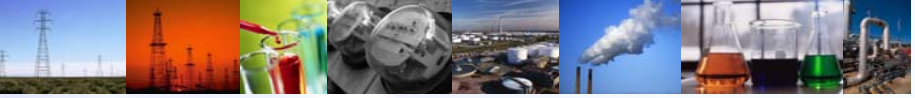
Compressed Air Systems

Where to Start



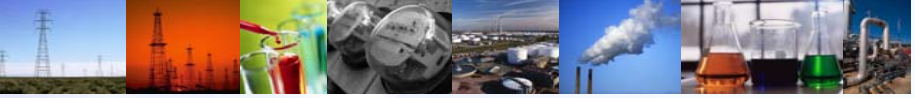
Why make a change?

- Important industrial energy source
- Inherently inefficient
- Consumes up to 20% of industrial electrical usage

Great energy & cost savings potential!

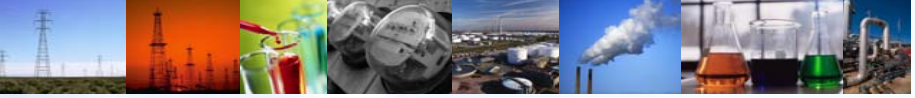
$$$

- **Save energy (25% or more)**
- **Reduce downtime**
- **Produce clean, dry air**
- **Eliminate maintenance crises**



Compressed Air System

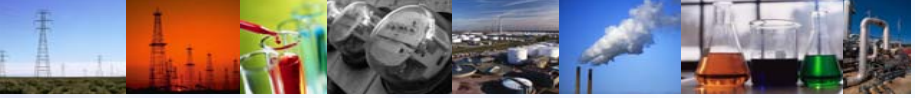
- Supply
  - Compressor
  - System Controls
  - Air Dryer
  - Aftercoolers
  - Air Filters
  - Primary Storage
  - Flow controls
- Distribution
  - Air piping
  - Filters, lubricators, regulators
- End Uses
  - Pneumatic tools
  - Mechanical drive
  - Blowers
  - Vacuum generators
  - Etc . . .



Benchmarking

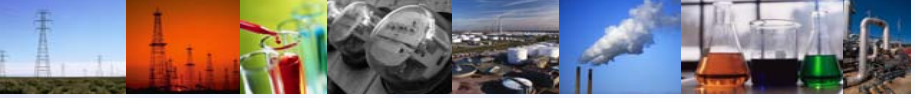
- Determine average power draw (kW)
- Determine total energy costs
- Determine marginal generation efficiency (kW/scfm)
  - Calculate energy savings potential for system improvements

- Worksheet “Estimate Your Compressed Air Cost”



Common problem areas

- Air Leaks
- No heat recovery
- High pressure drop
- Insufficient air storage
- Ineffective control strategy
- Multiple compressor operation not optimized
  - Base load vs. trim compressor
- Inappropriate end uses
- Poor record keeping
  - Electric usage
  - Air production



Air leaks

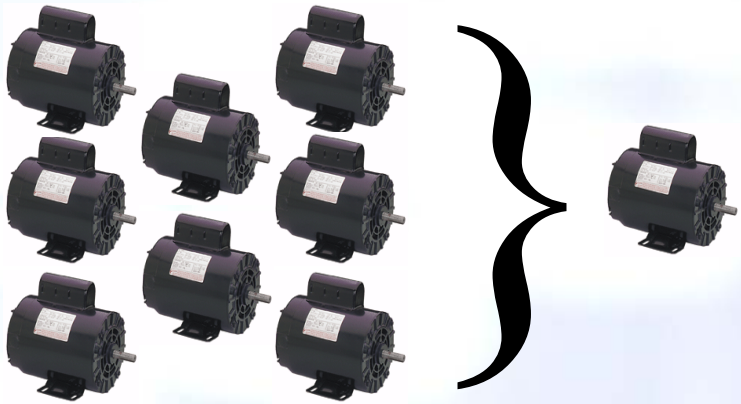
- When was your last leak survey?

  Leak surveys should be conducted quarterly!

- Poorly maintained systems
  - Up to 40% leak rate
  - Pressure problems
  - “We need to install another compressor.”

Heat recovery

8 compressor horsepower yields 1 horsepower of compressed air . . .

