



Learning, Teaching and Research



18th EAUC  
**Annual  
Conference**  
7-9 May 2014



NOTTINGHAM   
TRENT UNIVERSITY



18th EAUC  
**Annual Conference**  
7-9 May 2014



## Research into action: creating a Living Lab

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## Overview

- What is a Living Lab
  - Inspiration and Introduction
- Benefits
- University of Cambridge's Living Lab
- Implementation
- Challenges and solutions
- Bryn Pickering-Living Lab in Action



## What is a Living Lab?

- Using the campus or estate of a university as a test bed for research
- Using that research to reduce the environmental impact of the University
- Many different types of Living Lab examples depending on your specific goals for your University



## Inspiration

- Other Living Labs
  - University of British Columbia
- Other Universities including
  - Yale, Harvard, UMass Amherst, UC San Diego and the University of Portland
- Dow Chemical Award



## Benefits

### Universities

- Benefit by tapping into the resources offered by their brightest minds, and harnessing the energy of students, staff and academics keen to help solve the environmental problems encountered on campus
- Supporting the academic aims of the institution



## Benefits

### Students

- Have the opportunity to apply the knowledge from their degrees
- Gain experience and skills
- Receive dynamic and multidisciplinary learning
- Become more environmentally-aware members of society



## Benefits

### Academics

- Ability to bring their research ideas to life and test them on their own campus
- Have the opportunity for more interdisciplinary collaboration around projects
- Ability to be more engaging with students through practical projects
- Provides a resource for student projects





## Benefits

### Staff members

- Feel empowered by their involvement in living lab projects
- Gain a platform to address problems





## University of Cambridge's Living Lab

- Started in October 2012
- Funded by Santander
- Student focused programme
- Full time staff member
- Designed to engage students, staff and academics at different levels depending on interest and amount of time required

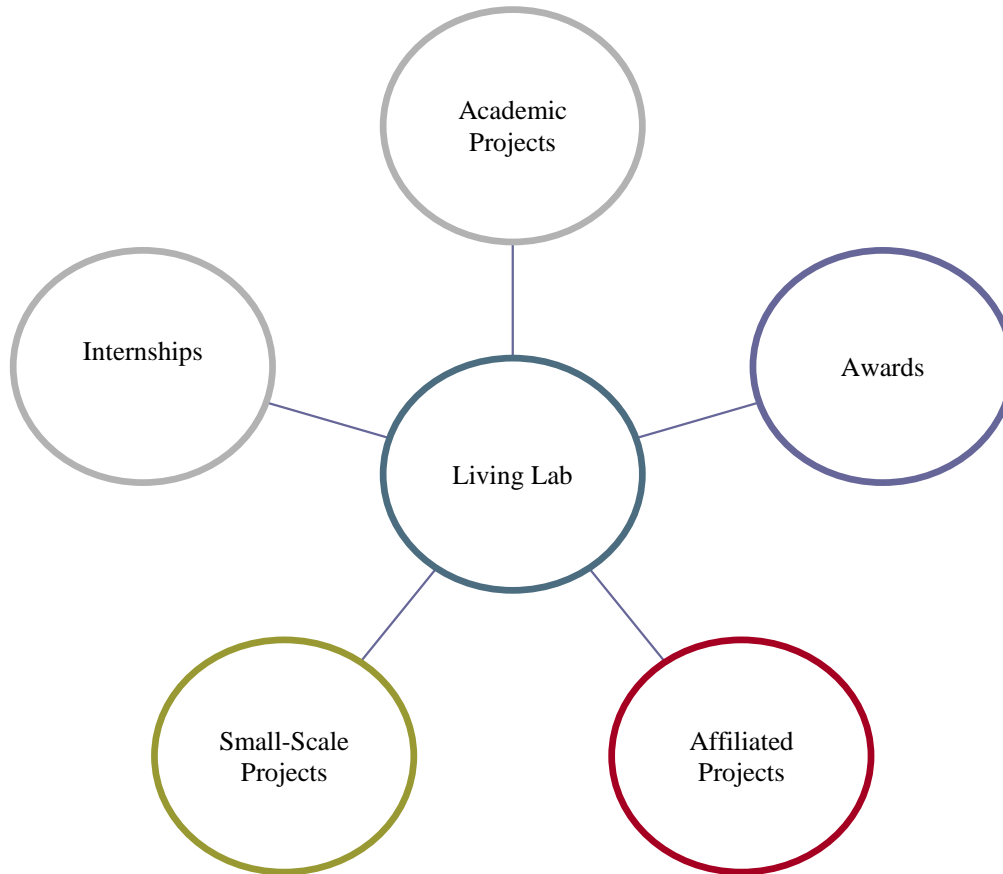


## Implementation

1. Funding
2. Full time staff member
3. Research and development
4. Internal support
  - Advisory Group
  - Approval from Advisory Group
5. Engagement
  - Academic and staff engagement
  - Student engagement
6. Project development



# University of Cambridge's Living Lab



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**CHALLENGE**  
• LIVING LABORATORY •





## Academic Projects

- Academic projects are student projects that will lead to academic credit towards their degree
  - For example fourth year undergraduate and MPhil projects
- These projects require academic supervisors working with the students as well as support from Estate Management staff

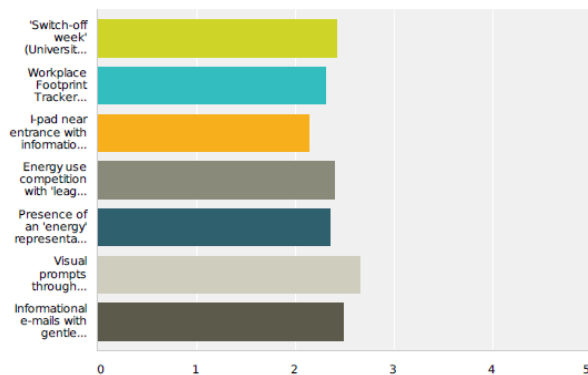


## Academic Project Example

- Dimitra Dantsiou PhD candidate
- Investigating the use of metering and energy dashboards at the University by building occupants

