CASE STUDY

INDUSTRY: Healthcare
PRODUCT(S): Steam boilers, economizers, Deaerator, condensate receivers.
APPLICATION(S): Humidification, Sterilization, Clean in Place (CIP), Domestic Hot Water.

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OVERVIEW

Traditionally, steam was the primary source for generating heat within a hospital. Steam was the lifeblood feeding critical systems such as humidification and sterilization loads, in addition to building heat, domestic hot water, onsite laundry, CIP, labs, and even cooking.

Modern hospitals and present-day retrofits have altered in approach to promote efficiency and emission reduction. "Low-grade heat" technologies such as condensing hot water boilers, heat pumps, and reheat chillers can now serve low-grade heat uses. However, sterilization, humidification, and lab steam among some other loads still require high-temperature and high-pressure steam.

In this case study, we detail the steam load profiles of modern hospitals as well as those evolving through retrofit. We review the new challenges facing steam boilers and how this can impact selection and performance. A deeper understanding of how steam boilers and systems integrate has never been more important.

CHALLENGES

By integrating low-grade heat technologies in conjunction with the existing seasonal load profiles and variances in temperate climates, we have exacerbated the profile of the steam system.

THE PROFILE OF A "MODERN HOSPITAL" STEAM PLANT IN A TEMPERATE CLIMATE BREAKS DOWN AS FOLLOWS:

Winter Profile:
The winter profile is the bulk of the total steam capacity of the plant less the N+1 consideration. Plants can expect to operate between 60 – 95% of the allocated steam capacity with the following uses active: Humidification, Sterilization, back-up (supplemental hot water), and lab / cart washing.

Summer Profile:
The summer profile can be minimal, especially if domestic and any CIP water are on the low-grade system. Modern hospitals are typically running around 5 – 15 % of the

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steam capacity during warmer months with the following uses active: Sterilization, occasional back-up hot water, lab steam, and cart washing.

IN ADDITION TO DIVERSE SEASONAL LOADS, HOSPITALS MUST CONTEND WITH THE FOLLOWING:

1. Energy Management & Efficiency improvements
2. Reducing Emissions (quickly becoming #1)
3. Reliability

SOLUTIONS

A reduction in cycling and precise load matching for better energy management, efficiency, reliability, and reduced emissions. It is essential to first look at the complete steam load profile from the peak to, more importantly, the base! Boiler selection is critical to ensure the boiler is capable of high burner turndown and whether the burner and boiler are efficient across the range of that turndown.

Optimize burner control by ensuring boiler burner combinations provide strong combustion control throughout the entire range. It is important to review what a manufacturer's expectation is for excess air at low fire, and if options such as O2 trim can be implemented to improve performance. High excess air at low fire is required by some boiler types but can also be an unseen inefficiency.

Utilize summer boilers with high turn down due to the significant variance in summer vs. winter loads. For example, if the winter load for a hospital is 500bhp (10:1 turndown = 50bhp bottom end) and the summer load is 100bhp, select a 150bhp boiler at 10:1 turndown to allow for system matching as low as 15bhp without excessive cycling. This will positively impact performance in the warmer months.

A clean boiler on the waterside is vitally important for maximum heat transfer. During the winter months when humidification makes up a large portion of the steam load, it requires high make-up water rates. Thus, blowdown management and pre-treatment of boiler water becomes even more important to maximize system efficiency and energy management.

Condensate management is hypercritical for any healthcare facility. Condensate is not only hot but also chemically treated and capture should be maximized. The way in which condensate is transferred back to the boiler plant is important. Typically, it is blindly pumped back in shots. The use of a surge tank of adequate sizing, that constantly pumps to the deaerator, is critical to smoothing out returns to the boiler and ensuring temperatures remain as hot as possible.

KEY BENEFITS HOSPITALS CAN EXPECT BY IMPLEMENTING THE ABOVE SOLUTIONS INCLUDE:

- **Reduced fuel consumption, energy consumption, and emissions.** As per Greening Healthcare's annual baseline reports, hospitals that implemented these considerations experienced meaningful increases in overall efficiency and reductions in emissions.
- **Reduced overall environmental footprint**
- **Improved reliability**
- **Cycling loss reduction.** This not only improves reliability but can be quantified by third parties such as Enbridge. The US Department of Energy equates excessive cycling to a 1–3% loss in fuel annually.
- **Excellent seasonal flexibility,** as a result of the higher-than-average turndown of a Thermogenics Boiler.
- **Improved safety.** Because the amount of water within a forced circulation type boiler at any given point in time is much less than traditional designs used for the same steam output, the potential energy that could suddenly be released is also much less.
- **Achieved mandatory N+1 Redundancy:** With the inherent advantage of a smaller unit size, Thermogenics can deliver more steam output per square foot of available space than traditional boilers, making it easier to achieve peak load and a mandatory N+1 redundancy. This improves the operational performance of the hospital, reduces loss, and has the ability to reduce the footprint while still maintaining the backup of the N+1 redundancy.

To learn more about the Thermogenics boiler advantage, please contact us at: info@yowns.com

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