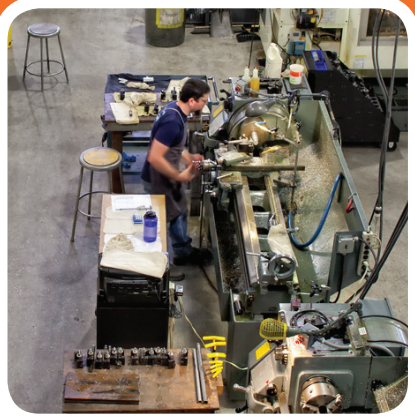
GEARED FOR ENERGY EFFICIENCY

KING CYCLE GROUP DEMONSTRATES HOW ENERGY EFFICIENCY PENCILS OUT FOR SMALL MANUFACTURERS

Chris King, owner of King Cycle Group, knows that top-of-the-line bike components can help optimize a cyclist's performance. So it follows that he would put a premium on high performance when designing his company's new manufacturing facility. Plus, a high-performance building would align with his environmental values and serve as an example for other small manufacturers.

With financial assistance from Energy Trust of Oregon, Mr. King and his staff designed a 65,000-square-foot facility that features an innovative whole-building water-source heat pump system, energy-efficient lighting and additional equipment such as an energy-efficient air compressor. Together these systems save approximately 48,916 kWh and 1,037 therms a year. As a result, the company is spending $6,145 less every year on their energy bills and proving that energy efficiency can be cost-effective for small manufacturers.

Energy Trust of Oregon



OCCUPANT COMFORT

King Cycle significantly increased occupant comfort by directing the waste machine heat into the water loop, instead of rejecting it into the manufacturing space.

COMPRESSORS

A new energy-efficient air compressor (shown on left) was a straight forward upgrade that delivered immediate and ongoing energy savings.

LIGHTING

The entire building is equipped with energy-efficient lighting which cost the company $60,000. With a three-year payback, King Cycle considered it a sound investment.

THE CHALLENGE

Designing an energy-efficient manufacturing facility cost effectively

Building an energy-efficient manufacturing facility poses some significant engineering challenges. Process loads—the energy used when running the production equipment—are large and unavoidable. This gives the facility engineer two options: spend big money on the purchase and installation of all new equipment, or think outside the box.

For its new space, King Cycle bought a warehouse shell in Portland previously used for storage and decided to tailor the interior to meet manufacturing needs. While energy efficiency was a priority in the design of this facility, the company could not afford to simply replace all of the existing manufacturing equipment. This meant that the project team, led by the company's manufacturing engineer Erik Drews, had to explore more creative solutions.

THE SOLUTION

Components of high performance

To get the facility up and running, the company installed multiple large manufacturing machines, which emit large amounts of waste heat during the manufacturing process. To get rid of that heat and maintain equipment thermal stabilization, they installed stand-alone air-cooled chillers. The chillers expelled machine heat into the manufacturing space and rooftop air conditioning units removed it from the building. The team, however, recognized they could save energy if the heat produced by the machines could be reused to warm the building during cool months. They could then simply expel the machine heat directly from the building during the warmer months, rather than paying to cool the machines and run the rooftop air conditioning units.

The team determined the most efficient way to accomplish this objective was by installing a water-source heat pump system that uses recovered heat from the manufacturing equipment to warm the building during cooler months, and an existing 70-ton cooling tower on the roof to reject heat in warmer months.

The company's facilities and maintenance team handled the electrical and mechanical work in-house. The resulting system includes reverse-flow piping around the entire core of the building and 19 heat pump units. The water is moved through the system by four pumps driven by premium-efficiency electric motors and controlled by variable frequency drives. As illustrated on the next page, each pump has a dedicated purpose. The first supplies water for the heat treating furnace, which is used for hardening and tempering metals.

The second is dedicated to the main water loop, which moves water around the building. The third pump is multi-purpose and provides back-up support. The fourth pump supplies water to the cooling tower. Thinking ahead toward expansion, the company included an open slot between pumps three and four for the addition of a fifth pump to meet future building demands. All the water in the loop returns to a large storage tank where it is mixed to even out the temperature and share energy between heating and cooling loads. A high-efficiency condensing boiler supplements the recovered heat during cooler months for whole building heating.

Cash incentives from Energy Trust also helped King Cycle purchase a new energy-efficient air compressor. This compressor includes an internal VFDs, which speed variable frequency drive which speeds up or slows down the compressor motor to match output with the compressed air demand of the production equipment. While the compressor can handle the company's largest production demand, about 70 percent of the time the loads are at 50 percent capacity. The old compressor, with a fixed motor speed, wasted a lot of energy under partial load conditions. Switching to an energy-efficient model was a straightforward upgrade for immediate and ongoing energy savings. To further reduce energy use, the company spent $60,000 on energy-efficient lighting for the entire building. With a three-year payback, King Cycle considered it a sound investment.

Results that penciled out

Cash incentives combined with energy cost savings made the project pencil out for King Cycle Group. Through working with both the New Building and Production Efficiency teams at Energy Trust, the company received a cash incentive of $51,722.

THE PUMP ROOM

Four electric-powered pumps equipped with premium-efficiency motors move the water through the whole-building water loop.

Group A—electric powered pumps

1. ***Dedicated to the heat-treating furnace***
2. ***Dedicated to the main water loop***
3. ***Backs up primary pumps 1 and 2***
4. ***Dedicated to the cooling tower***

Group B—connected to three horizontal wall-mounted water pumps

1. ***Beginning of water loop supply***
2. ***Supplies the cooling tower***
3. ***Supplies the heat-treating furnace***

Group C—High-efficiency condensing boiler

"Building sustainably is about doing the right thing. Incentives from Energy Trust absolutely helped because they provided cash flow to offset some of the upfront costs."

Chris King, owner
King Cycle Group

King Cycle's manufacturing engineer, Erik Drews, pops a wheelie in what the company hopes will one day become a 40,000 to 100,000 gallon underground water reservoir.

THE FUTURE

Looking ahead to more energy savings

King Cycle is committed to further reducing its energy use. To that end, the company has engineered the water loop so that it can be connected to a planned 40,000 to 100,000 gallon underground water storage tank, also called a reservoir. The plan is to partition and waterproof an existing concrete-lined basement area to serve as the reservoir. Adding the reservoir would balance the water-loop's heating and cooling loads, so the system could operate for an entire day without running the boiler or chillers, saving significant energy. King Cycle has also engineered the water loop with excess capacity so that all future manufacturing and HVAC equipment upgrades or replacements can be connected to the system.

PROJECT BENEFITS

- Reduced energy consumption
- Achieved thermal stabilization of manufacturing equipment
- Demonstrated sustainable design for other small manufacturers
- Minimized company's carbon footprint

ENERGY SAVINGS

- Annual savings of 48,916 kWh hours of electricity
- Annual savings of 1,037 therms of natural gas

FINANCIAL ANALYSIS

- **$51,722** incentive from Energy Trust
- **$6,145** in annual energy savings

UTILITIES

- Northwest Natural
- Portland General Electric

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To learn more, visit **www.energytrust.org** or call **1.866.368.7878**.

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