Low and No-cost Compressed Air Fixes for a More Efficient System

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ZORN
COMPRESSOR & EQUIPMENT

Let’s Start in the Compressor Room

Understand how compressors work and where energy goes

- Up to 94% of compressor energy becomes heat
- Only ~6% is used for compression
- Opportunity: Recover heat for process or facility
- Focus on compressor type, control, and layout

Compressor Inlet Piping Matters

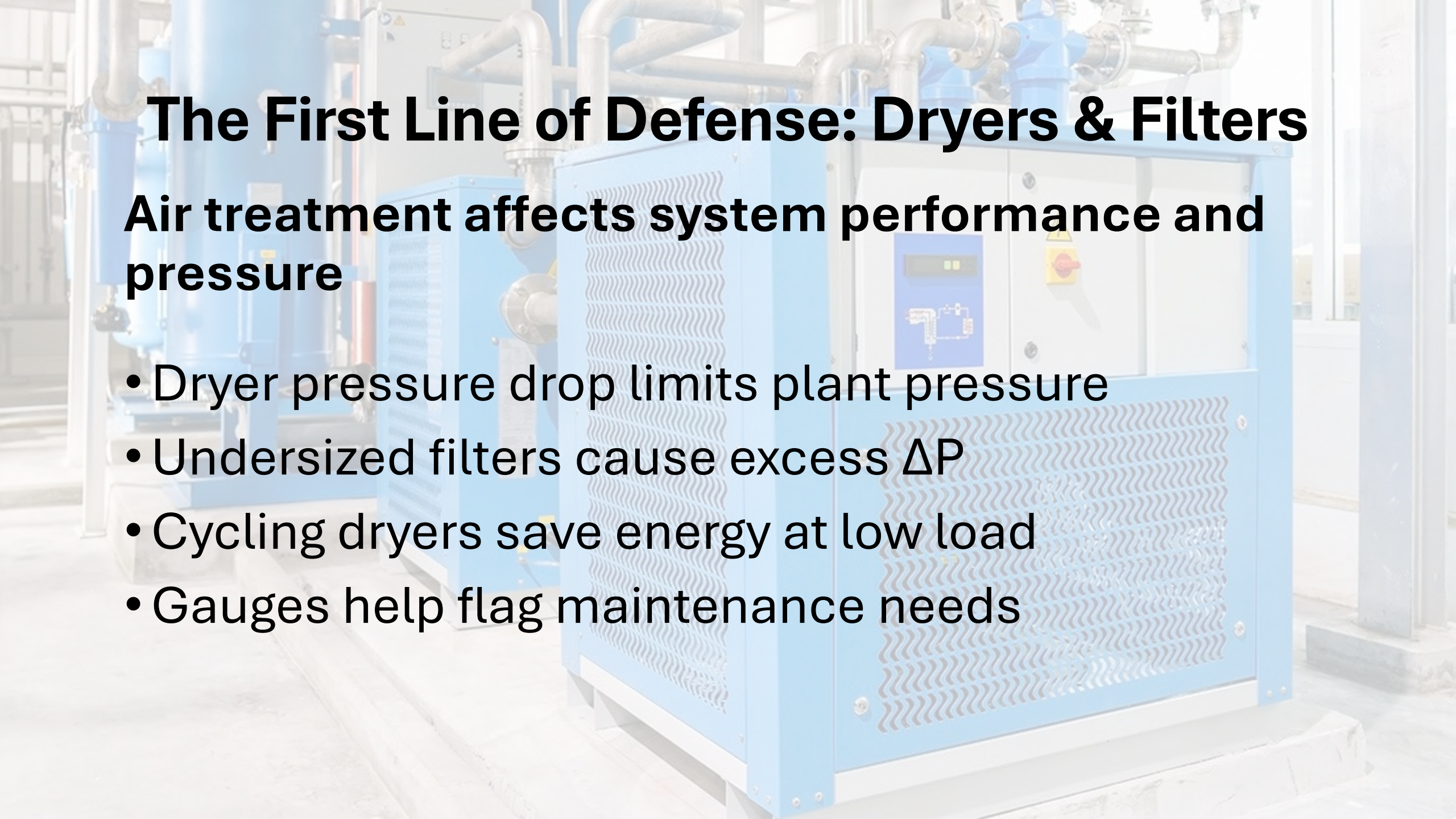
Poor inlet piping reduces compressor efficiency