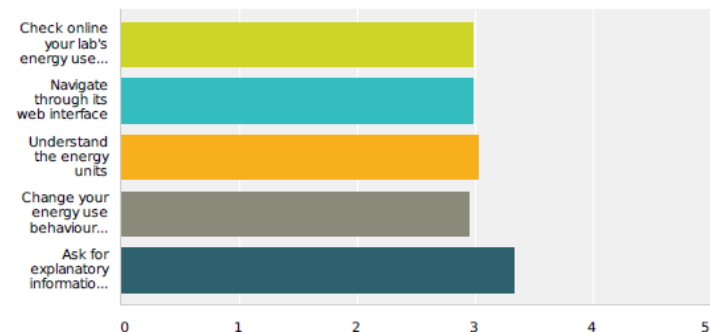
**Q9 To what extent do you think that the following information tools have changed your energy use behaviour?**

Answered: 97 Skipped: 8



**Q10 What is the degree of difficulty to carry out the following actions related to the Workspace Footprint Tracker ?**

Answered: 97 Skipped: 8



## Internships

- Paid internships are offered every summer for 8 weeks
- Focused projects to target specific needs



## Internships

- Summer 2013
  - Promoting Positive Environmental Behaviour Intern
  - Building Energy Intern
- Summer 2014
  - Environmental Data Intern
  - Communications Intern





## Small Scale Project

- These projects are carried out by students that are not part of their academic studies
  - For example, these may include students volunteering to undertake waste or energy audits





## Affiliated Projects

- Affiliated Projects are relevant projects or research which are already occurring at the University that the Living Lab can help collaborate on, support and promote
- These projects could be from, for example, student societies or academic research



## University Library project with Cambridge Retrofit and the Living Lab



## Awards

- Awards encourage students to challenge themselves and work in teams to create innovative sustainability solutions for the University





## 2013 Sustainable Retrofit Challenge



## 2014 Seed Award



## Challenges and solutions to creating a Living Lab

- Funding
- Resources
- Engagement
- Communication
- Integration of results



## Projects:

### **Analysis of current renewable sources on the Cambridge University Estate**

- 13 installations in total.
- Most due to city council requirements and are designed to meet 10% of the building's emissions.
- 5 installations non-operational.
- 1 installation providing as expected.
- University-scale emissions reductions requires:
  - Better monitoring and maintenance .
  - University-scale installations.
  - Student, staff and academic engagement in the work the University is doing.

### **Design of PV array for University Building**

- Capability for cost-effective emissions reductions through renewable installations
- Living Lab giving students the chance to connect theory to real-life work





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- University owned buildings: **300+**
- Buildings with renewables : **13**



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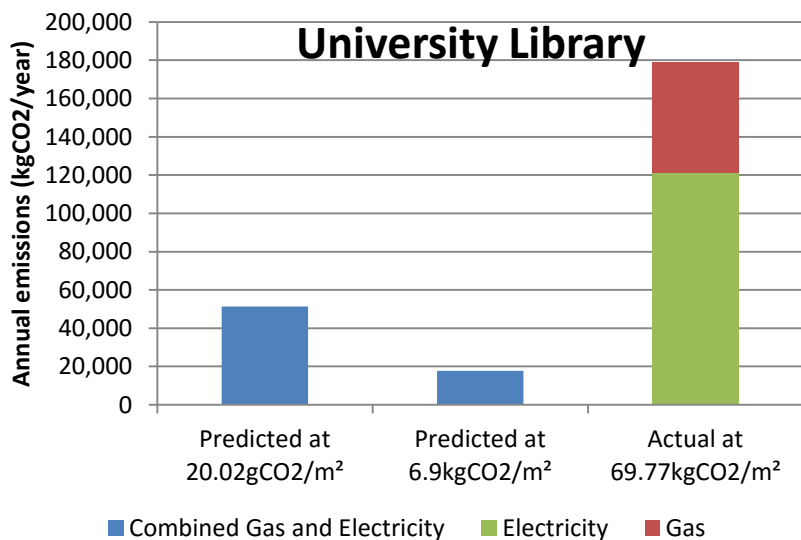


- University owned buildings: **300+**
- Buildings with renewables : **13**
- Buildings with renewables installed under the Merton rule: **10**

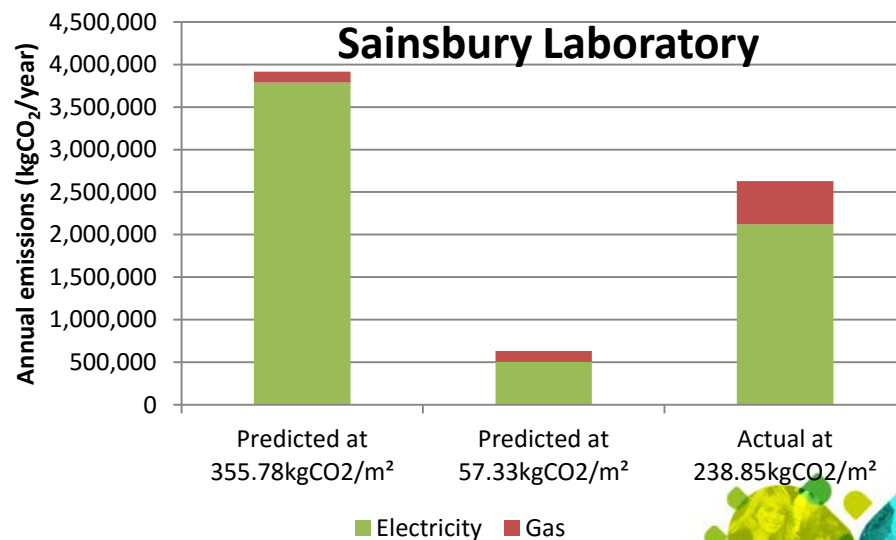


## “Merton Rule”:

City Council Regulation requires the use of renewable energy onsite to reduce annual carbon dioxide (CO<sub>2</sub>) emissions in the built environment.



