Greener Compressed Air Systems-Reducing the Environmental Impact

Paul Edwards
Compressed Air Consultants
Keynote Speaker

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PDH Certificates will be e-mailed to attendees within 2 days

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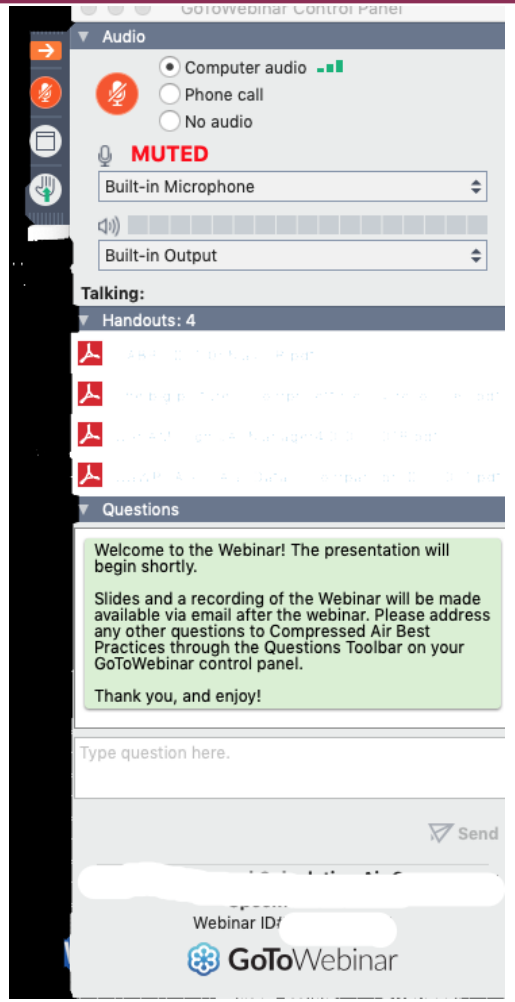

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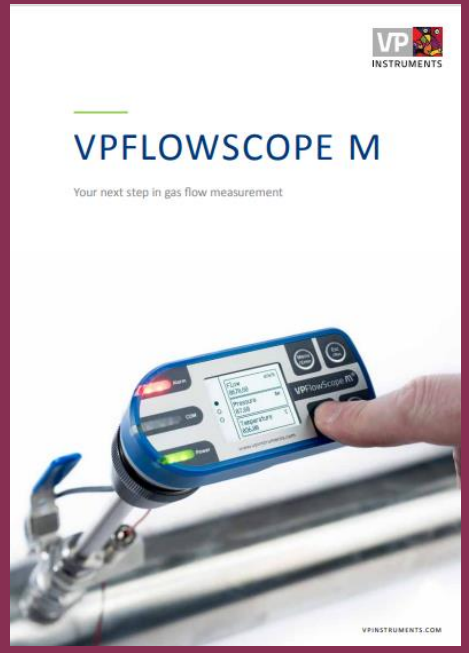
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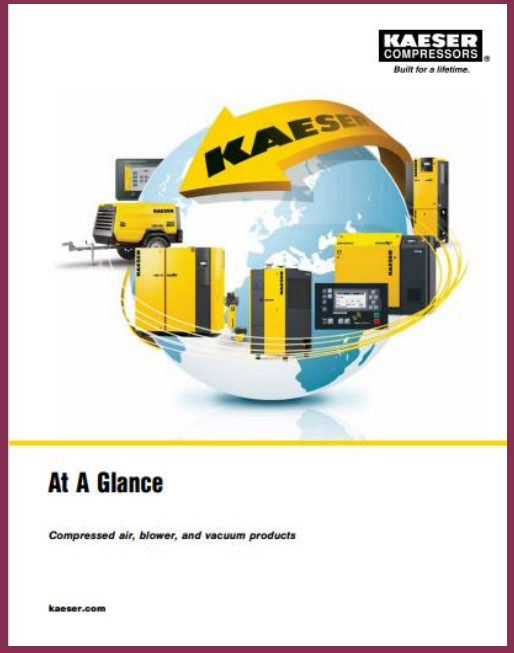
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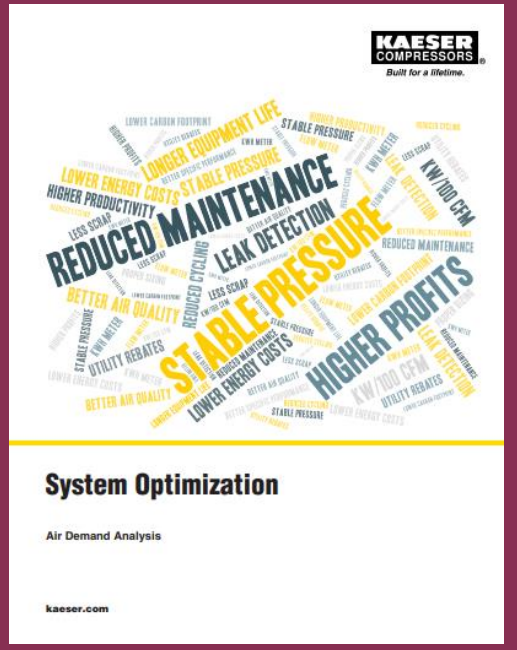
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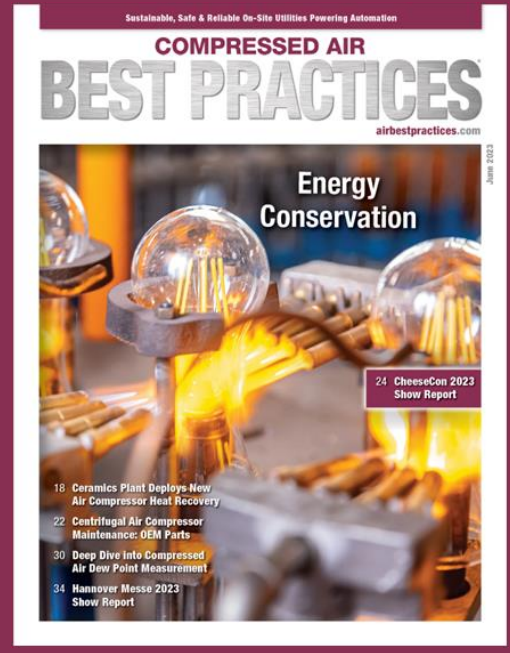
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Disclaimer

All materials presented are educational. Each system is unique and must be evaluated on its own merits.

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Greener Compressed Air Systems-Reducing the Environmental Impact

Introduction by

Compressed Air Best Practices® Magazine

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About the Speaker

Paul Edwards
Compressed Air Consultants

- President and Owner, Compressed Air Consultants since 2003
- 39 years of experience in the compressed air industry
- Former Marketing Manager, Product Manager, Ingersoll Rand
- Started up IR's audit business

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Greener Compressed Air Systems
A Challenge "by Industry" to our Industry

10/04/22

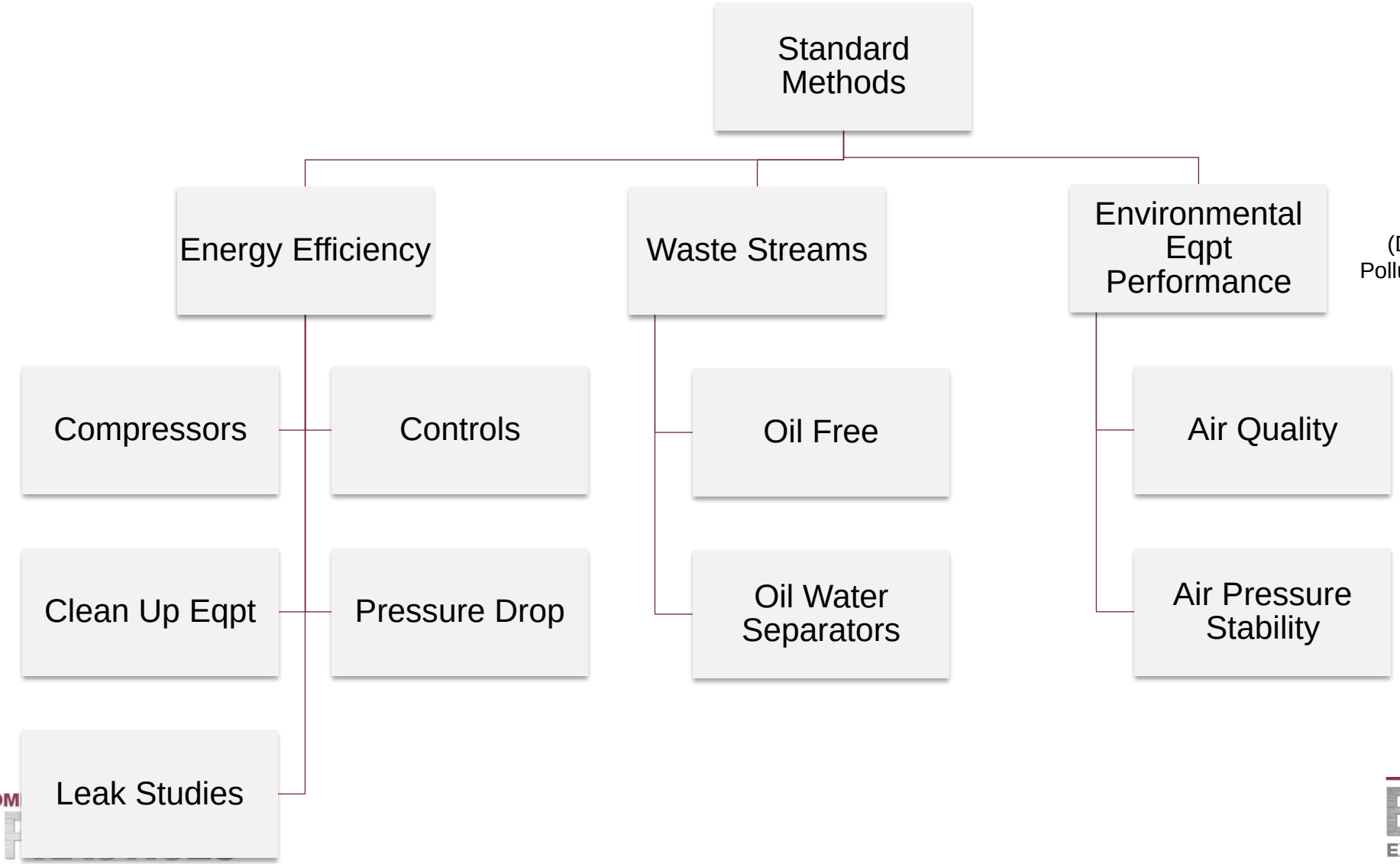
Paul Edwards
President
Compressed Air Consultants

