



Massey University
COLLEGE OF SCIENCES

Cold Homes in New Zealand: Low Heater Capacity or Low Heater Use ?

Mikaël Boulic¹, Pär Fjällström¹, Robyn Phipps¹, Malcolm Cunningham²,
Don Cleland¹, Philippa Howden –Chapman³, Ralph Chapman⁴, Helen
Viggers³, Andrew Pollard²

¹ *Massey University*

² *Building Research Association of New Zealand*

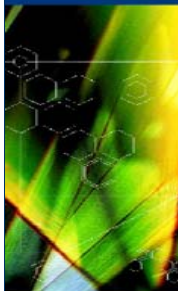
³ *University of Otago*

⁴ *Victoria University*



Institute of Technology and Engineering

Te Kunenga
ki Pūrehuroa



Background

- Houses in New Zealand are on average too cold in winter (*Isaacs et al 2004, Howden-Chapman et al 2007*)
- Poor insulation (building code deficiency)
- Low investment in heating systems
- New Zealanders tend to use only intermittent spot heating

- One of the highest rate of asthma in the world
(Holt and Beasley 2002)
- WHO indoor temperature recommendation levels are for people in good health 18°C - 24°C and for “at risk” people (asthmatic children) 20°C - 24°C *(WHO 1987)*

Housing, Heating and Health Study

- 412 families with asthmatic child involved over 3 years
- Insulation prior commencement
- Mainly low income families involved
- unflued gas heater / portable electric heater



Intensive monitoring in winter 2006

- 36 families in the Hutt Valley (subset sample)
- 80% of homes built circa 1950's
- Control Group (unflued gas heater or/and electric heater) 15 families
- Intervention group (heat pump, flued gas heater, wood pellet burner) 21 families

