SERVE

Sustainable Energy for the Rural Village Environment

CONCERTO

SERVE

Contract No.: TREN07/FP6EN/S07.71106/038382

Comparing DEAP to Actual Energy Performance

Energy Analysis, Monitoring and Integration

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5th Oct 2012

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TIPPERARY energy AGENCY

Introduction

- SERVE overview (brief)
- DEAP overview
- DEAP Statistics
- Comparisons
  - Overall energy consumption
  - Sub divided
- Conclude

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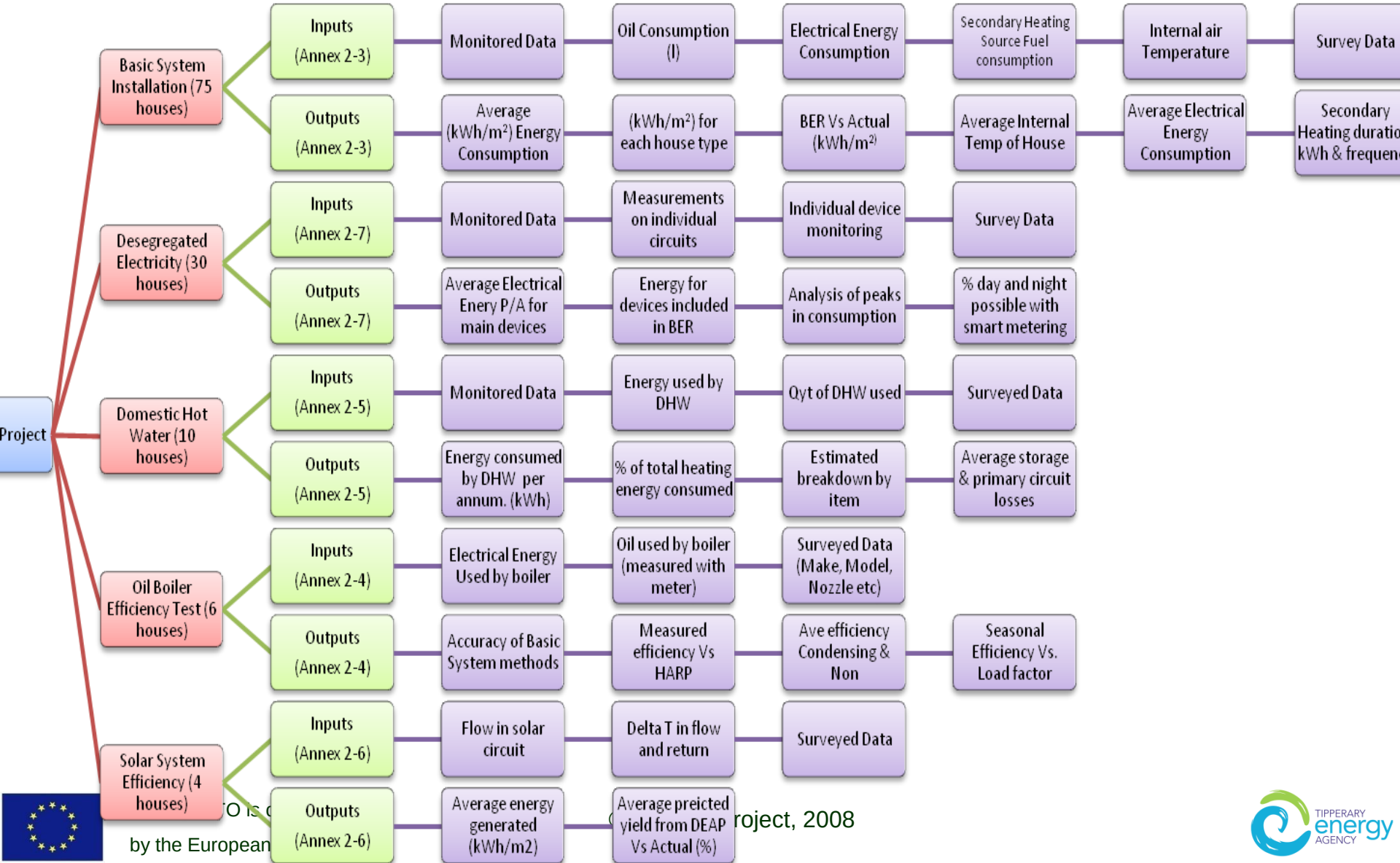
Energy Monitoring



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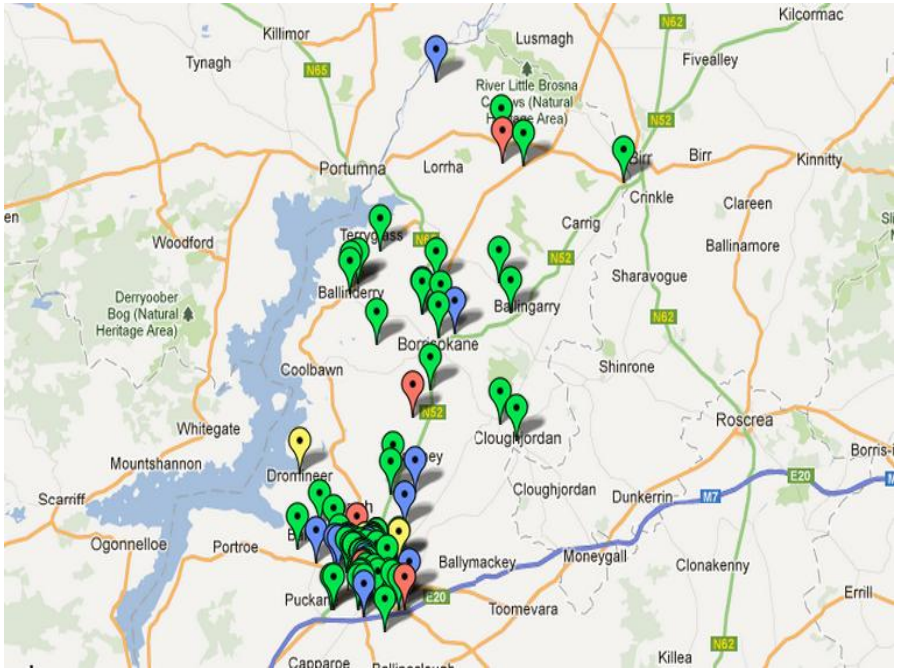
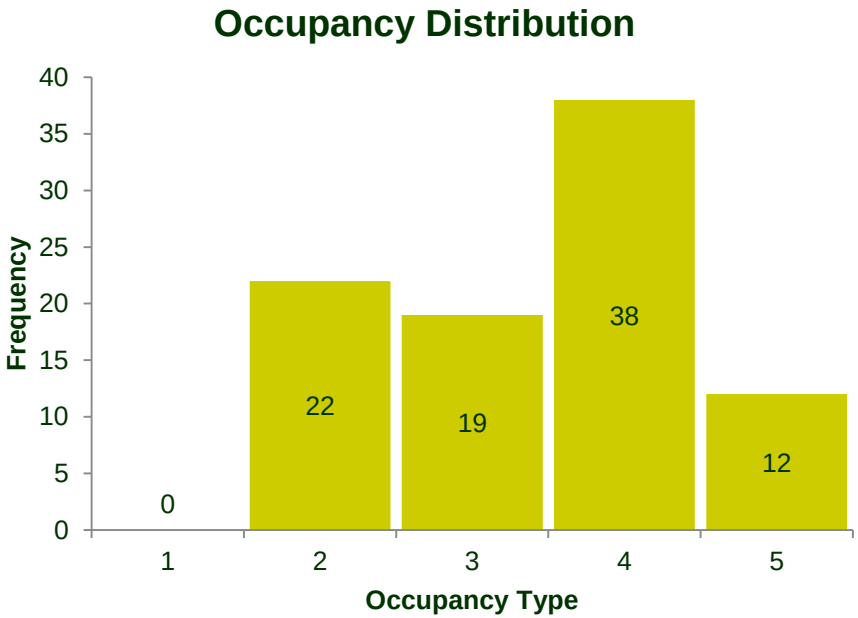
Representative Sample





