

COVENTRY & WARWICKSHIRE GREEN BUSINESS PROGRAMME



MAIN CAMPUS
MASTERPLAN 1
June 2007

THE UNIVERSITY OF
WARWICK



ENVIRONMENTAL
STATEMENT
Vol 1: Non-technical Summary
June 2007

THE UNIVERSITY OF
WARWICK

WARWICK

ENVIRONMENTAL
SUSTAINABILITY

Developing a low carbon campus

22nd November 2018 Joel Cardinal



Agenda



WARWICK

ENVIRONMENTAL
SUSTAINABILITY

Efficient growth to date &
UK Climate Change commitment

Warwick Energy Journey &
Need for paradigm shift

Efficiency + Behaviour + Innovation

Main Campus

“a 24/7/365 town of 30,000 people”

- 560,000m² built
- 290 Hectares
- 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
- 19km heating/cooling network
- Self-generate at least 50% of heat and power needs






Our Wellesbourne Campus

- 215 Hectares of Research & farming
- Research and Business park



£1,024

The amount we're spending every hour on    right now

The amount invested in sustainability since 2009

£11,500,000

 Water

Metering and efficiency enhancements.

 Gas

More connections to district heating, buildings optimised.

 Electricity

Efficient LED lighting, motion sensors.

New Energy Centre

Connected to **19km** heating network.

More efficient than separate heating/electricity by:

40%

Compared to 2009 figures, we're now saving:

£340 per hour on   

 x1,500 emissions per year

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Low carbon economy , a sound business case at Warwick

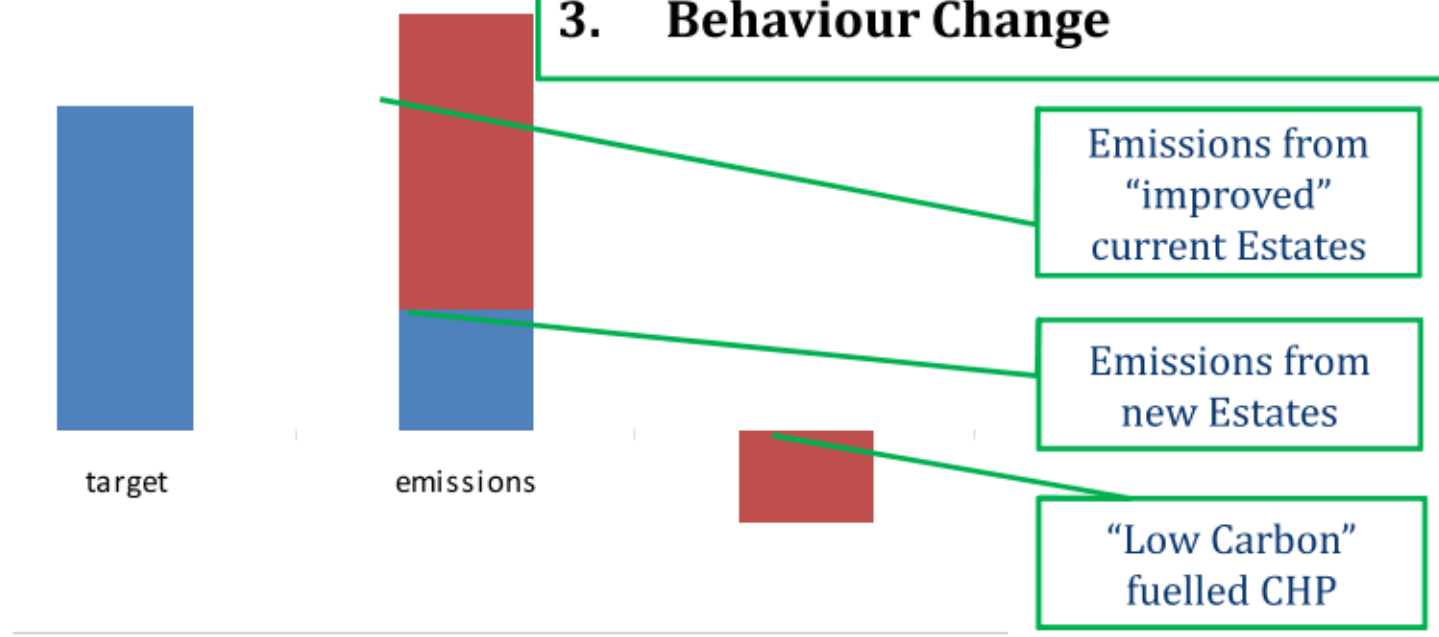
Latest water project saves enough water to fill 16 swimming pools annually

In excess of 1 acre of PV installations by 2018, enough to power 85 homes.

