



EAUC

Energy & Water Community of Practice

Estates Office 18 Jun 15

Mark Jarvis – Sustainability Engineer / “Your Energy supplier

WARWICK

Agenda

- ▶ Sustainability at Warwick
 - Context
 - Carbon Management Implementation Plan
 - District heating network & CHP
 - Engagement
- ▶ Technical and social/behaviour
- ▶ Innovations needed



University of Warwick Vision

- Globally connected leader
- High Quality teaching and research
- Sustainability at the core of everything
- Pioneer in knowledge transfer

“a living demonstration
of the principles of
environmental sustainability”



Warwick: an international university

Warwick is a globally connected University

“To make a real impact on global issues and deliver the **best research and teaching experience** for its staff and students it has chosen to form **close partnerships** with a select group of **research-heavy institutions** that exist in many locations, do research in many locations, and which produce students who see themselves as global citizens.



Such close and select partnerships can share research resources enhances the student experience and help serve a much wider community both nationally and Internationally. Warwick has also chosen to form partnerships, such as with **Monash University in Australia** and **CUSP in New York**, that are not based on geographical proximity or focused on a search for economies but has instead in each case sought partnerships between autonomous institutions that are academically excellent, share Warwick’s organisational and academic ethos between and which help create a truly global network.”



Our international energy projects

Some examples of our collaborative, energy-related projects with international partners:

- **Centre for Urban Sciences and Progress (CUSP)** – Warwick is part of this New York-based initiative, which has been developing rapid energy modelling technology for cityscapes.
- **Engineers Without Borders** – this project has seen Warwick Engineering students visiting Uganda and Tanzania to help with sustainable energy projects.
- **Climate KIC** – a programme that's seen energy-related placements from other European Universities at Warwick.
- **UK-China** – Warwick has several energy-related research projects on the go with institutions in China.



Our Campus

A 24/7 town of 25,000

- 1.5 mile long
- 7,000 students rooms
- More than 150 buildings
- 3 conference centres
- 2 Sport centres
- Retail / cafes / restaurants
- Arts Centre
- Offices & teaching buildings
- Industrial & Research buildings

