

## Good Practice Case Study

Installation of Decentralised Natural Gas  
Condensing Boilers at Lagan Valley  
Hospital, Lisburn



Decentralisation, as the name implies, involves replacement of large centralised boiler plant by a number of smaller localised more efficient boiler systems. At Lagan Valley Hospital, the benefits resulting from the decentralisation of boiler plant and the installation of condensing gas-fired boilers include:

- **Annual Cost Savings of over £15,000**
- **Carbon dioxide savings of over 240 tonnes/annum**
- **Payback period of about 7.6 years**

### Lagan Valley Hospital

Lagan Valley Hospital, situated on Hillsborough Road Lisburn, is an acute district general hospital serving a population of approximately 100,000 people living within the Lisburn City area in addition to patients from beyond the City Council boundaries. The original buildings on the hospital site date from the 1840s and the early days of the Irish Poor Relief Act, with the workhouse buildings designed to accommodate 800 people. It was administered by the Governors of the Lisburn Union and became functional in 1841. In the late 1920s the Lisburn and Hillsborough District Hospital was formed but it was not until the inception of the National Health Service in 1948 that the name became Lagan Valley Hospital. In the 1960s the residential and recreational accommodation for medical and nursing staff, the Geriatric Unit [now Department of Elderly Medicine] and the Main Ward Block Tower were erected on the site. During the past decade the hospital has been managed by the Down and Lisburn Health and Social Services Trust and focus has been placed on the development of modern high-quality facilities in patient areas to make them suitable for modern methods of patient care.

### The Project

Prior to 1999 the Lagan Valley Hospital site district heating was supplied by a centralised gas fired steam raising boiler plant. Owing to ongoing maintenance problems and the inefficiency of the steam distribution network, the Trust embarked on a programme of decentralisation. The decision to install, where possible, wall mounted gas condensing boilers was also a benefit, as they were restricted to reusing existing plant rooms.

In April 2002 the Trust formulated a project to decentralise the staff accommodation, a joint IT Department, the Staff Children's Nursery and the Ambulance Station. This project received 100% funding from the Northern Ireland public sector Central Energy Efficiency Fund and was completed in 2003.



Natural Gas condensing boilers at Lagan Valley Hospital

### Merits of Decentralising Steam Boilers

Decentralisation involves replacement of large centralised boiler plants, typically generating steam, by a number of smaller localised boiler systems. The most common centralised systems distribute medium or low pressure steam to local steam calorifiers feeding individual low pressure hot water (LPHW) systems. There are a number of potential energy savings from decentralisation. For instance, the central steam boiler plant could be significantly oversized due to changes in load patterns or building use, resulting in low overall steam boiler efficiency. In addition, and depending on the age of the system, there may be significant energy losses from steam and condensate return distribution systems. Furthermore, in order to ensure security of steam supply the steam mains may be kept live constantly regardless of individual LPHW system requirements.

Further benefits of decentralisation include reduced water treatment costs, reduced maintenance costs, elimination of statutory inspections and improved working conditions.

## Condensing Gas Boilers

The advantage of condensing boilers stems from the fact that most fuels contain hydrogen and, when the fuel burns, the hydrogen reacts with oxygen to produce water vapour. In non-condensing boilers this water vapour passes straight through the boiler heat recovery system and is lost out of the flue along with the other combustion gases. In general the flue gas exit temperature remains above 120°C to prevent condensation of the water vapour. This is essential for many fuels that contain traces of sulphur in order to prevent corrosive acids condensing out along with the water vapour and giving corrosion problems in the heat exchangers and flue gas system.

In natural gas-fired condensing boilers some or all the latent heat contained in this water vapour is recovered. Flue gases containing water vapour start to condense at 55C, but a flue gas temperature as low as 35C is usually required to achieve 100% latent heat recovery. An improvement in efficiency of 5-8% is possible over non-condensing boilers. However, the LPHW return water temperature has to be lower than 50C before flue gases start to condense.

## Energy and Cost Savings

Before this project the boilerhouse at Lagan Valley Hospital used 9,500MWh of natural gas at an annual energy cost of £118,400. Table 1 summarises the project benefits.

**Table 1 - Project Benefits**

	Predicted	Post Project Evaluation
Gas Savings	2,090 MWh	1,197 MWh
CO <sub>2</sub> Savings	425 tonnes/yr	244 tonnes/yr
Capital Cost	£86,000	£114,700
Savings	£22,100	£15,000
Payback Period	3.9 yrs	7.6 yrs

## Considerations for Other Sites

The following should be considered when decentralising central boiler plant:

- Building control and fire safety regulations requirements at the outset of the project;
- Selection of boiler type and size;
- Existing plant room space restrictions for new boiler plant;

- The formation of copper sulphate in the gas line to the boiler jets which can result in operational difficulties with the condensing boilers. This problem was resolved at Lagan Valley Hospital by treating the pipework internally;
- A significant reduction in maintenance time associated with the steam main and LPHW system. This analysis was not included in the Lagan Valley Hospital project economics.

## Project Conclusions

The project was installed, commissioned and is operating to the Trust's satisfaction. Minor technical problems still persist as a result of changing the system to a pressurised heating system; however, the heated environment is maintained at an acceptable level. The project has met with expectations and the Trust continues to decentralise where possible within the site. The Trust's objective within the next 2 - 3 years is to completely replace existing steam raising plant with LPHW boilers.

## Supporting Information

For further information on the Central Energy Efficiency Fund see website

<http://www.psecni.gov.uk/>

## Publications from the Carbon Trust

For details of the Carbon Trust's services and free publications, call the helpline on 0800 85 20 05 or visit the website

[www.thecarbontrust.co.uk](http://www.thecarbontrust.co.uk)

## Other Publications

GPG 369 - Energy Efficiency Office - Energy efficient operation of boilers

GPCS 134 - Energy Efficiency Office - Decentralisation of steam supply on small industrial site

Energy Efficiency Office - Good Practice Guide 312 - Invest to Save?

## Further Project Information

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