- Undersized or restricted inlet pipe = low inlet pressure
- 1" Hg drop = 4% more power needed
- Use smooth, short, straight inlet piping
- Install inlet vacuum gauge to confirm losses

Fix Header Layout Restrictions

Clean up piping to reduce back pressure and compressor load

- Avoid 'crossing tees' and sharp-angle connections
- High back pressure causes wasted compressor power
- Directional Y entries and large-radius bends improve flow



The First Line of Defense: Dryers & Filters

Air treatment affects system performance and pressure

- Dryer pressure drop limits plant pressure
- Undersized filters cause excess ΔP
- Cycling dryers save energy at low load
- Gauges help flag maintenance needs

Point-of-Use Desiccant Dryers

Localized drying minimizes system-wide purge losses

- Central desiccant dryers waste air in purge cycles
- Small dryers at sensitive points reduce total loss
- Right-sizing saves energy without systemwide impact

Cycling Refrigerated Air Dryers

Match dryer energy use to demand

- Non-cycling dryers run full-power 24/7
- Cycling models ramp energy to match flow
- Great for variable-load applications

Lowering System Pressure Reduces Energy

Every PSI counts in energy and leak savings

- Lower pressure reduces compressor energy demand
- Leak rate tied directly to pressure
- Reducing pressure by 10 PSI can save 5% in energy
- Match lowest necessary pressure for demand

Receiver Tanks as Pressure Buffers

Storage helps stabilize pressure and reduce compressor cycling

- Receivers absorb short bursts in demand
- Stabilize pressure drops across delay or system
- Enable trim compressor shutdown
- Size tanks based on system dynamics

Leak Reduction Without Repairs

Strategically reduce leak impact without fixing holes

- Lower system pressure reduces leak rate
- Isolate idle zones to reduce leak exposure
- Timed valves and solenoids can auto-isolate areas
- Savings without a wrench

Leak Detection with Repairs

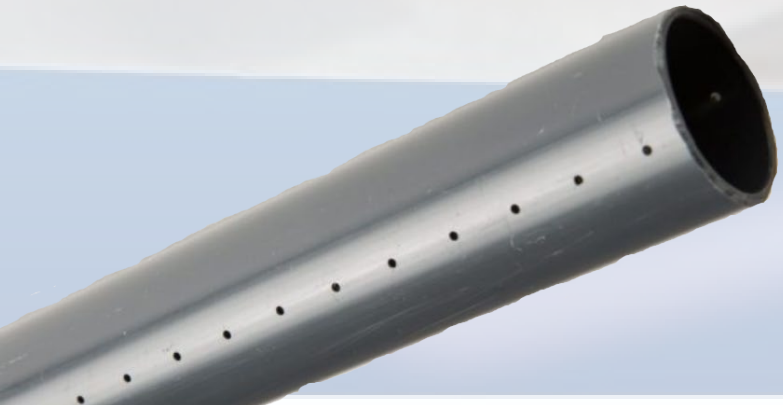
Fixing leaks pays back faster than most energy projects

