

The Research

- **Objectives of the Research**
 - To prove the effectiveness of a standardised package of heating controls under controlled lab conditions, in a building representative of a real world dwelling
- **Research Question**
 - What are the efficiency / cost/ carbon savings of different control packages, different control setups
- **Drivers**

Salford University Energy House



- Test facility is a house built inside an environmental chamber
- The House is representative of a large proportion of existing stock
- Facility opened by DECC Minister Greg Barker
- Designed to test effectiveness of retrofit technologies to reduce energy use

Salford University Energy House



- **House characteristics :**

- Solid wall building
- Single glazed windows
- 100mm insulation in the loft
- Uninsulated walls and floors
- Suspended timber floors
- Fully furnished

- **Environment:**

- Controllable chamber temperature between -12°C to $+30^{\circ}\text{C}$
- Rain
- Wind

- **Monitoring:**

- Temperature and Humidity of each room
- Temperature of radiators
- Boiler Feed and Return Temperatures
- Boiler Flow rate
- Gas consumption
- Electricity sub circuit monitoring
- Electricity mains monitoring
- Gas consumption

Set Up of Heating System

- **CIBSE 2007:**
 - Calculations has been made according to the CIBSE heating guide 2007
 - This is how the heating system was designed for this series of tests
- **The Boiler:**
 - A standard A rated combi boiler. The boiler is a wall mounted gas fired condensing boiler
- **Boiler timer:**
 - Set to the SAP standard timing of a typical 'twice a day' schedule:
 - ON at 06:30
 - OFF at 09:00
 - ON at 15:30
 - OFF at 23:00
- **Thermostat:**
 - A thermo-mechanical room thermostat manufactured by one of the TACMA members
- **TRVs:**
 - A standard off the shelf TRV selected randomly from the TACMA member products

Phase 2 results

- Three tests were carried out against SAP heating profiles at an average external temperature of 5°C:
 1. No controls
 2. Room thermostat only
 3. Room thermostat and TRVs

