

**Imperial College  
London**

**Carbon Management and Sustainability  
Activities Report 2018-19**





## Foreword

Welcome to our Carbon Management and Sustainability Activities Report 2018-19. This is our eighth report and covers the period 1<sup>st</sup> August 2018 to 31<sup>st</sup> July 2019. Within this edition, we highlight our performance over the year, detail interventions and initiatives undertaken, remaining open and honest about areas we believe there is room for improvement.

This year, we shine the light on seven areas of our work, exemplifying the diversity of activities taking place throughout Imperial College, all of which have a role to play in reducing the College's impact on the environment.

In a year when young people began to stand up and strike, demanding immediate and meaningful action to tackle climate change from global leaders, the importance of action by each and every one of us has perhaps never been more apparent. There have been some big changes at Imperial College this year, many of which we hope will have an enduring impact on sustainability at Imperial going forward. The appointment of an Academic Leader for Sustainability is an exciting step.

Founded in 1907, Imperial College has established itself as a global top ten University with a world class reputation in science, engineering, business and medicine. Imperial College has an opportunity to be a leader in reducing emissions from its activities, laying the path of transition to a truly sustainable world, inspiring others to follow our actions and not just our words.

*Andy Hammond – Head of Engineering, Energy & Environment*

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## Carbon and Energy Management

### South Kensington Combined Heat & Power (CHP) Performance

The College has a history of investing in large scale Combined Heat & Power (CHP) systems, the first of which was commissioned in 1999, under the Electrical and Electronic Engineering building, at the South Kensington Campus. The original system reached its end of life in 2015, with significant work undertaken to replace it with a new gas-powered CHP system in line with the South Kensington Campus Energy Strategy. The new CHP system at South Kensington was commissioned in 2017. Consisting of two 4.5MWe (Megawatts of electrical output) natural gas engines, they generate electricity and heat for use by buildings on the South Kensington campus.

During the 2018-19 year, the system generated about 80% of the electricity consumed by the campus, figure 1 shows the electricity mix for the South Kensington campus. The heat byproduct of generating electricity in our CHP is also utilised onsite, providing heating and hot water to our buildings.

When compared with a traditional arrangement of providing heating and hot water to buildings, in which large boilers would be present in each building, our CHP

system provides greater efficiency, as two processes, electricity generation and raising heat, are achieved at once. The financial benefit of the CHP system in the year was £6.6m in saved utility costs. CHP is a low carbon technology and is estimated to have saved more than 4,000 tonnes of carbon in the 2018-19 year.

South Kensington Electricity Mix 2018-19

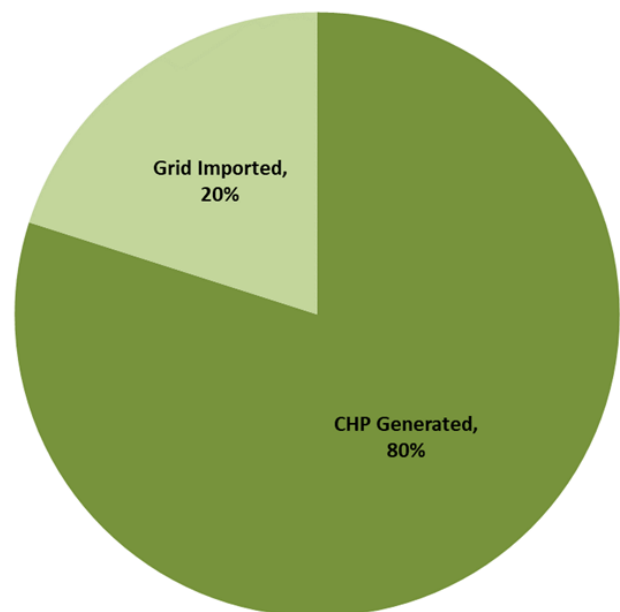


Figure 1. South Kensington annual electricity mix 2018-19

The South Kensington campus has two heat networks, one for heated water and one for steam. One of the conclusions of the 2017 Site Energy Strategy was to remove the legacy steam network and migrating heat load to the water district heat network, there are several short and long term benefits in doing this, mainly reductions in: emissions, operational and utility costs as well as streamlining legislative and regulatory matters. Figure 2 breaks down the headline 80% self-generated electricity total and shows how seasonality impacts on-site generation throughout the year. CHP engines need a demand for heat energy (hot water or space heating) to be run efficiently. In figure 2, you can identify heating and non-heating periods, we typically generate less electricity in June – September as a result of there being less demand for heat. We're working to add more of the campus's heat load to the district heat network, removing old and inefficient plant in addition to better balancing demand on the CHP to improve utilisation.

