

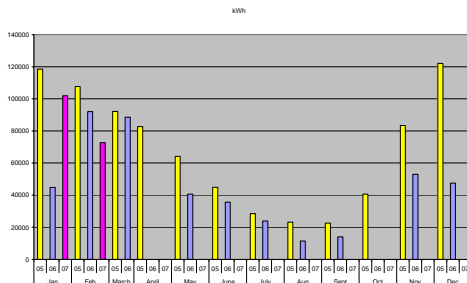


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# Carbon Academy Ambassador Training

Ade Williams & Al Brunker  
Global Action Plan

Jamie Agombar  
Ethical & Environmental Manager  
NUS Services



# Announcements

- Welcome
- Fire alarm procedure; toilets
- Informal so please chip in & ask questions
- This presentation will be available online next week

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# Global Action Plan

The practical environmental charity

**“the best organisation to engage people in environmental change”**  
**Jonathon Porritt, Chair of the Sustainable Development Commission**



# Aims for today

- **Demonstrate** the big £££ savings
- **Equip** you with background knowledge on energy efficiency
- **Outline** the key opportunities as identified by pilots
- **Develop** practical auditing skills
- *Not covering climate change – see an *Inconvenient truth**
- *Not covering new builds / advanced technology – a focus on quick and easy wins*

# Context

- Global warming
- Energy costs going up
- Increasing financial challenges for SUs
- *Never* a better time to save energy!



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# NUS Services

- The commercial arm of the NUS
- A successful purchasing consortium
- Consultancy and programmes; Ent's and NUS Extra.
- 25% owned by NUS; 75% owned by 236 shareholder students' unions
- A not-for-profit democratic company led by student volunteers

## **Ethical & Environmental Committee**

- One of three committees
- Established 1995
- 4 students, 3 staff: elected at NUS Services Convention
- Ethical & Environmental Coordinator since 1996

## **Remit**

- 45% time suppliers
- 45% time greening unions
- 10% time ensuring we practice what we preach



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## Greening Unions

- Environmental audits
- Sound Impact Awards
- Carbon Academy

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# The environmental impact of students' unions

## Our membership

- 236 Unions; 233 shops and 473 bars + offices
- 80% do not pay for utilities (44 we know of do)

## Our footprint

33 environmental audits in 30 months:

- Lots common good practice
- Lots common bad practice (ventilation; lights for cleaners; ice machines)
- Exemplary bad practice (thermostat in roof; windows painted black)



- Lots of inefficient technology
  - Tungsten filament lighting
  - Electric heating and poor insulation
  - Washrooms (water has CO<sub>2</sub> burden too!)

## Energy data

1. Through audits we found £364k savings through no or low cost actions = approx 12% of utilities.
2. Energy / water data from 22 separately metered unions.  
Average 624 t/CO<sub>2</sub>/year. 12% = 75 t/CO<sub>2</sub>/year.  
236 members x 624 t/CO<sub>2</sub>/year = **147,000 t/CO<sub>2</sub>/year**  
236 x 75 = **17,700 t/CO<sub>2</sub>/year** being wasted!!

www.chmainspse.com

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- 147,000 t/CO<sub>2</sub>/year = planting 750,000 trees...  
...726 football pitches. 12% = 90,000 trees



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# The Carbon Academy



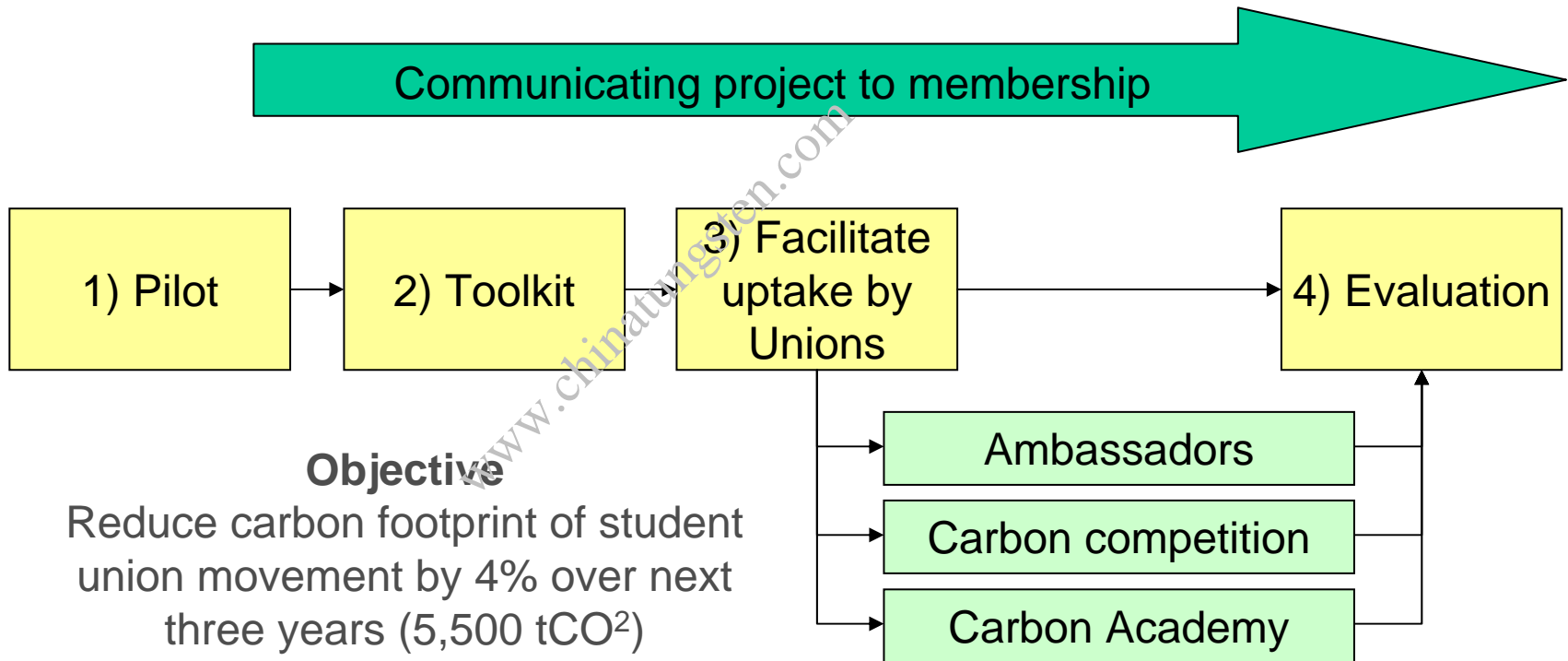
national union of students



**people & planet**

student action on world poverty and the environment

# The Carbon Academy



## Key target

- 30 metered unions to take energy saving actions and demonstrate savings
- 50 unmetered unions to take action

Roving champions

Carbon competition

Carbon Academy

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# An overview of energy management

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## Key principles

- **Electricity** is a flow of charged particles.
- **Voltage** is the pressure at which the charged particles are pushed/pulled at, measured in Volts, V. Mains voltage is around 240V. Low voltage is 12V.
- **Current** is the volume of charge particles flowing, measured in Amps, A.
- **Power** is the rate at which an appliance transforms electricity into other forms of energy, measured in Watts (W). NB:  $W = V \times A$ . 1,000W = 1kW. A 1kW appliance running for one hour uses 1kWh of energy.