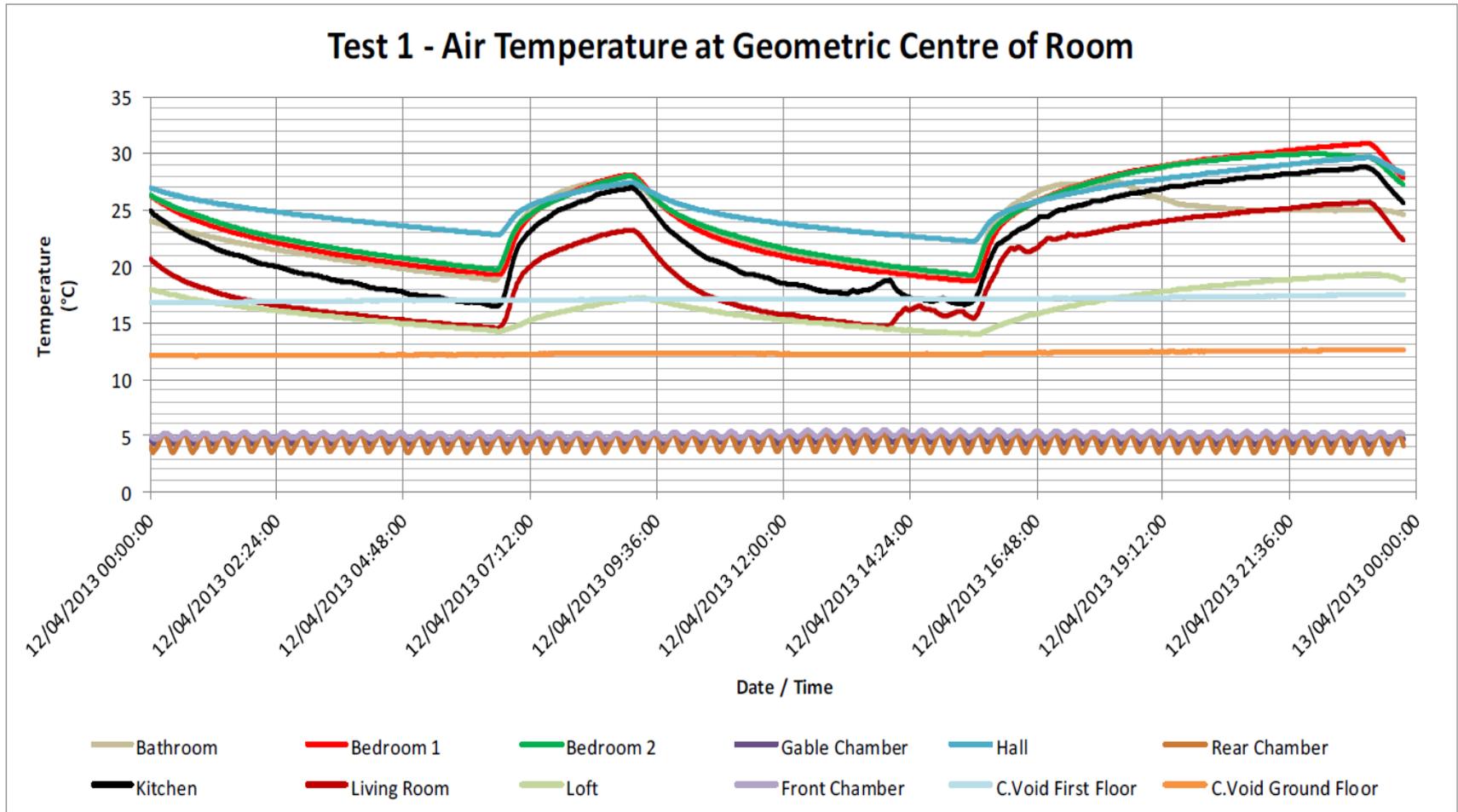
Test 1 – No controls

Test Conditions