Objective

Determine if low indoor temperatures are due to heater capacity or heater use

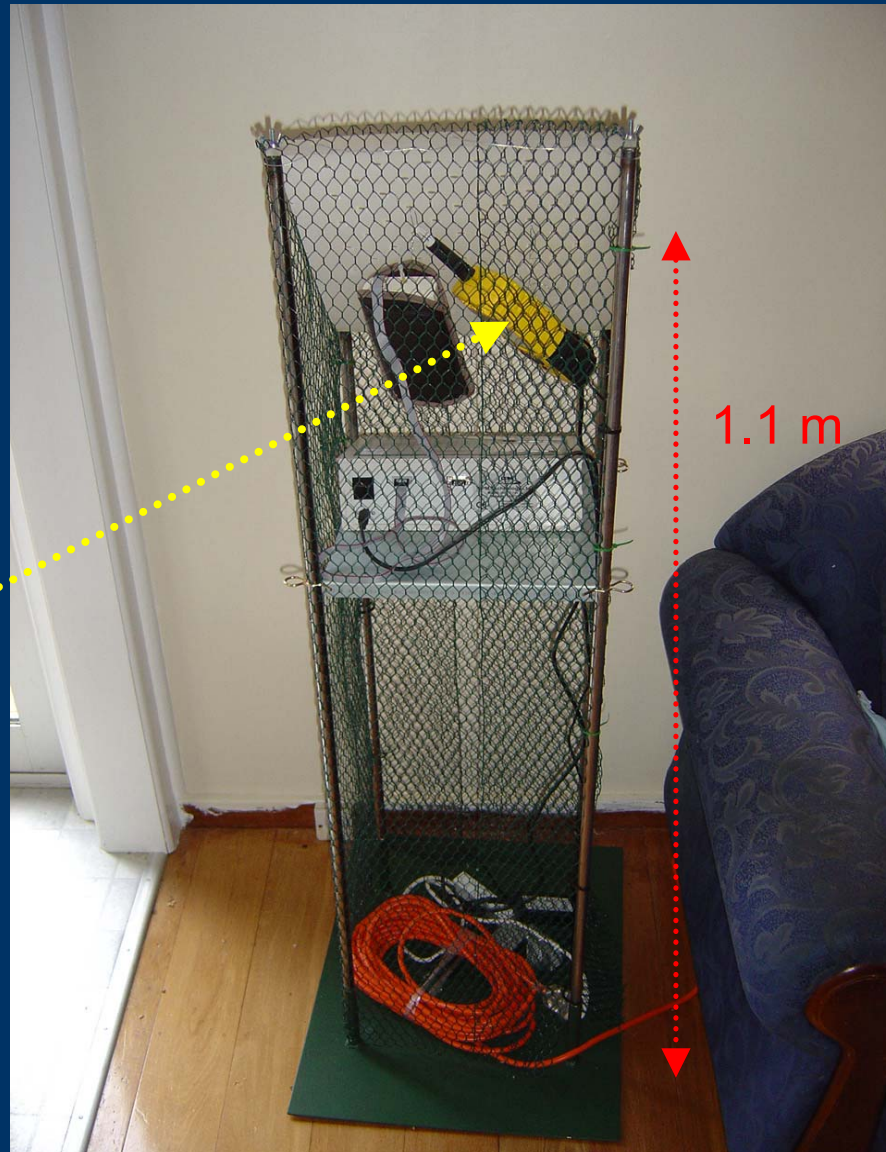


Monitoring

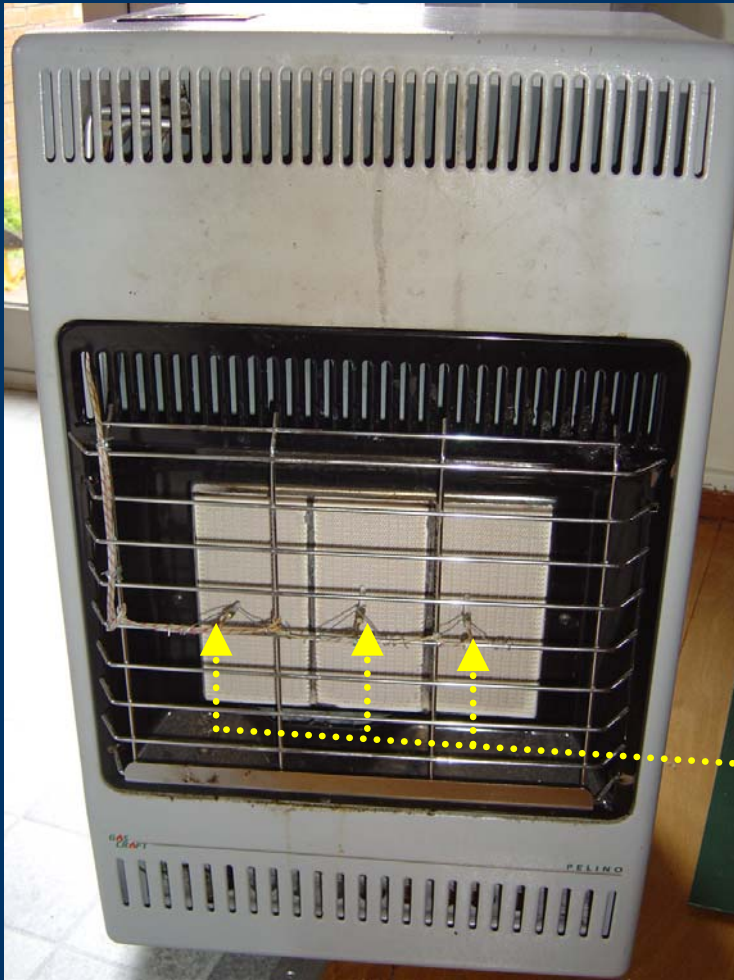
- Between June 2006 to September 2006
- In the living room and the asthmatic child's bedroom



