

**Imperial College
London**

**Carbon Management and Sustainability
Activities Report 2019-20**



Foreword

Welcome to our Carbon Management and Sustainability Activities Report 2019-20. This is our ninth report and covers the period 1st August 2019 to 31st July 2020. 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.

It was a challenging second half of the academic year as the COVID-19 pandemic began to take hold, profoundly impacting the way we in which we lived, studied and worked. Imperial College sought to protect its staff and students by reacting decisively, through consultation with its own subject experts and through Government guidance. A consequence of this action, was that some interventions and initiatives we anticipated taking place, were unable to come to fruition in this reporting period.

A big element of work this year has been on reviewing our reporting methodology and metrics, working to ensure they are appropriate, clear and align with best practice where possible. This helps us monitor our progress and effectively quantify what impact interventions we make, have in the future.

We turn the spotlight on areas of our work that reduce our overall carbon emissions and the environmental impacts of our activities. Within Estates, we're also working to decrease plant downtime, maintenance and overall operating costs.

The appointment of Professor Paul Lickiss as Academic Leader in Sustainability is changing the way the College thinks and acts on issues surrounding environmental sustainability. Initiatives such as the Sustainability Strategy consultation and the continued expansion of the Laboratory Efficiency Assessment Framework (LEAF) have been welcomed.

Founded in 1907, Imperial College London 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

During the academic year 2019-20 we continued to invest in projects to reduce energy use across the estate. South Kensington campus remains an investment priority as it accounts for over 70% of total annual energy consumption. South Kensington is home to two large gas fired Combined Heat and Power (CHP) engines that produce up to 9MWe (Megawatts of electrical output), which across 2019-20 produced around 78% of the electricity demand for the campus. The heat byproduct from these engines provides heating and hot water to buildings on the campus, courtesy of a large district heat network, connecting most buildings and providing greater efficiency of the system.

During the spring, summer and autumn seasons, some of the heat byproduct is not fully utilised and there are opportunities to replace many of the remaining gas boilers with connections to the district heat network. These additional connections provide opportunities for direct reduction of gas consumption, as we better utilise heat from our CHP engines, removing the need to burn gas in local boilers.

As an initial response to COVID-19 in March 2020, we disabled much of our air recirculation and placed several Air Handling Units (AHU) in to 24/7 operation. Reduced recirculation means we use more outside air than usual and therefore must provide more heating and cooling to maintain internal conditions. Whilst 24/7 operation of some AHU leads to increased electricity consumption. These necessary interventions have had an impact on our energy consumption and therefore Scope 1 and 2 emissions.

Carbon Emissions Breakdown

In our 2018-19 report, we highlighted Scope 3 emission reporting as an area we wanted to make strides in improving, and this year, we've done just that. We've implemented improvements in how we record and categorise expenditure, this includes business related travel by land, air and sea. As a result, we're delighted to be able to present a fuller picture of emissions resulting from our activity for the 2019-20 reporting year.

This means total emissions for 2019-20 were 234,588tCO₂e a breakdown of which can be viewed in figure 1. Though a far smaller overall percentage this year with the marked increase in reported Scope 3, our Scope 1 CHP emissions were almost identical to 2018-19, at around 39,000tCO₂e. In fact, total Scope 1 and 2 emissions were similar in magnitude across the board.

