

# **Certification and Sustainable Laboratories: Equipment and Operations**

**[www.effectivelab.org.uk](http://www.effectivelab.org.uk)**

**[www.imperial.ac.uk/estates-facilities/sustainability](http://www.imperial.ac.uk/estates-facilities/sustainability)**



# **Welcome and Brief Overview of Laboratory Sustainability in Imperial College**

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**Allison Hunter**

**Introduction**

**Dr Neil Jennings**

**Climate change, plastic pollution and laboratories**

**Rebeca Fiadeiro**

**Greening LMS**

**Andy Hammond**

**Head of Engineering, Energy and Environment**

**Allison Hunter**

**Freezers, autoclaves and beyond**

# Climate change, plastic pollution and laboratories

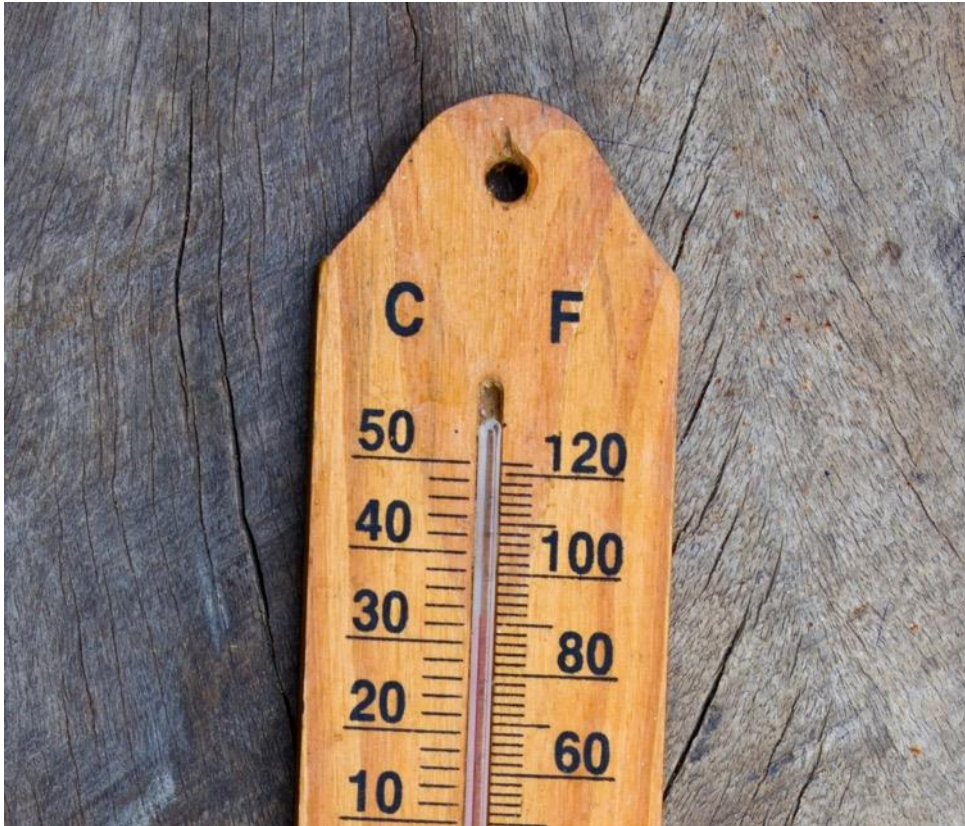
Dr Neil Jennings, Partnership Development Manager,  
Grantham Institute

