POLLUTION PREVENTION SERVICES

The Benefits of Compressed Air Audits & Lesser Known EEMs

Jeff Gorrie

- Iowa State Mechanical Engineering grad
- Background in Large Industrial and small commercial assessments
- Alum of the P2 intern program
- https://www.linkedin.com/in/jeff-gorrie/

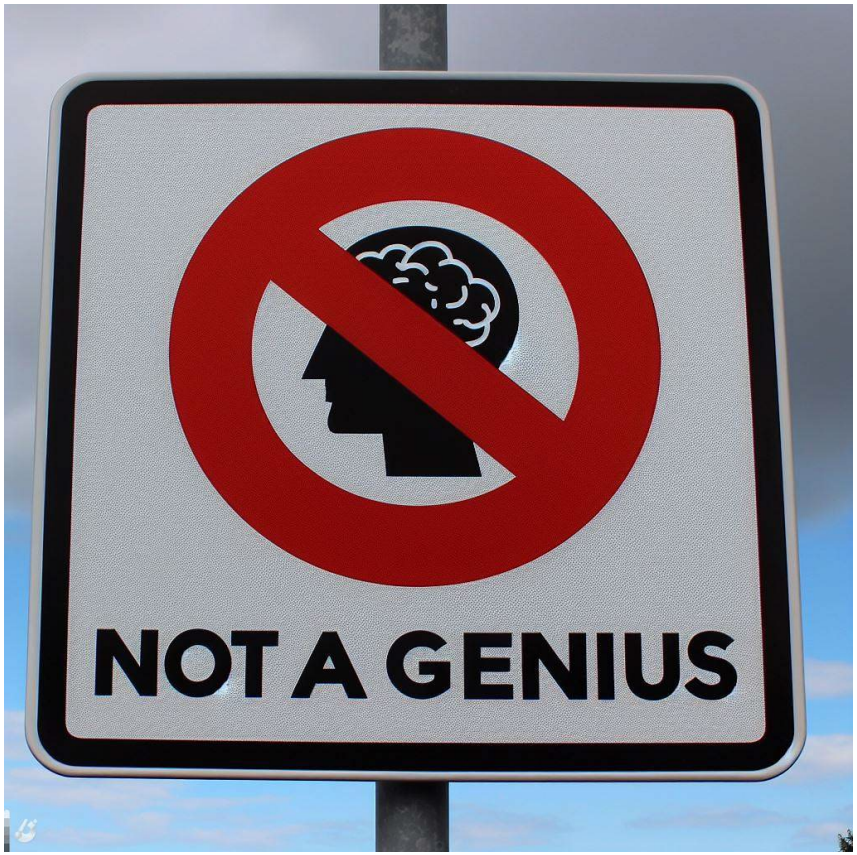
Outline

1. Why have a 3rd party look at my compressed air system?
2. Why is Leak Repair such a great EEM?
3. Data Logging for Diagnostics
4. Other Lesser known EEMs

Glossary of Terms

- EEM
  - Energy efficiency measure
  - AKA ECM
- CA
  - Compressed air
- CA Audit
  - A trained and qualified auditor looks at your system to see if there are opportunities to improve efficiency and save money
- CA Auditor
  - The person coming into your facility
- BO
  - Building operator/building owner/The Decision Maker
- SPB
  - Simple payback
  - $SPB = \frac{Project\ Cost}{Annual\ Energy\ Savings + Annual\ Maitenance\ Savings}$

"Why should I have a 3rd Party Come Into My Building?"



- Some caveats
  - We don't know more than you do about your system
  - It's very likely you know more about compressed air than the auditor
  - We're not trained in the operation and daily maintenance of CA systems
  - If there's something wrong with your system, we have "seen worse"
  - We're not OSHA!

"Why should I have a 3rd Party Come Into My Building?"