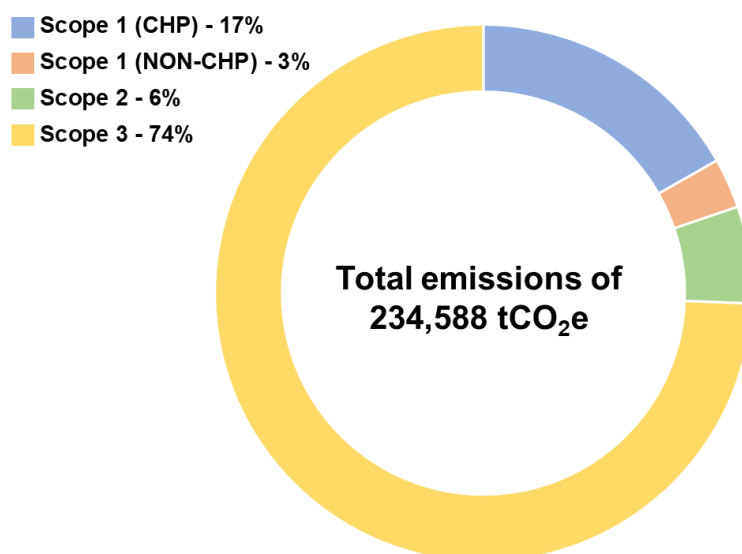


Figure 1. Carbon emissions by Scope - 2019-20

Emissions and Key Performance Indicators

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 tCO₂e by each intensity metric.

Annual Emissions – tCO₂e per annum

This year, we've captured data on much more of our Scope 3 activity and quantified our impact in a much more robust and clear manner. Figure 1 shows the scale of our annual Scope 3 related emissions and whilst we're working to reduce emissions across the board, the area in which we can have the most direct impact, is our Scope 1 and 2 emissions. This section breaks down that category for 2019-20 into more detail.

We self-generate a large portion of the electricity consumed by our South Kensington campus with our two 4.5MWe (Megawatts of electrical output) CHP

engines, the emissions directly attributed to these engines can be seen in figure 2. Although the largest single source of our emissions, it's important to note that CHP engines are a low carbon technology, and we would have been responsible for greater overall carbon emissions had we raised heat in gas boilers local to each building and imported all of our electricity from the grid. The CHP engines will continue to provide much of Imperial's South Kensington campus with electricity, heating and hot water over the coming years.

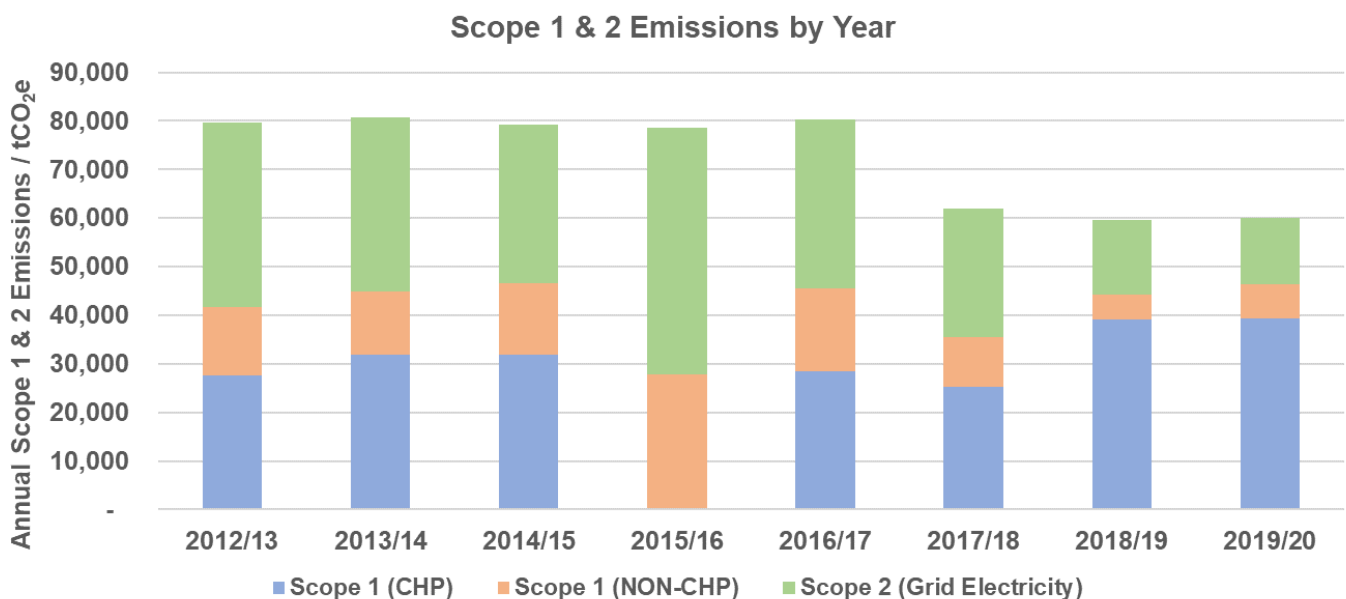


Figure 2. Annual Scope 1 and 2 emissions from 2012-13 to 2019-20

Scopes 1, 2 and 3 Explained

Scope 1 – Direct Emissions

Directly controlled emissions: combustion of fuel, company vehicles and fugitive emissions