- 60% / 40% rural split

- 5 - all of the time
- 4 - most of the time
- 3 - Evenings , weekends & some days
- 2 - Evenings and Weekends
- 1 - Only at weekends

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DEAP

- **D**welling **E**nergy **A**ssessment **P**rocedure
- Quotes taken from version DEAP manual 3.2.1 (2012)
- “DEAP is compliant with the methodology framework in the EU Energy Performance of Buildings Directive (EPBD). The DEAP calculation framework is based on IS EN 13790, and draws heavily on the calculation procedures and tabulated data of the Standard Assessment Procedure (SAP) for energy rating of dwellings in the UK”.
- “DEAP is used to demonstrate compliance with the EPBD in Ireland including elements of the Irish Building Regulations Part L 2005, 2008 and 2011 for new dwellings”.

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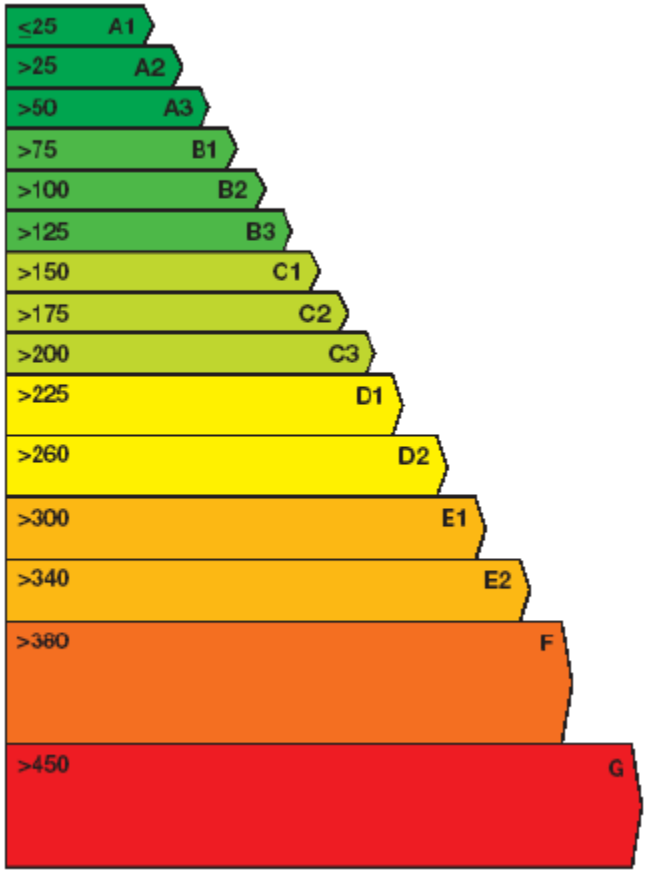
DEAP - Calculations

- DEAP is comprehensive and refers to IS EN ISO 13790:2004 but must make a number of assumptions in conjunction with calculations:
- DEAP assumes:
  - Standard Occupancy hours
  - Heating run hours and patterns
  - Number of occupants doesn't impact BER
  - Number, type and control of electric appliances
  - Standard climate data for whole country
- Ventilation
  - Calculated from data entered by assessor



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DEAP - Calculations

- Building Elements
  - Can be calculated from defaults of fabric & thermal bridges
  - More accurate if actual values calculated from construction data can be entered by assessor
  - Not always possible
- IS EN ISO 6946 – governs U-value calculations
- Domestic Hot Water
  - Derived from floor area
- Internal temperature & Schedule
  - Heated – Weekdays & Weekends: 07.00 to 09.00 and 17.00 to 23.00
  - The required set-point during heating periods are:
    - Living area: 21^{o}C
    - Rest of dwelling: 18^{o}C
    - A floor area weighted average temp is taken between living and rest of dwelling
- Heating season is October to May

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DEAP - Calculations

- Space heating requirements
- Seasonal efficiencies taken from **H**eating **A**ppliance **R**egister of **P**erformance (HARP) database or standard tables 4a or 4b
- Heating control types & responsiveness have factors associated
- CO2 factors are given in table 8
- Solid fuel heat, worst case is assumed, unless wood is proven
- DEAP assumes 33% of DHW is from back boiler if present
- Secondary heat, in kWh/year: from table 7 is 10% of total heat requirement

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DEAP – Main Theoretical Outputs

- Delivered energy, in kWh/year: energy bills for standardised occupancy
- Primary energy, in kWh/year: delivered energy, plus an allowance for the energy "overhead" incurred in extracting, processing and transporting a fuel or other energy carrier to the dwelling. The generation efficiency of power stations is included.
- Carbon dioxide emissions, in kg CO2 per year: Emissions are calculated on the basis of primary energy consumption, e.g. emissions at power stations associated with the dwelling's electricity use are included.

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SERVE – Analysis Status

- Analysis of data from database is ongoing (ECNet):
  - Data for Homeowners reports (including SEAI data) available mid July 2012.
  - SERVE data available primo September 2012
- Data analysis is done by Virtual Basic from Excel – making it easy to repeat the analyses
- Non-residential buildings: Bill data analysis agreed (TEA / ECNet)