- The incredible power of a fresh set of eyes
  - No institutional knowledge
  - No familiarity with the building
  - Auditor measures everything
- Auditor has more experience with different types of systems & Potential EEMs
- Trained to focus on alternatives – not solely maintenance and maintaining uptimes
- Safety is the #1 focus

The CA Auditor's Approach

The 4th Utility

- Compressed Air (CA) is a form of stored energy, generated on site

- CA is an **EXPENSIVE** and **INEFFICIENT** form of energy
- Improving CA energy efficiency is often overlooked
  - Not as visible as lighting & other forms of energy waste
- CA is one of the largest consumers of energy within a typical industrial plant

Compressor Efficiency

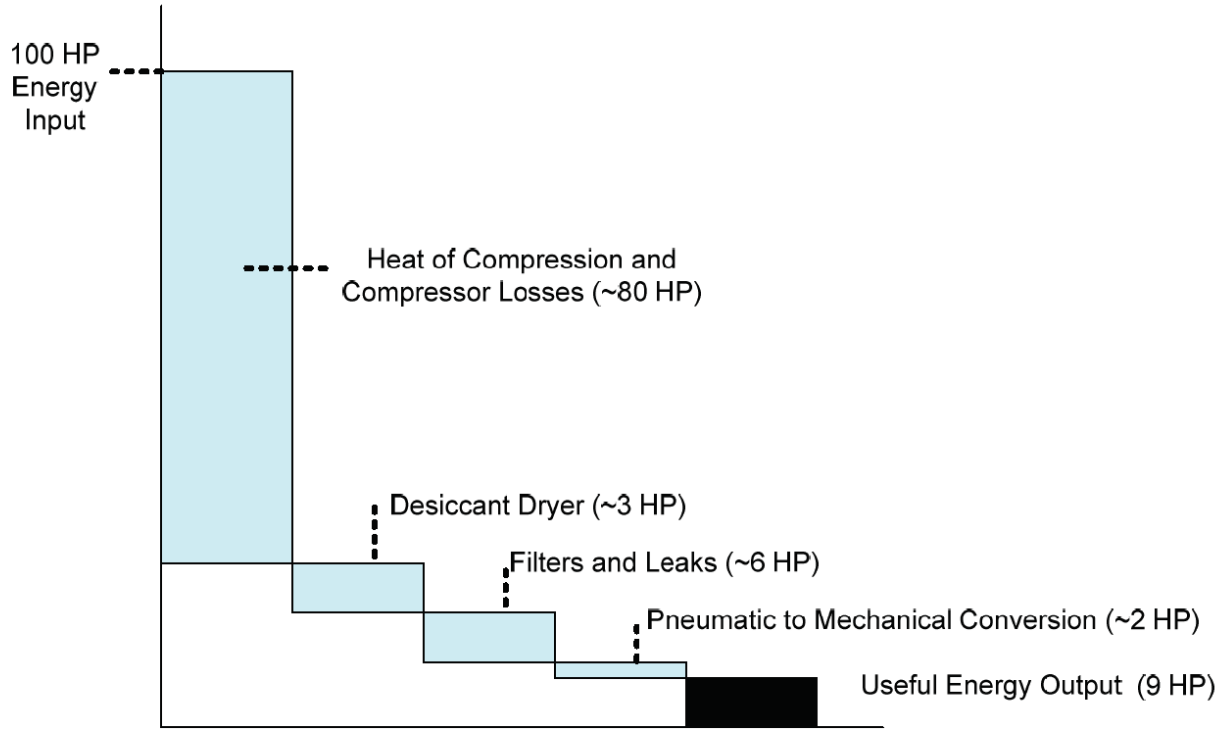
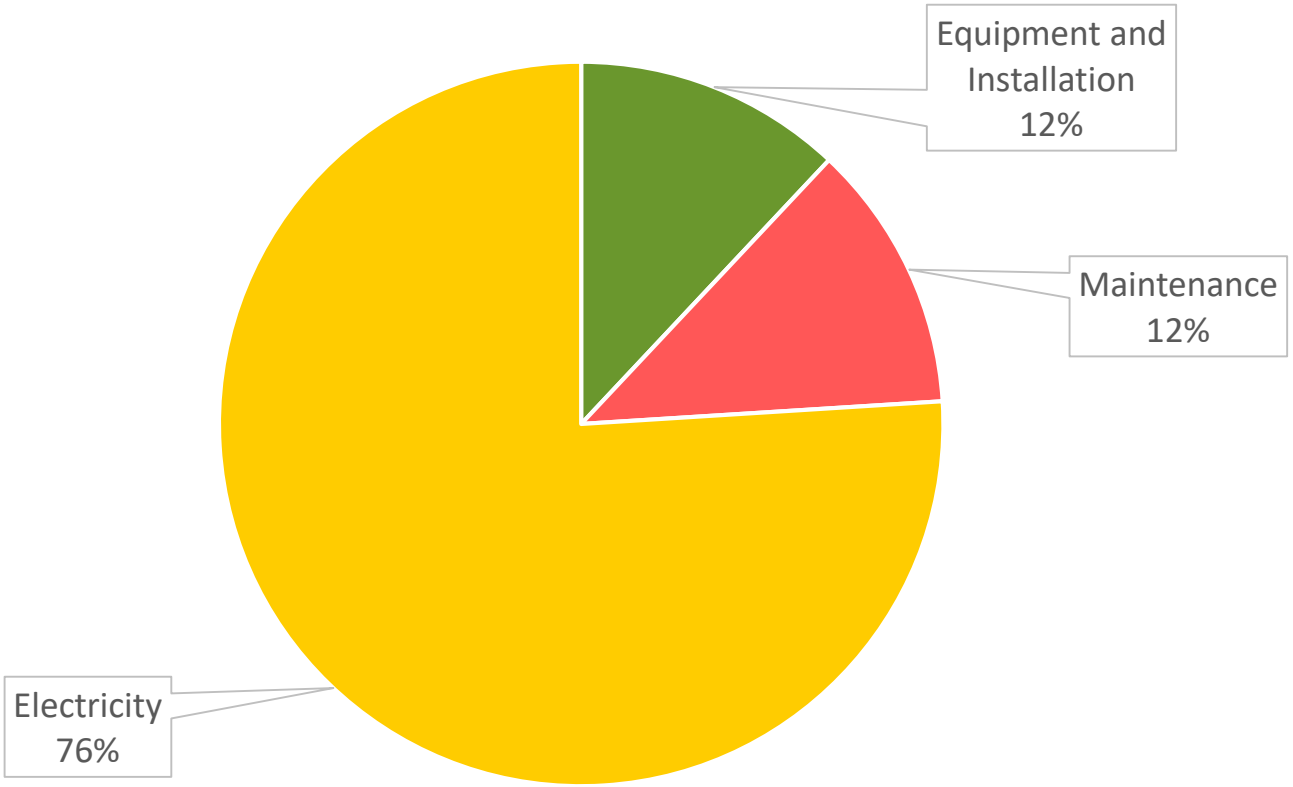