What is “Green”?

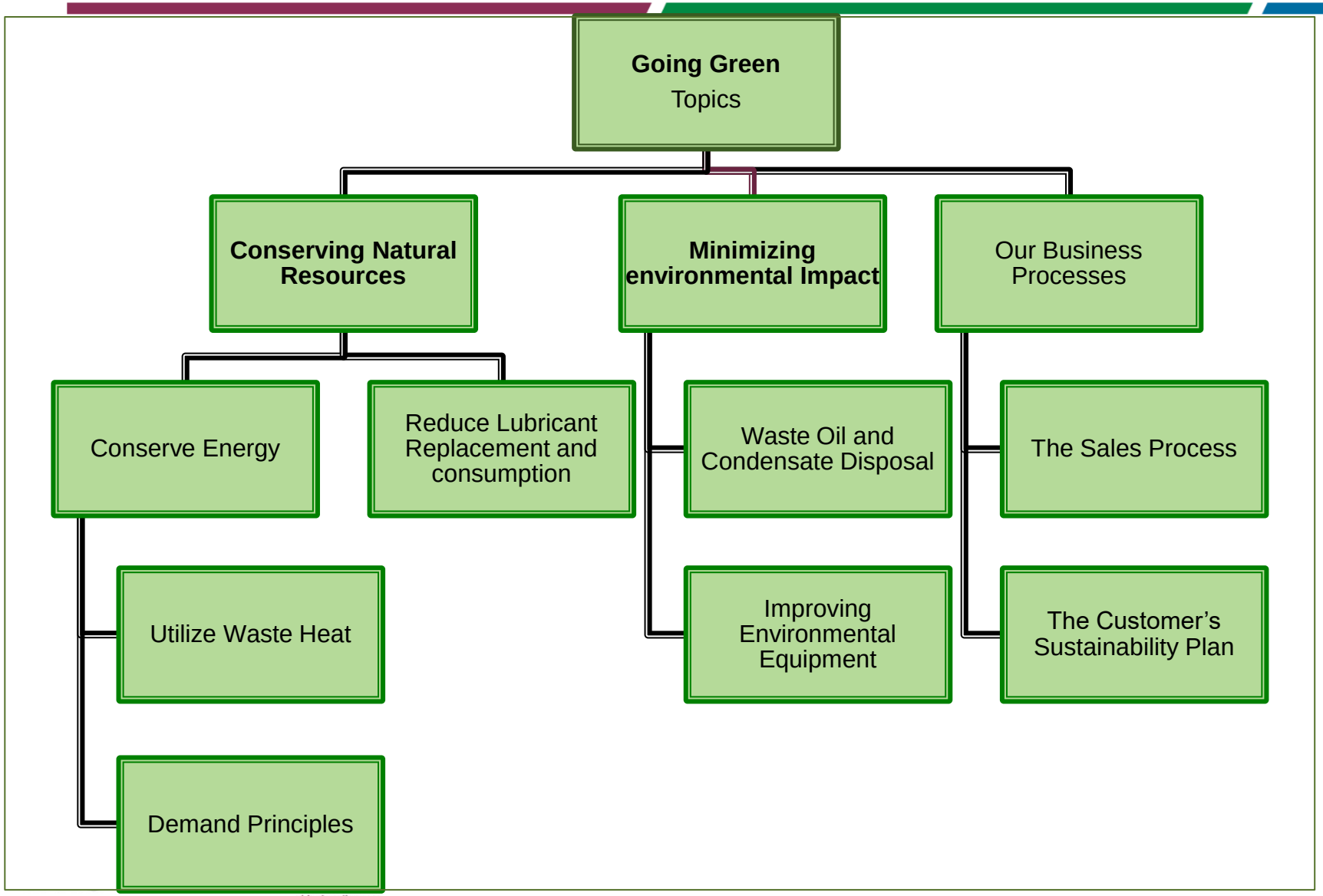
Green has no political boundaries.

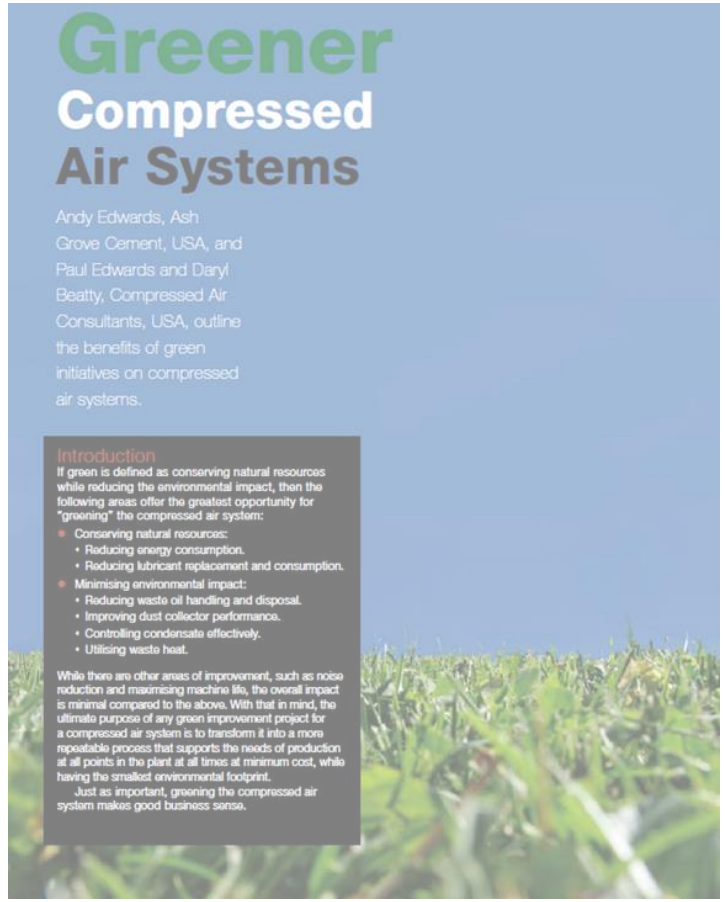
When we look deeper into the meaning of green, we will understand it extends well beyond the foundational aspects of recycling and environmental protection. Green means to continually improve upon the manner that resources are utilized that results in reduced impacts to human health and the environment and is done without sacrificing the current and future needs of our world. No legislative or political structure has domain over green. However, government has a place in this movement. Foundational environmental laws, based on sound science are important to create performance baselines, but legislation must keep pace with new technologies and not restrict **innovation that is holistically better for our world**. This is the foundation of pollution prevention, welcoming innovative solutions to our challenges and is accomplished using green chemistry and design for the environment disciplines. Doing so will reduce overbearing and restrictive legislation, especially when a total ecosystem approach or life cycle analysis concepts to problem solving are utilized.

