The Magazine for QUALITY & RELIABILITY in ENERGY-EFFICIENT Compressed Air Systems

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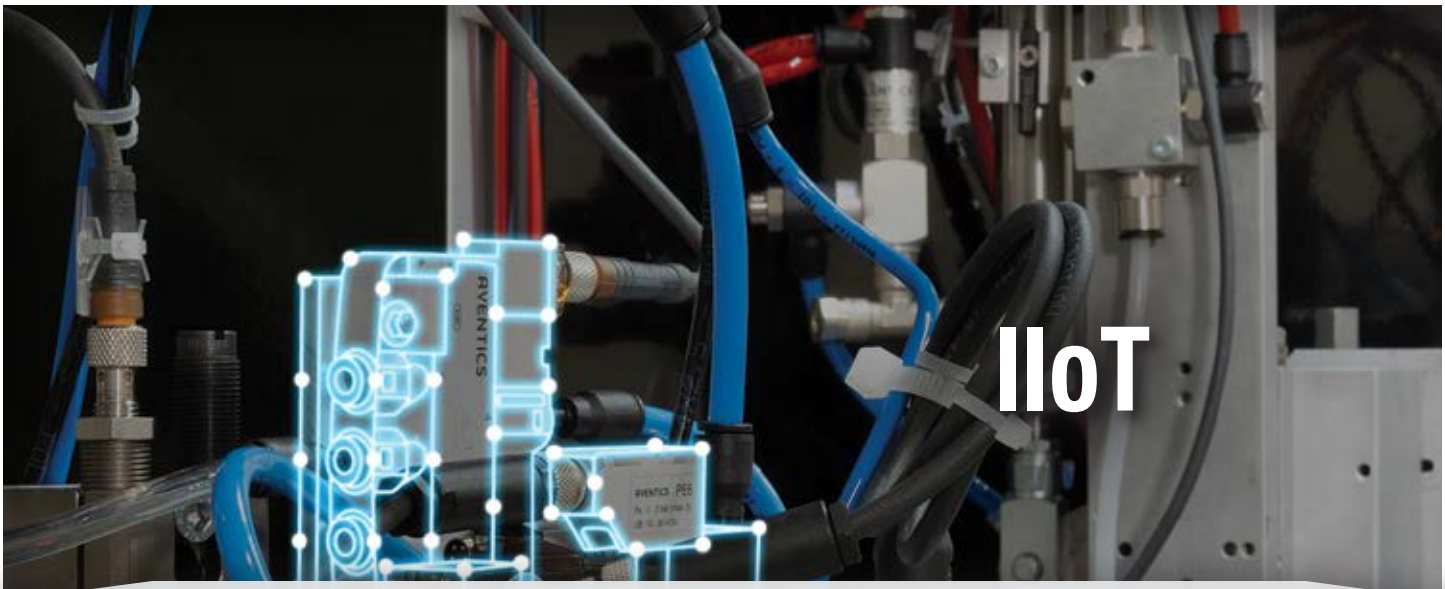
December 2020



PRODUCTIVITY, SUSTAINABILITY AND ENERGY CONSERVATION

Automaker to Save $3.6 Million Over 10 Years with Outsourced Compressed Air

By Kurt Metzler, Universal Compressed Air

A major automotive company needed a newer and more efficient compressed air system at one of its manufacturing plants. The original system had been operating inefficiently with old equipment and controls. Faced with a major capital investment, the plant switched to a performance contracting model.

The long-term agreement with Universal Compressed Air (UCA) for a dry compressed air supply service resulted in the installation of a modular and more efficient compressed air system that eliminated over $1 million per year of O&M costs including $440,000 of electrical power. Based on contract air supply costs, the plant expects to realize a net savings of $3.6 million over the next 10 years.

Aiming for Compressed Air Quality and Reliability

Automotive manufacturing facilities need large amounts of compressed dry air at pressures

"Annual power savings with the new compressed air system versus using the existing systems for future operations is 3,696,000 kWh."

— Kurt Metzler, Universal Compressed Air

up to 120 psig depending on application. Air is needed in almost every part of the process which includes stamping, painting, cleaning, engine and vehicle assembly. Typical uses of compressed air include:

- Air operated robots.
- Plasma cutting and welding.
- Air tools.
- Power to lift, position, move and convey items.
- Automobile finishing.
- Tire inflation.

Dry air is especially important given the need to reduce corrosion potential, improve controllability/operations and, among other things, support state-of-the-art environmentally friendly painting operations. At this location compressed air is used to operate solenoids, activate cylinders, provide blow-off of parts, etc. The amount of compressed air required is highly variable depending on how much of the process equipment is in operation and the weekly production schedule.

