THE NATIONAL TRUST

The National Trust's approach to energy efficiency in historic buildings

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The National Trust for England,
Wales and Northern Ireland

National Trust Environment Policy

"The National Trust was established to promote the permanent preservation for the benefit of the nation of places and artefacts of natural beauty or historic interest".

The National Trust recognises that it should promote the protection of the environment and, in particular, strive to:

- Prevent avoidable damage caused by human impact on the environment;
- Protect the Trust's long-term interests from environmental damage;
- Be an exemplar of good environmental practice

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National Trust Energy Policy

- Campaign to encourage:
  - Reduction in energy demand
  - Decentralisation of energy supply
  - Increase of renewables and microgeneration
- Reduce our own dependency on fossil fuels:
  - Energy security and costs
  - Climate change and pollution
- Current UK government targets:
  - 60% carbon reduction by 2050
  - 20% renewables by 2020

National Trust Building Stock

- Mansion properties and other buildings open to the public
- Holiday cottages
- Tenanted cottages
- Offices and estate buildings
- Farms

Mansion Properties

- Mostly Grade I listed; unique interiors, collections
- Environmental control required for collections conservation
- Energy issues: Large, leaky buildings, single glazed windows, uninsulated, oil-fuelled boilers

NT Definition of Conservation

‘…the careful management of change. It is about revealing and sharing the significance of places and ensuring that their special qualities are protected, enhanced, enjoyed and understood by present and future generations.’

Implementation of energy policy

- 1st stage: Measure baseline consumption and performance (Energy metering, Surveys, e.g. Carbon Trust)
- 2nd stage: Efficiency measures (insulation, upgrade old & inefficient installations, improve operating practices & maintenance)
- 3rd stage: Renewables and low carbon technologies

