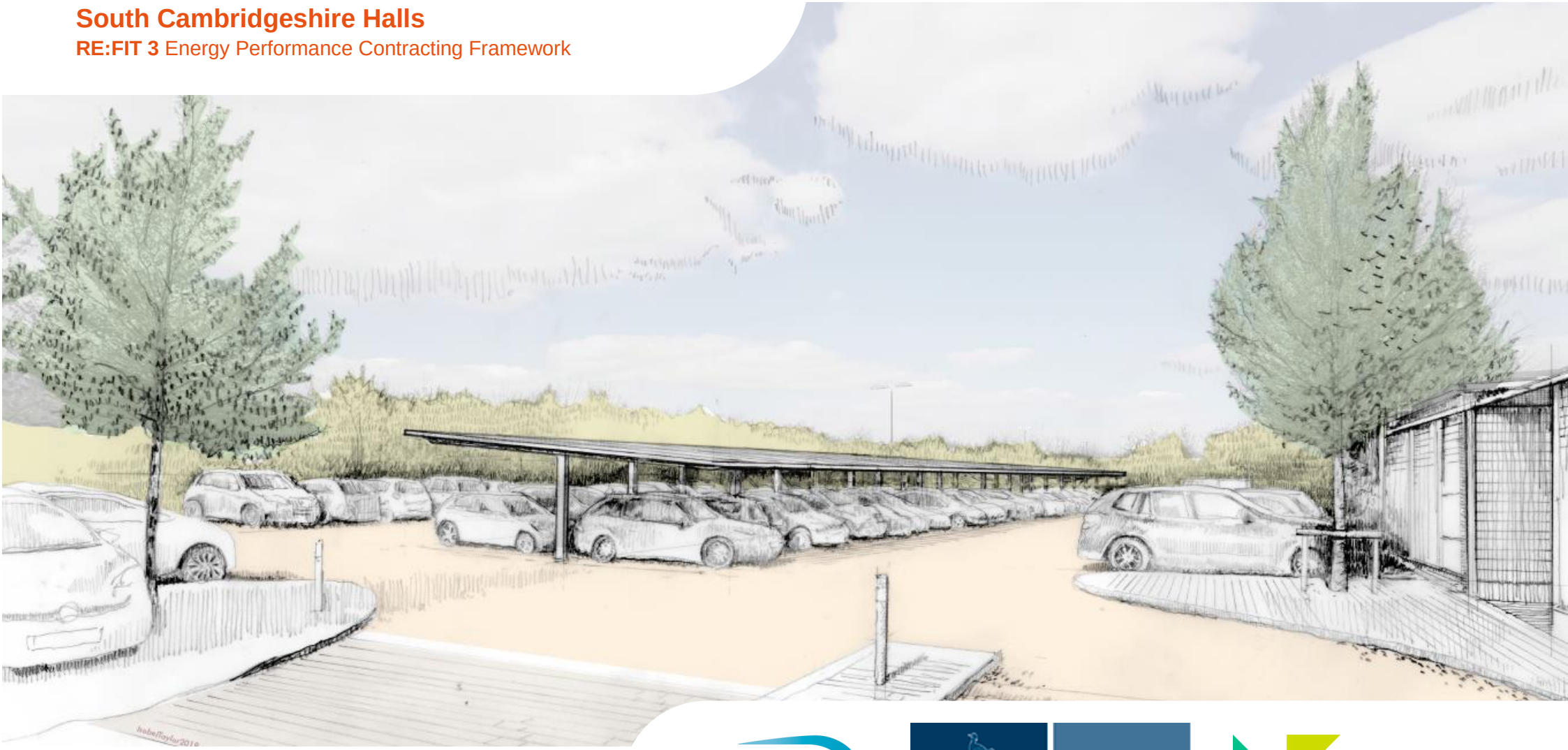
South Cambridgeshire District Council

Executive Summary

South Cambridgeshire Halls

RE:FIT 3 Energy Performance Contracting Framework



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BOUYGUES ENERGIES & SERVICES

South Cambridgeshire District Council

LOCAL PARTNERSHIPS

136kW Solar Carport
Delivers 20% of the site's annual peak electricity demand

LED Lighting Upgrade
1052 fluorescent lights replaced with LED, generating 17% site electricity savings

