

Hopes Sustainability & Bromley Council
Sustainability Learning Resources and Energy Efficiency Project for Schools
Initial insights and first phase of schools' feedback

At COP26 in November 2021, the Department for Education announced that it will be introducing a new sustainability curriculum in English schools from 2023. The Government's vision is that the UK will be the world-leading education sector in sustainability and climate change by 2030.

In England, they will achieve this through the following strategic aims:

- Excellence in education and skills for a changing world: preparing all young people for a world impacted by climate change through learning and practical experience.
- Net zero: reducing direct and indirect emissions from education and care buildings, driving innovation to meet legislative targets and providing opportunities for children and young people to engage practically with the net zero concept.
- Resilient to climate change: adapting to mitigate against the worst impacts of climate change in our education and care buildings and infrastructure.
- A better environment for future generations: enhancing biodiversity and increasing access to nature in and around education and care settings.

The Secretary of State indicated that the successful implementation of this strategy depends on collaboration and opportunities to share best practice, evidence and resources, and asked for engagement from organisations involved in this field to engage with the department, ahead of finalising the strategy. He also said the country needs highly trained teachers and students who are ready and able to enter the new green workforce.

This document sets out details and initial insights of a collaborative project which we believe fulfils all the DfE's strategic aims and could be a template for how practical sustainability education can be delivered on a mass scale.

The project is a collaboration between the London Borough of Bromley's Environment and Education teams and Hopes Sustainability C.I.C., a social enterprise that educates and inspires children to take action on environmental responsibility. They need to learn from an early age and through their formative years why sustainability is crucial and what it means to meet our own needs without compromising the ability of future generations to meet theirs.

"In recent UK research on the leadership skills required for a sustainable economy, 92% of the business and sustainability leaders agreed that businesses need to do more to prepare people for the transition to a sustainable economy." *Sustainability Leadership: Linking Theory and Practice - Cambridge Institute of Sustainable Leadership*

Whilst sustainability is becoming more and more a part of everyday life, the complexity of the issues and range of solutions are still unclear for most people. HOPES Sustainability aims to bring clarity and understanding to everyone, unpacking and explaining sustainability and its foundations of environment, society and the economy – or the three Ps – planet, people and profit.

As a social enterprise, Hopes offer schools a comprehensive and growing suite of educational resources, focused on environmental and sustainable issues and solutions. We analyse and optimise the energy and environmental performance of the schools we partner with and facilitate corporate and local government partnerships to enrich lessons and inspire pupils and their teachers with the vast range of exciting technologies being developed every day, and the green careers that will deliver them.

Hopes' primary objective is to motivate and empower children across the UK and in due course, globally, with a deep understanding of the challenges of climate change and inspire them with optimism about the solutions to achieving climate targets. We will take them on a journey of discovery through primary and secondary school years, using a best-in-class education programme paired with real-world actionable insights. This is achieved by linking and embedding an environmental and sustainable focus into the existing National Curriculum theories, which pupils can access to develop a clear understanding of the complexities surrounding sustainability and environmental stewardship, and gain a firm grasp on how they can contribute to delivering the solutions we desperately need.

HOPES Sustainability achieves this by:

- forming strategic collaborations with progressive and purpose-driven corporate, academic and government partners
- showcasing their sustainability journeys to our pupils
- creating practical learning resources.

A key focus of all the resources will be to link them to elements of the National Curriculum (including the three sciences, geography, maths, English, history, D&T, art and PSHE) and will include practical applications of the various theories in the real world, so pupils can learn how theories are being applied through a wide range of solutions to address and mitigate climate, biodiversity and sustainability issues.

Hopes will work with company personnel, taking information from their internal resources and repurpose them for use within the school environment as useful and digestible learning resources for teachers and schoolchildren. They will demonstrate how the theories they learn are applied and become relevant in the real world, and will raise awareness and empower pupils to explore the opportunities to personally contribute to achieving climate action targets. The resources will also showcase the range of potential green career initiatives and elements within various industry sectors and inspire them to explore how they can engage with sustainability in any type of career choice.

All of these, when used with a solid support structure and classroom environment, will provide a foundation of practical skills that will serve them well in any occupation, and especially for careers involving sustainability and environmental components.