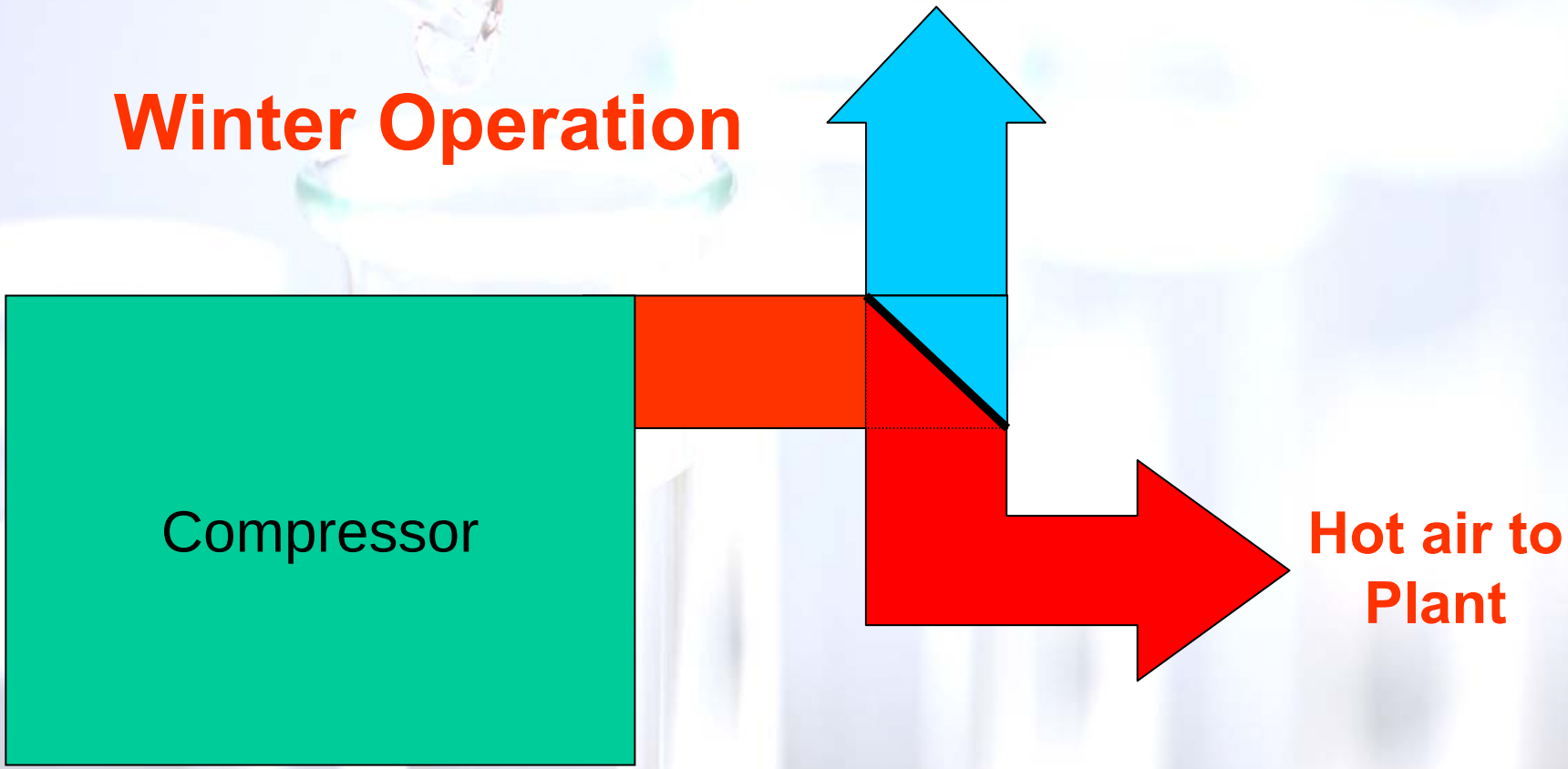


Where does the other ***7 horsepower*** go????