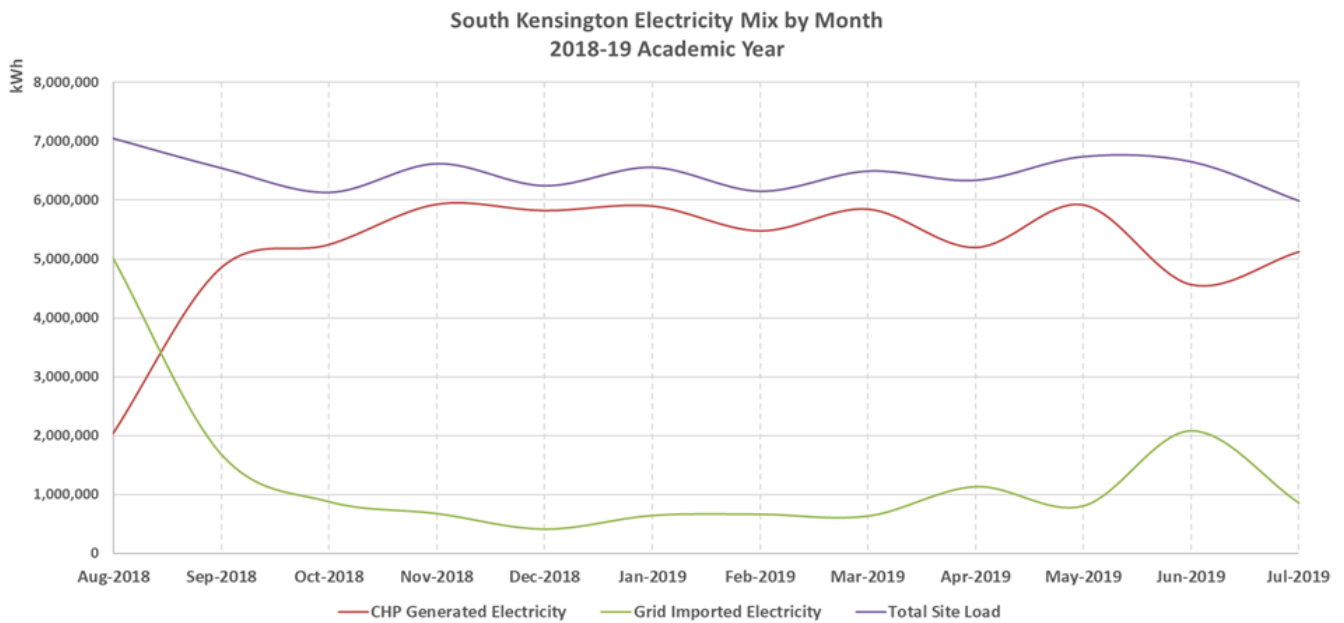


Figure 2. Monthly electricity mix for South Kensington campus

### Carbon Emissions Breakdown

For the 2018-19 reporting year, our total energy consumption from gas and electricity was approximately 277GWh, at a cost of around £11m. Imperial College London purchases 100% of its grid imported electricity through a Renewable Energy Guarantee of Origin (REGO) backed tariff from its supplier, we do this to show our commitment to sourcing electricity from renewable sources, which in turn helps drive demand for renewable energy across the energy sector, helping to increase the renewable mix through additionality.

Carbon emissions resulting from our consumption are presented in figure 3, which shows the breakdown of scope 1, 2, and 3 emissions for the year. Scope 1 is further split between the CHP and other scope 1 sources E.G. laboratory gas and boilers. Gas and electricity consumption at Imperial College London accounted for about 98% of reported emissions in the 2018-19 year. The largest proportion, around 64% of total emissions, is a result of the South Kensington Energy Centre, which houses our two 4.5MWe CHP engines.

It's important to note we believe scope 3 emissions to be larger than presented, however accurate data and methodology is not yet in place for many scope 3 activities across the College; this is an area of our reporting we're working towards improving in future.

- Scope 1 (CHP) – 64%
- Scope 1 (Non-CHP) – 9%
- Scope 2 – 25%
- Scope 3 – 2%

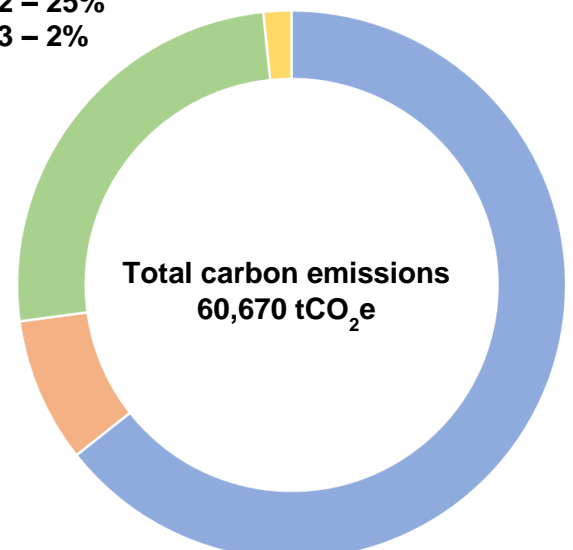


Figure 3. Carbon emissions by scope – 2018-19



## Scopes 1, 2 and 3 Explained

### Scope 1 – Direct Emissions

Emissions under direct control of a company, this includes: combustion of fuel, company vehicles and fugitive emissions.

### Scope 2 – Indirect Emissions

Emissions arising from the generation and transmission of purchased electricity, steam, heating or cooling.

### Scope 3 – All Other Indirect Emissions

All other emissions attributable to: goods and services, water, supply chain, waste disposal, assets, employee commuting and business travel.

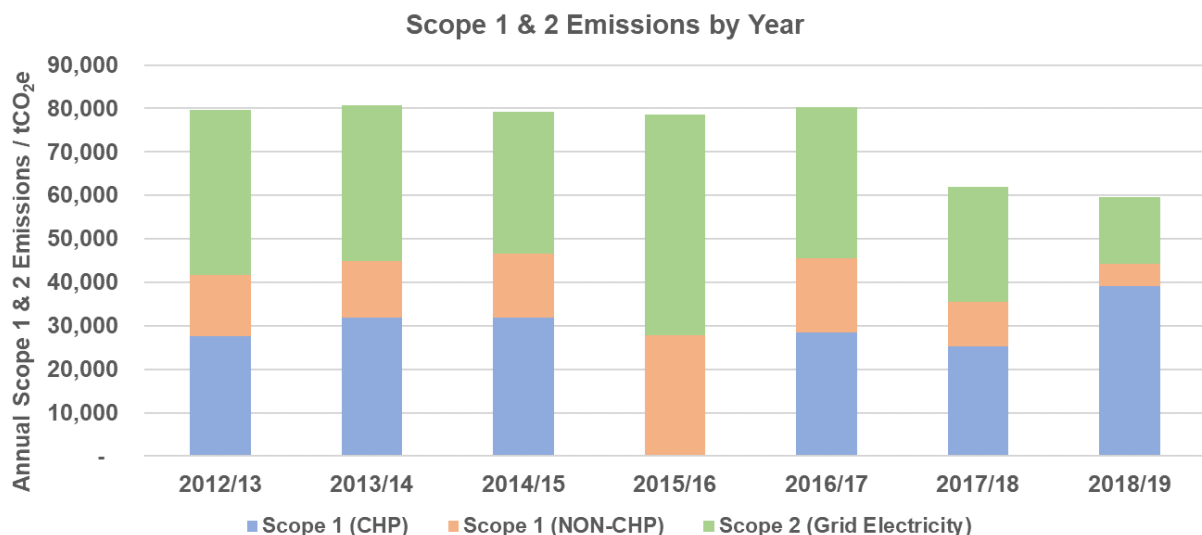
## Emissions and KPIs Through the Years

Understanding where we have come from is just as important as where we are today on our sustainability journey. This section shows scope 1 and 2 emissions from 2012-13 to present, allowing inter-year comparison, showing the overall trend and provides an update on Key Performance Indicators (KPI) used in previous years. Unless stated otherwise, each KPI and graph in this section uses the total emissions from our scope 1 and 2 activities shown as tCO<sub>2e</sub> by each intensity metric.