# 1.5°C versus 2.0°C

## English summer warmer than 2018

1.5°C rise: 1 in every 4 years

2.0°C rise: 1 in every 2 years



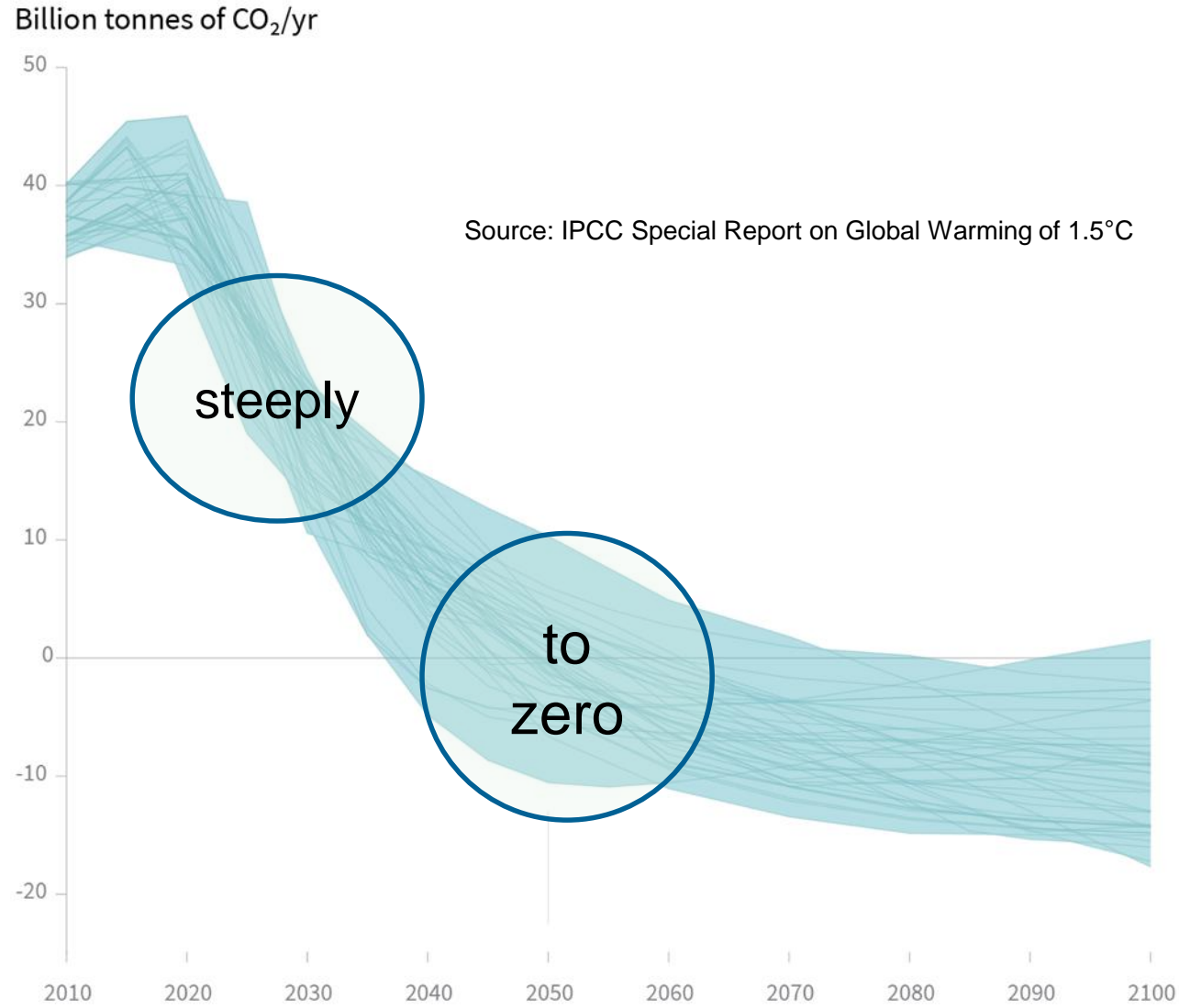
## Coral reefs

1.5°C rise: 75-90% in decline

2.0°C rise: 99% in decline

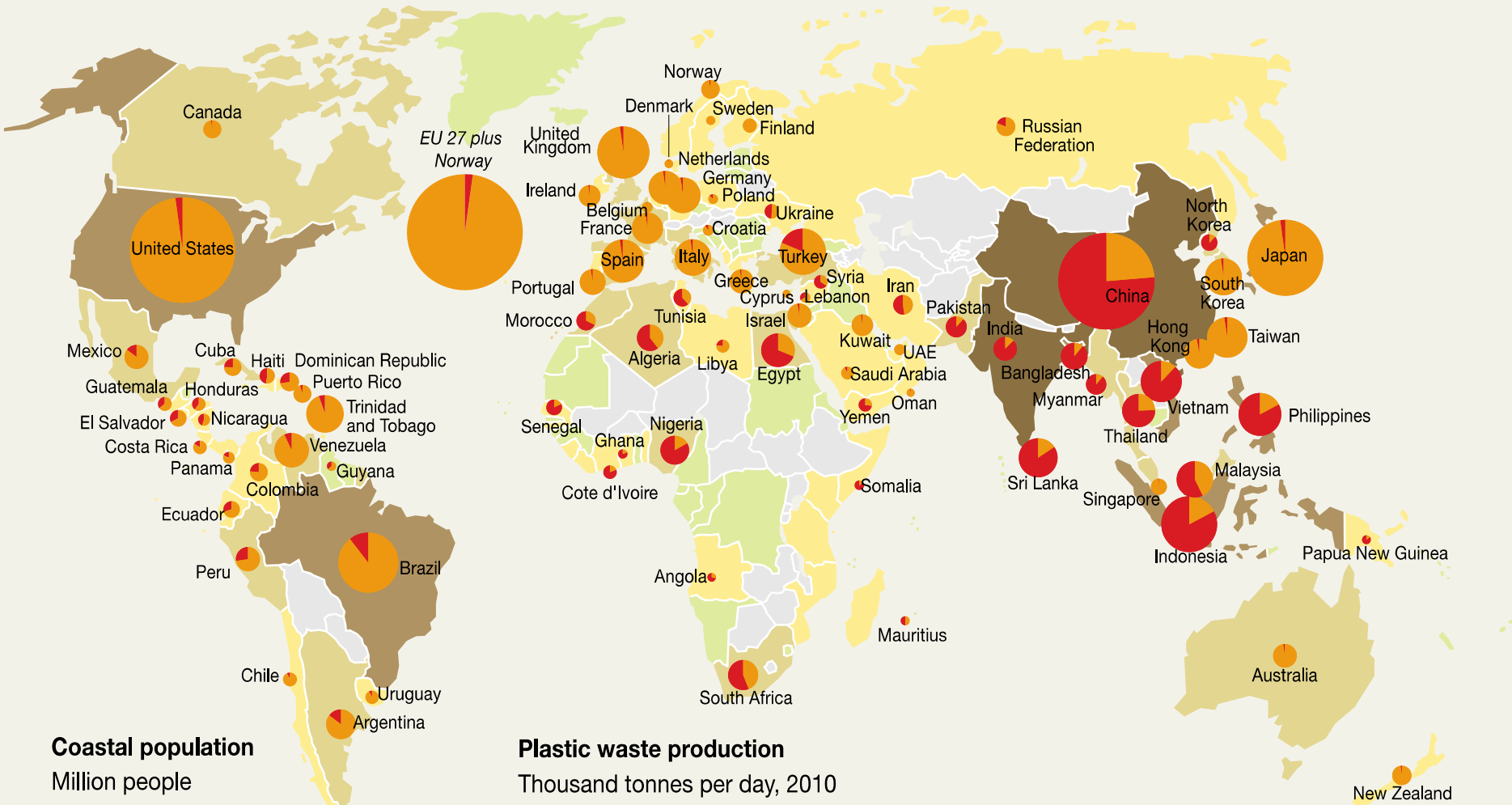


# Rapid decarbonisation to avoid 1.5°C



# Plastic waste produced and mismanaged

90% of plastic in our ocean come from just 10 rivers (World Economic Forum)



## Coastal population

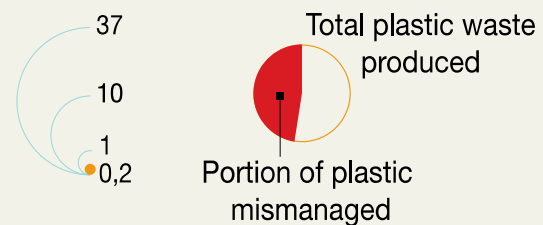
Million people

- Less than 1
- 1 to 2
- 2 to 10
- 10 to 50
- 50 to 263

Land locked country

## Plastic waste production

Thousand tonnes per day, 2010



Source: Jambeck, J., R., et al., Plastic waste inputs from land into the ocean, Science, 2015; Neumann B., et al., Future Coastal Population Growth and Exposure to Sea-Level Rise and Coastal Flooding - A Global Assessment. PLoS ONE, 2015.

# LEAF pilot

- Laboratory Environmental Assessment Framework
- 4 labs, estimated £1,600 saved over next 12 months, 24 tonnes of CO<sub>2</sub>
- Three labs bronze, one silver...

## Who are we?

Students and staff improving sustainability at the LMS

## Our main aim

Reduce waste and energy consumption



## What have we been doing?





## LAB WASTE - WHAT GOES WHERE?



WHAT	WHERE	EXAMPLES
Sharp		
Chemically/ Biologically Contaminated		
Non- Contaminated Plastic	 Check plastic type	 Remove lid and label. Rinse
Chemical Glass	Lab dependent. Ask your lab safety manager.	



Use us to store your reagents to help reduce the amount of plastic waste!



## #packitin twitter campaign to alert companies to reduce packaging

- 1 Attach a photo of your disproportional packaging next to the item
- 2 #packitin
- 3 Tag the company  
eg: @MERCK, @VWR, @thermofisher @BDBiosciences, @CellSignal
- 4 (Optional) Include a comment



## Returning Polystyrene boxes



Check for return stickers or return stamps



Stick the return label or expose the return stamp. Seal box.



Place the return box in your mail area for collection



A PC monitor left on overnight can waste enough electricity to laser print over 500 pages

## TURN OFF THE MONITOR



Reducing your PC monitor brightness from 100% to 70% can save up to 20% of the energy the monitor uses

## REDUCE THE BRIGHTNESS

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## What have we been doing?