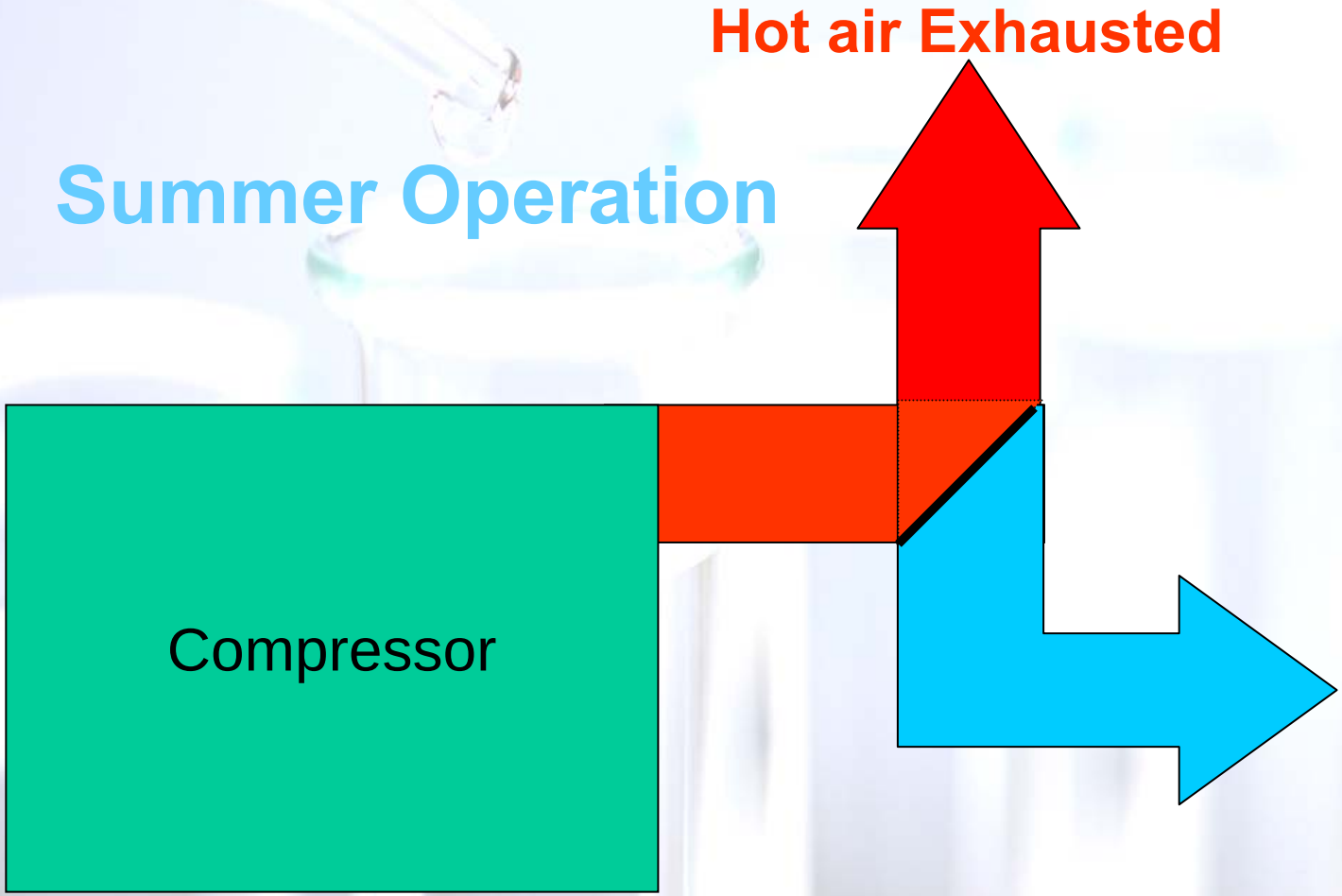
HEAT.