15,000L thermal store
To enable balancing of renewable heat supply with demand

GSHP Ground Loop
35 boreholes to deliver up to 400kW heat

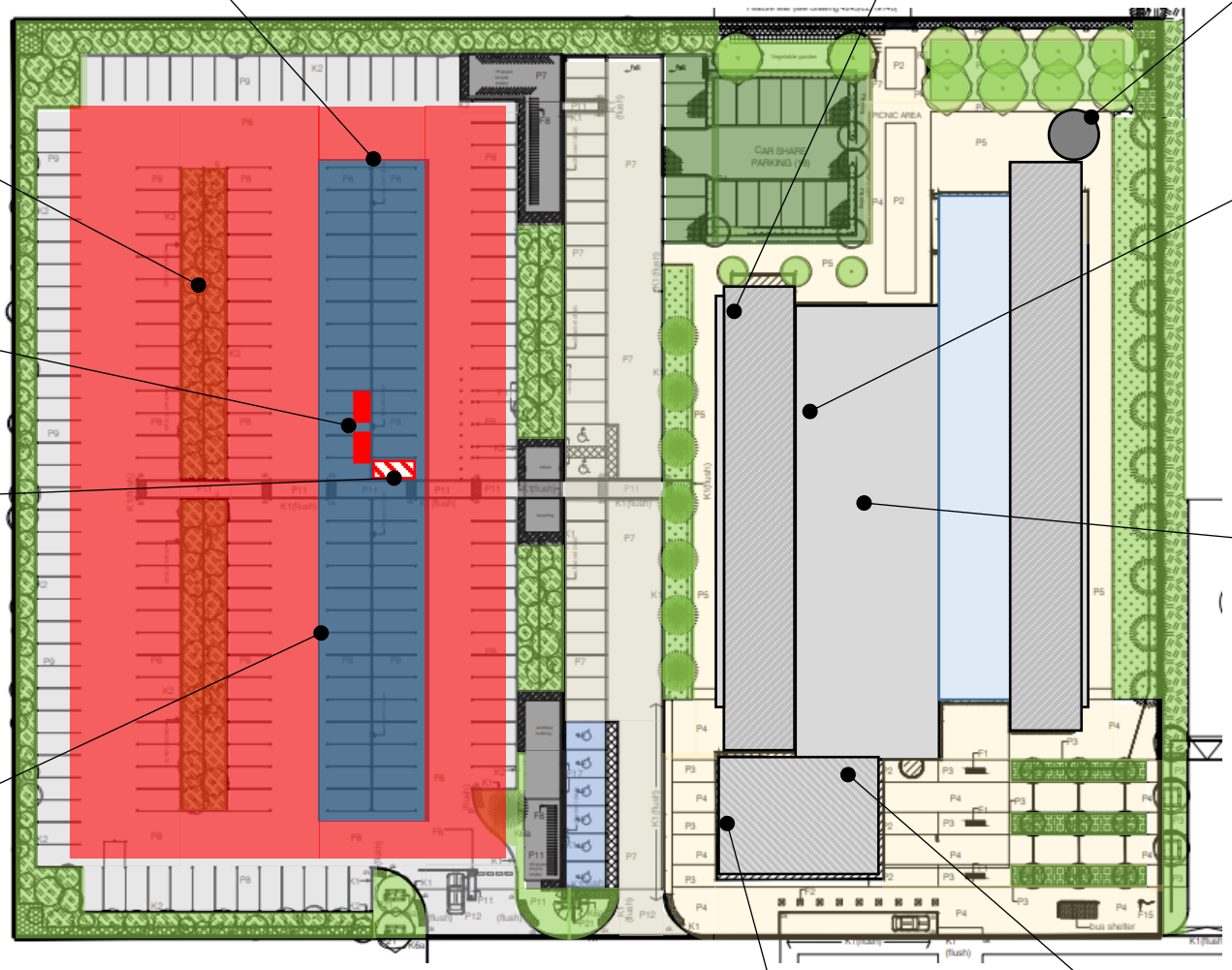
515kWt GSHP
To offset 79% of site's mains gas consumption with renewable heat

20 EV Charges
Integrated into the car port design to promote electric vehicle use

DC/AC Distribution
PV Carport DC/AC cabinet at the expense of 1 parking space

BEMS Renewal
Smart controls to replace the site's existing building management system