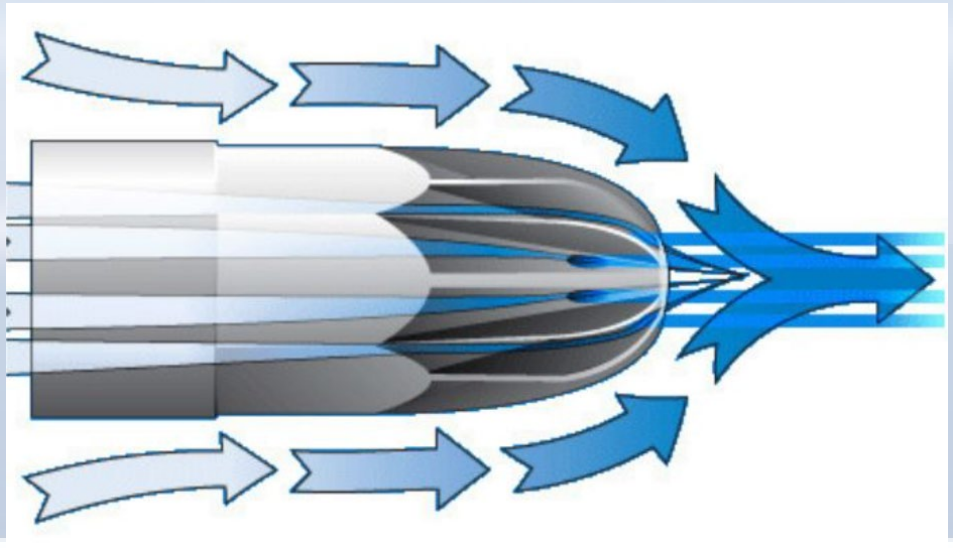
- Leaks can account for 20–30% of air demand
- Detection via ultrasonic, soap bubble, or visual sensors
- Typical ROI for repairs is under 6 months
- Fixing ¼-inch leak at 100 PSI saves ~$2,500/year

Nozzles vs. Open Blowing

Replacing open blow-off with engineered nozzles saves energy

- Open blowing = high, uncontrolled air loss
- Engineered nozzles reduce flow and maintain effectiveness
- OSHA compliance often improves with nozzle use
- ROI can be achieved in weeks





Pressure Regulation at the Point of Use