Heat recovery

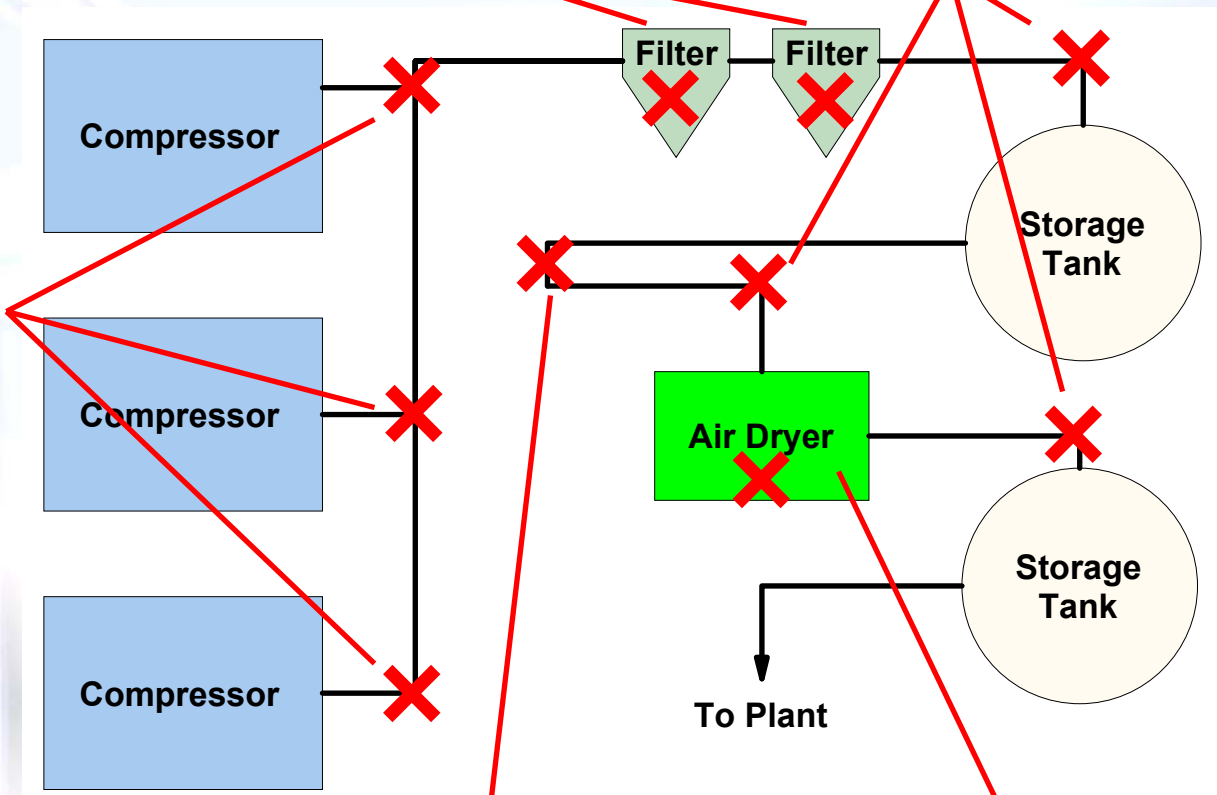
Winter Operation

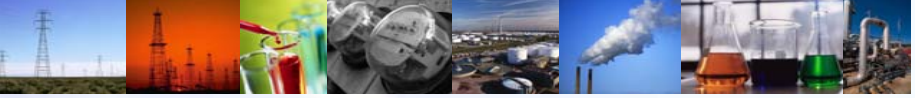


Heat recovery



Pressure drop – compressor room

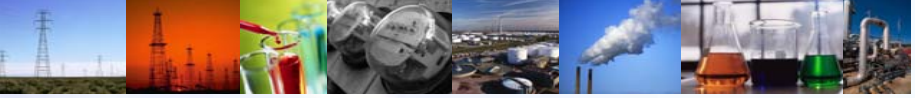




Pressure drop (continued)

- Distribution
- Worksheet “Calculating the Cost of High Pressure Drop”

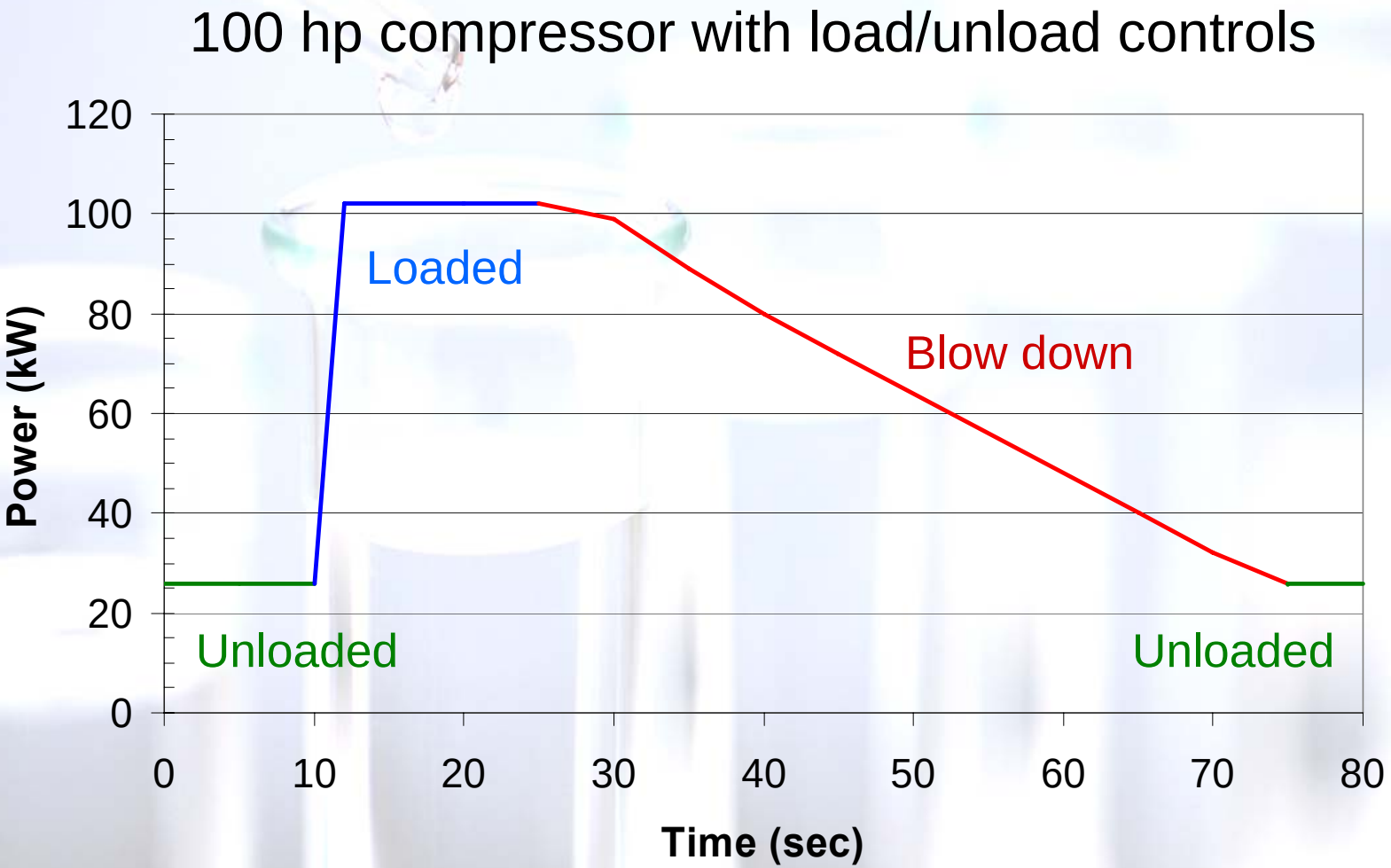
GOAL: ***0 – 4 psig*** pressure drop in compressor room



Air storage

- Rule of Thumb – *4 gallons of storage per compressor cfm*
- Remote storage for high periodic demands
- Wet vs. dry storage
- Piping rule
  - In at the bottom – Out at the top!