### Annual Emissions (tCO<sub>2e</sub> per annum)

As shown in figure 3, which breaks down our 2018-19 reported emissions by scope, scope 1 and 2 emissions comprise around 98% of reported emissions. Figure 4 puts the 2018-19 total in context, showing the lowest level of emissions directly relating to our energy usage, something to be

celebrated against the backdrop of an ever-expanding estate (13% increase in Gross Internal Area (GIA)) and growing staff and student FTE (18% increase) when compared with 2012-13. We've seen a combined reduction of some 25% in scope 1 and 2 emissions in the period.



**Figure 4. Annual scope 1 and 2 emissions from 2012-13 to 2018-19**

### Emissions by GIA (tCO<sub>2</sub>e/m<sup>2</sup>)

We are able to report on another year of decrease in this emissions intensity measuring KPI, presented in figure 5. There has been an 8% reduction compared to 2017-18. This KPI is helped by the almost 5% increase in GIA this year, although total energy consumption

marginally increased by 3.5% this was offset by the increased utilisation of our South Kensington CHP system, providing emissions savings over grid electricity and individual gas boilers. We are working hard to continue this trend next year.

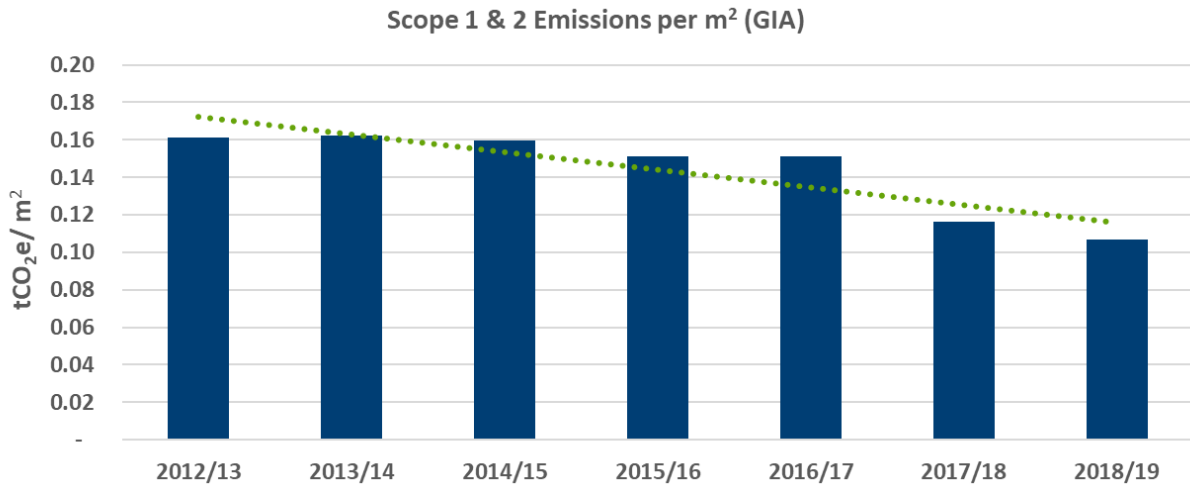


Figure 5. Annual scope 1 and 2 emissions per m<sup>2</sup> of GIA from 2012-13 to 2018-19

### Emissions by FTE (tCO<sub>2</sub>e/FTE)

This KPI, presented in figure 6, shows a similar trend to our emission by GIA above, a downward trend year-on-year. The detail behind this decrease is also much the same, we've seen a roughly 4% increase in staff and student FTE numbers and the

3.5% increase in consumption mentioned previously. The decrease in this metric is therefore a result of our increased utilisation of the South Kensington CHP, which has provided us with emissions savings.

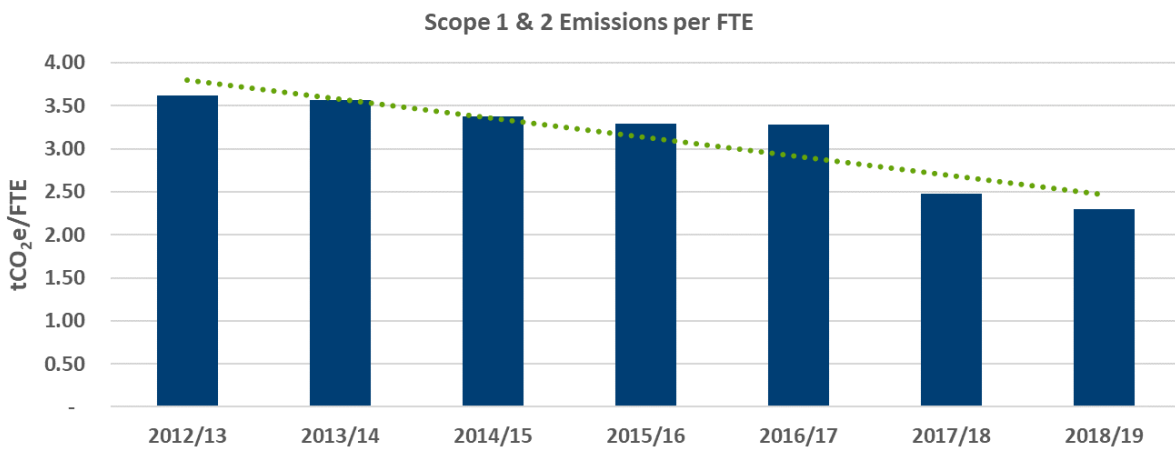


Figure 6. Annual scope 1 and 2 emissions per FTE from 2012-13 to 2018-19

## Purchased Gas and Electricity by FTE (kWh/FTE)

This analysis centres on kWh of gas and electricity purchased from the grid, this distinction of purchased energy is made to avoid double counting, as gas is consumed by our CHP to generate much of our electricity and heat energy.