Scope 2 – Indirect Emissions

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 by GIA (tCO₂e/m²)

We're pleased to be able to report on another successive year of reduced Scope 1 and 2 emissions per m² of GIA. A modest reduction of around 1.4% year-on-year is shown in figure 3, against a backdrop of an Imperial College estate which continues to grow each year, about 2% when compared to 2018-19. Overall consumption of gas and electricity was fairly consistent between the years, though the ever-decreasing carbon intensity of grid delivered electricity continues to play a role in reducing Scope 2 emissions.

We have plans in place, and will continue to refine and improve those plans, to continue this reduction and work toward the ambitious and challenging targets outlined in our 2021-2026 Sustainability Strategy.

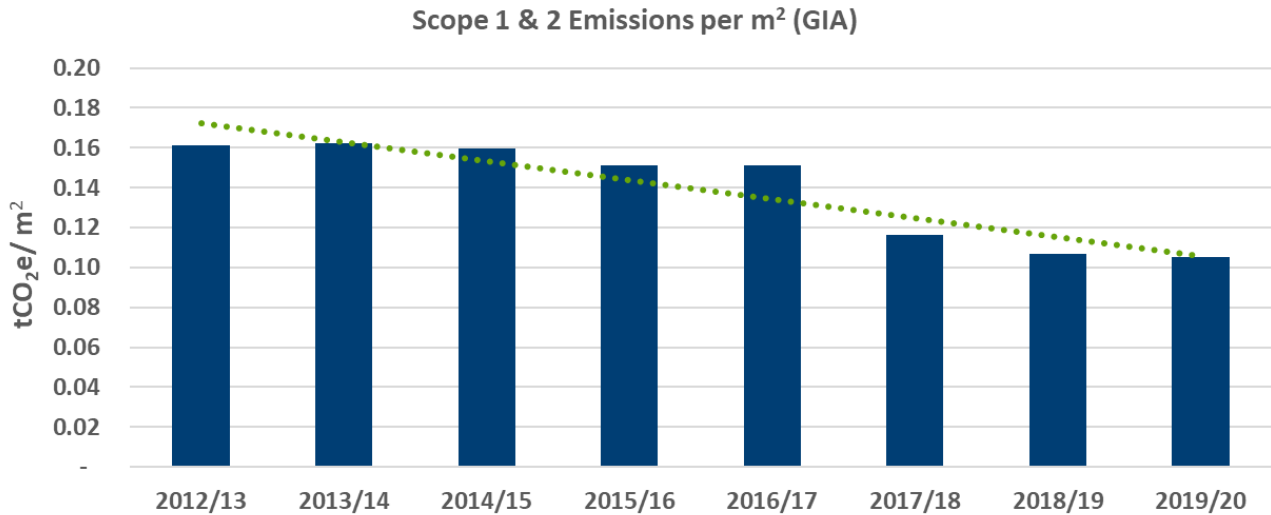


Figure 3. Annual Scope 1 and 2 emissions per m² of GIA

Emissions by FTE (tCO₂e/FTE)

Figure 4 presents our combined Scope 1 and 2 emissions per staff and student Full Time Equivalent (FTE). The tCO₂e/FTE figure for 2019-20 is almost identical to that of 2018-19, staff and student FTE increased by less than 1%, almost exactly the same percentage increase as our overall Scope 1 and 2 emissions, resulting in this metric showing no change. Whilst we would like to see decreases in every emissions intensity ratio each year, we have maintained our lowest levels for this metric and are working to continue reduction in the years to come.

