CASE STUDY: Repatriation General Hospital Steam Rationalisation Project

KEY INITIATIVES

- De-centralization of plants
- Maximum use of solar assistance contribution
- Use of Natural Gas close to point of consumption
- Use of heat recovery technology
- Design for part load performance
- Designed for efficiency rather than like for like replacement
- Use of intelligent controls
- Removal of inefficient reticulation

KEY OUTCOMES

- Gas Energy Savings:
  15,150 GJ pa
  (37% site reduction)
  519 MJ/m² pa
  (43% reduction per m²)
- Cost Savings:
  $119,410.00 pa
  (37% site reduction)
  $3.35/m² pa
  (35% reduction per m²)
- Greenhouse Gas Savings:
  783 Tonnes of CO_2 pa
  (37% site reduction)
  Equivalent to taking 178 average Australian Passenger Vehicles off the road
  27 kg CO_2/m² pa
  (43% reduction per m²)
- Payback Period:
  Less than 5 years
- Internal Rate of Return: 25%

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Government of South Australia
Department of Health

BACKGROUND

The Department of Health and the Repatriation General Hospital (RGH), are vitally interested in managing their energy cost and overheads, as well as meeting their greenhouse abatement target of a 25% reduction within their operations prior to 2014.

Systems Solutions Engineering (SSE) was commissioned to investigate, design and deliver a range of projects for RGH to achieve these energy initiatives as part of an overall asset upgrade.

Several projects were targeted, holistically known as the "Steam Rationalisation Project" and have now been delivered within last 2 - 3 years replacing obsolete plant, equipment and delivery mechanisms. As a result of these initiatives, the site gas consumption has reduced dramatically, surpassing the original expectations for the site.

The steam use was identified as predominantly for the generation of domestic hot water, heating hot water, pan flushing and steam for sterilizing in theatres. It was also identified that the majority of plant had reached the end of its serviceable life and was becoming more and more problematic, as well as inefficient and labour intensive.

In addition to the Steam Rationalisation Project the Department of Health and the RGH have further invested in the replacement of the air handling systems serving the Operating Theatre Building which was both inefficient and past its economic serviceable life resulting in poor internal conditions being achieved, putting at risk procedures undertaken.

The focus of this case study is the resounding success of the project to progressively replace the Central Steam Systems with local gas fired alternatives augmented by the use of solar assistance for the domestic hot water plant. 104 solar panels have been installed as part of this project from 2004 to 2006 which contribute to reducing the consumption of gas by 37%.

SITE

RGH was founded in 1936 and is located at 216, Daws Rd, Daw Park, South Australia. RGH has undergone a great deal of redevelopment over the years by adding many buildings to the site. The site is quite large with a predominance of single level building stock totalling approximately 38,000 square metres, spread out over the 30 Ha site.

A centralized steam boiler plant comprising old attended gas fired boilers supplied the steam/ heating requirement for the kitchen, theatre suite domestic hot water, heating hot water and various pan flushers around the site.

More than a kilometre length of steam and condensate pipework were reticulated around site with metre lengths of bare surfaces resulting in the overall steam system inefficiencies. Most plant was either in its original form dating back to the various development dates or had been repaired or replaced "like for like" over the years without regard to the performance aspects.

REPATRIATION GENERAL HOSPITAL DAW PARK

PROJECT 1

- Modifications to the air handling systems serving Theatre Suites 1 to 4 and preparation area, to incorporate 50% air recirculation for its normal mode of operation to satisfy current Department of Health standards for Health Buildings.
- Pre-treatment of the outside air streams by indirect evaporative humidification techniques.
- Increasing the size of the supply air ductwork to the Operating Rooms to suit the increased supply air flow rate.
- Running the supply air fans with variable frequency controlling. These are controlled according to the supply side static pressure requirements of the systems accounting for air filtration degradation.
- Introduction of new horizontal single zone draw-through air handling units each comprising a backward curved centrifugal supply air fan internally sprung, special circuited chilled water coil and a hot water heating coil or standard chilled water coil and a hot water heating coil.
- Introduction of waste heat reclaim systems comprising an air-to-water heat reclaim coil.
- New air handling units to serve separate areas of the building.
- Introduction of outside air economy cycle mode of operation for non Theatre zones.
- New BMS to control both the new and retained existing plant and equipment items.

