



UNIVERSITY OF  
**LEICESTER**



WILLMOTT DIXON

SINCE 1852

# Monitoring Studies at Centre for Medicine

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**ukpassivhaus**  
**conference**2016



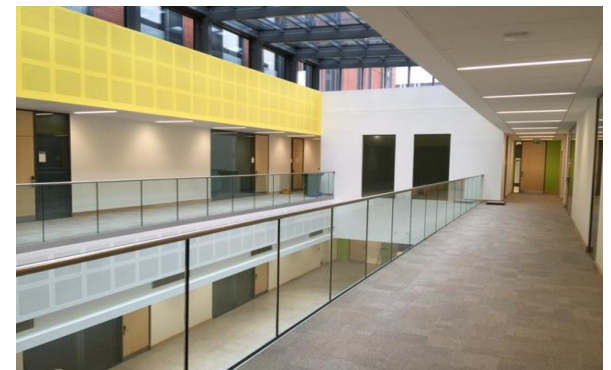
# Content Summary



- Introducing the UK's largest Passivhaus building - Centre for Medicine
- Soft Landings as a means to translate Passivhaus low carbon build to low carbon operation
- Proactive monitoring of energy data
- Non-energy monitoring information / user & behavioural factors
- Future monitoring and management Issues

# UK's Largest Passivhaus Building

- ✓ Total GIA -13,526 m<sup>2</sup>
- ✓ Certified to the PassivHaus standard
- ✓ 15 kWh/m<sup>2</sup> per year heating demand
- ✓ 120 kWh/m<sup>2</sup> per year total primary energy demand
- ✓ BREEAM 'Excellent' Rating
- ✓ Air-tightness target of 1m<sup>3</sup>/m<sup>2</sup>.hr @50Pa (0.33 ACH)
- ✓ Energy Performance Certificate 'A'
- ✓ DEC rating target of 'A' – how the building performs in use
- ✓ First use of computer controlled shading system in the UK
- ✓ Ground to Air Heat Exchange Labyrinth under the building - 1.6km of ventilation pipework
- ✓ Connected to the Leicester District Heating Scheme & CHP unit within the University
- ✓ £42M investment by the University



# Our Rationale



“...to bring world-leading research and high-quality medical education under one roof for the first time.”

To use this building as the major contribution to reducing the estates carbon emissions by 60%.

# Our Current Building Stock



**Maurice Shock Building**

320kWhr/m<sup>2</sup> per annum space heating

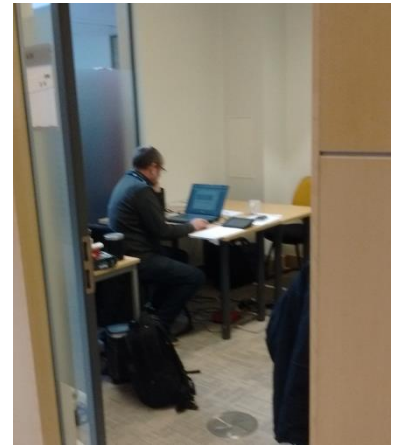
500kWhr/m<sup>2</sup> per annum total energy

£360,000 per annum energy bill



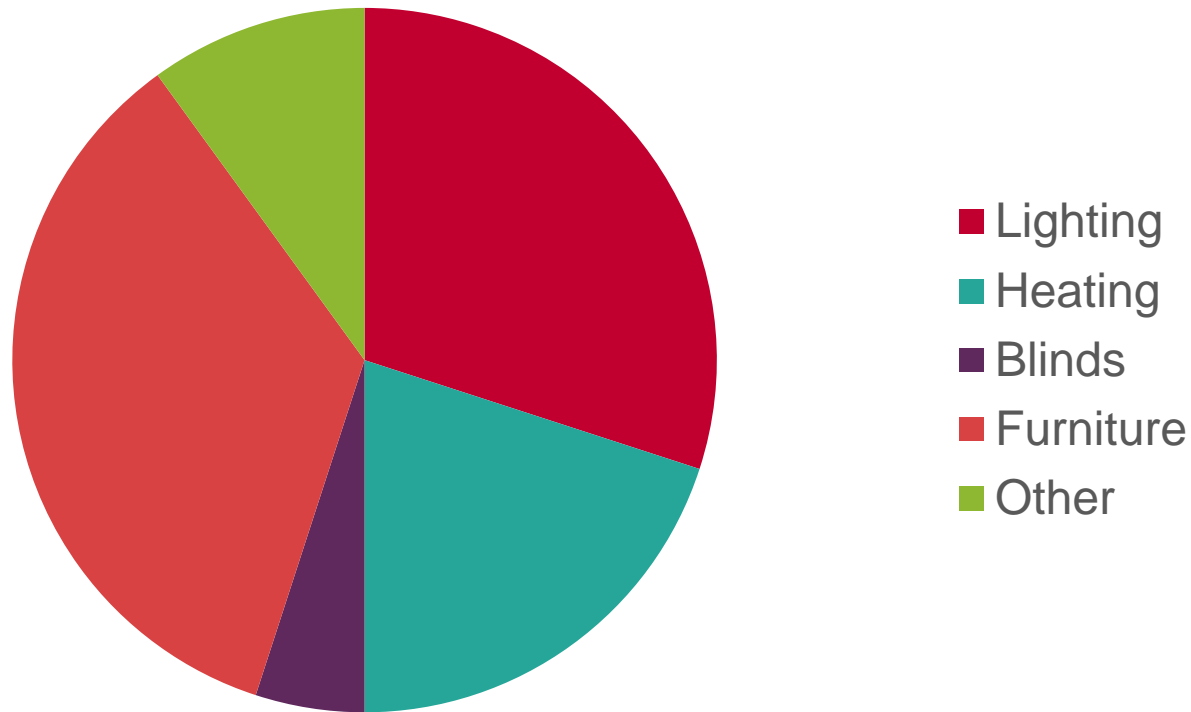
# Soft Landings - Translating Passivhaus/Low Carbon Build to Low Carbon Operation

- Soft Landings and Passivhaus (needs to go hand-in-hand).
- Involvement in Soft Landings (final stages of construction, handover and post occupancy support for 3 years).
- Importance of operations and actual use of the building from a energy and carbon reduction strategy is paramount.
- Building user training during handover is key.
- First time where users, University FM teams and contractor working together post construction.