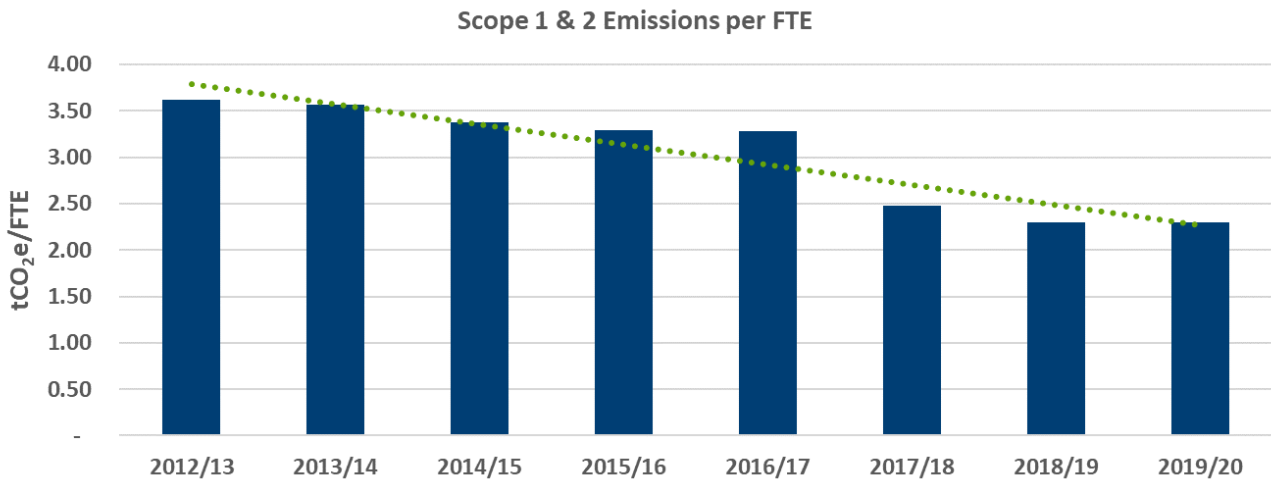


Figure 4. Annual Scope 1 and 2 emissions per FTE

Purchased Gas and Electricity by FTE (kWh/FTE)

This KPI allows us to make a distinction between energy consumed and energy purchased, which is of particular import due to the two CHP engines at the South Kensington campus. Assessing the total gas and electricity purchased provides insight into the effectiveness of our CHP engines and an understanding of our raw energy consumption.

Figure 5 shows we consumed approximately 5% more gas in 2019-20 than the previous year. This was primarily driven by increases in consumption away from the CHP. Much of this increase was observed at our White City campus, with buildings being utilised more, particularly the residential tower which draws heat energy from the White City heat network. An increase in this KPI was anticipated due to the expansion of our estate in the last few years, as increases in GIA have been greater than increases in FTE.

