

Good Practice Case Study

CHP Installation at Ards Leisure Centre



Combined Heat and Power (CHP) achieves efficiencies of 60-80% or more and can make significant overall energy, cost and carbon savings compared to conventional forms of electricity generation and heat only boilers. At sites with relatively constant heat demands the installation of a CHP system can lead to significant cost and carbon savings. At the Ards Leisure Centre, the benefits resulting from the CHP installation include:

- **Annual Cost Savings of over £35,000**
- **Income from the sale of electricity of £7,800**
- **Carbon dioxide savings of over 310 tonnes/annum**
- **Payback period of about 4.1 years**

Ards Leisure Centre

Ards Borough is located 10 miles from Belfast City and has Strangford Lough at its heart. Ards Borough Council has two leisure centres, Ards Leisure Centre in Newtownards and the Comber Leisure Centre. Both of the centres have a wide range of facilities. Ards Leisure Centre is the centre for swimming, and it includes a sports hall, exercise suite and outdoor pitch. It is open to the public for more than 80 hours per week.

The Project

A Nedalo 210kW_e (210kW electrical output) gas fired reciprocating engine CHP unit was installed to provide the base load heat requirement for the leisure centre. Most of the electric power generated by the CHP unit is used on site, with surplus electricity wheeled to other Council sites when necessary. The CHP unit consists of a natural gas engine, alternator, heat recovery system, stainless steel exhaust silencers and acoustic housing. The installation of the unit required the removal of a disused oil tank and additional building works, including a new natural gas supply system, new exhaust flue, ventilation ductwork, electrical connections including G59 protection and emergency standby facility. The CHP heat recovery system was connected to the low pressure hot water (LPHW) system providing heat for the whole leisure centre with a heat rejection radiator for any excess heat. This project received 100% funding from the Northern

Ireland public sector Central Energy Efficiency Fund in April 2002 and was installed and commissioned in March 2003.



Background to CHP Technology

Conventional power stations have an electrical generation efficiency of between 35% and 40% the remaining 60% being low grade heat lost to the atmosphere or water. Thermodynamic constraints limit steam power plant efficiencies to under 50%, with typical efficiencies of under 40%. The most advanced natural gas combined cycle plants achieve maximum efficiencies of about 55%. Taking into account grid transmission losses from power plant to end user, overall electricity generation efficiencies could be as low as 35%.

Combined Heat and Power is a technology that has been used for over 100 years to generate electricity and heat for use in community heating schemes and industrial processes. CHP plants generate electricity at slightly lower efficiencies than conventional power plants, but the overall efficiency of a typical CHP plant can be as high as 70-75% because waste heat from the generator is recovered and used.

The benefits of CHP depend on the application. A key determinant is the heat to power ratio of the site. For a typical building, a CHP plant could increase the overall energy efficiency for the site by up to 25-35% with a corresponding decrease of energy costs and greenhouse gas (GHG) emissions. Traditionally CHP units have been used for large-scale industrial applications using coal, fuel oil or natural gas to run steam turbines or gas turbines. More recently smaller scale reciprocating engines have been used in leisure centres, hospitals and care homes, hotels, housing developments and other government buildings.

Energy and Cost Savings

Before the CHP installation the annual electricity and heat energy consumption for the Ards Leisure Centre was metered at 915MWh and 3,094MWh respectively, with a total annual energy cost of £112,000. Table 1 summarises the project benefits.

Table 1 - Project Benefits

	Predicted	Post Project Evaluation
Reduced Grid Electricity	769 MWh	776 MWh
Increased Gas Consumption	1,134 MWh	1201 MWh
CO ₂ Savings	343 tonnes/yr	315 tonnes/yr
Capital Cost	£140,200	£143,100
Additional Maintenance Cost	£9,500	£10,500
Cost Savings	£42,000	£35,100
Income from Electricity Wheeling	£3,400	£7,800
Payback Period	3.3 yrs	4.1 yrs

Considerations for Other Sites

- Accurate sizing that corresponds to individual project needs and continuous monitoring of a CHP unit is crucial to realising the benefits from its installation. If the CHP is poorly designed, installed and operated the overall efficiency of the system reduces greatly making the installation uneconomic to run. Agreements should be made from the start to ensure performance; these should include monthly reporting on actual savings.
- Wheeling electricity could be too complex for some sites and this should be taken into consideration from the onset. Special agreements with electricity suppliers could be sought where necessary. The Ards Leisure Centre agreed upon a simple credit system with their electricity supplier. However, this may no longer be available due to recent regulatory changes.
- CHP maintenance costs are a significant ongoing financial burden and over the lifetime of the system could cost as much as the initial capital outlay. Maintenance costs should be negotiated at the tender stage as costs could increase from year to year. The most effective type of maintenance agreement is on a per kWh generated basis. If this were not available an alternative would be on an hours run basis.

Project Conclusions

The installation and commissioning of the system were satisfactory. The CHP system's operation and benefits have impressed staff at the site and Ards Borough Council have registered the CHP unit under the CHP Quality Assurance (CHPQA) programme. This will help to reduce the cost of Climate Change Levy on natural gas to the building when the current exemption ends. The CHP unit provides emergency back-up power in the event of a Northern Ireland Electricity outage thus obviating the need to install a standby generator.

Supporting Information

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

www.psecni.gov.uk

Publications from the Carbon Trust

GPG388 - Combined Heat and Power for Buildings

FL87 - Saving Money With Combined Heat and Power

GPCS458 - CHP at an Engineering Company

GIR082 - The Managers Guide to Custom Built Combined Heat and Power Systems

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

The Combined Heat and Power Association

Website: www.chpa.co.uk

The Combined Heat and Power Quality Assurance Scheme

Website: www.chpqa.com

Other Publications

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

Further Project Information

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