

ROYAL BOTANICAL GARDENS - WAKEHURST



THE CUSTOMER

The Royal Botanic Gardens are one of the world's most famous botanical gardens.

RBG Wakehurst located in the heart of Sussex, is often described as "Kew's wild botanic garden". It is home to an extensive collection of plants, woodlands, and the globally important Millennium Seed Bank.

The 500-acre estate combines beautifully designed gardens, a diverse range of natural landscapes, and conservation-focused facilities, making it a destination for both plant enthusiasts and conservationists.

The Millennium Seed Bank is a state-of-the-art facility and the world's largest wild plant seed bank, dedicated to collecting, storing, and preserving seeds from wild plants that face threats of extinction. The Seed Bank's goal is to safeguard the genetic diversity of plants, especially those that may have future uses in food security, medicine, and climate resilience. The bank holds seeds from over 40,000 plant species from 190 countries, making it a vital resource in the global fight to conserve plant biodiversity.



**"IT HAS BEEN AN HONOUR FOR BIRDSALL TO BE A PART OF
RBG'S FIRST DECARBONISATION PROJECT. THIS SUCCESSFUL
PROJECT HAS ACCOMPLISHED AN IMPORTANT GOAL"**

PAUL BIRDSALL
BIRDSALL MANAGING DIRECTOR

"THE TEAM AT BIRDSALL TOOK OUR INITIAL DESIGN THROUGH THEIR OWN DILIGENT SURVEYING AND ROBUST DESIGN PROCESSES TO ENSURE A FINAL CONTRACTORS PROPOSAL ACHIEVED OR EXCEEDED OUR STRINGENT ENERGY EFFICIENCY CRITERIA. THIS IN TURN ASSURED THE INSTALLATION PHASE OF THE PROJECT DELIVERY RAN VERY SMOOTHLY AND PROFESSIONALLY. WE ARE VERY PLEASED WITH BOTH THE PROCESS AND THE INSTALLATION"

RICHARD GARFIELD
SENIOR PROJECT MANAGER

THE SUSTAINABILITY STRATEGY

The Royal Botanical Gardens employs over 1,000 staff, including 350 scientists and 150 horticulturists, working passionately to protect and promote the value of plants and fungi. They inspire over 2 million visitors a year to connect with nature.

It is their mission to tackle the interwoven climate and biodiversity crises not just through their work, but also the way they manage their sites, and through their supply chains and partnerships.

RBG new Manifesto for Change sets out a clear and vital role in striving to reverse environmental destruction and restore our planet to health. Their aspiration is to end the extinction crisis and to help create a world where nature is protected, managed sustainably, and valued by all.

They have committed to developing a rigorous offsetting policy, selecting high-quality, certified, nature-based carbon offsets to more-than-balance our unavoidable emissions and become climate positive by 2030.

Birdsall's net zero pledge reflects a strong commitment to environmental stewardship that aligns closely with RBG values and sustainability goals. By pledging to reach net zero, we are actively reducing our carbon footprint and enhancing resource efficiency across all levels of our operations.

This commitment allows us to support clients who are equally dedicated to sustainable practices, ensuring that together, we are making a positive impact on the planet.

Through transparent actions, measurable targets, and innovative solutions, we are working collaboratively with our clients to address environmental challenges, advance renewable energy use, and promote responsible practices.

This alignment not only strengthens our client partnerships but also underscores our shared responsibility in building a sustainable future.

There were specific performance indicators that needed to be considered when Kew Gardens were appointing a suitable supplier:

The project included:



Principle Designer Capabilities



Fully Decarbonised Solution



Data Capture & Analysis to support heat pump selection



Continued After Sales Support

THE CHALLENGE

With their decarbonisation plans in full force, RBG wanted to start the first phase at Wakehurst to replace its oil-fired heating system with air source heat pumps. Air source heat pumps (ASHPs) work by absorbing heat from the outside air and amplifying it before transferring it to provide heating and hot water. Outside temperatures as little as 1 deg C can be converted into room temperatures of over 30deg C. This is a much greener alternative compared to traditional fossil fuel systems, which emit carbon dioxide and contribute to environmental pollution as well as negatively affecting the energy efficiency of a building.