3 steps Energy & Carbon Strategy

- Meet carbon emissions targets
- Reduce UoW Operating costs
- Increase Resilience

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

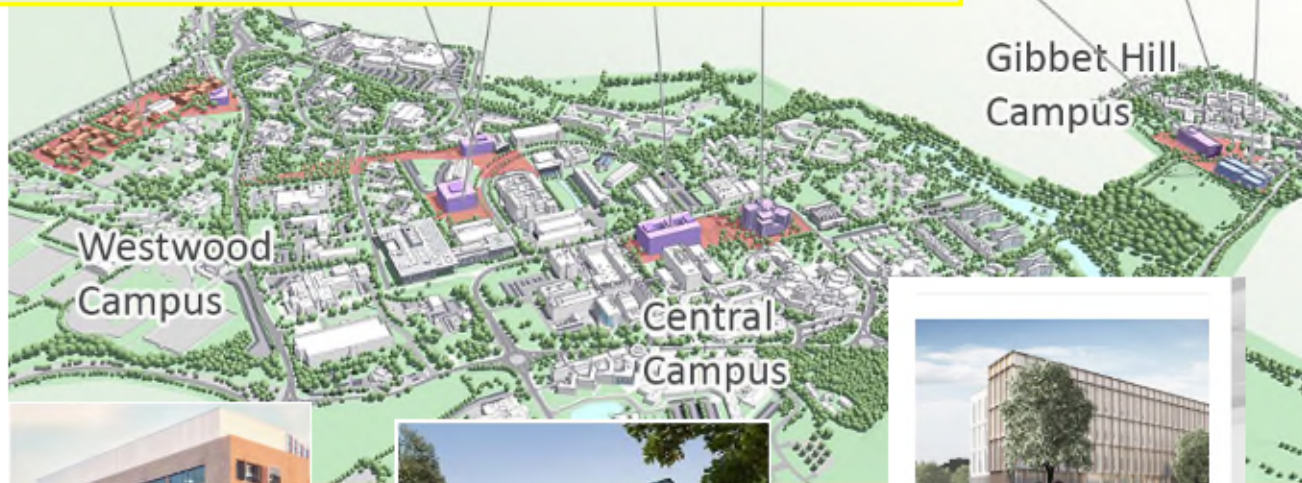


Successful University Growth

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- ✓ University Buildings are 20-30% better than Buildings Regulation
- ✓ We continuously work on comfort, efficiency and performance