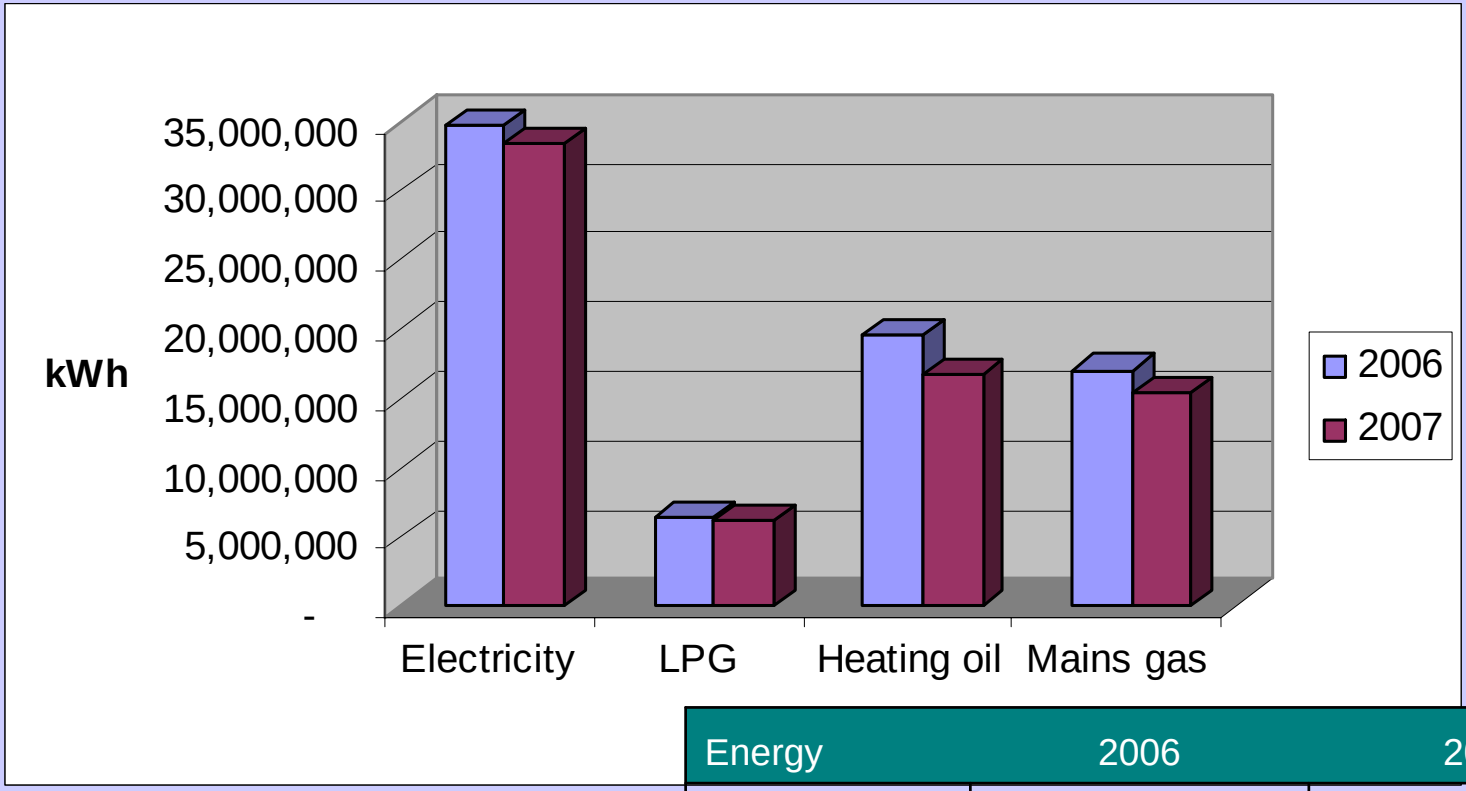
Partnerships

- Carbon Trust
- Philips
- Green Dragon EMS
- NPower Green Energy Fund

Progress to date

- 2006 baseline energy consumption quantified per property (kWhr oil, gas, LPG, electricity)
- Smart metering underway (Comfort heating, conservation heating, catering, lighting, etc)

National energy use and targets



Energy	2006	2007	% change
Electricity	34,636,060	33,439,878	-3%
LPG	6,450,861	6,122,583	-5%
Heating oil	19,554,327	16,658,605	-15%
Mains gas	17,060,513	15,514,393	-9%
Total	**77,701,761**	**71,735,460**	-8%

Efficiency measures (1)

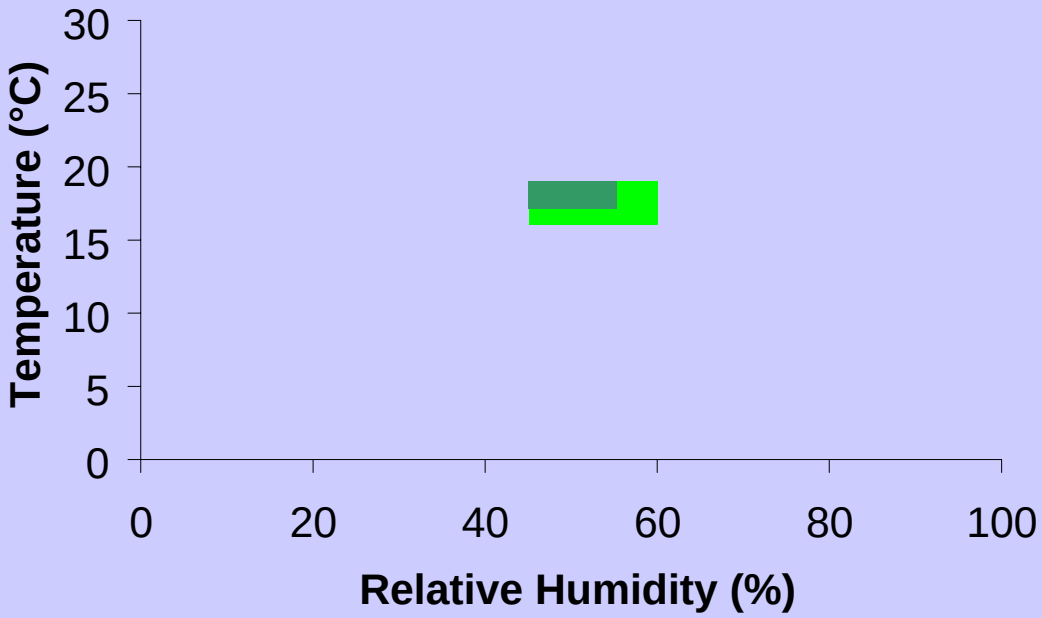
- Environmental control for collections conservation
- Energy efficient lighting
- Reduced heat loss
- Improved maintenance/operating practices