Differing predictions due to change of modelling techniques



Differing predictions due to distinction between regulated and unregulated emissions



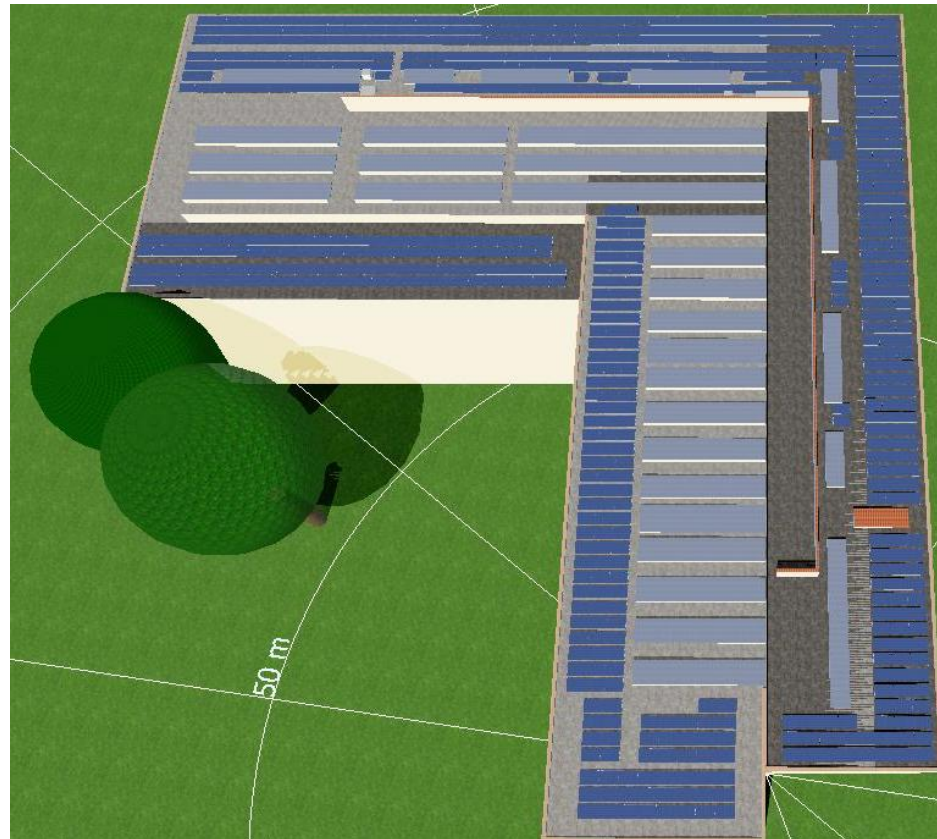


Sainsbury Laboratory





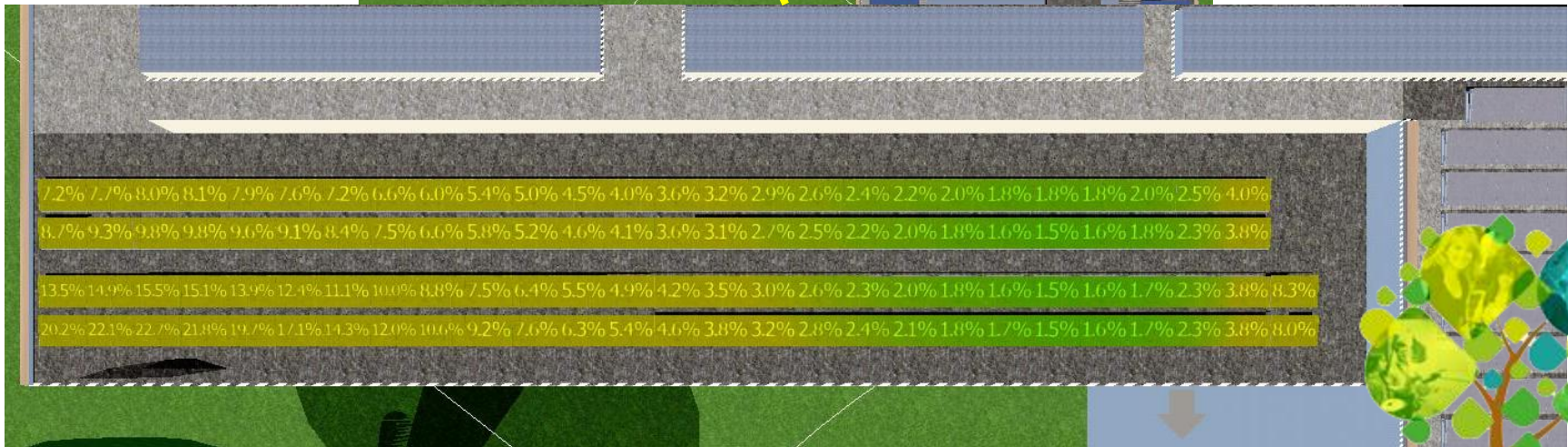
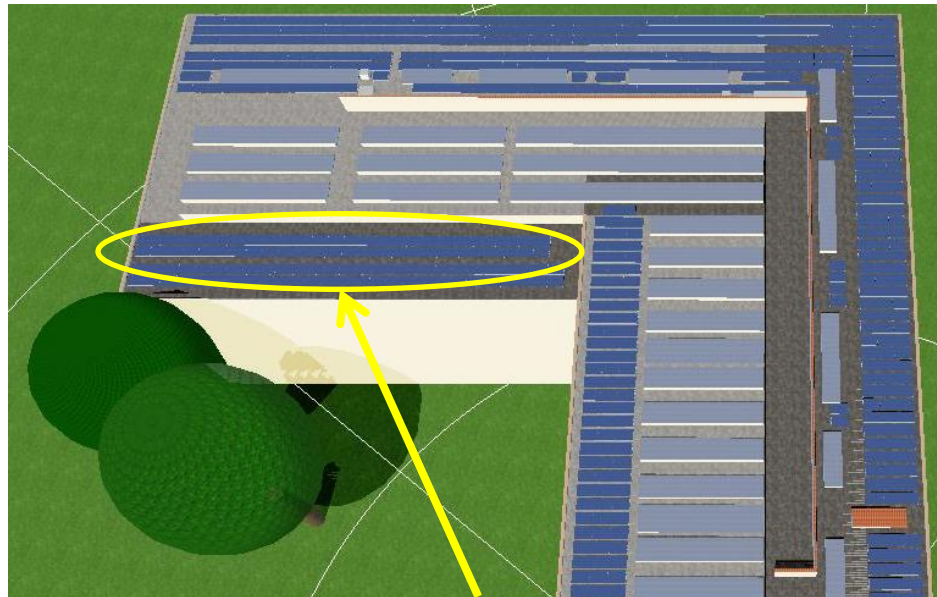