Figure 7 shows gas and electricity separately as columns and combines both as a line graph to represent the total figure, a dotted, linear trend line is also present to

show the overall trend. When looking at figure 7 in conjunction with figures 5 and 6, the impact of our CHP and district heat network can be seen, 2015-16 being an example of this, gas consumption dropped significantly, with electricity consumption increasing to compensate as our CHP system was less utilised, our CHP typically has a lower carbon intensity when fully utilised and run effectively.

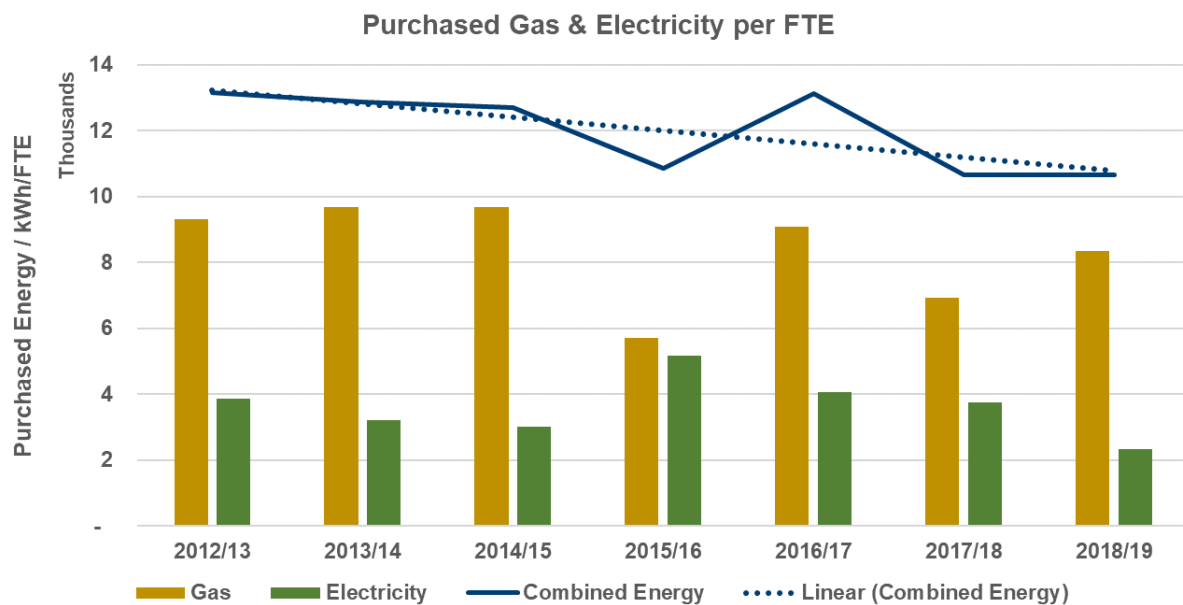


Figure 7. Purchased gas and electricity (kWh) by FTE from 2012-13 to 2018-19

## Future Plans

- ⇒ **Further quantify scope 3 emissions** – We will seek to develop and implement appropriate metrics to better: quantify, monitor and report upon our scope 3 emissions
- ⇒ **Improve utilisation of the CHP** – By expanding our district heat network at South Kensington, we can improve the efficiency of our CHP through increased utilisation of the heat energy generated



## Water Management

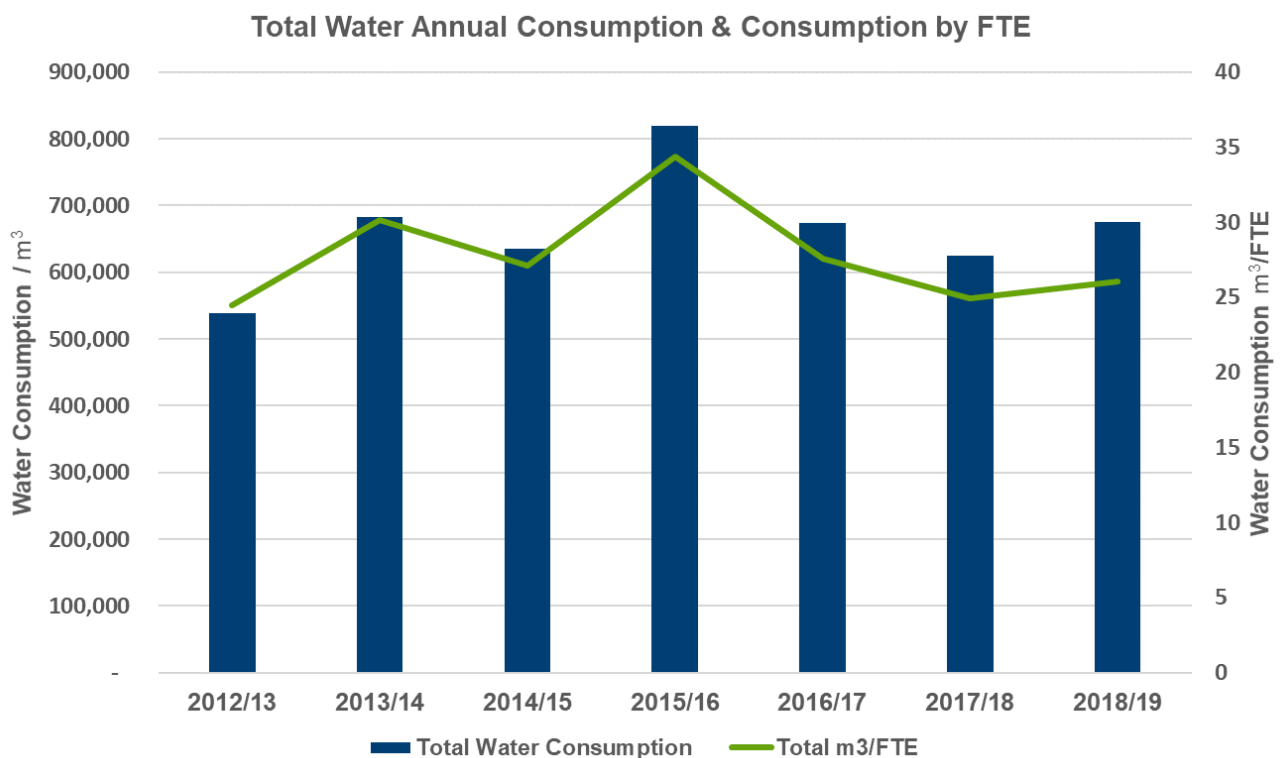
In previous years, we have made limited progress toward conservation and efficient management of water resources. During 2018-19, we worked on reviewing our practice and identifying areas for improvement and will be looking to undertake an array of actions over the coming years.