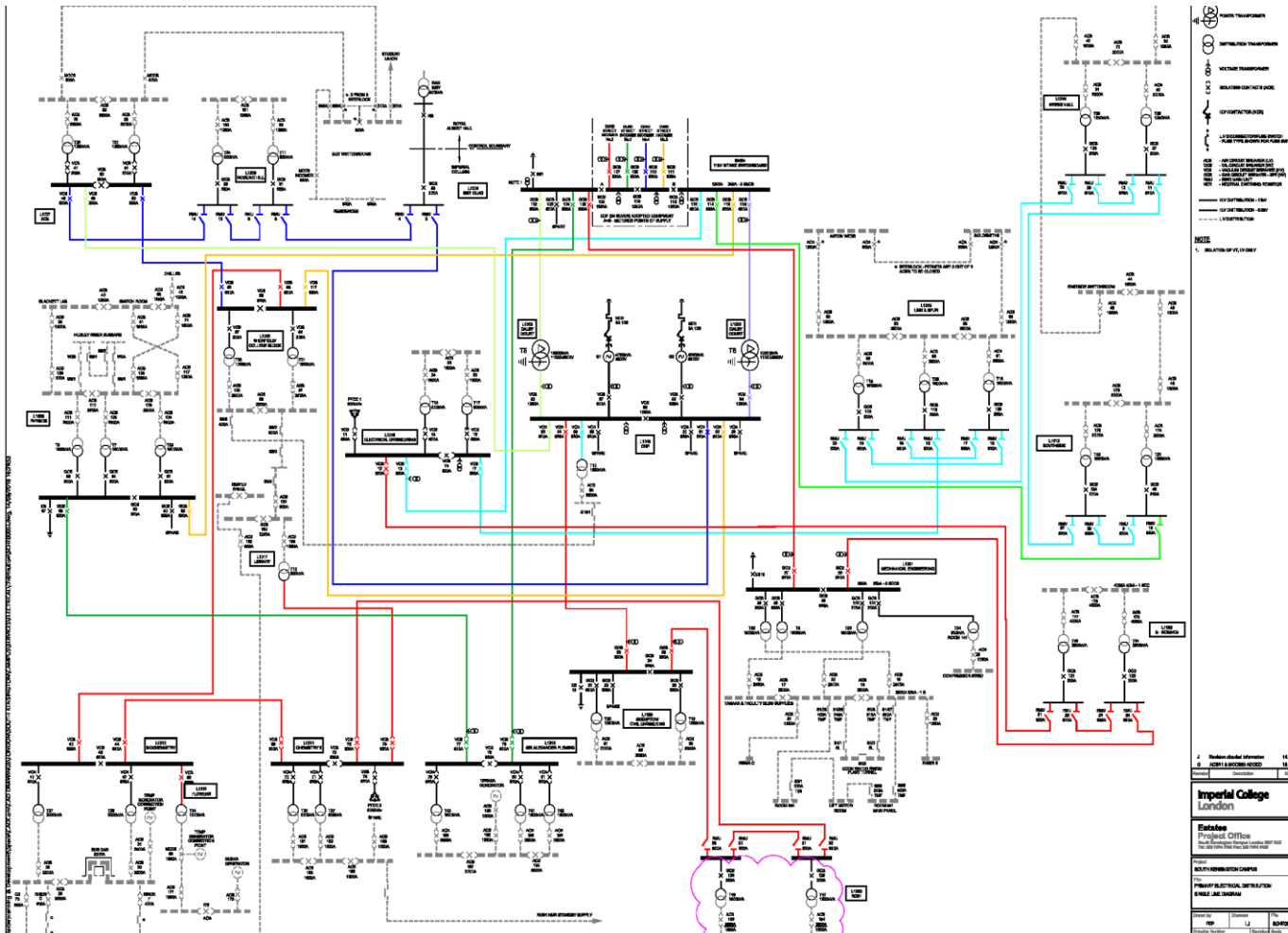


# Imperial College London

SOUTH KENSINGTON

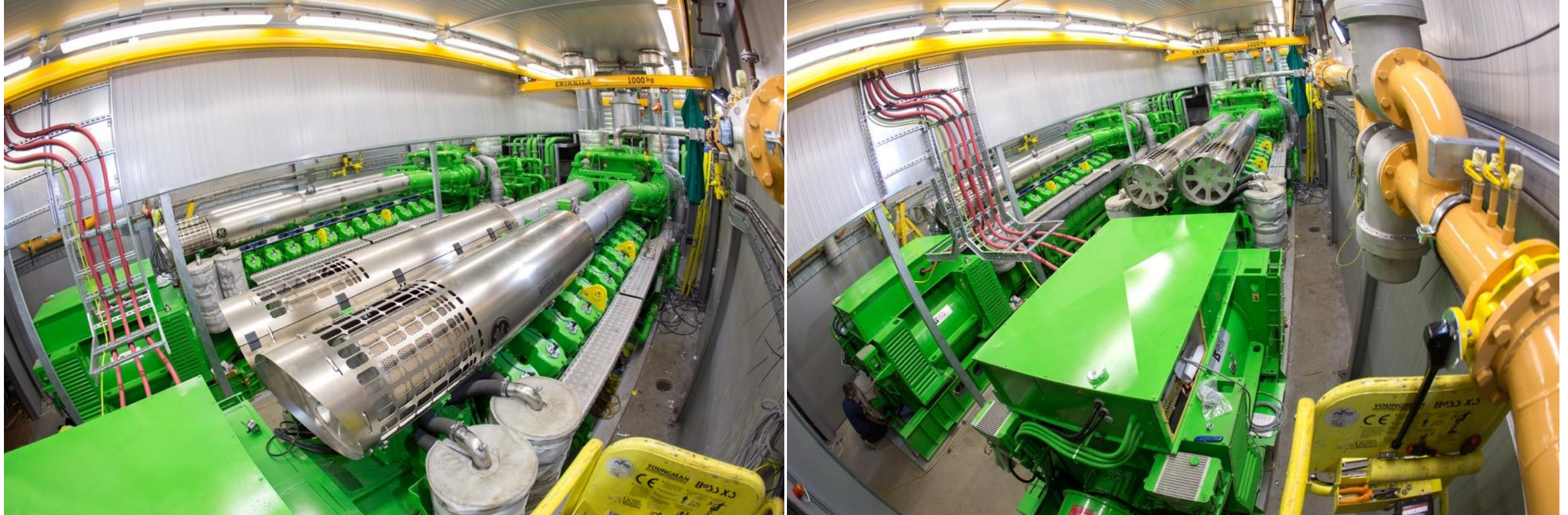




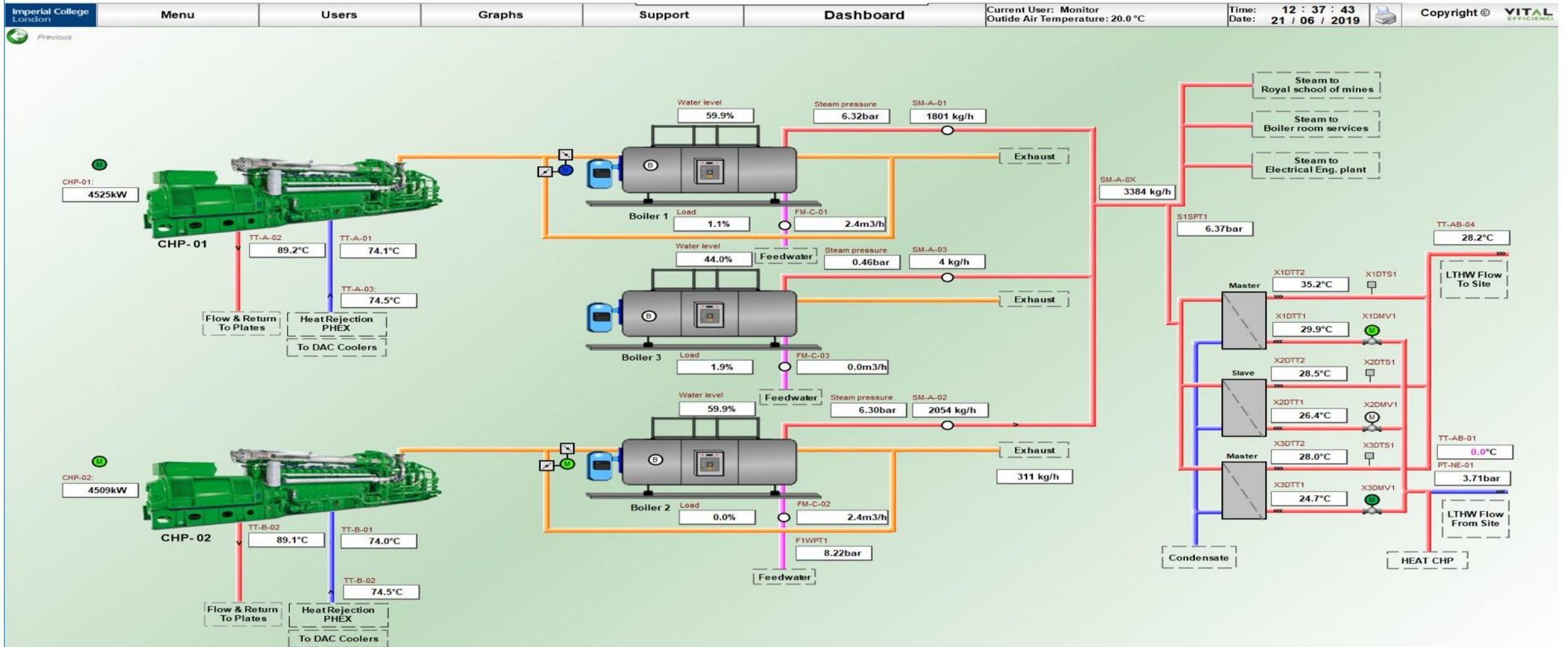


Power derived from Duke Street Substation in Mayfair  
4 Main Incomers capable of providing 20MVA at 11,000Volts  
Private 11,000 and 6,600 volts network made up of 18 Sub Stations interlinked via 2no 10MVA transformers





In 2017/18 the SK Campus power demand was 85.5GWh of which 63.6GWh or 77% was generated by the CHP Engines