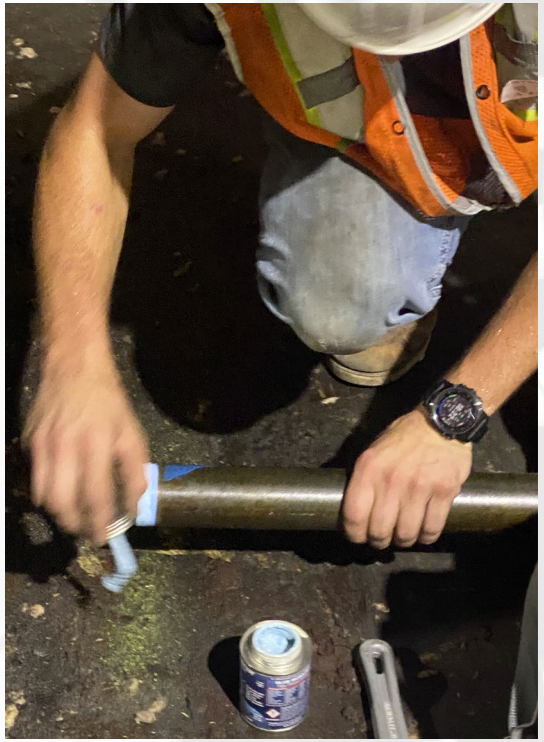
Figure 3 – Compressed Air Energy Input and Useful Energy Output (Adapted from Northwest Energy Alliance)