728 PV Panels facing ~South at 5° inclination.

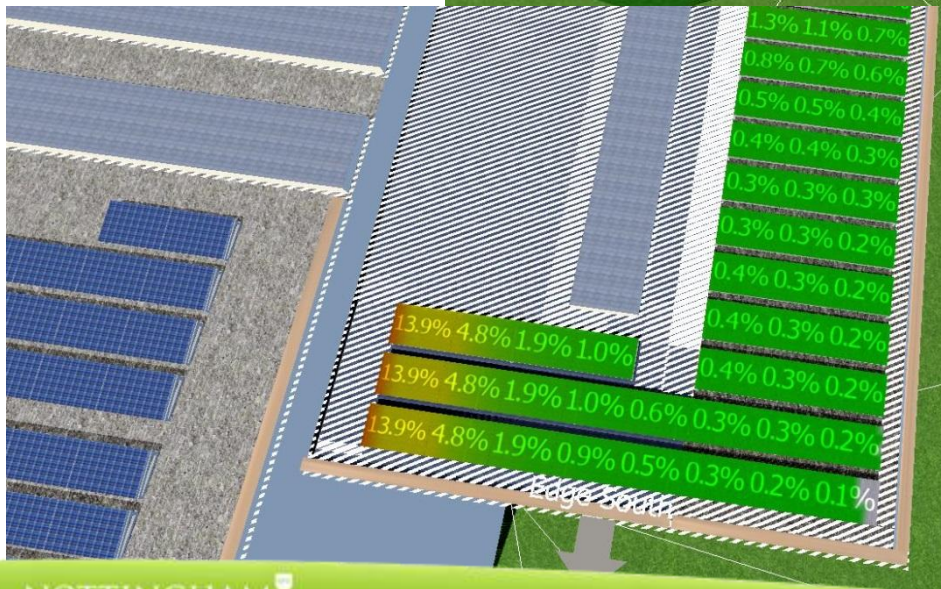
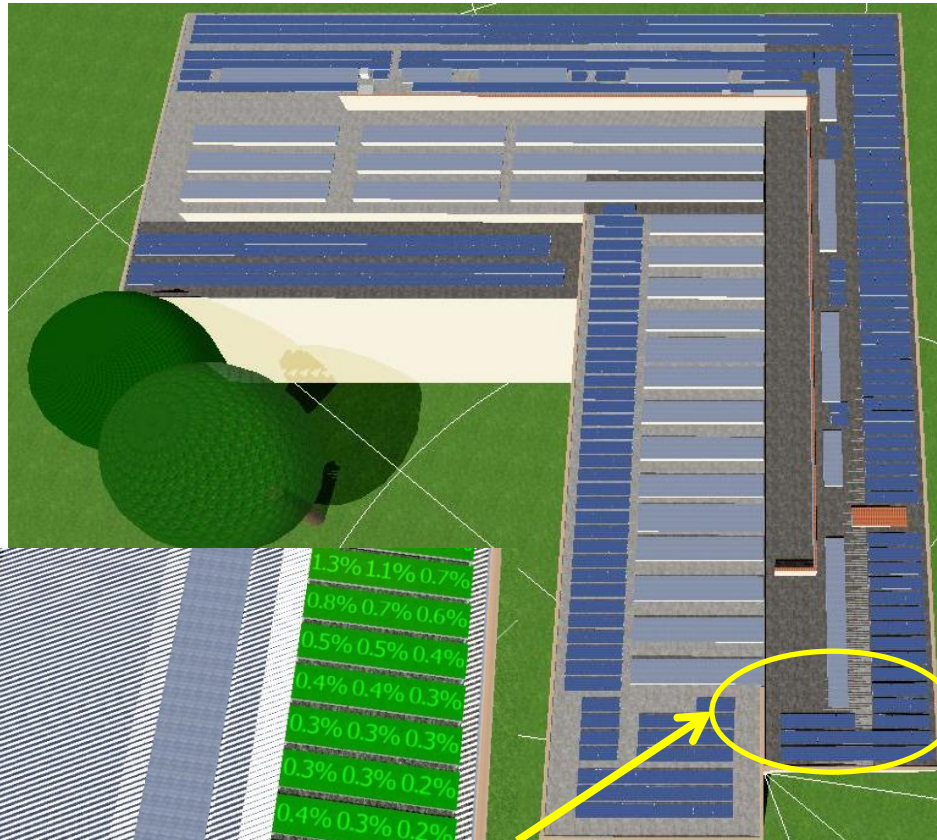




