hr_04	Hr_05	Hr_06	Hr_07	Hr_08	Hr_09	Hr_10	Hr_11	Hr_12
Baseline	**Weekday**	Flow	1885.9	1861.7	1938.5	2063.2	2042.3	1918.0	1871.9	2004.4	2123.6	2054.3	2036.3	2004.
Baseline	**Weekend low production**	Flow	947.2	922.7	944.0	939.7	913.2	904.9	895.9	910.2	893.3	871.3	877.8	873.
Baseline	**Weekend running**	Flow	1764.0	1723.1	1603.6	1662.1	1640.2	1623.8	1686.3	1689.1	1699.7	1698.3	1670.2	1634.
		Weekday hourly avg of kw												
		#10000 KW	126.8	126.9	127.0	127.6	127.7	127.0	126.9	127.1	128.0	127.1	127.1	127.
Day Type		#11000 kW	126.2	126.2	126.4	126.9	127.0	126.4	126.2	126.4	127.3	126.4	126.4	126.
Excluded Days		#12000 KW	106.8	101.6	114.5	118.9	115.0	112.0	103.2	118.3	119.2	119.5	116.6	113.
Weekend running		#13000 kW	0.0	0.0	0.0	24.8	26.3	1.1	0.0	12.5	38.9	24.8	27.0	19.
Weekend running		Total kW	359.9	354.7	367.9	398.1	396.0	366.5	356.3	384.3	413.5	397.8	397.2	386.
Excluded Days														
Excluded Days														
Weekday		Weekend low production hourly avg of kw												
Weekday		#10000 KW	120.2	118.2	119.5	118.4	119.7	117.1	116.2	117.7	114.7	112.1	112.0	112.
Excluded Days		#11000 kW	64.2	60.3	64.6	61.0	61.1	58.4	60.5	59.3	62.4	60.4	61.5	63.
Weekend not running		#12000 KW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
Weekend not running		#13000 kW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
Excluded Days		Total kW	184.4	178.5	184.1	179.4	180.8	175.5	176.7	177.0	177.2	172.5	173.5	176.
		Weekend normal production hourly avg of kw												
		#10000 KW	129.4	129.7	129.3	130.3	130.6	131.0	130.2	129.9	129.7	129.4	129.8	130.
		#11000 kW	122.9	119.0	120.1	123.1	120.9	118.6	120.6	123.3	123.0	123.9	121.5	118.
		#12000 KW	84.0	78.2	56.5	65.0	59.3	58.3	69.0	69.1	68.7	71.5	66.6	61.
		#13000 kW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
		Total kW	336.3	327.0	305.9	318.4	310.8	307.9	319.8	322.3	321.5	324.7	317.9	310.
	Weekday	SCFM/kW	5.2	5.2	5.3	5.2	5.2	5.2	5.3	5.2	5.1	5.2	5.1	5.
	Weekend low production	SCFM/kW	5.1	5.2	5.1	5.2	5.1	5.2	5.1	5.1	5.0	5.1	5.1	5.
	Weekend norm production	SCFM/kW	5.2	5.3	5.2	5.2	5.3	5.3	5.3	5.2	5.3	5.2	5.3	5.

