



**Assessment of ATC Underfloor Heating System
at
Alexandra Walk Apartments, Whitefriar St, Dublin**



OP – 090

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SUMMARY

This report evaluates the heating system installed in a 2 bedroom apartment in the Adelaide Chambers Plaza development, Dublin. The heating installation is the ATC electric underfloor heating system. The Adelaide Chambers Plaza is a city centre residential apartment development and ATC heating systems are used throughout.

The apartment selected for evaluation (No.31) has a floor area of 68m². All of the rooms are heated with ATC electric underfloor heating cables fixed to the floor slab and screeded over. The bathrooms are similarly heated with both heating cables and temperature sensors laid under the floor tiles.

The heating system is designed to take advantage of low cost night rate electricity to provide heat most of the day and uses day rate electricity to boost heat in the evening. The system is divided into 6 zones and each zone is controlled individually with a ATC wall mounted controller. The controller is used to select the run times for the heating and regulates the room temperature.

The heating was run on test from the 2nd April 07 up to the 16th April 07 to assess the performance of the system and the running costs. Data for typical weather conditions during a heating season was extracted and the system was estimated to use 575 kWh of electricity at a cost of €75 for a 30 day heating period.

The average temperatures recorded over a 24 hour period were:

Living room / kitchen	19 deg C
Bedrooms	18 deg C

The effect of solar gain and the operation of the heating controls are discussed.

The economy of this system is dependent on:

- high levels of insulation and good construction quality
- the use of cheap night rate electricity
- careful heating management, facilitated by the use of ATC zone temperature/timer controllers.

ATC UNDERFLOOR HEATING SYSTEM ASSESSMENT

Introduction

Powertherm was commissioned by ATC Electrical & Mechanical Ltd. to perform an assessment of the underfloor heating system installed in the Adelaide Chambers Plaza apartment development at Whitefriar Street, Dublin. The assessment was carried out on a two bedroom apartment. The objective of the study was to evaluate the heating system performance and assess the running cost.

Overview

This development is a multi-storey city centre residential apartment complex. The apartments were constructed in 2006 and the development is now partially occupied. The heating system installed throughout the development is the ATC Underfloor Electric Heating System. Insulation levels throughout comply with current building regulations.

Test Apartment

The apartment selected for testing is a new 2 bedroom corner unit located on the 1st floor. The accommodation comprises a kitchen / living room area, main bedroom c/w ensuite, 2nd bedroom, bathroom and hallway giving a total floor area of 68m². The apartment has been occupied for a short time by two occupants. Both occupants are working and the apartment is vacant during the day.

There are solid wood floors throughout (and tiles in the bathrooms). The livingroom / kitchen has a full height south facing window (approx 4.5 metres x 2.3 metres). There are adjustable blinds fitted but there are no curtains installed.

The adjoining apartment on one side and the apartment above are occupied. The space below at ground level is vacant and awaiting a fitout for retail or commercial use. There is no ceiling or insulation and it is currently open through to the basement level. This will result in increased heat loss from the apartment above (test apartment).

Heating System

The apartment is heated with braided electric cables laid in the floor slab. The cables are attached to the concrete subfloor and covered with a 35mm gypsum screed.

The area is divided into 6 separate zones: kitchen / living room, hall, bedroom 1, bedroom 2, bathroom and ensuite. Each zone is controlled separately by a local wall mounted ATC time / temperature controller. This has the facility to set 2 timed on / off switching operations each day and control the room temperature to the selected setpoint when the heat is switched on. When the heat is switched off the controller limits the temperature drop to the minimum temperature setpoint (user adjustable).

The room temperatures are sensed in the wall mounted controllers mounted at approximately 1.2m above finished floor level. The temperature sensors in the ensuite and the bathroom are laid in the floor with the heating cables.