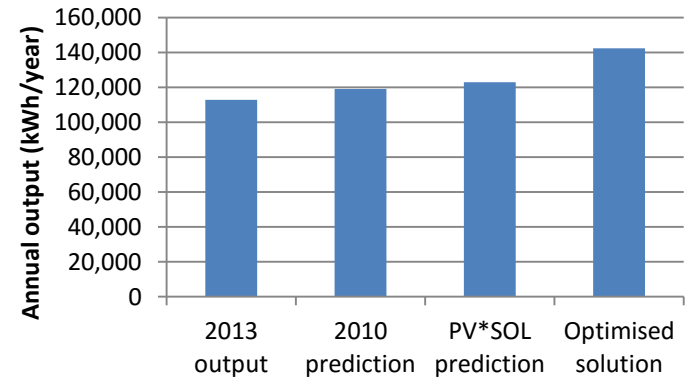
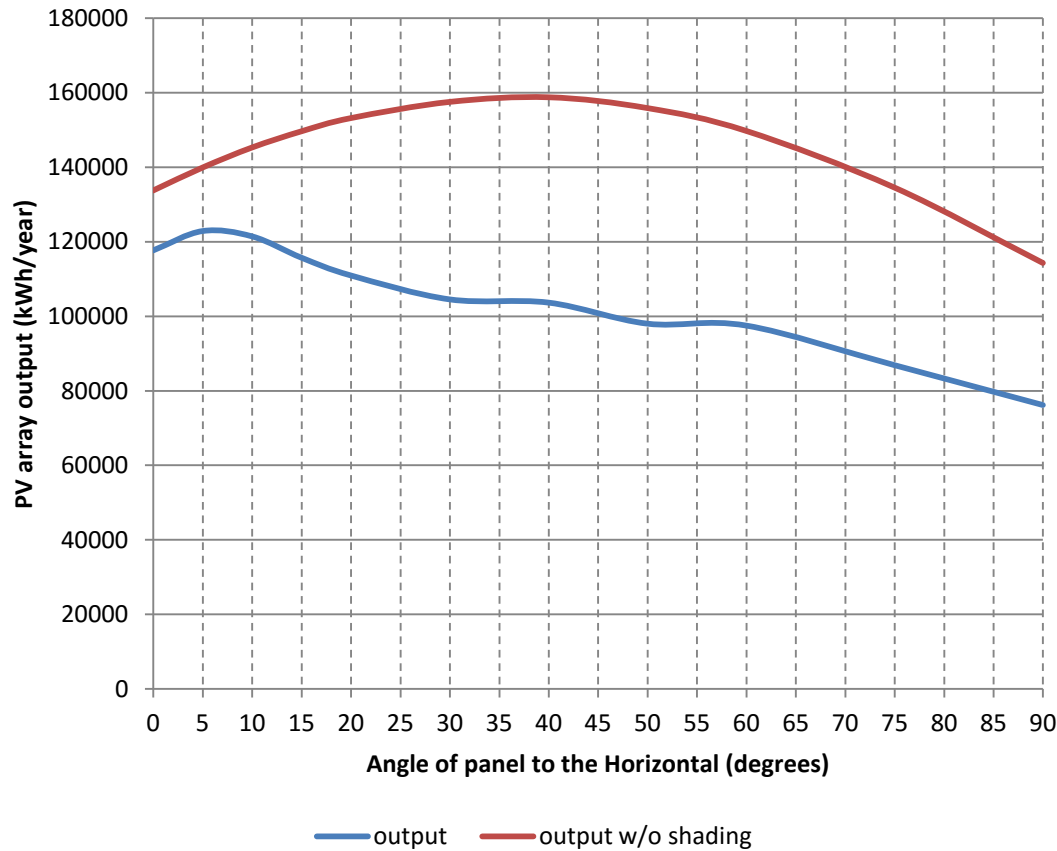