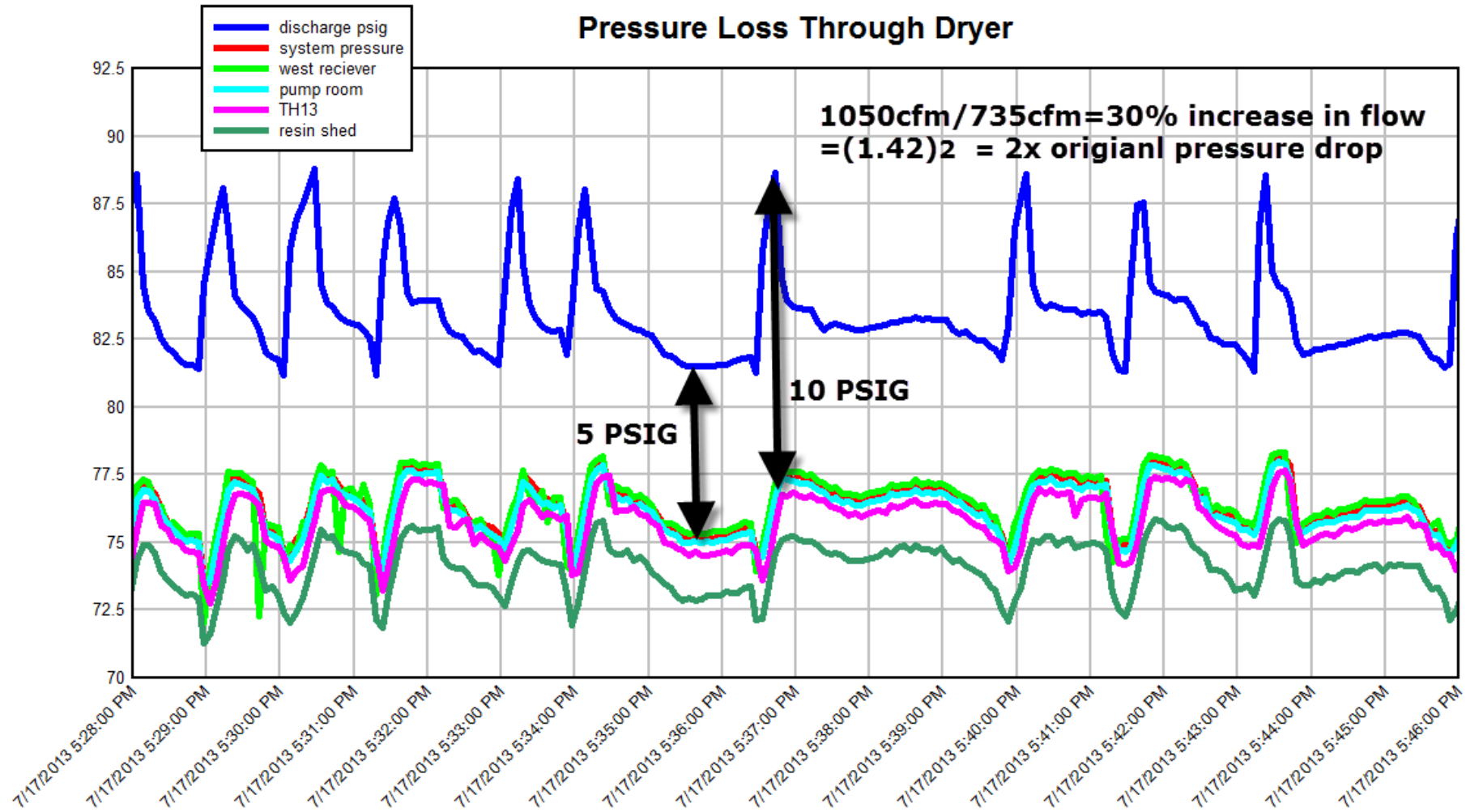

Trend Plot: Right-Click for Action Menu
Interval data (30 seconds) for System (Supply Side) and Periods (Baseline)
12/1/2006 12:00:00 PM to 12/11/2006 10:00:00 PM
kW
scfm
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Sat 02
Sun 03
Mon 04
Tue 05
Wed 06
Thu 07
Fri 08
Sat 09
Sun 10
Mon 11
#10000 KW (kW)
#11000 KW (kW)
#12000 KW (kW)
#13000 KW (kW)
Flow (scfm)


Trend Plot: Right-Click for Action Menu
Interval data (30 seconds) for System (Supply Side) and Periods (Baseline)
12/10/2006 1:58:52 AM to 12/10/2006 2:36:33 AM
kW
scfm
#10000 KW (kW)
#11000 KW (kW)
#12000 KW (kW)
#13000 KW (kW)
Flow (scfm)