Zone time/temperature controller



Living room & hall controllers

Heating installation	
Kitchen / Living Room	2.0 kW
Hall	1.5 kW
Bedroom 1	1.7 kW
Bedroom 2	1.7 kW
Bathroom	0.5 kW
Ensuite	0.2 kW

Test Set Up

The heating system controls were set on the 2th of April 07 and run until 16th April 07. The room controllers were set as follows:

Location	Temp. set point	Time on	Time off	Time on	Time off	Min temp. set point
Living Room	22 deg C	5.00 am	8.00 am	4.00 pm	8.00 pm	14 deg C
Hall	18 deg C	5.00 am	8.00 am	5.00 pm	7.00 pm	14 deg C
Bedroom 1	22 deg C	5.00 am	8.00 am	7.00 pm	9.00 pm	14 deg C
Bedroom 2	22 deg C	5.00 am	8.00 am	7.00 pm	9.00 pm	14 deg C
Bathroom	24 deg C	6.00 am	8.00 am	7.00 pm	9.00 pm	10 deg C
Ensuite	24 deg C	6.00 am	8.00 am	7.00 pm	9.00 pm	10 deg C

Recording Equipment

The electricity used was recorded by a data logger recording electricity used in the house at 15 minute intervals. The wiring configuration did not permit the electric heaters to be separately logged and the logs taken include the cooking load and the lighting load.

The temperature and humidity were recorded in bedroom 1 and the temperature was recorded in the kitchen. The external temperature was monitored by positioning a thermocouple outside the kitchen window. The temperature loggers were set to record at 15 minute intervals coinciding with the electricity logging.



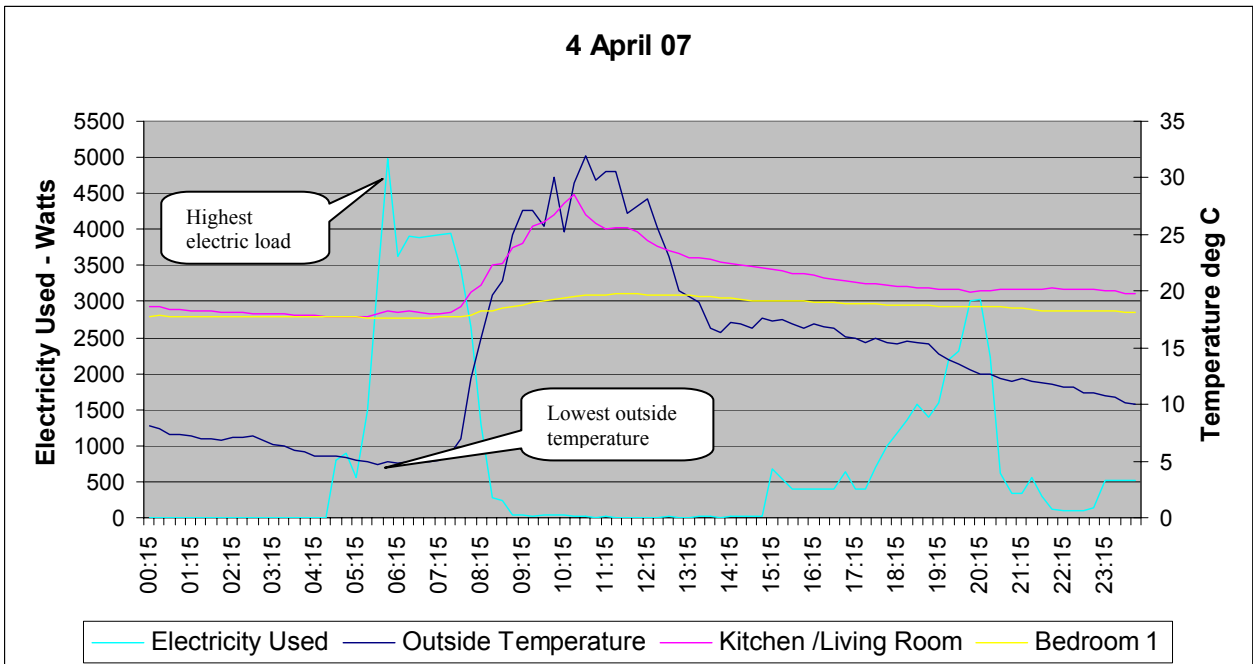
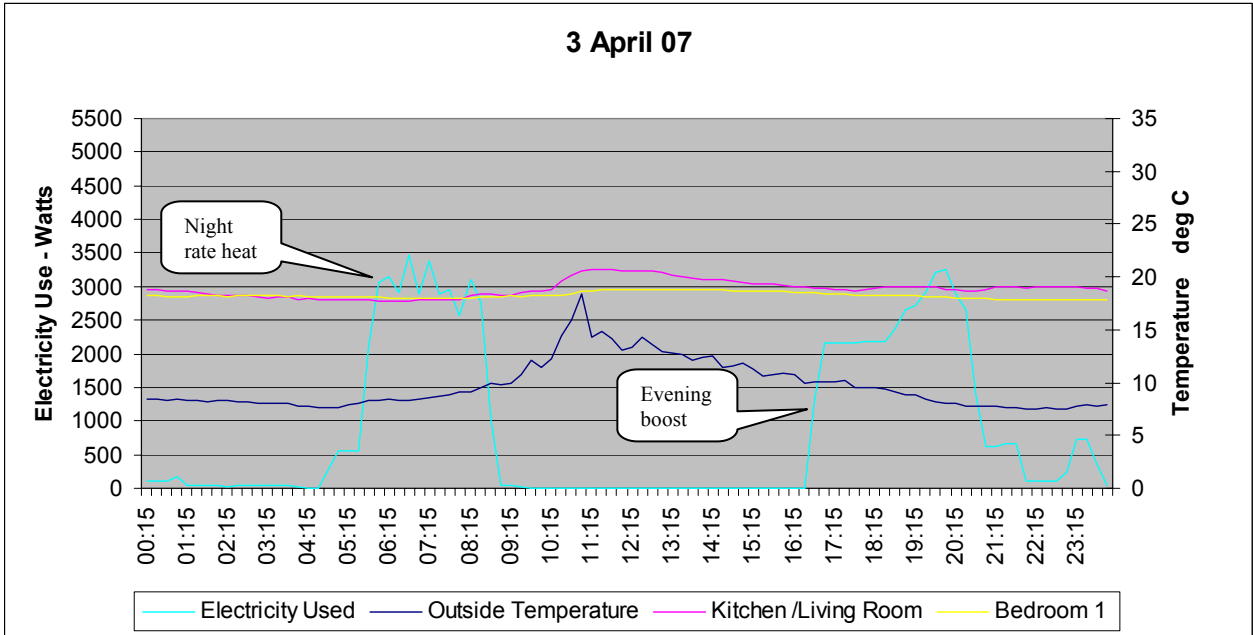
Temperature and relative humidity logger