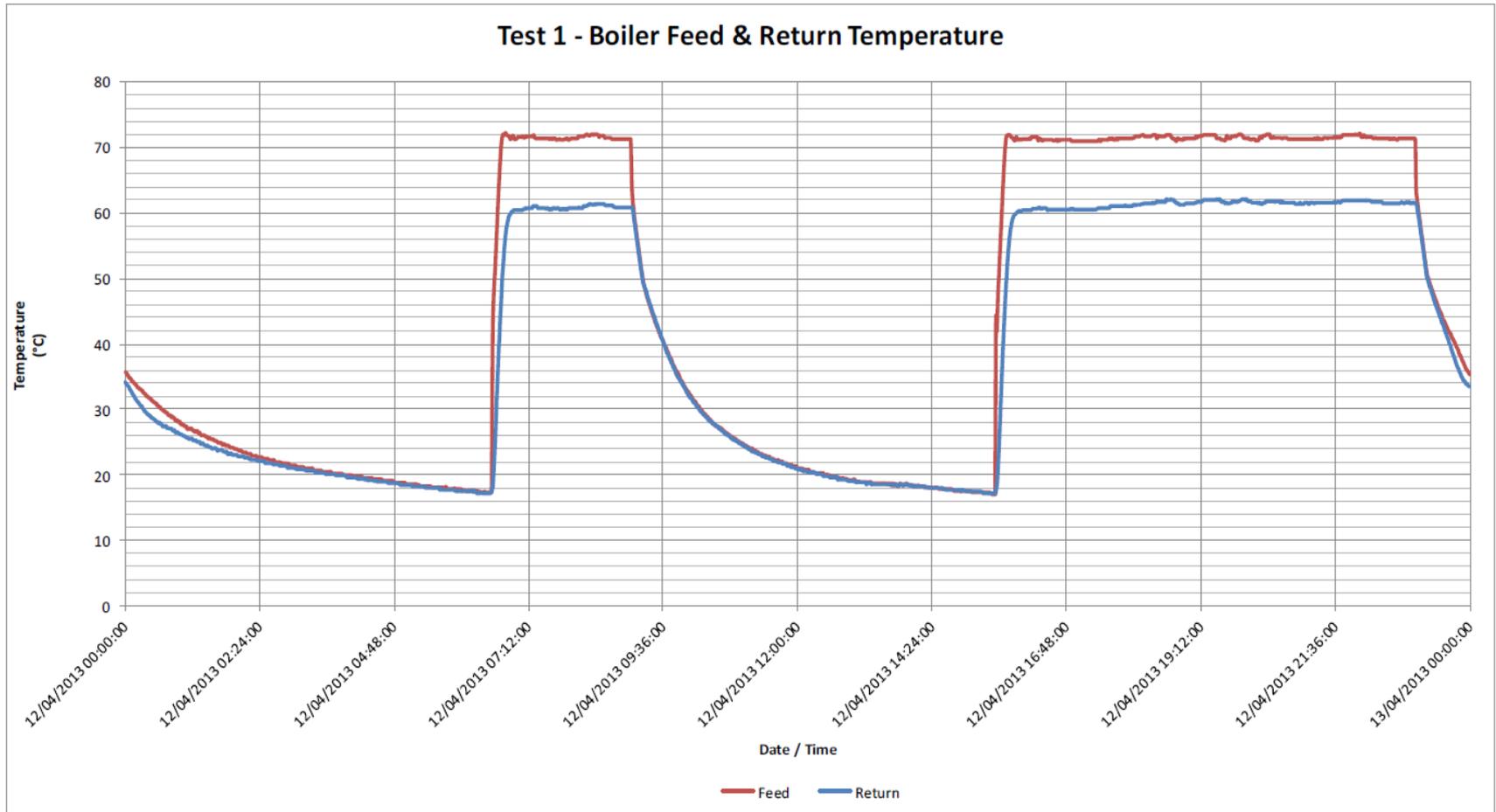
Heating system under control of the boiler thermostat.