Birdsall were invited to tender for the scheme which reconfigured heating delivery in three separate staff areas. Our deep knowledge of decarbonising heating systems ultimately saw us appointed as Principal Contractor and Principal Designer for the scheme.

Wakehurst would remain open to visitors and staff, which would present significant challenges. It was therefore important that Birdsall implemented a robust health & safety plan which was compliant with regulations with effective co-ordination and scheduling to minimize disruptions with considerations for maintaining access to key areas of the site while works were ongoing.

Birdsall conducted the project under the Construction (Design and Management) Regulations, often referred to as CDM Regulations as the basis of our planning. This was essential in order to ensure that the project was designed, planned, and executed safely and efficiently, minimizing risks to workers and the public.

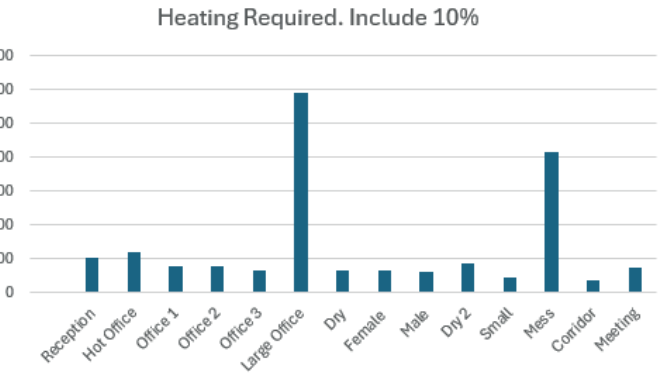
THE SOLUTION

In order to understand the site fully, we carried out an electrical load survey which involved systematically data logging the energy consumption patterns of the buildings over a period of several months.

RBGK Wakehurst															
Calculation of Indoor Unit Heating Loads - CIBSE Admittance Method 2021															
Office Building	Unit Measurement	Reception	Hot Office	Office 1	Office 2	Office 3	Large Office	Dry	Female	Male	Dry 2	Small	Mess	Corridor	Meeting
Wall of Gross Windows	m2	14.0	15.0	8.7	8.7	7.8	40.5	7.9	7.9	8.0	11.4	6.9	46.8	0.0	7.0
	U2	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
	Yw2 T3.49	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Window	m2	0.0	2.3	2.3	2.3	1.1	8.8	0.0	1.0	0.0	0.0	0.0	7.7	0.0	0.0
	U2	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	Yw	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Door Area	m2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0
	Door U	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	Yd	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Roof Area	m2	14.0	15.0	10.0	10.0	9.6	119.0	10.0	9.0	9.0	12.0	3.0	60.0	12.0	14.0
	U _r	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	Y _r T3.50	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
Floor Area	m2	14.0	15.0	10.0	10.0	9.6	119.0	10.0	9.0	9.0	12.0	3.0	60.0	12.0	14.0
	U _f	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Y _f T3.51	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
Radioactive Proportion R Table 5.10 Forced Air		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Room Volume	m3	35	38	25	25	24	298	25	23	23					
Cv at 1.0AC=1/3NV	W/k	11.7	12.5	8.3	8.3	8	99.2	8.3	7.5	7.5					
Fr Eq 5.14 Page 5-16	AY+Cv	147	159	101	101	94	905	96	90	90					
	AU+Cv	49	60	39	39	33	281	31	32	30					
	fr	3	2.7	2.6	2.6	2.8	3.2	3.1	2.8	3					
F3 Eq 5.45	to=12hrs	1.5	1.5	1.4	1.4	1.4	1.5	1.5	1.5	1.5					
Base Heat Required Q=UAΔT	dt=C	25	1237	1492	982	982	833	7028	773	810	743				
Heating Required, Include 10%	QxF3+10%	2037	2387	1554	1554	1352	11796	1286	1311	1229					