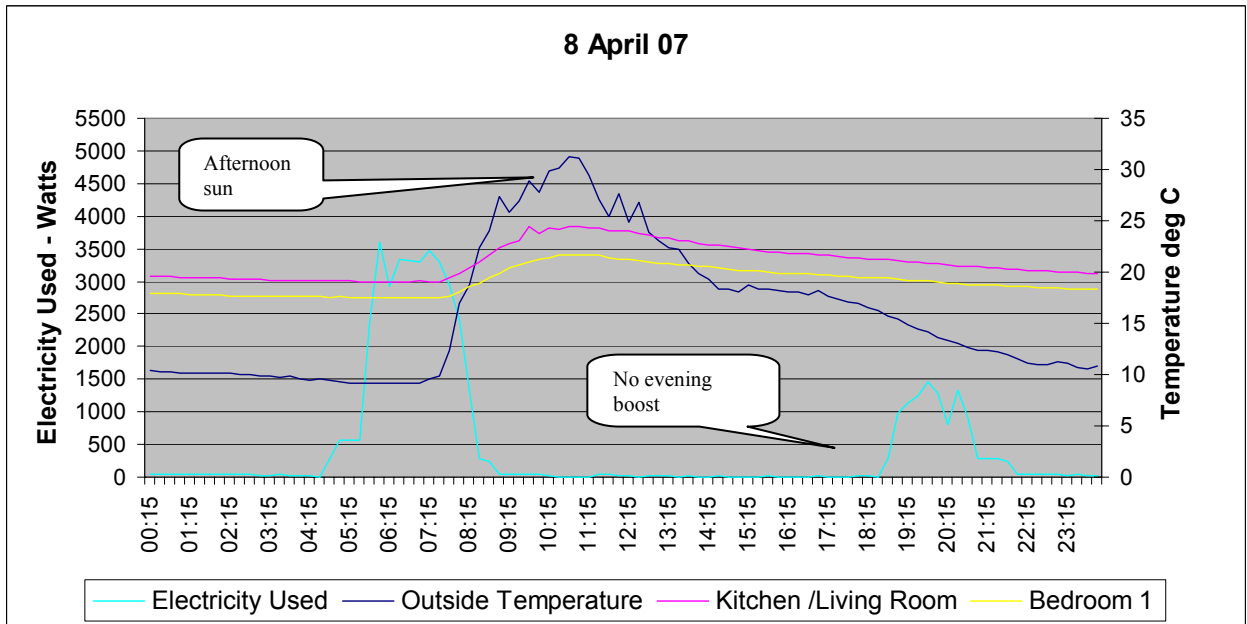
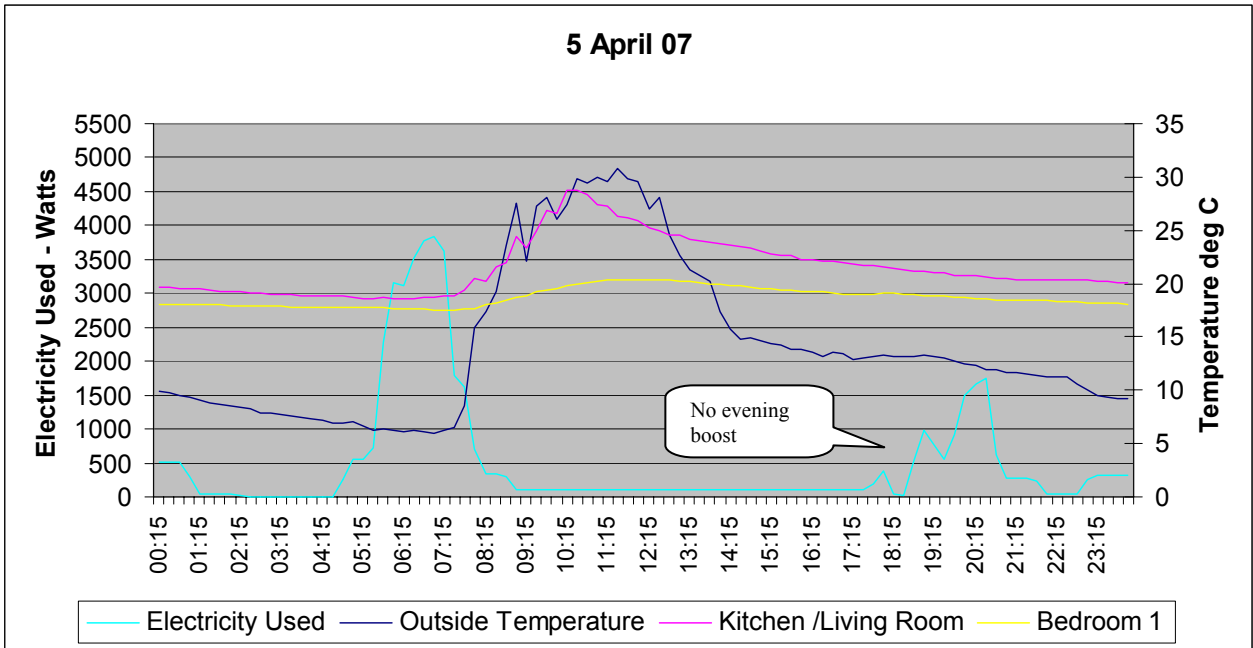
The outside temperature was recorded in a position which was influenced by the afternoon sun.

