

## Good Practice Case Study

### Conversion of Major Boiler Houses to Natural Gas at Queen's University Belfast



Converting to natural gas from oil could save money and provide a number of other benefits for a site. These include reduced emissions, reduced fuel deliveries and reduced maintenance costs. At Queen’s University Belfast, it was impossible to quantify the benefits resulting from the conversion because there was a marked increase in building occupancy and use patterns were dramatically changed immediately after the boiler upgrade. However the predicted benefits before installation included:

- **Potential Annual Cost Savings of over £45,000**
- **Potential Carbon Dioxide Savings of over 2,300 tonnes/annum**
- **Potential Payback Period of about 2.0 years**

### Queen’s University Belfast

Queen’s University Belfast is the ninth oldest university in the United Kingdom and was founded as Queen’s College in 1845. The estate comprises over 250 buildings, of which over 100 are listed as being of special architectural interest. There are also playing fields and grounds extending to over 100 acres. The majority of the buildings are located in the main campus area of south Belfast. The buildings range from the original Victorian Lanyon Building of 1845 through to the modern purpose-built properties constructed in the last decade. A major capital investment programme is under way, including plans for a £45 million new library to be completed in 2009.

### The Project

This project involved the conversion of five main boiler houses on the Queen’s University Belfast site from heavy fuel oil or gas oil to natural gas. The five boilerhouses supply heat to a total of 22 buildings, which mainly consist of science and engineering teaching buildings, one student accommodation building and one sports centre complete with swimming pool. This project received 100% funding from the Northern Ireland public sector Central Energy Efficiency Fund and was installed and commissioned in April 1999. Alterations to the original specification were made to allow for dual fuel Ecoflame burners to be installed. The extra cost was borne by the Queen’s University Estates Department.

### Energy and Cost Savings

Before the boiler conversions the heat energy consumption for the five boiler plants at Queen’s University was metered at 25,313MWh, with a total annual energy cost of £248,000. Table 1 summarises the project benefits.

**Table 1 - Project Benefits**

	Predicted	Post Project Evaluation
Gas Consumed	25,313 MWh	28,603 MWh
CO <sub>2</sub> Savings	2,360 tonnes/yr	2,053 tonnes/yr
Capital Cost	£92,000	£110,000
Savings	£45,700	£0*
Payback Period	2.0 yrs	N/A*

\*The building occupancy increased significantly and thus savings could not be accurately monitored or analysed.

### Conversion to Natural Gas

There are three main drivers for converting from to natural gas. The first is the lower cost of natural gas compared to other fuels, especially the cleaner fuels, such as gas oil and kerosene. In this particular project natural gas was similar in cost on a £ per MWh basis to heavy fuel oil (HFO), but only half the price of gas oil, LPG or off peak electricity. However, the relative costs of alternative fuels may vary considerably depending on energy market developments.

The second driver is the lower environmental impact of natural gas. Compared to HFO and gas oil, natural gas based systems emit 27% and 24% less CO<sub>2</sub> respectively. Additionally, natural gas provides cleaner combustion, improved controllability, a reduction in sulphur dioxide (SO<sub>2</sub>) and particulates emissions, and reduced maintenance costs

The third driver is the efficiency benefit for natural gas based systems compared to HFO systems. This efficiency improvement comes from the elimination of HFO storage tank heating, the higher combustion efficiency of natural gas compared with HFO and the ability to install condensing boiler systems.



### Considerations for Other Sites

- Dual fuel (natural gas/gas oil) burners could be up to 30% more expensive than standard burners.
- The ventilation in the boilerhouse may need to be upgraded to comply with CORGI regulations. In this project the existing ventilation worked well under the original arrangements for use with oil; however, increased ventilation was necessary and this has led to greater risk from frost during winter.
- The response time for the gas burners to reach steady state burning is up to 2 minutes longer.
- Lack of expertise with industrial gas appliances in Northern Ireland has been a problem. For this project the site plant operators required training on CORGI gas regulations.
- Care must be taken to match burner operating pressure to the gas supply pressure.
- Savings due to increased boiler efficiencies should be expected when converting to natural

gas from fuel oil. In this project these savings were offset by increased building use.

- A further benefit of converting to natural gas is the reduction in fuel deliveries by road tanker.

### Project Conclusions

During interruptions in the gas supply, the University uses gas oil as the alternative fuel. This has the advantage of retaining and reusing the existing oil tanks, allowing the University to choose the most cost effective fuel and protecting it from large variations in the market price of both natural gas and gas oil.

If the site had still been on HFO, energy costs would be in the region of £130,000 higher because of the rise in HFO price. A 3 year capped price contract has helped protect the University from the 50% increase in oil and gas prices experienced by other University sites.

### Supporting Information

For Further information on the Central Energy Efficiency Fund see website:

[www.psecni.gov.uk](http://www.psecni.gov.uk)

DUKES - Digest of UK Energy Statistics  
[www.dti.gov.uk/energy/inform/dukes](http://www.dti.gov.uk/energy/inform/dukes)

DEFRA - [www.defra.gov.uk](http://www.defra.gov.uk)

### Publications from the Carbon Trust

GPG381: Energy Efficient Boiler and Heat Distribution Systems

GPG369: Energy Efficient Operation of Boilers

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

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

### Further Project Information

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