Wyeth Nutritionals

RECOVERS WASTE HEAT

Wyeth is a global leader in pharmaceuticals, consumer health care products, and animal health care products. With net revenues of $22.4 in 2007, Wyeth has 50,000 employees across four continents. Wyeth is the largest pharmaceutical employer in Ireland with over 3,000 employees in five locations.

Wyeth has had a manufacturing presence in Ireland for over 30 years. It currently operates four manufacturing facilities in the country, including Wyeth Nutritionals, Askeaton, Co Limerick.

The Askeaton facility, established in 1974, employs over 550 people, manufacturing and distributing infant nutritional products – both powdered infant formulas and a range of liquid, ready-to-feed products.

PROJECT TO RECOVER WASTE HEAT

In 2007, Wyeth Nutritionals, Askeaton implemented a waste-heat-recovery retrofit in its gas-turbine combined heat and power (CHP) plant. This system uses a heat exchanger to extract heat from de-aerated boiler feed water and uses it to 'preheat' water before it enters the vessel.

This project was driven by the need to achieve a significant reduction in energy costs and an associated reduction in CO_2 emissions. These objectives were met in full:

- Effective steam output of the CHP unit increased by 346 kW;
- Heat-recovery efficiency of CHP unit increased by 4.3%;
- Gas consumption per annum reduced by 2,880 MWh;
- CO_2 emissions per annum reduced by 543 tonnes.

This project was part-funded by Sustainable Energy Ireland's Industrial Best Practice Initiative.

Based on the energy savings outlined above, Wyeth Nutritionals, Askeaton has a payback timeframe of 3.2 years for this retrofit.

THE PREVIOUS SETUP

Wyeth Nutritionals, Askeaton produces almost 90% of the electricity and steam used on site in a 5 MW CHP plant, operating since 2004. This CHP plant, designed and installed using standard CHP design practice, was a key element in an energy-efficiency drive, which delivered a 40% reduction in CO_2 emissions at the site. The steam system's feed-water circulation system uses direct-drive pumps, which are either on or off, depending on demand.

The Askeaton facility, like most industrial plants, uses a de-aerator to treat boiler feed water. In the de-aerator, the water temperature is increased above boiling point so that the air is driven out. The hot water is then pumped to the CHP plant feed tank, where it resides until it is fed

into the CHP unit to create steam for the plant.

The cycle goes as follows:

1. De-ionised mains water at 15°C (25%) is mixed with steam condensate returned from the plant at 92°C to produce water at 75°C;
2. This 75°C water is heated to 103°C in the de-aeration process;
3. The 103°C water is transferred to the CHP feed-water tank, where it is ready for use in the CHP;
4. Heat from the CHP exhaust, in a series of steps, converts the 103°C water to steam for use in the plant;
5. 25% of the water is lost within the plant distribution system, and the remaining 75% is brought back to the beginning of the cycle.

HEAT-RECOVERY OPPORTUNITY INVESTIGATED

It was well understood early in the plant's operation that water cooler than 103°C would absorb more heat and make greater use of the CHP waste heat.

Energy consultants, using the Pinch Technology approach, identified an opportunity within the system to reduce that feed-water temperature by transferring the heat back to the de-aerator through using a water-to-water heat exchanger. Pinch Technology involves using a set of thermodynamically-based methods, tools and algorithms that guarantee minimum energy levels in the design of heat-exchange networks.

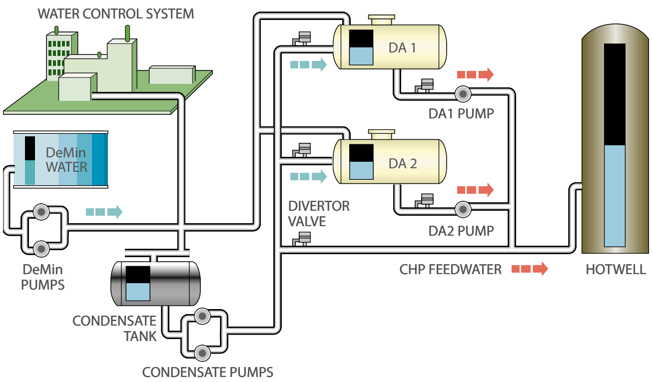
The resulting lower exhaust air temperature from the CHP would indicate that more heat was being transferred to the steam – indicating a 4.3% increase in system heat-recovery efficiency.

In addition to increasing the output and efficiency of the CHP plant, this would reduce the temperature in the CHP feed-water tank, thereby eliminating the steam flashed off when the water reaches the tank.