Lifecycle cost of a Compressor



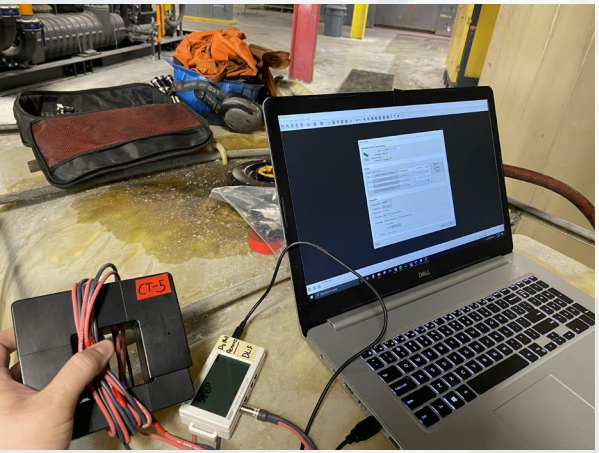
Why Is Leak Repair So Good?

- High savings
  - Typically EEM #1 due to low SPB
- Low project cost
- Most leaks can be repaired without large capital purchases
- Leaks happen regularly
  - Repeatable (every year)
- It's easy to implement



Why should I care about other EEMs?

- Longer SPB, but higher savings potential
- Other EEMs have bigger impacts on extending the service life of your equipment
- Sometimes other EEMs should be completed BEFORE leak repair



DATA LOGGING FOR DIAGNOSTICS

Data Logging for Diagnostics

- A good auditor can find multiple EEMs from just data logging
- More efficient than just observing compressor room
- Higher fidelity data
  - Data points can be recorded every second over a period of a week
- Actionable results, influential visual data

Data Logging for Diagnostics

- Can be used to find/diagnose:
  - Improper sequencing
  - Compressor cycling
  - Suboptimal controls and modulation
  - Faulty equipment
  - Demand side issues
  - Issues with runtimes