Environmental control for collections

- Temperature & relative humidity controlled to prevent
  - Biodeterioration
  - Physical damage
  - Chemical deterioration
- ~ 150 Trust properties accredited museum status

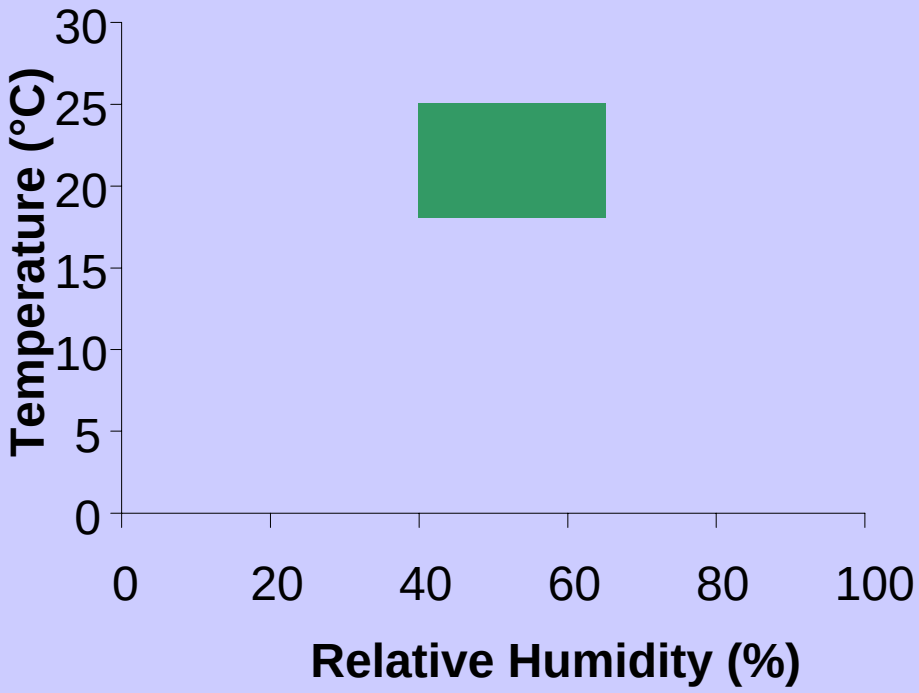
Archival Storage BS5454:2000

- RH at a fixed point between 45 and 60% with a tolerance of ±5%
- Temperature between 16 and 19°C with a tolerance of ±1°C
- Light green zone = std outer limits
- Dark green is for set points T = 18 ±1°C; RH 50 ±5%
- Realistically, can only be achieved with mechanical control



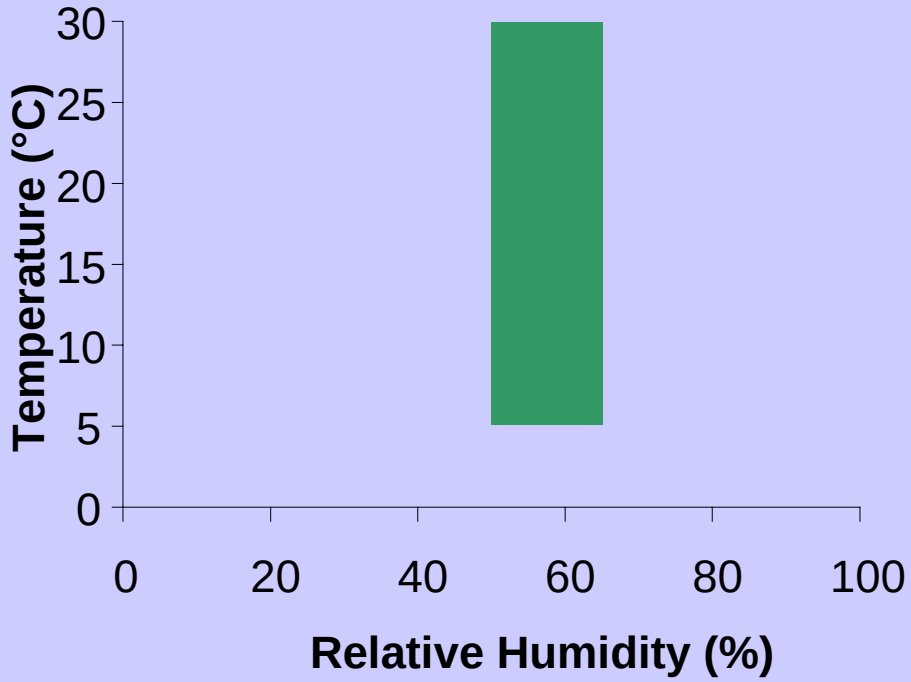
Victoria & Albert Museum Policy

- RH between 40 and 65% with hourly fluctuations < 5%
- Temperature between 18 and 25°C

