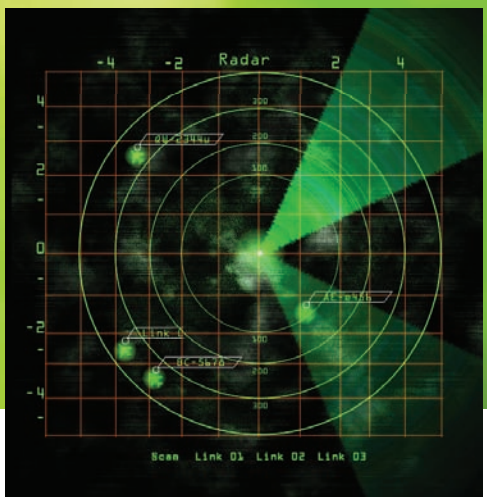
Energy Recovery In Action:



Innovative Reuse of Heat Cuts Energy Costs

"This energy recovery system allows us to heat the boiler room, improve the boiler's operating efficiency, and cool the compressors and dryer. The water feeding the boiler is hotter than the return water. Total heat recovered is 105,795 BTUH. Instead of venting heat from the compressors, we're putting it somewhere else that's productive."

Jim Schaff
Manufacturing Engineer
Raytheon Advance Device Center

Did You Know?

It's simple physics: compressing any gas, including air, gives off heat. Reusing that heat can reduce energy costs.

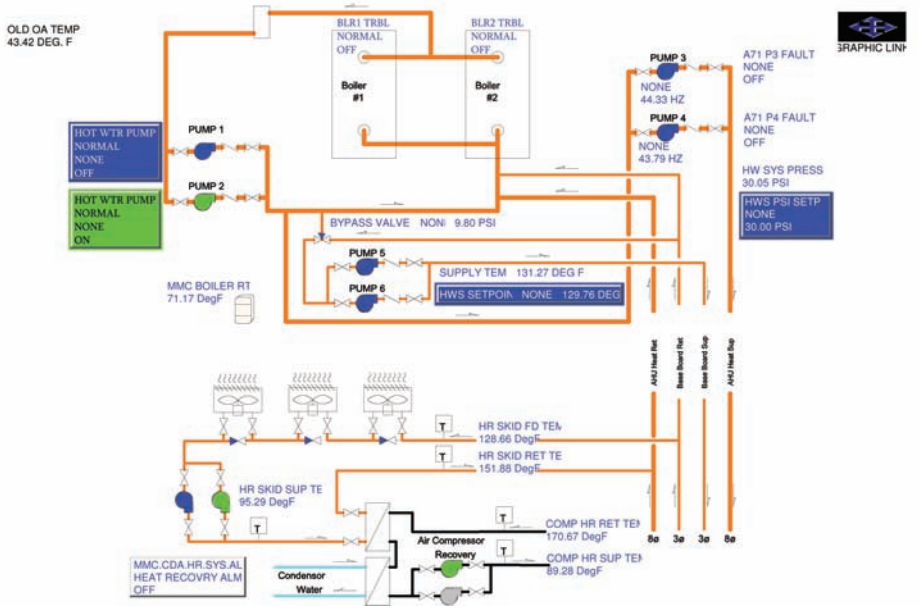
Raytheon Integrated Air Defense Center (IADC) operates a micro-electronics Wafer Fabs in Andover, Massachusetts, that produces semiconductors for radar, guidance systems and avionics used in military applications. At the facility, oil-free compressed air is used for semiconductor manufacturing applications, process air and a variety of other in-house uses.

Now, heat generated as a natural byproduct of air compression – heat that is typically vented to the atmosphere – is being reused as part of the first "Carbon Zero" project in New England.

In 2009, Raytheon's capital budget included funds to upgrade old compressed air equipment. "The equipment Raytheon had been operating was 20 years old," explains Ron Whelan, Atlas Copco Sales Manager in Massachusetts. "It was time to replace it and there was a budget in place. Raytheon is a customer that understands they can optimize efficiency by investing in the best new technology, so they selected two ZR Series Variable Speed Drive compressors, an MD dryer and Atlas Copco's Carbon Zero energy recovery system. Atlas Copco is known around the world for our innovations in energy efficiency, and these are the most energy efficient technologies we offer."

For this project, Raytheon's goal was to gain cost-saving benefits by capturing and reusing heat that is a natural byproduct of compressing any gas, including air. Jim Schaff, Facilities Engineer at the IADC, designed a system that directs heat recovered from the air compressor into the facility's boiler room space. Warming the air in the boiler room increases the system efficiency by lowering the consumption of natural gas that heats the boiler.

Schaff explains how it works. "The system directs water returning from our building's baseboard loop to hydronic heaters that warm the boiler room space, then it runs through two circuits that pick up heat from the air compressor and the dryer. This heated water is then sent back to the boiler. This flow arrangement lets us heat the boiler room and also increase the boiler return water temperature by 15 or even 20 degrees, all at no energy cost." (See diagram.)



Before this new heat recovery system was installed, Raytheon used unitary heaters to protect the boiler room space from freezing. "Warm air increases combustion efficiency for our gas fired boilers," says Schaff, "and those unitary heaters helped, but with the new heat recovery system, the boiler room stays in the 60's, at least 20 degrees warmer than before, and we're heating the space for no cost. Most times we're putting more heat back into the boiler water than we take out. Another indirect benefit is that we're using less water because the condenser water from our cooling towers isn't being used to cool all the stages in the compressor."

This heat recovery concept works great for winter in New England, but what happens during the summer months? "During warm weather," Schaff explains, "we don't have to heat the boiler room so we bypass it and send heat recovered from the compressor and dryer directly to the boiler to reduce the load. Our system is more effective in winter since we need to heat the boiler room anyway, but either way we're using the heat of compression to reduce the operating cost of our boiler. We've got it tuned pretty much perfect for winter, so now it's just a case of optimizing the system for summer use. It looks like preheating water for domestic water use is the best option."

Raytheon is a technology driven company so it's not surprising they wanted to upgrade their compressed air system to take advantage of newer and more energy efficient technology. They chose two ZR series oil-free VSD compressors set up in a lead-lag configuration with Atlas Copco's Elektronikon control system automatically switching them once a week to promote even wear. The MD adsorption dryer, designed specifically to work with the oil-free ZR compressors, provides highly efficient drying and continuous drying regeneration using compression heat.

The project pays benefits to Raytheon on many levels:

- $13,270 reduction in annual energy bill (94,829 kWh reduction per year @ $0.14/ kWh)
- $19,858 incentive paid by National Grid
- 105,795 BTUH heat recovered
- Indirect energy savings from the reuse of heat that wasn't being used before but which now is being put to productive use
- Secondary water savings
- Reliability benefits related to new equipment with new warranties

Whelan says that Raytheon is a great example of a forward-thinking customer. "After 20 years their compressed air equipment still worked all right and they could have just kept doing what they were doing. But by taking advantage of new technology and an energy supplier rebate, Raytheon has improved the efficiency of their compressed air system as well as their gas-fired boiler. On top of that, they get all the advantages of new equipment backed by a new warranty. Atlas Copco consistently emphasizes the value of increased energy efficiency when making new product presentations, but this time the customer was the driving force in wanting to maximize efficiency. The willingness of Jim Schaff to actively participate in the process helped immeasurably in a successful project."

To learn more about Raytheon, visit

www.raytheon.com