Reduce consumption by regulating pressure only where needed

- Not all tools need full system pressure
- Regulators downstream of filter/dryer save energy
- Prevents over-driving tools and components

Best Practices for Air Gun Usage

Control compressed air at the user level

- Use OSHA-compliant nozzles to limit pressure
- Train staff to shut off guns when not in use
- Add triggers, timers, or foot pedals to reduce runtime
- Swap out for vacuum or mechanical tools where possible

Blow-Off Alternatives

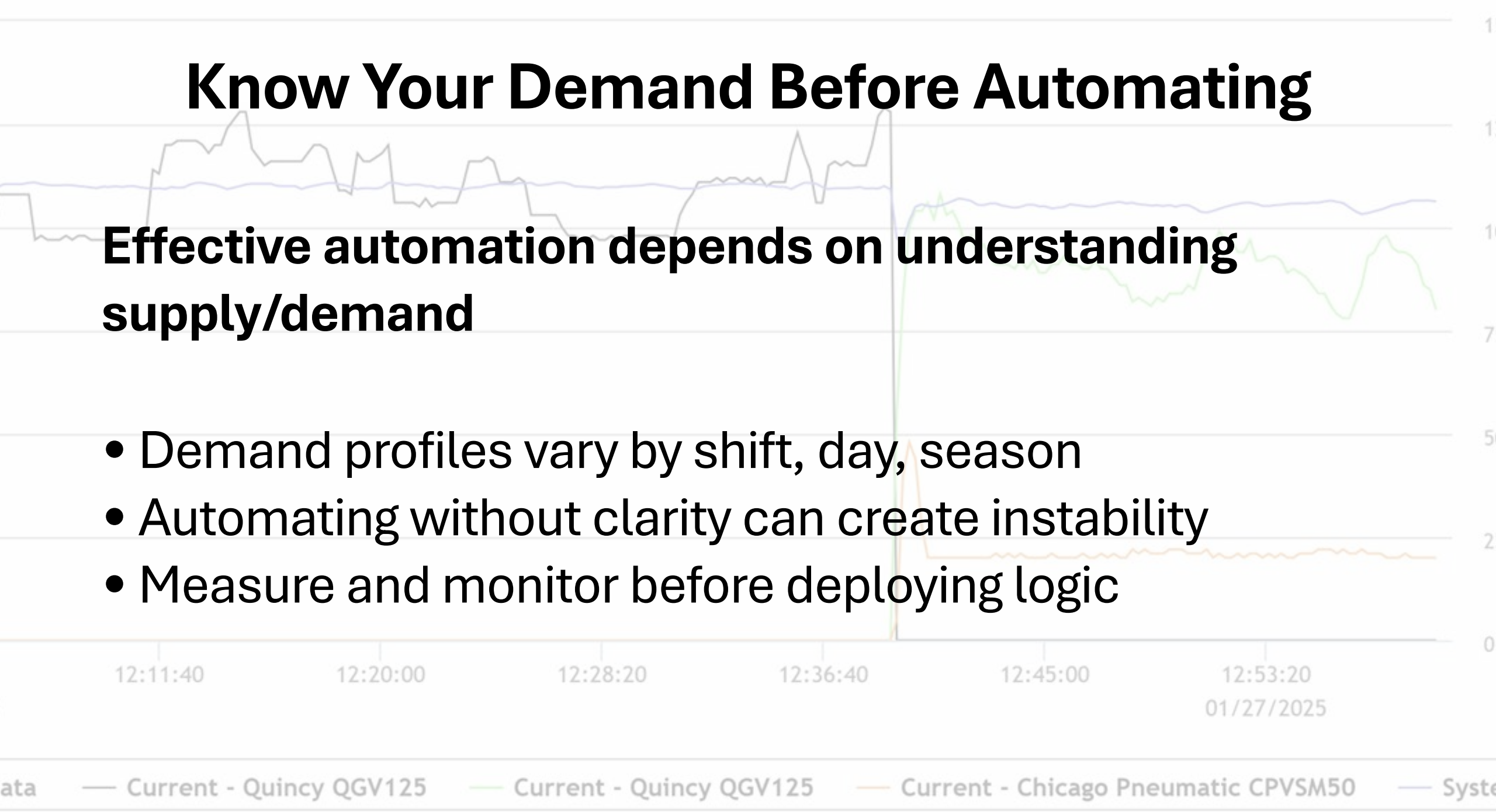
Replace open air blow-offs with targeted solutions