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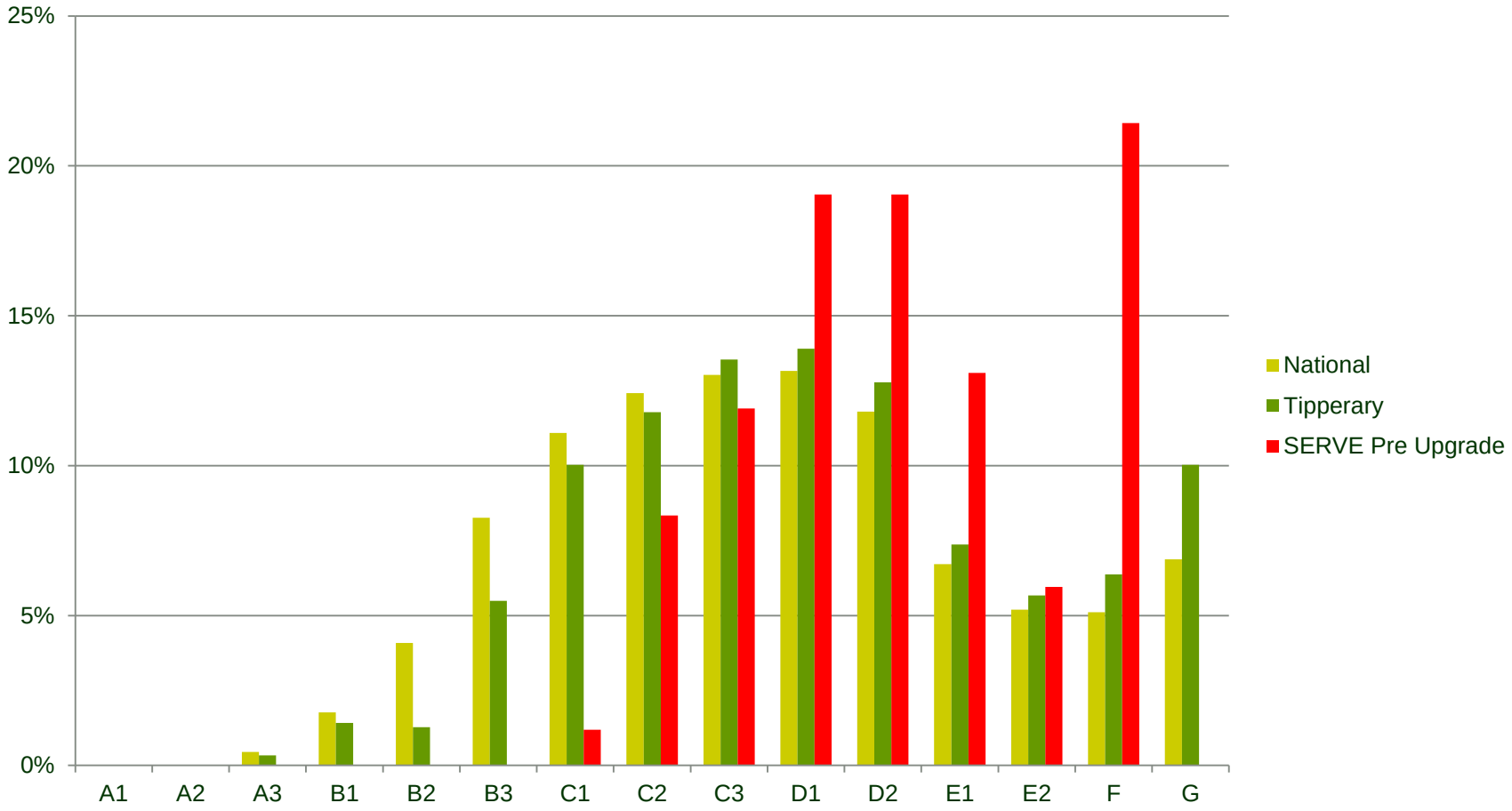
SERVE Monitored Houses – BER Pre Upgrade



Using National & SERVE BER Databases

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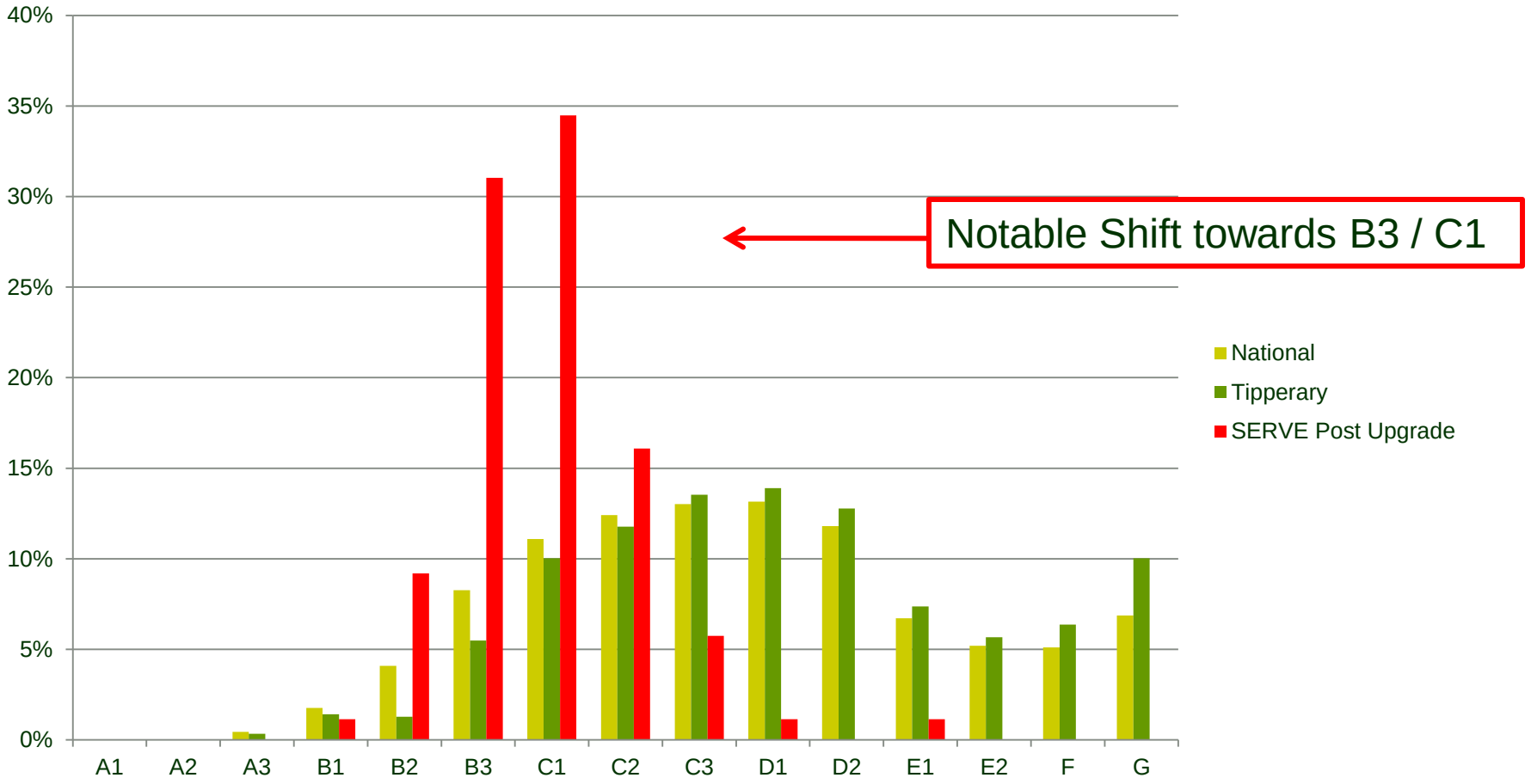
SERVE Monitored Houses – BER Post Upgrade