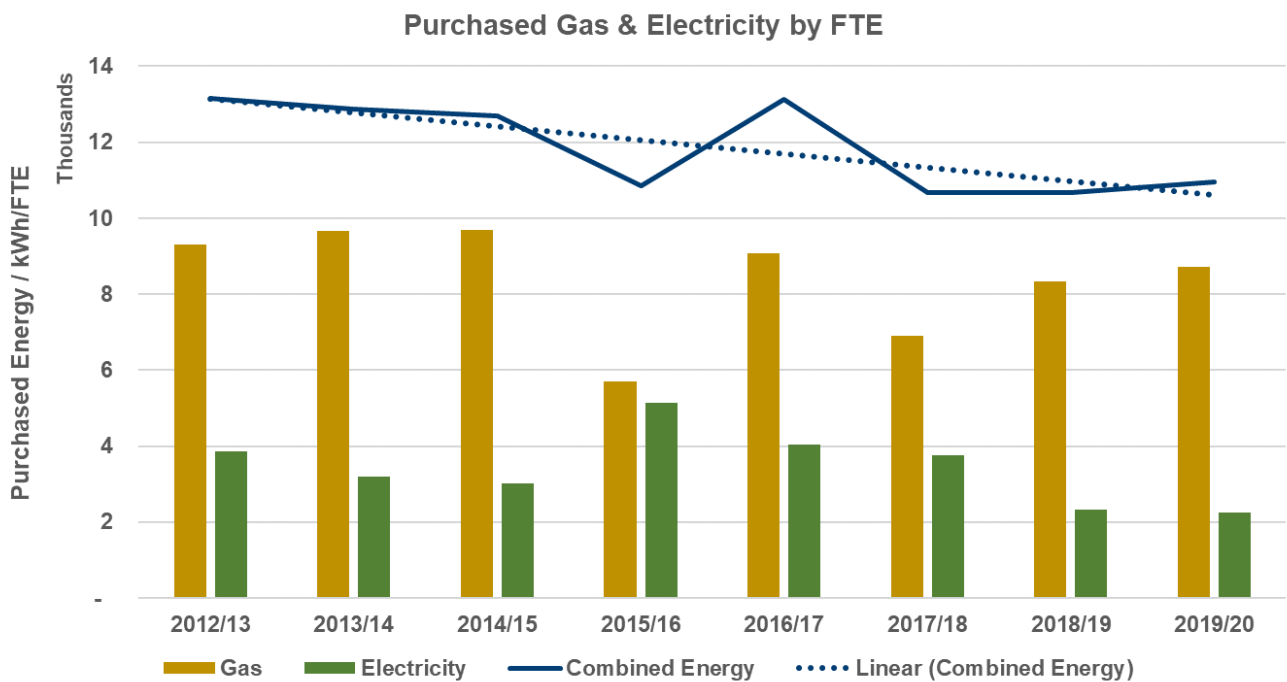


Figure 5. Purchased gas and electricity (kWh) by FTE

Gas Boilers Out, District Heating In Bessemer and Royal School of Mines

This project involved replacing natural gas boilers located on the roof of Bessemer and Royal School of Mines, with a connection to the district heating network from the Energy Centre.

Boilers serving Bessemer were reaching the end of their service life and were due for replacement. Instead of replacing like for like, the decision was made to utilise the district heat network, with both heating and hot water now delivered to each building from the Energy Centre.



Figure 6. Before: gas boiler - Bessemer roof



Figure 7. After: plate heat exchangers connecting Bessemer to the heat network

Buildings connected to the district heat network are hydraulically separated, this means water within a building is not the same as water in the network. This separation is achieved by using a plate heat exchanger and other ancillary plant. Heat energy is exchanged between the network and the building.

Benefits of migrating from local gas boilers to our district heat network include:

- low carbon heat and power delivery
- reduced emissions
- improved plant availability
- lower maintenance costs
- reduced overall operating costs.

City and Guilds Building - Steam to Water Based District Heating

The City and Guilds building has two separate water heating systems generating hot water, one for process, the other for domestic. This consisted of five steam to hot water heat generators. The steam-based network at South Kensington is slowly being removed, with the heat demand migrated to the more efficient water-based network. This work is a significant undertaking by the College and will lead to considerable efficiencies in the raising of heat energy.

The system consists of five large hot water storage vessels, each with its own electric immersion heaters, acting as a backup system. Each tank is connected to a plate heat exchanger, further utilising the network at South Kensington.

Hot water used in the taps within the building is now raised by CHP byproduct, so for approximately a third of the year the hot water will be supplied from what is currently unutilised heat byproduct, further improving the efficiency of the overall system.

Replacement of Steam Heating Services in 170 Queens Gate

The heating and hot water generation systems in 170 Queen's Gate were steam powered and due for replacement as the installation had reached its end of life. As the building is located at the far extremity of the heat networks there currently isn't enough capacity in the water heat network to take the heat capacity that the steam services provided. This makes migrating the services from steam to water district heat not possible at this time. However, future works are planned to address this and upgrade the water district heat network in this area.



Figure 8. High efficiency Hamworthy gas boilers in 170 Queens Gate

In line with Campus strategy for accommodation the building will eventually be served primarily by a water district heat connection with a gas boiler backup system. In this instance, and due to the network constraints, the natural gas boilers have been installed first, figure 8. Figure 9 shows an extract from technical documentation on possible future works, this shows an allowance to connect to the district heat network. The project work completed this year, was to remove the steam and condensate systems, replacing them with new gas boilers.