Temperature data logger



Monitoring Heater use







Unflued gas heater



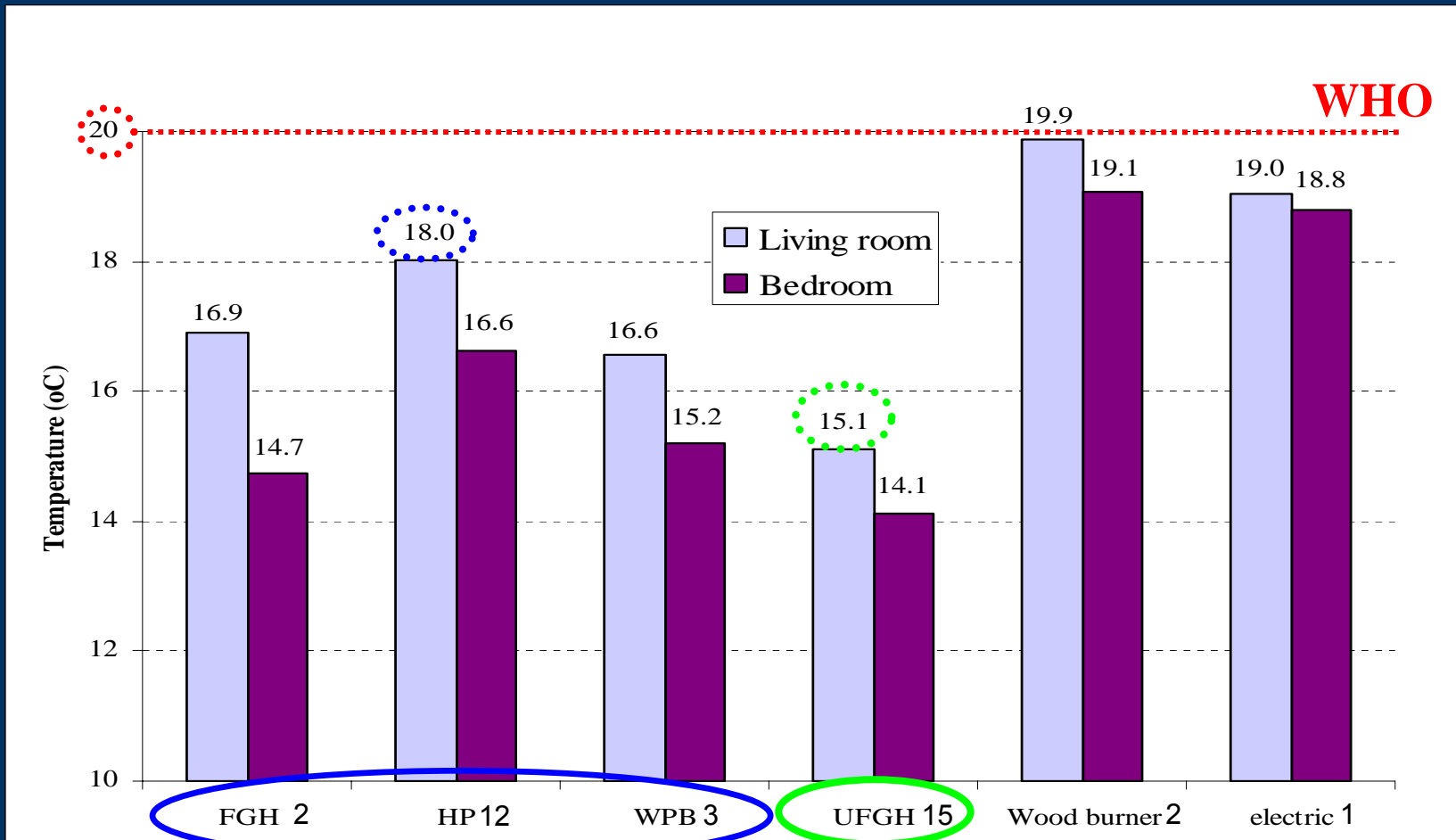
Logger

Type K thermocouples

Results

Main Heater Type	Intervention Group	Control Group
 Unflued Gas Heater (UFGH)	2	13
Electric oil column	0	1
 Heat Pump (HP)	12	0
 Wood Pellet Burner (WPB)	3	0
 Flued Gas Heater (FGH)	2	0
Wood burner	1	1
Missing data	1	0
Total	21	15