Air Storage – Compressor Loading



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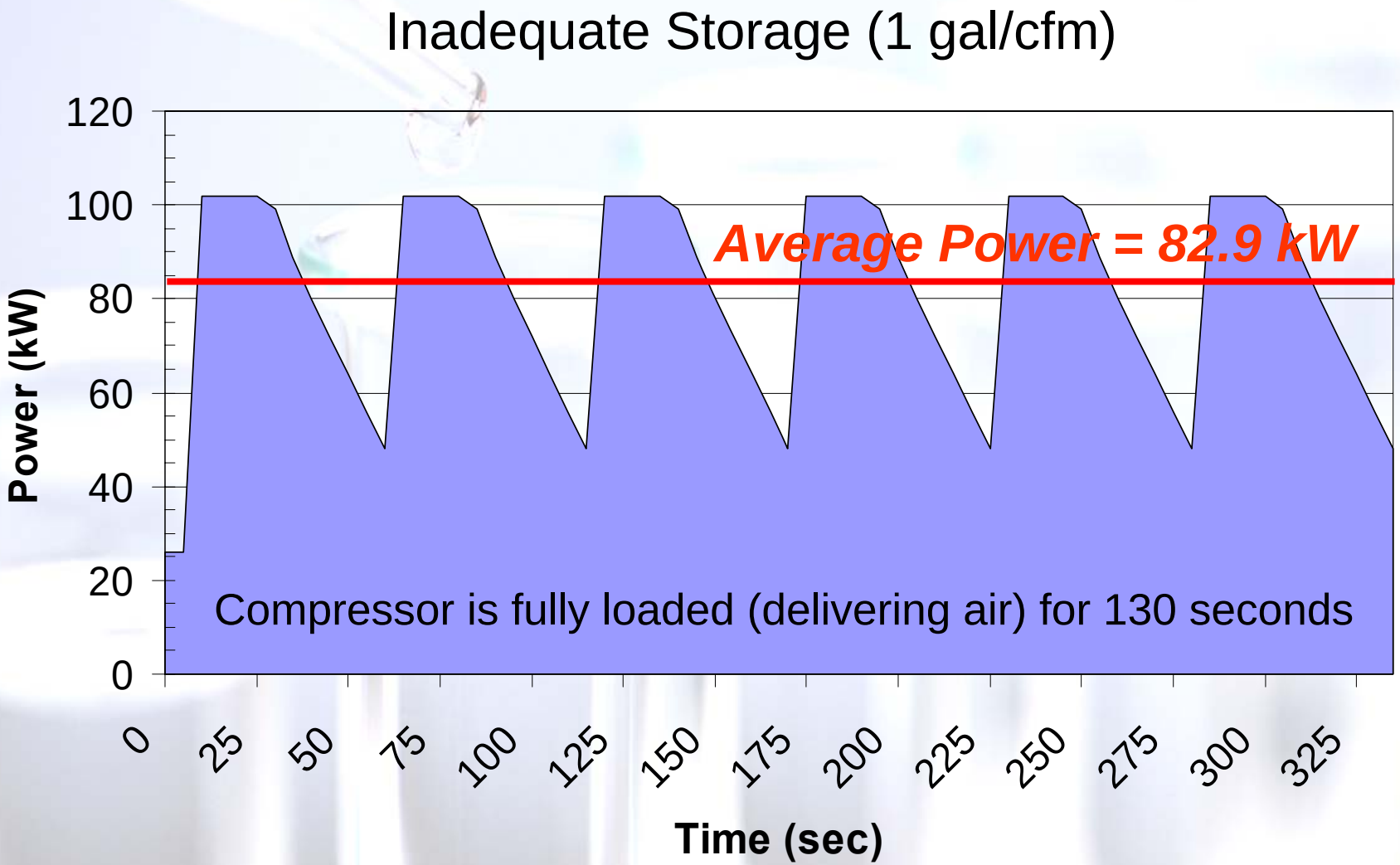