Mathematical Sciences Building - OCI



National Automotive Innovation Centre - CGI



Interdisciplinary Biomedical Research Building: artist's impression

Bream
Excellent

EPC-A

DEC – Energy in
use

Air tightness

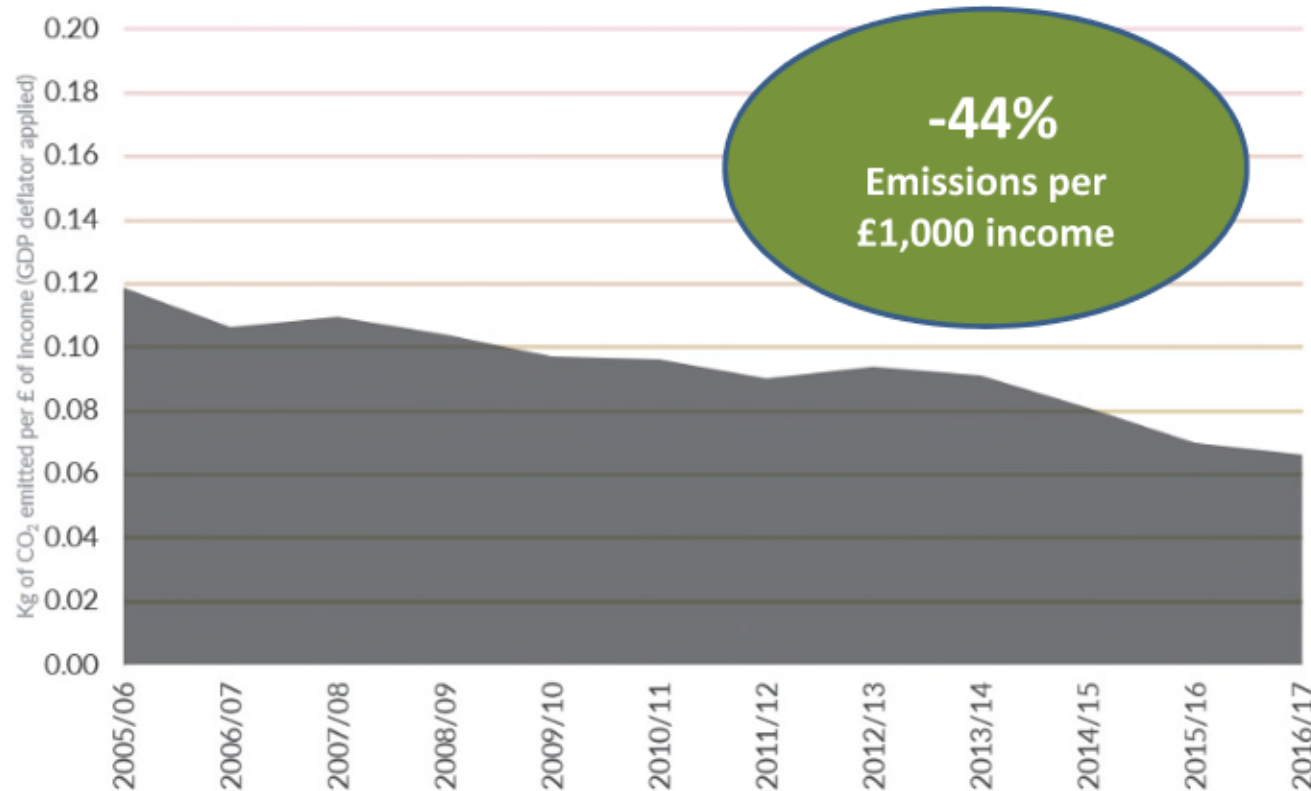
CO₂e Emissions Improvement

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Efficiency: Carbon emitted per £ of income

In the graph below you can see how the carbon efficiency of the University has dramatically improved over recent years. This trend, which we aim to continue, has seen our efficiency almost double since 2005/6.



- 🔌 We generate 60% of our electricity and hot water on campus through an efficient Combined Heating and Power system.
- 🏠 We opened the Cryfield Energy Centre in 2014 to provide more super-efficient combined heating and power for campus.
- 🏢 Making sure all the new buildings we add to campus are much more efficient than the older ones they're replacing.
- ♻️ We worked to add more renewable energy sources to campus.
- 💧 We worked to cut our Water use - water cleaning produces emissions too.
- 👥 Our staff and students have made a real effort to think in a more sustainable way.

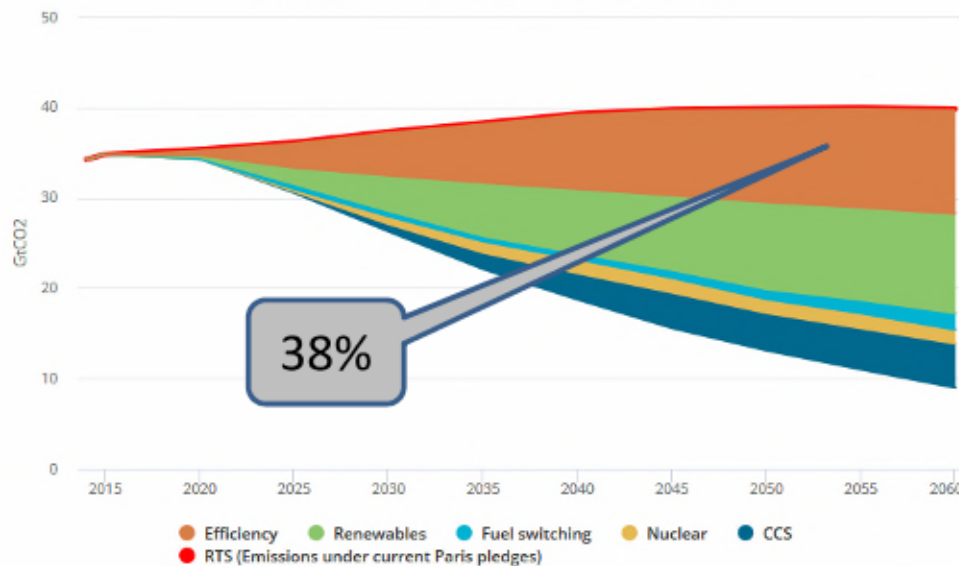
2015 Paris Agreement / UK Climate Change