Data Logging Example: Improper Sequencing

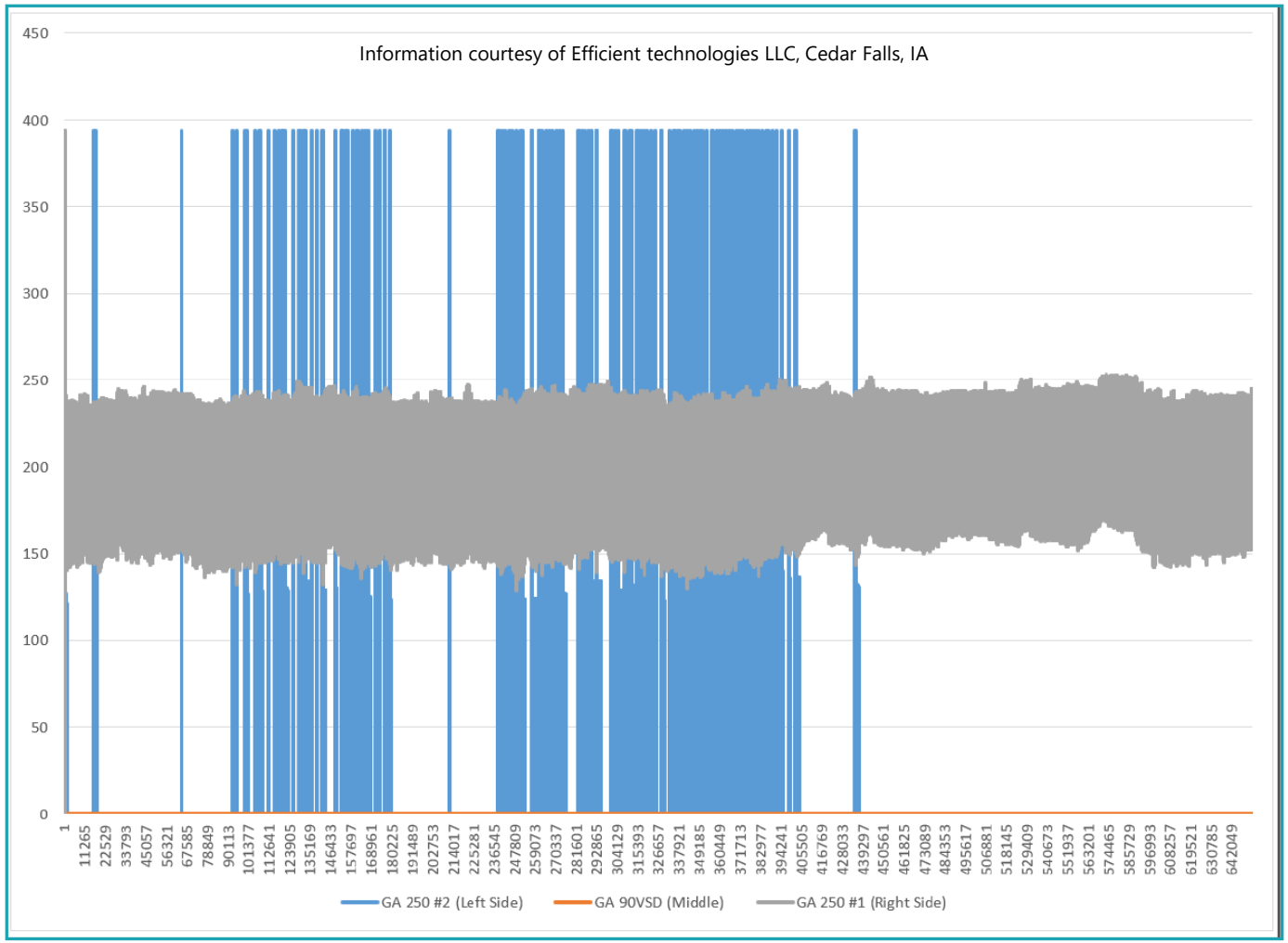


Figure 10 - Power Demand for Each Compressor for a Duration of 7.56 Days

Data Logging Example: Excessive Compressor Cycling

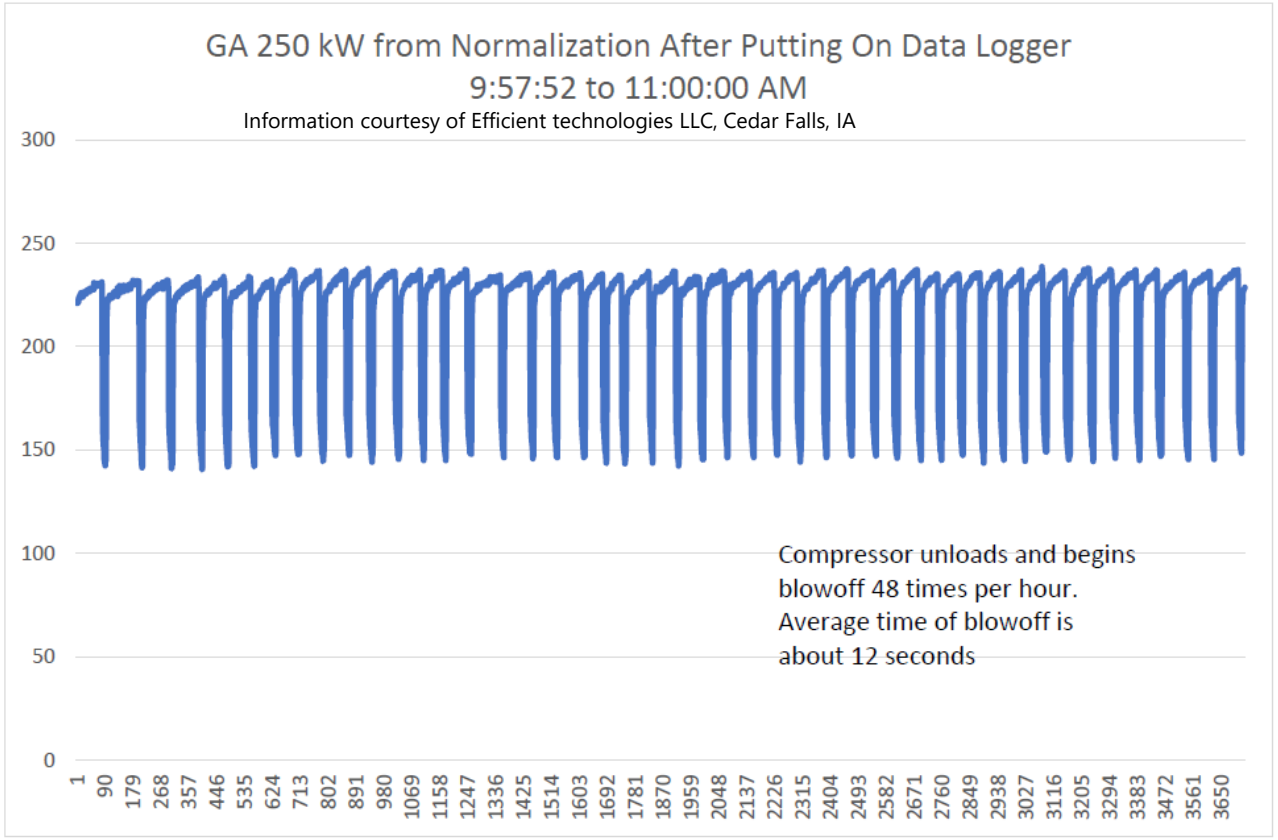


Figure 7 - Energy Consumption of GA 250 (right side) for a Period of One Hour

- This compressor is constantly cycling into blow-off mode
- This sort of power versus time curve for a compressor indicates that the CFM supply at 125 PSI (roughly 1,468.8 CFM, per CAGI datasheet) is *slightly* higher than the CFM demand in the plant.

Data Logging for Diagnostics

- Using data logging for diagnostics can:
  - Create actionable, and compelling insights
  - Extend equipment life
  - Cut down on maintenance cost
  - Help to put off recurring expensive replacements
  - Identify hard to detect issues


MU05GL
Panel AC-1
Micro controller
INGERSOLL-RAND
REMOTE ENABLED
TROUBLE INDICATION
PRELUBE PUMP RUNNING
CONTROL POWER OFF ON
EMERGENCY STOP

OTHER EEMs

Air Nozzles

- For applications where a blower system is not viable
- Where there is a need for high pressure, low volume, high force blowing
- Save money and energy by reducing cfm used

Zero loss condensate drains

- More efficient than simple open-shut drains
- No possible to leave it open and lose CA