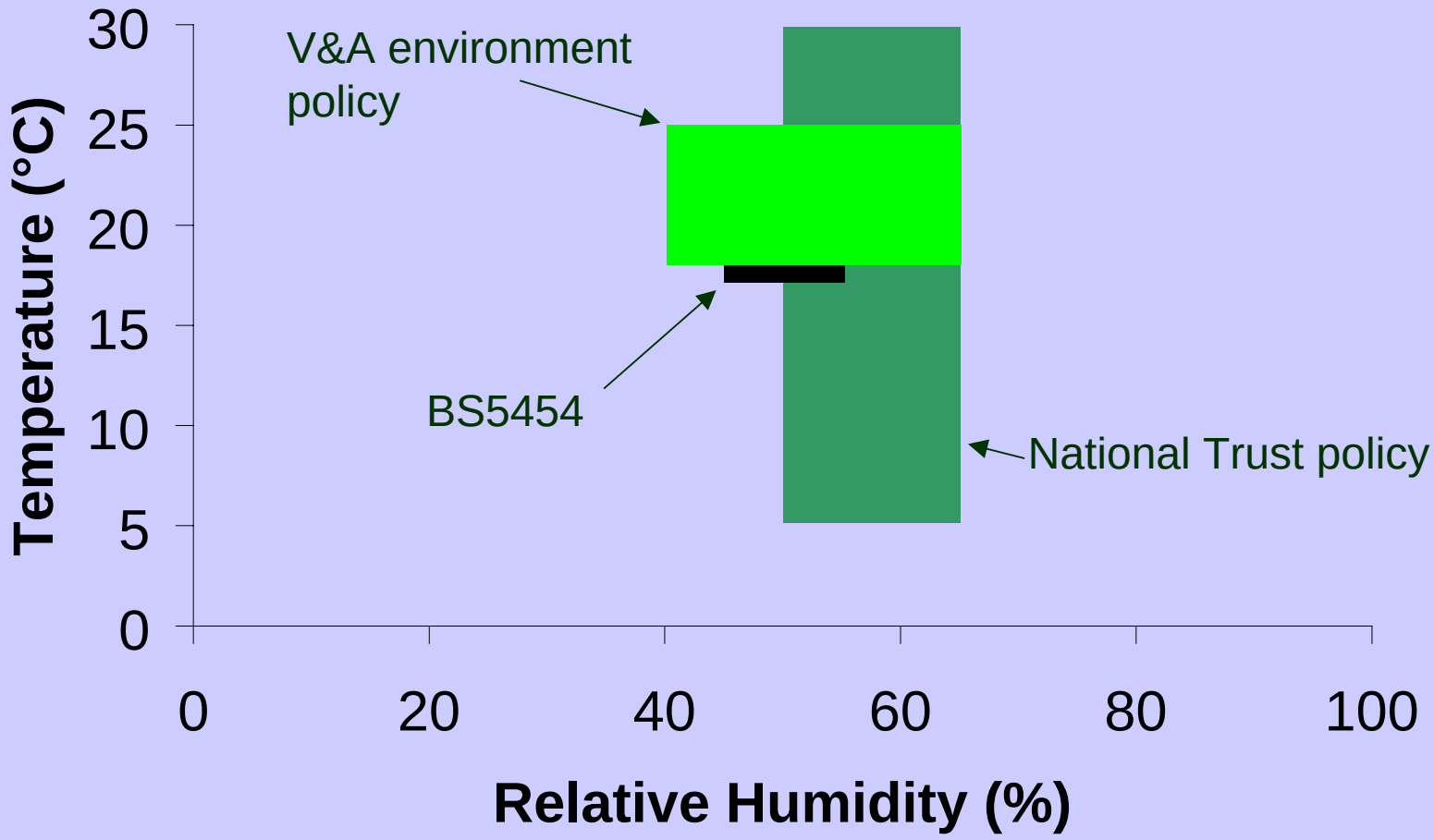


National Trust Historic House Environment Policy

- RH between 50 and 65%
- Wide temperature variation (controlled only between 5 and 22°C)
- Achievable in leaky natural ventilated buildings with ‘conservation heating’