## All about Wattages

- Many appliances say Wattage



# Energy

Manufacturer

Model

COOLZONE  
CZ51035WFR  
MINI BAR

More efficient



Less efficient

Energy consumption kWh/year  
(Based on standard test results for 24 h)

602

Actual consumption will depend on how the appliance is used and where it is located

Fresh food volume L  
Frozen food volume L

Noise  
( dB (A) re 1pW)

40

Further information is contained in product brochures

Norm EN 153 May 1990  
Refrigerator Label Directive 94/2/EC



- Some even give kWh estimates per year



- Some don't say either Wattage or kWh
- If not they usually have a label that shows useful data, typically voltage and amps.
- You can use this to calculate Wattage yourself using  $W = V \times A...$



Example: This label is on the bottom of our laptop.  
How many Watts could it be using?

$$W = V \times A. 19.5V \times 4.62A = 90W$$

## Energy tracker demonstration

- Actually uses about 38 Watts most of the time
- 80 Watts when charging
- Increases further if fan comes on / if running a DVD
- Therefore maximum possible is 90 Watts
- Energy trackers useful as can monitor actual consumption over time

## Exercise – Wattages of appliances

Mix and match each item with a suitable wattage

1 x standard TFL bulb

1 x energy efficient bulb

Air conditioning cassette

Bottle fridge

Dairy deck fridge

Electric heater

Mobile phone charger on standby

Night club ventilation system

Water cooler

10,000 W

3,500 W

2,500 W

2,000 W

900 W

750 W

100 W

11 W

>1 W

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Night club ventilation system	10,000 W
Air conditioning cassette	3,500 W
Dairy deck fridge	2,500 W
Electric heater	2,000 W
Bottle fridge	900 W
Water cooler (NB: when cooling)	750 W
1 x standard bulb	100 W
1 x energy efficient bulb	11 W
Mobile phone charger on standby	>1 W



## What about carbon?

- If you know how many kWh you use (appliances, energy tracker, meter or bills) it is very easy to calculate a 'carbon footprint'. Can calculate for appliances, buildings, people.
- Energy sources for UK electricity generation (DTI, Aug 2007)
 

Coal	35.8%	}	= Fossil Fuels 76.7%
Natural Gas	38.8%		
Other (oil)	2.1%		
Nuclear	18.6%		(produce CO <sub>2</sub> )
Renewables	4.7%		
- The average volume of CO<sub>2</sub> released into the atmosphere per kWh of electricity is **0.523 kg** (DEFRA's new figure).

# Energy

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Model

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CZ5103SWFR  
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More efficient



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**G**

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Further information is contained in product brochures

Norm EN 153 May 1990  
Refrigerator Label Directive 94/2/EC



$602 \text{ kWh/year} \times 0.523 \text{ kg} = 315 \text{ kgCO}_2/\text{year}$

So this little fridge is responsible for 0.3 tCO<sub>2</sub>/year

- Lots accurate conversion web pages  
<http://actonco2.direct.gov.uk/index.html>
- Include gas – gas bills often in kWh too
- Key point of reference: average footprint of a person in the UK is **10 tCO<sub>2</sub>/year**

## £££ cost of electricity

Union	Elec (kWh)	kg CO <sub>2</sub>	Cost	£ per kWh
University of Warwick Students' Union	1,888,993	812,267	£84,490	£0.0447
University of Bristol Union	1,083,450	465,884	£98,500	£0.0909
Loughborough Students' Union	1,325,224	569,846	£98,000	£0.0739
University of London Union	1,367,976	588,230	£132,324	£0.0967
Sheffield Hallam University Union of Students	1,000,000	430,000	£100,000	£0.1000
University of Abertay Dundee Students Association	620,011	266,605	£62,651	£0.1010

- This is 2006 data
- Gone up 65% in last 4 years!!
- Heading one way
- A typical current campus cost is 10p / kWh including CCL and charges
- Consider:
  - Day and night rates
  - Available supply capacity (maximum demand)

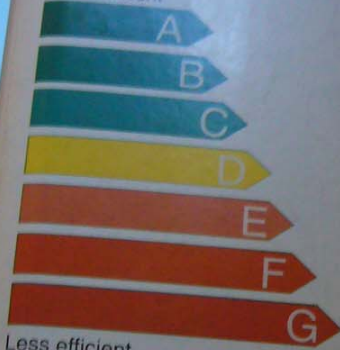
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Less efficient

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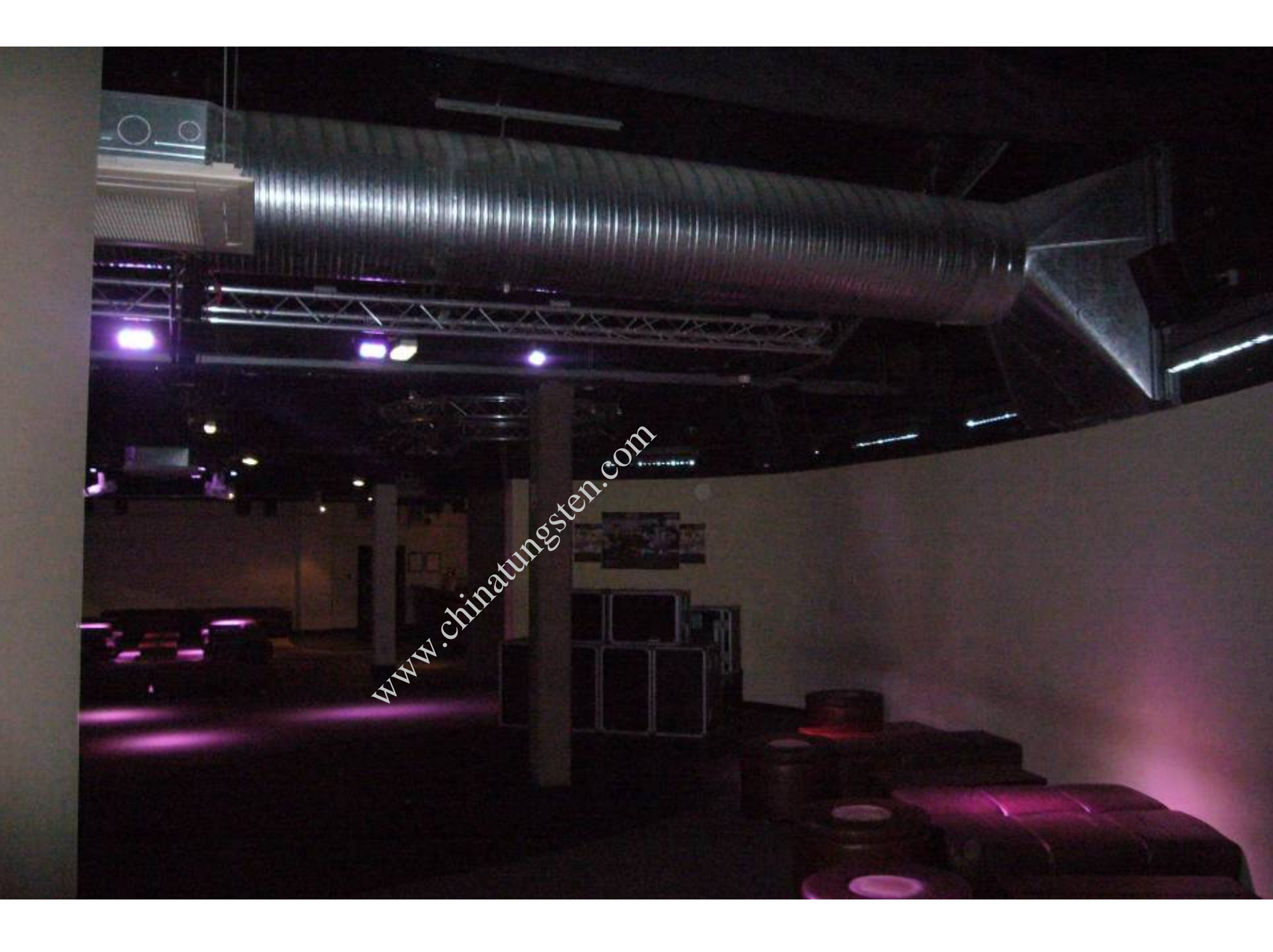
602 kWh/year x  
£0.10 = £60.20 per  
year

So this little fridge  
will cost around £60  
to run a year

## Focus on ventilation and a/c

### Ventilation

- 40W/m<sup>2</sup> threshold for natural ventilation
- Concept of air changes per hour
- Air handling very costly!
  - Desk fan (40W)
  - Nightclub air handling, 20-30 kW (i.e. 500-750 desk fans!)
- Often goes unnoticed
- Usually on a timer; usually wrongly set up. Easy win!
- Not technical, but... principle of variable fan speeds (VSDs) - vary speed by temperature and air quality