Pressure Flow Controllers

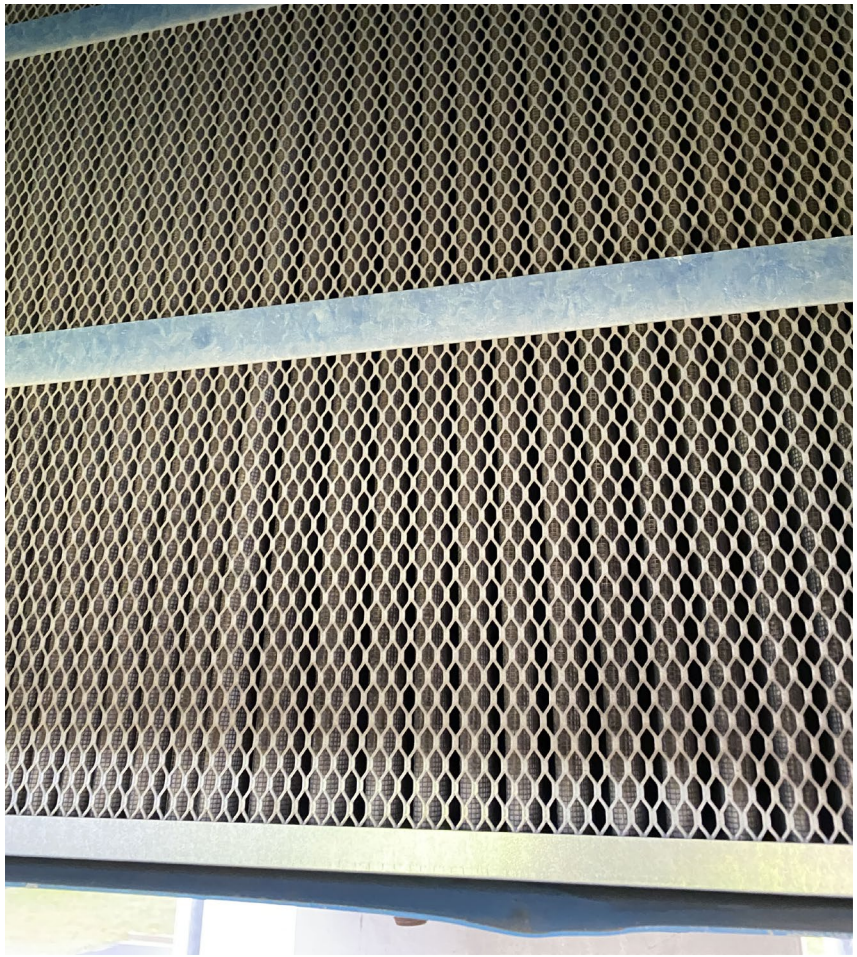
- In load/unload trimmed systems can save CFM and better regulate supply
- Can enable system pressure to be lowered

Flow Meters for Diagnostics

- Greater insight into system operation
- Fault detection
- Seeing them impacts of plant changes
- They now make non-destructive flow meters

Clean Dirty Filters

- Air intake filters must be cleaned regularly to maintain optimal performance
- Maximizes equipment expected useful life



Compressor Replacement

- Compressors should be replaced near the end of their service lives
- Compressors should be replaced if they're oversized
- Compressors should be replaced if there is a much more efficient compressor available
- An auditor can provide a business case for replacement

Lower Plant Pressure

- Many times, plant air pressure is higher than it needs to be
- Implemented in phases
- Care should be taken in deciding whether to implement before or after other EEMs

Right Sizing Storage

- Often plant operations expand and contract
  - Leading to increased or reduced demand, compressors, storage
- Often the CA storage on site isn't sufficient

CA storage tank that was plumbed out of the system

Inappropriate End Uses Of Compressed Air

- Improper uses:
  - Cleaning
  - Agitating/vibrating
  - Blowing
  - Drying
  - Cooling
  - Creating a vacuum
  - Atomizing
  - Cabinet cooling
  - Abandoned equipment

- There is always a cheaper way to do these tasks
- May not always be a viable alternative

Improper CA End Use Example

Improper CA End Use Example

Figure 9 - Compressed Air Use at Bottom of WBW Ground Floor Conveyors

The Unbelievable Stuff

- Things that just are the way they are because it's the way it's always been
- Isn't shocking if you see it everyday
  - The incredible value of a fresh set of eyes
- Convenience is often the enemy of energy efficiency