Comparing the approaches



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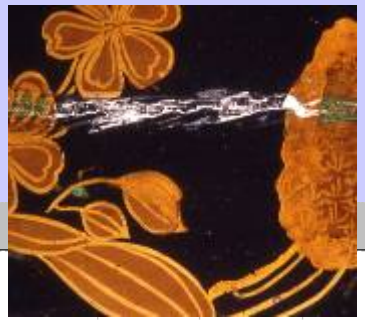
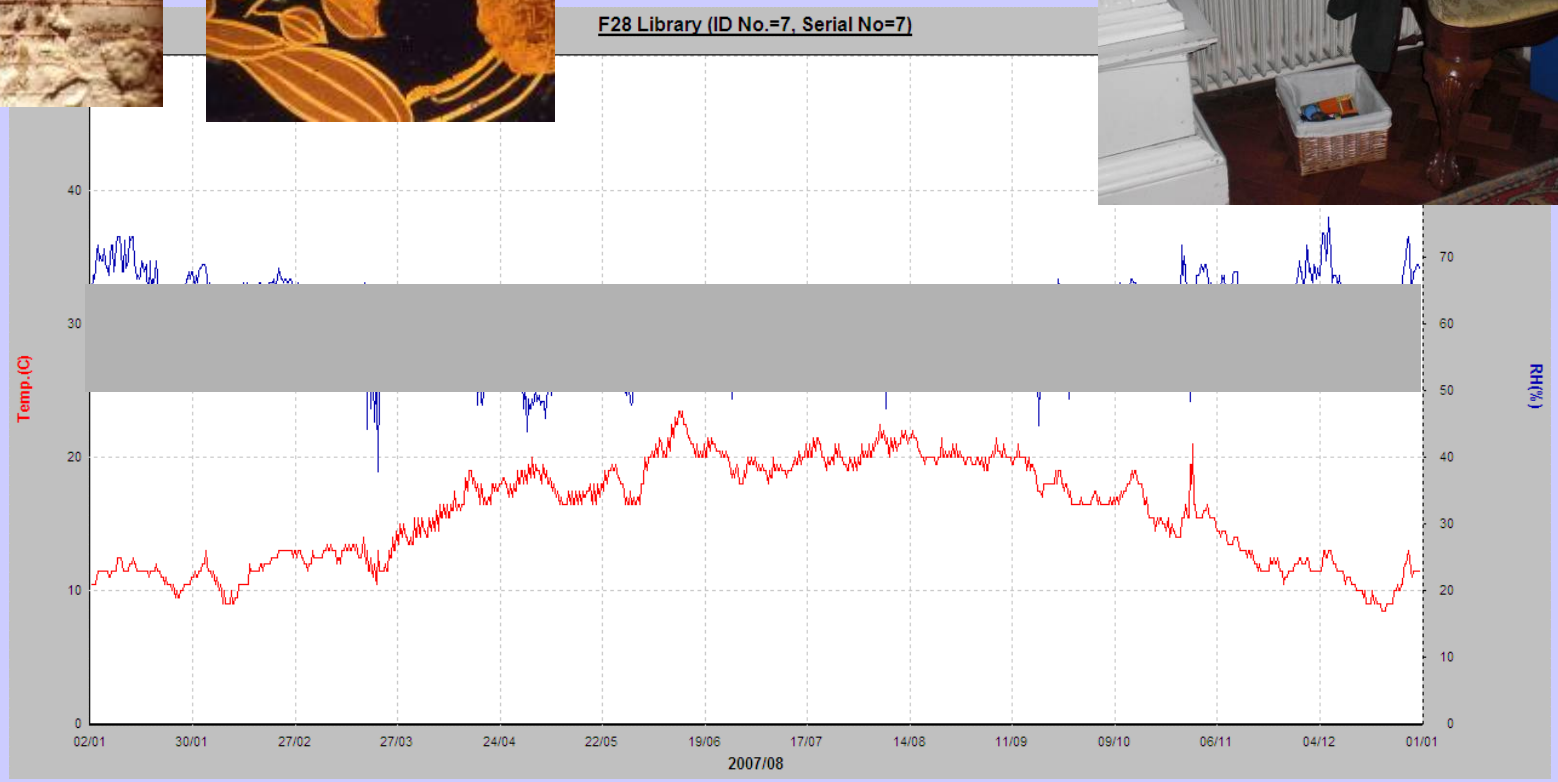
Environmental control in NT Houses: conservation heating