### Water Consumption

Figure 8 shows an increase in absolute water consumption between 2012-13 and 2018-19, from about 538,000m<sup>3</sup> to almost 676,000m<sup>3</sup> respectively, an increase of 25%. Whilst ultimately working toward reducing absolute consumption, it is important to understand the detail behind this increase.

During the same period, Imperial has undergone a process of significant growth,

in its estate size (13% increase) and staff and student population (18% increase). Therefore, to effectively compare consumption and allow meaningful comparisons between years, figure 5 also shows consumption by staff and students, presented as m<sup>3</sup>/FTE. Using this metric, a more modest increase of approximately 6% is observed over the seven-year period.



**Figure 8. Total annual water consumption (primary axis) and consumption by FTE (secondary axis)**

## ADSM Partnership

Imperial College has engaged ADSM, a leading company in water management, to help us identify, plan and implement changes where there are opportunities to reduce wastage and improve efficiency. 2018-19 marks the first of a five-year partnership between ADSM and Imperial College as part of the AquaFund framework, a Government funded scheme to drive reduction in water consumption. The agreement was signed in April 2018.

During the first full year, ADSM have visited most buildings across Imperial's portfolio, undertaking a fundamental review of water services within buildings, from supply to distribution and discharge. These reviews are key in highlighting areas end-users can reduce their consumption, but mostly focus upon engineering steps that can be taken

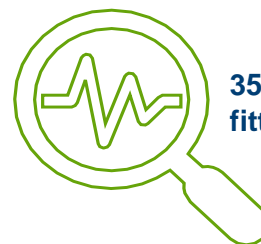
and the essential process of data collection.

As part of their works, ADSM have been busy installing Automated Meter Reading (AMR) devices on Imperial's large water supplies, AMR allows us to see consumption at a more detailed and granular level, to identify trends and patterns in usage.

Typically, water companies only take meter reading per month for large supplies, and as few as one every six months for smaller ones. This means analysing consumption profiles and identifying wastage is very difficult. With AMR fitted, readings can be taken every 30 minutes, giving us around 1,440 readings in a typical month. This provides access to much needed data with which to work.



Over 100 on-site investigations



35 AMR meters fitted

## Future Plans

- ⇒ **Work with ADSM** – Continue reviewing our buildings and infrastructure, making improvements where identified
- ⇒ **Target laboratories through LEAF** – Work with lab managers, technicians and users to trial more efficient water practices and equipment e.g. waterless condensers
- ⇒ **Water reduction strategy** – Assess options for creating and implementing a water reduction strategy across Imperial's campuses

## Sustainability and Research

Imperial College London's mission, as stated in the 2015-20 strategy, is to achieve enduring excellence in research and education in science, engineering, medicine and business for the benefit of society.

Since Imperial launched this strategy, we have made significant progress, producing ground-breaking research, with world-changing collaborations and critical policy interventions.

Undertaking high quality research in these fields often requires very specialised equipment and highly serviced laboratory environments and spaces. Creating and maintaining suitable spaces to meet the needs of our academics and students is at the forefront of our efforts within Estates, doing so sustainably is a challenge we're meeting head-on.



**103 groups participated across 17 institutions**

**35 ICL Labs will be using LEAF in 2019-20**



**620 tonnes CO<sub>2</sub>e saved across 17 institutions**

### Laboratory Efficiency Assessment Framework (LEAF)

LEAF is a tool being developed by University College London (UCL), the framework is intended to help lab users become more aware of sustainability and efficiency in their specialised environments. LEAF contains criteria specific to lab spaces around areas such as: energy efficiency, waste & recycling, equipment management and procurement. LEAF was piloted in 2018-19 across 17 Universities and research institutes. Imperial College was one institution involved in the pilot year, providing feedback to help develop the scheme.

### Future Plans

- ⇒ **Turn over a new LEAF** – Expand our usage of LEAF
- ⇒ **Improve LEAF** – Feedback to UCL and help further develop the framework

We piloted the LEAF scheme in a handful of our labs, overall we felt the pilot was successful and feedback from lab users was positive, as a result we're intending to roll-out LEAF with 35 Imperial labs signed up to participate in the 2019-20 year. We look forward to reporting on their achievements in our next report.

## Waste and Recycling

Our Waste and Recycling KPI allows inter-year comparisons, providing a performance benchmark. Our goal is to continue to move up the waste hierarchy, with as much waste diverted from landfill as possible. Generally, the higher up the waste hierarchy we are, the greater the environmental benefits and fewer emissions.