Standard “Green” Approaches



2008 Definition

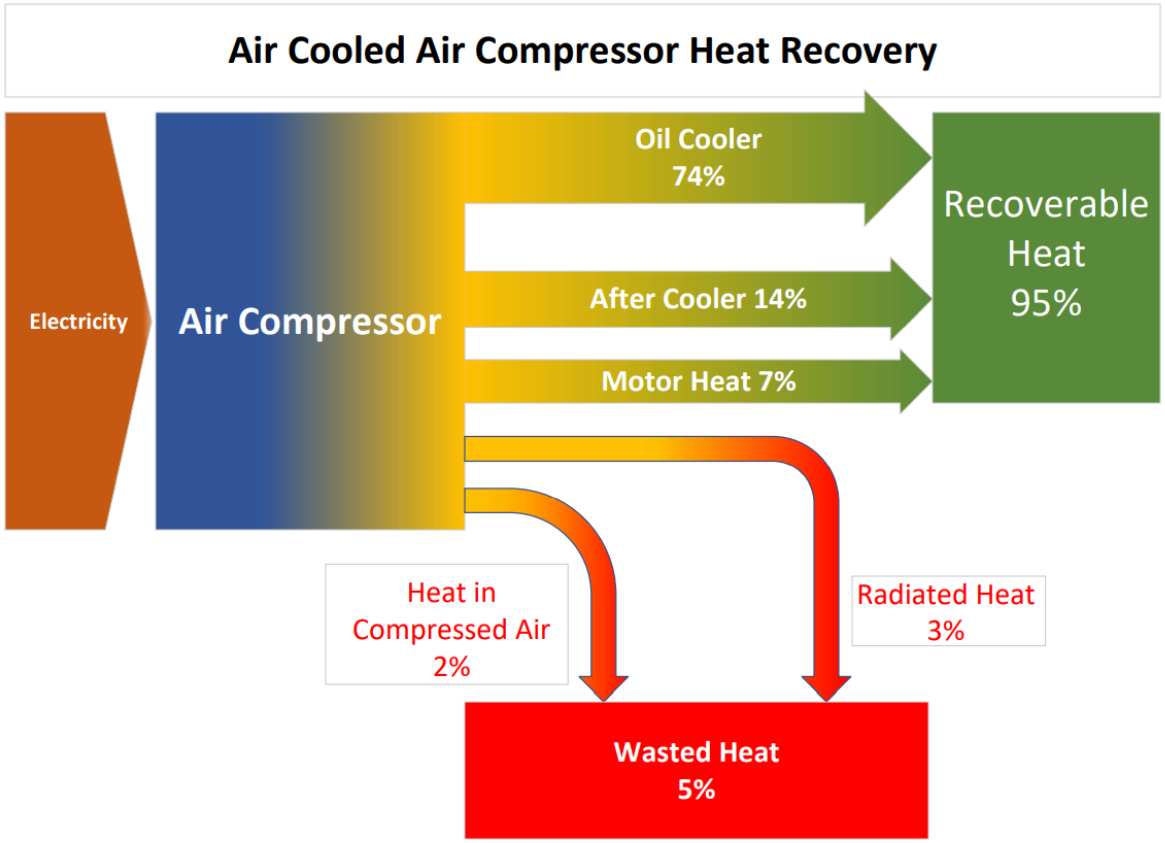




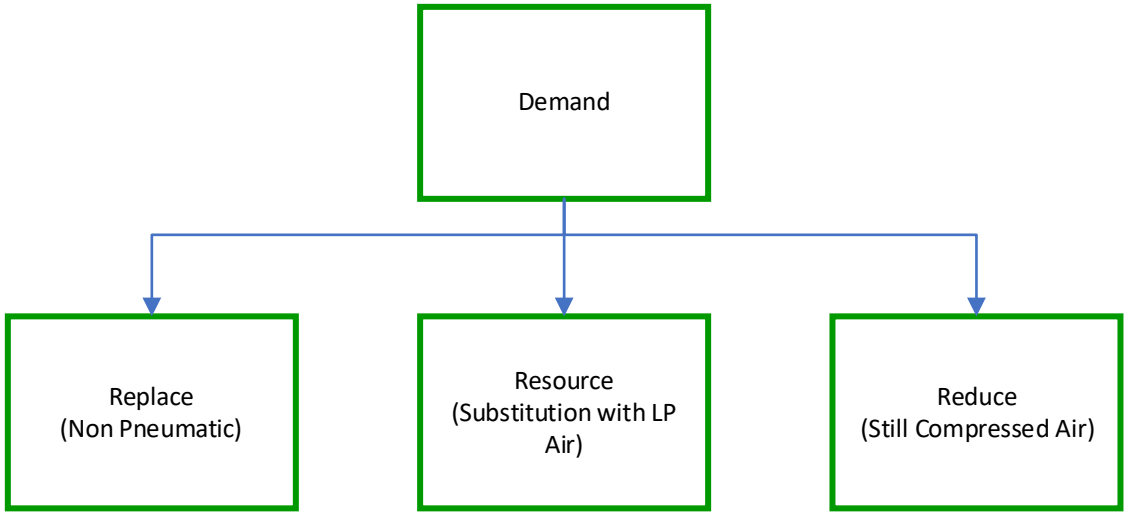
Waste Heat Utilization

- Could another way of looking at it be that a Compressor is an Inefficient Heater that just happens to produce compressed air?

- Water Cooling
  - Boiler Pre-heat, cleaning water
- Air Cooled
  - Space Heating, Drying



Demand Is More than Leaks



Application	Current	Proposed	Savings
Supply Side Desiccant Dryers	1078	0	1078
Application A	1745	618	1127
Application B	150	25	125
Application C	291	50	241
Application D	249	175	74
Application E	135	140	-5
Application F	44	44	0
Application G	50	50	0
Application H	50	50	0
Application I	486	486	0
Application J	5	0	5
Miscellaneous	963	963	0
Application K	213	167	46
Application M	40	20	20
Application N	127	0	127
Safety/Fudge Factor	0	500	-500
Leaks	98	48	50
Total	5723	3336	2388

Additional Energy		HP	
Open Blowing Replacement	0	20	
Application D Motors	0	5	
Additional HP Load		25	

Demand – Replace (Non Pneumatic) with Mechanical or Hydraulic

Drum and Barrel Heavy-Duty Electric Motor Mixers

NEPTUNE

Heavy-duty mixers for mixing contents of 55-gallon drums and barrels—choose from three mounting styles
These high-quality mixers are available in three mounting versions for heavy-duty mixing.
Adjustable hand screws secure the drum-lip model to the rim of 55-gallon (200 liter) drums. The C-clamp model mounts to any open head tank or drum and allows you to adjust the angle of the mixer. The 2" NPT(M) mount model screws directly into a standard 2" (51 mm) female bung to keep odors in and debris out.
Drum-lip and NPT(M) mount models include a folding impeller to pass through bung that attaches to the shaft with set screw and opens to a maximum

MORE +

$908.00 - $1,108.00 USD / EACH

6 variations of this product are available.
SEE ALL PRODUCT OPTIONS BELOW

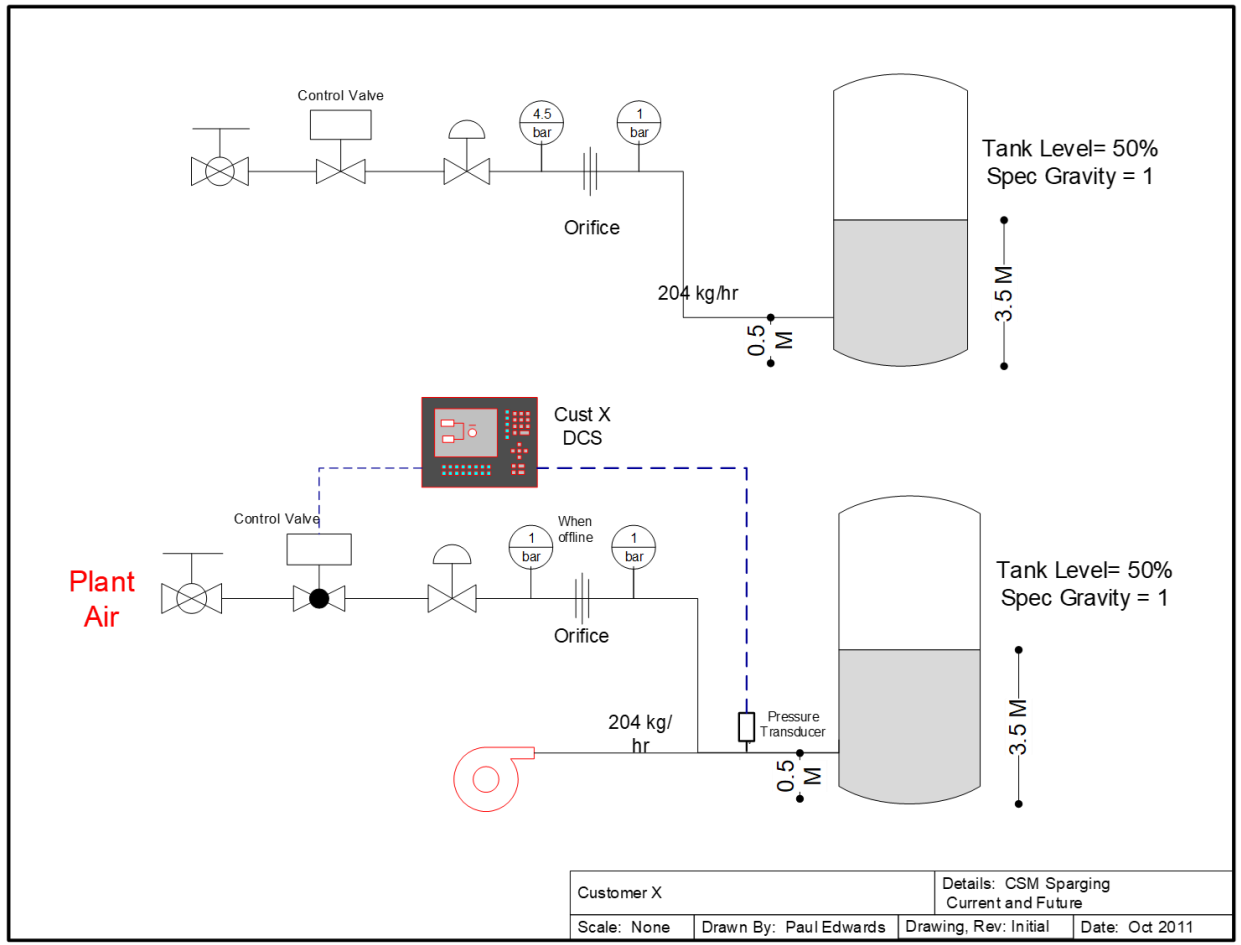
Demand – Replace (Non Pneumatic)