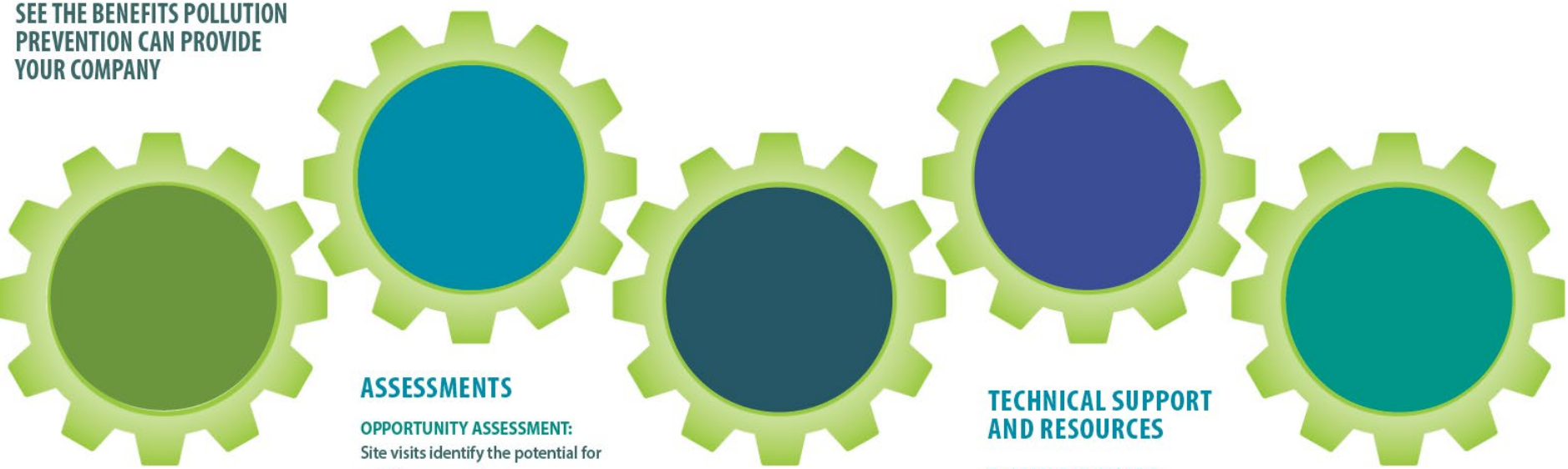
A CA blower hose with no shut off, running 24/7. A $10 valve was added for $1,073 in annual savings.

The Abridged List of Other EEMs

- Implementing VFD/VSD Compressors
- Implement smart compressor sequencing controls
- Overhaul of compressor sequencing/control strategy
- Waste heat recovery
- Outdoor air intake
- Air dryer optimization/replacement
- Ensure FRL assemblies are full of lubricant
- Avoid operation of air tools without a load
- Shut off equipment at idle times
- Attend CAGI training
  - Compressed Air and Gas Institute
- Emphasize CA maintenance
  - Implementing maintenance plans
- Phase out abandoned equipment
- Low pressure drop filters
- Replacing pneumatic motors with electric motors

P2 Service Offerings from Iowa DNR

SEE THE BENEFITS POLLUTION PREVENTION CAN PROVIDE YOUR COMPANY



WORKSHOPS

Our workshops and webinars facilitate the sharing of best management practices and new technologies, focusing on topics like water conservation, energy efficiency, and waste management. They provide critical insights to lower costs and reduce environmental footprints.

ASSESSMENTS

OPPORTUNITY ASSESSMENT:
Site visits identify the potential for pollution prevention.

FOCUSED ASSESSMENT:
In-depth analysis of a single process or media within a facility.

THERMOGRAPHIC ASSESSMENT:
Infrared cameras spot inefficiencies in structures and systems.

Our team provides a detailed report on waste reduction and pollution prevention strategies, support for implementation, and help in applying for EPA recognition programs. Areas of focus include energy efficiency, waste reduction, and water conservation.

ENVIRONMENTAL MANAGEMENT SYSTEM (EMS) SUPPORT

An EMS offers a structured way to manage environmental responsibilities. Our confidential technical assistance helps with EMS development and continuous improvement.

TECHNICAL SUPPORT AND RESOURCES

P2 RESOURCE LIBRARY:
Access a digital library of best practices and new technologies.

TECHNICAL ASSISTANCE:
Get answers to your queries in-person, over the phone, or by email.

EQUIPMENT LOAN PROGRAM:
Monitoring equipment is available to support your initiatives.

P2 UNIVERSITY:
Our online training portal provides interactive technical modules on various topics.

P2 INTERN PROGRAM

We hire engineering students to conduct assessments and research solutions. They establish usage baselines and quantify benefits of system improvements. Our intern program has facilitated more than $100 million in savings for companies looking to meet environmental goals while providing valuable experience for students.

Questions?

- You are welcome to contact me after this presentation!
  - Jeff Gorrie, CEM
  - jeff.gorrie@gmail.com
  - 309-678-5579
  - https://www.linkedin.com/in/jeff-gorrie/