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How each technology area contributes to CO2 emissions reductions

ETP 2D5 Scenario. Click a technology in the legend to show/hide.



© OECD/IEA

SHELL Sky report to meet Paris climate agreement = <https://www.shell.com/energy-and-innovation/the-energy-future/scenarios/shell-scenario-sky.html>

BP report to meet Paris climate agreement = <https://www.bp.com/content/dam/bp/pdf/about-bp/energy-challenge-climate-change.pdf>

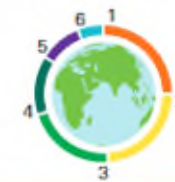
IEA report Energy Technology Perspectives 2017 (zero by 2060) = <http://www.iea.org/etp/>

BP recognizes that the existing trend of increasing greenhouse gas emissions worldwide is not consistent with limiting the global average temperature rise to 2°C or lower.

A complex issue

BP believes global action on climate change is needed. It's a complex issue and all aspects of the debate should be considered in their totality.

There are multiple actors and actions



1. Electricity and heat	25%
2. Agriculture	24%
3. Industry	21%
4. Transportation	14%
5. Other energy	10%
6. Buildings	6%

Source: IPCC (2014)

Emissions to rise through continued fossil fuel use



All fossil fuels are not equal



1. Coal	60%
2. Oil	25%
3. Gas	15%

There is a variety of oil and gas users



80-90%

of CO₂ emissions from oil and gas products are from their use by consumers



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Genesis

- University granted Royal charter in 1964

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On the outskirts of Coventry, at Gibbet Hill, the first buildings of the University of Warwick were rising in readiness for the initial intake of students: 26th October 1964.

CHP and District Heating

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- 6 CHP engines across the campus
- Self-generation capacity = 8.6MWe + 9.5MWth
- 15MWth back-up boilers
- 4 absorption cooling networks around campus = 1.2MWth

2off Cryfield engines
(2,700 bhp each)



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



1off Gibbet Hill engine
(550 bhp)



Diversity & Energy Storage

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- 4off absorption chillers (reduces carbon emissions by making chilled water from available heat)
 - Increase summer heat load and reduce electrical consumption
- Back up boilers (high efficiency boilers)
- 500m³ Thermal storage (daily storage support peak time demand and avoid firing boilers)
- 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