## Air conditioning

- Typically doubles energy consumption if building fully air conditioned
- Never quench hot air with cold air!
- If air con is essential, set to 24°C and shut windows



## Focus on lighting

- The three types of lighting technology
  - TFLs
  - Fluorescent
  - LED
- GU10 spotlight fittings
- Know your fluorescent tubes
- Placement and best practice

## Technology 1) Tungsten filament lamps

- How they work  
Tungsten filament glows in gas. Sometimes a halogen gas
- Advantages
  - Inexpensive to buy
  - Variety of bulb formats (spotlights, floodlights, candle bulbs, colours, etc.)
  - Dimmable
- Disadvantages
  - 100 year old technology! Gives out more heat than light
  - Expensive to run (= very energy inefficient) - going to be banned?
  - Short life (2,000h)
- Uses
  - Flood lights
  - Beams
  - Nightclubs

## Technology 2) Fluorescent lights

- How they work  
No filament. Gas gets hot and glows.
- Advantages
  - Cheap to run
  - Good life (10,000h)
  - Not hot but warm
- Disadvantages
  - Splayed light
  - Take time to warm up
  - Most not dimmable
- Uses
  - Offices the world over
  - CFLs now replacing TFLs as the choice in homes

## Technology 3) LED lights

- How they work
  - One or more LED in single fitting
- Advantages
  - Exceptionally cheap to run
  - Exceptionally long lamp life (30,000h)
- Disadvantages
  - Not very bright
  - Expensive to buy
- Uses
  - Corridors
  - Nightclubs

## GU10 spotlight fittings

- Available as TFL halogen, CFLs and LED
- Specimens at front
- 50w TFL – Shop displays only
- 11w CFL – Bars, washrooms
- 1.2W LED – Peripheral lighting
- Everywhere else use standard fluorescent lamps...



## T5, T8 and T12 Fittings

- T12 is the old original tube. Not comparatively inefficient. Usually found in non-mirrored units
- T8 is more energy efficient
- T5 the most efficient
- All tubes say their wattage on them
- The slimmer the better



## Placement and best practice

- Switches for lights should be in rows along windows
- Label light switches
- Motion sensors
- Light sensors
- Only light rooms if people are in them!

# Calculating energy consumption

## Example – Halogen bulbs in a washroom

A union has 44 x 50W tungsten filament halogen bulbs in the male washroom of its nightclub. They are on for eight hours, four nights a week for 31 weeks a year. Assuming an average tariff of £0.09 per KWh, and applying a Climate Change Levy of 0.0043p per KWh, what is the value of the energy they consume in a year? And what is their carbon footprint?

8 hours x 4 days = 32 hours per week.

32 hours per week x 31 weeks = 992 hours per bulb per year.

50 W/hour x 992 hours = 49,600 Watt hours per bulb per year.

49,600/1000 = 49.6 kWh used per bulb per year.

49.6 kWh x £0.09 (cost per kWh) = £4.46 per bulb per year.

49.6 kWh x £0.0043 (CCL per kWh) = £0.21 per bulb per year.

£4.46 + £0.21 = £4.68 per bulb per year

£4.68 x 44 bulbs = £205.80

49.6 kWh x 44 bulbs = 2,182 kWh

2,182 x 0.523 kg = 1,141 kgCO<sub>2</sub>/year

1,141/1000 = 1.1 tCO<sub>2</sub>/year



## Exercise 1 – Nightclub ventilation

A union nightclub has a 12.5 kW air handling unit that runs at full capacity when on. At present the system is never switched off. The venue is only used three nights a week, 33 weeks a year. The nightclub opens at 10pm and closes at 3am. Assuming an average tariff of £0.1143 per kWh (inclusive of all charges and the CCL), how much will the union save a year by switching it off?

## Exercise 2 – Passport photo machine

A students' union has two identical passport photo machines. Each uses 600W of energy as their minimum demand and is not switched off overnight or at weekends. The union is considering removing one to reduce its carbon footprint. How much energy, carbon and money will they save assuming an average tariff of £0.10 per KWh (inclusive of all charges and the CCL)?

## Answer to Exercise 1 – Nightclub air conditioning

### Present maximum cost

24 hours x 7 days = 168 hours per week

168 hours per week x 52 weeks = 8,736 hours per year.

12,500 W/hour x 8,736 hours = 109,200,000 Watt hours per year.

109,200,000 /1000 = 109,200 kWh used per year.

109,200 KWh x £0.1143 (cost per KWh) = £12,481 per year.

### Switching off regime

5 hours x 3 days = 15 hours per week.

15 hours per week x 33 weeks = 495 hours per year.

12,500 W/hour x 495 hours = 6,187,500 Watt hours per year.

6,187,500 /1000 = 6187.5 kWh used per year.

6,187.5 KWh x £0.1143 (cost per KWh) = £707.23 per year

### Maximum potential saving

£12,481 - £707.23 = £11,773.77

## Answer to Exercise 2 – Passport photo machine

24 hours x 7 days = 168 hours per week.

168 hours per week x 52 weeks = 8,736 hours per year.

400 W/hour x 8,736 hours = 3,494,400 Watt hours per year.

3,494,400 /1000 = 3,494.4 kWh used per year.

3494.4 KWh x £0.10 (cost per KWh) = £349.44 per year.

3,494.4 kWh x 0.523 kg = 1,827.57 kg

1827.57 kg / 1000 = 1.8 tCO<sub>2</sub>/year



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**Time for a break!**

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# The Carbon Academy Toolkit

- All about the pilots and lessons learned
- 30 mins - Carbon Academy priority action briefing
- 60 mins - Six pilot case studies / plans
- Half a day - Carbon Academy audit checklist
- Branded awareness raising resources
- Download from [www.nussl.co.uk](http://www.nussl.co.uk)



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## **Six pilot case studies**

Loughborough Students' Union

University of Bristol Union

Sheffield Hallam University Union of Students

University of Abertay Dundee Students Association

University of Warwick Students' Union

University of London Union

# 1) Loughborough

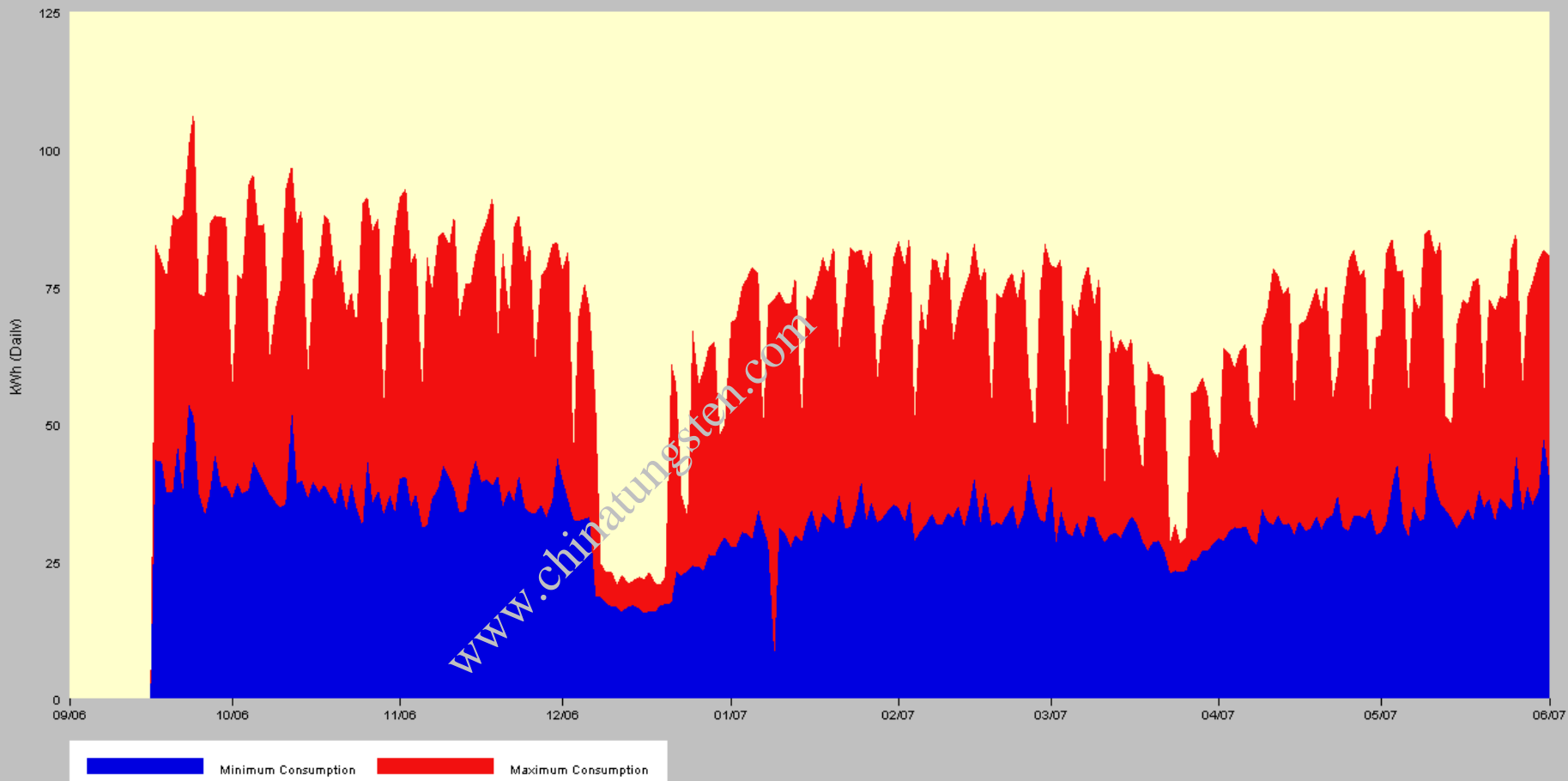
- AC in media centre (11.3t, £1.7k)
- T8 to T5 (6.3t, £1k)







