



# Laboratories of the Future Safe, Successful & Sustainable



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# About Us



- ❖ [www.goodcampus.org](http://www.goodcampus.org)
- ❖ **Higher Education Environmental Performance Improvement project**
  - centrally funded by HEFCE etc
  - university focused, with outreach
- ❖ **Green Building**
- ❖ **Sustainable Laboratories**
- ❖ **Green IT**

# Growing Pressures

- ❖ **Rising costs**
  - **staff, equipment, utilities**
  - **research complexity**
- ❖ **Funding constraints**
- ❖ **Regulatory/stakeholder constraints**
  - **environmental**
  - **health and safety**
  - **dignity and welfare**
- ❖ **Quality/transparency constraints**
- ❖ **Employee requirements/demands**

# The Sustainable Laboratory

- ❖ Collaborative/flexible working
- ❖ Highly adaptable
- ❖ High quality working spaces
- ❖ Highly IT intensive/automated
- ❖ More systematic
- ❖ Low impact and resource efficient
- ❖ More efficient/effectively utilised eqt
- ❖ More effective management

# The IT-Intensive Lab



- ❖ Lab automation
- ❖ Computation
  - intensification
  - in vivo/vitro to in silico
- ❖ New working methods
- ❖ Lab information systems
- ❖ Challenges
  - technical capability
  - energy efficiency
  - information overload

# ClimateGate



# Chemical Management

- ❖ **University of Edinburgh**
- **tracks all chemical location and use**
- **saved £100,000 purchasing in year 1**
- **reduced spoilage**
- **management benefits**
- **research time**



# Sample Storage

- ❖ **Storage guidance**
- ❖ **Sample management**
  - **Blizzard eliminated 50% of samples**
- ❖ **Energy efficient equipment**
  - **725L -80 freezer 6,000–21,000 kWh/y**
  - **University of Newcastle replacement**
- ❖ **Stanford University**
  - **surface temperature DNA storage**

# Energy Costs

- ❖ **‘Millionaire’ laboratories**
  - **Cambridge Chemistry Lab £1.2 m pa**
- ❖ **Typical Constant Volume Fume Cupboard running 24/7**
  - **uses ~£2000-5000 pa**
  - **equals 2 UK average houses**
- ❖ **Rising electricity prices**

## ❖ Energy

- up to 5 from list of 13

- fume cupboard x 3; fan energy; diversity; grouping; load responsiveness

❖ Fume cupboard safety – BS14175

❖ Lab-focused commissioning

❖ Lab specific user guide

❖ Labs 21 design process

❖ Green IT

❖ Innovation

- EPC “A”
- OUTSTANDING BREEAM
- UNDER 18Kg/CO2 per m2
- UNDER 55 kWh per m2
- MAXIMISE NATURAL LIGHT



# New Ways of Working - Chemistry

- ❖ **Resource/workflow management**
- ❖ **Micro scale experimentation**
- ❖ **Green chemistry**
- ❖ **In silico research/teaching**
- ❖ **Reduce/eliminate servers**  
**- virtualisation, cloud computing**

# Good Housekeeping

- ❖ **Frugality**
  - switching off/powering down
  - avoiding spoilage/wastage
  - recycling equipment/materials
- ❖ **Order/Tidiness**
- ❖ **Procedures**
  - chemicals/sample storage
- ❖ **Awareness**
  - stickers
  - understanding the lab

# SUSTAINABLE SYNERGIES

- Health and safety
  - better risk characterisation
- Working conditions
  - more attractive and productive environments
  - high daylighting and natural ventilation
  - sustainable materials,
- Involvement
  - 'unsung heroes and heroines'
  - lab technicians; maintenance etc.
- Flexibility
  - reusing equipment & space cuts waste
  - avoids the impacts of replacement

# THE RIGHT QUESTION?

- Environment or Safety?
- What is Safety?
- Following time honoured norms that are often not evidence based?
- A risk based approach informed by a good understanding of design configurations and working practices?



# Lab Energy Efficiency (kwh/m<sup>2</sup>)



	Typical		Good		Best	
	FF	Elec	FF	Elec	FF	Elec
All Labs	296	312	135	227	79	143
Medical/Bio (Secure)	397	362	198	227	100	245
Chemical	353	367	244	333	177	327

# Equipment Energy Varies

Model	Capacity (l)	Cost/litre (£)	Annual running cost (@7.3p/kWh)
New Brunswick (Green model)	570	0.54	£306.18
New Brunswick (Green)	570	0.55	£314.84
New Brunswick (Green)	570	0.57	£326.13
van der Woude Revco	570	0.76	£434.85
Lab Impex Research	570	0.85	£487.15
Heraeus	691	0.93	£641.93
Illshun DF8517	484	1.12	£541.63
Kaye Sanyo MDF-U70V	728	1.13	£824.93
New Brunswick	101	1.79	£180.28

Biological Safety Cabinet	kWh	Annual running cost (@7.3p/kWh)
Trimat 2 (Ducted)	0.44	£281.37
ESCO ACZ 4D1 (recirculating)	0.33	£211.03

Growth Cabinet	kWh	Annual Running Cost
Sanyo Fitotron	20.64	£549
Percival small	26.90	£716
Percival scientific	36.36	£968
Sanyo 2	62.0	£1,814
Convion	92.85	£2,711