- Notes:
1. Calculations by CIBSE Guide A 2021 with correction for intermittent heating
 2. Outdoor design -3c, Indoor 22c - Salix Spec Page 3
 3. Intermittency: to = run 12 hours per day
 4. R=0.5 for U/F Htg, 0.3 Radiators, 1.0 fans
 5. 10% safety margin above CIBSE calculation included
 6. Roof Insulated 150mm Polysty U=0.15w/m2C
 7. Floor U P/A=0.25 Table 3.35 gives U=0.45

The follwing images show the report we generated to calculate the indoor heating loads for each area and the amount energy required and the building heat losses considered.



This long term monitoring allowed Birdsall to collect data on peak demand, noting any fluctuations. By analysing this data, we were able assess overall energy efficiency and identify potential issues such as overloads or underutilisation. This enabled informed recommendations for optimisation, such as upgrading equipment, reconfiguring circuits, or implementing energy-saving strategies. The extended timeframe ensured that any anomalies or trends were captured, providing a detailed understanding of the electrical system's performance.

Birdsall also carried out a heat loss survey on the various buildings on the site which assessed how and where heat escapes. We assessed heat losses and cross referenced this data with the delivery performance data for various heat pumps. The process included the use of specialised software and equipment, such as thermal imaging cameras, to identify areas of poor insulation, draughts, or thermal bridging in walls, windows, doors, and roofs. The data collected assisted our design team to arrive at a specification for the heating modules and distribution arrangement. Backed up by firm data we knew the selected system would offer the greatest efficiencies and exceed the client expectations.



Tractor Store - New distribution cassettes mounted on frames



Orchard Back Office - Pipe work in progress



Orchard Main Office - New Ceiling tiles reinstated around new heating arrangement.



Orchard Staff Room - completed ceiling cassettes



New Daikin Air Source Heat Pump installed

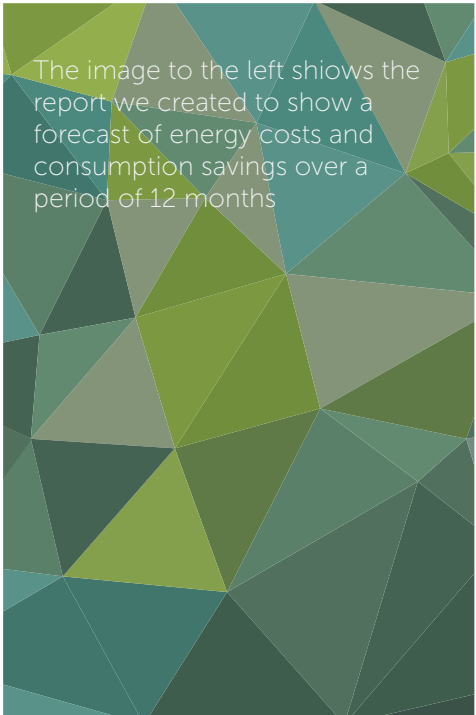
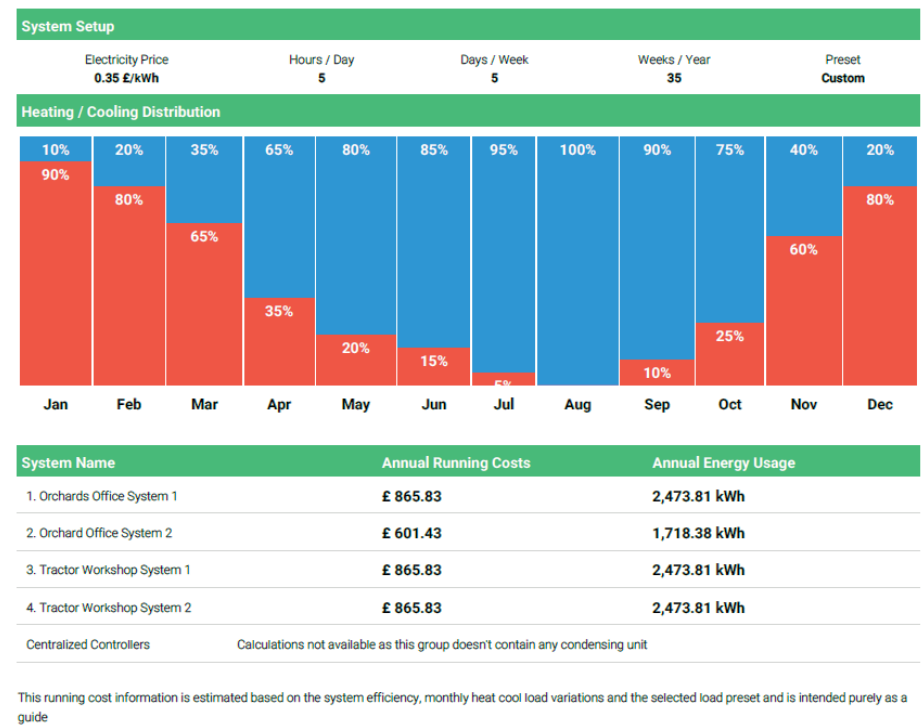


