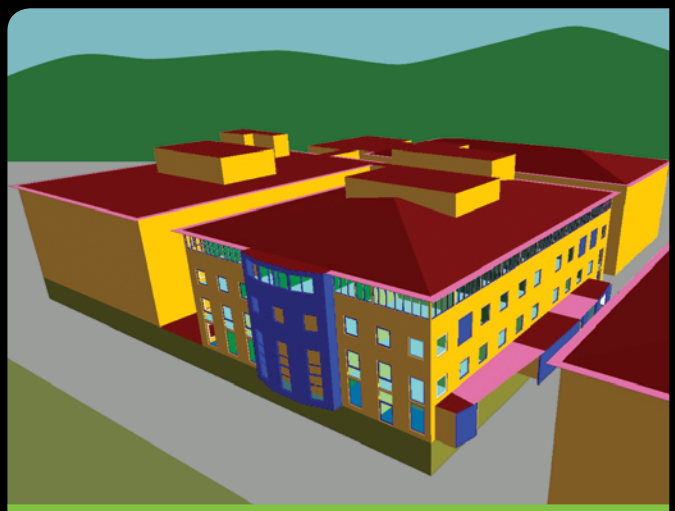
EnergyManagement
Association of New Zealand

Design advice sets up a strong foundation for an energy efficient rebuild



St. George's Hospital Stage 2 Rebuild detailed energy model

Stage 2 Rebuild foundations

Client: St George's Hospital, Christchurch.
EnergyMaster: Sam Roose, Enercon (A division of LTH Limited).
Challenge: To develop a concept and provide detailed energy efficiency design advice for the new 6,300m² 'Stage 2 Rebuild' of St George's Hospital in Christchurch.
Solution: Enercon provided energy modelling for the building in full (building envelope and HVAC plant) to determine appropriate glazing, daylight control, insulation, central plant requirements, free cooling and heat recovery. Enercon's work was part-funded by the EECA commercial buildings programme.

In brief: Enercon worked with St George's Hospital to provide energy modelling and detailed energy efficiency design advice for its rebuilt facility following the 2011 earthquake. The scope of Enercon's work included:

- A detailed design review to ensure specifications locked in the energy efficiency benefits, with consideration for ongoing management of the building such as ease of monitoring and targeting energy savings and providing automated control
- Comparing existing energy sources to dedicated new plant, with the most suitable options providing significant energy cost savings alongside other design benefits such as extra floor space, better sound insulation and reduced capital cost
- Validating multiple ground source heat pumps to replace the pre-2011 LPG boiler and screw chiller setup
- Looking at how to optimise capital cost in simple ways such as using the right amount of insulation necessary to meet design requirements
- Assessing the suitability of upgrading building technologies such as EC fans for fan coil units.

The project

St George Hospital's suffered significant earthquake damage and as a result around 50 percent of the site is being rebuilt in a staged process. The Stage 2 building, expected to be completed late 2016, will eventually be connected to the similarly sized Stage 3 building, expected to be completed in late 2019.

Enercon was brought in by St George's and the Stage 2 project management team to carry out an EECA-funded independent design review for the new Stage 2 building. This was then extended to a review of the building envelope.

The solution

Enercon Divisional Manager Sam Roose said his team worked with the Stage 2 Rebuild project management team, including mechanical engineers (Powell Fenwick Consultants) and architects, to ensure the design could be as energy efficient as possible within the project budget. This included assessing how energy cost and project capital cost could be optimised, by establishing the comparative benefits and payback times for additional installations to the baseline building.

With further rebuild stages to come, the configuration of central plant was an important consideration. Enercon built an energy model of the Stage 2 Rebuild for the building envelope and HVAC plant, and used this to calculate both annual energy use for the baseline building and the effect that adjustments (such as an improved central plant) would have on that use.

"The process was used as a means of saving both energy use and costs and capital investment costs, while ensuring the building remained comfortable and usable," said Sam. "EECA contributed funding to make sure the project happened, because they knew there would be a return on the investment through the energy efficiency."

"Once the baseline energy model was in place, we could see the results of making changes to different parts of the hospital. If you look at heat recovery from returned air or equipment waste heat, some parts of the hospital might have significantly more payback than others because of the amount of air/waste heat able to be recovered in those areas."

From the energy model, Enercon could make energy efficiency recommendations and provide business cases for each area of the hospital, which was important to get approval for the project.

Following a feasibility study for appropriate central plant (conducted in conjunction with Powell Fenwick Consultants), the study validated multiple ground source heat pumps, which will now replace the pre-2011 LPG boiler and screw chiller setup, resulting in increased plant efficiency. A single ground source heat pump was found to be around four times more efficient for the Stage 2 building than a single LPG boiler for the type of central plant in operation. Also, the configuration of the plant meant that having multiple heat pump units allows each unit to operate at maximum efficiency more often.

Along with the energy study, Enercon carried out an overheating risk assessment, to address areas of the building envelope where solar gain caused overheating in intermittent spaces. Enercon was able to assess client comfort at certain temperatures in the spaces, which reduced the amount of air conditioning required for unnecessary cooling.

Enercon also assessed the insulation specifications, with interesting outcomes. "Often a high level of insulation is habitually specified in a building design. When we checked how much insulation was really required, we found that going beyond minimum insulation was not necessary because the central plant was designed to be very energy efficient, and additional insulation did not provide significant additional cost savings. We were able to demonstrate that, with central plant in place designed for optimal energy efficiency, insulation could stay at a minimum and capital costs could be saved," said Sam.

The overall energy efficiency and savings calculations have been made for the Stage 2 Rebuild project (compared to pre-2011 plant and code building fabric):

- Anticipated energy savings = 1.3 million kWh/year
- Anticipated cost savings = $210,000/year
- Expected capital cost of additions to the baseline buildings = approx $470,000
- Simple payback period = approx 2.2 years
- Internal Rate of Return (IRR) = 44%
- Net Present Value (NPV) = $980,000 (10 years), $2.3M (25 years)

The project at St George's is ongoing. Having worked on two stages of the concept and detailed design, Enercon will now be working on finalising central plant design for Stages 2 and 3, and ensuring the designed buildings are commissioned correctly and optimised for energy efficiency once built.

The company

Enercon is an energy and utility consultancy established in 2004, and employs a team of engineers.

The two senior engineers, Kees Brinkman and Sam Roose, are Accredited *EnergyMasters Auditors*, with a combined experience of 45 years in achieving energy savings (and adding value) for industrial, institutional and commercial clients.

For more information, see **www.enercon.co.nz**

"Enercon's modelling and advice has given me the comfort of knowing that St George's has considered and validated the energy efficient (and therefore environmentally friendly) solutions on offer to benefit future generations."
Greg Brooks, CEO, St George's Hospital.

"Enercon integrated well with Powell Fenwick Consultants to assess energy efficiency initiatives and their cost benefits for the St George's Hospital Stage 2 project. Enercon provided independent verification of the energy efficient measures integrated by the design team to provide St George's Hospital with certainty and comfort that the correct decisions were being made."
Scott Waller, Powell Fenwick Consultants.

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