Indoor Temperature Level

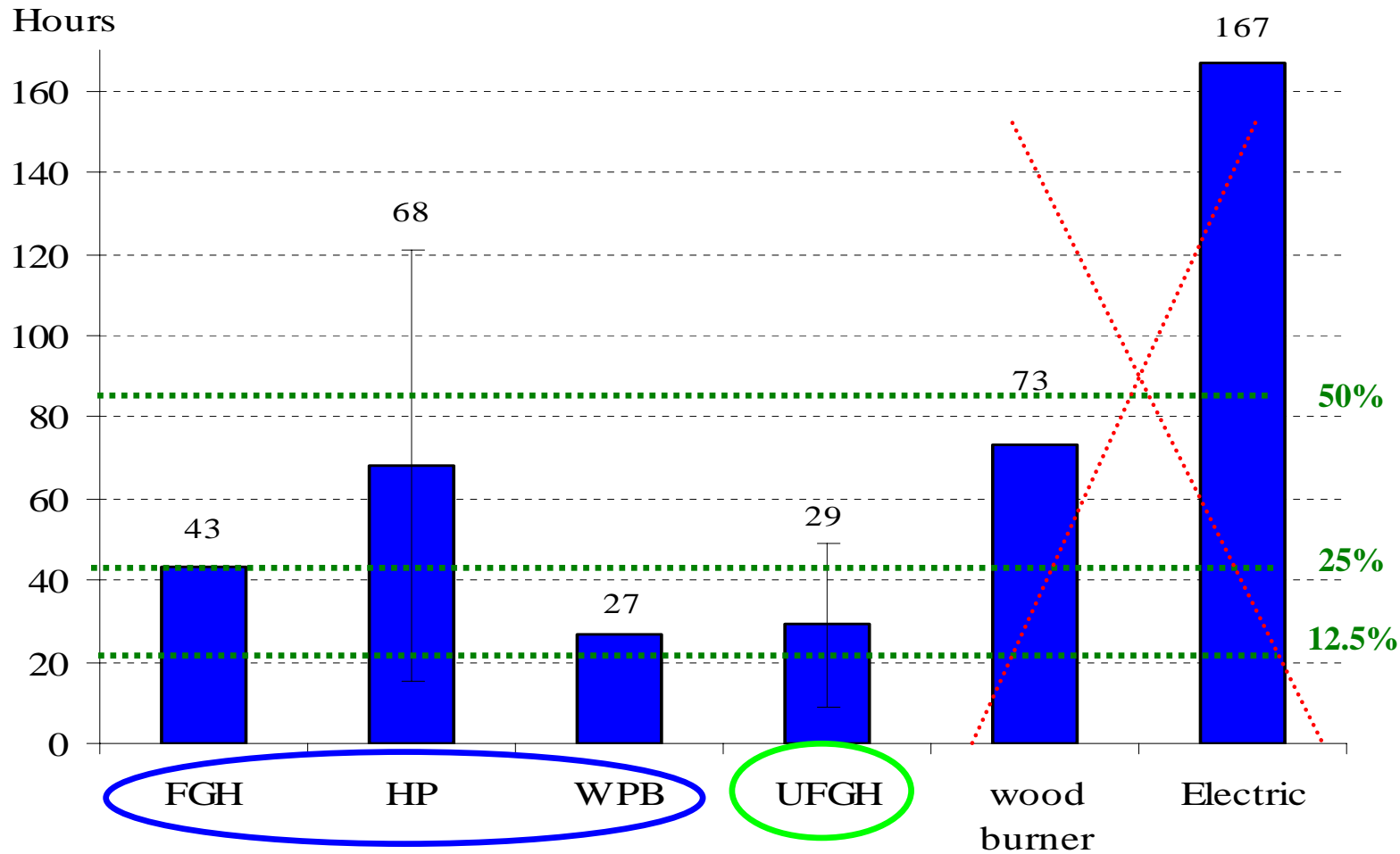


Intervention **Control**

Average outside temperature : 7.6 °C - 9.5 °C

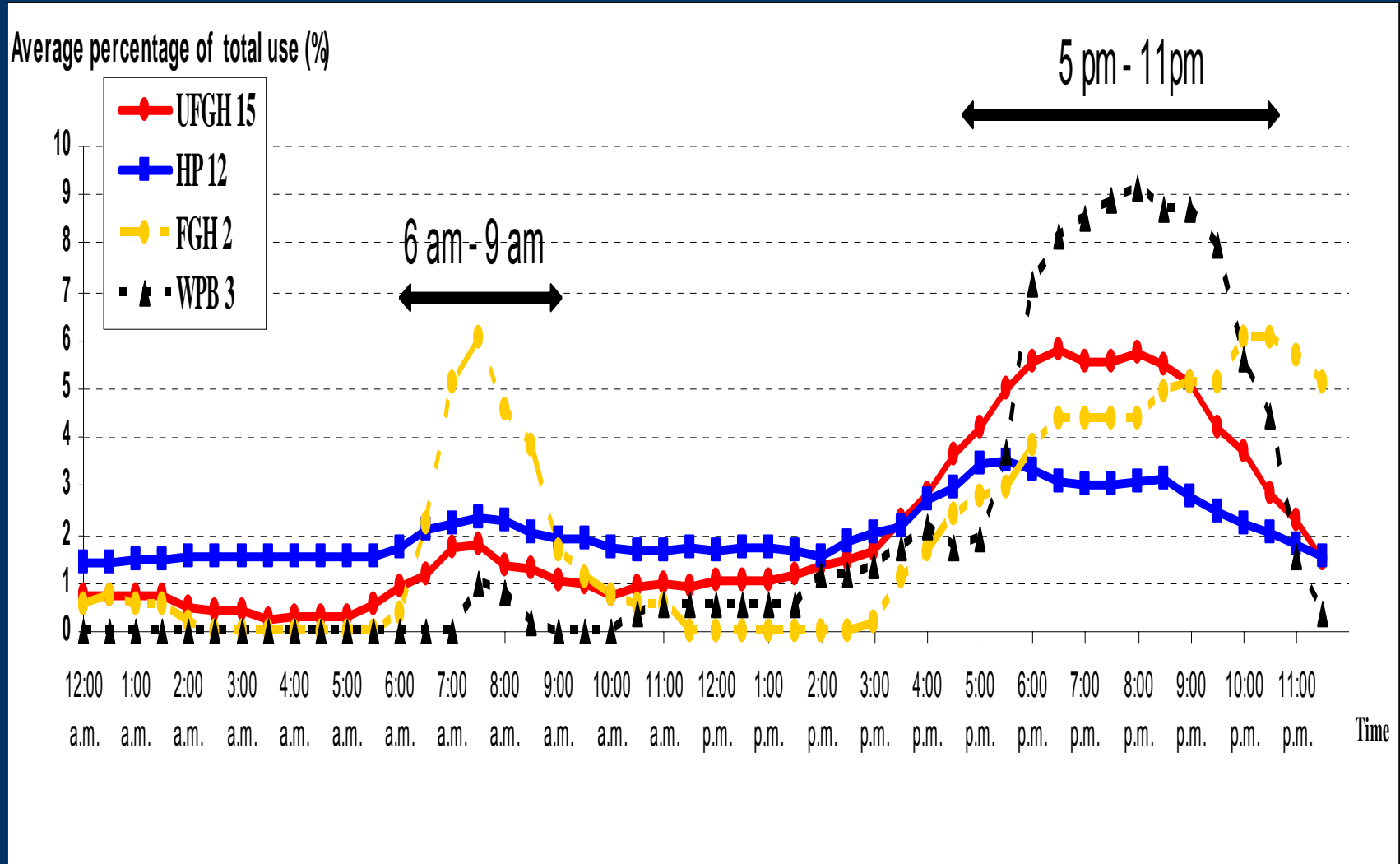
Pooled standard deviation 3.5 °C bedroom and living room