- Ready Made Conversions

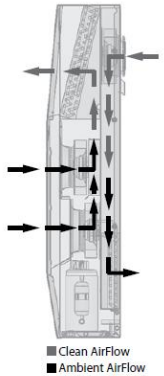
Vibrator Force or Impact Lbs.	ELECTRIC MODELS PAGE NO. 2P Page 24-28	4P Page 24-28	6P Page 24-28	8P Page 24-28	SPR Page 29-30	US Page 31-32	SFC Page 34	FC Page 34	SCR Page 23-24	PNEUMATIC MODELS TURBINE Page 3-12	BALL Page 13-14	PISTON Page 15-18	SVR Page 19-20	BIG BUSTER Pge 21-22	HYDRAULIC MODELS TURBINE Page 21-22	BIG BUSTER Page 21-22	BIN SKIN Thickness Max.
10									SCR-50/60	BVS-60, BVS-100		5/8, 3/4	1 & 1-1/4		B-130		20 Ga.
20					SPR 20 & 21						BV-130, BB, V-100						20 Ga.
40					SPR 40				SCR-100	VS, BBS-130							1/16
60	2P-75				SPR 60	US-100		FC-100			BB-160	1-1/4 - 1-1/2S	1-1/4				1/8
80		2P-100			SPR 80		SFC-100			BBS-160	BV-190, V-190	1-1/2L or LS, 2S	1-1/2		B-190		3/16
100																	1/4
150	2P-150	2P-200	6P-300	8P-500		US-300		FC-300	SCR-200/300	BVS-250, VS-250	BV-250, V-250	2L, 3S	2, 2LS		B-250		5/16
200							SFC-300										5/16
300						US-450				BVS-320, VS-320	BV-320, V-320	4, 3L	3, 3LS	PF-800			3/8
400		4P-350	6P-500					FC-400	SCR-400/500						B-320		3/8
500	2P-450									BVS-380, VS-380	BV-380, V-380			PF-1200			7/16
600		4P-700		8P-1000		US-900			SCR-1000								7/16
700										BVS-510, VS-510				PF-1500		LF-1000	1/2
800		4P-1000															1/2
900						US-1600				BVS-570			SVRS-SVR-3000, SVR-4000	PC-PF-3000			1/2
1000		4P-1400															1/2
1200	2P-800									CCF-2000				PC-PF-3500		HF-800	1/2
1400		4P-2000															3/4
1600														SVRS-SVR-5500			3/4
2000		4P-3000														HF-1500	3/4
2500	2P-1700									CCF-5000							3/4
3000																	1
3500	2P-2500													SVR-8000			1
4000		4P-5000															1-1/4
4500																	1-1/4
5000																	1-1/4
6000		4P-10000															1-1/4
7000																	1-1/4
8000																	1-1/4

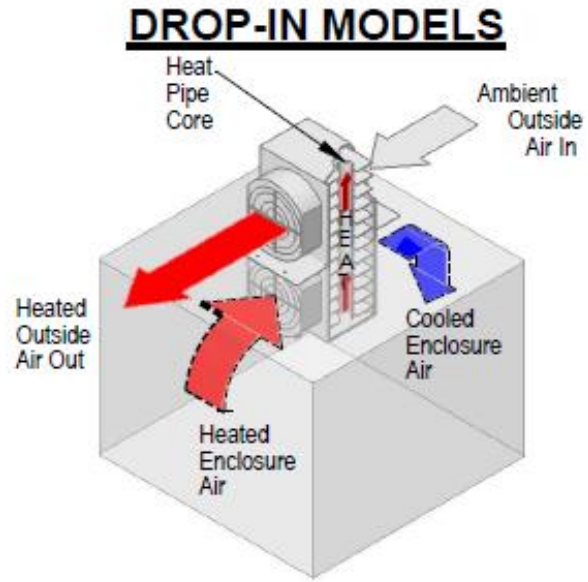
Demand – Re-source (Substitute HP Air with LP)

Estimated Comparison of Costs	M3/hr	KW	M3/hr/kw	% of Rotary	€/m3/yr
Rotary Screw	757	89	8	100%	64
LP Screw-30 psi	850	49	17	49%	31
Lobe	1013	33	30	28%	18
Pressure Blower	680	6	112	8%	5



Demand – Reduce Compressed Air Consumption





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Waste Streams –

- How much does it really cost to make a long life lubricant?

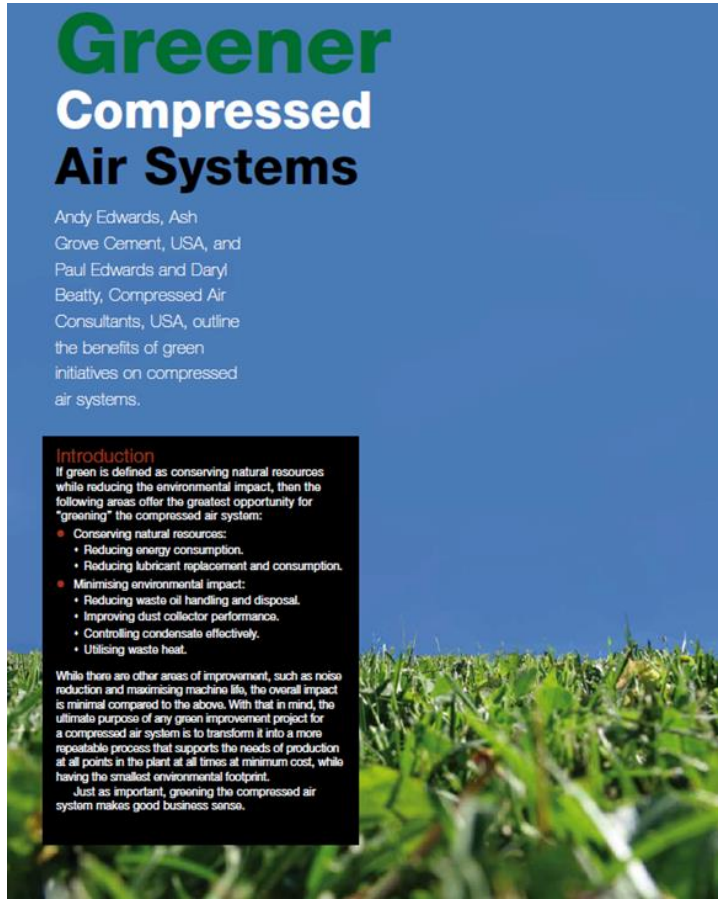
- Time Based or Condition Based Maintenance? What are end users moving towards?
  - Lubricant?
  - Airends?
  - Compressors?