Glycol (3.2t, £510)







## 2) Bristol

- Windows (20.3t, £2.7k)



LERP (18t, £4k) & vacation shutdown (10.4t, £2.2k)



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TFLs (11.5t, £1.9k)



Swimming pool timers & cover (36.8t, £5k)

### 3) Sheffield Hallam

- 248v to 216.2v (56.0t, £12.6k)







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[www.chinatungsten.com](http://www.chinatungsten.com)

Lights in A, B and C Pods (4.3t, £970)



Motion sensors P-Pod & stores (4.4t, £900)



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28 W on standby!!



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#### 4) Abertay

- 4kW emergency lighting (11.27t, £1.7k)





BMS (32.1t, £5.7k)



Label light switches (1.7t, £300)





## 5) Warwick

- A/C on BMS (12.4t, £2.2k)
- Passport photo machine (1.0t, £177)





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- Remove bulbs (0.7t, £130)
- Light sensors (4.8t, £840)



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LERP (23.0t, £4k)

## 6) ULU

- Bottle fridges off and Ecubes (17.0t, £2.6k)





Venue heating / Nightclub cooling (22.0t, £3.3k)

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The gallery  
→

Drink  
☑ ☑







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275 x 50W GU10s (19.4t, £3.1k)

**TURN IT  
OFF!**

**CARBON  
TRUST**  
Making business green  
and carbon smart



Comfort cooling policy (8.6t, £1.3k)





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AIR  
EXTRACT

www.chinatungsten.com











[www.chinatungsten.com](http://www.chinatungsten.com)

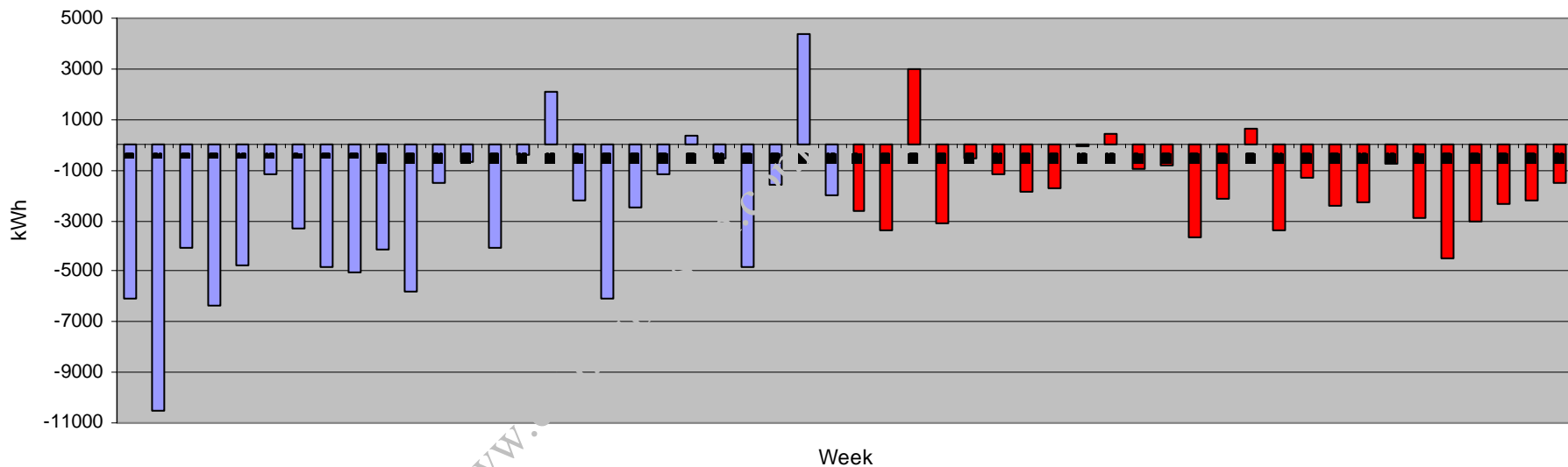


## Targets and progress

	Footprint	Investment	Annual savings	Projected savings tonnes CO2	% reduction in footprint
<b>Loughborough</b>	679.9	£20,375	£9,648	60.6	<b>8.9</b>
<b>Bristol</b>	1021.4	£3,606	£23,663	137.1	<b>13.4</b>
<b>Sheffield Hallam</b>	433.7	£12,044	£24,624	113.7	<b>26.2</b>
<b>Abertay</b>	392.3	£19,554	£16,957	96.3	<b>24.6</b>
<b>Warwick</b>	671.1	£4,757	£19,477	107.9	<b>16.1</b>
<b>ULU</b>	631.4	£4,420	£28,508	160.1	<b>25.4</b>