Heater Use

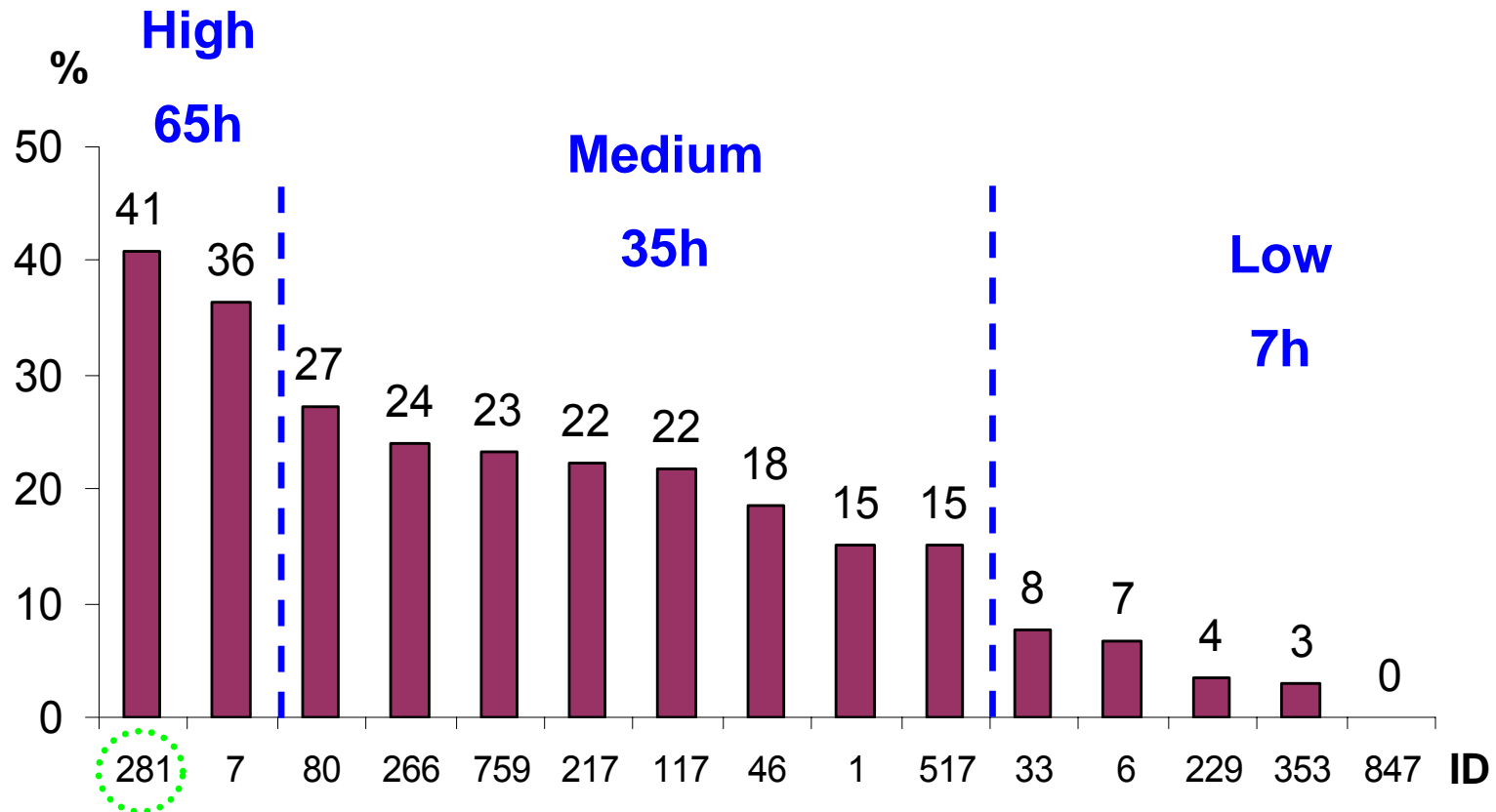


- Higher use for intervention group (mainly HP)
- Lower use for control group

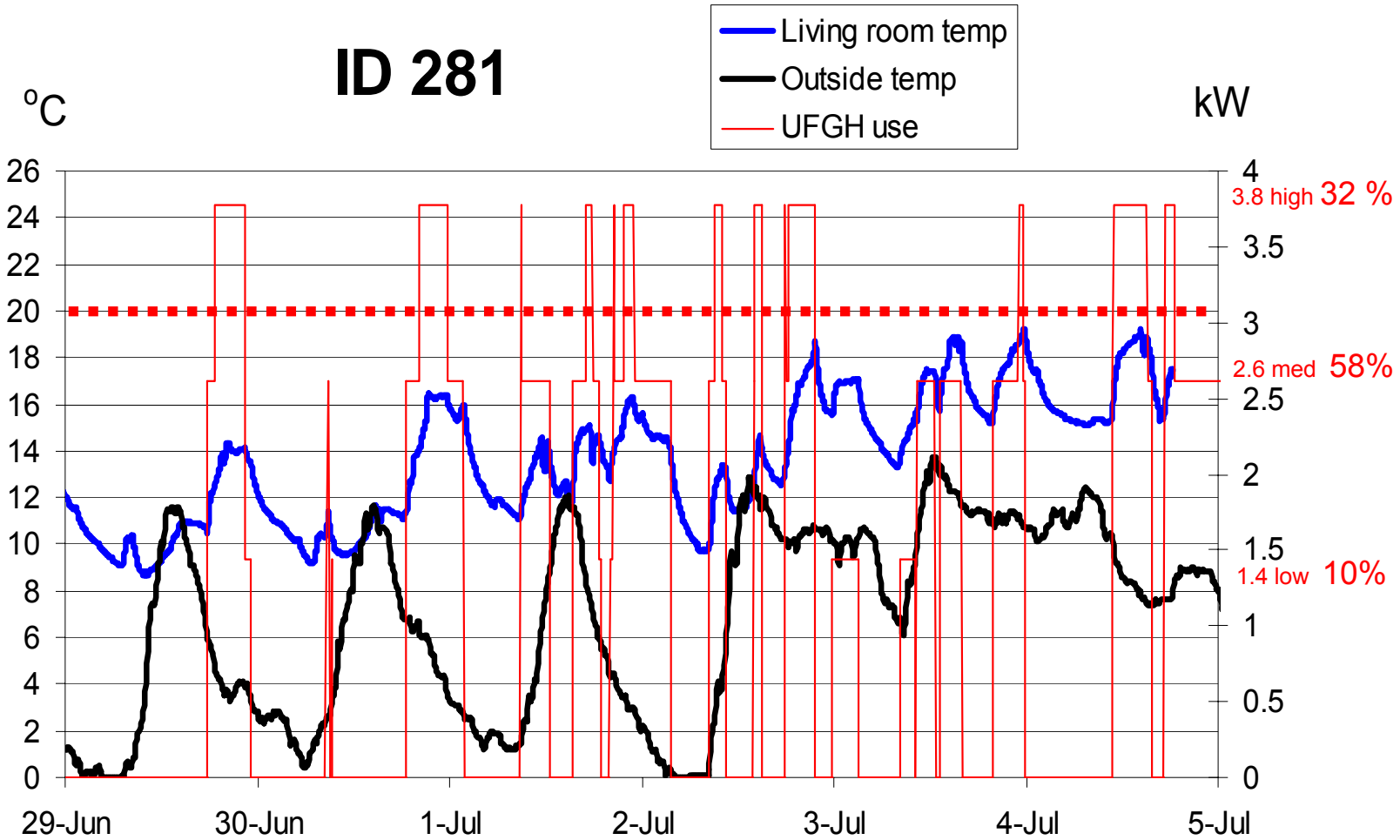
Time of Use