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*“The College continues its commitment to recycle as much waste as possible, recognising our obligation to limit our environmental impact and demonstrate social responsibility.”*

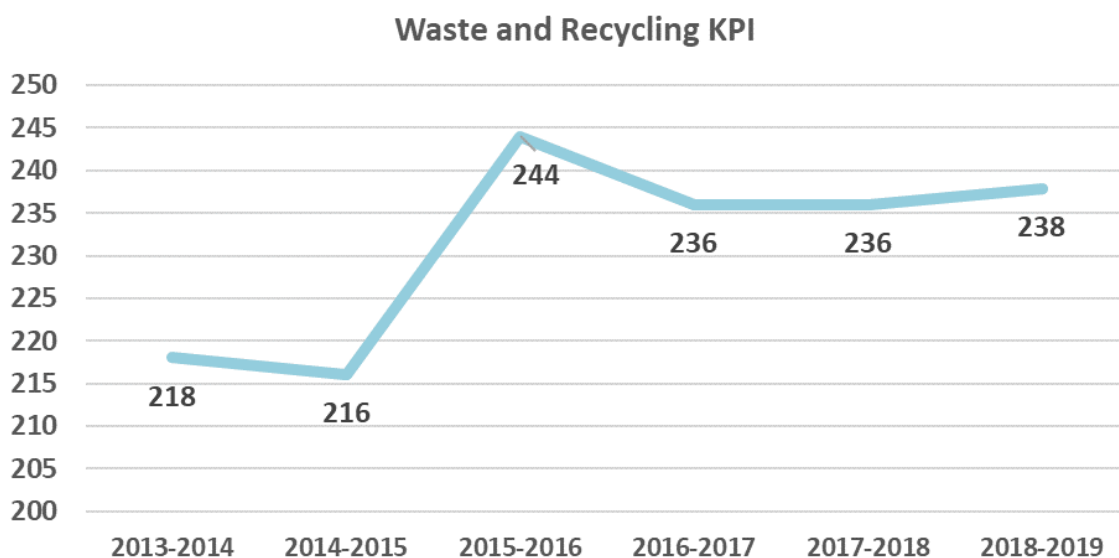
**Nic Dent – Head of Soft Services**

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### Waste KPI

Within Estates Operations, there are several waste categories we monitor, as such, it is not always obvious how successful we are at reducing our impact. To quantify our impact, we created a metric which standardises the impact of each waste stream, providing us with a number for comparison. To achieve this, we apply a weighting to each of the categories (higher weighting for the preferred options) and use this to calculate an overall metric.

This allows us to assess performance and demonstrates if we are moving waste up the hierarchy. Figure 9 shows our year-on-year position since 2013-14, this year we achieved a small increase over the previous two years but are marginally down on our highest recorded position in 2015-16. We’re continually reviewing our waste streams and looking for innovative disposal routes that may become available.



**Figure 9. Waste and Recycling KPI – performance metric for waste management (higher is better)**



## Student Reuse Scheme

At the end of each year, students are encouraged to donate all unwanted goods: clothing, shoes, bags, books and small electrical items. A reuse scheme was set up two weeks before the end of term in June. Through this scheme, we managed to capture over 5 tonnes of material that would otherwise have been disposed of as general waste, ending up in landfill. That's up from around 4 tonnes diverted in 2017-18.

As well as unwanted goods, we collected food donations from halls of residence, this year food was donated to the Felix Project in North Acton to be distributed to those in need. We estimated around a tonne of food was donated (approximately £8,000 worth) which made a significant contribution to the

Felix Project as well as avoiding unnecessary waste.

For the first time this year we engaged with a company called Better Reuse, who collected unwanted bedding including duvets, which has previously been a problematic waste stream. Better Reuse collected 2.8 tonnes of bedding, material which was redistributed between homeless charities across the London area.

All the items and food collected was put to good use by the British Heart Foundation, homeless charities and the Felix Project. This reuse scheme is a valuable operation to raise awareness of the benefits of reuse and recycling.

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## WARPit

Imperial College uses the WARPit scheme, a redistribution network similar to Freecycle, which allows individuals and Departments alike, to give away or loan items they no longer require, but which others may have a use for.

An example of this would be a Department undergoing a refurbishment, which includes new furniture, the furniture to be replaced is often perfectly serviceable and can be offered on WARPit to users who have a need for such items.

WARPit is useful for many unrequired or underused items, it's particularly suitable for furniture and office consumables. WARPit brings the unused into use, saves money, frees up space, diverts resources from landfill, reduces carbon emissions and saves on the costs of removal and disposal. The network continues to be a useful tool, this year the scheme had 205 transactions saving 28.77 tonnes of CO<sub>2</sub>e and reusing 4.72 tonnes of what would otherwise have become waste. This is a 6% increase in transactions on last year.

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## Waste and Recycling in Numbers

When something is no longer required, there are generally different routes available for disposal, such as reuse, recycling, recovery, landfill or specialised methods. Routes vary depending what is being disposed of, with different routes having variable impact on the environment, from possible leachate production in landfills, to the CO<sub>2</sub>e impact of each route. Landfill is seen as a last resort for our waste, this is because items which are landfilled often have greater emissions associated with them. Figure 10 shows the scale of impact our work to move waste up

the hierarchy has and is the reason we continue to identify ways of diverting waste from landfill where able. The bar chart section shows the impact of our diversion, with the black and white textured bars showing emissions if sent to landfill, and the various coloured bars showing the actual emissions as a result of our work.

The pie chart within figure 10 shows the full impact of emissions from our waste related activities, a total of 4,150 tonnes of CO<sub>2</sub>e was emitted in the year, over half of which was a result of general landfill waste, something we're working hard to reduce.