Carport LED Lighting
Integrated into the car port design for efficient, low light pollution lighting



Chiller Efficiency
New controls and fans to improve the efficiency of the chiller plant

AHU Fan Upgrades
Improve the efficiency of the ventilation system by 18%

Executive Summary

South Cambridgeshire District Council (SCDC) has commissioned Bouygues E&S to complete an Investment Grade Audit (IGA) for an Energy Performance Contract at South Cambs Hall, Cambourne. This is SCDC's headquarters and is the centre of the council's operations. Whilst modern in its construction, the building represents the largest single energy consumer of the council's estate. The council has an ambition to significantly reduce their carbon footprint, so this site is a key focal point in the delivery of this goal.

Bouygues E&S' appointment was made following the production of a High Level Assessment (HLA) which was undertaken at no cost to SCDC. Our initial options appraisal evaluated a series of technical solutions to meet the council's brief and an outline business case was developed to evaluate the economic viability of the selected scheme. The Investment Grade Proposal summarises the detailed investigations, analysis and outcomes of the audit and the proposed project. It is supported with a numerical business case, which provides a breakdown of capital, operational and lifecycle costs, savings against baseline counterfactual costs, carbon emissions projections and energy performance. Technical designs, product information, tenders and supplier proposals are also appended for South Cambridgeshire District Council's review.

Whilst the IGA and resultant IGP are formed on the basis of the solution proposed as part of the HLA, the additional investigations and research, competitive engagement with supply-chain and optioneering has resulted in a more significant proposition. The differences between the HLA and IGP are explained in the body of the technical documentation.

Pending SCDC's approval, the parties will enter into an Energy Performance Contract for the delivery of the project, in which Bouygues E&S will assume ultimate responsibility for the project's implementation and its ongoing performance. This project is delivered under the RE:FIT 3 framework agreement, which sets out our obligations under this Energy Performance Contract, which include a binding guarantee to achieve the energy savings set out in the Investment Grade Proposal for the duration of the Payback Period.

South Cambridgeshire District Council has declared a Climate Emergency.

Members of all parties at South Cambridgeshire District Council unanimously backed a motion proposing that "South Cambs shows responsible climate leadership by supporting the transition to zero carbon by 2050 in the next Local Plan."

We share this commitment and hope that the proposed project will support the Council in meeting this objective.

Recap of Project Brief & High Level Assessment Outcomes

An initial project brief was agreed between SCDC and Bouygues E&S prior to the commencement of the High Level Assessment. This set out SCDC's main objectives and criteria upon which a decision to proceed would be based. These are as follows:

To explore any potential technology option (to include the investigation of solar car ports located in the carpark) to deliver the following benefits:

- Lower emissions through energy efficiency and renewable energy generation
- Savings on energy bills
- Long-term revenue stream and return on investment
- Increase energy self-sufficiency for the organisation

Our initial High Level Assessment largely accomplished the above objectives and allowed SCDC to make a decision to proceed to the Investment Grade Proposal stage.

The key outcomes of the High Level Assessment formed the targets to be achieved by the Investment Grade Proposal. These included a maximum payback of 13.99 years, a minimum energy saving of 691,981kWh/annum and a minimum renewable energy generation of 570,907kWh/annum. The details of how the IGP matches up to these targets are included under the 'Investment Grade Proposal Key Outcomes' section later in this document.

Summary of Proposal

This proposal combines a series of innovative energy efficiency and renewable energy technologies to form a system that significantly reduces the Hall's carbon footprint. This includes the following:

Solar Car Port	A 136.5kW double-bay car port, equipped with 420 translucent bi-facial monocrystalline high-efficiency solar PV modules and SolarEdge power-optimised inverters to maximise solar yield. The system will have a premium T-Frame mounting system which minimises the risk of collisions when compared to the standard V-Frame	We have designed the solar car port to best match the load profile of the building. The proposed installation would offset over 20% of South Cambs Halls peak electricity demand.
Ground Source Heat Pump (GSHP)	A closed-loop ground source heat pump system, comprising 515kW high-temperature heat pump, 35 200m closed-loop boreholes, located in the car park around the car ports. Subject to agreement, the heat pumps will be located in the ground-floor server room (to be repurposed), with pipework connecting to the main heating and hot water system at roof level.	The renewable heat generated will directly offset the demands placed on the gas boilers, thus reducing gas consumption. We anticipate a minimum of 79% saving in the annual volume of gas consumed by the site.
LED Lighting Upgrade	The replacement of 1,052 existing fluorescent luminaires with high-efficiency LED luminaires throughout the Halls building. We will also incorporate the innovative Light IP lighting controls system to give full, fitting by fitting dimmable control over the luminaires yielding significant operational and occupancy comfort benefits.	The electricity drawn by the LED lights is approximately 60% less than that of the existing fluorescent lighting. Over the course of the year, we anticipate a saving of 15% of site peak electricity demand.
Building Energy Management System Renewal	The replacement of the existing obsolete TREND IQ2 building management system with a cutting edge Priva BlueID building energy management system. This will be programmed to minimise the energy expended to meet the required comfort conditions and maximise renewable energy use via a new demand-driven control strategy. The controls will integrate with the proposed GSHP and new chiller controls (below).	The BEMS will avoid excessive energy demands associated with heating, cooling and air conditioning and will reduce the loads placed on the plant. This in turn will result in avoiding unnecessary gas and electricity consumption.

Chiller Efficiency Improvements:	The modification of the existing chiller and chilled water system to improve its coefficient of performance and delivery efficiency. This will be achieved through the replacement of the existing condenser fans with high-efficiency EC plug fans, replacement of the chiller's controller and floating head pressure system.	We estimate that the chiller modifications will result in a reduction in associated electricity demand of approximately 28%. The new controller will improve the operational efficiency, as well as extend the chiller's lifespan.
Air Handling Unit (AHU) Fan Replacement	The replacement of AHU 01's inefficient belt-driven supply and extract fans and motors with new ultra-high EC backward curve plug-fans with variable speed controls.	This will result in a dramatic improvement in the specific fan power of the AHU by 20%, thus reducing the amount of electricity used to move the same volume of air. Coupled with the proposed BEMS, this will generate significant electricity demand savings.
Electric Vehicle Chargers	We have included for the installation of twenty 11kW smart EV chargers as part of this proposal. These will be integrated into the car ports, essentially allowing a direct supply of renewable electricity to the EV chargers (with mains electricity available when the solar car port is not producing electricity). The original proposal was for six but this has been increased to incentivise further uptake of electric vehicles.	The addition of electric vehicle chargers will provide SCDC with the option to charge for the use of this service, and thus reclaim the energy costs associated with charging. We have not factored any savings or revenues with this measure.

In its entirety, the project will deliver a reduction of 56% in mains gas and electricity demands, 617MWh of renewable energy, 35% reduction in energy supply cost and £47,666/annum revenue via renewable energy subsidies. The overall payback period for the project is just over 16 years. The project is delivered under an energy performance contract, meaning that Bouygues E&S will underwrite the energy performance of all energy conservation measures, as well as guarantee the maximum price of the project. Hence, SCDC may make this significant investment with enhanced confidence and assurance on the delivery of the proposed outcomes.

Investment Grade Proposal Key Outcomes

The project has developed significantly since we embarked upon the High Level Appraisal. We are conscious of the increase in capital cost and in payback duration associated with the works; however, the results of the IGP incorporate various benefits that cannot be measured financially. It can be observed that we have significantly improved upon three of the five HLA Key Performance Parameters, namely:

- **Renewable energy generation increased by 8%**
- **Carbon emissions savings increased by 17.5%**
- **Energy savings increased by 17.5%**

The strategic objectives of this project have evolved over the course of the development of the Investment Grade Proposal. The priorities have shifted toward long-term carbon abatement and realising an improvement in the workspace environment – our aim has been to ensure that the final project specification aligns with these objectives. With these elevated ambitions to maximise the carbon emissions savings involved with the project, we have expanded the scope of the project and incorporated additional requirements that have been raised throughout the IGP development.

The site team at SCDC has seen some changes since we first embarked on this proposal; the new team is focused on maximising comfort for building occupants as well as futureproofing the building. We have worked closely with the team to satisfy these priorities and have incorporated solutions that significantly improve working conditions, allow systems to be used easily, reduce O&M costs and promote sustainable technologies to the buildings occupants.

We are confident that the proposal we have put forward satisfies the carbon emissions targets that were laid out before us and we look forward to delivering such an innovative, significant and ground-breaking project.