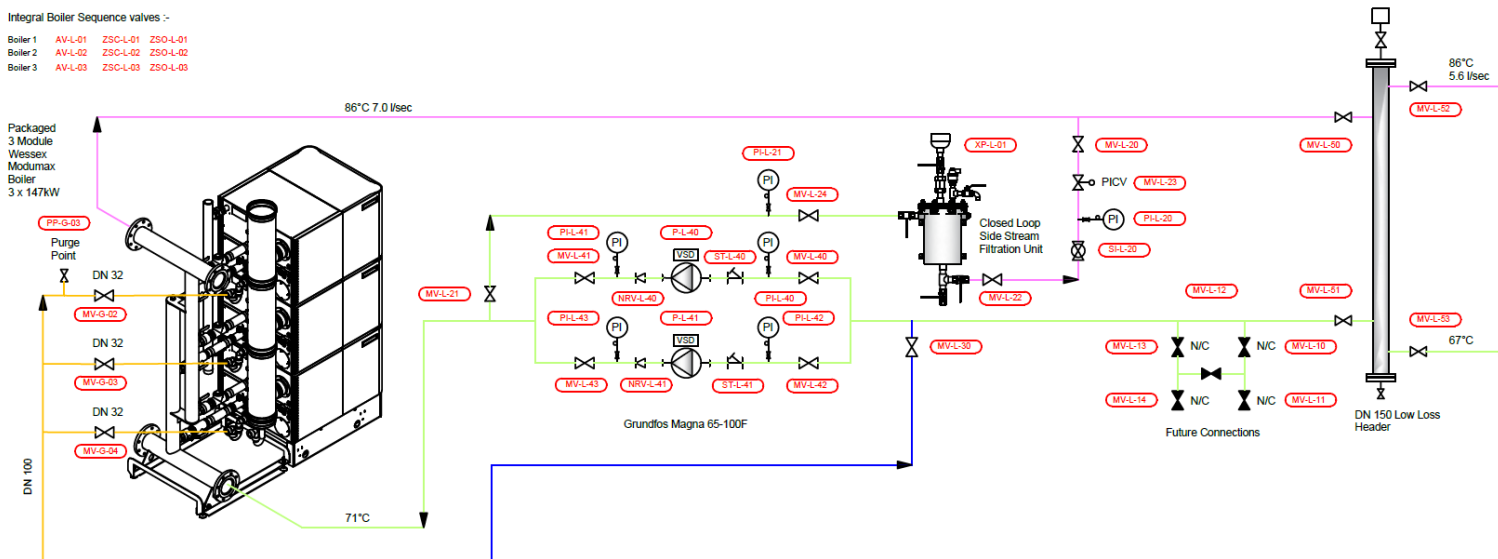


Figure 9. Example of a possible future district heat connection

Water Management

As part of our commitment to accurate reporting, we continually review the information we gather and the processes by which this is done. As such, we have amended the methodology behind how our water consumption data is gathered, to align more closely with reporting best practice. This has resulted in a small adjustment to water consumption figures reported for 2018-19 year, increasing consumption for that period from roughly 676,000m³ to 681,000 m³.

Water Consumption

During the 2019-20 reporting period, we saw a substantial decrease of almost 26% in our year-on-year water consumption, both in absolute consumption and per FTE, making 2019-20 the lowest water consuming period of the years shown in figure 10.

As part of our response to lockdowns and the reduced occupancy of buildings, regular flushing of building water systems

was undertaken to prevent Legionella growth.

With many students leaving halls of residence to return home, and face-to-face teaching curtailed due to COVID-19 during five months of this period, we are predicting a slight rise in consumption in the next report for 2020-21, though lower than 2018-19.