- Air knives or curtains optimize flow across wide areas
- Vacuum-based systems reduce blow-off demand
- Brushes, rollers, or mechanical scrapers can replace air
- Evaluate each application: don’t assume air is best

Know Your Demand Before Automating

Effective automation depends on understanding supply/demand

- Demand profiles vary by shift, day, season
- Automating without clarity can create instability
- Measure and monitor before deploying logic



Automated Isolation of Idle Zones

Use timed or demand-based valves to reduce idle air usage

- Solenoid or timed shutoff valves for breaks, weekends
- Reduces system volume exposed to leaks
- Maintains uptime while cutting waste

System Pressure Band Control

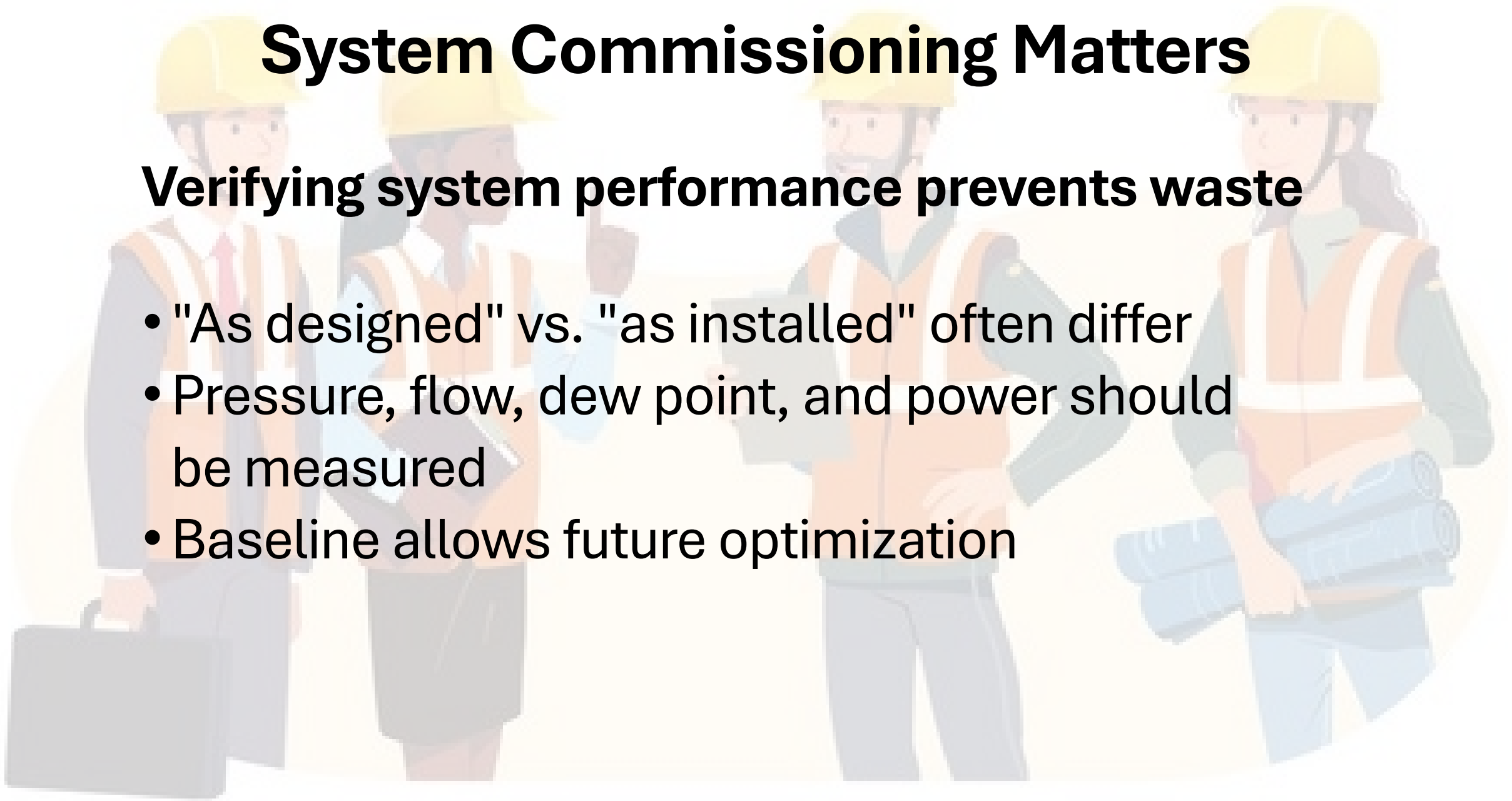
Match compressor staging to system demand

- Prioritize base-load machines with best efficiency
- Use trim compressors for fine-tuning system pressure
- Automate for shift-based or seasonal demand changes
- Use cascade or VFD logic to smooth pressure control
- Avoid "short cycling" and unnecessary starts

System Commissioning Matters

Verifying system performance prevents waste

- "As designed" vs. "as installed" often differ
- Pressure, flow, dew point, and power should be measured
- Baseline allows future optimization



Use Data Logging to Find Hidden Losses

Logging flow, pressure, and power reveals patterns

- Detect pressure drops, wasteful cycles, off-hours use
- Data informs targeted improvement
- Enables smarter controls and maintenance

Remote Monitoring Dashboards & Alerts

Use real-time visibility to catch problems early

- Web dashboards show flow, pressure, dew point, and power
- Set alarms for high dew point, filter ΔP, or rapid cycling
- Track daily trends, uptime, and peak usage
- Enables proactive maintenance and faster response

Optimize Pneumatic Tubing Layout

Shorter tubing saves air and speeds actuation

- Shorter tubing = less air per stroke
- Improves responsiveness, reduces purge loss
- Layout changes = big savings in automated tools

Reduce Internal Blow-Off in OEM Machinery

Customize machine blow-off timing or sequence

- Delay blow-off until part is clear
- Use proximity sensors or timers
- Switch from always-on to intelligent control

Match Air Cylinders to Load

Right-sizing actuators saves air

- Oversized cylinders waste air on every stroke
- Lower pressure needs smaller volume
- Review all high-cycle applications

Pressure vs. Flow Misunderstandings

High pressure doesn’t equal high flow

- Flow is volume over time; pressure is force
- Many systems raise pressure to “fix” flow problems
- Often masks layout or restriction issues

Don't Assume Demand Reduction = Energy Savings

Control scheme determines energy savings

- Fixed-speed compressors may not respond
- VFDs must be properly programmed
- Must link demand and supply behavior

Thank you