Heat Network Efficiency >10%

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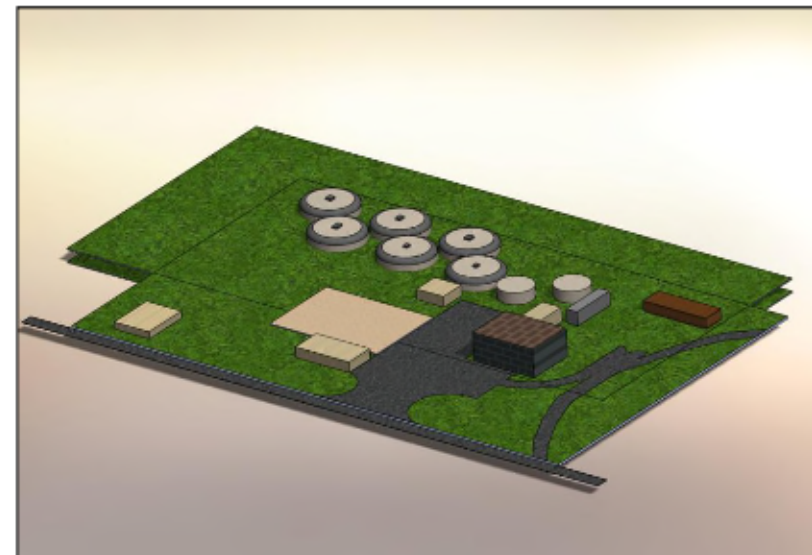
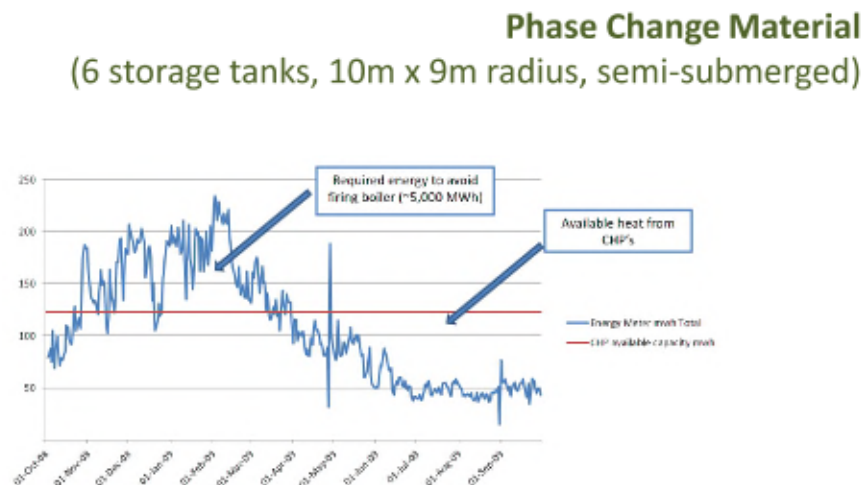
- Optimise controls
 - Increase district flow / return temperatures differential
 - Reduce CHP heat dump (clean heat exchangers)
 - Boilers management (Control firing, “boilers inhibit” to avoid heat waste)
- Optimise heat distribution
 - Fix short circuits to lower DH return temperature
 - Set Samson valves to control delivery
 - Adequate pressure reference points
- Play tune with capacity
 - Heating 24/7 to match heat delivery with heat demand?
 - Include “floating” buildings to controls
 - Include new Thermal Stores in controls

Inter-seasonal Heat Storage (2009 Students project)

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- The excess heat from CHP exhaust gases during summer is stored as latent heat in a phase change material (PCM)
- This thermal energy storage system is then used over the winter months to heat water and replace the need for boilers



Battery Energy Storage

(2017 Research project)

Installed capacity 50kW / 35 kWh

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PCSR^{Lab}



IoT (internet of things) data
collection and management
platform
built and installed in Power and
Control System Research
Laboratory
School of Engineering



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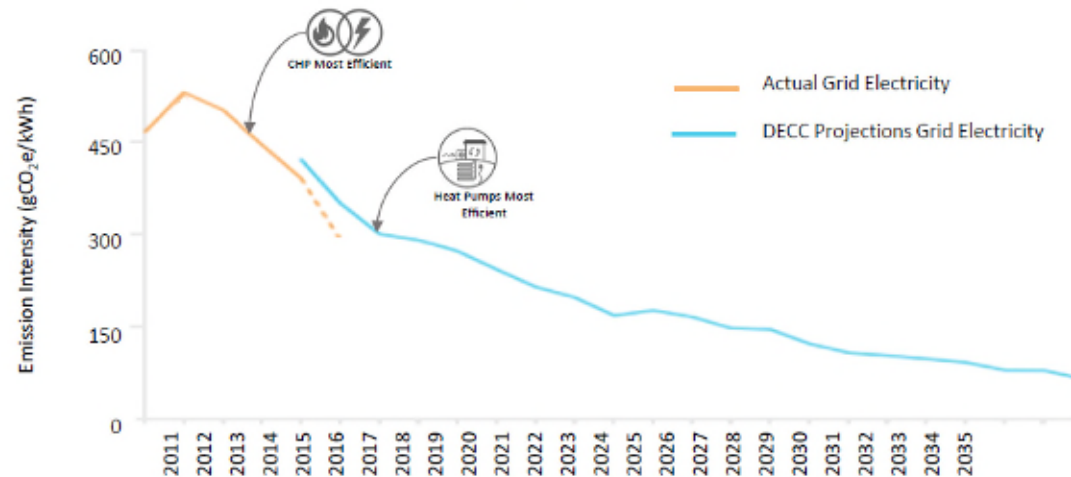
Masterplan – UK grid is decarbonising

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couchperrywilkes[®]
engineering change