Scatter Plot: Right-Click for Action Menu
supply receive (Pressure) vs. comp 2 kW (Power)
15 second interval data for System (Not Assigned) and Period (Not Assigned)
Power (kW)
100
90
80
70
60
50
40
30
20
116
117
118
119
120
121
122
123
124
125
Pressure (psig)

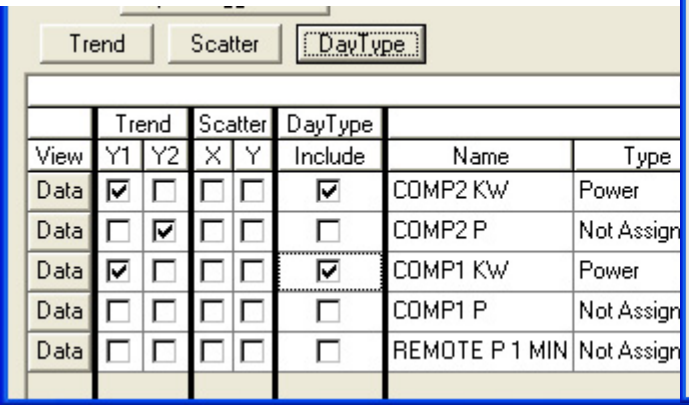
Log Tool Plot

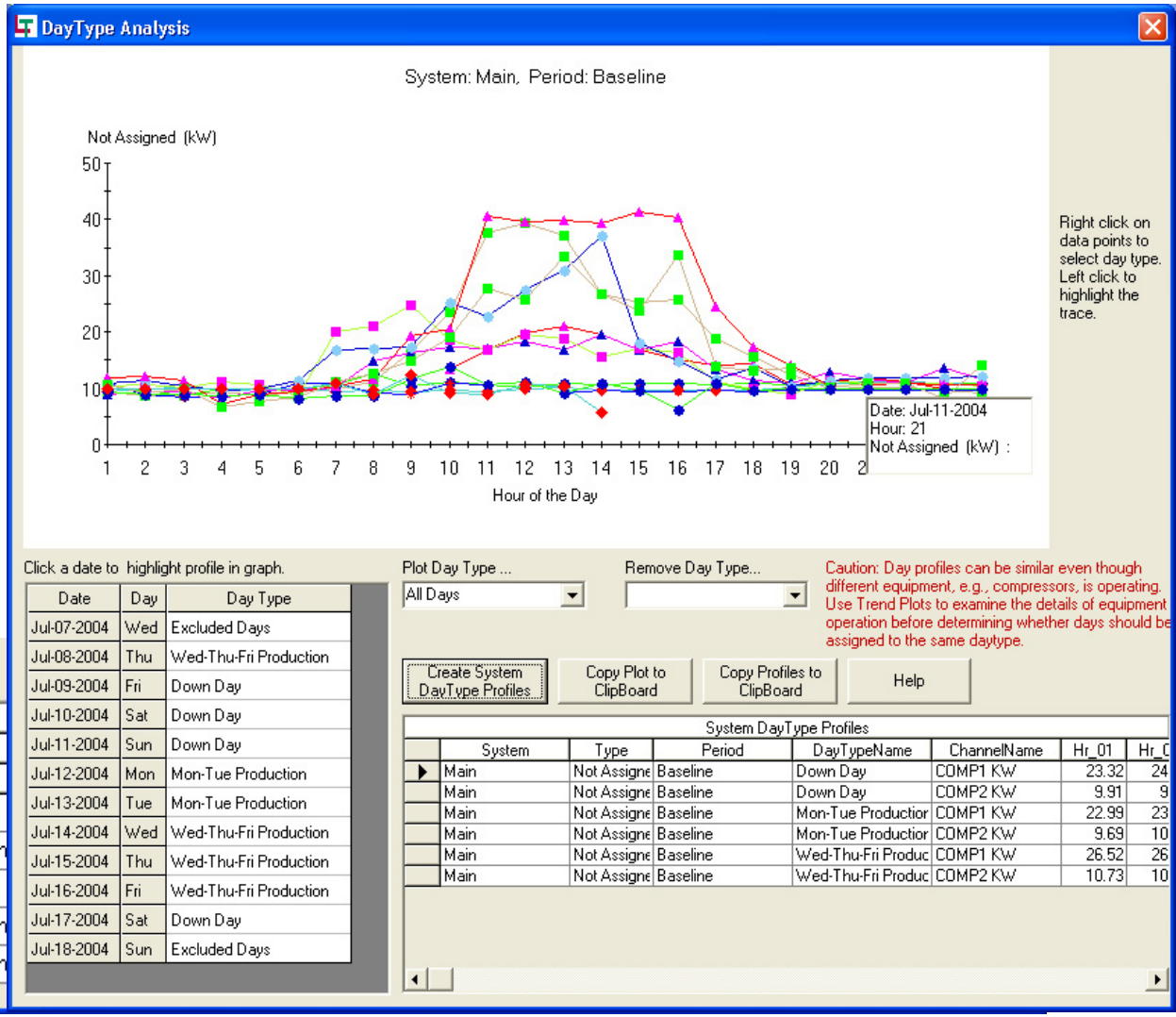
- Understand Your Pressure Profile
  - Pressure drop increase with the square of the flow increase