Lubricant Purification

- Increase the lube lifetime by up to 4x
  - Ion Resin prevents lubricant from going acid
  - Moisture removal helps bearing lifetime
  - Additional filtration improves lubricant quality to the bearings

2008 Definition Update

- Conserving Natural Resources
  - Reducing Energy Consumption, decreasing CO2 emissions
  - Reducing Lubricant Replacement and consumption
- Minimizing environmental Impact
  - Reducing Waste Oil handling and disposal
  - Improving Environmental Equipment Performance
  - Controlling Condensate Effectively
  - Utilizing Waste Heat
- Optimizing Spending/Improved Analysis
- Faster Feedback
- Operator Training

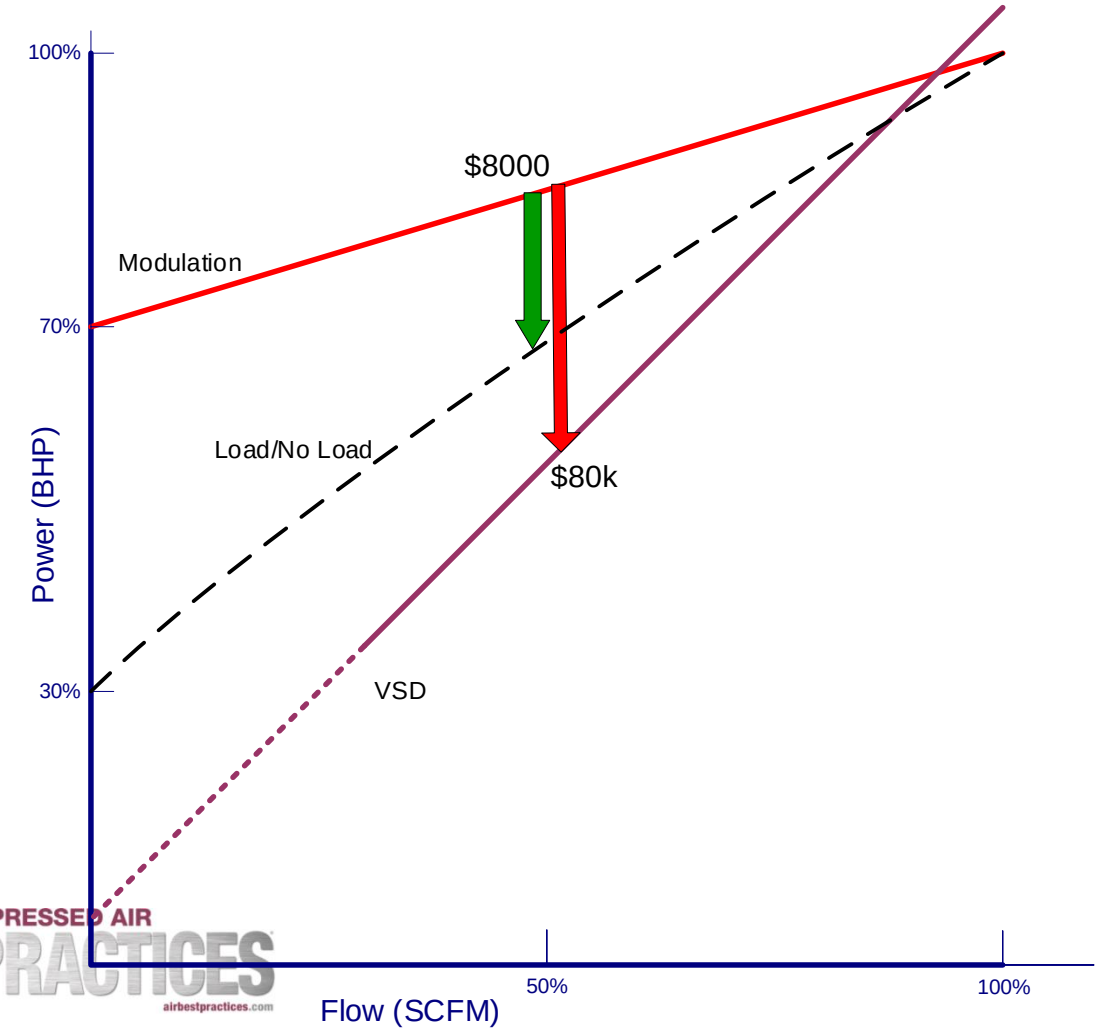


Optimized Spending

- Green is more than equipment
  - *Green means to continually improve upon the manner that resources are utilized that results in reduced impacts to human health and the environment and is done without sacrificing the current and future needs of our world.*
- Is spending money on a sub-optimal solution truly green?
  - Could that money spent on the new VSD have been put to better use?

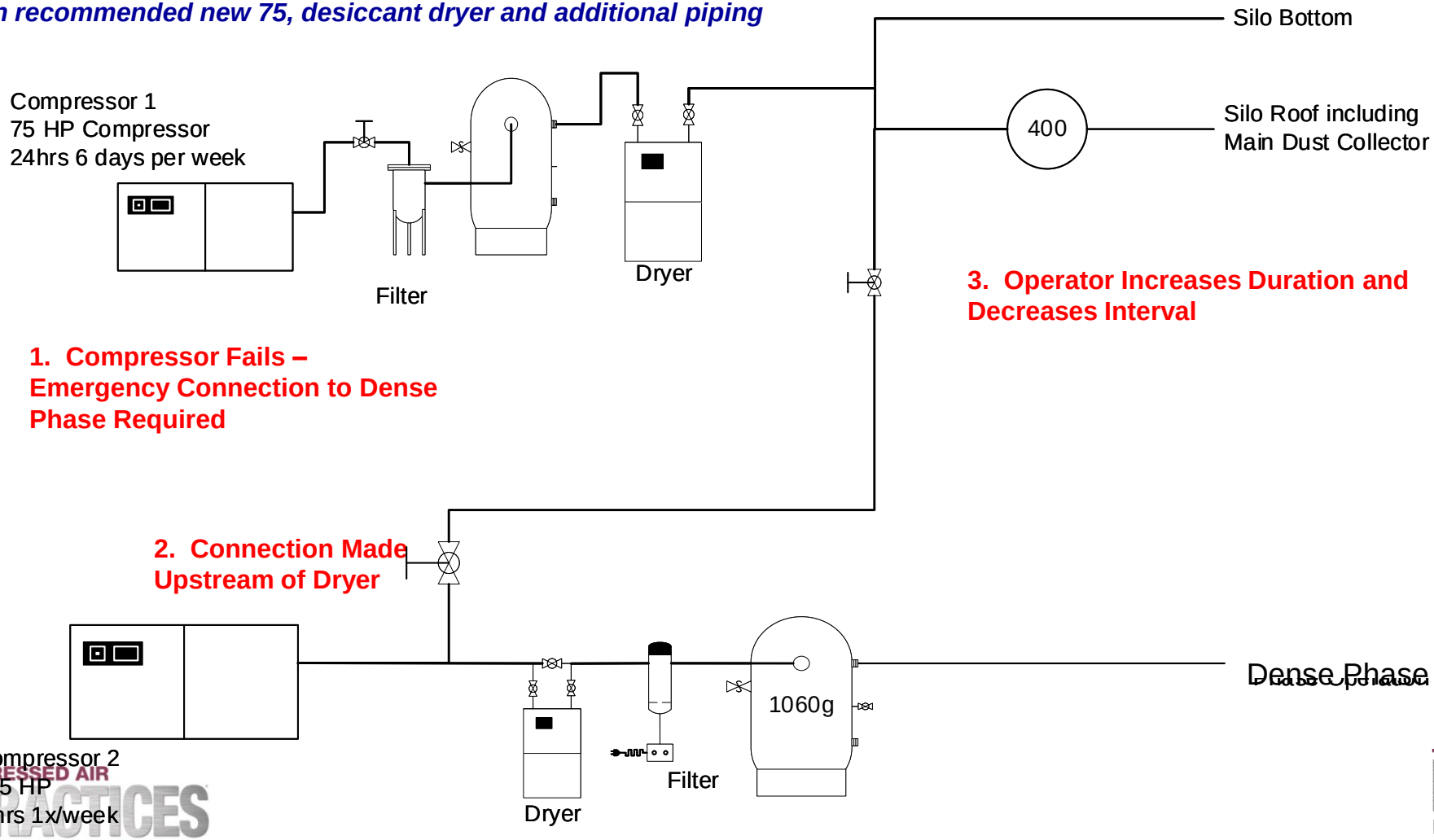
Challenging “Common Sense” – Stewards of the End Users Resources

- Should ROI be considered when it comes to going green?