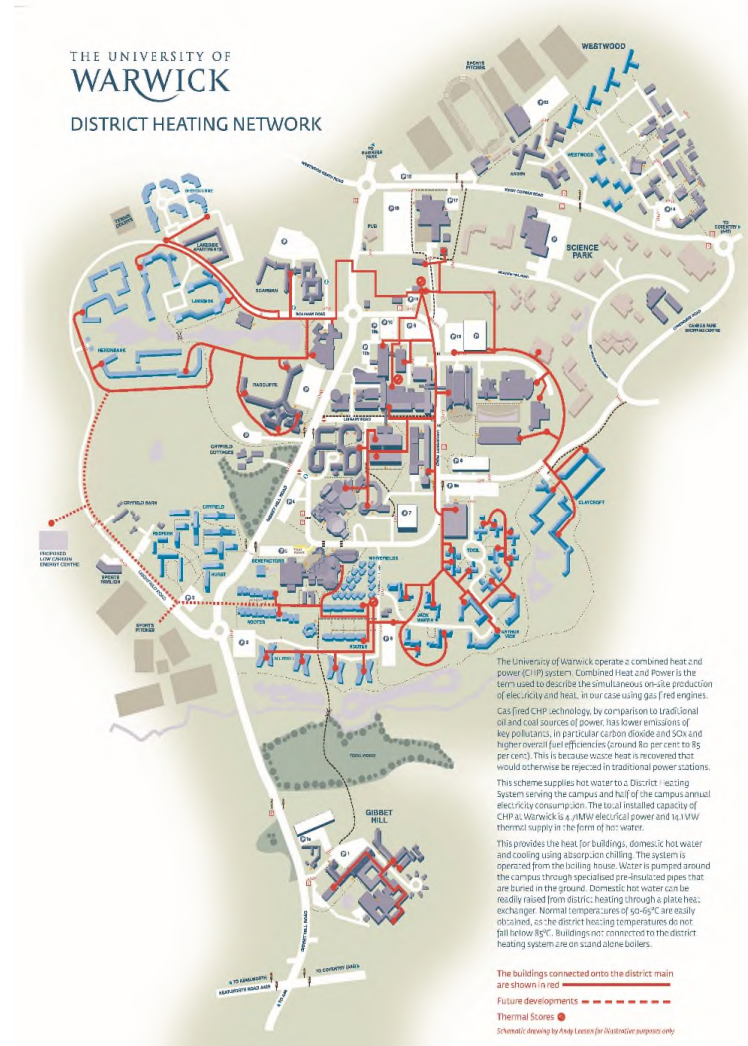
Generate 50% of heat & power

2nd E. Centre open June 2014

Saving compared to grid supply to increase from 5,000 to 8.000 tCO₂

Own & maintain all services networks

Including 2,200 utilities meters



Our Energy Profile

2013/14 main campus	Typical Annual Figures	UK household equivalent
Total Utilities Cost	£9.3m	7,300 homes (£1,272 pa)
Electricity Consumption	60,000,000 kWh (approx. 50% self generated)	15,000 homes (4,100 kwh pa)
Gas Consumption	150,000,000 kWh	10,000 homes (16,000 kwh pa)
CO ₂ emissions	45,878 tonnes	8,600 homes (5.35 tCO ₂ pa)
Water Consumption	605,000 m ³	4,600 homes (360 litres per day)

Statistics references in Power Point file notes



CHP and District Heating

- Overall benefit
 - Reduce University carbon emissions by 10%
CHP & District save in excess 5,000 tCO₂pa
Thermal stores & controls contribution saves circa 700 tCO₂
- 6 CHP engines across the campus

2 off Cryfield engines
(2,700 bhp each)



3 off Boiler House engines
(1,900 bhp each)



1 off Gibbet Hill engine
(550 bhp)



CHP and District Heating

- 4off absorption chillers (reduces carbon emissions by making chilled water from available heat)
 - 4 district cooling networks around campus
 - 1.2MWth
 - Increase summer heat load and reduce electrical consumption
- 4off 7MWth boilers (high efficiency boilers)
- 500m³ Thermal storage (daily storage support peak time demand and avoid firing boilers)
 - 300 tonnes at energy centres
 - New buildings have local storage
 - ~10MWh capacity
- Advanced Controls policy
 - Continuous modulation to optimise carbon emissions
 - Maximise thermal stores cycling
 - 4 hours CHP load forecast
- Maintenance policy
 - Dynamic monitoring to avoid heat wastage



Research & Investment

- SALIX / HEFCE / University Funding
 - £2.3m invested in 45 energy savings projects (Projected annual saving £580,000, 4,200 tonnes of CO₂ (9% of annual carbon emissions)).
- University Own Funding
 - Cryfield Energy Centre (Investment: c.£10m, Projected CO₂ saving: over 3,000 tonnes per annum).
- Use the campus as a living laboratory
 - Electrical network used for monitoring & modelling
 - Campus used for Behavioural sciences research
 - Buildings used for Smart heating research project
 - Heat network innovation – Government project (phase 2 application in progress)



From Vision to Implementation



Context of UK – Higher Education

► Institutions must have approved Carbon Management Plan – ‘HECMP’ to include..

Scope 1 – Direct Emissions

Scope 2 – Indirect Emissions

Scope 3 – Report & Manage from 2013/14

► Condition of UK Government funding support and/ or for receipt of UK/ EU Research Awards



University of Warwick Challenge

- ▶ Historically grown by c 4-5% pa
- ▶ UK target -34% emissions from 1990 – equivalent to 60% reduction from 2005 baseline (scope 1+2)
- ▶ Growing campus = by 2020 we have to get from 47,288 tonnes CO₂e to 18,915 tonnes CO₂e while continuing expanding.