LogTool v2 Trend Plot

- Create Day Types for AIRMaster+ System Profile





LogTool v2
Paste DayTypes into Excel

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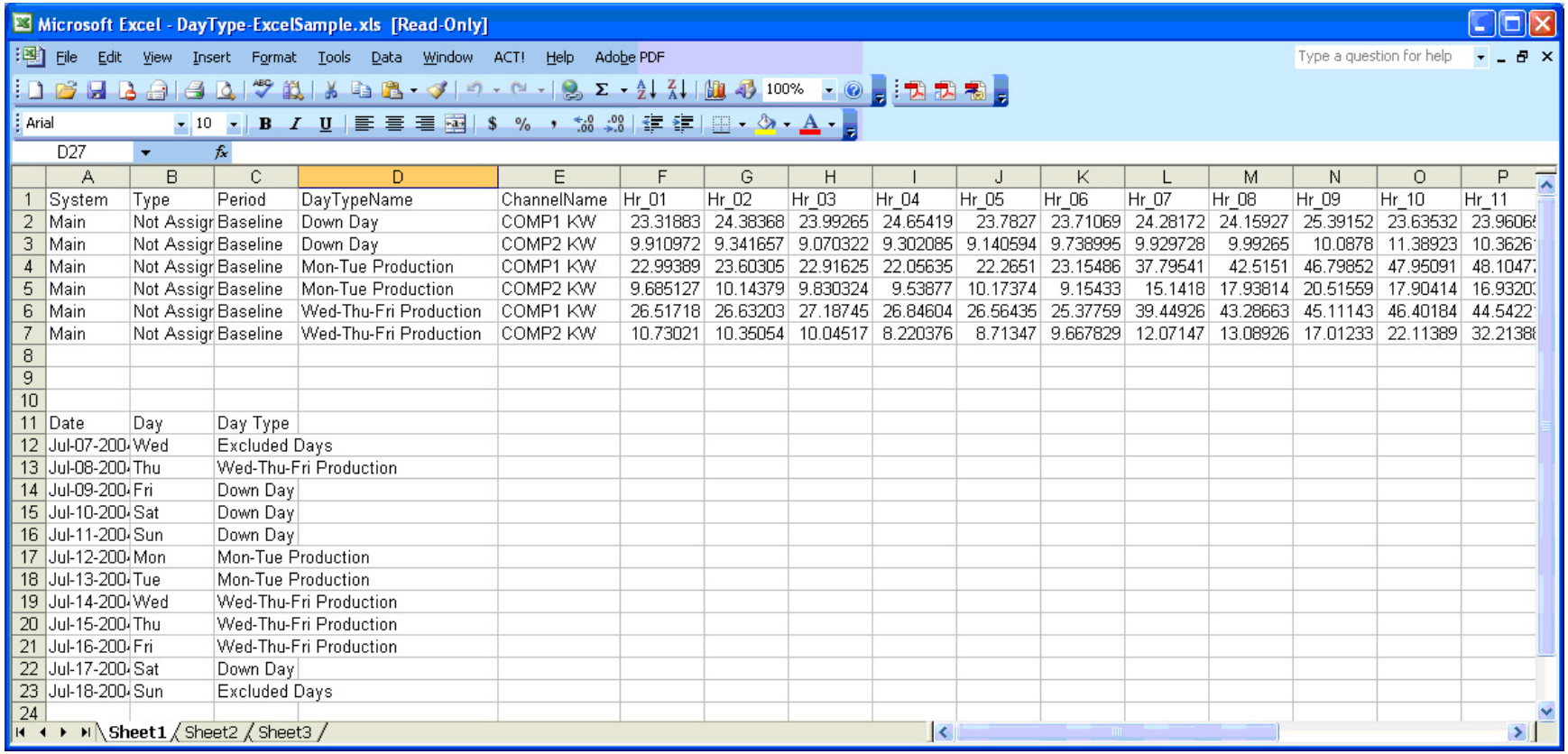
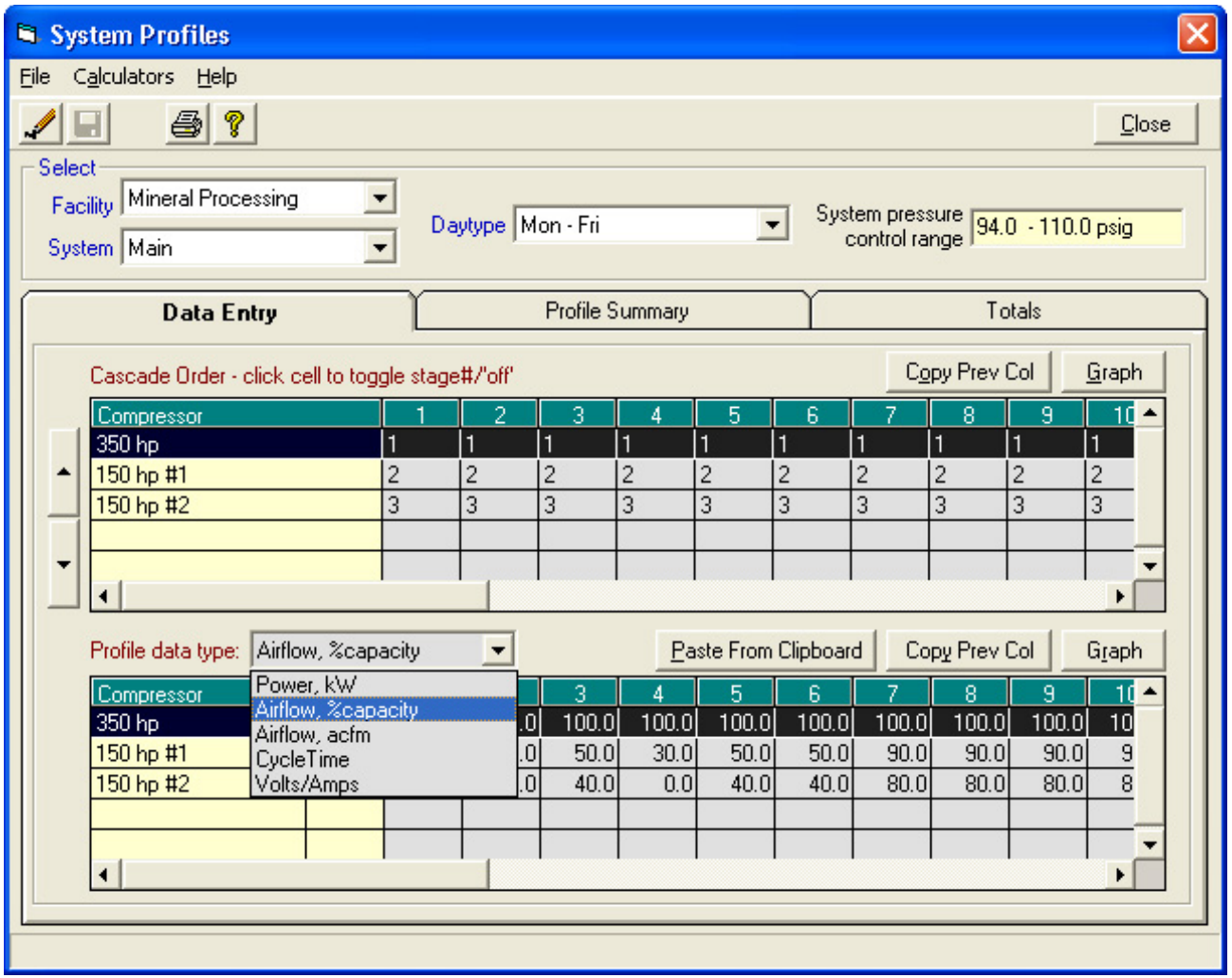
❑ View DayType Profiles in Excel