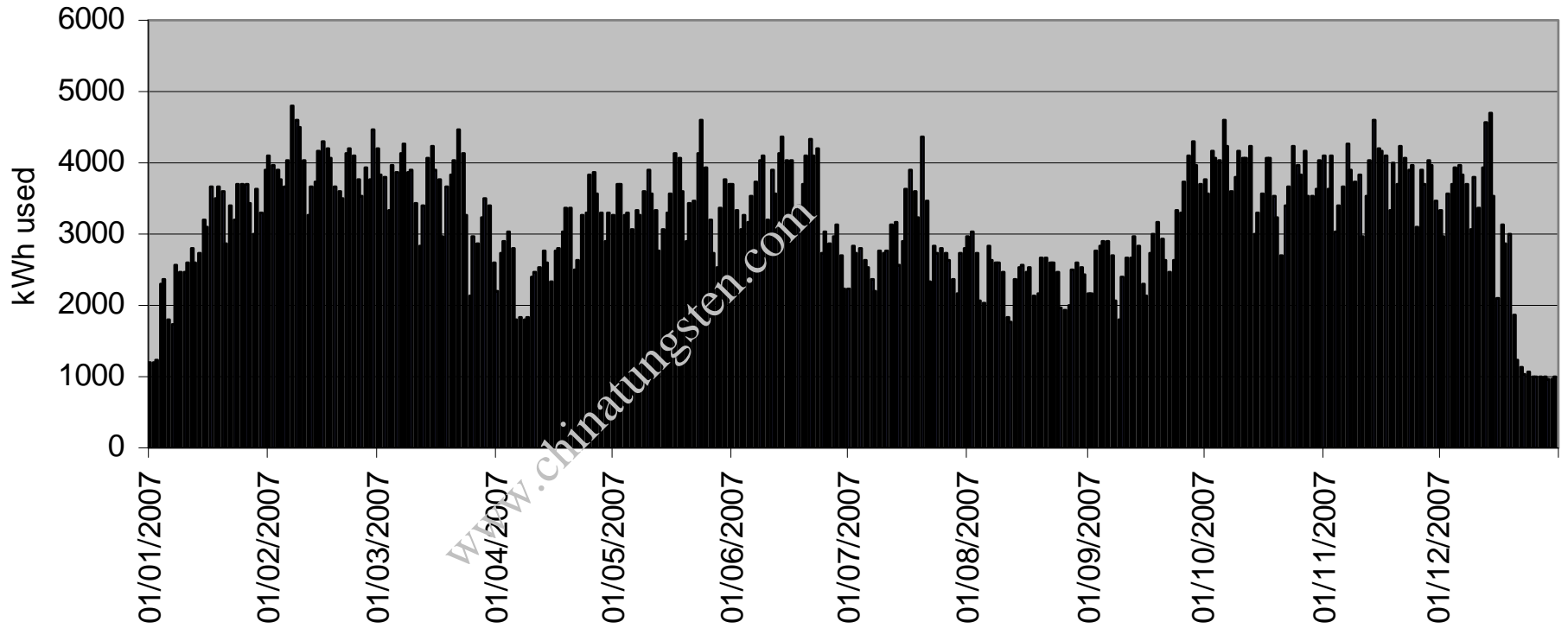
Loughborough Students' Union - Difference by week 2007 vs. 2006



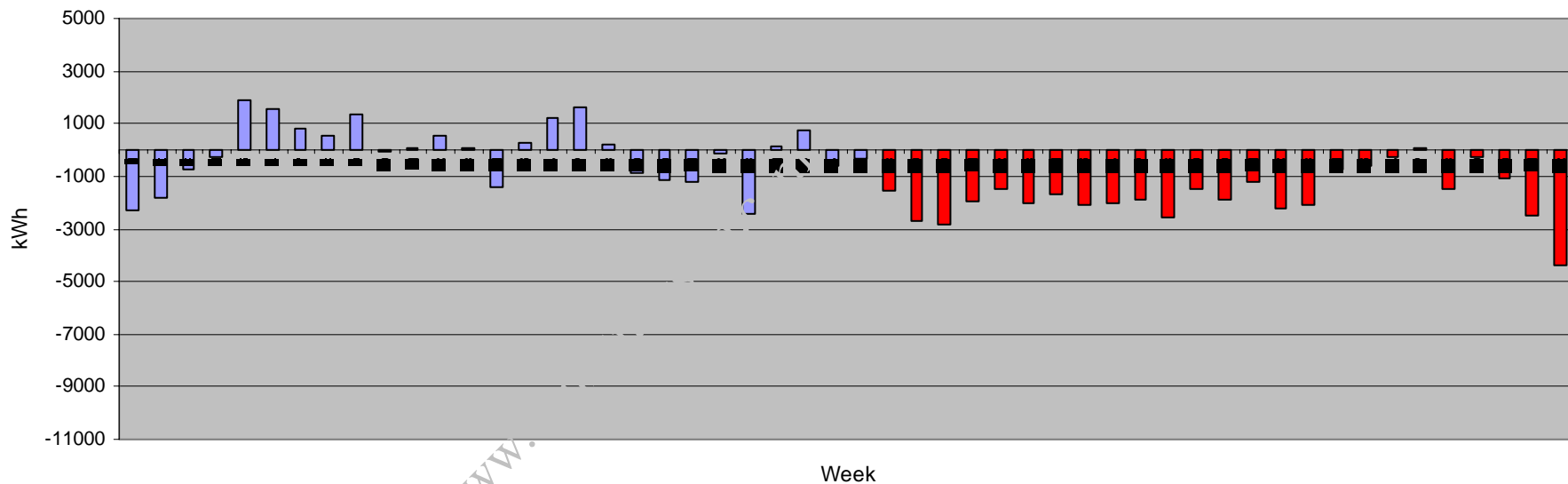
NB: 1,000 kWh = £100



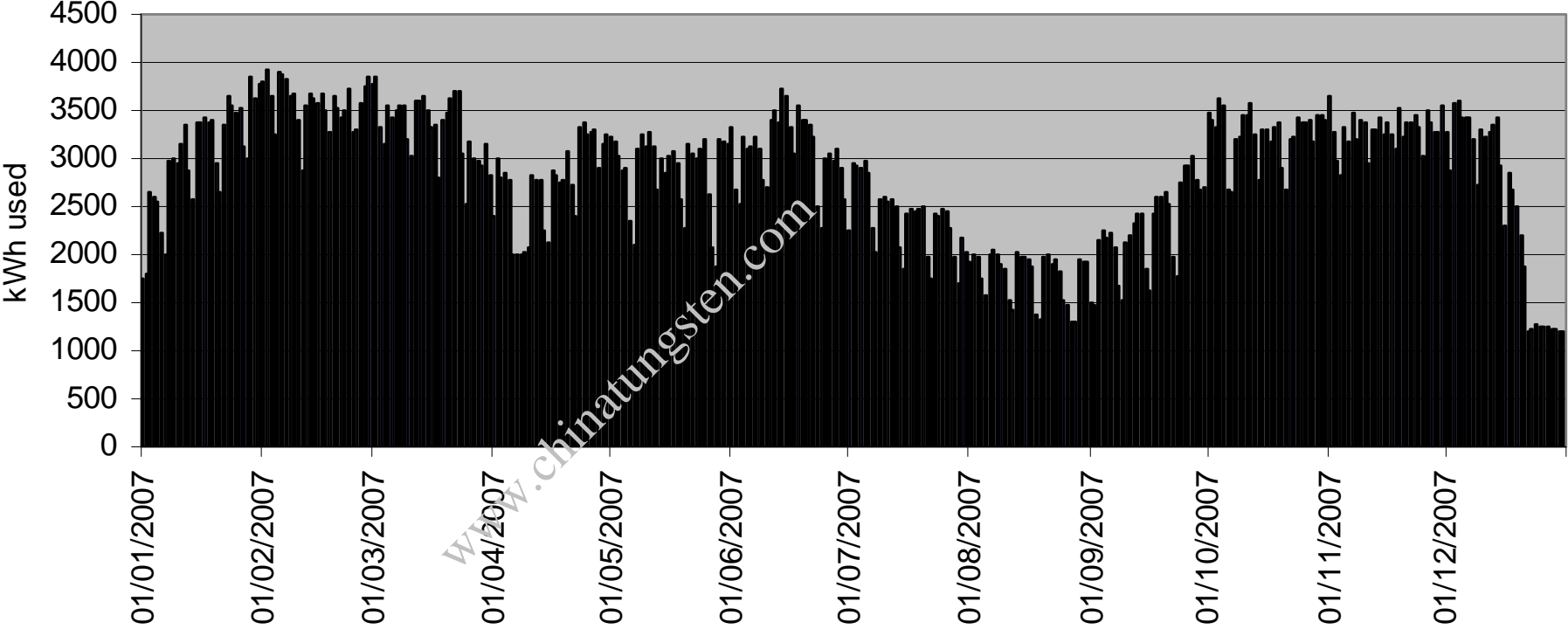
Loughborough Students' Union - Daily energy consumption 2007