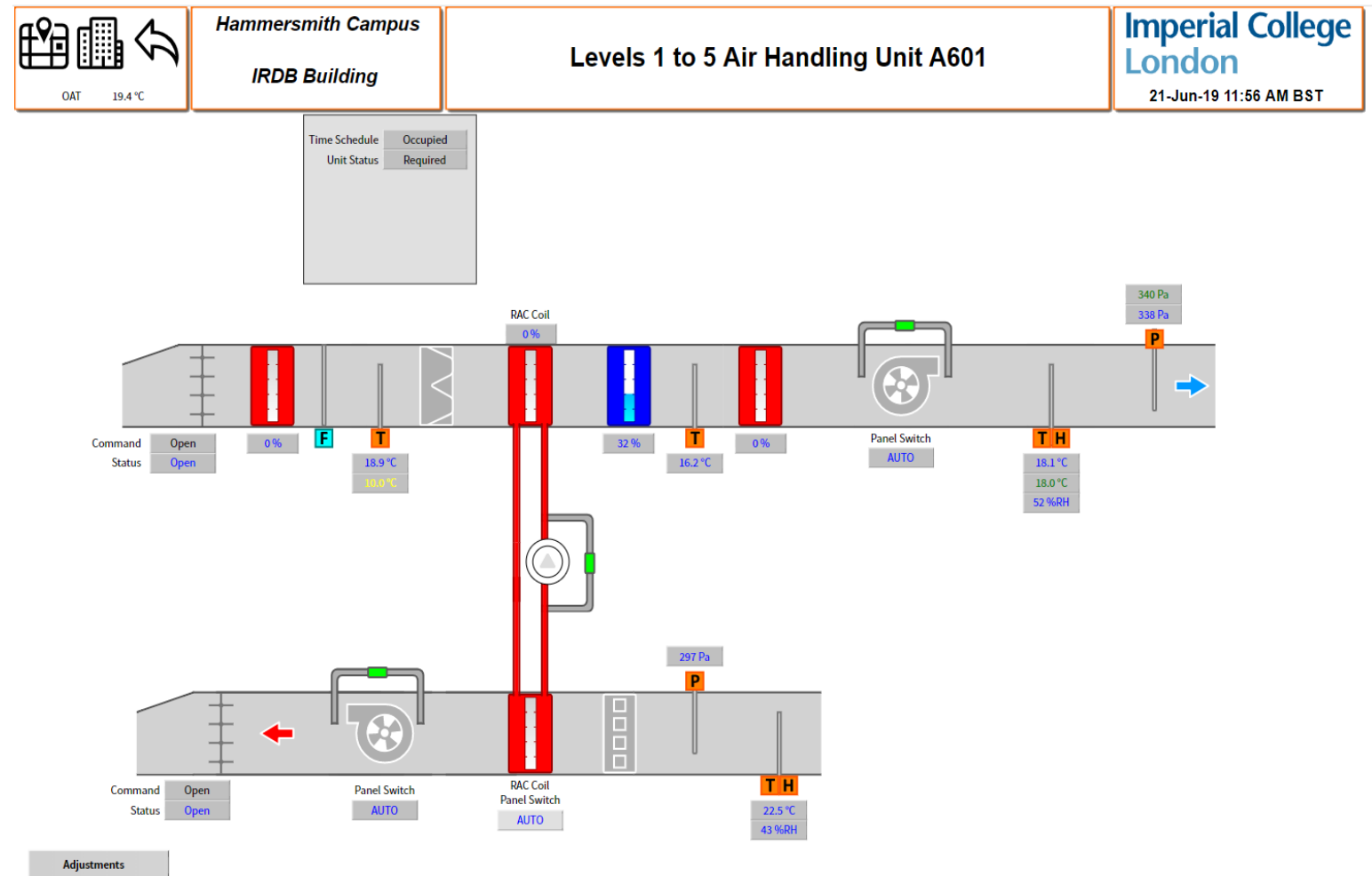
### Energy Efficient Systems

- Controlled Supply and Extract Systems
- Controlled LED Lighting Systems
- Ultimately energy intensive

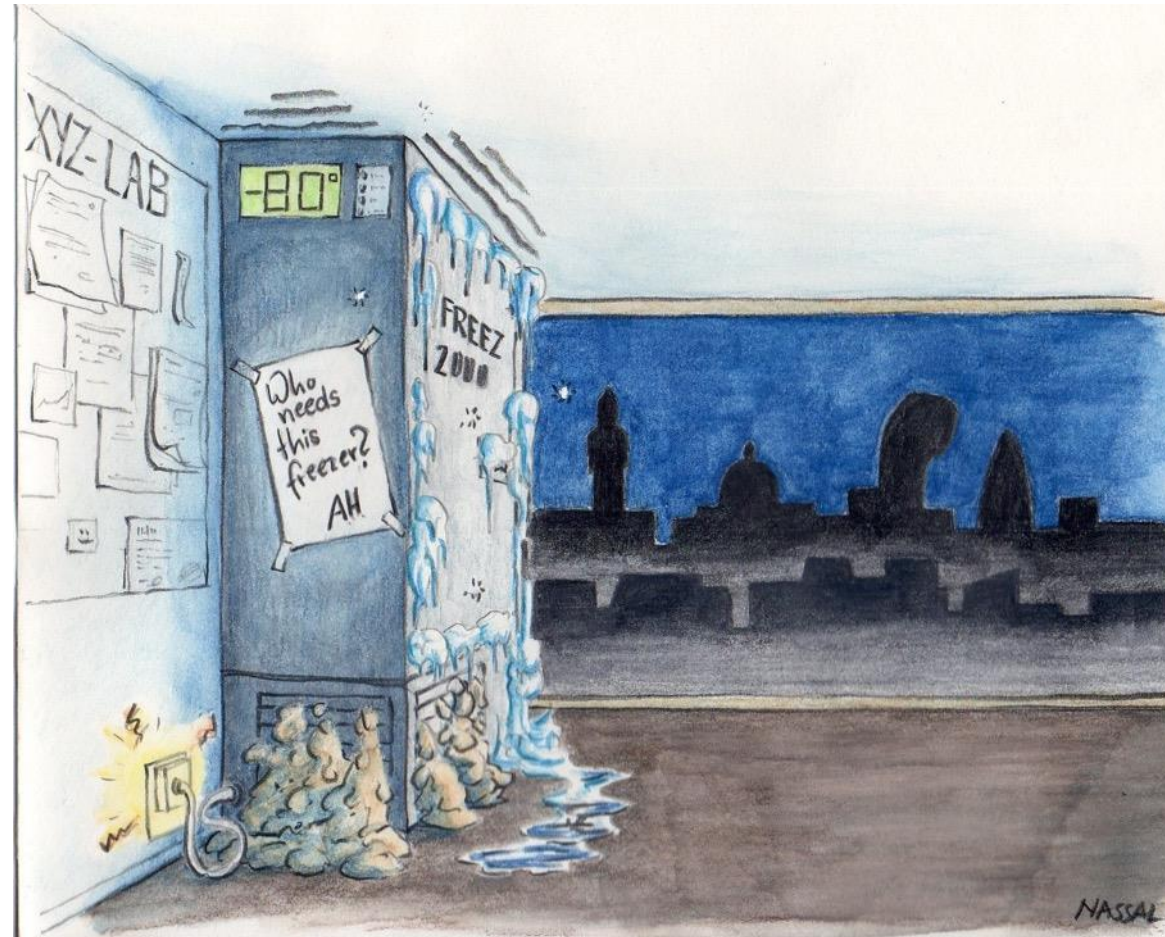




- TREND BEMS – connected via College LAN Network
- 90,000 BEMS Points
- 7,000 Outstations
- 13,500 Graphic Pages
- 230 Active User Accounts
- 510 Air Handling Units