# Soft Landings - Translating Passivhaus/Low Carbon Build to Low Carbon Operation

Soft Landings issues – Post Occupancy



# Monitoring Building Performance

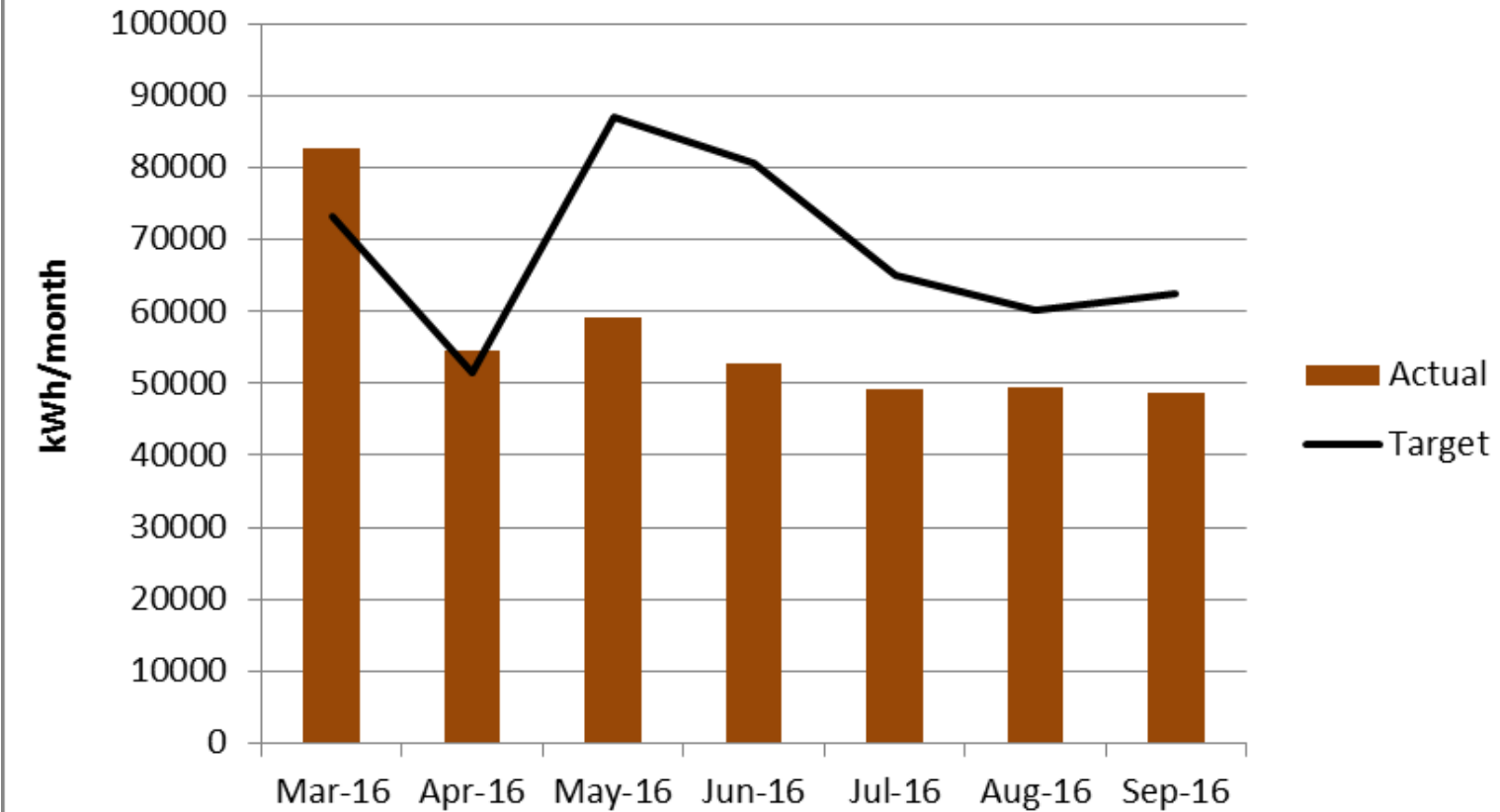
- The building has over 90 sub-meters.
- The meters record electricity, heat/cooling and water consumption data on 30 mins interval.
- Each type of energy use has been benchmarked and is proactively monitored by Estates Energy Team.

Energy Loads in CFM	Estimated Total Energy Use (kWh)	March Estimated Energy Use (kWh)	March 2016 Actual Energy Use (kWh)
Lighting	148,110	13,440	7,680
Lifts & Escalators	40,300	3,360	717
Small Power	195,890	19,960	4,468
Catering	41,890	4,270	3,210
Server Rooms	36,830	3,750	4,936
Domestic Hot Water	72,290	7,370	7,370
Fans	88,990	5,550	10,691
Pumps/controls/heat rejection	9,600	940	
Total Cooling	58,330	3,250	1,907
<b>Total Elec</b>	<b>692,200</b>	<b>61,900</b>	<b>40,979</b>
<b>Total Heating</b>	<b>112,400</b>	<b>10,400</b>	<b>13,444</b>