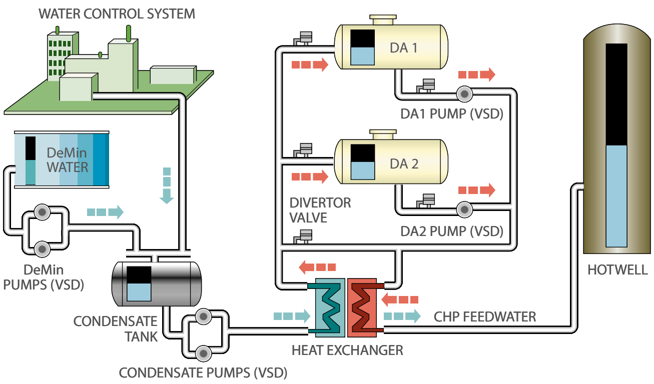
This counter-flow heat exchanger would lower the de-aerated water temperature to 83°C and raise the de-aerator feed-water supply temperature to 95°C.

The heat exchanger requires a continuous flow of water to maximise efficiency. To modulate flow according to demand, the existing direct-drive pumps would have to be replaced by Variable Speed Drive (VSDs) pumps.

Before Heat Recovery



After Heat Recovery



ACTIONS TAKEN

Based on the investigation, an engineering scope of work and schematic design were developed as a collaborative effort between Fingleton White and Co., the CHP plant owner and operator, the Wyeth Energy Team at Askeaton, and Wyeth Energy Program personnel.

In addition to a counter-flow water-to-water heat exchanger, the scope of work included some additional actions to enable the new system to operate more efficiently:

- replace direct-drive pumps with VSDs;
- relocate some piping and water-treatment equipment;
- add a pump to overcome heat exchanger pressure drop;
- reconfigure controls.

The project was evaluated and costs and savings were estimated. The senior management team at Wyeth, Askeaton approved the project. The final design and installation phase was carried out by the CHP unit owner and operator.

THE SAVINGS AND BENEFITS

An existing data-gathering system was used to monitor efficiency improvements brought about by the project. It began delivering benefits immediately:

Increased energy recovery and efficiency of the CHP unit

As the water in the CHP feed-water tank is now at a lower temperature, there is a greater temperature gradient between it and the exhaust gases from the CHP plant. This means that more heat can be extracted from the exhaust gas, which is leaving the facility at a lower temperature than before (13°C lower). An additional 269 kW is thus being recovered from the system, an increase of 4.3%.

Elimination of flash-off steam in the feed-water tank

In the past, the 103°C water caused steam to flash off in the feed-water tank. Since the heat exchanger was installed, the feed-water tank temperature is operating at 85°C, and no steam is flashed off. This has been estimated to save approximately 77 kW.

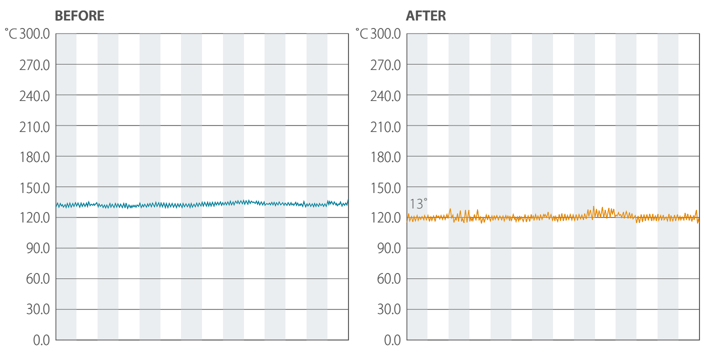
Improved monitoring and control

The upgraded automation and new level controls throughout the system, along with the use of VSD pumps, have resulted in site operations having better control and information trending of the boiler feed-water system.

The energy savings are:

- a reduction of 2,880 MWh of gas consumption per annum;
- a commensurate reduction of 543 tonnes in CO_2 emissions per annum.

ECONOMISER STACK TEMPERATURE



BEST PRACTICE AND REPLICATION

This project demonstrates best practice by using Pinch Technology methods in examining a retrofit on a CHP installation to increase thermal efficiency.

"The project can be replicated successfully across many other combined heat and power installations. Wyeth Nutritionals, Askeaton is currently evaluating similar Pinch Technology applications throughout the plant and is confident of developing future energy-saving projects."

Tom Moore,
Energy and Utilities Manager,
Wyeth Nutritionals

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