Electrification of Heat



Period	Carbon Intensity (gCO ₂ e/kWhr)
Part L 2013	519
Actual Year 2017	275
Predicted Year 2023	175
Predicted Year 2030	110
Predicted Year 2035	65

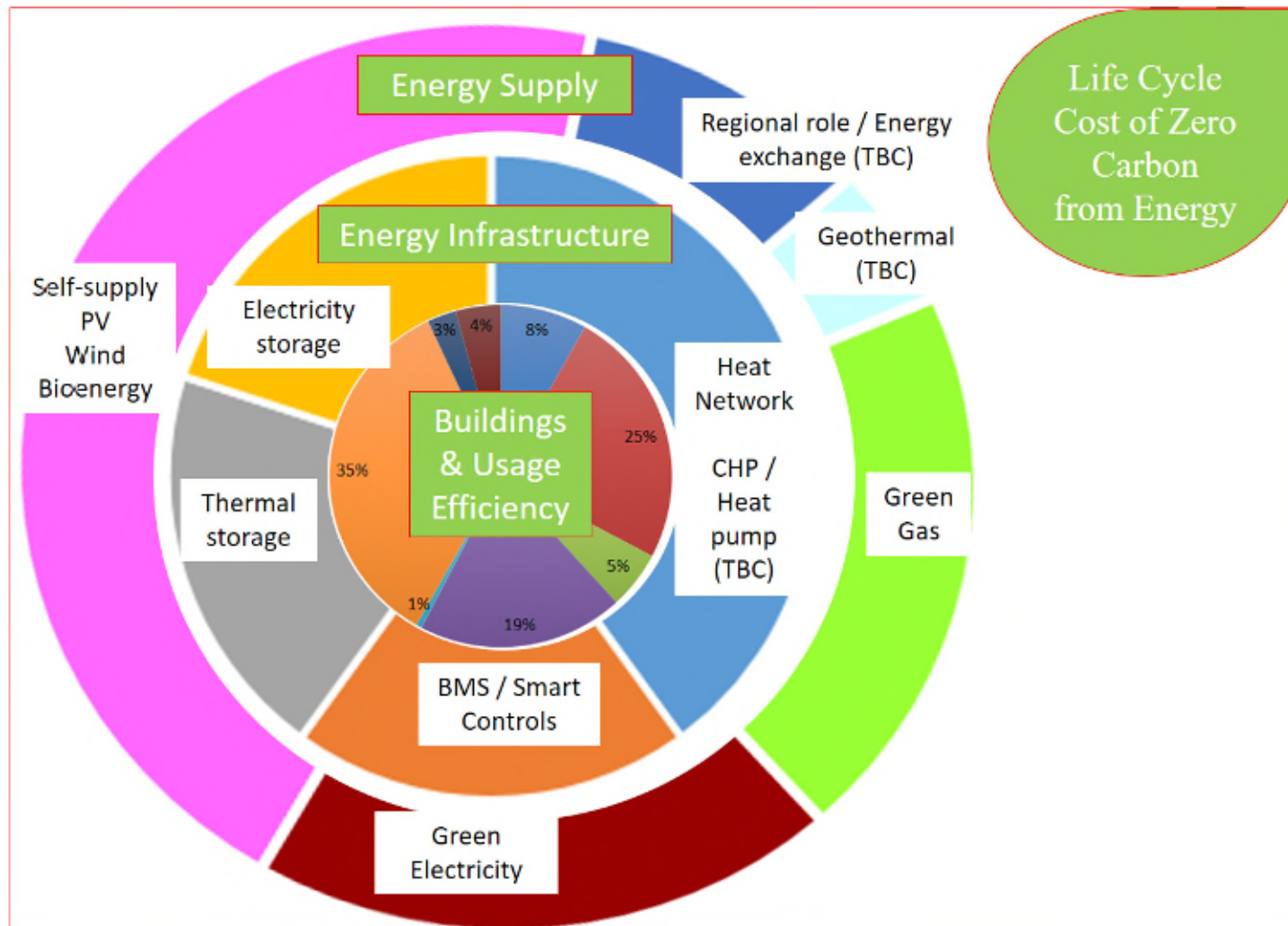
**Heat
delivery**

**Natural gas
powered CHP
require model
shift**

Zero Carbon Strategy from Energy

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3 steps

Optimise
consumptions

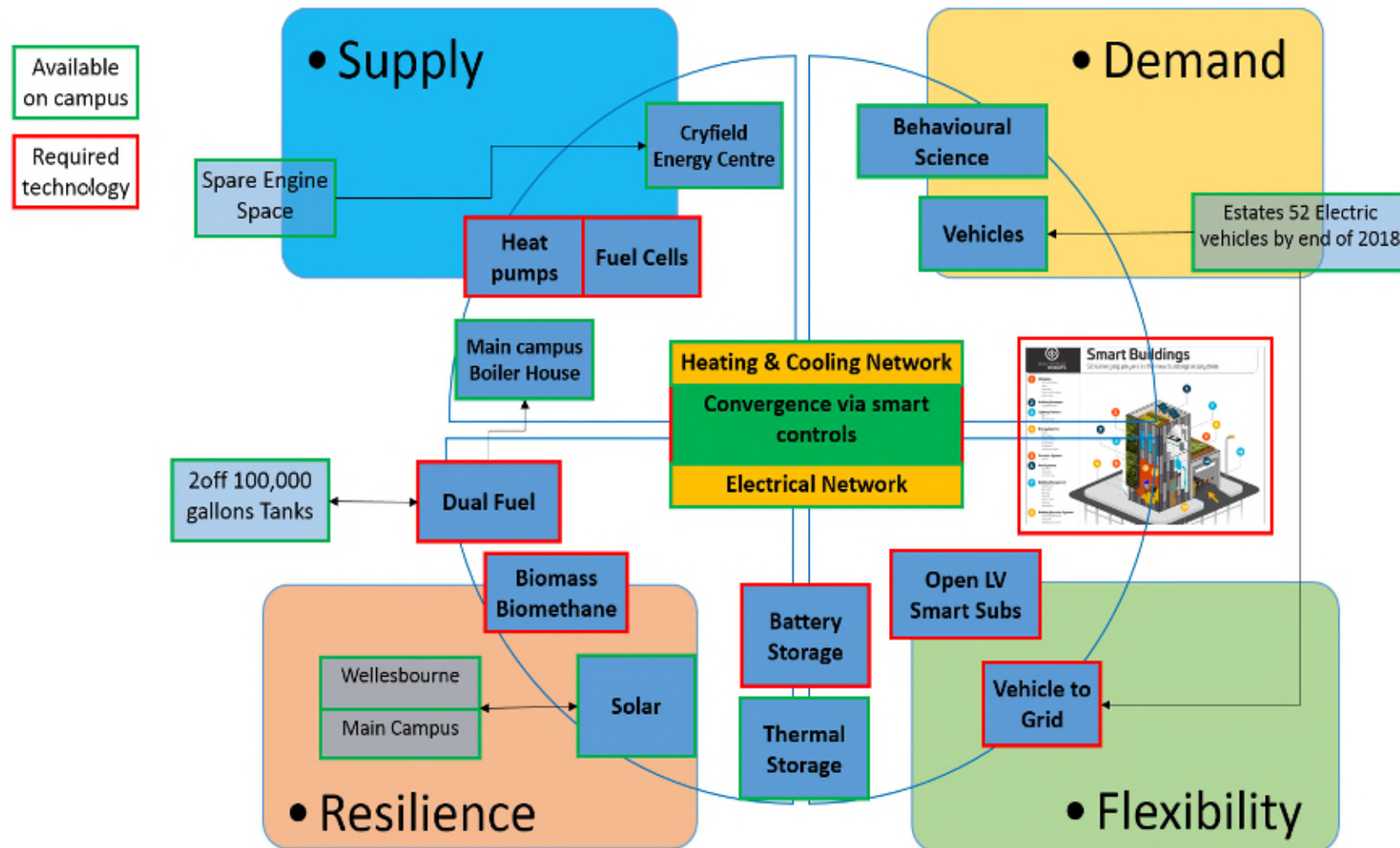
Plan suitable
infrastructure


Procure supply

Energy Masterplan Strategy

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Only achievable through Coordinated action plan

Estates can support Teaching & Research

- Support Education for Sustainable development
- Interdisciplinary modules
- Increase students employability

Departments can influence energy and carbon efficiency

- Raise awareness
- Users behaviour
- Infrastructure & energy needs
- Buildings design

Collaboration

- Sustainability Innovation process
- Use the campus as a living laboratory (research and teaching)
- Students employability skills
- Assignments / Internships / talks / Research

Awareness / Behaviour Change

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This Friday at noon the University of Warwick will be observing the nationwide minute silence, in respect of all of the Tunisia attack victims.