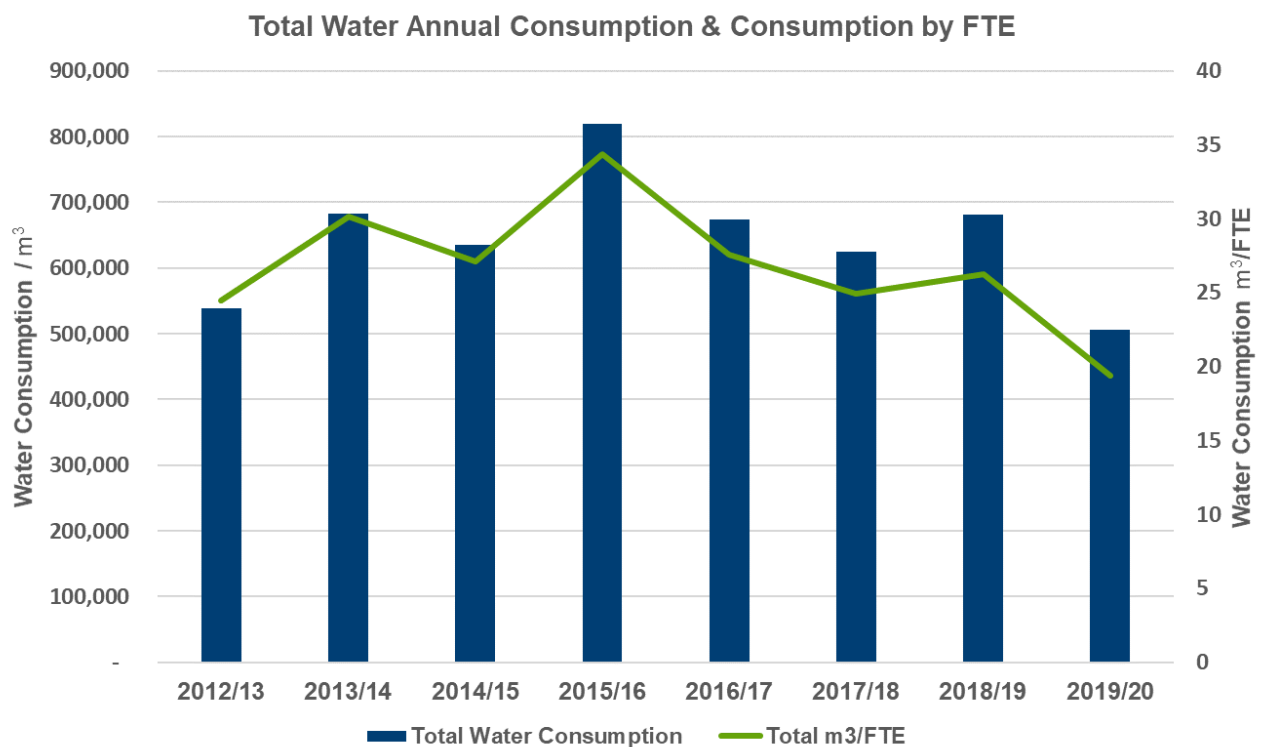


Figure 10. Annual water consumption (primary axis) and consumption by FTE (secondary axis)

ADSM Partnership

Imperial College is continuing to work with Advanced Demand Side Management (ADSM) through its 5-year partnership which began in April 2018. ADSM are a leading company in water management, their work across our estate helps to identify large scale pipe leaks as early as possible, reduce wastage through leaky fittings and improve efficiency of some plant. Imperial is working with ADSM as part of the AquaFund framework, a Government backed scheme to drive reductions in water consumption across the UK.

Sustainability and Research

Sustainability Strategy Consultation

In summer 2020 a consultation was held with internal and external stakeholders, via interviews and a staff and student survey, along with scoping and benchmarking against national and international institutions to inform the development of a College-wide sustainability strategy. The College survey received over 1,100 responses. Key findings included:

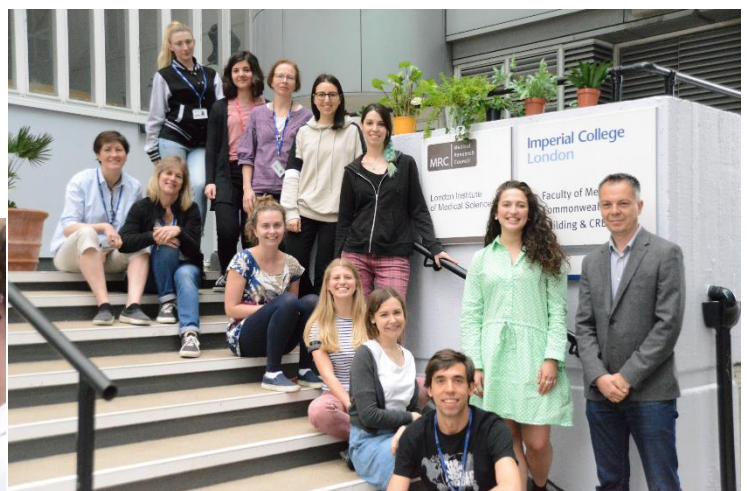
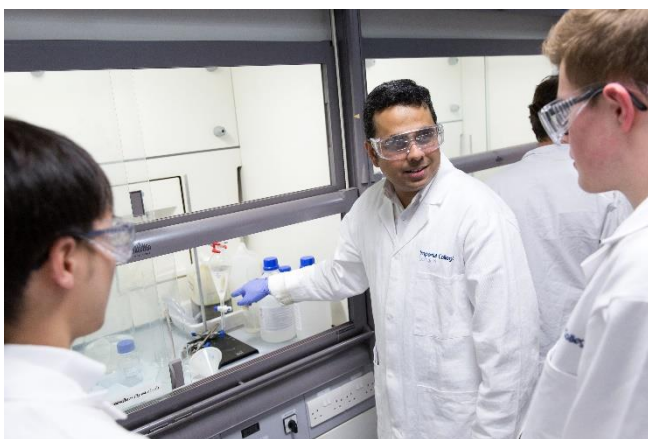
- The top three sustainability priorities cited by respondents were:
 - Reducing carbon emissions
 - Energy efficiency
 - Resource efficiency and waste reduction
- Over 85% of undergraduate students, and over 75% of teaching staff said they would like to be involved in sustainability activities

It is our intention that the College Sustainability Strategy 2021-2026 will be published in December 2020 and officially launched at an online event during Sustainability Week in February 2021. Work to gather data as the basis for new policies continues as the College moves towards the commitments made in the Strategy.

Turning Over a New LEAF

In 2019-20, Imperial continued to expand the number of laboratories participating in the Laboratory Efficiency Assessment Framework (LEAF) Participation in LEAF resulted in savings of £74,000 for the College despite many laboratories being closed, owing to COVID-19 restrictions.

Given the success of the scheme in a tumultuous year, it is hoped that more laboratories across Imperial will join in coming years, leading to ever increasing reductions in carbon and cost.



Biggest savings

- Fume cupboards
- Switching off



119 tCO₂e saved by labs participating in LEAF



**50 labs participated
6 silver awards
15 bronze awards**

Greening Imperial

Academic Leader in Sustainability

As a result of the Greening Imperial cross-campus and community initiative's report, the position of Academic Leader in Sustainability was created and Prof Paul Lickiss was appointed in November 2019.

Switching On, to Switching Off

Imperial continued its participation in the annual student switch off campaign, an event which seeks to engage students, encouraging teams from halls of residence across Imperial to drive down wasted energy consumption. The winner this year was Pembridge Hall.

69,287kWh of energy saved



6% reduction

16tCO₂e saved

Institutions that participated in the switch off campaign saved a total of 860,000kWh and 265tCO₂e with 82,600 students helping to do their bit. The campaign is a way of driving engagement with our student population, and we will continue to participate.

831 student pledges

22 student ambassadors



Figure 11. Pembridge Hall - student switch off winner 2019-20

External Networks

As well as many presentations and meetings with staff across the College and the Imperial College NHS Trust, Prof Lickiss was invited to attend external sustainability forums and meetings, including the LERU Sustainability Group and the Hammersmith and Fulham Climate Alliance. We aim to build on such connections and join more external networks, enabling us to collaborate on sustainability goals, learn from best practice and increase Imperial's visibility in this area.

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