Using National & SERVE BER Databases

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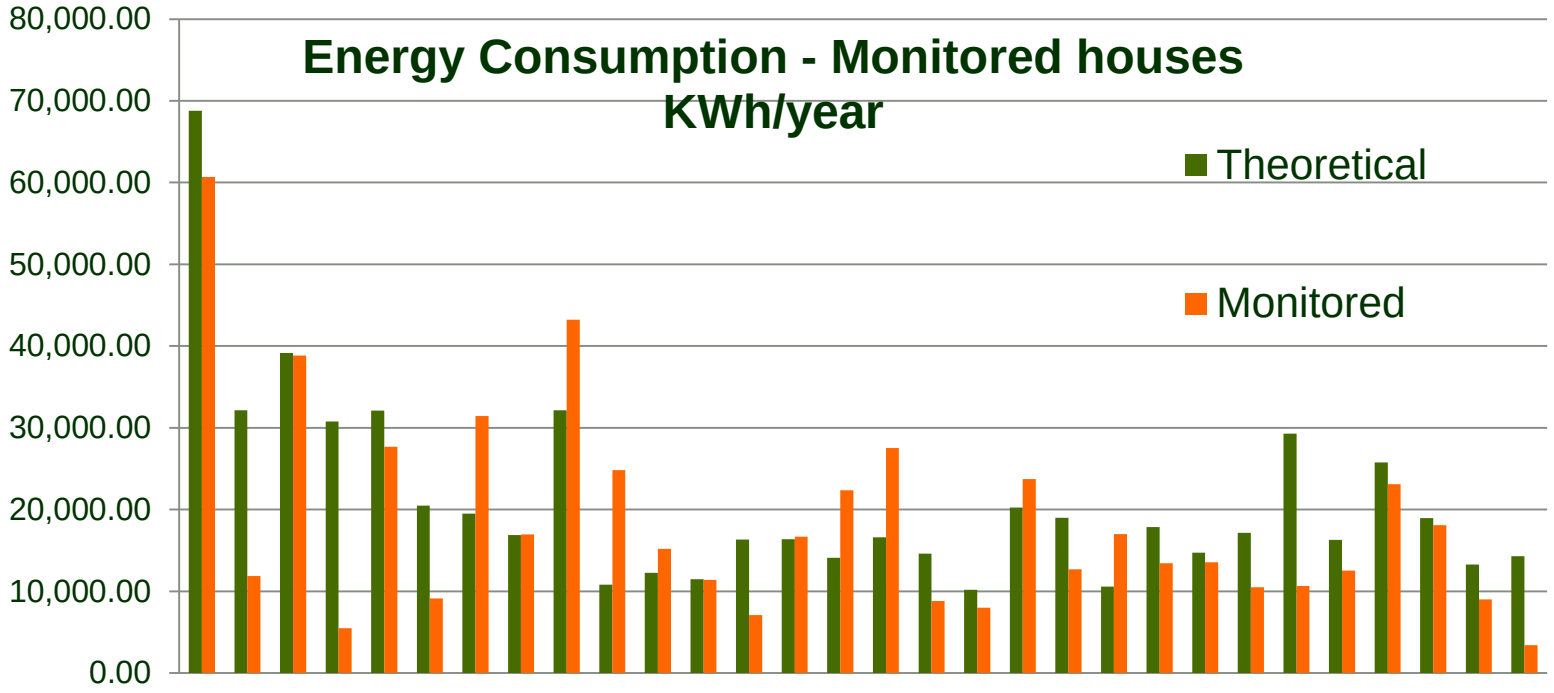
Monitoring Results compared to DEAP



- Theory (BER) – Measured = 13% lower on average
- Theory (BER) was adjusted to take account of Actual Degree Data from local weather station

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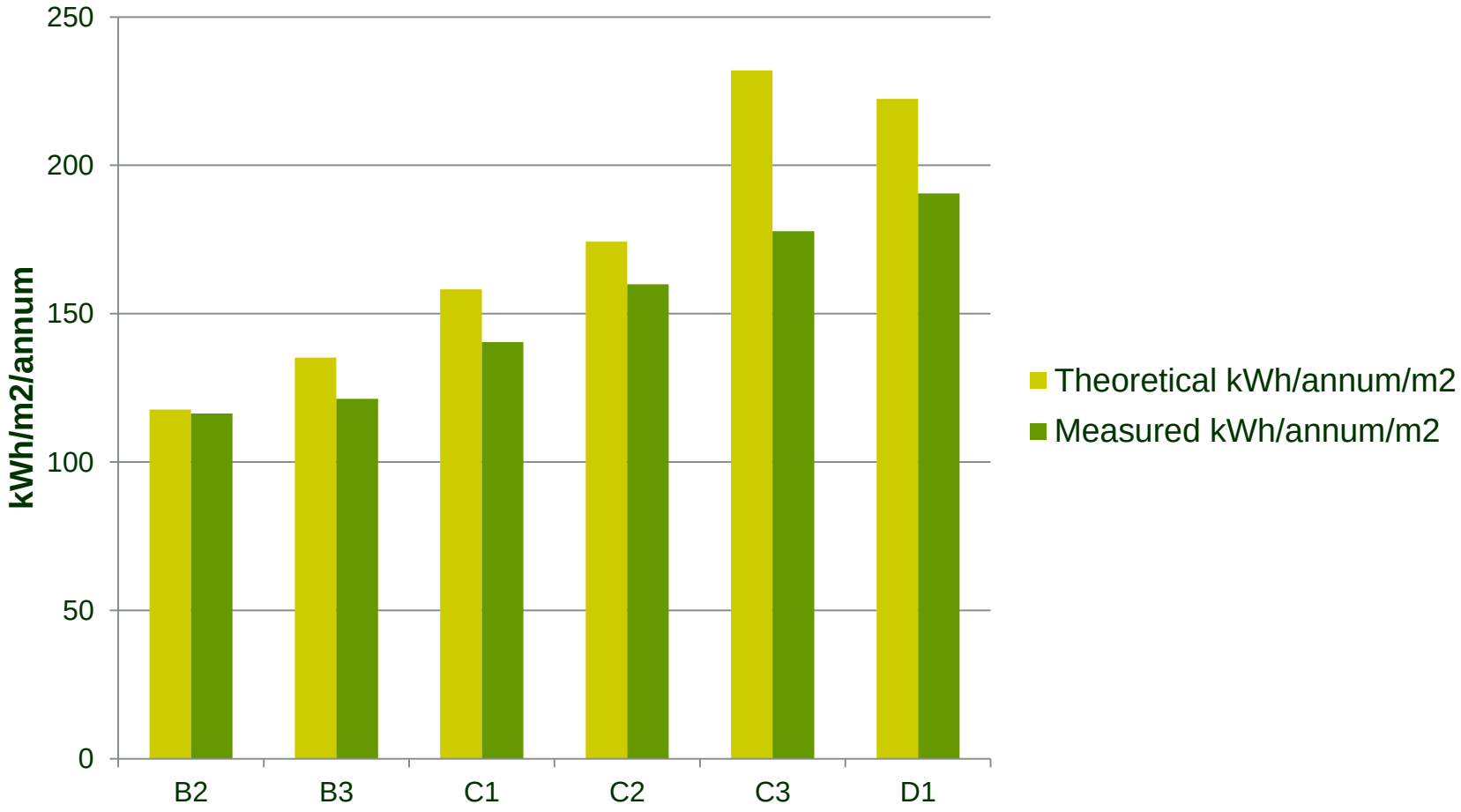
DEAP Predicted vs Actual Energy Performance