Sustainability & Carbon Management

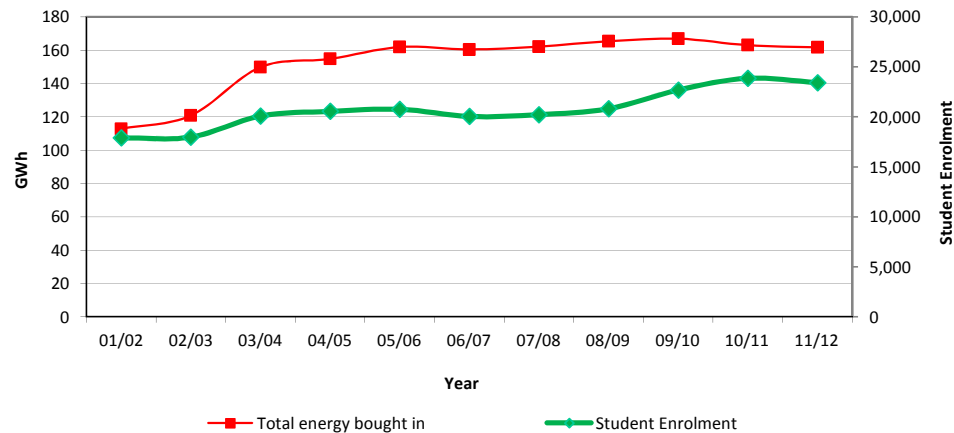
- Long history of Energy and Carbon management
 - Integrated controls of buildings services since 1990's
 - One of the UK largest district heating and CHP network
 - All new buildings are BREEAM Excellent + EPC A (8 to date).
- Support government target for CO₂e emissions reduction
 - Reduce CO₂e emissions by 34% compared to 1990
 - Target absolute emissions -60% compared to 2005/6
- Collaborate with Academia & Students
 - Support Research bids - make infrastructure available
 - Involve staff & students - assignments – Awareness - communication...



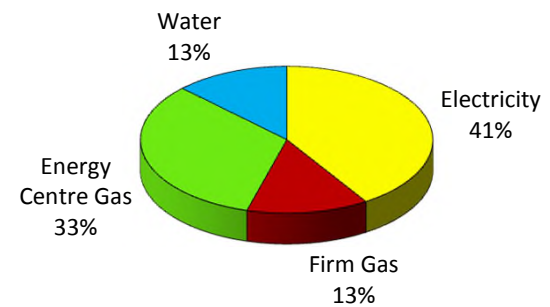
Our Energy Profile

Number of Students (FTE)	23,400
Number of Staff (FTE)	4,900
Annual Cost of Utilities	£8.2m
Over 150 Buildings	290 hectares

Total Energy Bought In (before CHP)