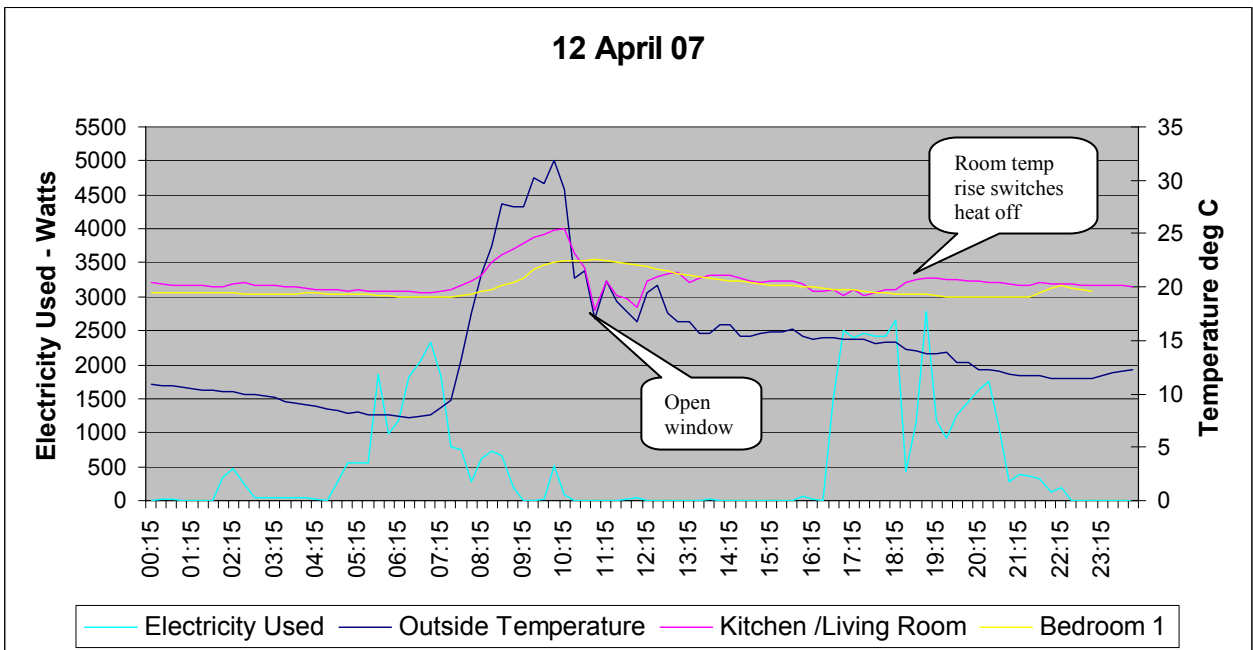
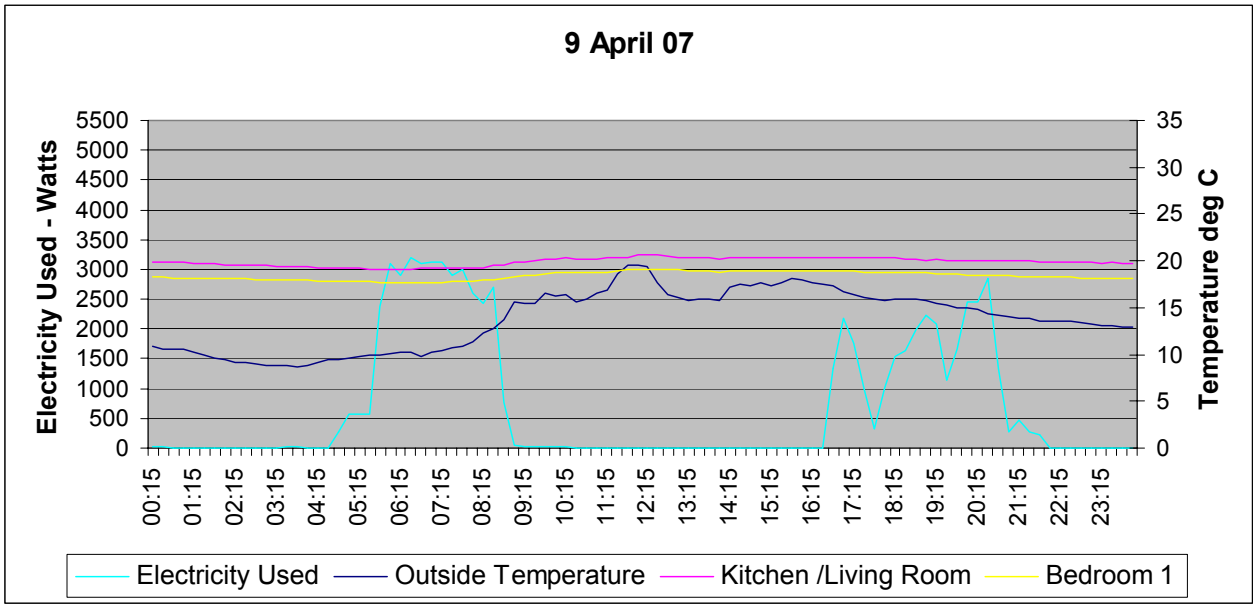
The recording period started on the 2nd of April and finished on the 16th of April.