Improving the Recommendation Process

- ***Insufficient Pressure on Silo Roof Leads to Dusting***
- ***Without any change in the process, the 125 hp went to 24/8 from 8/1***
- ***Salesman recommended new 75, desiccant dryer and additional piping***



Faster, Better Feedback

- Minimum KPIs
  - SCFM for Demand Side Efficiency
  - SCFM/kw for Supply Side Efficiency

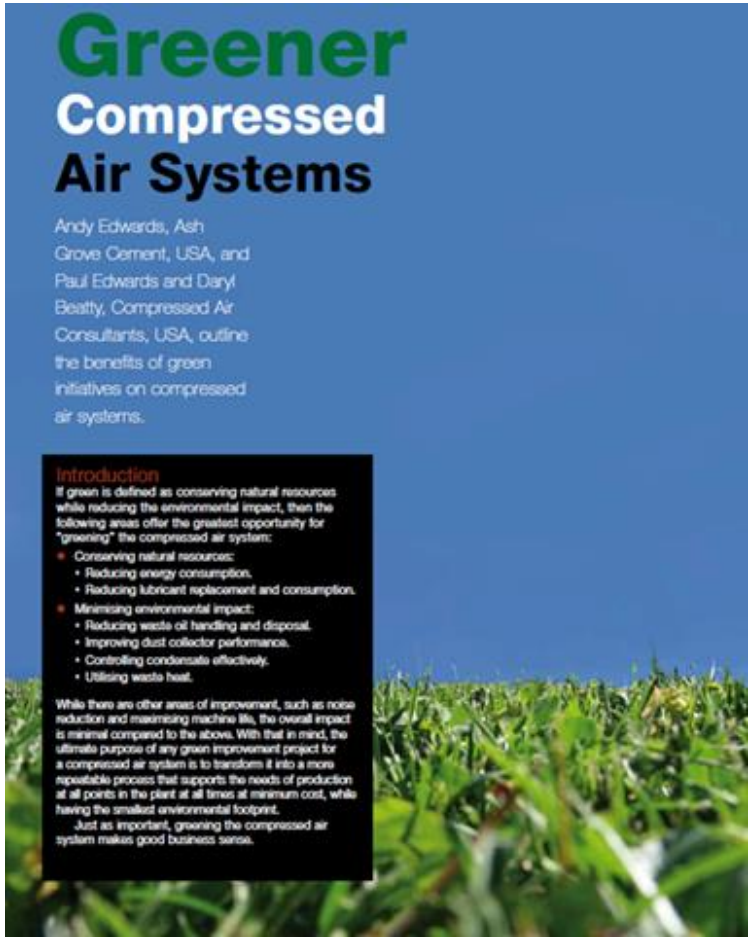
Operator Training

- *Never underestimate the Ingenuity of Operators to Come up with Techniques That Throws Away Money That You'll Never Know About*
- Training Plant Personnel on the cost of compressed air is critical to long term success
- Retaining the "Tribal Knowledge"

Air, your most Expensive Energy. Even a little adjustment can cost plenty ($5000 per year)

Summary

- More and More End Users Value "**Green**"
- Suppliers Can Profit by Providing It
  - Existing Processes and Techniques
  - Underused Techniques
  - Better Evaluations
- Generating Profit for End User and Supplier alike



About the Speaker

Pascal van Putten
VPInstruments

- CEO, VPInstruments
- > 20 years experience
- VPInstruments offers industrial clients Energy Management Solutions for compressed air, technical gases as well as other utilities

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Stop estimating

Start making well founded decisions


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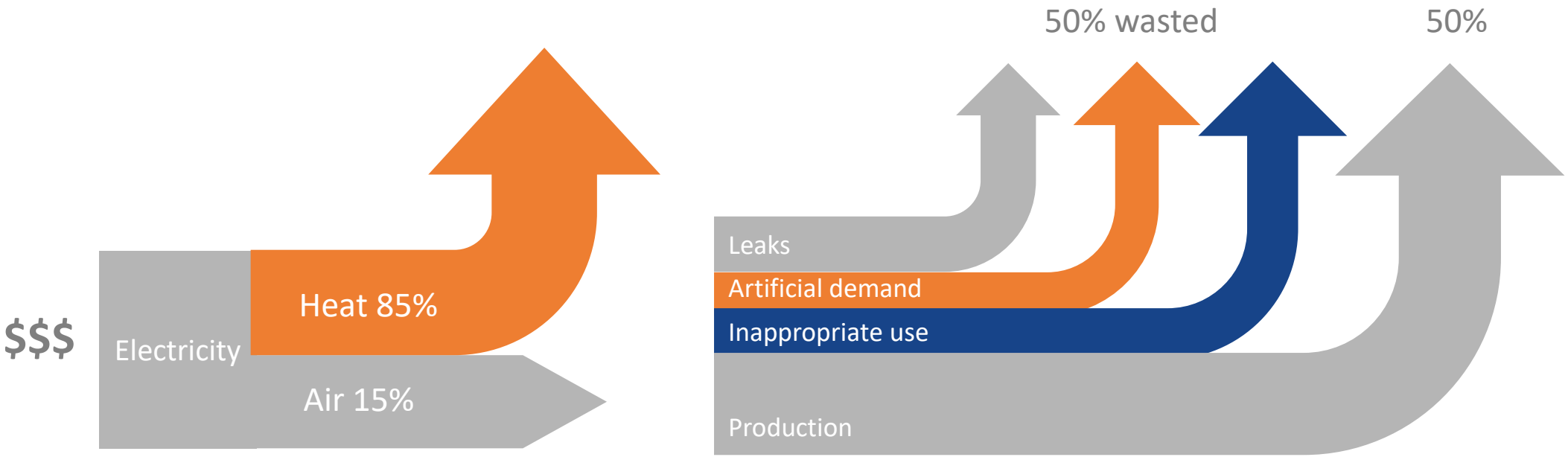
Costs of compressed air

- 8 to 10 x more than electricity
- 10% - 30 % of the electricity bill of an average production plant
- Still often considered as “free”



What is your focus?