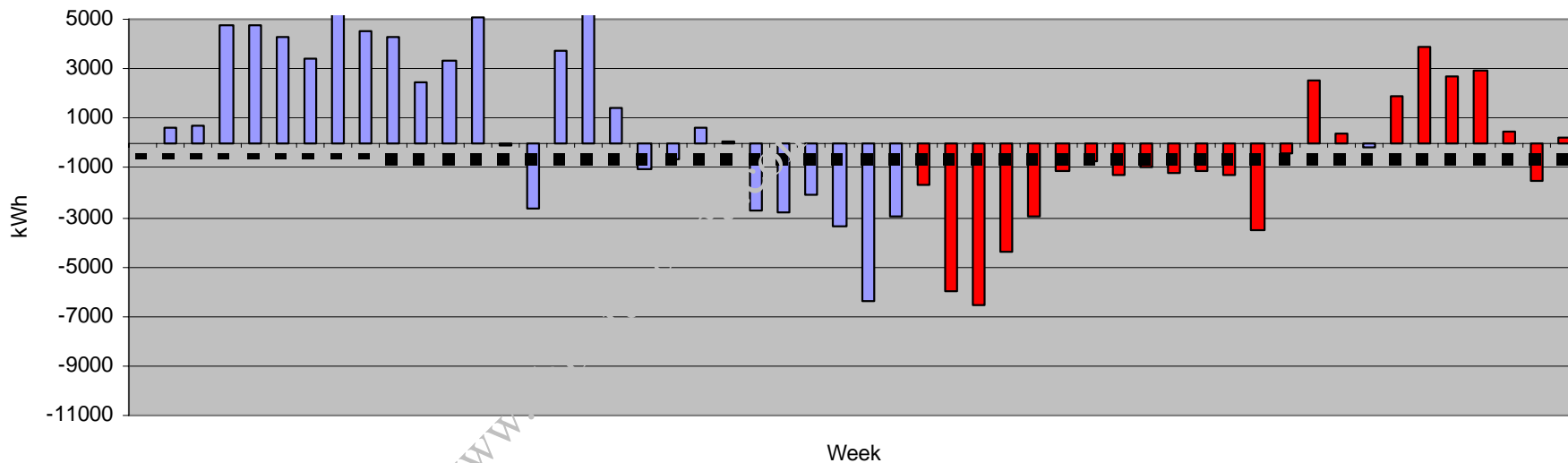
University of Bristol Union - Difference by week 2007 vs. 2006