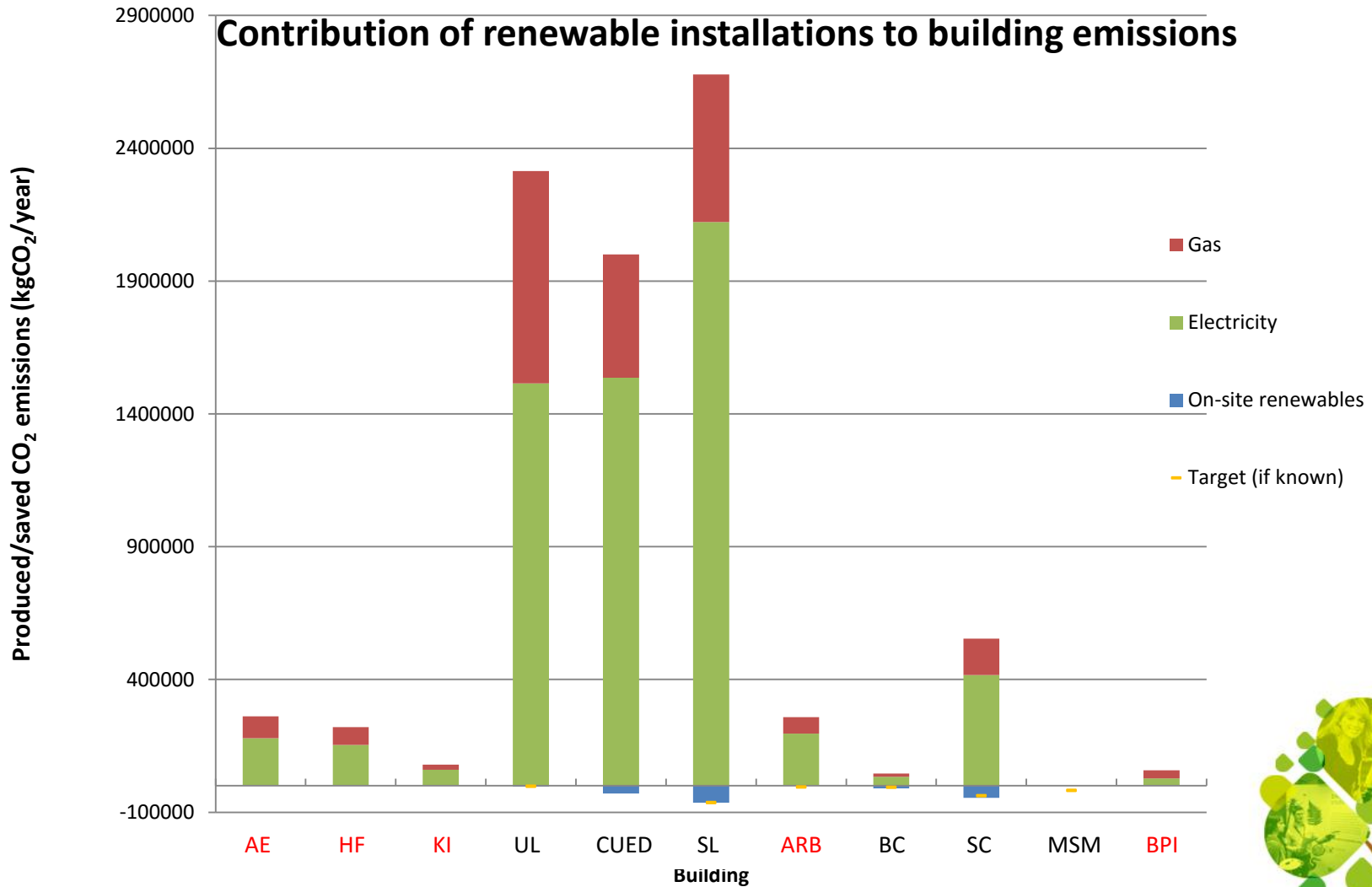






## Sainsbury Lab PV array output predictions:



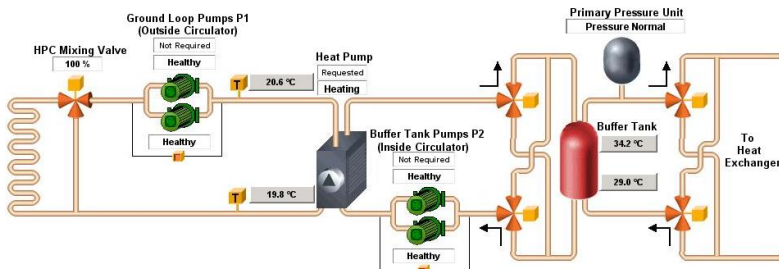




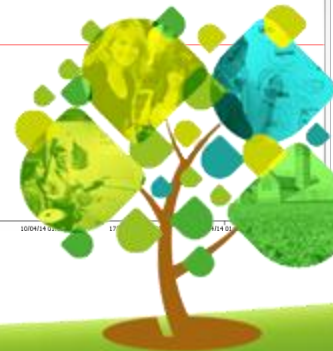
# GSHPs are looking a little worse for wear...



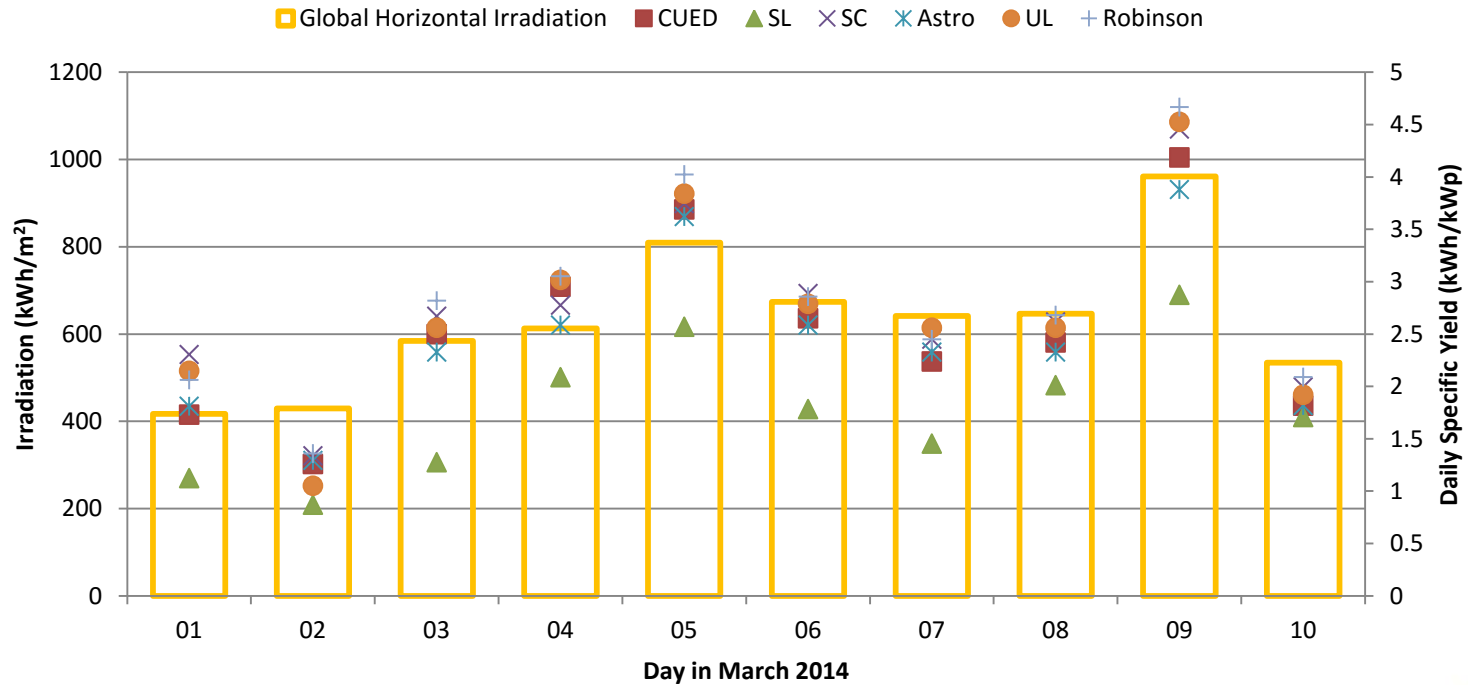
Back 11.3 °C Kavli Institute Ground Source System Kavli Institute Menu Time : 02/05/14, 16:25