# CfM - Total Energy Usage

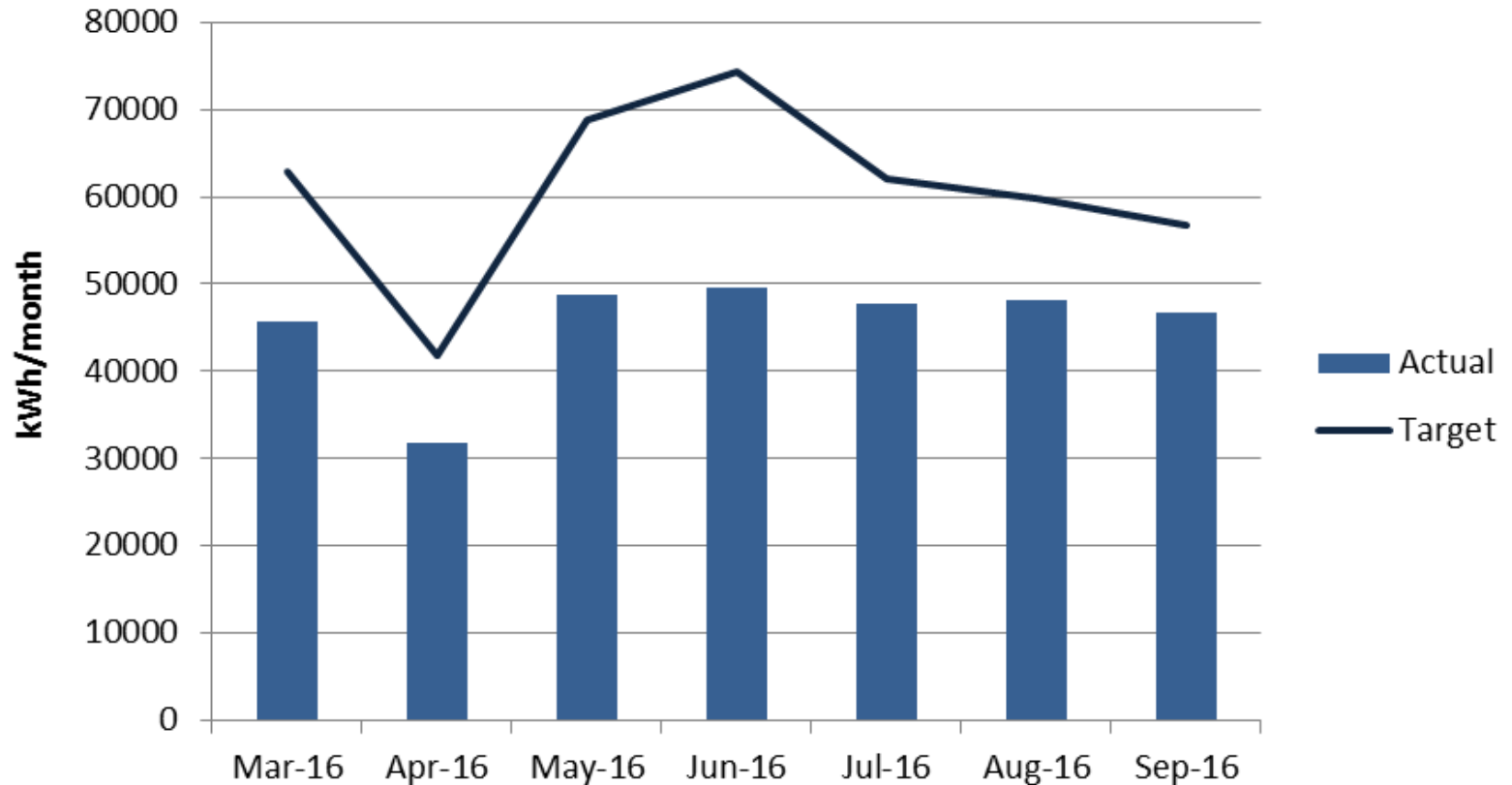
Elec + Heat totals



17% below cumulative target usage to date

# CfM - Total Elec Usage

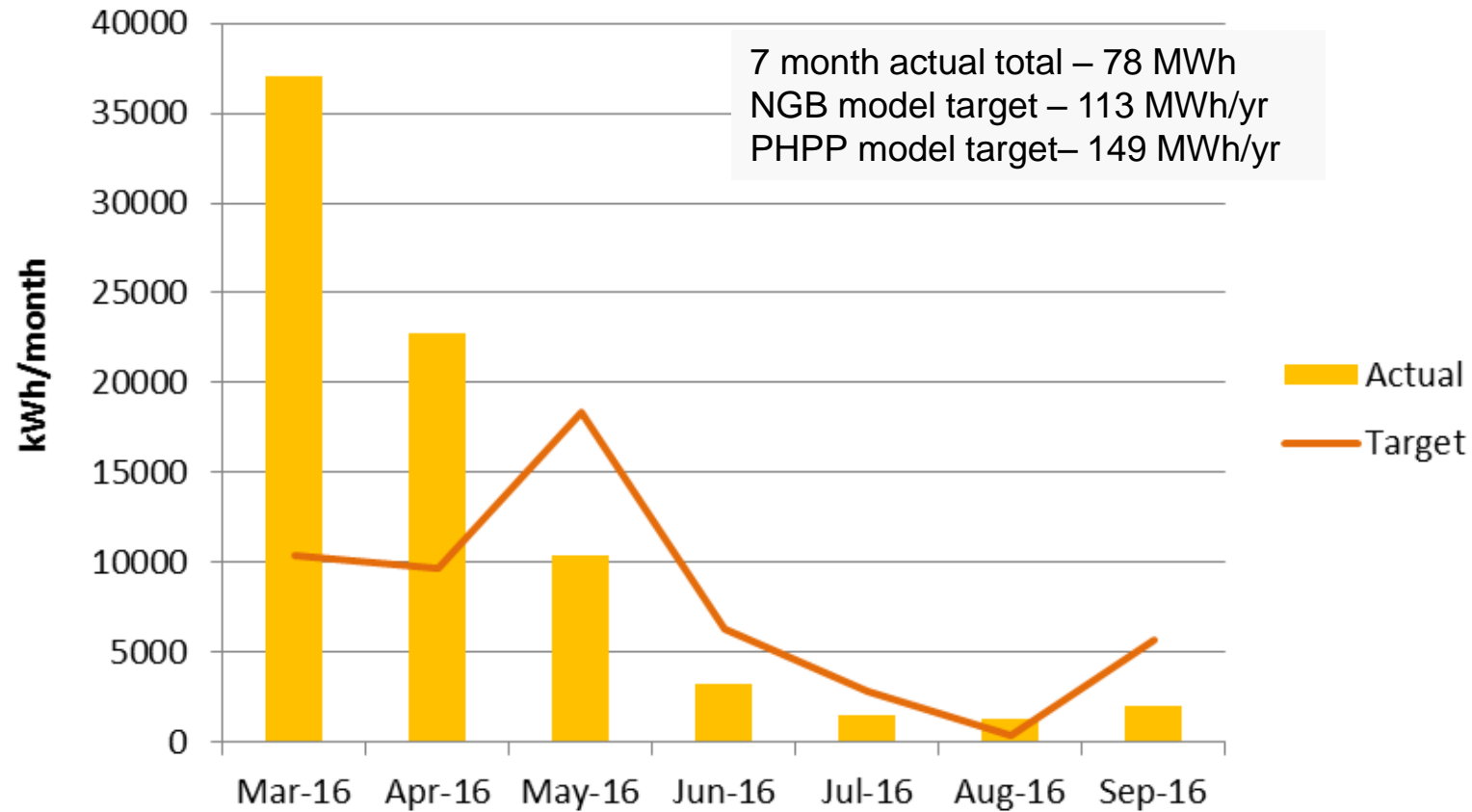
HV incomer meter + PV generation