# University of Bristol Union - Daily energy consumption 2007

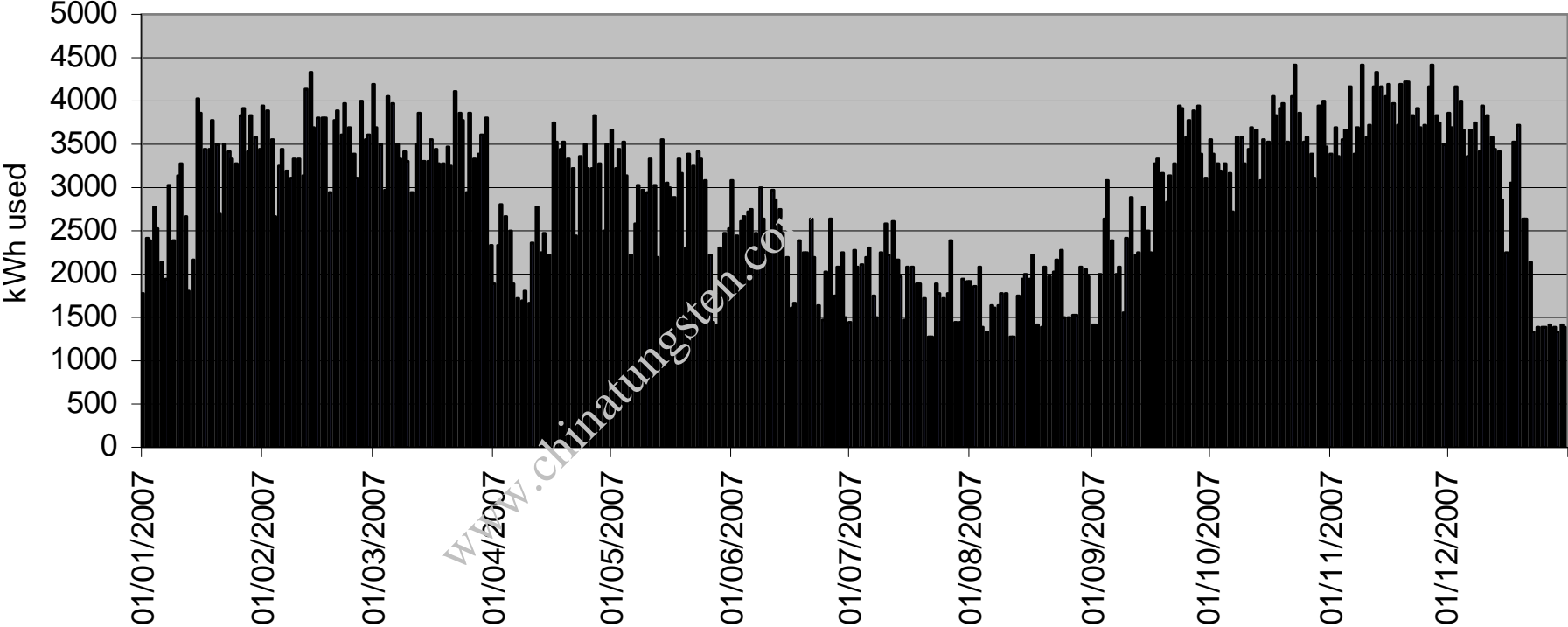


Sheffield Hallam University Union of Students - Difference by week 2007 vs. 2006

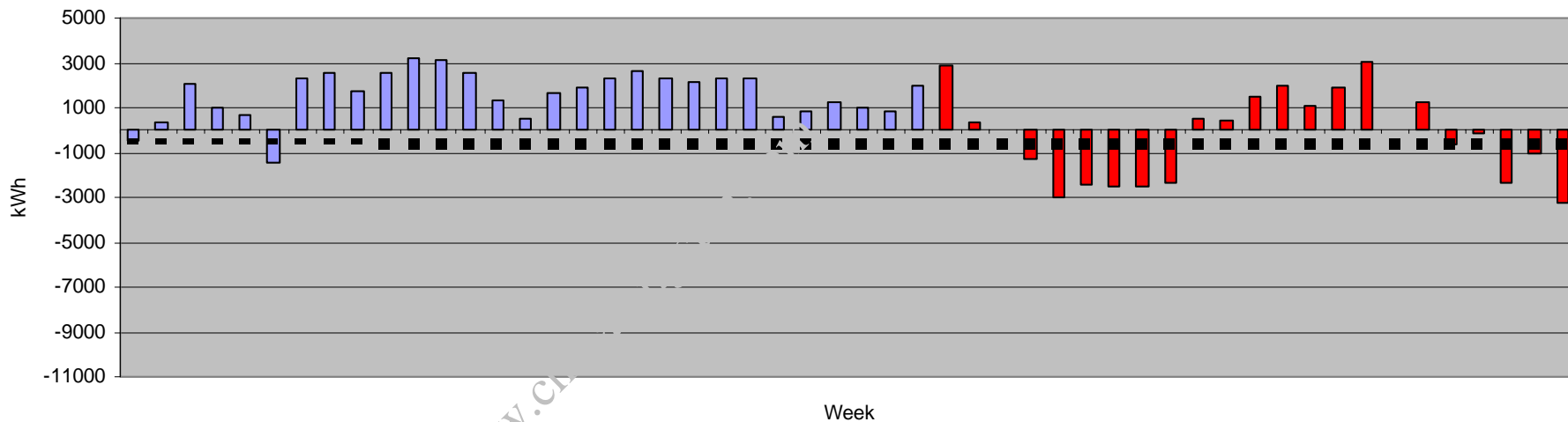


NB: 1,000kWh = £100

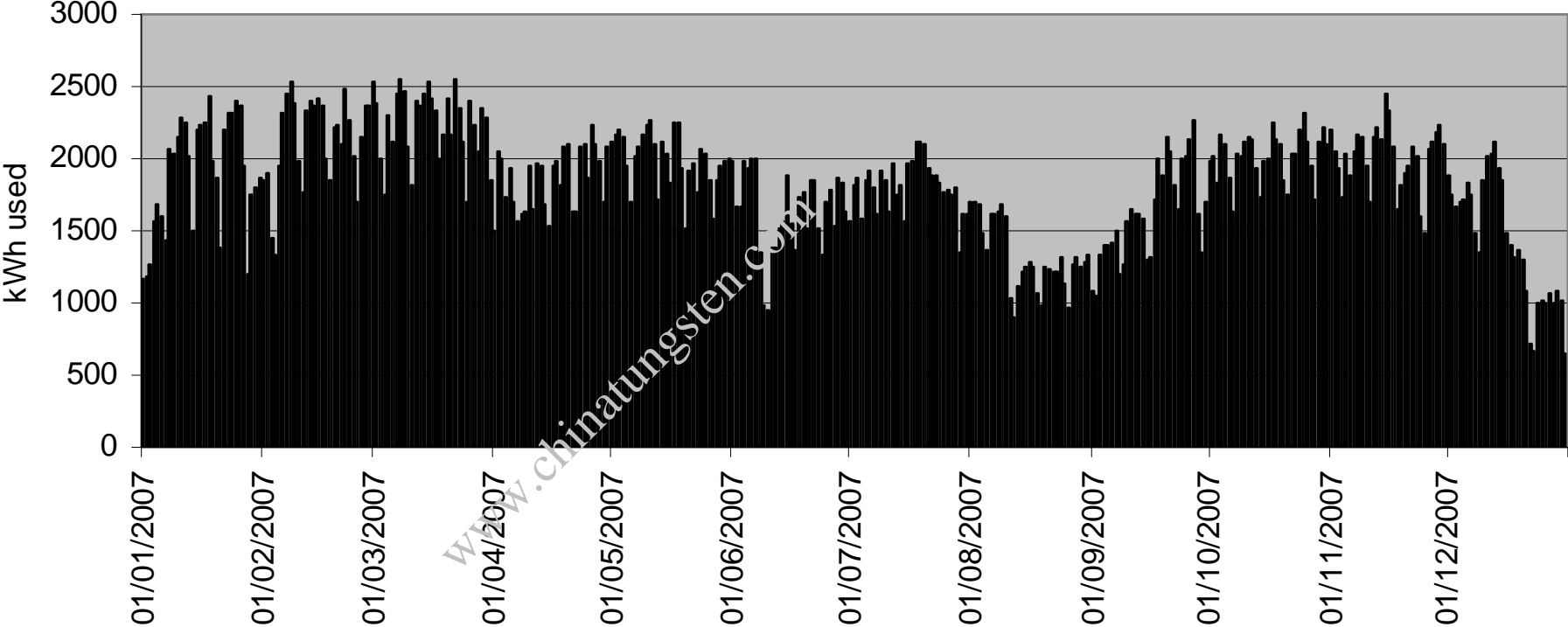
Sheffield Hallam University Union of Students - Daily energy consumption 2007



University of Abertay Dundee Students Association - Difference by week 2007 vs. 2006

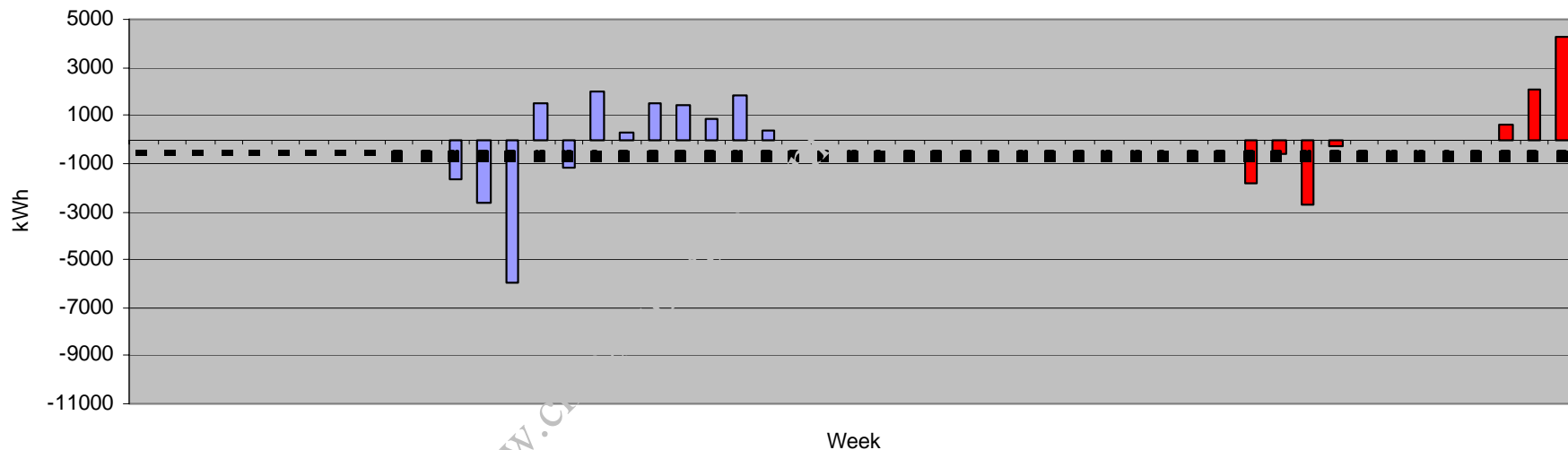


University of Abertay Dundee Students' Association - Daily energy consumption 2007