GSHP Low Pressure Healthy  
 Fault  
 Ground Source System  
 Fault



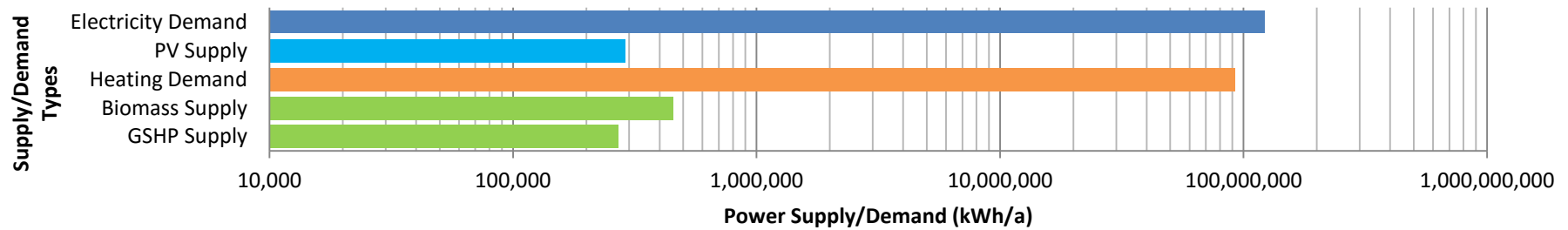
# Comparing effectiveness of PV installations





# Renewables supply vs. University demand

(based on theoretical output of devices if they were operational)