## Allison Hunter: Freezers, autoclaves and beyond



## 1) Freezers: Savings on cold storage costs and CO<sub>2</sub> (King's College)

NHH	£	Tonnes CO <sub>2</sub>
Total previous cold storage spend	80257	
Savawatt controls savings	<u>-15783</u>	67.86
subtotal	64471	
-80°C to -70°C savings on 7 units	<u>1430</u>	
Current cold spend	63044	
£80257 minus £63044 =	<b>17,213</b>	
FWB		
-80°C to -70°C savings on 12 units =	<b>2453</b>	18.78
<b>Total savings in NHH &amp; FWB</b>	<b>£19,666</b>	<b>86.64</b>

## Working out how much CO2 you are saving (2014 Defra factors)

- 80°C		- 70°C	
6424		4380	kWh
x0.48357		x0.48357	defra factor
3106.45 kgCO2		2118.04 kgCO2	sub total
x 44		x19	number of freezers
136683.95 kgCO2		40242.70 kgCO2	<b>Total</b>
<b>Comparison of 19 freezers</b>	<b>at - 80°C &amp; -70°C</b>		
59022.55 kgCO2	minus	40242.70 kgCO2	18779.85 kgCO2
59.02 tonnes CO2	minus	40.24 tonnes	<b>18.78 tonnes</b>

## **HEFCE Catalyst Small Project Grant awarded 2014**

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- to obtain funds to hire one person as sustainability co-ordinator
- roll the programme out across other College campuses
- to co-ordinate and liaise with the Savawatt installation on freezers
- Induction; exit checklists; defrosting and decanting protocols to standardise across the university

## Lab Management: regular defrosting and decant protocols



## -80°C freezer costs in Dept of Life Sciences at Imperial

Freezer type	kWh/day	Number of days	Cost of electricity	Cost per annum	Number of freezers	Cost per annum (£)
-80°C	17.6	x 365	x 0.1	642.40	x 57	<b>36,616,80</b>
-80°C	12	x 365	x 0.1	438.00	x 57	24,966
-80°C	8	x 365	x 0.1	292.00	x 57	16,644

## Lab refrigeration standards in the EU

- No information about energy efficiency, total life-cycle costs, and potential savings
- Onus on the end user to have to ask manufacturers for information and to compare models
- No test for colder temperatures: all based on food methodologies +5°C to -15°C
- No harmonised standard test for all products
  - EU (Germany/ Switzerland) pharmaceutical and labs would welcome mandatory standards on energy consumption and quality