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	System	Type	Period	DayTypeName	ChannelName	Hr_01	Hr_02	Hr_03	Hr_04	Hr_05	Hr_06	Hr_07	Hr_08	Hr_09	Hr_10	Hr_11
2	Main	Not Assigr	Baseline	Down Day	COMP1 KW	23.31883	24.38368	23.99265	24.65419	23.7827	23.71069	24.28172	24.15927	25.39152	23.63532	23.96065
3	Main	Not Assigr	Baseline	Down Day	COMP2 KW	9.910972	9.341657	9.070322	9.302085	9.140594	9.738995	9.929728	9.99265	10.0878	11.38923	10.36261
4	Main	Not Assigr	Baseline	Mon-Tue Production	COMP1 KW	22.99389	23.60305	22.91625	22.05635	22.2651	23.15486	37.79541	42.5151	46.79852	47.95091	48.10477
5	Main	Not Assigr	Baseline	Mon-Tue Production	COMP2 KW	9.685127	10.14379	9.830324	9.53877	10.17374	9.15433	15.1418	17.93814	20.51559	17.90414	16.93203
6	Main	Not Assigr	Baseline	Wed-Thu-Fri Production	COMP1 KW	26.51718	26.63203	27.18745	26.84604	26.56435	25.37759	39.44926	43.28663	45.11143	46.40184	44.54227
7	Main	Not Assigr	Baseline	Wed-Thu-Fri Production	COMP2 KW	10.73021	10.35054	10.04517	8.220376	8.71347	9.667829	12.07147	13.08926	17.01233	22.11389	32.21388
8																
9																
10																
11	Date	Day	Day Type													
12	Jul-07-200	Wed	Excluded Days													
13	Jul-08-200	Thu	Wed-Thu-Fri Production													
14	Jul-09-200	Fri	Down Day													
15	Jul-10-200	Sat	Down Day													
16	Jul-11-200	Sun	Down Day													
17	Jul-12-200	Mon	Mon-Tue Production													
18	Jul-13-200	Tue	Mon-Tue Production													
19	Jul-14-200	Wed	Wed-Thu-Fri Production													
20	Jul-15-200	Thu	Wed-Thu-Fri Production													
21	Jul-16-200	Fri	Wed-Thu-Fri Production													
22	Jul-17-200	Sat	Down Day													
23	Jul-18-200	Sun	Excluded Days													
24																

Sheet1 / Sheet2 / Sheet3

AIRMaster+
System Profile – Data



Quantifying Opportunities – Tools to Help

- Software Tool – AIRMaster+
  - Baseline Measurement & Annual energy use
  - EEM's (energy efficiency measures) and savings
- Software Tool – LogTool
  - Charting trend performance
  - Assess dynamics, and Compressor Control Response
  - Daily System Profiles Define Day Types

INPLT on-site March 24th – 26th, 2015

Compressed Air System Energy Savings

INPLT Compressed Air Training System Approach

- Systems engineering focuses on defining stakeholders' needs and required system functionality. From energy input to air compressors to work performed in the production process.
  - Understand compressed air point of use as it supports critical plant production functions.
  - Correct existing poor performing applications and those that upset system operation.
  - Eliminate wasteful practices, leaks, artificial demand, and inappropriate use.
  - Create and maintain an energy balance between supply and demand.
  - Optimize compressed air energy storage and air compressor control.