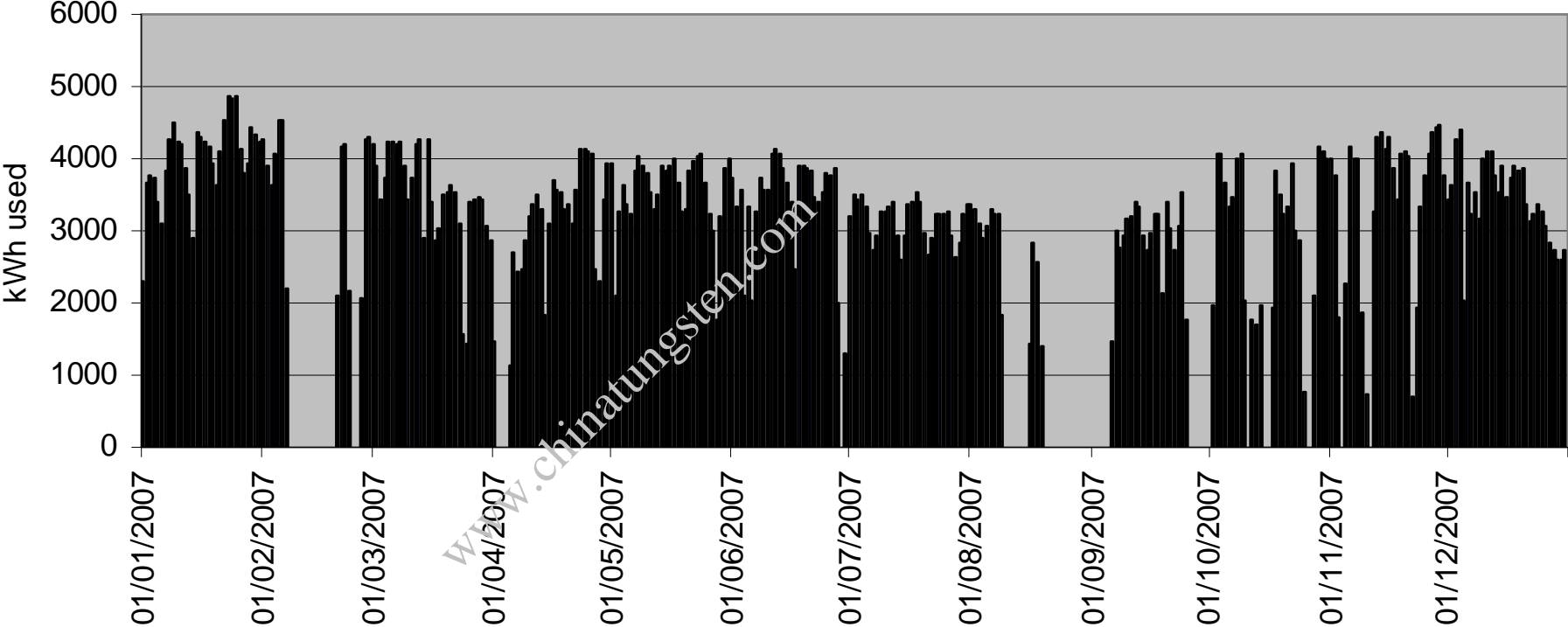




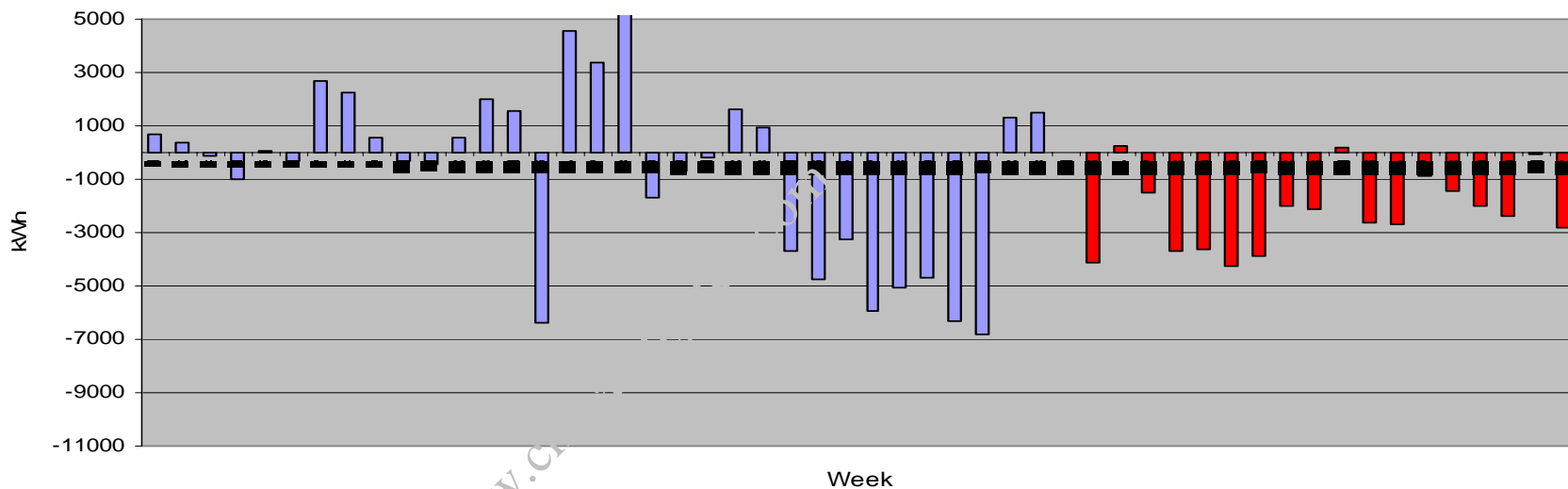
University of Warwick Students' Union - electricity - Difference by week 2007 vs. 2006



University of Warwick Students' Union - Daily energy consumption 2007

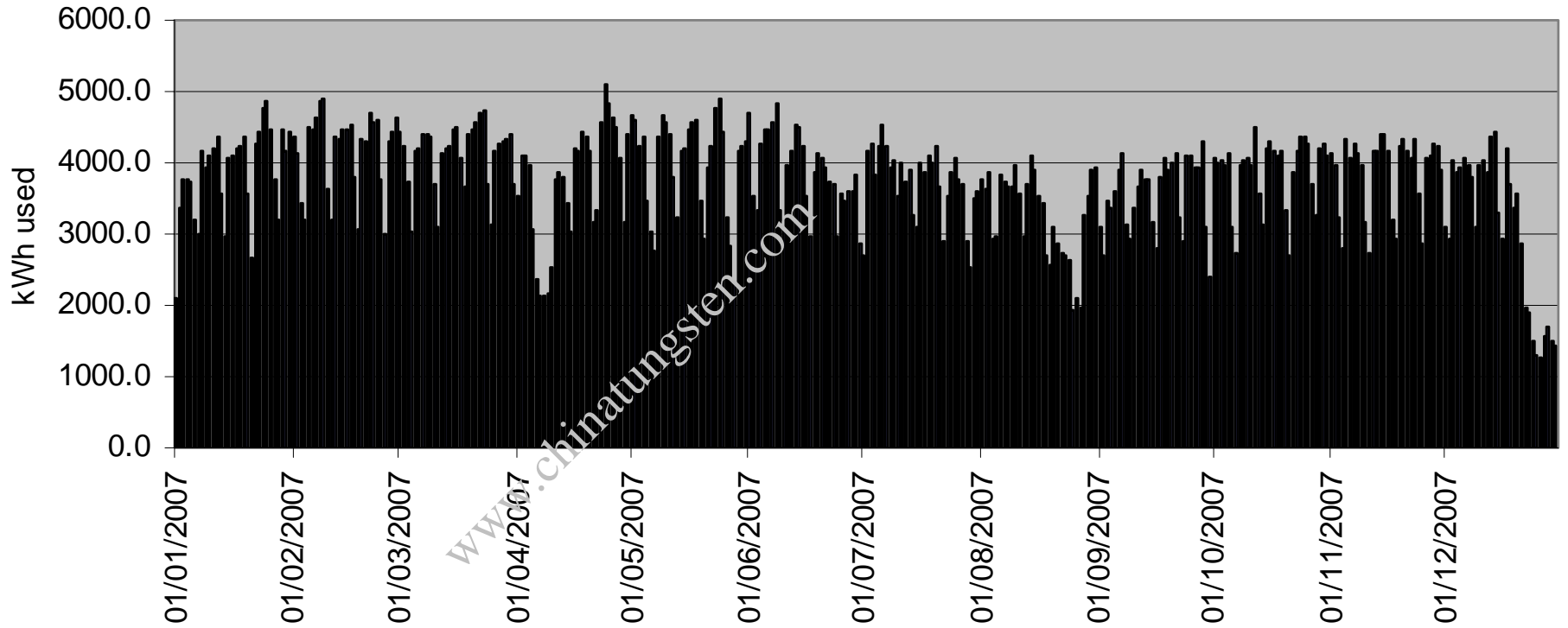


University of London Union - Difference by week 2007 vs. 2006



NB: 1,000kWh = £100

University of London Union - Daily energy consumption 2007



## The top 20 energy saving opportunities

### Equipment

1. Games machines; photo machines; vendors; water coolers; laser printers
2. Personal kettles and fridges

### Fridges

3. Location of ice machines
4. 48h rule for bottle fridges
5. Dairy deck blinds

### Heating, cooling and ventilation

6. Don't assume switched off by timers
7. Switch off as early as soon as possible
8. BMS
9. Comfort cooling and heating policy



## Lighting

10. Old standard tungsten filament bulbs
11. Halogen GU10 spotlights
12. Cleaners
13. Motion sensors
14. Light sensors
15. Over-lighting
16. Banks of switches

## Water

17. All urinals should be regulated

## Awareness

18. Nurture a switch off culture

## Generic operations

19. Maintenance plan for efficiency. Fan grills and de-icing

20. Lighting & equipment responsibility; Vacation shutdown

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# Quick tour looking at energy efficiency

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## Time for Lunch!

- Resume at 1:30

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## Practical exercise

In groups:

- Look for potential energy savings in one area of the students' union
- Focus on bad practice; make use of audit checklist!!
- We will take photos of what you find...
- ... two people from each from to present back – decide before you go.
- 30 mins walk-about; 10 mins preparation time



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## Groups feedback

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## Questions session

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## Assessment (in a minute)

- 10 questions
- Multiple choice
- For savings calculations, show workings
- If you get stuck we can help – raise hand
- If you get 7/10, you can have a Certificate of Achievement to take away!
- Need to submit today. Bring to front when finished
- Before we start...

## Concluding thoughts

- Thanks for coming!
- Go forth and save energy in your union
- An ongoing challenge, not a one off
- Do make use of toolkit. It is there to help
- Contact us if you need help;  
[carbonacademy@nusl.co.uk](mailto:carbonacademy@nusl.co.uk)
- Feedback forms
- Safe journey back