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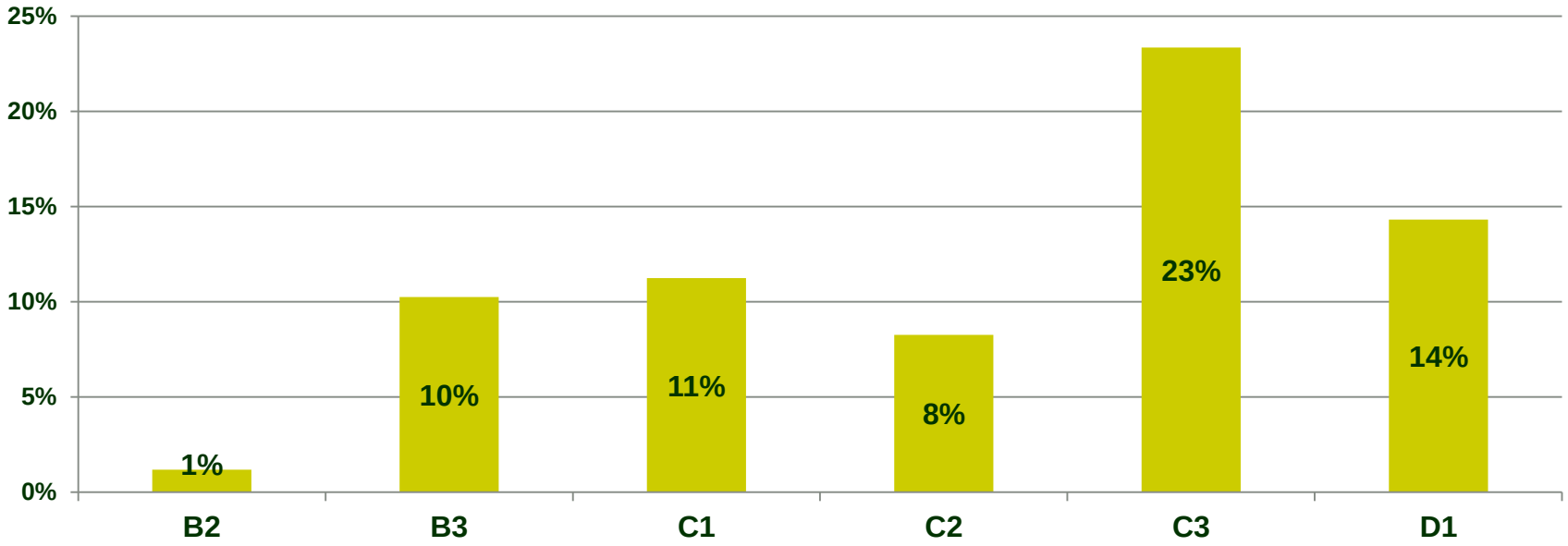
BER over calculates actual energy by:



	B2	B3	C1	C2	C3	D1
Theoretical kWh/annum/m2	118	135	158	174	232	222
Measured kWh/annum/m2	116	121	140	160	178	191
Difference	1%	10%	11%	8%	23%	14%
Number of Houses	8	27	30	14	4	2

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Secondary Heat

- Secondary fuel use was quantified by numerous methods:
  - Survey of quantity of each fuel type purchased per annum
  - Survey & weighing of quantity of fuel burnt in appliances each instance
  - Number of lighting instances quantified by:
    - Survey questions: How many per week in shoulder seasons, how many in peak season?
    - Temperature sensor placed on mantle piece, coupled with algorithm
  - Accuracy of surveys ensured by fuel diaries
  - Results of methods were compared to ensure correlation of methods

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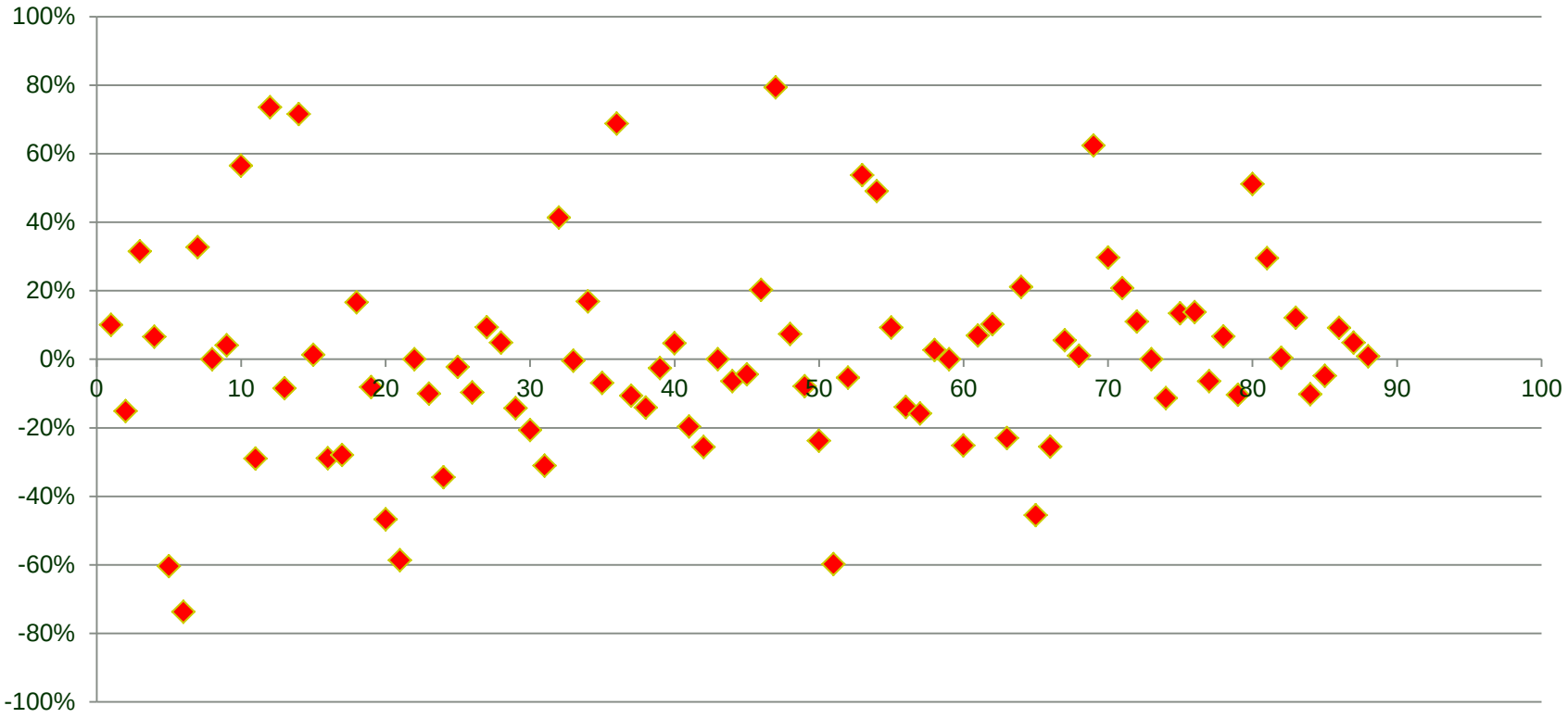
Secondary Heat Survey Correlation



