

Ketley Town Junior School, UK

1 Photos



Figure 1: Ketley Town Junior School



2 Project summary

Project objectives:

The main aim of the project was to trial the effectiveness of a new burner management system on the boilers at the school in order to determine whether the system was worth investing in at other schools in the local authority area. The system was provided by the manufacturer (GasForce) on a sale or return basis.

Short project description:

Two burner management units were installed, one on each of the two boilers at the school. Tests were then carried out by operating the boilers on alternate days with and without the burner management units switched on. Initially gas meter readings were taken each day but when the results were checked no energy savings were evident. However, following the re-commissioning of the system and the installation of an "Eco Warrior" energy monitoring system at the school, which monitors energy consumption on a half hourly basis, further trials were carried out that did demonstrate significant energy savings.

Stage of construction:

The project was completed in 1999.

3 Site

Telford, UK, latitude: 52.4°N., longitude; 2.3°W. Altitude: 120 m. Temperate coastal climate. Mean annual temperature (Midlands): 10.1°C, mean winter temperature: 4.8°C.

4 Building description /typology

4.1 Typology / Age

Typology/Age	Pre 1910	1910-1930	1930-1950	1950-1970	1970-
The main hall school				1	

1. Scola design
Educational level: Primary

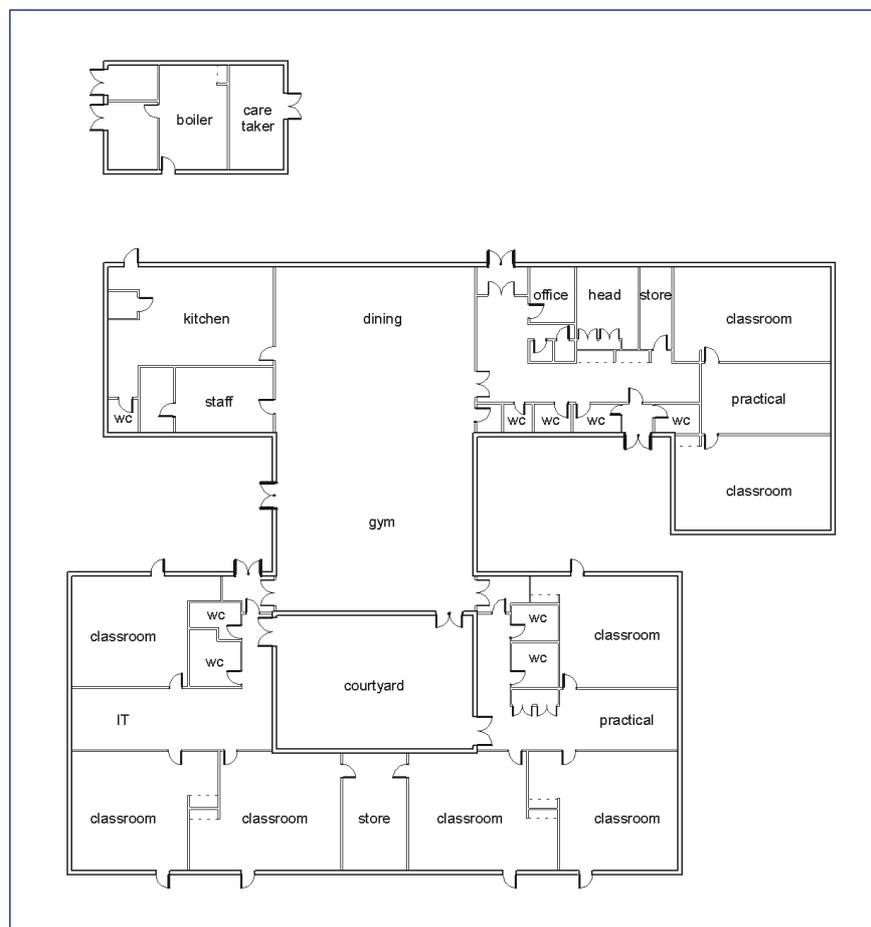
4.2 General information

Year of construction: 1966
 Year of renovation (as described here): 1999
 Total floor area (m²): 1,326 m²
 Number of pupils: 219
 Number of classrooms: 8
 Typical class room size (m²): 49 – 54m²
 window/glass areas (m²): Not available
 number of pupils: 27

Hours of operation: Normal junior school day. 9 am to 3.30 pm and there is an average of 2 hours per night of clubs and other activities for 5 days a week.