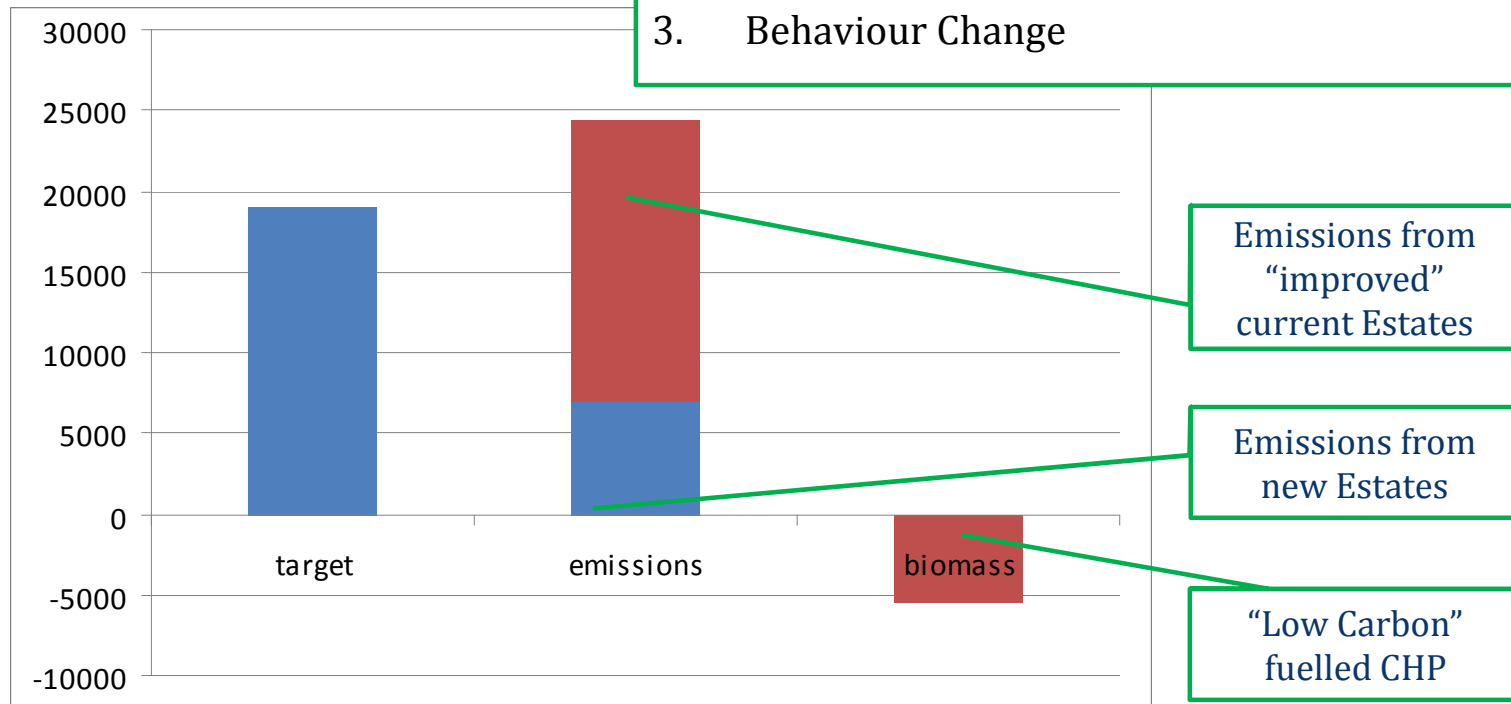


Utility Cost Breakdown



Our Energy and Carbon Strategy

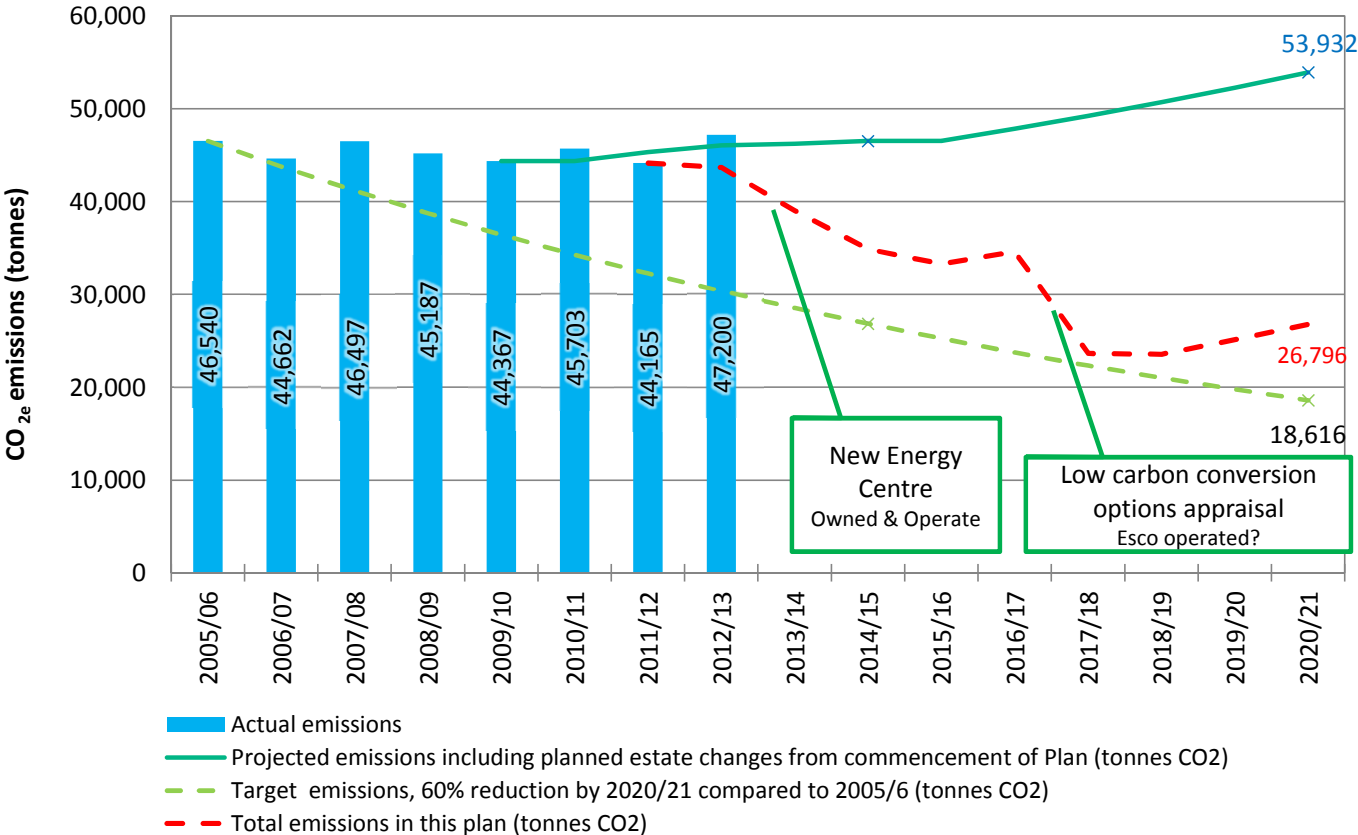
1. Energy conservation & efficiency
2. CHP district & Low carbon generation
3. Behaviour Change