- Over 60% of houses showed 25% correlation between methods

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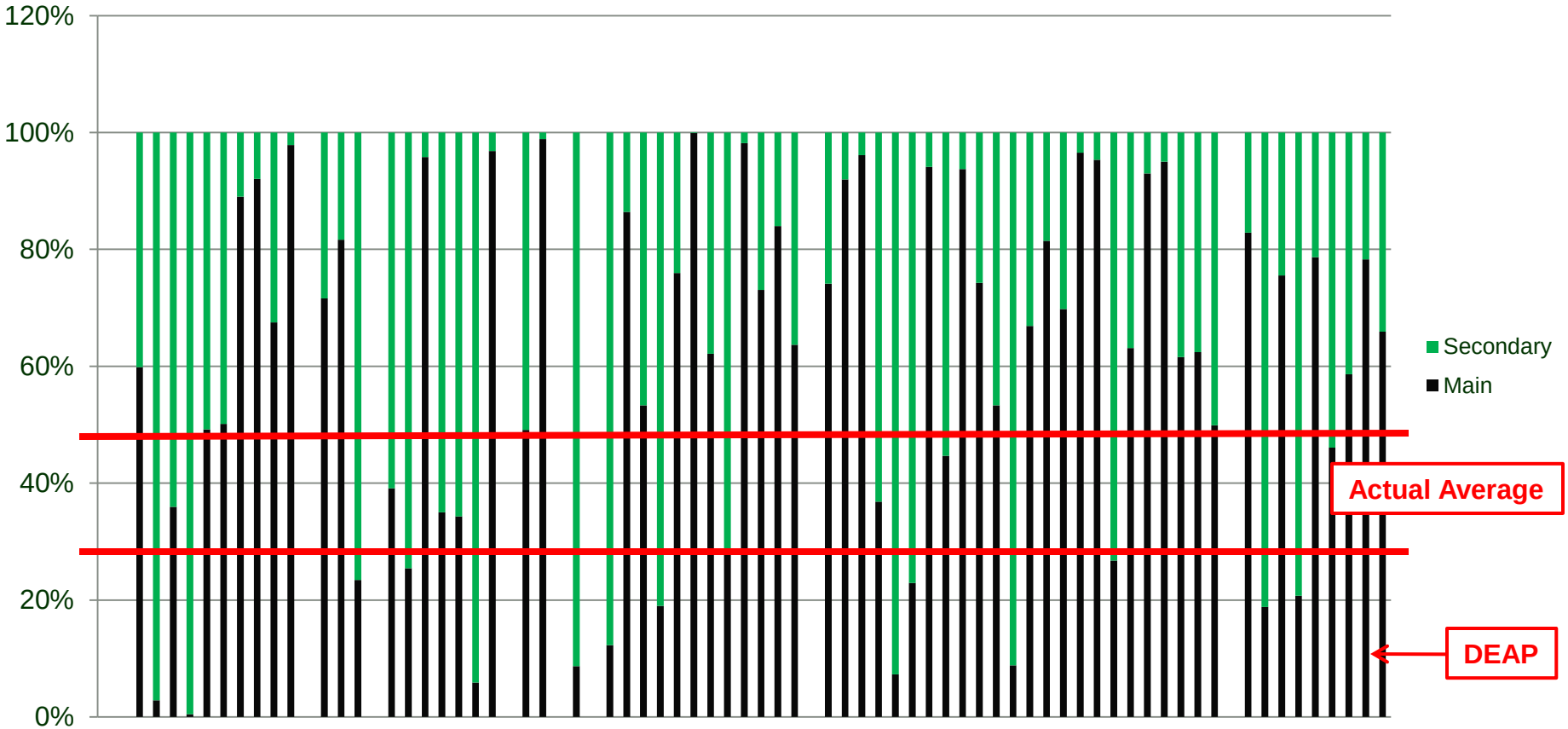
Secondary Heat Percentage

- DEAP table 7 assumes that secondary heat energy supplies 10% of the space heat demand for most applications. The analysis shows:



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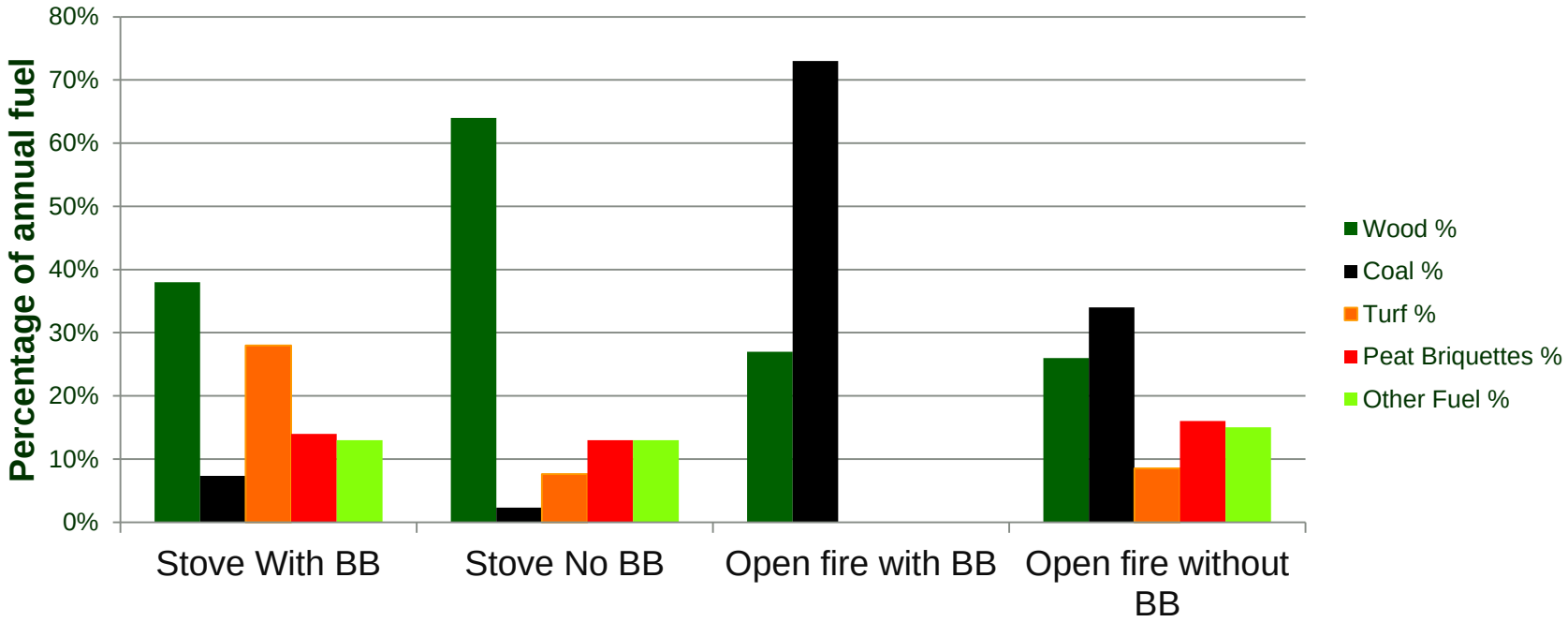
Secondary Heat Fuel Breakdown