Given the age of its compressed air system, the facility needed an update to improve efficiency, increase reliability and reduce maintenance costs. The company knew substantial savings could result by retiring its ten air compressors and replacing them with a new state-of-the-art system. The automotive company established the criteria to guide the new design. It wanted to:

- Increase system efficiency.
- Reduce utility costs.
- Better match air supply with air demand.
- Improve controls and locate air compressors in a central location.
- Reduce air leaks.
- Improve reliability.
- Reduce total cost of compressed air supply including O&M resources/ materials, make-up water, water treatment, etc.
- No capital outlay.
- Eliminate compressed air piping insulation that was a maintenance headache.

With goals established, the company began discussions with UCA to review the plant's compressed air system operation and establish plans for the future.

Plant Compressed Air Use Analyzed

Before working with UCA, the company had an assessment done to determine future air consumption if they were to continue running their existing equipment in a more efficient way.

The company decided it could operate the existing air systems at 85 psig and save a significant amount of power. The assessment analyzed weekly operations as air consumption changes dramatically throughout the work week. Weekend demands can be 40 to 50 percent of weekdays and air use is still required during shutdowns. Peak flow demand was predicted to be 9,330 scfm and the average weekly flow was 5,930 scfm. Continued use of the existing compressed air system with the predicted flow profile showed a future air volume of 3.2 billion cubic feet per year and total annual energy usage of 13,090,400 kWh.

Universal Compressed Air of Bethlehem, Pennsylvania, supplies an automotive manufacturer with compressed air through a long-term contract featuring a modular compressed air system. The new system is expected to save the plant $3.6 million during the next 10 years.

AUTOMAKER TO SAVE $3.6 MILLION OVER 10 YEARS WITH OUTSOURCED COMPRESSED AIR

After defining how the existing equipment would perform under future conditions, the plant evaluated outsourcing its air supply to UCA. Based on a performance-based air delivery contract, UCA would design, build and construct a new air facility and then operate and maintain it for the duration of the multi-year contract. Additionally, UCA would guarantee performance (power consumption and a minimum savings) over the life of the contract. The auto company would be compensated if performance goals were not met.

The benchmark for performance was a pre-project air study. UCA assessed air consumption and performance for the existing operations through analysis of historical logged data and observations of the system. The existing air compressors had been installed in the automotive plant's utility building. Multiple older air compressors (both centrifugal and reciprocal units) with refrigerated dryers were delivering air at a 40°F (4.4°C) dew point.

Contracting for Compressed Air

With the potential benefits of UCA's compressed air system clearly defined, the automotive company contracted with UCA to build, operate and maintain the air system to receive their compressed air supply like a utility. They chose UCA's Pipeline Air™ option for their supply.

The new UCA system includes four high-efficiency Atlas Copco ZH centrifugal air compressors with three Heat of Compression (HOC) dryers capable of a -40°F (-40°C) dew point and new cooling towers. Each air compressor has a nominal capacity of 3,250 scfm airflow. Compressed air is provided at 85 psig and a pressure dew point of +0°F (-17.7°C) or lower depending on daily operational requirements.

With this design, UCA modeled the air compressor performance curves to evaluate operating the air system under average annual conditions at the expected future flow profile discussed previously. Turndown, air venting and auxiliary equipment loads, such as cooling towers, water pumps, and other miscellaneous equipment were considered. The resulting total energy usage was estimated at 9,394,000 kWh (versus 13,090,000 kWh with the existing system). Annual power savings with the new compressed air system versus using the existing systems for future operations is 3,696,000 kWh. This represents a savings of $440,000 per year at a $0.12/kWh cost of power. The company's existing systems were to be shut down.

Inlet air hoods protrude from the main modules of the compressed air system at the automotive plant. The overhead door of the modular system provides easy access for maintenance.

System Built for Efficiency and Reliability

UCA's centralized modular systems allows the plant to cost effectively shut down its existing inefficient units. These systems can be located at a site outside of the existing production buildings and piped to the main plant, saving valuable real estate within the manufacturer's plant that is better suited for an upgrade or expansion. Highlights of the system built for the automotive plant are as follows:

- It is designed to meet peak flow requirements of the plant. Selection of the right equipment and a robust control system ensures efficient operation, especially during turndown.
- Centrifugal air compressors provide the highest efficiency with variable flows. Utilizing the efficient centrifugal air compressor sequencing and variable flow is key to minimizing product air venting.
- The new air compressor motors are more efficient than the older units.
- The air compressors have inlet guide vane control that can efficiently vary airflow. Each air compressor has its own microprocessor that controls critical air compressor operations. The individual microprocessors are integrated into a master control system that optimizes the whole facility operation to meet the demand pattern while minimizing energy consumption.
- HOC dryers use waste heat generated by the air compressors to regenerate the desiccant dryers. This eliminates the need for a heater which reduces capital costs and saves power.

- The master control system is designed with the latest Bay Controls Distributed Capacity Control (DCC) technology to efficiently run the facility. The system eliminates unnecessary air blow-off by allowing the most efficient air compressors to run at full capacity while varying flow only on one unit. The average efficiency is higher this way than if all air compressors were run at turndown. After maximum turndown is achieved on one unit, the control system will determine the maximum efficient operation of the remaining units. The master controller also allows for tighter pressure control (approximately plus or minus one to two psi across all the air compressors for lower power consumption).