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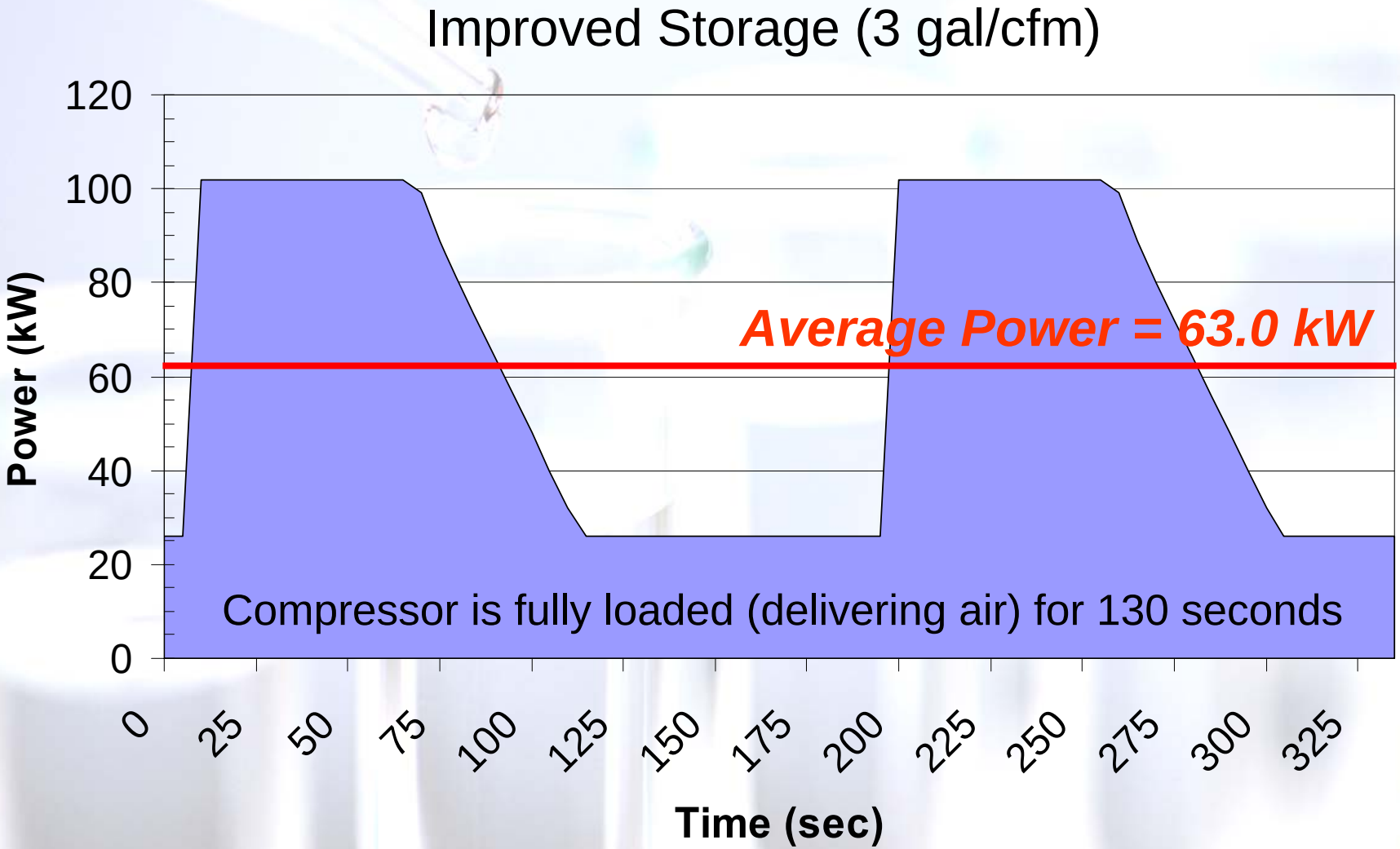
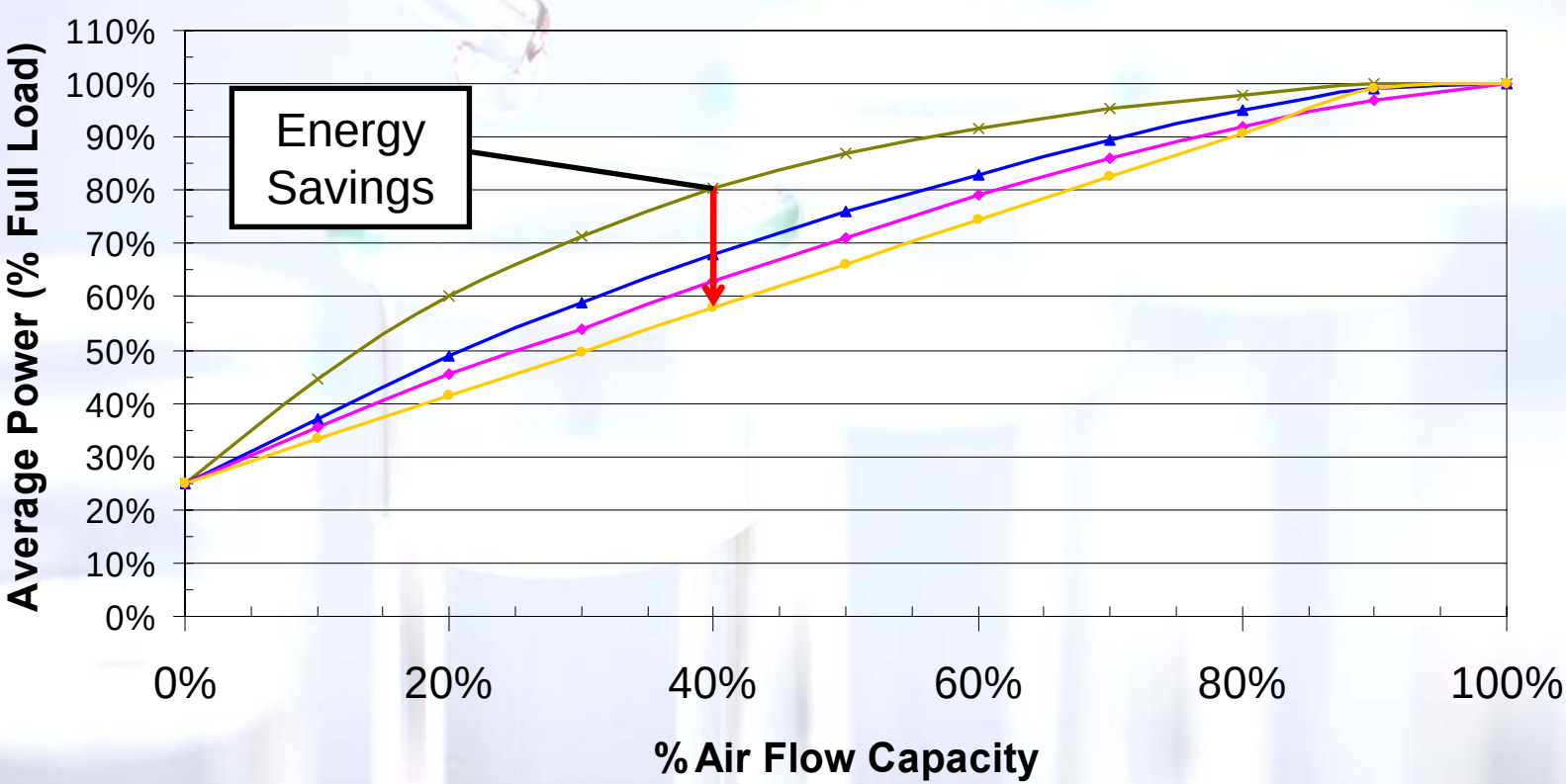