Wood	Coal	Turf	Peat Briquettes	Other Fuel
39%	29%	11%	11%	10%

- SERVE specified wood burning stoves only (no multi fuel) , this is illustrated in the data.

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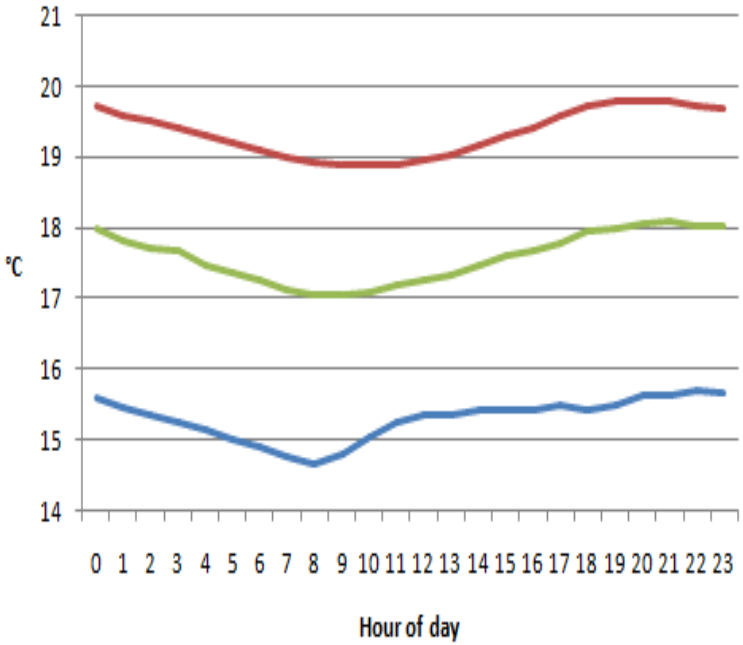
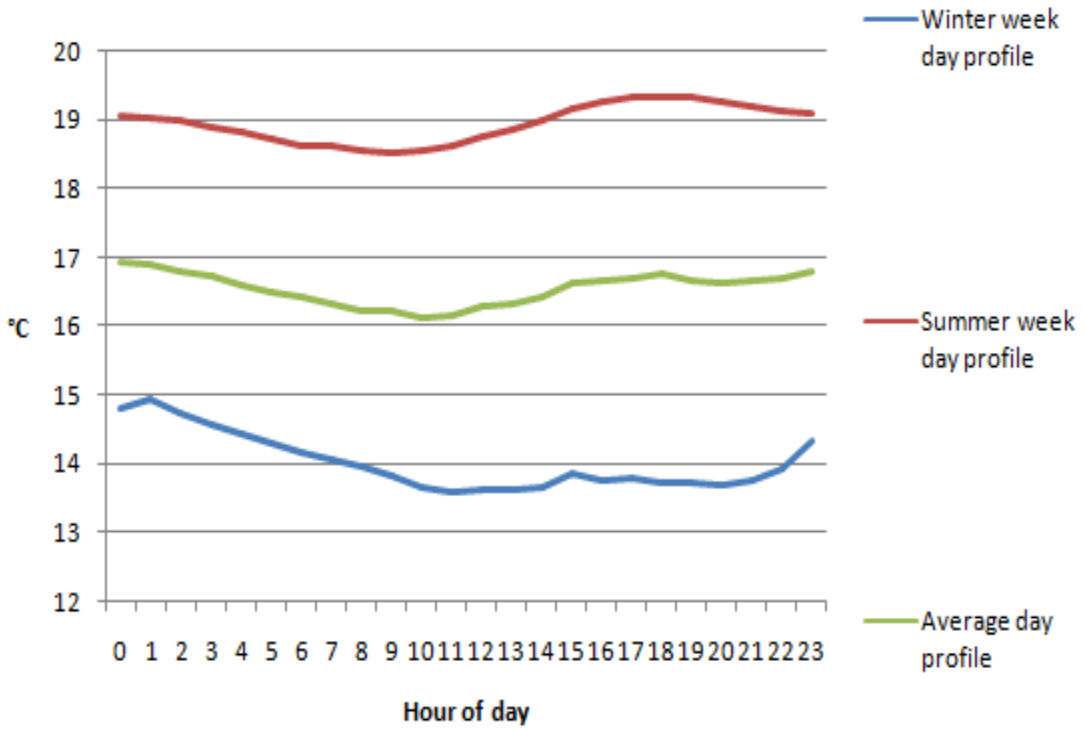
DEAP - Temperature

- DEAP assumes 21ºC in living area and 18ºC rest of house.
- SERVE included two temperature sensors – one in the 'living' room and one in the main bedroom





- Two Representative houses (rest of house sensor)