Additional small space heater added in cloakroom to improve staff comfort.

THE OUTCOME

Birdsall removed the fossil fuel heating system and replaced it with an air-source heat pump (ASHP) which enables RBG to reduce their carbon footprint. Unlike traditional heating systems that rely on burning fossil fuels such as oil or gas, which release significant amounts of CO₂, ASHPs draw heat from the air outside and use electricity to transfer it indoors. Since air-source systems don't combust fuels, they emit no direct greenhouse gases, which aligns well with carbon-conscious goals. By making this transition, businesses can significantly reduce operational emissions and contribute to cleaner, more sustainable energy practices.

One of the main advantages of air-source heat pumps is their efficiency. For every unit of electricity they consume, ASHPs can produce three to four units of heat, offering efficiencies that far surpass conventional fossil fuel systems. When paired with a renewable electricity source, such as on-site solar panels or a green energy provider, the system becomes even more sustainable, reducing net carbon emissions to nearly zero. For a carbon-conscious organisation like RBG, this dual benefit of lowering operational costs while supporting environmental goals can have a strong positive impact on both finances and reputation.



THE ONGOING OPTIMISATION

Birdsall's service & maintenance agreement provides ongoing support for monitoring and optimising the air source heating system to ensure maximum efficiency and performance. Through continuous monitoring, we track key parameters and performance indicators that reflect the system's operation. We adjust settings and make improvements based on seasonal variations, occupancy levels, and other relevant measures that may impact energy use. This proactive approach not only helps maintain consistent indoor comfort but also reduces energy consumption and operational costs over time.

We schedule essential and proactive maintenance to ensure the longevity and optimal operation of an air source heat-pump system. By adhering to regular maintenance, we ensure that the system remains compliant with manufacturer warranty requirements, safeguarding RBG's investment and potentially extending its life span. Proactive checks and servicing allow us to detect and address issues before they escalate, which helps to prevent unexpected break-downs and reduces downtime significantly. This thorough approach not only helps maintain peak performance and efficiency but also minimises operational disruptions, allowing the system to consistently deliver reliable heating and energy savings year-round. This system not only delivers immediate improvements in energy efficiency but also aligns with broader decarbonisation goals by supporting cleaner energy use. As the first phase, it sets the stage for future initiatives that build on these gains, helping our client meet and exceed their carbon reduction targets over time.



TAKE THE NEXT STEP WITH US
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