Test Results

The information recorded is presented in chart form below for a number of recording days.

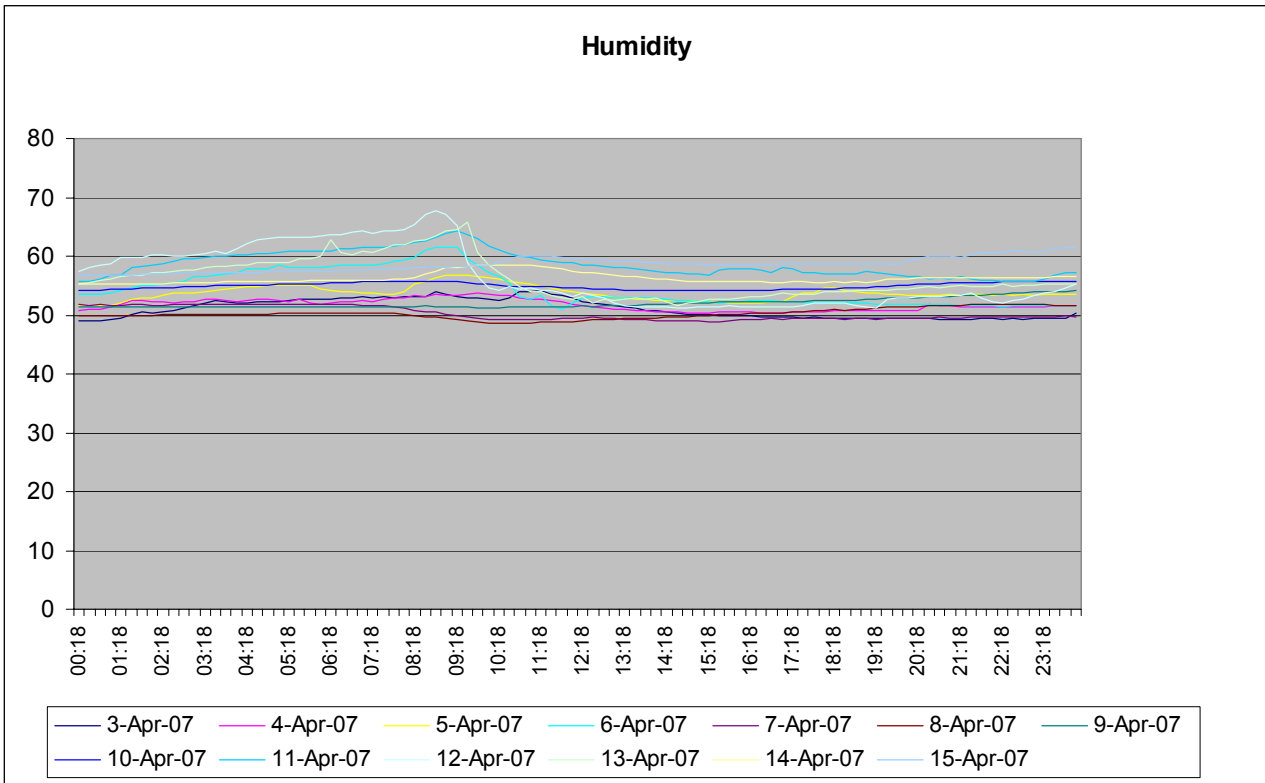






Relative Humidity

The instrument located in the main bedroom also monitored the relative humidity for the test period. The RH is fairly constant over the period and increases overnight with falling temperatures. The small sharp increases are probably caused by the steam from the adjoining shower.



Heating System Evaluation

The mild weather experienced over the test period was not ideal for monitoring the performance of a heating system. Our instruments recorded outside temperatures as high as 31 deg C on one afternoon. The first 2 days of the test are typical of weather conditions during our heating season but the subsequent days were exceptionally warm.

The performance of the heating system is best evaluated by looking at the data for the 3rd April 07. This shows a recorded average outside temperature of 9.5 °C and this compares with an average air temperature of 9 °C measured in Dublin on that day. We note that the annual average Dublin air temperature is 10degC.

The room temperatures recorded in the early morning heat up period are below the set points and the heating system switches on between 5am and 8am. During this period the electrical load is approximately 3kW. This is about half of the connected heating load. The temperature set points on the controller are limiting the heat input to the apartment. The hall will not switch on as it is set at 18 deg C and the room temperature sensors in the other locations (set at 22 deg C) are also limiting the heat input to the floor elements. Our logged temperatures are close to the windows and are reading below 22 deg C at this time.

In the evening the 2 switch-on periods can be seen, between 4pm and 8pm and between 7pm and 9pm. Again the room temperature sensors are reading satisfactory temperatures and limiting the heat input.

The average temperature recorded in the kitchen / living room for the 24 hour period is 19 deg C and in the main bedroom is 18 deg C.

The bathrooms were not monitored separately but the underfloor heating is well suited to maintaining warm, dry and comfortable floors.