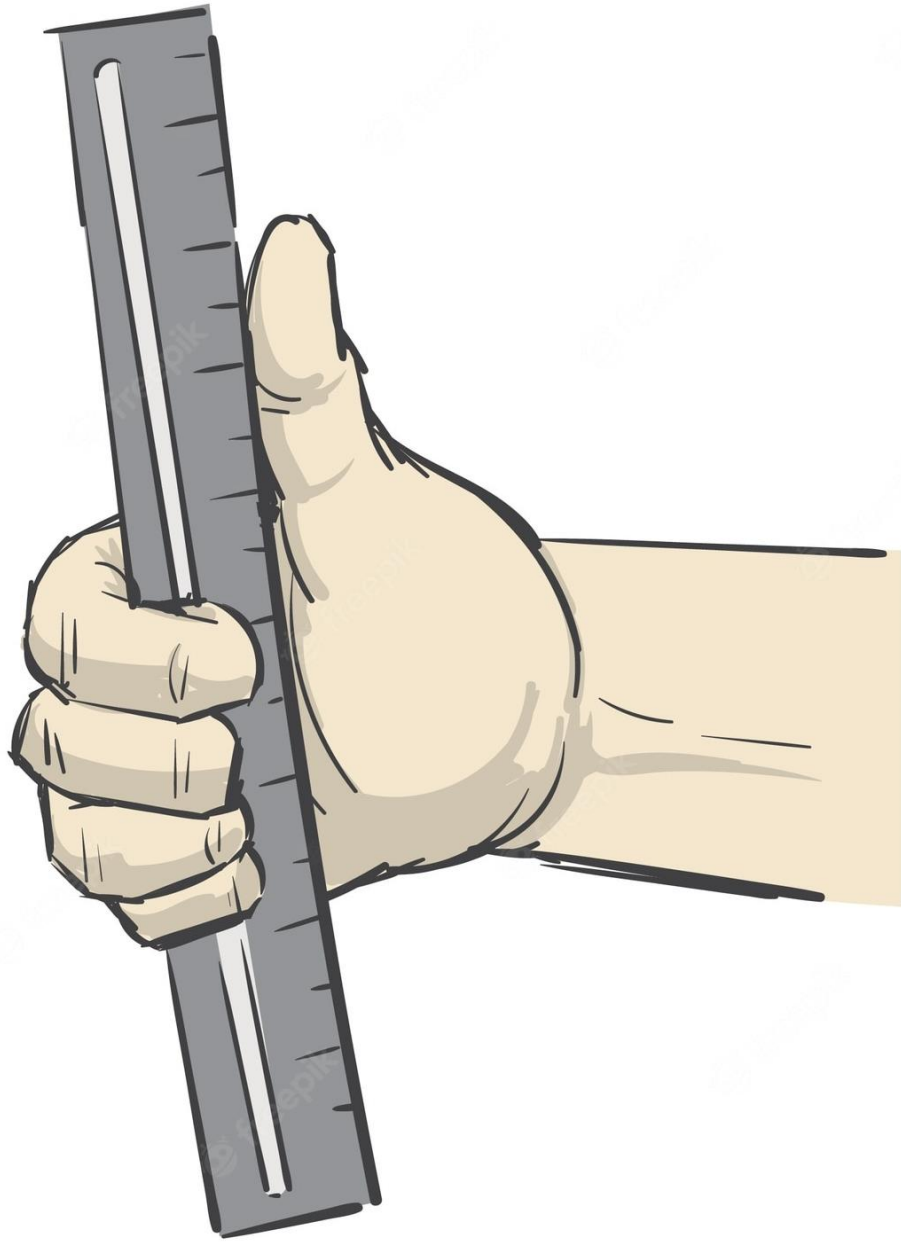
ROI

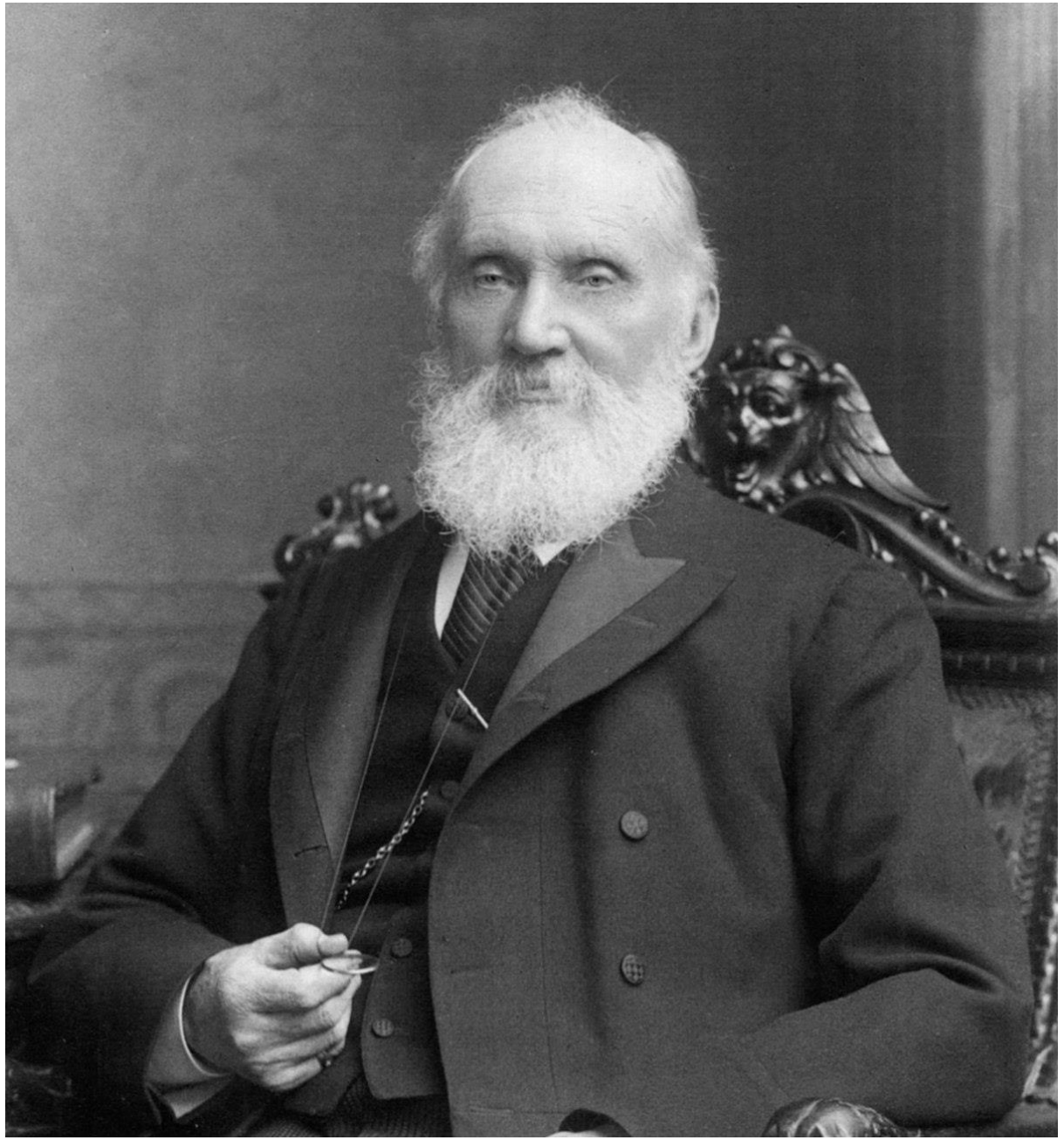
In compressed air savings industry, typical rule of thumb:

At least **10% savings on energy costs** → make this your initial ROI target

Typical measures:

- Leak detection and repair
- Demand side management
- System pressure optimization
- Proper dryers and filtration
- Receiver tanks/ storage





“If you cannot measure it, you cannot improve it”

Lord Kelvin

Savings Example Sauce Plant

Initial state

- No monitoring used on site
- No production in weekends
- 1 compressor room with 2 x 100 hp/ 75 kW compressors
- One of the compressors was designed for back-up
- Both machines were running most of the time

Savings Example Sauce Plant

Solution

Basic monitoring system + 4-in-1 flow meter + 2 x Amp meter

Measures taken

- Keep track of leakage rates and associated energy costs
- Set automatic alarm when the back up compressor comes on

Results

- After 1 week data: Annual leakage $ 40,000 detected and fixed
- 1 compressor can be shut down. Back to back-up role
- **ROI: ~ 1.5 month**

(Cash) Flow meter

½” 1” 2” > 2”

Size (inch)	Max flow (SCFM)	USD/ min	USD/ hour	40 h week USD/ year	24/7 USD/ year
½ inch	50	0.02	1	$ 2,080	**$ 8,840**
1 inch	150	0.05	3	$ 6,240	**$ 26,000**
2 inch	600	0.18	10	$ 20,800	**$ 87,360**
3 inch	1350	0.41	25	$ 52,000	**$ 218,400**

Disclaimer

- This example is to illustrate the general line of thought.
- Flow meter and installation costs vary depending on type, location and other requirements
- Leakage repair costs can vary from a simple gasket towards overhaul of a machine and are not included in this example
- “A flow meter alone does not save anything”, but it does open your eyes and reveals issues which you cannot see otherwise.

(Cash) Flow meter

Example for 10% savings

Size (inch)	Max flow (SCFM)	USD/ hour	Flow meter + installation	40h 10%	ROI (years)	24/7 10%	ROI (years)
½ inch	50	1	$ 1,000	$ 210	**4.80**	$ 884	**1.40**
1 inch	150	3	$ 1,500	$ 620	**2.40**	$ 2,600	**0.70**
2 inch	600	10	$ 2,000	$ 2,080	**1.00**	$ 8,736	**0.30**
3 inch	1350	25	$ 4,000	$ 5,200	**0.80**	$21,840	**0.20**

Disclaimer

- This example is to illustrate the general line of thought.
- Flow meter and installation costs vary depending on type, location and other requirements
- Leakage repair costs can vary from a simple gasket towards overhaul of a machine and are not included in this example
- “A flow meter alone does not save anything”, but it does open your eyes and reveals issues which you cannot see otherwise.

The costs of procrastination

Costs/ 1000 SCFM : 30 cents

Leak : 60 SCFM

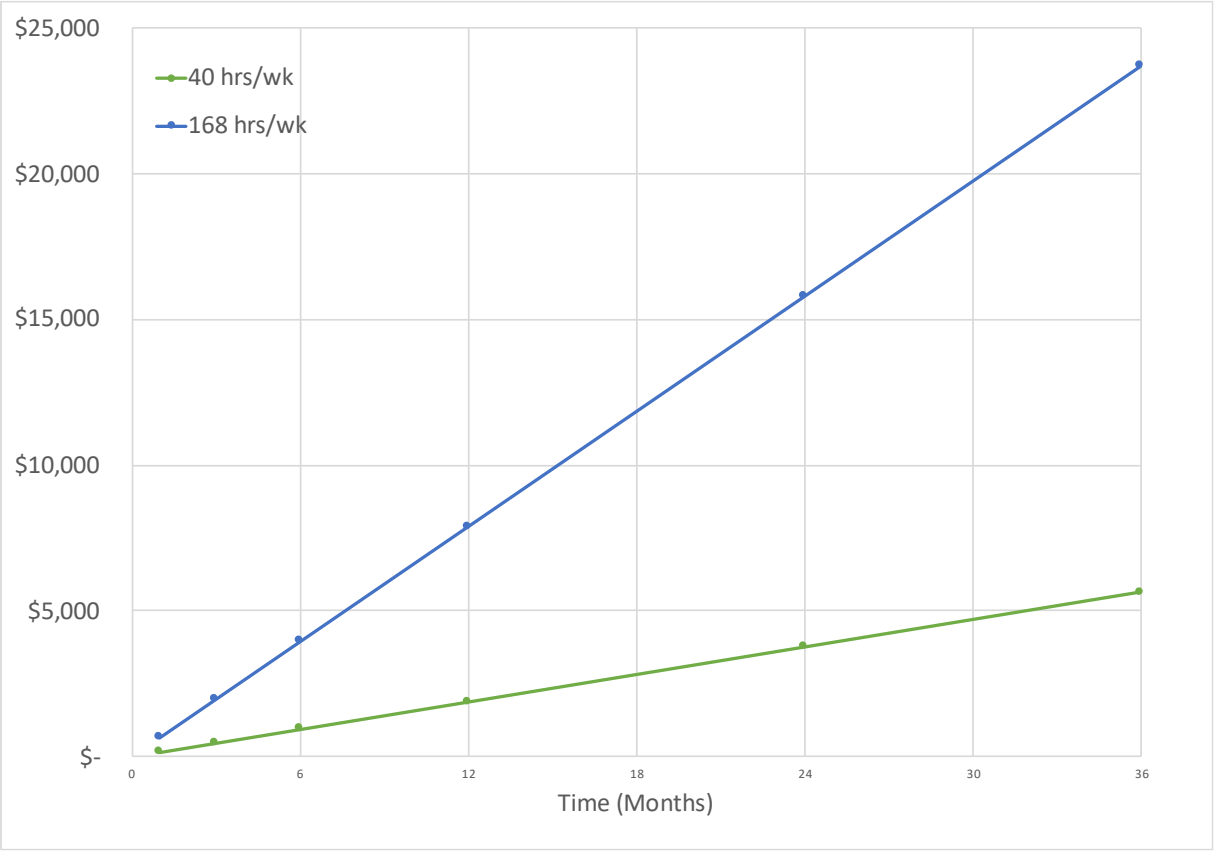
Waste per month : ~660 USD

Leak repair budget : 2500 USD

Budget wasted in (24/7) : ~ 3.8 months

Budget wasted in (40h) : ~ 16 months

Budget/waste ratio < 6 months: **“just fix it”**



Why are improvements not your priority?