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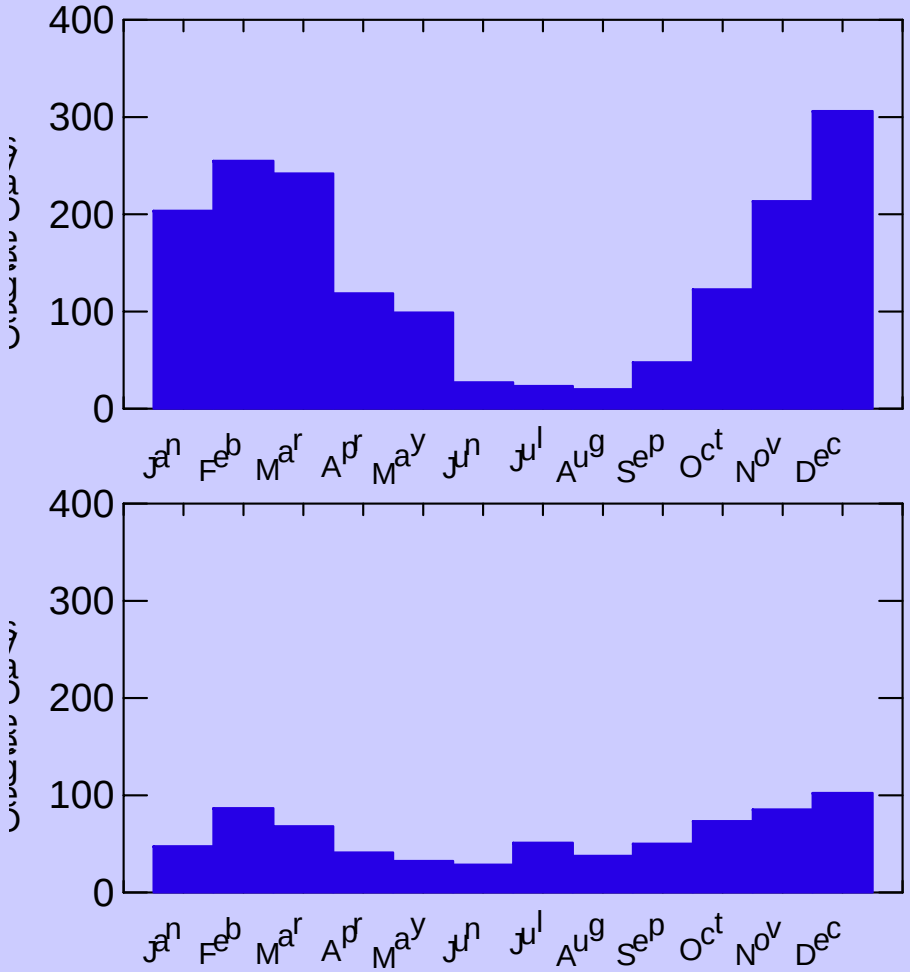
Energy demand of conservation heating – Dunham Massey 2007