- TRVs fully open in all rooms
- Living room thermostat disconnected from boiler
- Boiler thermostat set to maximum (74°C)

Test 1 – No controls



Test 1 – No controls



Test 1 – No controls

Results

	m ³	kWh ^{*1}	£ ^{*2}	kg CO ₂ e ^{*3}
<u>Gas:</u>	10.72	121.8	5.2	22.55857
<u>Electric:</u>		0.83	0.11	0.431907
<u>Total:</u>		122.63	5.3	22.99047

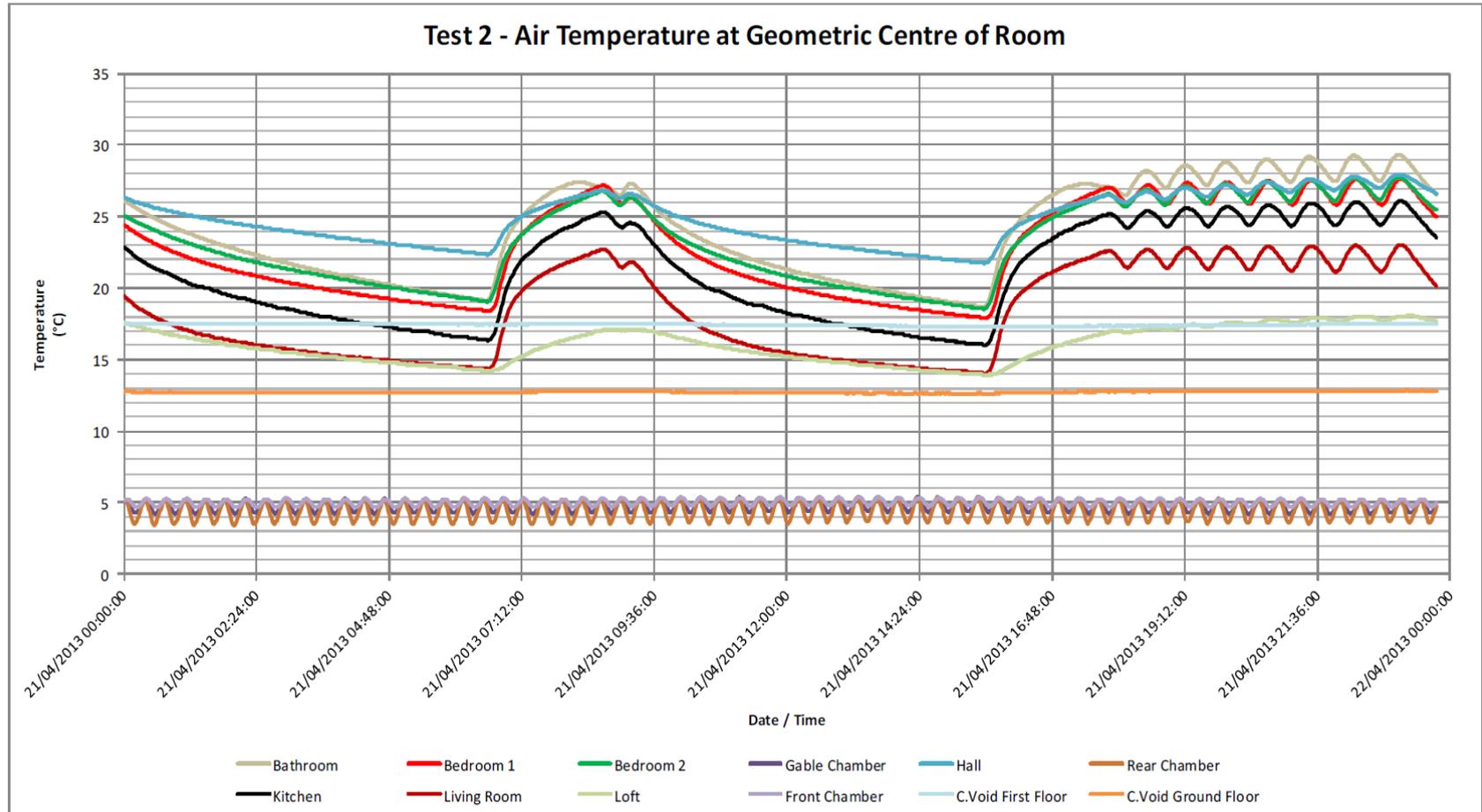
Test 2 – Room thermostat only

Test Conditions

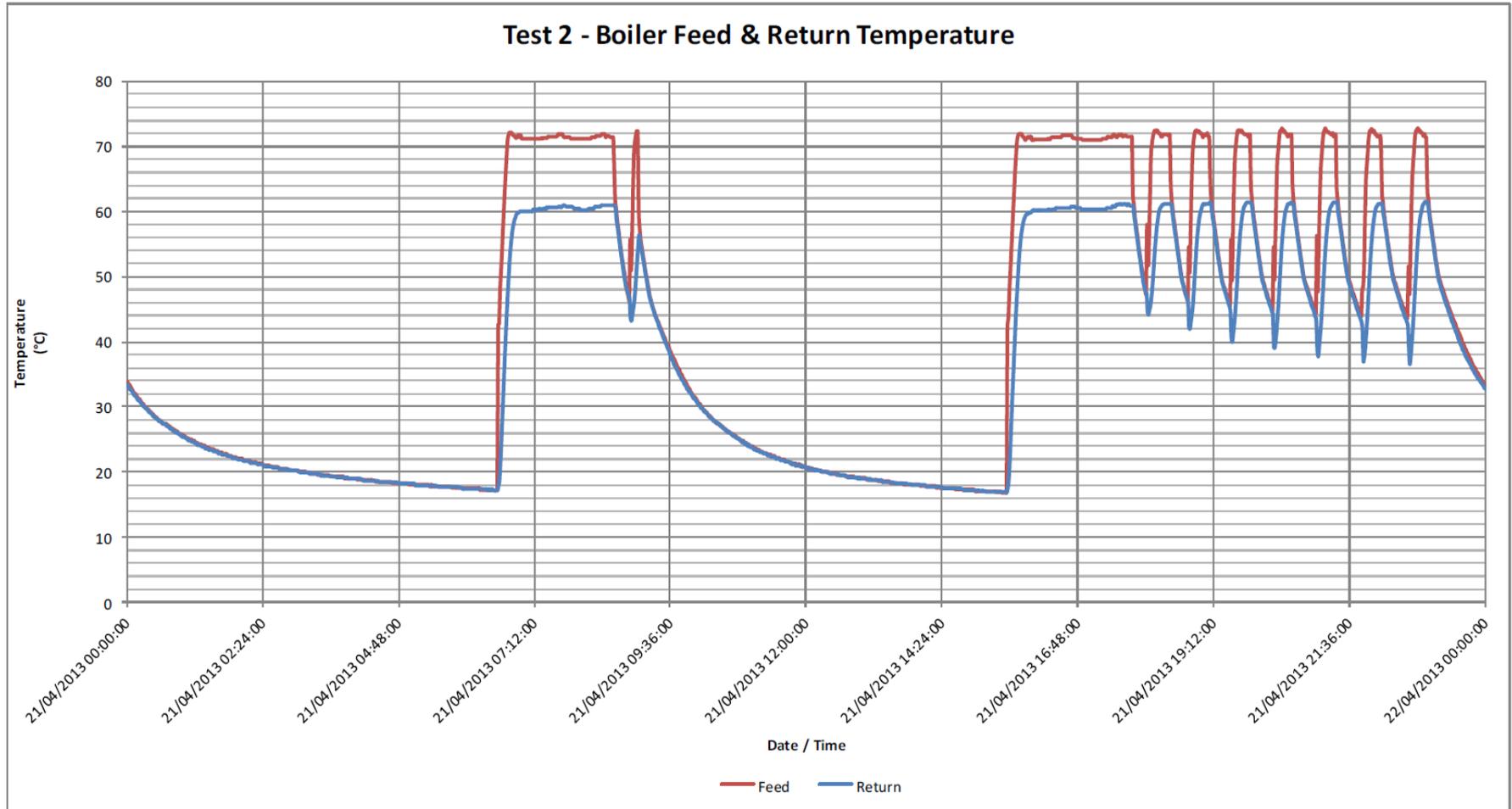
Heating system under control of the boiler thermostat and living room thermostat.

- TRVs fully open in all rooms
- Living room thermostat set to 21°C
- Boiler thermostat set to maximum (74°C)

Test 2 – Room thermostat only



Test 2 – Room thermostat only



Test 2 – Room thermostat only

Results

	m ³	kWh ^{*1}	£ ^{*2}	kg CO ₂ e ^{*3}
<u>Gas:</u>	9.42	107.04	4.575	19.82487
<u>Electric:</u>		0.75	0.10	0.390277
<u>Total:</u>		107.79	4.675	20.21514