UFGH Use

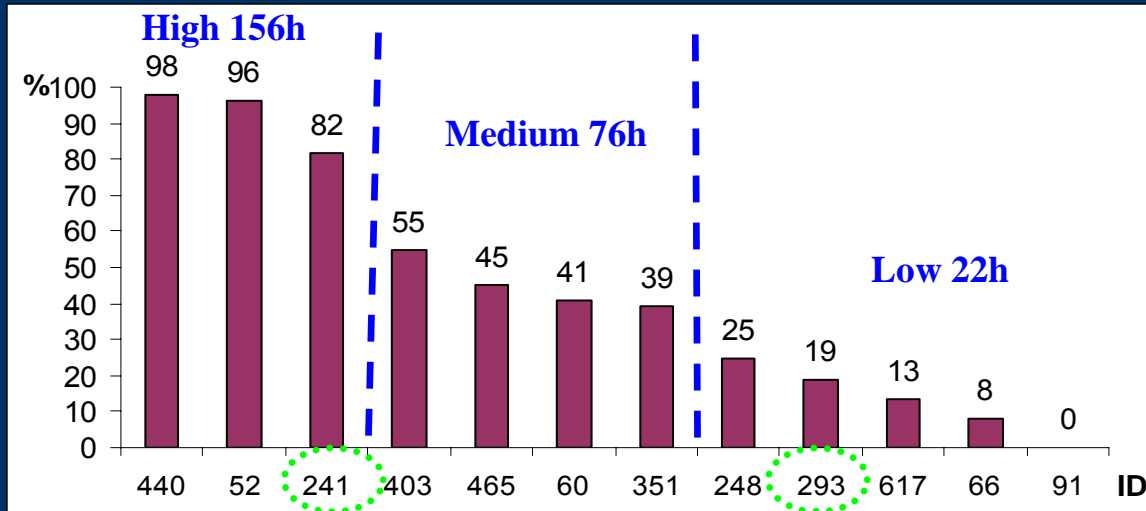


ID 281



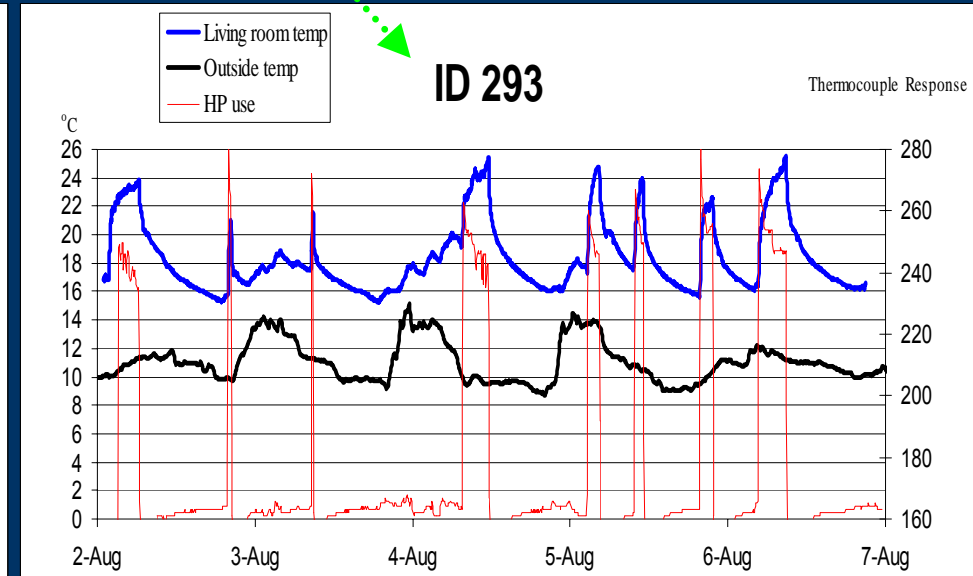
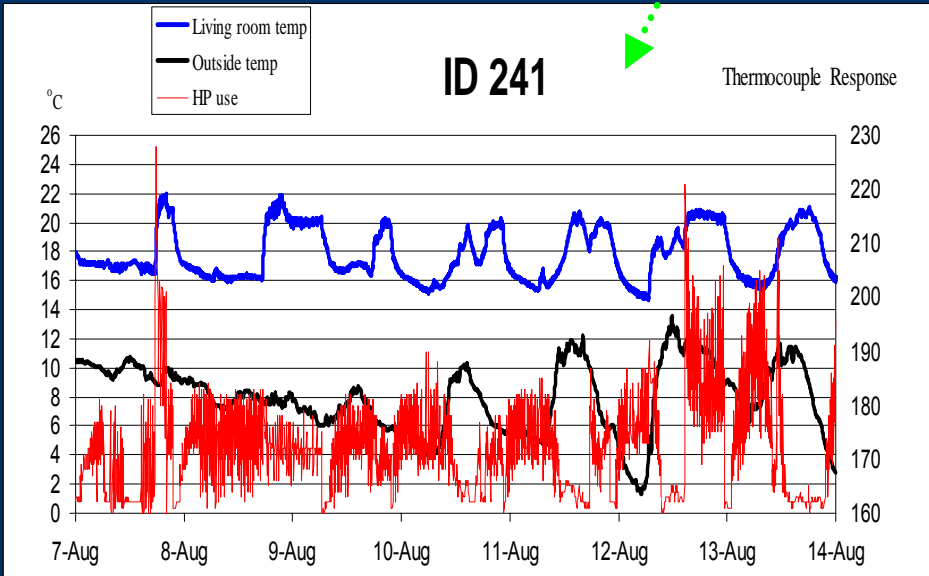
Weekly average outside temperature 7.0 °C