The electricity used during this 24 hour period is 21 kWh and the heating cost is estimated at €2.50. (Lights and cooker are included in our logged reading). This equates to €75 for a month under similar ambient conditions (including VAT).

40% of the electricity is charged at night rate (€0.08/kWh) and 60% is at day rate (€0.16/kWh). The overall average unit price is €0.13.

Heating Controls Evaluation

The underfloor electric heating system is essentially a storage heating system with a slow response time. The rapidly changing temperatures experienced over the test period can cause problems for heating controls. The afternoon sun raised the temperature in the south facing kitchen/living room and from the 4th April on the evening boost to the heating system was inhibited either partially or completely. Despite the absence of an evening boost the temperature in the living room stayed at around 20 °C throughout the late evenings.

The ability to control the charge times and temperature settings for each of 6 zones allow the system to run economically and take advantage of weather conditions and occupancy requirements. If zone control were not in place, the cost of running this system with time control only would have been €147 for the month.

Availing of Mild Weather and Solar Gain

The effect of solar gain can be seen throughout the charts by comparing the temperature lines for the bedroom (which has some gains) with the south facing kitchen / living room with full height windows. The heating controls take full advantage of the heat gains.

The electricity used over the test period was 180 kWh at a cost of €1.45 per day and equating to €44 per month (including VAT). 43% of the power is used at day rates and 57% is used at night rate and the average unit price is 12 cents.

This is a reduction of over 40% on our estimate of monthly heating cost at 9degC (i.e. €75) and it is achieved with an ambient temperature rise of 2.5 deg C using good controls and south facing windows.

Concluding Remarks

The economy of this system is dependent on:

- high levels of insulation and good construction quality
- the use of cheap night rate electricity
- careful heating management, facilitated by the use of zone time/temperature controllers.

The prices quoted are the ESB Urban Domestic nightsaver rates applicable in 2007 and include VAT. We have ignored standing charges, as these would be incurred in any case.