# Carbon Emissions from Waste

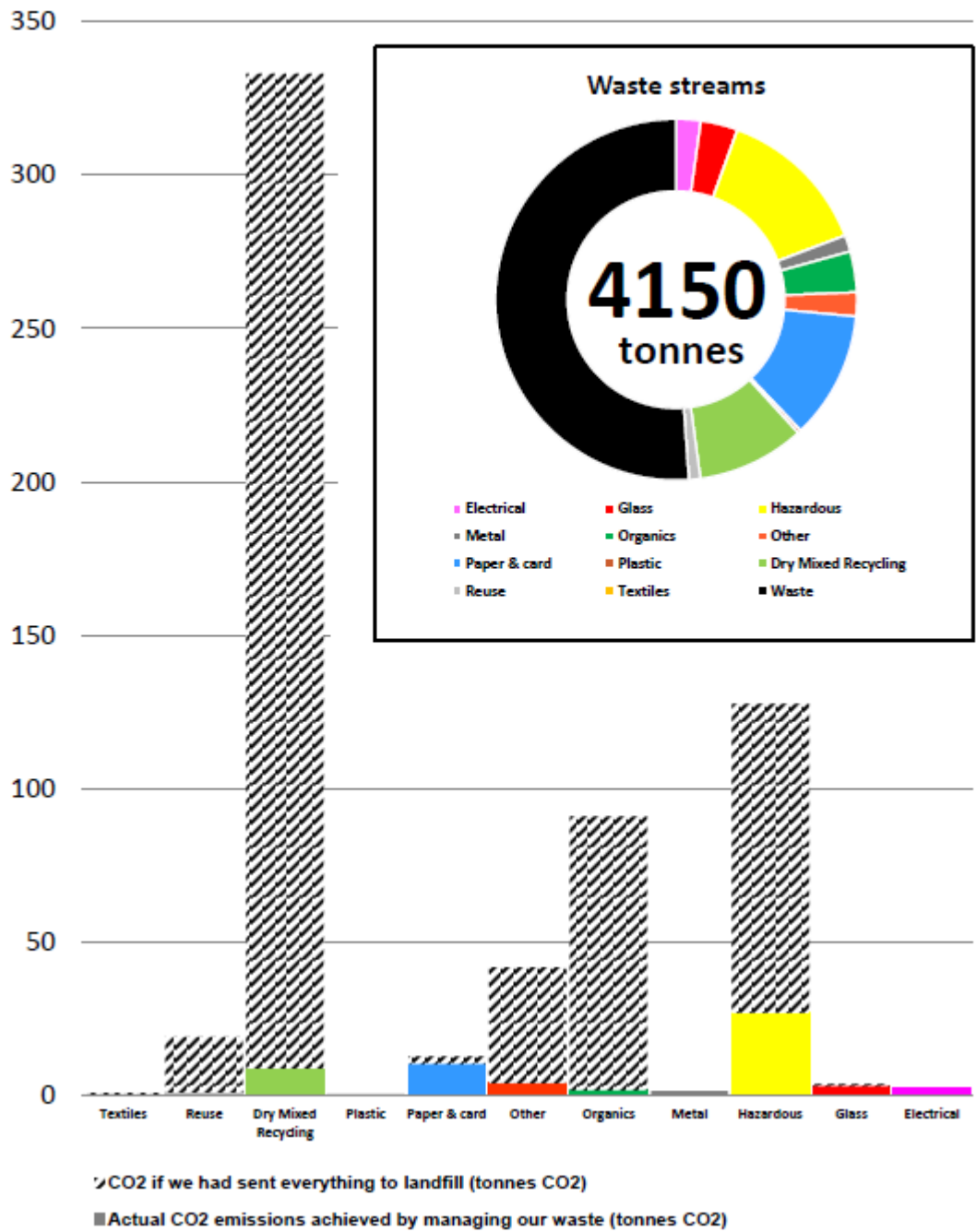


Figure 10. Waste emission comparison – achieved disposal route compared with landfill only



**WARPit – 205 transactions**

**Student donations – 5 tonnes of items donated to charity**



**2.8 tonnes of bedding donated to homeless charities**

## Future Plans

- ⇒ **Continue work to move waste up the hierarchy**
- ⇒ **Divert waste from landfill** – Investigate further options for recovery and diversion to reduce the amount of waste sent to landfill



## Maintenance

Imperial College operates hundreds of buildings, from those which have been purpose built and newly constructed such as the White City campus, to older, listed properties with historic and architectural significance, as many of those on our South Kensington campus are. The Maintenance section of Estates Operations are tasked with the day-to-day upkeep of Imperial College's buildings, handling reactive and preventative maintenance whilst also delivering the long-term maintenance plan.

With an average of 70,000 planned and reactive maintenance tasks undertaken each year, it is a section with massive opportunity to help deliver Imperial's sustainability goals.

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### An Air of Change – Ventilation Refresh in Blackett

Originally built in the 1960s the Blackett building houses a mixture of lecture theatres, classrooms, office space and laboratories.

The ventilation system replaced as part of these works was original to the building, consisting of large centrifugal fans, propelled by externally mounted, belt driven motors. This arrangement is inefficient and requires frequent maintenance to check for belt wear and tension. The ageing system had reached the end of its life cycle containing many obsolete parts, experiencing several



reliability issues, leading to poor and inadequate control of environmental conditions within the building.

The system has been replaced with a more energy efficient fan and fitted with a variable speed drive (VSD) which can self-modulate, speed up and slow down, depending what volume of air is required at a given time. Known as a plug fan, greater volumes of air can be moved at lower fan speeds and with less electricity required, the system also allows for filtration and is fitted with heat recovery, further improving overall efficiency.

## Expanding the District Heat Network – (RCS1)

This project involved removal of the gas fired boilers which provide RCS1 with a means to raise heat, produce hot water, provide space heating and pre-warming of air within the ventilation system. This system has been replaced by a connection to the South Kensington district heat network, which now provides the heat energy for each of these building services. The network provides greater reliability and a more consistent temperature to research spaces.

This project is part of Imperial's wider strategy to maximise the efficiency of its district heat network. By connecting more buildings on the campus to the network, we can better utilise the heat byproduct of our CHP engines, improving the overall efficiency of the system.



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## Modernising Infrastructure – Lift Replacement



Maintenance has a rolling program of replacing ageing lift systems with modern, energy efficient ones. The new system can detect inactivity and switch certain parts into a form of 'sleep', which consumes less energy, whilst being able to turn back on instantaneously when required. Lighting in the lift car and shaft is

LED and motors operating the doors are inverter controlled. Efficient AC motors are controlled by variable frequency inverters. As well as improving performance behind the scenes, the new lifts operate with a controller algorithm, which will position idle lift cars at frequently used floors, reducing waiting times and providing a more optimised service for users, all of which results in an estimated 15% energy saving compared with the replaced lifts.



## Greening Imperial

Greening Imperial is a cross-campus and community initiative that aims to transform Imperial into a University that is a pioneer and exemplar in sustainability, ultimately becoming one of the most sustainable and respected Universities globally. The motivation for this initiative comes from a realisation that historically the College has lagged behind its peers and that significant demand exists amongst students and staff for the College to improve its ethical and environmental policies, practices and performance.