Collaborative pilot project with Bromley – outline and initial insights

The London Borough of Bromley commissioned Hopes Sustainability to develop and implement an innovative climate action project with 5 pilot primary schools in the borough, in order to embed sustainability in all elements of pupils' education journeys. The objectives of the pilot programme are to:

- Engage pupils across a wide age range with learning resources about sustainability, so they move over time from superficial perceptions of the issues to a deeper understanding of the complexities of the science behind climate change, and become aware of the wide range of potential solutions being implemented in the real world by the business community, government and academia
- Collect data on patterns of energy consumption in schools in order to identify areas of wastage and opportunities to improve energy efficiency. Based on the data, provide actionable insights for school leaders to implement a combination of technology and behaviour changes and improvements over time, thereby reducing costs and CO2 emissions, with the capacity to monitor their implementation over time
- Empower the pupils to active participants within their school's journey towards carbon neutrality, rather than passive receivers of disconnected knowledge
- Develop and prepare a high-level Decarbonisation Plan for each school, setting out a pathway for the schools to implement their own Net Zero journeys. Based on analysis of the consumption data and a comprehensive site survey, the Plan will include the most appropriate options for infrastructure and capital investments to achieve those targets, which will be considered by the Council when deciding how to apply further funding from their Carbon Offset funds.

Hopes commenced implementation of the project in December 2021 and the initial sets of sensors were installed in the schools during the first half of January 2022. The data collected and initial insights set out in this document cover a 35 day period from mid-January.

Hopes has completed the first set of 6 weeks of learning resources and schools will commence teaching with them during the second half of the Spring term of 2022. Once the teaching has been completed, we will collect feedback from teachers, so no conclusions will be reached about their impact in the pilot schools until the beginning of the Summer term.

“Bromley Council are very excited by this project as it represents a first in London. It is an innovative programme which includes unique data visibility and bespoke high-level Net Zero pathways for each school. This will inform the much needed and highly competitive funding for retrofit applications. The inclusion of lesson plans based around the captured data, means the children will be brought along their school's journey to Net Zero, making for a holistic educational approach. The feedback surveys will also allow the Council to measure the wider social impact that the scheme is having. This novel programme is already bearing fruit and we are excited to be sharing the results once the pilot has completed.” *George Brown, Environmental Officer, London Borough of Bromley*

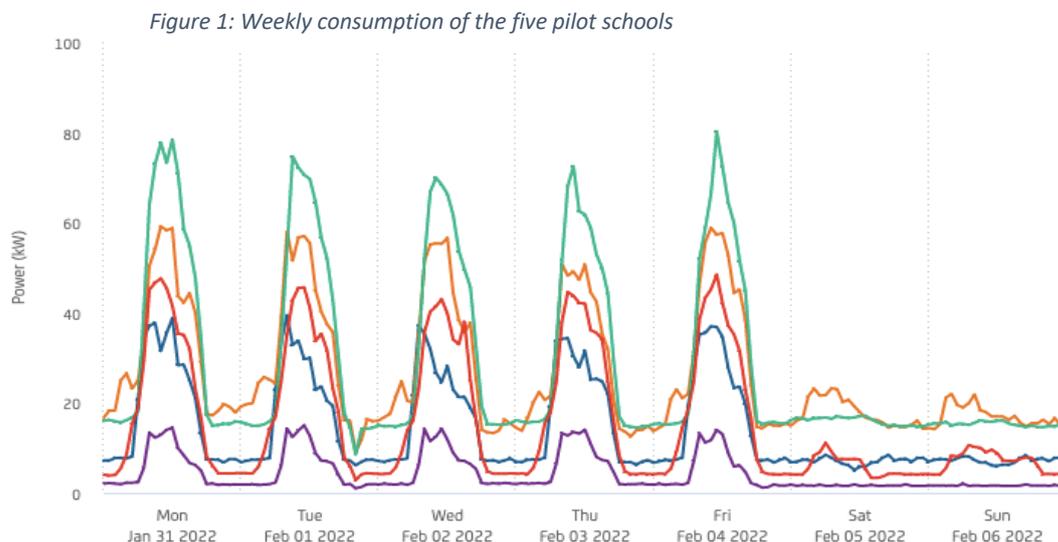
Technology – cloud platform, sensors, data and initial insights

The insights highlighted below apply to the schools' electricity consumption, as we currently only have one of the five schools set up with gas monitoring equipment at this point, due to technical or infrastructure issues around gas metering, which mean the connection of sensors to monitor gas consumption in 3 of the schools has been delayed while connection solutions are being explored.

The five weeks' worth of data show the same patterns being repeated each week, which mean we have been able to reach some initial conclusions about electricity consumption that we believe will be applicable in principle across the whole year.

We have extrapolated the results on the assumption that the patterns will hold across the year, but will continue to monitor the data to update and validate those conclusions. We also plan to engage with more schools in other local authority areas in order to gather wider data which can be used to benchmark the efficiency opportunities.