1.4.3 Architectural drawings

Figure 2: Floor plan



5 Previous heating, ventilation, cooling and lighting systems

The school is heated by a gas boiler and radiator system, with natural ventilation. The lighting is standard fluorescent lighting.

There were no specific problems with the heating system at the school. Ketley Junior School was selected for the trial of the burner management unit as it was considered to be typical of the 68 primary schools managed by Telford and Wrekin Council.

6 Energy saving features

6.1 Energy saving concept

The main energy saving feature of the project was a burner management system which modifies the burner firing pattern of the boilers to minimise wasteful over-firing. The frequency of firing is reduced, but the water flow temperature to the system is maintained. Significant fuel-input savings are achieved without depletion of system performance. Just as in a car having 'cruise control', unnecessary acceleration is eliminated, whilst a steady speed maintained.

The "Eco Warrior" energy monitoring system that was subsequently installed at the school, as well as demonstrating the energy savings achieved by the burner management system, also has the potential to achieve energy (and water) savings by providing half-hourly data on consumption in a graphical format that is easy to analyse. These displays show the energy being used in "real time", with direct comparison to the energy being used at the same time the previous week, month or year. It operates by monitoring the pulsed outputs from the utility meters, using a computer connected via its serial port to a connection box, from which cables (which can be up to 1,000m long) run to each meter. The requirements for the computer are not onerous by modern standards - in fact it can provide a use for an 80386 or 80486 computer that would otherwise be obsolete. Typically, 10-15% energy savings are achieved as a result of the rapid identification of sources of waste by the system.

6.2 Building

There were no improvements to the building fabric as part of this project.



Figure 3: Burner management unit.



6.3 Heating

See 6.1 Energy saving concept.

1.6.4 Ventilation:

There were no improvements to the ventilation system as part of this project.

1.6.5 Lighting

There were no improvements to the lighting system as part of this project.

1.6.6 Other environmental design elements

The installation of an “Eco Warrior” energy and water monitoring system at the school has enabled the identification of any wastage of energy or water and additional savings due to the elimination of this wastage. A data logger has been installed on each of the burner management units to enable the energy savings to be calculated.

7 Resulting Energy Savings

Laboratory testing of the burner management units by the Building Research Establishment indicated that energy savings of up to 20% may be obtained. In practice, the trials at Ketley Town Junior School demonstrated energy savings in practice of between 8% and 25% depending on the heating load, although over a full year they averaged out at about 10%, or about 16,670 kWh/year in the case of this school.

Further energy savings may well have been achieved as a result of the early identification of any wastage by the “Eco Warrior” system. The cleaner in charge operates the system and keeps an eye on energy wastage. However no specific analyses of the savings due to this have been carried out to date.

8 User evaluation

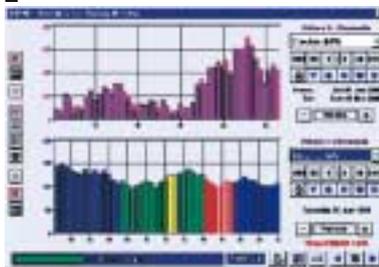
The building occupants are very pleased with both the burner management system and the energy monitoring system, as they feel more in control of their heating costs and able to control their heating more effectively.