Agenda

- **Schedule for On-site Assessments**
  - The following is a general overview of a typical 3-day, on-site assessment. The schedule may vary based on specific circumstances.
  - **Day One:** The Qualified Specialist/Energy Expert conducts a safety briefing for your plant team and tours the plant. Your team agrees on potential energy efficiency opportunities to investigate, and begins data collection for potential opportunities.
  - **Day Two:** The data collection continues and the DOE software assessment tool is applied to quantify potential opportunities. The lead person at your plant and the Qualified Specialist/Energy Expert discuss and agree on the opportunities identified.
  - **Day Three:** Wrap up the software tool analysis and focus on answering questions. The lead person at the plant and the Qualified Specialist/Energy Expert discuss how to gain management support to implement opportunities identified in the assessment. A close-out meeting is held in the afternoon to review results.
- After the assessment, your plant will receive a detailed report identifying opportunities. View assessment reports from other plants.

Darigold INPLT Training On-Site Agenda

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Tuesday March 24th

8:00-8:30am	**Arrival at Darigold Plant, Introductions and In-Plant Training Overview, Opening Remarks etc. Safety Overview**	• **Frank Moskowitz (**Draw Professional Services, Energy Experts in Compressed Air Systems) • **Paul Lemar** (DOE Technical account manager) • **Tom Rouleau** (Technical manager Sunnyside) • **Uli Schildt** (Darigold Energy Engineer)
8:30-11:00am Presentation and Discussion	Compressed Air Energy Management Training • Energy Savings Assessment Results—Summary • Overview on DOEs Free Compressed Air Software Tool (AirMaster+) • Q&A and Discussion	Frank Moskowitz
11:00-11:15	**Coffee Break**	
11:15-12:00 Plant Tour	Plant Tour: Measurement and Savings Project Demonstration	Frank Moskowitz
12:00-12:45	**Lunch Break**	
12:45-4:00	Measurement and Savings Project Demonstration Cont'd	Frank Moskowitz
4:00-4:30	Complete Training Evaluation Form and Adjourn	_____

Darigold INPLT Training On-Site Agenda

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Wednesday March 25th

8:00-8:30	**Introductions and Q&A from previous day**	Frank Moskowitz
8:30-11:00	Data Collection, Field Work and Discussion	Frank Moskowitz
11:00-11:15	**Coffee Break**	
11:15-12:00	The data collection continues and the DOE software assessment tool is applied to quantify potential opportunities	Frank Moskowitz
12:00-12:45	**Lunch**	
12:45-4:00	More Data Collection, Field Work, Discussion	Frank Moskowitz
4:00-4:30	Wrap-Up and Complete Evaluations	Frank Moskowitz and _____

Darigold INPLT Training On-Site Agenda

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Thursday March 26th

8:00-8:30	**Introductions and Q&A from previous day**	Frank Moskowitz
8:30-11:00	Wrap up the software tool analysis and focus on answering questions	Frank Moskowitz
11:00-11:15	**Coffee Break**	
11:15-12:00	discuss how to gain management support to implement opportunities identified in the assessment	Frank Moskowitz
12:00-12:45	**Lunch**	
12:45-1:30	Close out meeting to review results	Frank Moskowitz
1:30 – 2:00	Wrap-Up and Complete Evaluations	Frank Moskowitz and _____

Thanks for Attending!

- Questions?

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  - pll@rdcnet.com
- Frank Moskowitz
  - Draw Professional Services
  - fmoskowitz@drawproservices.com
  - 602-809-4195 cell