- An overall Supervisory Control and Data Acquisition system (SCADA) is furnished to tie the air compressors, dryers and auxiliary system controls together into one package which also provides remote monitoring at all times, as well as data logging for reporting/evaluating performance and assistance with maintenance planning.

- Locating all air compressors in a centralized area and controlling them with a master controller allows the airflow from all air compressors to be managed to meet demand thus minimize venting air. This is a simple point but key to improving the efficiency of today's industrial plants whose air systems have evolved inefficiently over time due to technology obsolescence and situational-independent upgrades. Many plants did not have space in their central utility locations when they were expanded. Due to limited space, new independent air systems may have been dispersed in different locations.

At the automotive plant, modules for the compressed air system are individually offloaded by a crane and set on a foundation.

The entire system employs an "N+1" reliability design so that the loss of any one piece of equipment (i.e., air compressor, dryer, cooling tower, etc.) does not disrupt production. This ensures the plant can maintain 100% air supply. The approach adds cost to the project but maintains full air production in the event of an equipment or component failure and allows maintenance of equipment without disrupting production. A new dedicated electrical supply system is included. Redundant transformers enhance reliability by handling all the new load on either unit. A split bus electrical architecture with a "tie-breaker" ensures either transformer can power the entire system if needed.

Clear Advantages with Performance-based Contract

UCA supplies the automotive plant with compressed air through a performance-based contract, which guarantees the company will save a pre-specified amount of energy based on the pre-project analyses. The savings were calculated to be 400 kW ($440,000 per year). If UCA does not deliver savings of at least this amount, the automotive company will be credited the sum of the shortfall.

After consideration of the contract air supply costs, there is a net savings of $3.6 million over the next 10 years. This includes cost savings for power, cooling water make up, water treatment, maintenance, rental compressors, etc. In addition, the automotive plant is projected to benefit from:

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- Minimal capital investment in a new air utility system, which frees up capital that can be allocated for capital investment in their core business (expansions, productivity improvements).
- The ability to use critical resources to focus on core business functions.
- Elimination of worries to support a utility system that creates headaches/distractions from critical production activities. Monthly utility costs are fixed/predictable and scheduling maintenance and renting backup air compressors, if needed, are all handled by UCA.
- A new state-of-the-art compressed air facility.

Typical project duration for this type of installation is 10 to 12 months from contract to startup. This result was accomplished on this project even with factors such as COVID-19 and weather induced transportation permit delays.

Modular Design Philosophy Fuels Success

The key to successful project execution is UCA's modularized design philosophy. UCA has experience with retrofits to existing plants but prefers supplying modular designs that minimize the occurrence of unpredictable and unproductive events that can occur in the field.

Generally, installation occurs on a plot adjacent to the customer's main compressed air users where the air is piped directly to the facility. Modular plant systems are used to improve cost, reduce field installation time, lower delivery/other risks, minimize customer business interruption and save space versus "stick-built" construction within the customer's plant.

Modular construction is performed at an off-site fabrication shop unimpacted by weather and site issues. In the shop, accuracy and productivity are high and safety conditions can be monitored better than a field installation. Module installation time in the field is much lower than with a stick-build installation and interactions/disruptions to the customer's facility and people are minimized.

The modular design for this project has the main compressed air supply equipment housed in multiple shop-built modules of similar dimensions meeting over-the-road trucking limitations. The modules, dual transformers and cooling water towers were shipped and installed in the field.

High Comfort Level with Contract Air Supply

The compressed dry air facility commissioning went well and the plant has been running successfully since startup. Having met project execution, reliability and transparency expectations, the automotive company has developed a strong comfort level with the concept of a contract air supply. Also, a transparent, real-time access to operational data builds confidence. And, certainly, meeting performance goals to date (power, production, and reliability) is an important step in building trust for the future.

Space has also been freed up in the automotive plant by moving the compressed air system outside of the current production facility. UCA's modular design approach minimized field construction time and inconvenience to the plant. Guarantees are in place to make sure the company will achieve targeted savings. UCA's reliability philosophy and guarantees ensure reliable pipeline air supply. Lastly, UCA and the automotive company have a long-term relationship that will be based on open communications and shared objectives. BP

About the Author

Kurt Metzler is the Business Development Manager for Universal Compressed Air. He has extensive background in the industrial gas industry and has experience in both the technical and commercial aspects of industrial gas project development. Contact Kurt at email: kmetzler@UniversalCompressedAir.com, tel: 610-419-9053.

About Universal Compressed AIR

UCA, Bethlehem, Pennsylvania, is an industrial gas company specializing in producing and distributing compressed air to manufacturing sites that require air as a utility for around-the-clock operations. To do this UCA maintains complete compressed air supply and distribution systems for a range of companies and markets reliable compressed dry air delivered like a utility under the Pipeline AirTM trademark. For more information, visit www.UniversalCompressedAir.com.

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