25% below cumulative target usage to date

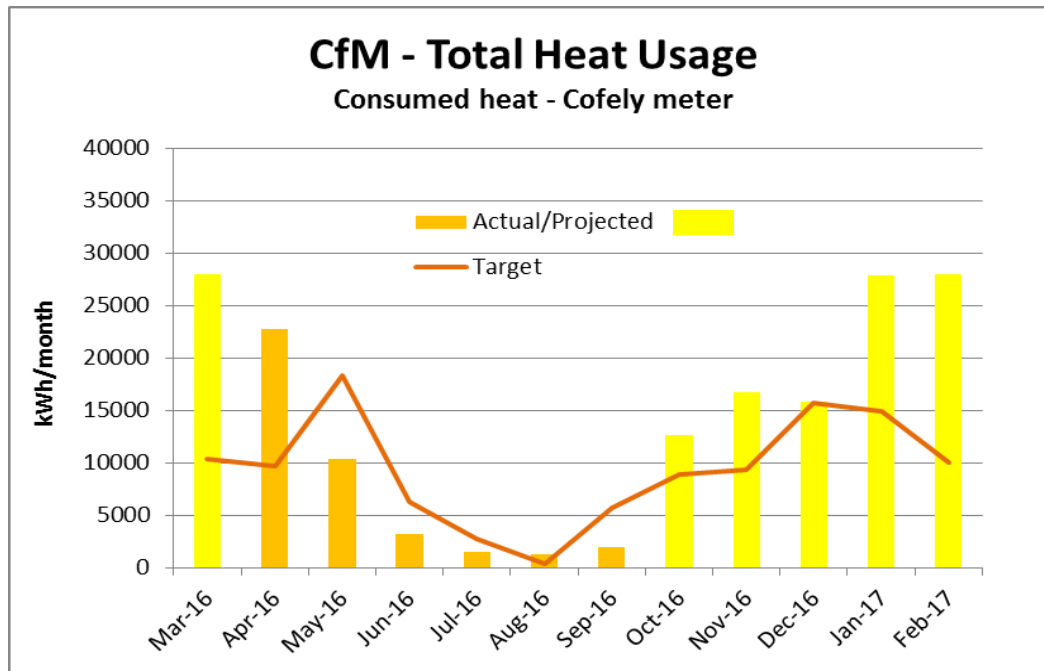
# CfM - Total Heat Usage

Consumed heat - Cofely meter



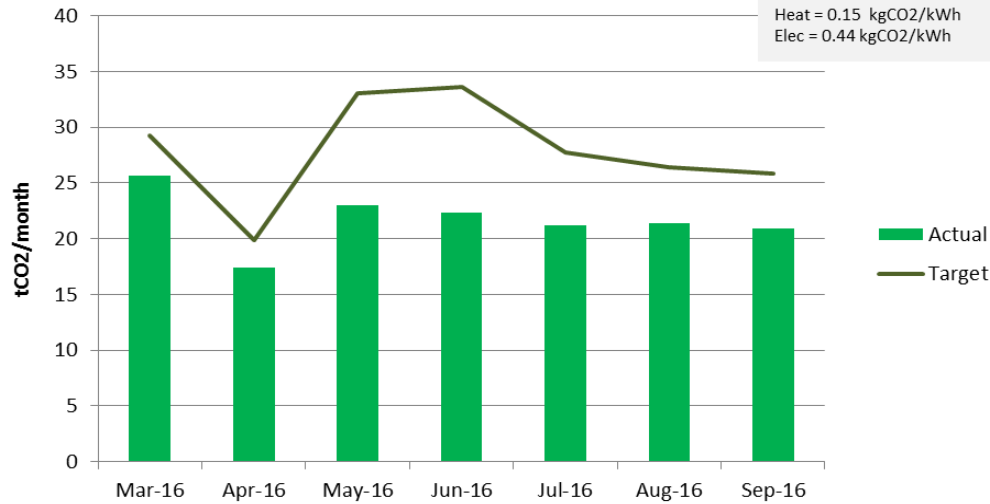
46% above cumulative target usage to date