Predicted 2020 CO₂e emissions for Planned campus expansion as per Master Plan & Strategy 2007

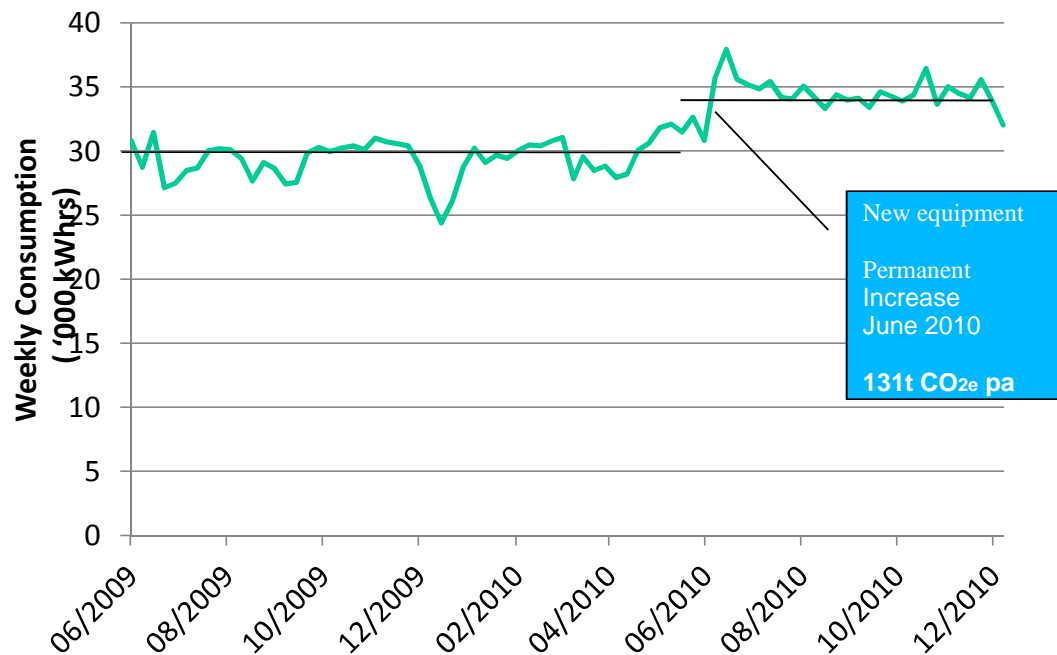


CO2e Emissions Status and Plan



But not easy...

Electricity Consumption Trend (18 Months of Data June '09 - December '10)



CTU building emissions
80t CO₂e pa

The complex block contains two photographs of the CTU building. The left photo shows the exterior of the building, a modern structure with a glass facade. The right photo shows the interior of the building, a bright, open-plan office space with red seating and a white table.