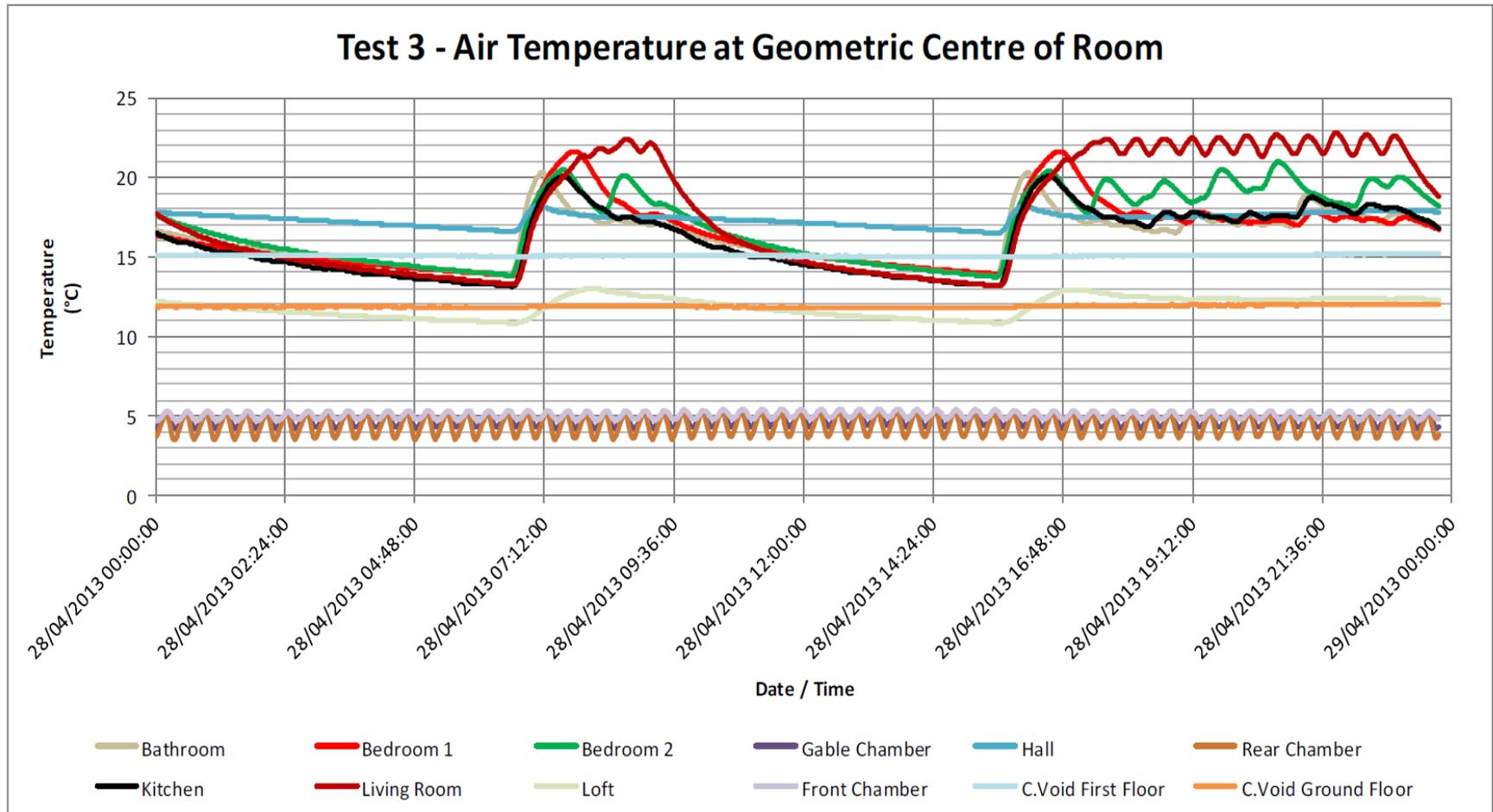
Test 3 – Room thermostat and TRVs

Test Conditions

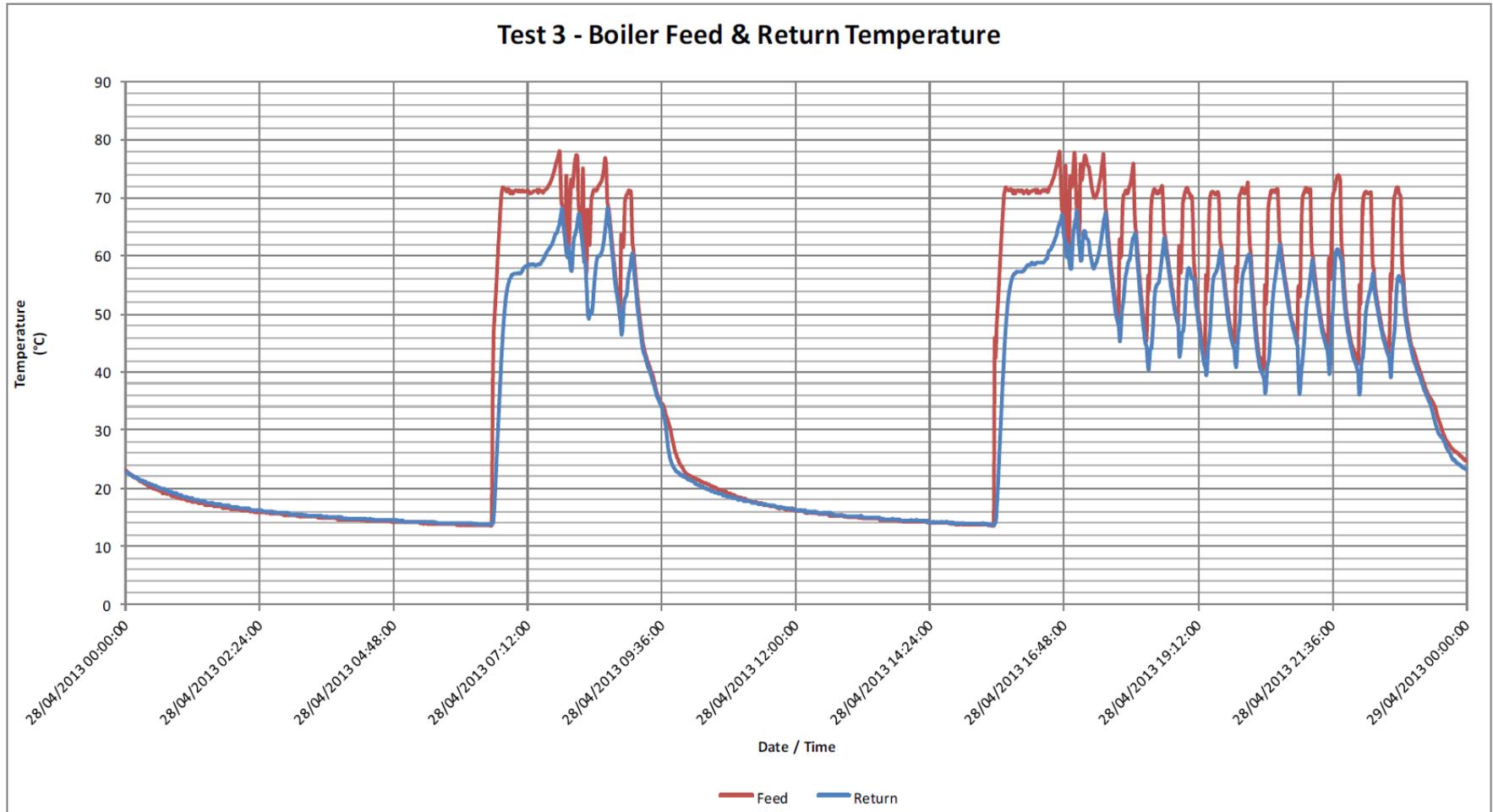
Heating system under control of the boiler thermostat, living room thermostat and

- TRVs in all rooms except living room.
- Living room thermostat set to 21°C
- TRVs set to maintain temperature of 18°C in all other rooms
- Boiler thermostat set to maximum (74°C)

Test 3 – Room thermostat and TRVs



Test 3 – Room thermostat and TRVs



Test 3 – Room thermostat and TRVs

Results

	m ³	kWh ^{*1}	£ ^{*2}	kg CO ₂ e ^{*3}
<u>Gas:</u>	6.28	71.36	3.05	13.21658
<u>Electric:</u>		0.74	0.095	0.385073
<u>Total:</u>		72.1	3.15	13.60165

Cost comparison and savings

Test		Energy cost (24 hr)	Savings
1	No controls	£5.31	-
2	Room stat	£4.68	12%
3	Room stat + TRVs	£3.15	41%

Comparison of SAP estimated heating demand with TACMA study results