The “Eco Warrior” system produces display screens that are very easy and quick to interpret. Four examples are provided below:

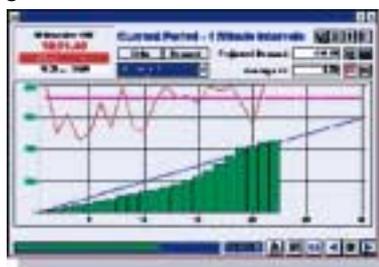
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3



1. Current period data. This displays the current half hour information with historical comparisons with the same period yesterday, last week, last month and last year. Current predicted demand is recalculated every 5 seconds based on data obtained every 100th of a second. Four LED's and an audible alarm give advance warning of excess energy demands. An option for automated demand control is also available. Power factor is displayed real-time giving advance warning before penalties are incurred.

2. Typical profiles. Profiles of daily, weekly, monthly, quarterly and annual use of energy can be displayed at the touch of a button. They are colour coded according to time periods. Profiles can be of units, demands or costs of energy monitored. Clicking on the “Y Q M W D” buttons shows the data as Yearly, Quarterly, Monthly, Weekly or Daily. The “+” and “-” buttons allow data to be displayed as days, weeks, months or quarters in any sub category, i.e. a year in days, weeks, months, or quarters. The Video “<<” “>>” buttons allow movement between years, quarters, days etc.

3. Demand projection display. Shows units used each minute and projects a calculation of cumulative demand and average Power Factor. Data can also be seen non-cumulative as a profile of the half hours energy use. This is often used for analyzing specific equipment.

4. Monitoring and targeting display. The red line shows maximum value and light blue the minimum value allowed for each half hour. These are set using historical data. If the days energy use remains between these values the days graph is green. If it is exceeded it goes red. If it is below it goes blue. If it goes above and below it goes black.



9 Renovation costs

The cost of the burner management units was £1,200 (£600 each). The cost of the four channel “Eco Warrior” system installed at Ketley Junior School was £3,000.

10 Experiences/Lessons learned

10.1 Energy use

The annual energy use at the school was reduced by about 10% following the installation of the burner management units. However it should be noted that this is a small school that was already quite well managed with respect to its energy consumption. Higher percentage savings have subsequently been obtained from burner management units in other schools with larger boiler systems.

The energy consumption at the school in 2001/02 was 212,683 kWh/year for gas and 40,187 kWh/year for electricity.

Eco Warrior systems have now been installed in 15 schools in the Telford and Wrekin Council area. A good example of the potential for these to support the achievement of significant energy savings through good housekeeping came from monitoring the electricity consumption in the kitchens at Moorfield School. Following the installation of some new electrical equipment in the kitchen and an increase in the number of meals being produced, it was expected that the energy and water consumption would rise. However, the electricity, which was being monitored on Eco-Warrior, increased by a much larger than expected figure of around 100%. The following graph (Figure 4) shows how the electricity consumption first increased with the new equipment and then reduced following the simple “good housekeeping” measures that were implemented.

