1. Summary

In October 2012, an assessment of energy saving opportunities at Stratheden Hospital was undertaken by Mabbett, Consulting Engineers, on behalf of the Carbon Trust. The primary objective of the report was to identify options to improve the existing provision of heating and hot water services within the hospital. The report considered a number of alternative methods to provide heating and hot water services, including biomass, CHP and full decentralisation of the central steam raising boiler plant. Following evaluation of the options, the report recommended that full decentralisation of the existing boiler plant would provide the best solution for the hospital.

NHS Fife made an application for funding to Health Facilities Scotland, as part of the Carbon Reduction Programme, to replace 2 no. existing steam raising gas boilers with high efficiency gas fired boilers located within existing and new plantrooms. The application for funding was successful and was made available in 2013/14 financial year. Work started on the replacement of the centralised boiler plant in September 2013 and was completed end of March 2014.

The localised gas boilers have been operational for more than 12 months and gas consumption through the main site gas meter for 2014/15 compared to the previous year has reduced by more than 35% in absolute terms, equivalent to 3753326 kWh, and 34% when weather compensated.

2. Introduction

Stratheden Hospital is a community hospital providing clinical services, primarily mental health, and is located approximately 1 mile to the west of Cupar. It is typical of a hospital built in the Victorian era (1860’s), with a number of buildings spread over a large area. Developments over the last 20 years have seen much of the core, older buildings vacated, while new buildings have been built on the periphery of the site. These new buildings have localised boiler plant installed and have not required connection to the steam services that fed the older buildings. In addition, a number of the older buildings had been previously converted to localised gas fired heating and hot water services, removing the need for steam supplies. The impact of this partial decentralisation on the central boiler plant over this period has been to reduce the efficiency of the plant and increasing operating costs, etc.
The central steam raising boiler plant was located in the main boilerhouse to the north of the site. This supplied steam to a number of plantrooms, and crucially, steam to the plantroom providing heating and hot water to Ward 21, the furthest point from the central boilerhouse. While the age and condition of the steam boilers were also giving concern, the priority for the site was to improve efficiencies of the heating and hot water services.

The recommendations from the Carbon Trust report were taken forward by Alan Wilson, Estates Manager, now Acting Head of Estates, who acted as the Project Manager, Paul Paterson, Estates Officer and Colin Todd, Estates Officer, acted as the Technical Advisers for the project and Mark Valentine, Head of Asset Planning and Sustainability who acted as the Project Director.

3. Objectives

Decentralisation of the central steam boilers with localised high efficiency gas fired LTHW gas boilers was anticipated to provide the following savings and benefits:

- A reduction in the consumption of natural gas in the order of 3,324,135 kWh per annum.
- A reduction in energy costs in the order of £100,680, based on 2011/12 gas prices.
- A reduction in the amount of CO₂ emissions in the order of 610 tonnes.
- An improvement in the energy performance of the site compared to Encode good practice benchmark.
- Support continuing efforts to rationalise the site and align infrastructure services with future clinical service needs.
- Reduce backlog maintenance burden for NHS Fife.

4. Outcomes

The new gas fired boilers have been operational for 15 months, from April 2014, and comparing the financial year 2014/15 to the previous year gas consumption, an overall reduction of more than 35% has been achieved. This is equivalent to 3753326 kWh of gas (2013/14 – 10455705 kWh minus 2014/15 – 6702379 kWh).

When consumption figures are compensated to take account of weather conditions, a reduction in gas consumption of 34% has been achieved, equivalent to 3545723 kWh.

The improvement in efficiency as a result of not having to supply steam to remote locations is most obvious in the reduction in baseload for the site. A regression analysis of the consumption figures compared to degree days shows a difference between the baseload for 2013/14 and the baseload for 2014/15 of 217886 kWh per month, a total of 2614632 kWh per annum. The removal of standing losses has had the biggest influence on the amount of savings achieved.

The actual financial saving for the financial year 2014/15 was in the region of £113,334. Conversion of the kWh figure into CO₂ emissions using the 2014/15 conversion factor of 0.184557 kgCO₂/kWh provides a reduction in the amount of emissions by 693 tonnes. The 2014/15 cost per tonne of CO₂ in the forward sale for CRC was £15.60 and the cost saving as a result of the energy reduction in the number of allowances required was £10,806.

The total financial savings from the energy reduction is calculated as £124,141.
Scottish Health Technical Memorandum 07-02: EnCO.de – making energy work in healthcare provides guidance on the consumption of energy in healthcare buildings. The suggested energy performance for a Community Hospital is given as 65 GJ/100m³, with a split between electricity and fossil fuels being 21% and 79% respectively. The good practice figure suggested for a Community Hospital is given as 50 GJ/100m³.

Based on 2013/14 figures, the energy performance for Stratheden Hospital site was 76.47 GJ/100m³ with a fuel split of 11% electricity and 89% fossil. A significant improvement in the energy performance of the site was seen in 2014/15, reduced to 53.86 GJ/100m³ and at the present time is anticipated to improve further in 2015/16 to 51.64 GJ/100m³.

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<tbody>
<tr>
<td>Encode Good Practice</td>
<td>76.47 GJ/100 m³</td>
<td>53.86 GJ/100 m³</td>
<td>51.64 GJ/100 m³</td>
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<tr>
<td>Heated Volume</td>
<td>65477 m³</td>
<td>65477 m³</td>
<td>65477 m³</td>
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<tr>
<td>Total Actual Energy</td>
<td>1390812 kWh</td>
<td>9795466 kWh</td>
<td>9392308 kWh</td>
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<tr>
<td></td>
<td>50068 Gj</td>
<td>35264 Gj</td>
<td>33812 Gj</td>
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<thead>
<tr>
<th></th>
<th>Electricity</th>
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<tbody>
<tr>
<td>% Encode Energy Split</td>
<td>20.9%</td>
<td>79.1%</td>
<td>20.9%</td>
<td>79.1%</td>
<td>20.9%</td>
<td>79.1%</td>
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<tr>
<td>Encode Energy</td>
<td>2906733 kWh</td>
<td>11001079 kWh</td>
<td>2047252 kWh</td>
<td>7748214 kWh</td>
<td>1962992 kWh</td>
<td>7429316 kWh</td>
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<tr>
<td>Actual Energy</td>
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<td>12432390 kWh</td>
<td>1456229 kWh</td>
<td>8339238 kWh</td>
<td>1450278 kWh</td>
<td>7942031 kWh</td>
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<tr>
<td>% Actual Energy Split</td>
<td>10.61%</td>
<td>89.39%</td>
<td>14.87%</td>
<td>85.13%</td>
<td>15.44%</td>
<td>84.56%</td>
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Monitoring of the gas consumptions through the main gas meter to the site will continue to verify the savings that are anticipated from the project.

The future use of the site in terms of clinical service provision is currently under development and a new IPCU building is currently under construction. Clinical service managers are determining their requirements and a masterplan detailing essential buildings and those that can be declared surplus will provide opportunities to further improve the efficiency and performance of the site. The decentralisation of the steam boilers will allow a more flexible approach to be adopted in this exercise.

As a result of the installation of the new boilers, etc, total backlog maintenance costs (risk rated and impending) were reduced by £579,397.
5. Additional Information

![Chart 1: Stratheden Hospital Main Gas Meter](chart1.png)

- Consumption - kWh
- Degree Days
- Regression Analysis - Stratheden Hospital

![Chart 2: Regression Analysis - Stratheden Hospital](chart2.png)
Existing Central Steam Raising Boiler Plant

Replaced with installations in plantrooms