## 2) Autoclaves



3 autoclaves basement SAF

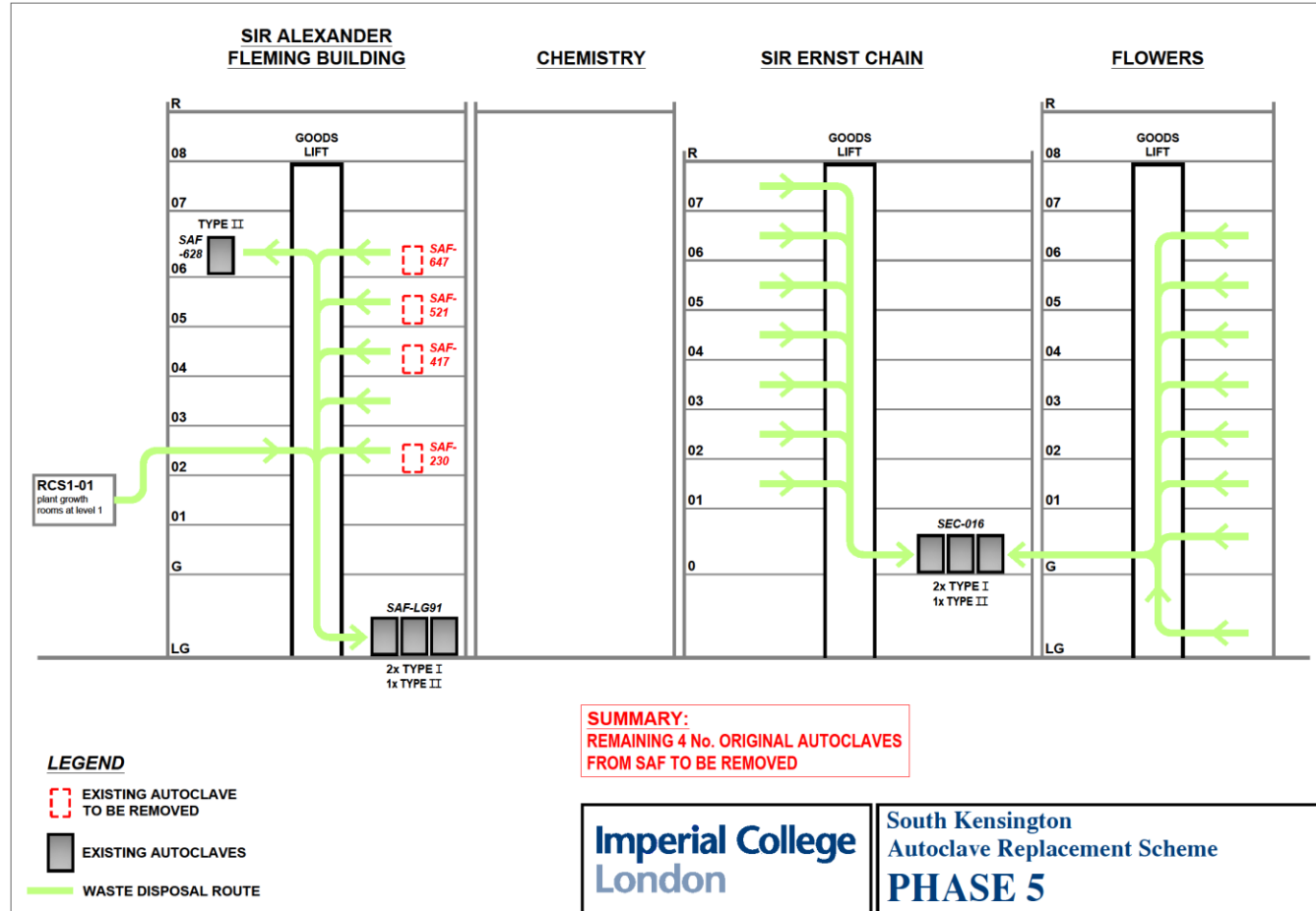
1 autoclave SAF 628 CL3

3 autoclaves basement SEC

All self steam generators

Used for sterilising dry goods, liquid growth media,  
buffers and biohazardous waste

# Reducing autoclaves from 10 to 7 while maintaining same throughput



### 3) And beyond..... Lighting for Plant Growth Rooms



Dept of Life Sciences

CE rooms 72

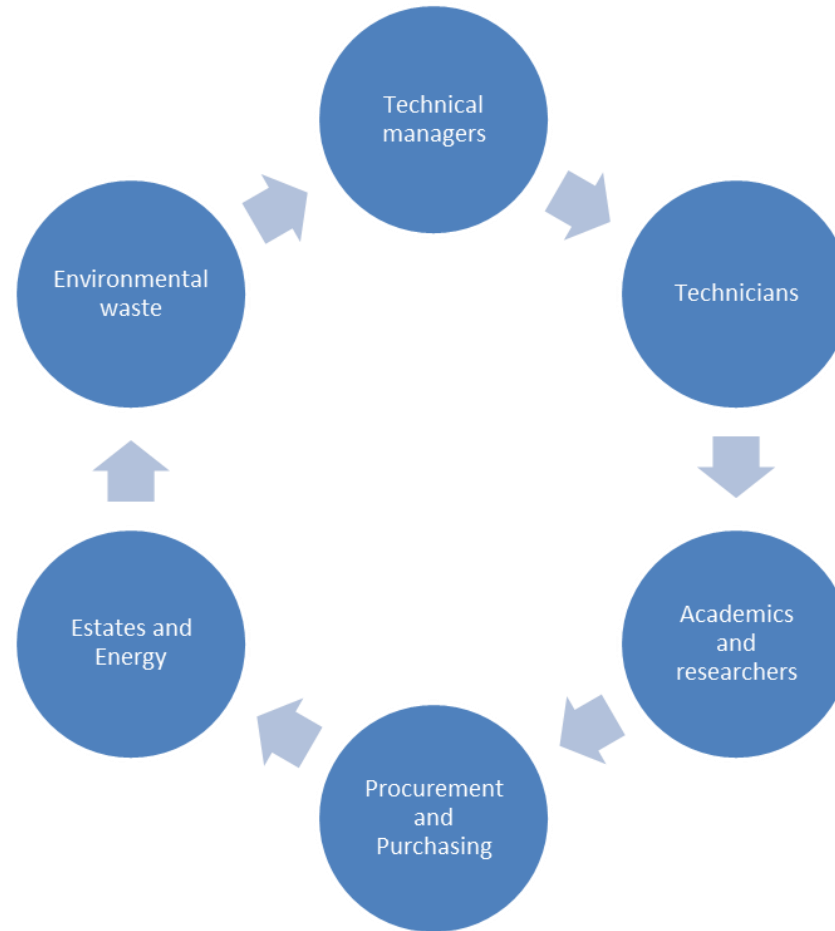
Plant growth rooms 20

Fluorescent tube £8000

(costs per annum)

Costing to change to LEDs

# Collaboration



**Questions?**

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# **ACT: A New Laboratory Product Environmental Certification Programme**

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Allison Paradise

Raj Patel

CooLED

# The Freezer Challenge

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Allison Paradise

# **Certification of Laboratory Sustainability: US and Irish Experience**

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Allison Paradise

Introduction

Dr. Una FitzGerald

'Galway Green Labs'



## **Discussion on UK-related issues**

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