Only achievable through Coordinated action plan

► Estates can support Teaching & Research

- Green Steps (EWG)
- Implement green curriculum
- Interdisciplinary modules
- Increase students employability

► Departments can influence the 8 strands of the action plan

- Users behaviour
- Infrastructure & energy needs
- 19% of target unidentified
- Buildings design

Collaboration is necessary

- Enables Estates to have visibility on overall cost of target delivery.
- Regular review with HoD enable estates to have a clear view of departments projects and needs.
- Estates assist in awareness, green curriculum, scope 3 mitigation, buildings use & refurbishment



Students and academics are contributors

Current contributors; 30-50 students per year

- School of Engineering,
- Chemistry
- Psychology department



- Modelling and optimisation of heating profile
- District heating plates retrofit
- Animated / interactive schematic for chiller farm 2
- Natural ventilation in Millburn
- Coventry House mechanical ventilation

- Business case to refurbish steam generation plant
- Argent Court building retrofit to minimise CO2 emission
- Recycle Nitrogen
- Awareness on Energy use



Students and academics are contributors

Develop partnerships with academics to identify innovative opportunities

Business school – 3 years PhD on behaviour

Create knowledge Transfer Partnership with businesses

- ▶ Collaborate with students societies
 - Students without borders (more wind turbines?)
 - Financial society (validate business cases?)
 - Arts (awareness campaign – communication)
 - Laws (www.realfoodchallenge.org)



Existing Collaboration with Departments

- ▶ Scope 1+2
 - Estates financial subsidy for energy efficient -80 degrees freezer.
 - Identify carbon efficiency projects aligned with department needs. E.g. Chemistry fume cupboards
- ▶ Scope 3
 - Users influence on water consumption, waste generation and travel.
 - Transport coordination / car share
- ▶ Behaviour
 - Energy Champions network
 - New Intranet carbon pages
 - GreenSteps program will create direct interaction between stakeholders



Like what?

Global Research Programs

- ✓ GRP Energy
- ✓ GRP Cities – CUSP Centre of Urban Science

WBS

- ✓ Global Energy MBA
- ✓ Sustainability & Behaviour Research

WMG

- ✓ Metering and building controls in IIPSI
- ✓ Empowerment programme with UCL
- ✓ Research

Engineering

- ✓ Course on sustainability + Students working on feasibility studies
- ✓ Research



Like what?

Social Sciences

- ✓ Psychology behaviour change project
- ✓ Climate Change related research

Students

- ✓ Request for green curriculum
- ✓ Wind turbine project
- ✓ Green Steps

And loads of other stuff

- ✓ Enterprises Partnerships & Suppliers
- ✓ Biodiversity group and allotments
- ✓ Knowledge in the Community European programme



What does the Estates Office do about it?

**Lead & implement Warwick University
Sustainability action plan**

**Demonstrate Sustainability
at your Doorstep**



Master Plan – 8 work streams

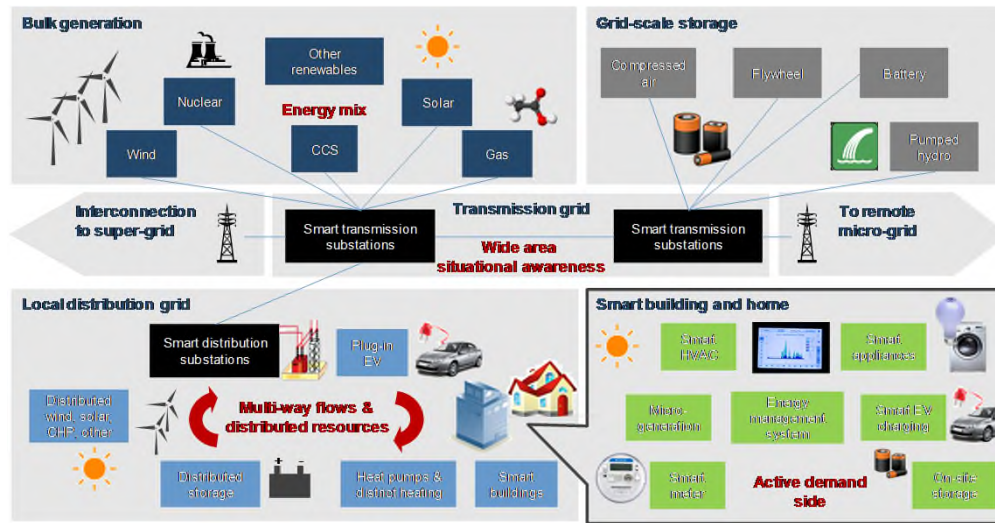
1. Building improvement to reduce heat consumption.
 - ✓ Additional insulation and air tightness improvement to buildings
 - ✓ Heat recovery from ventilation to ensure good air quality
2. IT Services reduction of electricity consumption
 - ✓ Abandon air conditioning in all data centres
 - ✓ Power management and energy efficient computers/peripherals
3. Lighting reduction of electricity consumption
 - ✓ Replace existing lamps by new technology and LED lighting
 - ✓ Implement better controls and timers
 - ✓ Maximise use of daylight and reduce artificial lighting
4. Cooling changes to reduce heat and electricity consumption
 - ✓ Implement “free cooling” technologies
 - ✓ Maximise use of absorption cooling from CHP