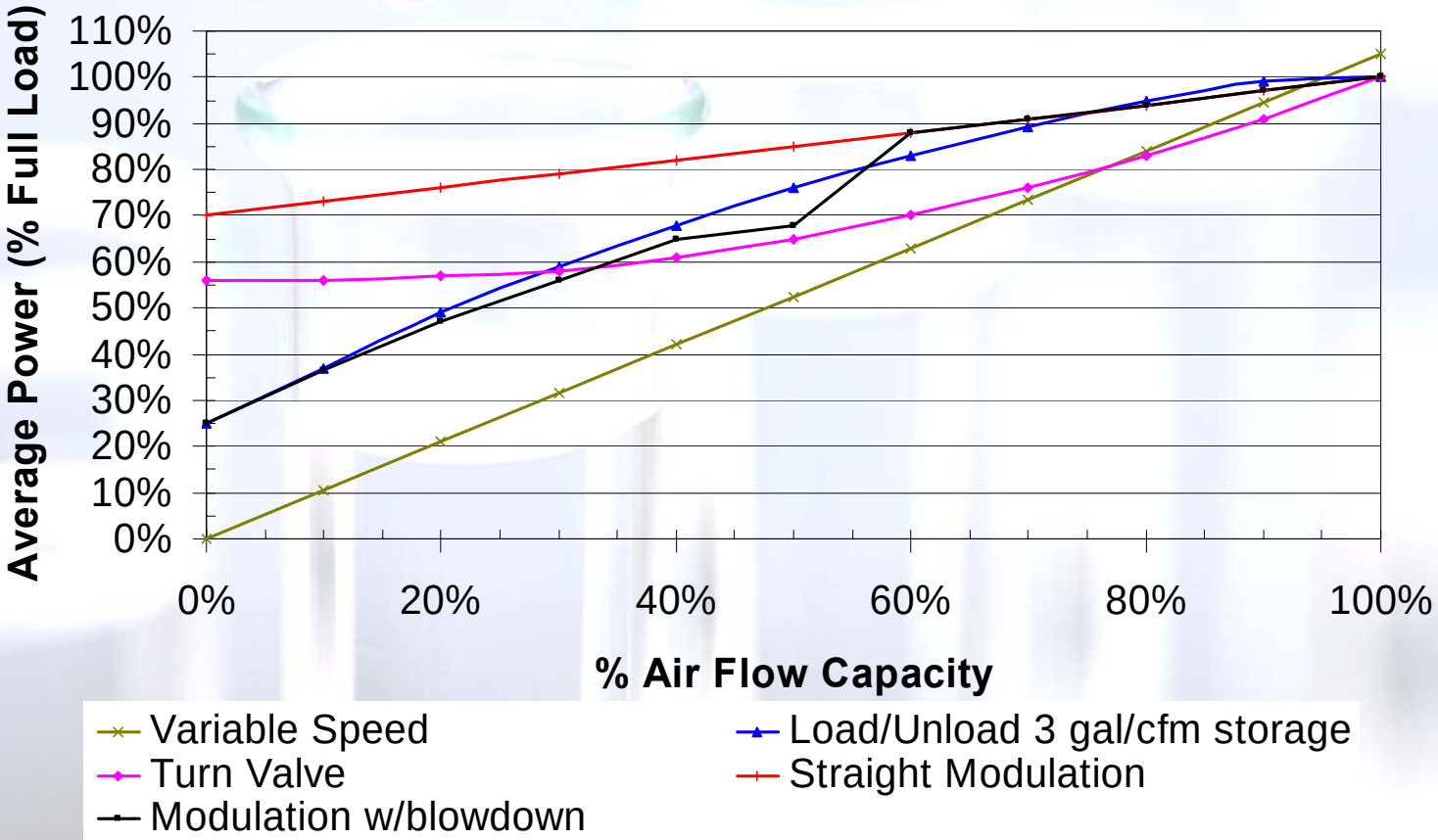
Air Storage

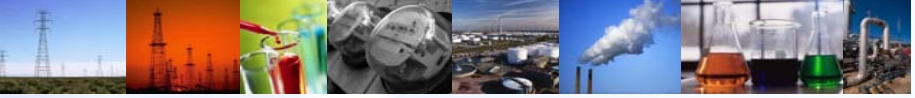
Generalized energy savings for increased storage in load/unload compressors



Compressor controls

- Control strategies impact compressor energy consumption

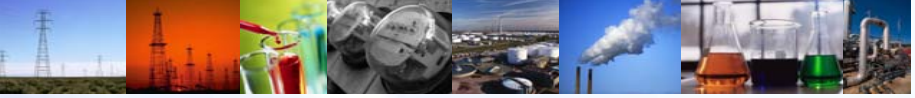




Inappropriate End Uses

- Open blowing - Cooling, drying, clean-up
- Sparging - Aerating, agitating, oxygenating, percolating
- Aspirating - Inducing flow in another gas (*e.g.*, flue gases)
- Atomizing - Dispersing or delivering a liquid to a process as an aerosol
- Dilute phase transport - Transporting solids such as powders
- Dense phase transport - Transporting solids in batches

continued…



Inappropriate End Uses

- Vacuum generation - used with a venturi to generate negative pressure mass flow
- Personnel cooling
- Open blowguns or lances
- Diaphragm pumps
- Cabinet cooling

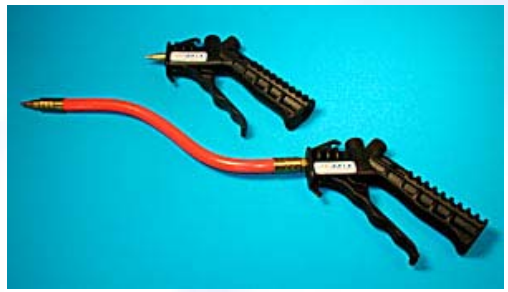
Zero Loss Drains

- Timer drains either:
  - Waste air
  - Fail to remove all liquid

- Zero loss drains remove liquid with no air loss

Air Amplifiers

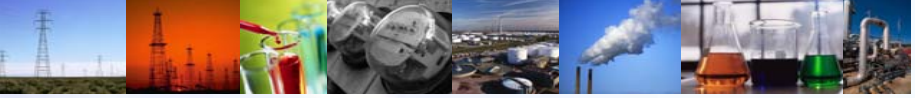
- Amplifiers entrain still air to increase air flow from blowing components
- Advantages
  - Increase blowing force
  - Significantly reduced compressed air usage
  - Reduced noise
  - Fully adjustable
- Applications
  - Air curtains/knives
  - Hand blow guns
  - Blow off manifolds



Source: ARTX

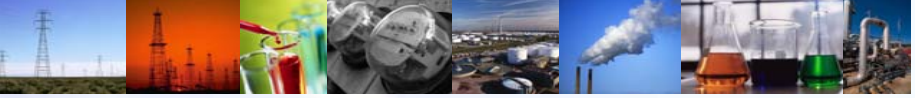