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14:25 Thu 24°C
Wednesday 01 July Fri 28°C

LAST 30 MINUTES

+2.5% ELECTRICITY USAGE VS. YESTERDAY

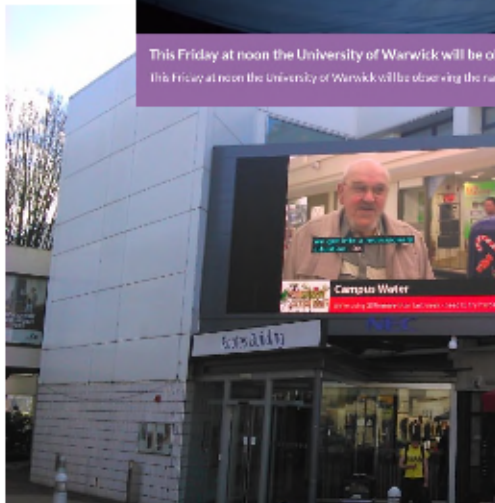
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Student Switch Off 2015/16
1st Oct 2015 — 2nd May 2016 (ends in 10 days)

Tocil

▼ 8.4%
▼ 6.8%
▼ 6.7%
▼ 4.9%
▼ 4.2%
▼ 3.4%
▼ 2.2%
▼ 0.4%
(BCDE)
▼ 0.1%

21/04/2016



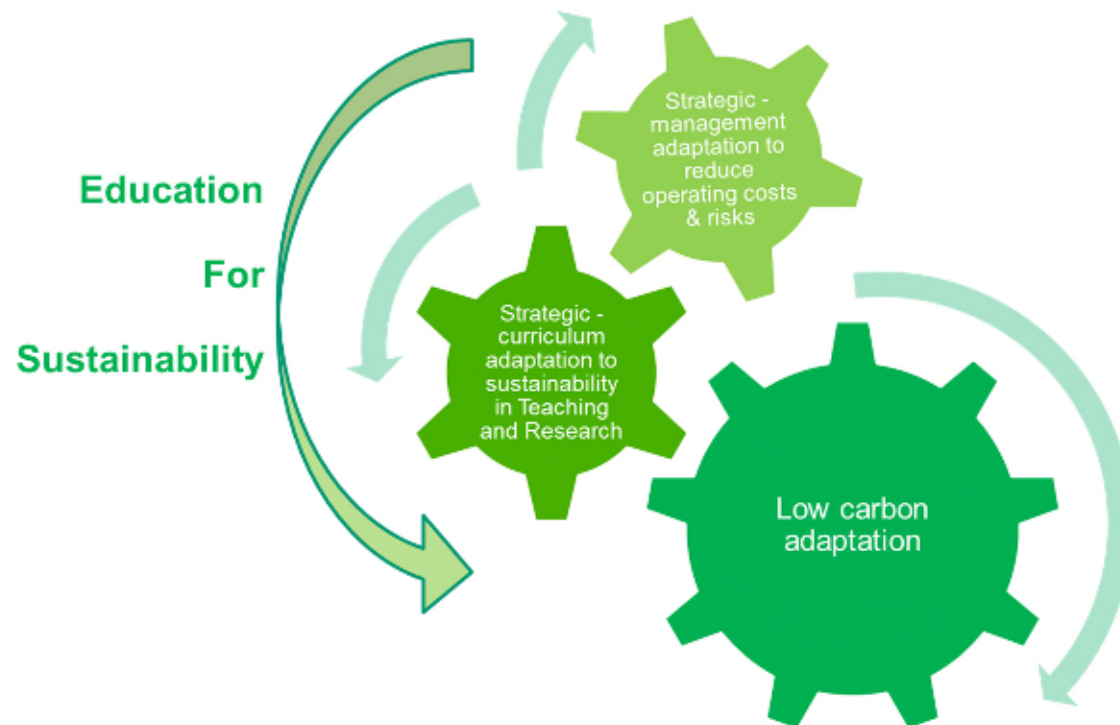
Global Approach to Sustainability

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“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.