PROJECT 2

- Replacement of steam generated (Calorifier) hot water system in the Outpatients building, Ward 16 and Ward 17 with new solar assisted hot water systems. New systems comprise panel type solar collectors, expansion tank, solar pre-heat tank, natural gas fired burner unit and intelligent controlling system.
- Introduction of ultraviolet water disinfection system complete with water hammer arrester.
- New energy efficient water circulating pumps to suit the system.
- New Rehau Cross Linked Polythylene domestic warm water pipework replacing inefficient and bare surfaced hot water, steam and condensate pipework.
- New gas service connection and gas meter and also new natural gas external mains and internal gas services to water heaters.
- New ventilation louvres to plant room.

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PROJECT 3

- Replacement of steam generated (Calorifier) hot water system in the Administration building (A Block) plant room with new solar assisted hot water systems.
- Natural gas fired burner unit including associated electronic controllers and heater flues to above roof line.
- Introduction of ultraviolet water disinfection system complete with water hammer arrester.
- New water circulating pumps.
- New copper hot water pipework, replacing bare surfaced and inefficient hot water, steam and condensate pipework.
- Mains cold water supply to new plant room.
- New 100mm natural gas external mains from the existing meter and internal gas services to water heaters.
- Upgrading the existing gas meter.
- All electrical supplies to the new plant room including all new equipment.
- Modifications of existing pipework to facilitate the installation of thermostatic mixing valves to provide tempered water to existing showers and hand basins in A Block, B block, C block, IPU-Radiology, Kitchen and Pharmacy.

PROJECT 4

- Disconnection of kitchen steam supply from old boiler plant, making redundant approximately 2km of 100mm steam and 50mm condensate pipework.
- New gas fired steam boiler plant in the kitchen area. The system is fully automatic via intelligent controls, complete with stainless steel flue transition and safety valves.
- New mild steel fully automatic blowdown tank, with self actuated cooling system and time based blow-down action.
- New copper feeder tank, complete with thermal insulation, fully automatic steam heating system, low and high level switches. Galvanised steel feeder tank stand, complete with drip tray and hard wood bearers.
- Mains water connections for new steam plant.
- Automatic chemical dosing system.
- New steam and condensate reticulation pipe.
- Pump for condensate water to boiler feed.
- New mechanical switch board and electrical wiring and control systems to operate the new steam plant.
- Natural gas supply pipe to the boiler.
- High and low ventilation to the plant room.
- Fire detection system to the plant room.

PROJECT 5

- Designing of New plant room whilst removing the steam reliance of the old steam system. This is the last stage of steam system decentralisation.
- New natural gas boilers to provide Theatre suite's steam requirement, Theatre suite's and Ward's hot water requirement for domestic and space heating.
- Redesigning of hot water system to serve Wards 1-8 and Theatre suites.
- New energy efficient pumps.
- New lagged and sheathed pipework and boiler flues.
- Instantaneous domestic hot water units boosted with solar energy. A solar contribution system in conjunction with three heat exchangers heats cold domestic water, provides domestic hot water at a temperature of 65°C for reticulation to the Theatre suites and Wards.
- Ultraviolet disinfection units comprise germicidal mercury vapour lamps which irradiate a lethal dose of ultraviolet (UV) light to kill the micro-organisms.
- Provision of chemical water treatment for control of corrosion within the system.
- BMS to control and monitor the domestic hot water supplies, UV sterilisation systems and return water pump.

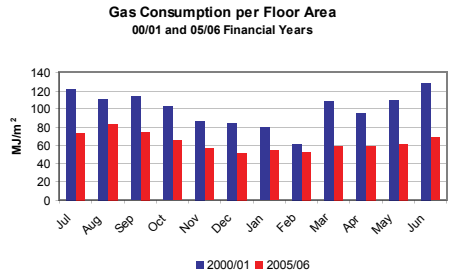
BENEFITS

Monthly gas consumption per floor area graph compares gas energy saving in 2005/06 against 2000/01 financial year.

RGH has achieved a reduction of 37% gas energy reduction per floor area in 2005/06 when compared to 2000/01.

More gas energy savings are yet to be confirmed at the end of 2006/07 financial year as projects were completed in March 2006 and the full affects will not be measurable until then.

The Repatriation General Hospital is an environmentally responsible site that System Solutions Engineering is proud to showcase our clients.



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