The platform and technology used by Hopes provides the ability for remote metering, measuring, reporting and analysis of electricity and gas consumption. The 'PowerRadar' platform is provided by Centrica Business Solutions and is used to identify issues and anomalies, highlight opportunities to improve efficiency and provide schools with insights into where and when energy is being used and wasted, identifying ways to reduce consumption, costs and CO2 emissions. The technology uses non-invasive wireless sensors that connect to a cloud platform for easy installation and secure data transfer.



As can be seen from Fig. 1, the schools' baseload consumption (the consumption when the school is closed) ranges from around 2kWh per hour, to roughly 16 kWh per hour, every hour when the school is closed. At 15 pence per kWh, the 16kWh equals £2.40 every hour the school is closed. Baseload is the easiest way to reduce wasted energy consumption. If a school is closed for 118 hours per week, they could be spending £283.20 per week on electricity when the school is closed, and most electrical equipment should be switched off.

While there will be some baseload, e.g. servers and fridges, that cannot be switched off, this level of baseload is significantly larger than expected – ranging from 33-49% of total electricity consumption each week.

The next step is to fully scope the schools' distribution boards to identify the key sub-elements that need to be monitored continuously. Once the scoping has been completed and arrangement agreed with the school on what additional sensors are needed to provide the required levels of granularity, Hopes will commence detailed measurement and monitoring of the causes of excess consumption, identify key areas of inefficiency and then recommend changes to working practices, technology, and behaviour changes/improvements. The technology will then monitor the impact of changes implemented to ensure they are maintained, and provide continuous management information to allow school leaders to assess impact and compliance with all new policies.

Environmental Sensors - Explanation

The project scope has included two sets of environmental sensors and a weather station for each school, which are linked to a cloud platform provided by a second partner, ScienceScope, an education IoT company. These sensors measure temperature, CO2 levels, light and sound, rainfall and humidity and the data is uploaded to their cloud platform which includes both analysis and educational tools. The system also collects the energy consumption data from the PowerRadar platform, so Hopes will be able to make integrated analyses linking consumption and environmental data, to analyse issues like how does energy consumption vary due to changes in external temperatures.

The project will also analyse schools' solar panel performance (when installed) by comparing the solar radiation with the energy data gathered.

Initial Financial Insights (based on 35 days of data monitoring) and potential levels of savings

School	1	2	3	4	5
Size of school	2 form +- 400 pupils	2 form +- 400 pupils	2 form +- 400 pupils	Special school	1 form – less than 100 pupils
Annual bill extrapolation*	£15,773	£16,795	£31,666	£37,534	£4,577
Potential Excess cost annually	£5,465	£6,517	£16,652	£18,091	£1,553
Potential Excess cost as a % of total cost	34.7%	38.8%	52.6%	48.2%	33.9%
5-year total excess consumption projection – current rates (+- 14p/kWh)	£40,036	£47,261	£118,085	£111,908	£11,015
Annual potential savings - current rates	£6,434	£7,269	£16,325	£18,362	£1,847
Annual potential savings per year @ 20p per kWh	£9,191	£10,384	£23,321	£26,231	£2,639
Potential savings over 5 years @ 20p per kWh	£45,955	£51,921	£116,604	£131,154	£13,194
Year 1 sensor set-up and project costs - estimated	£8,400- £11,400	£8,400- £11,400	£8,400- £11,400	£10,100- £13,000	£6,400- £8,000
Expected project management costs p.a. – Year 2 onwards	£2,500- £4,000	£2,500- £4,000	£2,500- £4,000	£2,500- £4,000	£2,500- £4,000

* The extrapolation has been calculated by taking the averages of weekday and weekend consumption over the 35 day monitoring period and applied them across the year, based on 195 school days and 170 weekend and holiday days

This table illustrates the potential scale of efficiency savings if the consumption patterns from the data period are replicated across the whole school year (including allowances for school holidays), rather than specific targets and calculations. They are based on achieving 80% savings on baseload consumption (out of hours) and 20% efficiency savings during school opening hours.