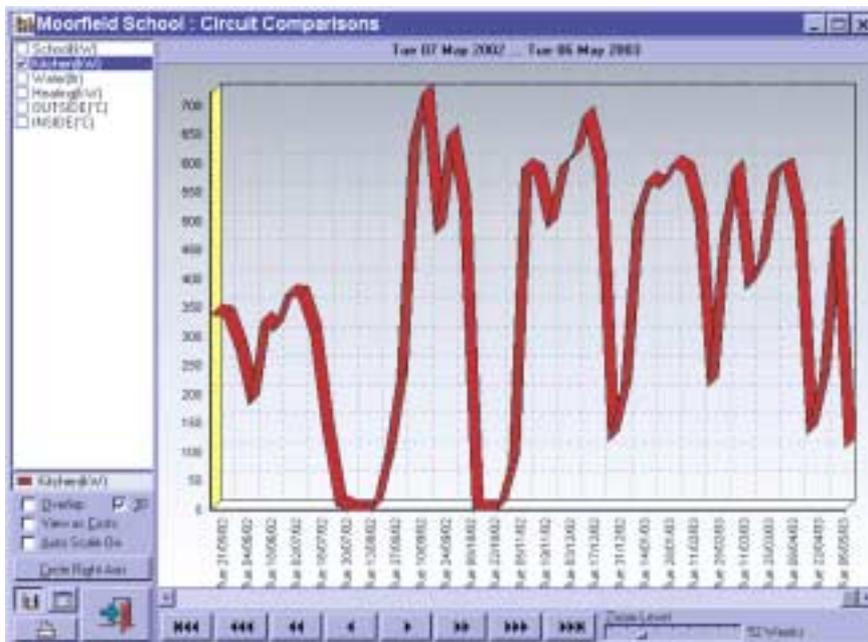


Figure 4: Moorfield School kitchen electricity consumption monitor

1.10.2 Impact on indoor climate

No impact.

1.10.3 Economics

The estimated simple payback period for the capital cost of the burner management units in this case was around 5 years although in some other schools paybacks of 3 years have been obtained. Following the verification of the energy savings in these trials, the burner management units qualified for grants that effectively halved the payback on the user's contribution while the SchoolEnergy Programme was running.

1.10.4 Practical experiences of interest for a broader audience

Telford and Wrekin Council have subsequently installed burner management units at 20% of their sites that account for 80% of their gas usage, with savings of around 10% being achieved in all cases.

The Eco Warrior system has now been installed at 15 schools in the Telford and Wrekin area. Although these are proving to be very useful for the identification of specific sources of energy (and water) waste, they are not currently achieving their full potential. At the Council offices, energy consumption has been reduced by 30% as a result of notifying occupiers of the buildings of the details of energy consumption produced by the Eco Warrior system installed there. Attempts have been made to replicate this in the schools by persuading teachers to use the displays produced by the Eco Warrior system and the underlying data in the classroom as a teaching aid. This could assist in the delivery of the National Curriculum and help raise energy awareness and support a campaign to reduce energy consumption through "good housekeeping" by teachers and pupils. However, this has proved difficult to implement, even where teachers have been keen to make use of the system, for two reasons. Firstly, teachers do not have time to experiment with new initiatives such as this, even where they will help them to deliver the National Curriculum. Secondly, the system is difficult to use in the classroom except with small groups as it is on a separate computer in a corner of the room – the ICT network operators will not allow it to go on to the network, so it cannot be shown to the whole class on the smart board. Attempts are being made to resolve this second problem by either displaying HTML pages of the Eco Warrior output via the internet (although this will not be interactive) or by making the CSV files from the Eco Warrior output available to the network every half-hour (which would support teaching on data manipulation).

1.10.5 Resulting design guidance

In 2002, the Building Research Establishment Ltd (BRE) carried out extensive laboratory testing of the burner management system demonstrating fuel-input savings in a range 6 – 16%. BRE Certification has been given - Certificate No. CFP 234.

11 General data

11.1 Address of project

Ketley Town Junior School
Riddings Close, Ketley, Telford, Shropshire, TF1 5HF.

11.2 Project dates

<i>Project initiation:</i>	1999
<i>Design completed:</i>	Not applicable
<i>Renovation construction completed:</i>	Not applicable
<i>Monitoring and evaluation completed:</i>	2000

11.3 Date of this report/revision no.

29/07/2003

12 Acknowledgements

Builder: Not applicable
Architect: Not applicable
Engineers: Mike Webb, Energy Conservation Officer,
Telford and Wrekin Council
John Kightley, GasForce, Maeswood, The Waen,
Llantsanffraid, Powys, SY22 6SX,
Tel: 01691 828098,
E-mail: kightly@maeswood.freemove.co.uk

National, international support programmes: None

Author (of this description): Alan Pither

13 References

Gasforce website: www.gasforce.com
Eco Warrior website: www.sotaew.co.uk