Heat Pump Use



Weekly average outside temperature 8.0 °C

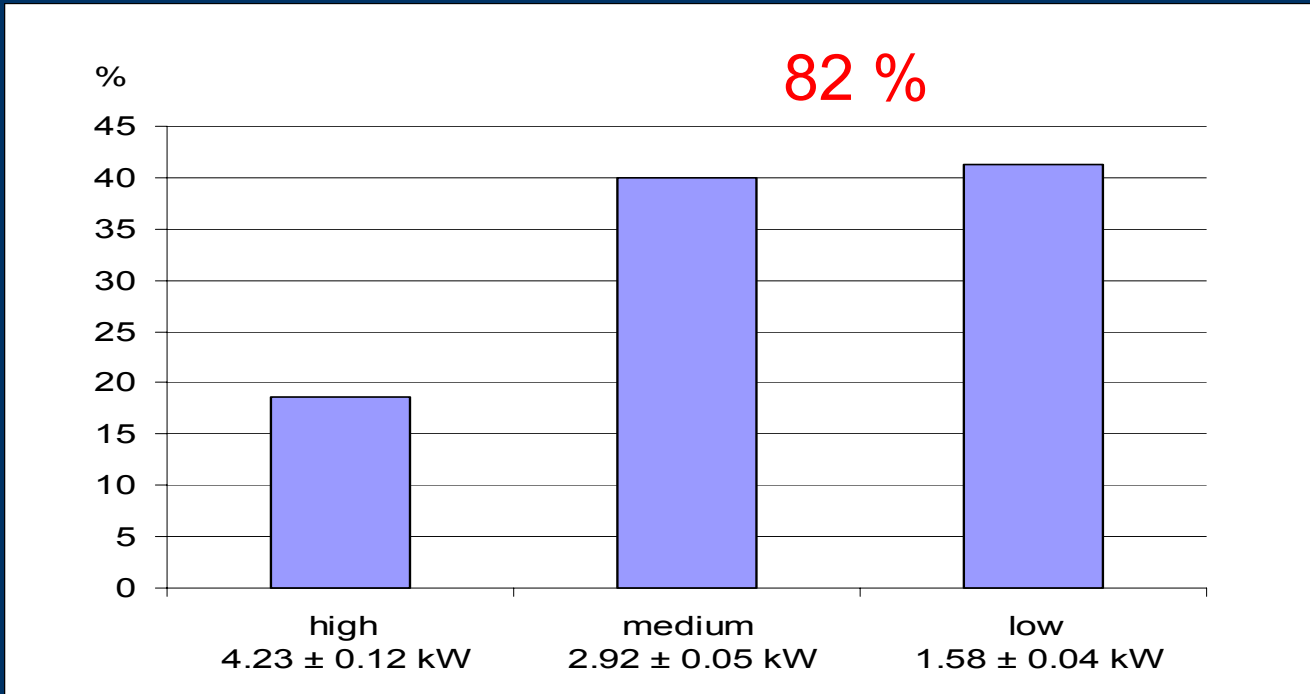
Weekly average outside temperature 11.0 °C