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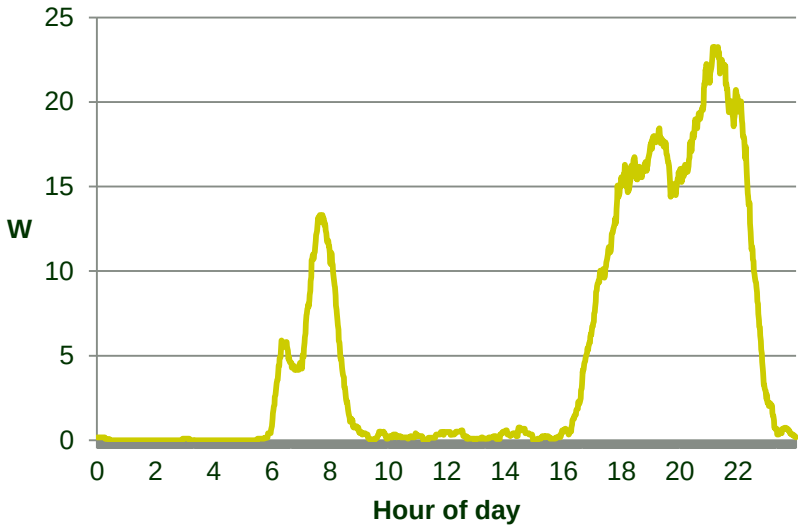
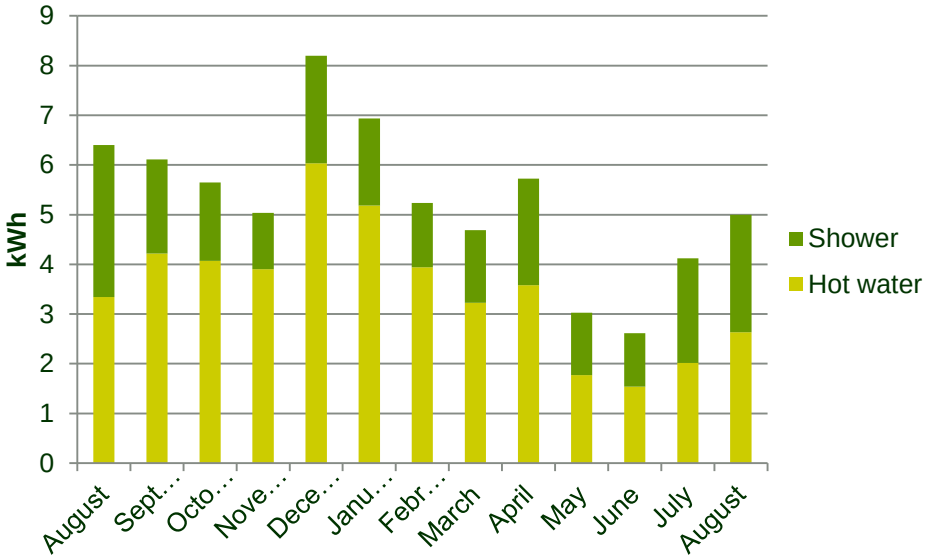
Other DEAP Assumptions

Lighting (30 houses)



- Average 5.7%
- 220kWh/year
- 1.5kWh/m²/year
- 1512 hours/year or 4hours/day

Domestic Hot Water (10 houses)



- 1475kWh/yr
- 244kWh/person/yr
- 1.06kWh/person/day

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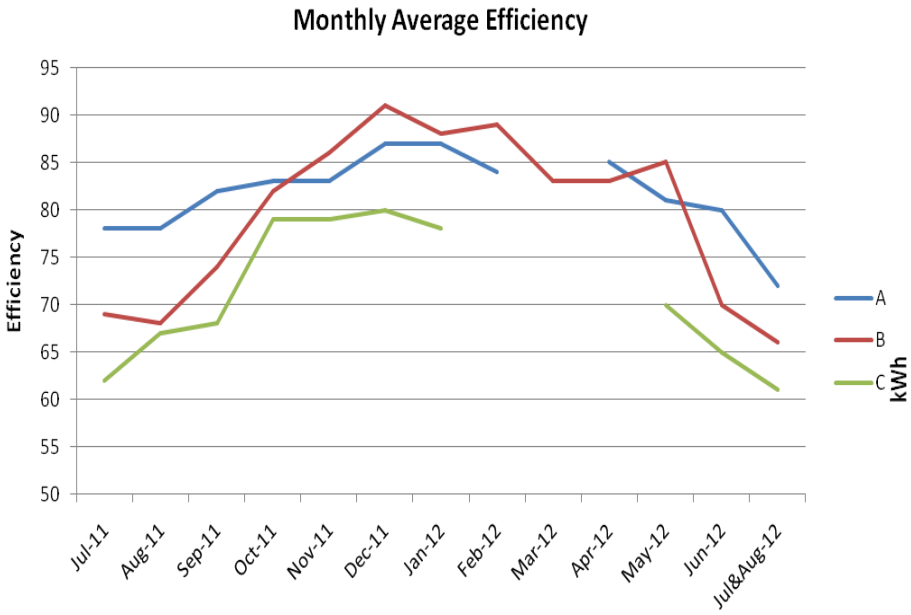
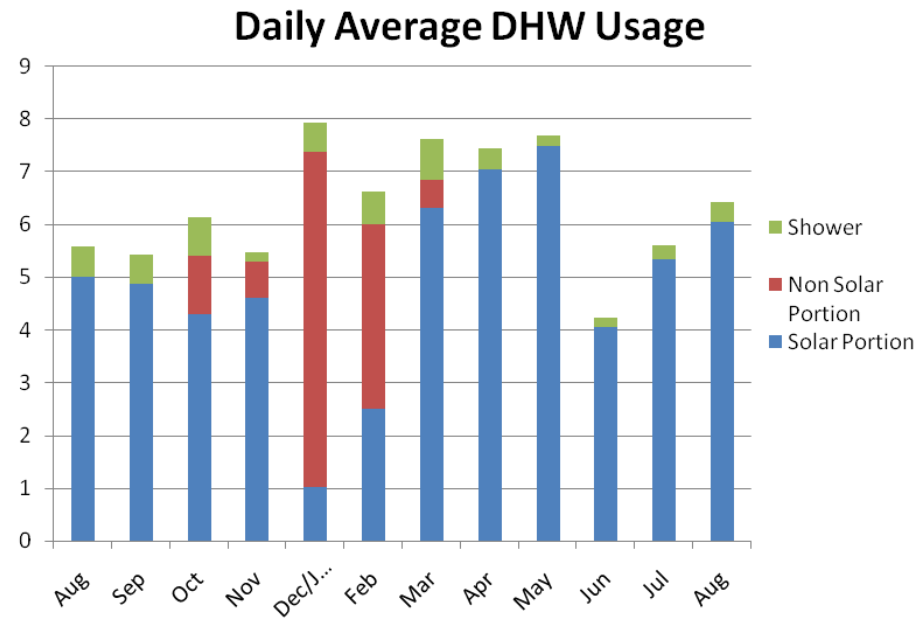
Other DEAP Assumptions

Boiler Efficiency



Solar



Seasonal efficiencies NB
Primary losses will be tested

- 384kWh/yr/m² Installed Solar (Flat Plat)

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Conclusions

- Some analysis remains to be finalised
- Valuable databases for future work
- Valuable lessons learnt – much more than DEAP compared to actual energy performance
- Blend of ‘soft’ survey data and ‘hard’ measured data offer much more ‘information from the analysis

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Conclusions

- Quantified confirmation that DEAP differs to the actual
  - Overall
  - Secondary Heat (Quantity & Breakdown)
  - Temperature
  - More to follow (Solar, Boiler Efficiency, DHW, Lighting…)
- DEAP over calculates energy consumption
- Further analysis to be done to drill further into each assumption from DEAP
  - Renewable outputs
  - Boiler seasonal efficiencies
- The data is available, perhaps scope to widen the sample set
- Value in pursuing a longitudinal study
- Value in sharpening DEAP to resemble actual consumption

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Thank you for your attention

Questions?

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