4-in-1 flowmeter: your ”Swiss army knife”

- Flow
- Pressure
- Temperature
- Total flow
- Data logger

Final tip

Start mapping with your team

- Sketch of your compressed air system
- Set a target for:
  - Annual costs
  - Nominal consumption
  - Nominal pressure
  - Efficiency
- Identify issues past 6 months, consequences and discuss how to prevent/overcome them
- Small improvements/ repairs? **Just fix it** when ROI < X months, but keep a permanent eye on results

THANK YOU!

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About the Speaker

Michael Camber
Kaeser Compressors

- Marketing Services Manager, Kaeser Compressors
- Joined Kaeser in 1997
- Member of Kaeser's active training team
- KFaCT Master Certified
- Prior US Marine Corps officer

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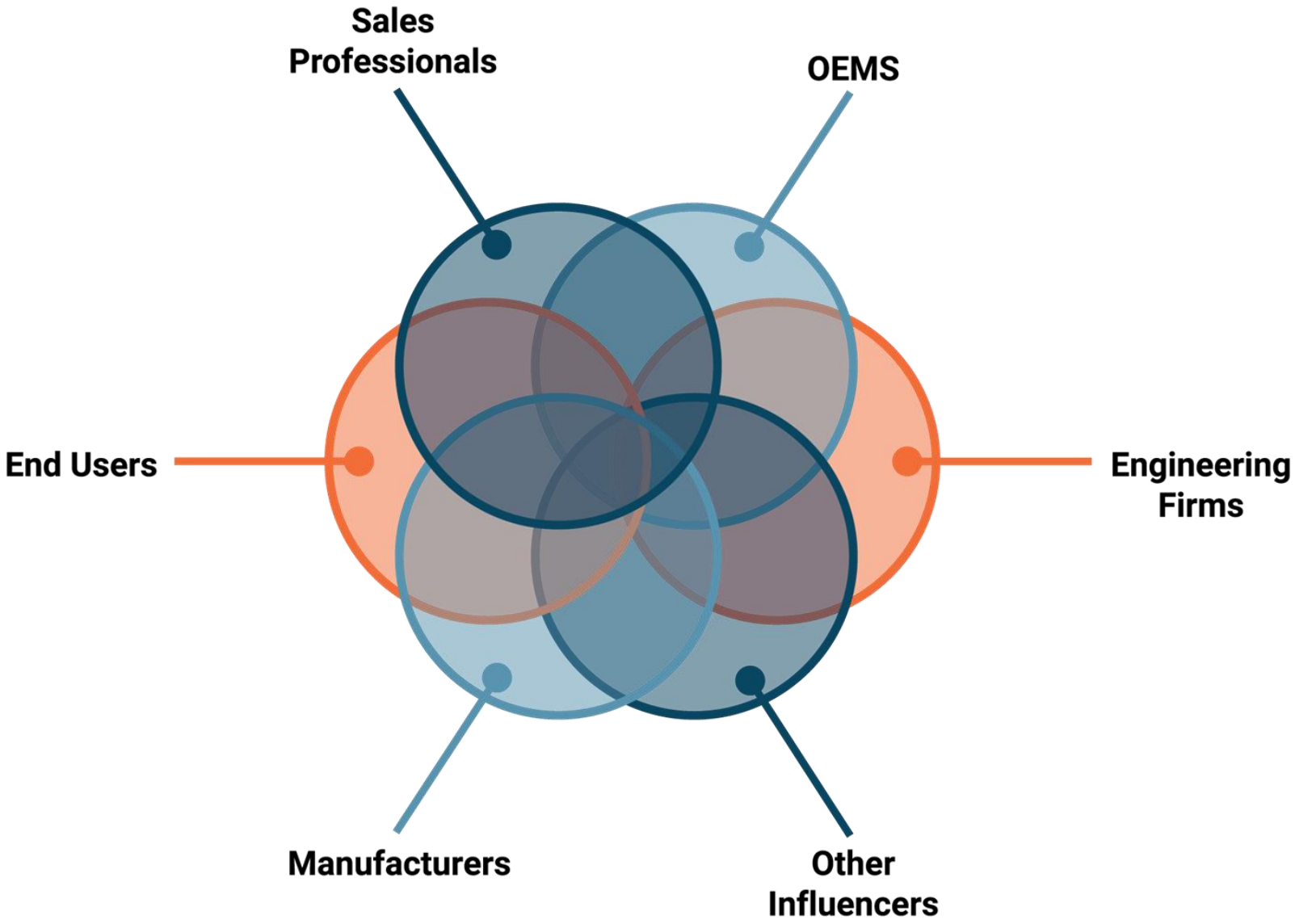

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See The Bigger Picture

- Energy consumption is only part of the picture
- Need to consider the whole life cycle
  - Extracted resources
  - Embodied energy
  - Energy consumption in operation
  - Consumables
  - Replacement parts
  - Lifespan
  - Disposal

The Problem with Oversizing

- Many systems are grossly oversized
- More metal mined, etc
- More transport fuel
- More consummables ($$)
- Larger repair parts ($$)
- Short cycling=>more wear
- Shorter compressor life

Manufacturers

- Employ green manufacturing practices
- Design equipment that is efficient
- Build it to last
- Reduce materials in consummables
- Educate customers, sales teams and influencers on system design

Sales/Service Partners

- Educate end users
- Use available data for system design
- Challenge inclinations to oversize
- Help them identify causes of waste
- Help them keep equipment running longer
- Know when to recommend replacement
- Use data from air energy studies and controls
- Look for heat recovery opportunities

End User Roles

- Eliminate inappropriate uses
- Reduce pressure/artificial demand
- Invest in periodic or full time data collection
- Measure and manage
- Commit to leak reduction
- Resist oversizing compressors
- Employ heat recovery

Engineers, OEMs and Influencers

- Resist oversizing compressors
- Promote use of controls
- Promote use of data collection
- Look for heat recovery opportunities

What Can We Do?

Supply Side

- Good system design *(sizing & controls)*
- Compressor selection *(e.g. CAGI datasheets)*
- Ongoing data collection
  - Supply audits
  - Live data from instruments
- Keep good machines running

Demand Side

- Operate at lower pressure
- Leak reduction
- Eliminate inappropriate uses
- Demand audits
- Heat recovery

The greenest energy is the energy you don't use

KAESER COMPRESSORS®

Built for a lifetime.

The Good News: We Can Make A Significant Impact

Comprehensive approach to energy also addresses oversizing

Let's get the numbers and do the math.

It's good for the bottom line

Thank you

Best Practices EXPO Contest

Play for a chance to win a **FREE Full Conference Pass** to the Best Practices 2023 EXPO & Conference!! This is a $675 value! This contest is open to factory personnel, compressed air distributors, utility incentive programs and engineering firms. Exhibiting and sponsor companies are not qualified. Winners will be randomly selected from those who submitted a correct answer and notified tomorrow via email.

Please submit your answer in the upcoming poll

What % of an air-cooled air compressor's heat can be recovered?

A	•14%
B	•74%
C	•95%

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*By entering you are giving permission to announce your name if you are a winner

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Greener Compressed Air Systems-Reducing the Environmental Impact

Q&A

Please submit any questions through the Question Window on your GoToWebinar interface, directing them to Compressed Air Best Practices Magazine. Our panelists will do their best to address your questions and will follow up with you on anything that goes unanswered during this session.

Thank you for attending!

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Thank you for attending!

The recording and slides of this webinar will be made available to attendees via email later today.

PDH Certificates will be e-mailed to Attendees within 2 days.

July 2023 Webinar

Design Considerations When Transitioning to Oil-Free Compressed Air Systems

Tim Dugan
Compression Engineering Corporation
Keynote Speaker

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