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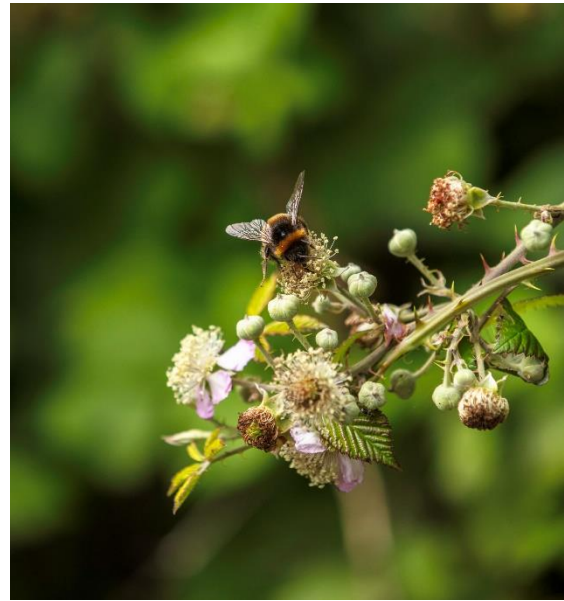
*“Sustainability should run through the whole of College thinking and activity at all levels and across all campuses.”*

**Professor Paul Lickiss – Academic Leader for Sustainability**

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### Sustainability Steering Group

The Greening Imperial steering group consists of academics, staff, students and the Student Union, who are trying to move sustainability and action on climate change forward at Imperial. In the 2018-19 academic year, a significant amount of activity took place under the banner of Greening Imperial and is detailed in this section. The crowning achievement of Greening Imperial during the academic year was securing agreement for the appointment of an Academic Leader for Sustainability – a position that we were delighted to see taken-up by Professor Lickiss in November 2019. Greening Imperial looks forward to working closely with Professor Lickiss.



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### Imperial on Aviation and Scope 3

Greening Imperial has supported PhD students to investigate the University's aviation emissions, an area which it is acknowledged improvement on reporting is required to better quantify our scope 3 emissions. The report, published in September 2019, recommends

improvements in data collection for flight data at Imperial a recommendation which the College is hoping to implement over the coming year. The report is well worth a read, you can find it on the Greening Imperial website<sup>1</sup>.

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### Working with our Neighbours

Greening Imperial has worked with the Exhibition Road Cultural Group and the Royal Albert Hall, founding the South Kensington Sustainability Champions group in July 2019.

The purpose of the group is to share experience and encourage best practice with our neighbours in and around the South Kensington campus.

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### Future Plans

- ⇒ **Connect academic communities** – We're bringing together our academics on the White City campus development, to help showcase our engineering expertise
- ⇒ **Reviewing aviation** – Build on work to date, assessing options for incentivising alternatives and offsetting where flying is unavoidable



## Catering

Operating 29 food and drink outlets across Imperial's campuses, the catering team have a significant part to play in sustainability at Imperial. From changes to how food is delivered for events, aimed at reducing waste, to removal of single-use plastics and increased plant-based menu choices, Campus Services have been working hard to improve sustainability at Imperial.

### Catering Initiatives

A 25p levy has been introduced for single-use cups in October 2018. On average, 2,750 single use cups were used each day, figures on the impact of this initiative are expected to be reported in next years' report. Staff and students are encouraged to utilise a reusable cup. All proceeds from the levy are being reinvested in sustainability initiatives across Imperial.

In conjunction with the levy, the catering service have launched a range of reusable bamboo cups and water bottles, these are available from outlets around Imperial and are sold at cost price, £5 for a bamboo cup and £4 for a plastic bottle.



### Plantworks

Launched in April 2019 and based in the Junior Common Room at the South Kensington campus, Plantworks is Imperial College's first entirely plant-based and vegan catering outlet. Plantworks features a contemporary menu of fresh plant-based food and drink products, so whether you're looking to make a more sustainable or healthier choice, Plantworks is a great option.

### Plastic

Plastic cutlery has been replaced with FSC certified wooden cutlery, which is reusable, recyclable and compostable.

Plastic trays have been replaced with wooden alternatives, with single-use stirrers and sugar sachets also being removed in preference of reusable spoons and sugar cubes, a pretty sweet change.

### Drink, Fill, Repeat

The Drink, Refill, Repeat campaign, a collaboration between Campus Services and Greening Imperial, encourages students and staff to transition away from disposable drinks bottles and toward reusable containers. To support this, we have introduced several water fountains across our campuses and removed cups from water stations, saving approximately 850,000 plastic cups per year.

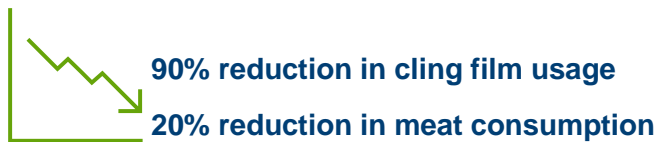
## Sustainable Palm Oil

Palm oil is used in a wide variety of foods but the palms that produce it only grow in the tropics, where their cultivation can have negative impacts on the environment and biodiversity. The College's primary food supplier, Brakes, is a member of the Roundtable on Sustainable Palm Oil

(RSPO) and, in 2019, achieved RSPO Supply Chain Certification for the purchase, storage and distribution of products. We are committed to working with Brakes in ensuring that product recipes and lines are using palm oils in a sustainable manner wherever possible.

## Future Plans

- ⇒ **Reduce meat** – Adjust College outlet menus to promote more non-meat options
- ⇒ **No single use** – Continue the disposable cup levy to encourage reusable choices



**Disposable cup levy – around 2,750 used per day**

# Imperial College London

**Estates Operations  
Imperial College London**

Web: [www.imperial.ac.uk/sustainability](http://www.imperial.ac.uk/sustainability)  
Email [sustainable@imperial.ac.uk](mailto:sustainable@imperial.ac.uk)