Extended Heating Periods

On/off with overshooting

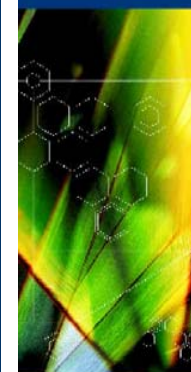
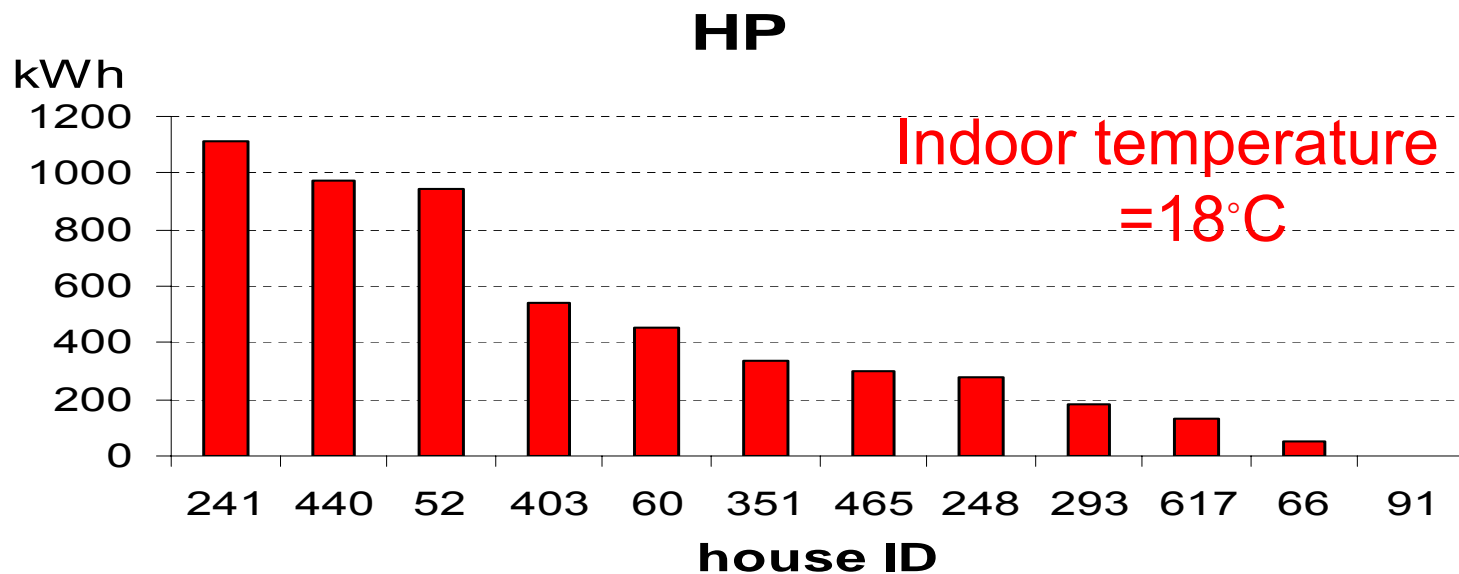
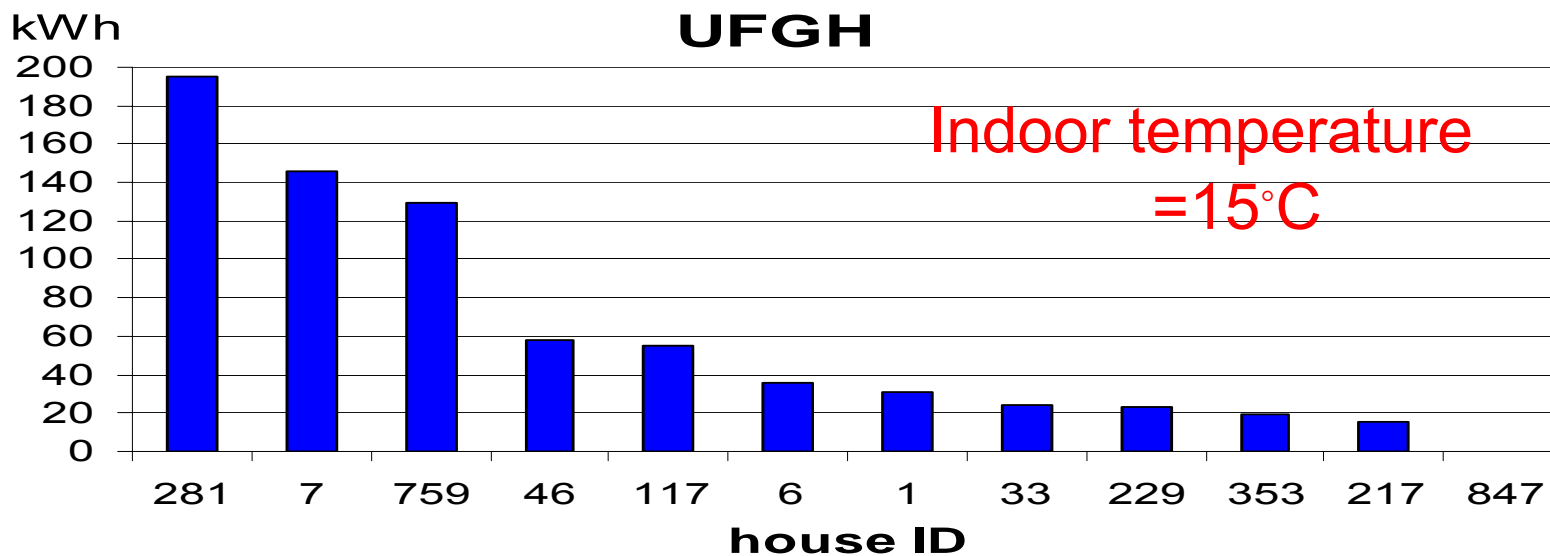
Heating Capacity



Average UFGH heating capacity = 2.6 kW.

Nominal HP heating capacity range : 4 - 8 kW

Estimated Heat Output



From the Families....

“We used to pay around NZ\$160 per month and this time, it was NZ\$302 so I turned off the HP”

“HP is very convenient to dry the clothes”



Conclusion

- Most of the dwellings monitored were too cold
- UFGH : low use (15% of time) + medium / low setting (82% of time) = Heat output insufficient
- Only a few families knew how to use the HP (education, not drying clothes inside, fuel poverty).
- People used WPB like UFGH (pellet supplying and cash flow).
- Cold homes mainly due to low heater use.

Acknowledgements



Questions



M.Boulic@massey.ac.nz

Te Kunenga
ki Pūrehuroa



ID 281 Low setting

Date	Start	Stop	Running hours	kW	kWh
29/06/2007	10:25:00 p.m.	11:05:00 p.m.	0.67	1.441	0.96
1/07/2007	6:35:00 p.m.	6:55:00 p.m.	0.33	1.441	0.48
1/07/2007	8:00:00 p.m.	8:25:00 p.m.	0.42	1.441	0.60
3/07/2007	12:00:00 a.m.	3:15:00 a.m.	3.25	1.441	4.69
3/07/2007	8:15:00 a.m.	10:15:00 a.m.	2.00	1.441	2.89
			6.67		9.63

	Weekly running hours	Heating capacity (kW)	Weekly heat output (kWh)
Low setting	6.67 9.8 %	1.441 <i>with a gas flow of 104 g.h⁻¹</i>	9.63 4.9 %
Medium setting	39.17 57.6 %	2.611 <i>with a gas flow of 188 g.h⁻¹</i>	102.26 52.3 %
High setting	22.17 32.6 %	3.778 <i>with a gas flow of 272 g.h⁻¹</i>	83.75 42.8 %
Total	68 100 %	NA	195.6 100 %

With a LPG calorific value of 50 kJ.g⁻¹ or (50/3.6) W.g⁻¹