Space Heating Usage	Basis	MWh/yr	kWh/m2.yr
Target	NGB model	113	9.6
Target	PHPP model	149	12.6
Target	PHPP standard	176	15
<b>Actual *</b>	<b>6m measured + 6m projected *</b>	<b>170</b>	<b>14.6</b>



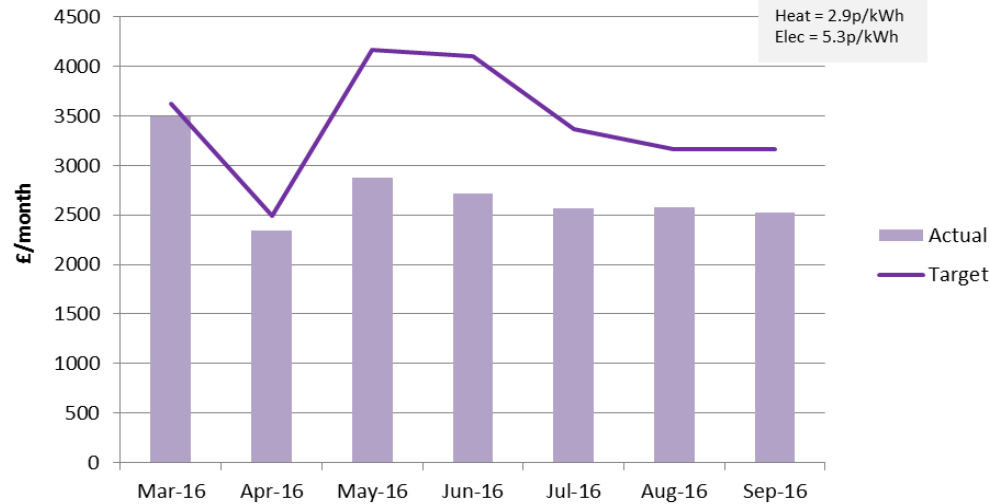
\* April - Sept 2016 correlation between actual usage and heating degree days, Oct – March projected based on 2015/16 degree days. Heating controls not fully optimised in March 2016.

### CfM - Total Carbon Emissions



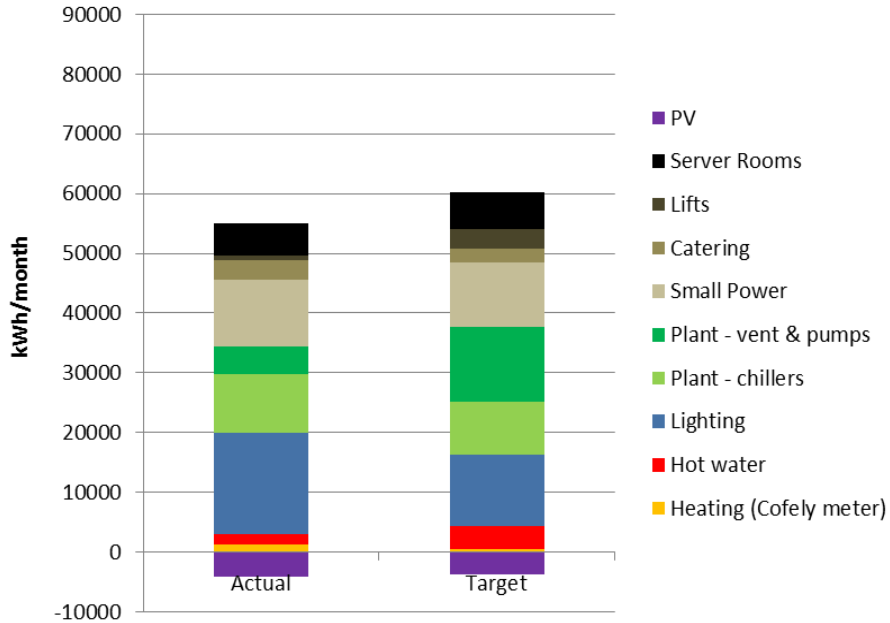
22% below cumulative target emissions to date