PV supply **.3%** of electricity demand

GSHP & Biomass **.8%** of heating demand

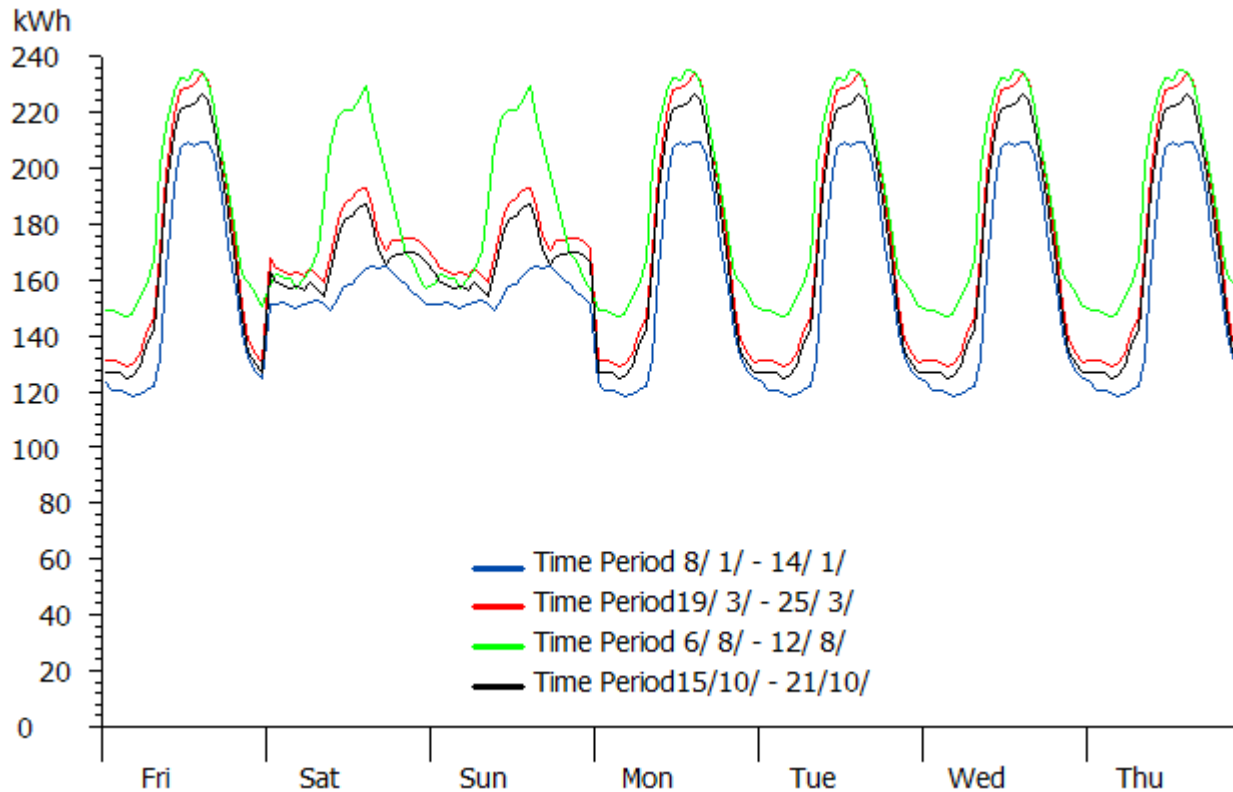




William Gates Building

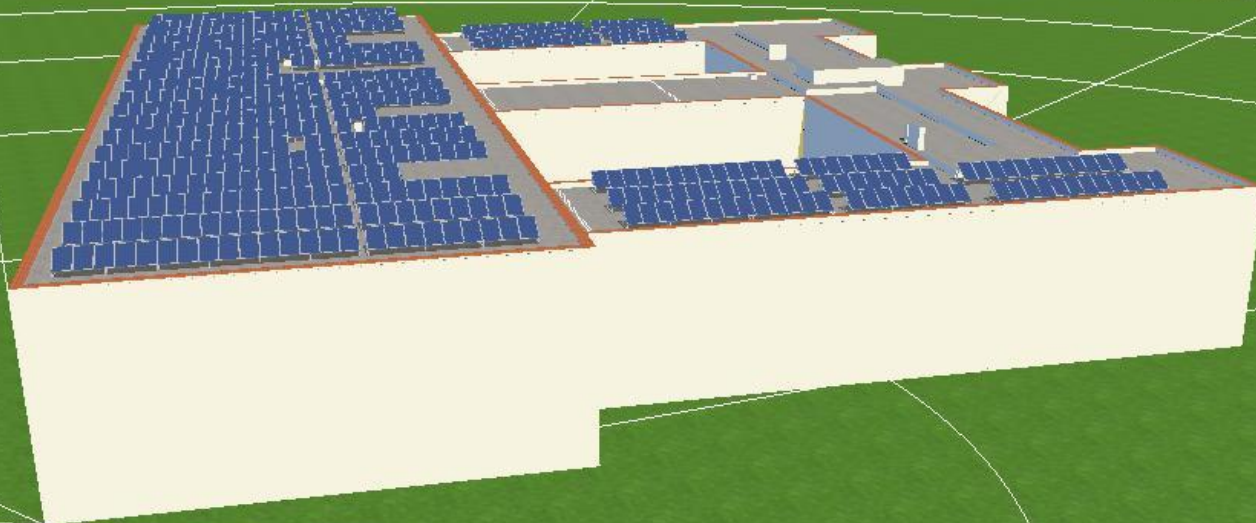


## Electricity Consumption:



Annual Consumption: 1,474,420kWh





Energy Produced by array: **153,445 kWh/a**

Total Investment: **£233,427**

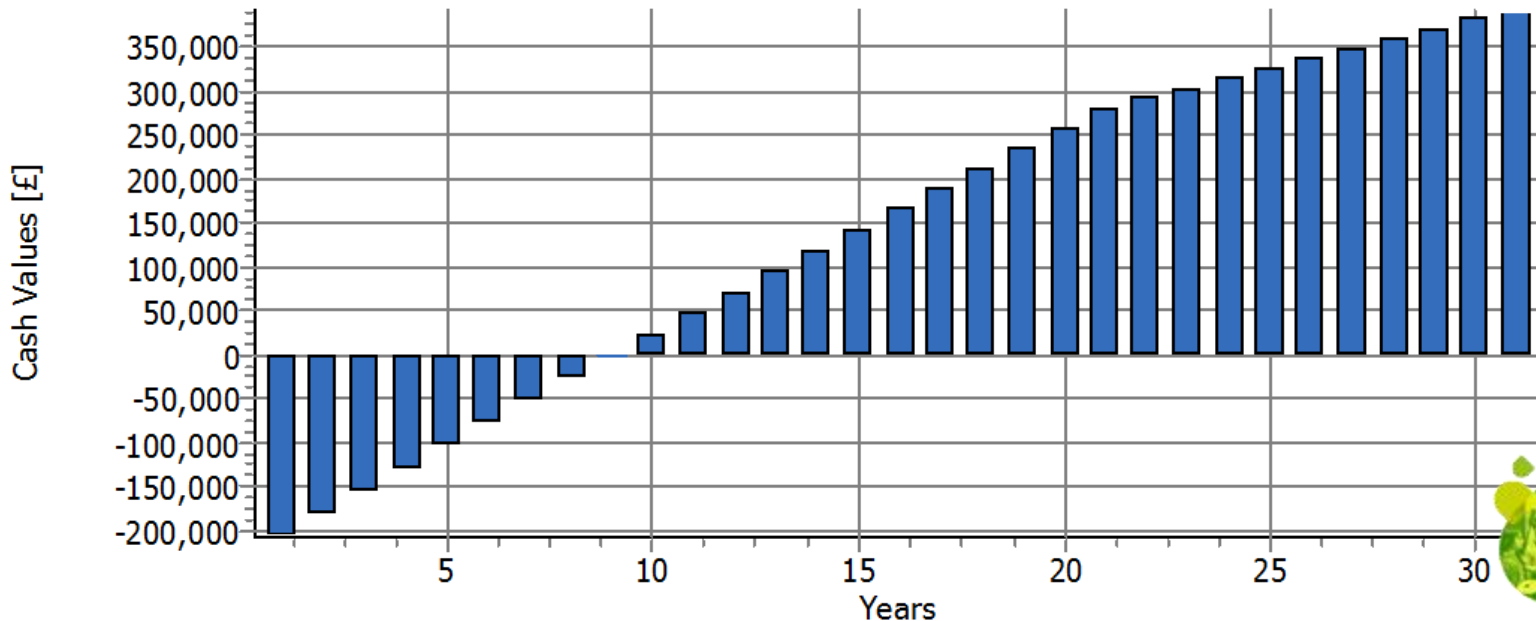
Percentage of consumption: **10%**  
 supplied by array

Net Present Value: **£392,795**

CO<sub>2</sub> Emissions avoided: **94 ton/a**

Payback Period: **9.1 years**

**Cash Balance (Accrued Cash Flow)**



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Aha?



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- One size does not fit all
  - Know your university: tailor your programme to fit your needs as an institution. Understand your strengths and weaknesses and create a programme that plays to your strengths, but also addresses and attempts to improve your weaknesses.
- Provide the appropriate resources
  - Before starting it is important to have the appropriate resources in place.
- Build strong networks
  - A Living Lab will only work well if all needed parties are engaged and informed. Building strong networks will enhance involvement and integration of project results.