Electric Solenoid Valves

- Reduce leaks in piping to equipment that is shut off
- Timer control
- Machine panel control
- Manual control



Steps to Evaluate Your System

- Determine the cost of your air
- Check for air leaks
- Replace all dirty filters with high efficiency filters
- Set efficient control strategies
  - Base loaded compressors – modulating control
  - Trim compressors – Load/unload control
- Pressure issues
  - Check that all end use pressures are regulated
  - Check for excessive generation pressure (<10 psi drop between compressor and highest end user)
- Address inappropriate end uses
- Check for adequate storage (>3 gal/cfm)
- Shut down idle compressors
- Check for moisture in storage tanks and drip legs



Assessment Resources

- Energy Resources Center @ UIC www.erc.uic.edu - can provide expertise in industrial steam systems, also will perform energy assessments for industrial clients.
- Industrial Assessment Centers http://www.oit.doe.gov/iac/ - will provide energy assessments (including steam systems) free of charge to qualified industrial clients.
- US DOE AirMaster Program - provides a wide range of technical assistance materials, tools, and services to the industrial market.
- Rutgers IAC “Self Assessment Guide” http://iac.rutgers.edu/manuals/selfassessment.pdf - guide to assessing industrial plants for energy efficiency.

UIC ERC Energy Resources Center

Industrial Assessment Center University of Illinois at Chicago