### CfM - Total Energy Cost

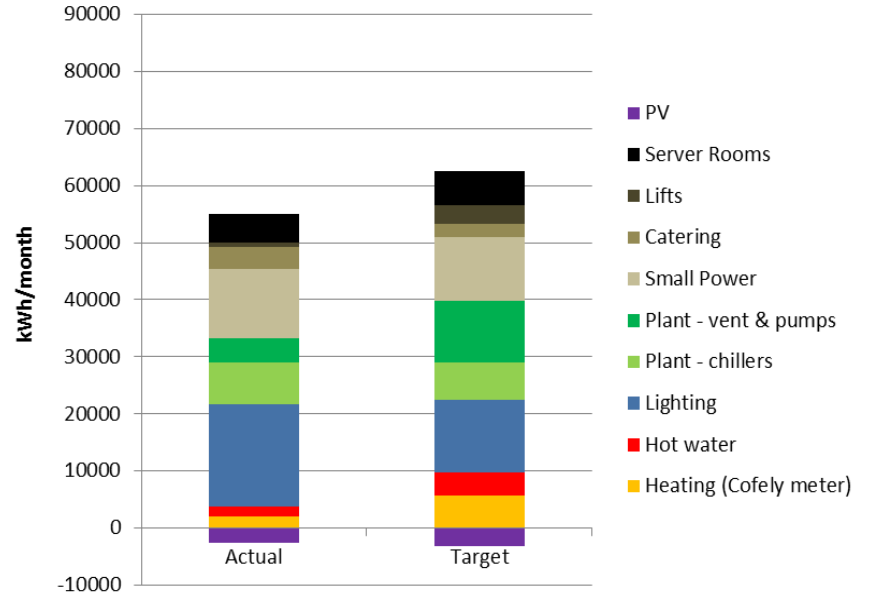


21% below cumulative target costs to date

**CfM - Monthly Energy Usage - August 2016**

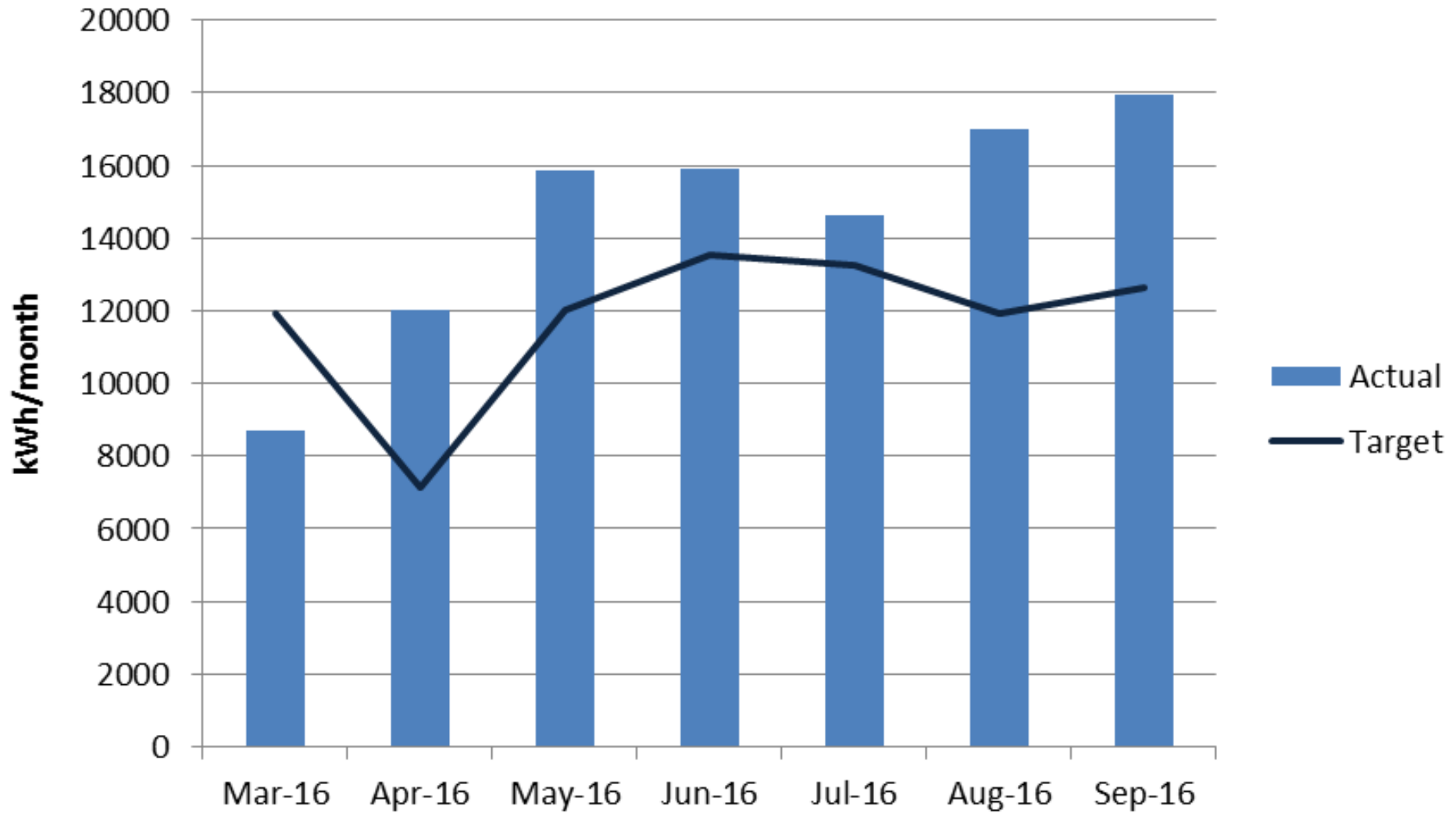


**CfM - Monthly Energy Usage - September 2016**

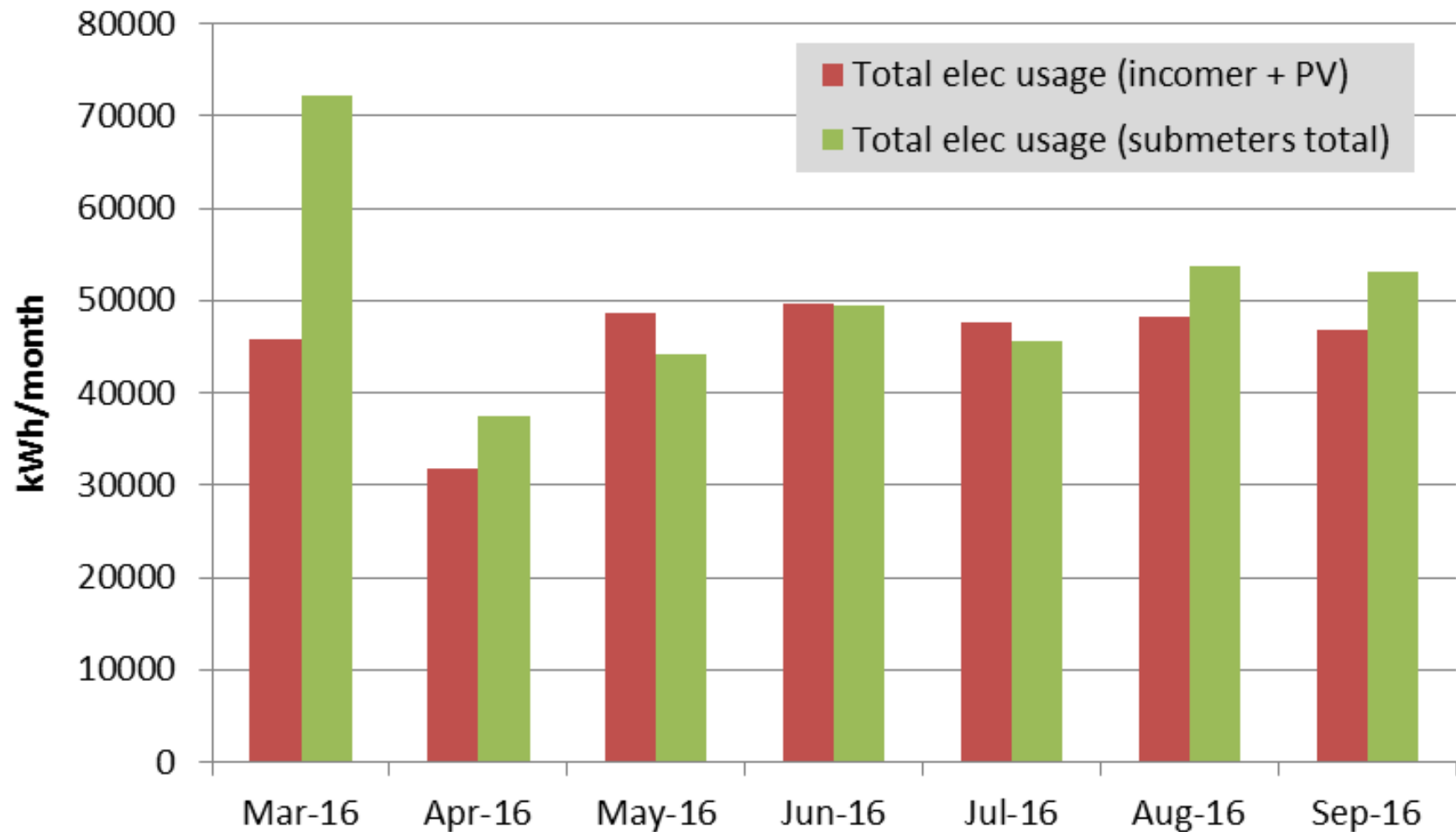




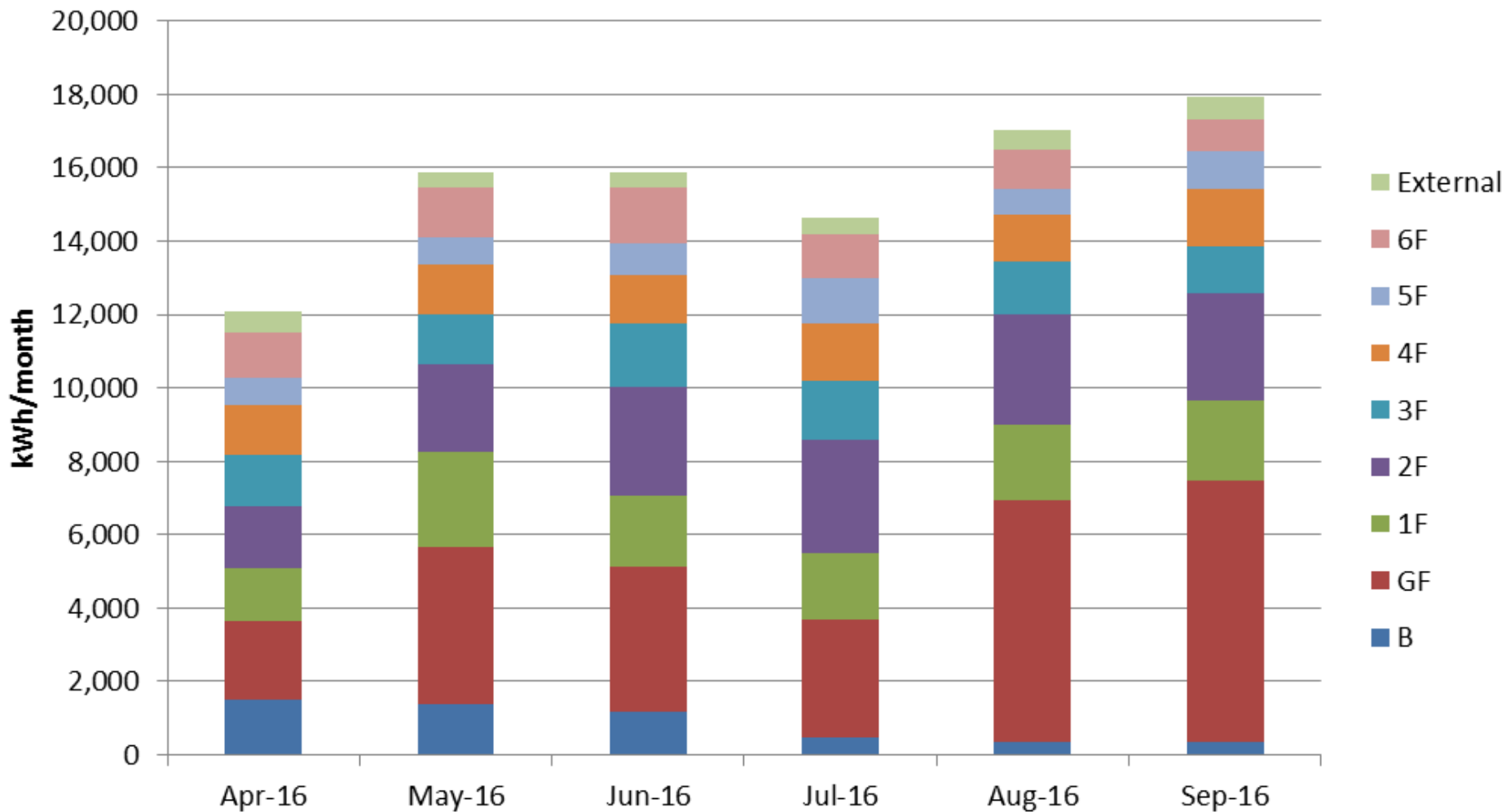
# CfM - Lighting Usage



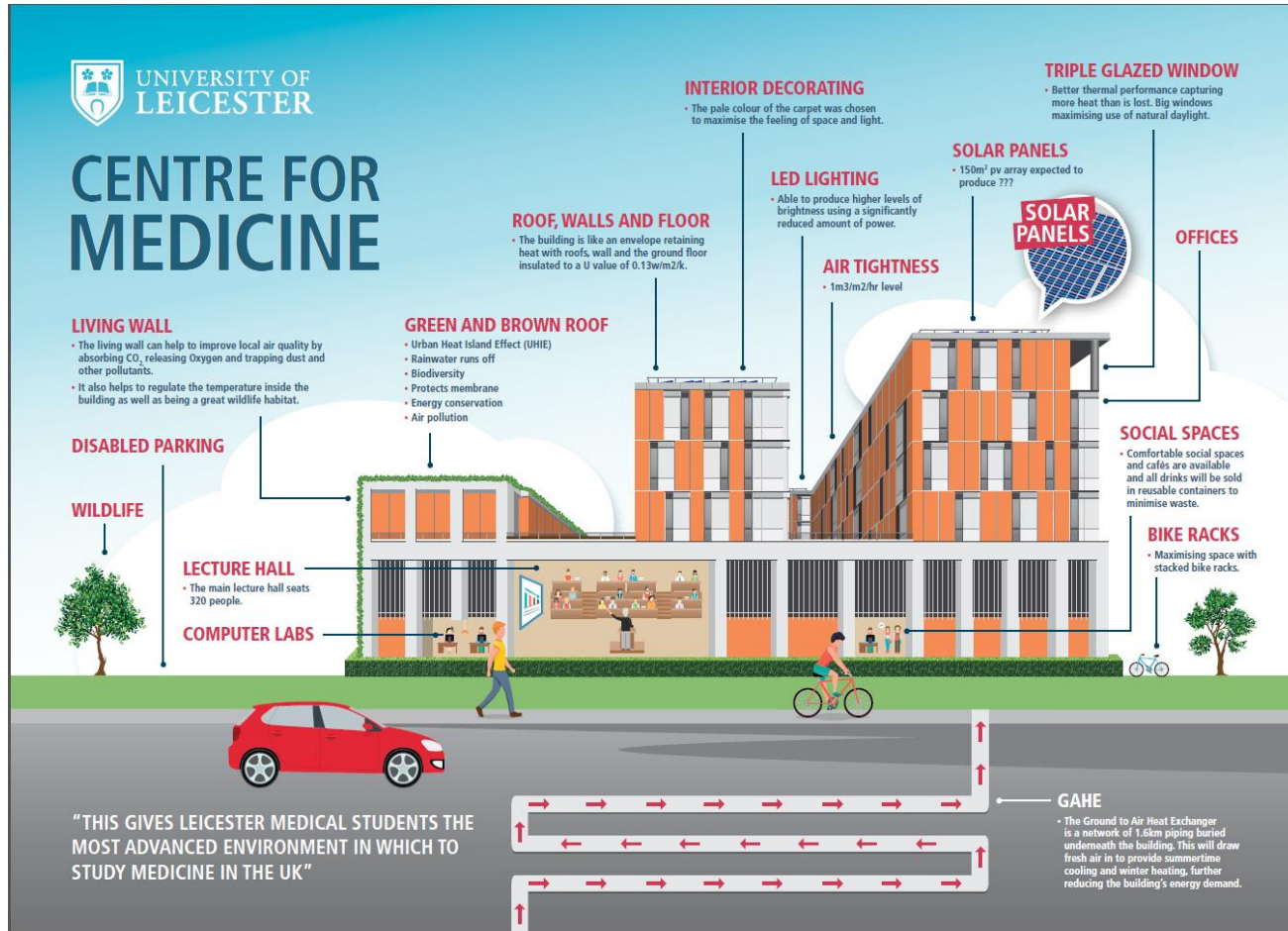
# CfM - Total Elec Usage/Submeter Check



# CfM - Lighting Usage (Actual)



# Non-energy monitoring information / user & behavioural factors



# Non-energy monitoring information / user & behavioural factors

## Community living

- Working harmoniously
- Building a community
- Sharing the building with students
- Sharing the building with visitors



# Non-energy monitoring information / user & behavioural factors



Get-togethers





# Future Monitoring & Management Issues

## Current Building Stock



### Maurice Shock Building

320kWhr/m<sup>2</sup> per annum space heating

500kWhr/m<sup>2</sup> per annum total energy

£360,000 per annum energy bill

Vs

## New Building Stock



### The Centre for Medicine

15kWhr/m<sup>2</sup> per annum space heating

80kWhr/m<sup>2</sup> per annum total energy

£57,600 per annum energy bill

# Future Monitoring & Management Issues

- Provide monthly feedback to building users.
- Using automated metering alarms to pick up anomalies on data and consumption.
- Key ongoing challenges:
  - On-going building user engagement
  - Maintaining competency of how to use the building
- Issue the first Display Energy Certificate (DEC) during May 2017.
- Aim is to obtain DEC 'A' by May 2019.



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# Questions?



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