Master Plan – 8 work streams

5. Behaviour changes in academic and non academic areas to reduce utilities demand (including water)
 - ✓ Engage and empower with staff and students
 - ✓ Make departments responsible for their emissions. Issue target and monitor results through the proposed Energy Committee
 - ✓ Adapt policies allowing less air conditioning and less heating
6. “Low carbon” energy generation
 - ✓ New CHP energy centre to deliver “low carbon” heat and electricity to the campus
7. Estates Modifications to reduce Utilities Demand & Cost
8. Fleet (Scope 3)
 - Report & Manage scope 3 emissions from 2013/14
 - ✓ Water
 - ✓ Emissions embedded in Procured Goods
 - ✓ Travel / commuting

Future ...? The Smart Mix

A world of opportunities



what's going on at Warwick?
See our Energy Trail for a glimpse..

What can you do?



- **Collaborate**
- **Innovate**

Switch Off:

- Lights
- Do not use portable heaters

Close:

- Windows, Doors

Report:

- Lights always on
- Leaking taps
- Areas too warm / draughty

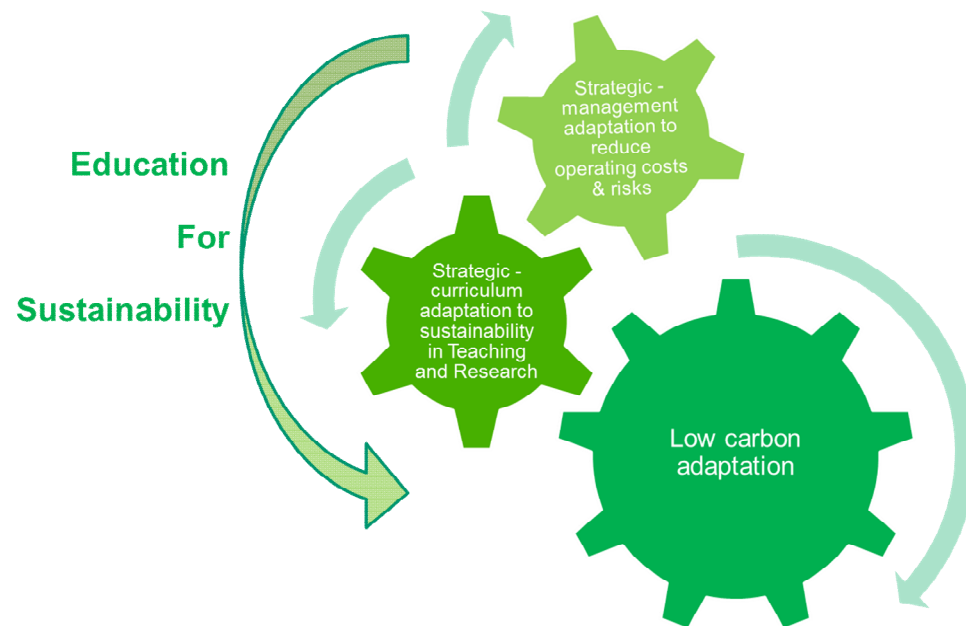
***“Environmental Sustainability
is everyone’s job”***



Global Approach to Sustainability

“In the end, we will protect only what we love. We will love only what we understand.
We will understand only what we are taught.”

Baba Dioum, Senegalese poet and naturalist



Come and join us.

Your ideas welcome.

Research and industrial
partnerships.



Thank you for your attention

Find out more about our Carbon Plan: <http://www2.warwick.ac.uk/insite/carbon>

Best regards
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