Comfort heating to 19°C

Total degree days = 1678

Conservation heating to 58% RH

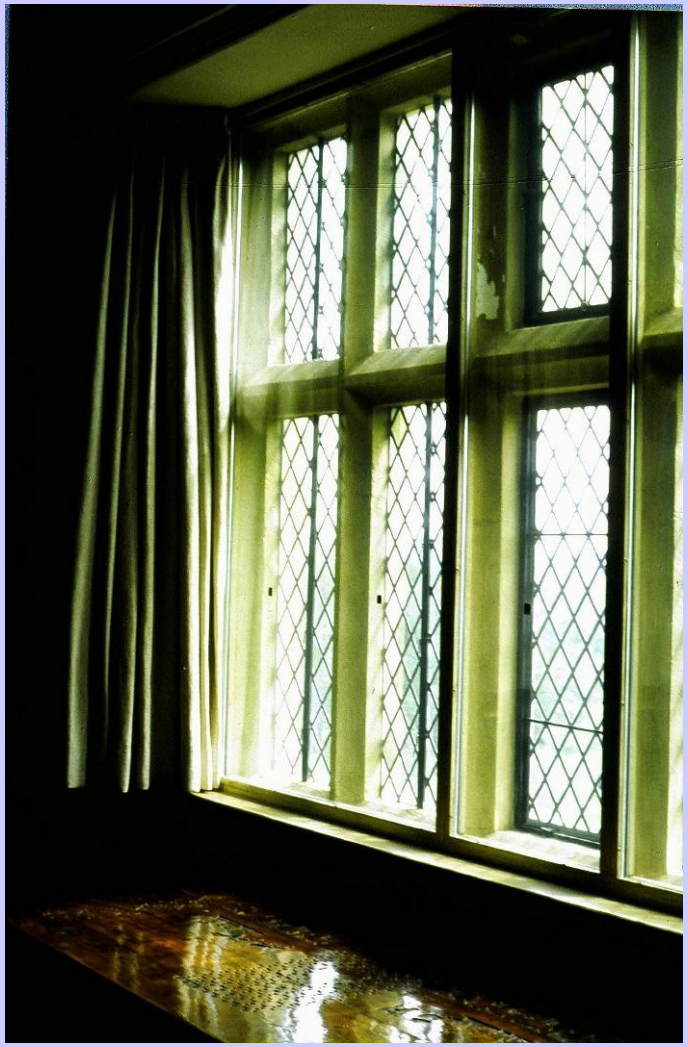
Total degree days = 705

Efficiency measures (2) Lighting: ‘Big Switch’ project (2008)

- Switch from traditional incandescent lamps to low energy alternatives, e.g.
- 60W candle incandescent (1000hr life)
  - 12W compact fluorescent (8000 hour life)
  - 40W energy efficient tungsten halogen (2000 hour)

Efficiency measures (3): Reduce heat loss

Secondary glazing



Window shutters

Action	**U Value** (W/m^2K)
Single pane glass as existing (baseline)	5.2
Fitting a standard roller blind	3.2
Closing the shutters 2.2	
Fitting heavy lined curtains	3.1
All 3 above	1.6
Fitting a modern honeycomb blind	2.8
Insulating the panels in the shutters	1.6
Fitting secondary glazing	1.6

(data from Historic Scotland's *Energy Efficiency in Traditional Homes*)

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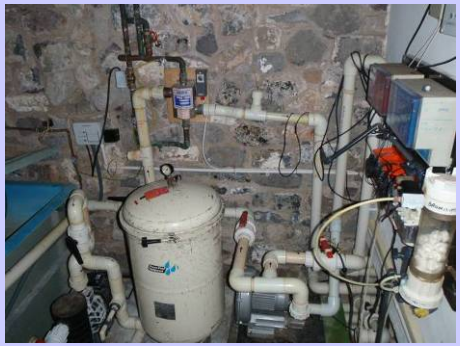
Loft insulation

Efficiency measures (4): Improve maintenance/operation

- Green Dragon Environmental Management System:
  - Environmental policy
  - Environmental review
  - Improvement plans
  - Communication & training
  - Monitoring
  - Environmental legislation & compliance
  - Management of the process

Environmental review: initial findings from Welsh properties

- Meters – lack of sub-metering, incorrect tariffs
- Time clocks – inefficient or out of date settings
- Design – over-sized heating systems & boilers
- Maintenance – not focussed on efficiency
- Operation – inefficiencies in control settings; lack of understanding of systems at properties



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Renewable energy and micro-generation

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Renewable energy installations at National Trust Properties

- Solar photovoltaic (10)
- Solar thermal (36)
- Wind, micro scale (4)
- Hydroelectric (7)
- Biomass, wood pellet, chip, log (25)
- Ground and air source heat pumps (18)

Solar photovoltaic

Dunster Castle: photovoltaic installation on roof

Hydroelectric: 9kW & 1.5kW turbines

Gibson Mill – updating history: new turbine installed alongside the 1920s original

60 kW Woodchip boiler

Hot water and under floor heating for 880 m² Regional Offices, Westley Bottom, Suffolk

Acknowledgements

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