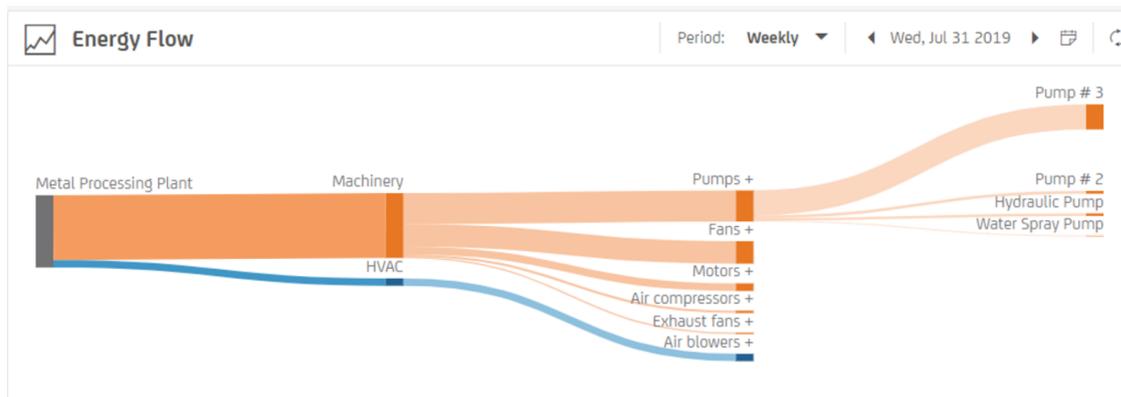
If these consumption patterns are repeated by schools nationally, which anecdotally would seem to be the case, then schools are haemorrhaging between **£120 - £150 million** of taxpayers' money annually on wasted energy usage. And that's at historic energy rates – assuming the market volatility and impact of global events on energy prices continues, **the level of wastage could reach £300 million each year**, for no benefit to the schools or the UK economy.

This project illustrates the power of providing visibility of consumption patterns and energy wastage to school leaders, and the consequent massive savings potential such visibility provides.

The cost of the one-off technology installation required for successful analysis should be easily covered by the savings opportunities generated – we expect most schools (other than very small schools) will cover the set-up costs within 6-12 months, while the savings will continue to be generated for the foreseeable future.

Next steps to improve quality of data analysis

The installed sensors have generated a high-level understanding of consumption. The next step is to prepare a scoping document for each school that will identify the components of the electrical circuit board to be monitored, to provide full granularity of consumption and generate a comprehensive understanding of each school's system. Hopes will then discuss with the schools and Bromley Council to agree what additional equipment needs to be installed to monitor each school effectively.



This graph illustrates the level of granularity that can be achieved to maximise insights and provide actionable insights to reduce wastage and improve efficiency.

Alongside the ongoing data collection and analysis, Bromley Council and each school will be provided with a high-level Decarbonisation Plan, taking into account data from the Centrica platform as well as an infrastructure survey. We are working with a renewables infrastructure company who specialise in providing renewable energy solutions in order to deliver these plans. We expect to deliver these plans during Q2 of 2022.

Sustainability Learning Resources:

- Global Warming (2 weeks of lessons)
- Renewable Energy - Wind and Solar (4 weeks of lessons)

Hopes has begun developing a suite of learning resources covering a wide range of sustainability topics. We have created the first 6 weeks of lessons (including 3 practical investigations for pupils) on the topics of Global Warming and Renewable Energy, with an initial focus on Wind and Solar energy. The pilot schools will commence teaching these resources during the second half of the Spring term. and the feedback received about ease of use, engagement and impact will inform how we develop further resources over time.

Apart from the subject based and cross-curricular enrichment described earlier, additional resources will be developed through partnerships with companies that have adopted decarbonisation plans and are implementing processes within their operations to achieve Carbon Zero targets and address other components of the climate crisis.

Initial comments from school leaders on the Bromley pilot project

“The combination of having technology as well as the staff involved is so important in terms of building that culture within the school. We can promote and encourage them in different ways so that they start to feed into that culture within the school and understand the importance of what the school is trying to achieve by saving energy.”

“The school intends to re-invest all savings generated from the energy efficiency project into teaching the kids about sustainability. We intend to both support and promote environmental sustainability, through a clear and concise whole school environmental policy. The innovative approach and support of Hopes Sustainability excites us, as our journey gathers momentum. In particular, we are as one with regard to embedding the concept of sustainability into our curriculum, enthused by their vision and the practical support and encouragement Hopes provides.” -

Mike Parker, the Deputy Chair of Governors at Poverest Primary School, Bromley

“How much human interaction is needed for those numbers [potential savings] to pan out?”
A mixture of human and technological fixes will bring about these savings. Good housekeeping is the easiest way to get consumption down, though it can be difficult to sustain without sufficient monitoring. That is the role that the data monitoring sensors and platform come it – they provide visibility for school leaders on how new processes and behaviour changes are implemented over time, and provide alerts and reports for school managers when remedial action is needed.