Should SCDC decide to move forward with the works then we would enter into a maximum fixed price contract, all foreseeable project costs have to be included within the final project capital cost meaning that SCDC can invest with confidence.

IGP Key Performance Outcomes

Project Maximum Capital Cost	£1,869,674
Maximum Payback Period	16.05 Years
Renewable Energy Generation	617,036kWh/yr (42%*)
Carbon Emissions Saving	171TCO_2/yr (49%*)
Minimum Savings Guarantee	827,331kWh/yr (57%*)

*of existing annual baseline values

Project Benefits

The project will deliver a number of SCDCs strategic goals, minimising South Cambs Hall's carbon emissions being the obvious outcome but also supporting the local economy. Bouygues has a proud history of delivering energy performance contracts in Cambridgeshire and has a diverse network of local delivery partners. The delivery of the GSHP and the Solar Carport will be carried out by companies within Cambridgeshire with other energy conservation measures being delivered by partners located throughout the region.

Comfort level for occupants will be significantly improved. The BEMS proposals will regulate and improve the thermal comfort of the building while minimising energy consumption. This will also improve resilience and the ability to identify and rectify faults with the mechanical engineering infrastructure in the building.

The Lighting controls take this occupancy satisfaction priority one step further, allowing individual fitting dimmable control to tailor work station lighting to individual occupant's preferences. This feature will also promote flexibility in the use of the workspace, noting that SCDC may wish to change the use of areas within the building in future.

The project will significantly increase the value of South Cambridgeshire Hall as an asset. The GSHP and the Solar Car Port will demonstrate that the building is capable of meeting the challenges faced with future energy supply. The flexibility afforded through installing the LED lighting, lighting controls and the new Building Management System will improve the conditions of the building and make the building an even more attractive location for businesses and members of the public should SCDC seek to sublet or hire out areas of the building.

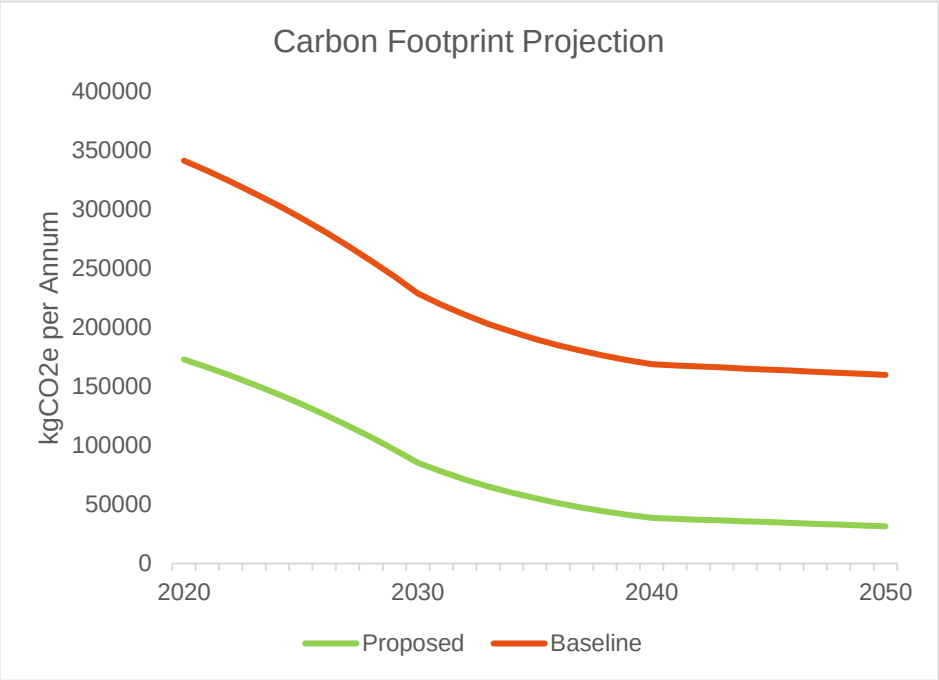
We have proposed a premium solar car port frame that is specifically designed to minimise inconvenience in parking. The T-frame system we have proposed offers the same structural integrity of the industry standard V-frame but designs out one of the main objections to solar car ports. The T-frame system does not introduce any additional obstacles to vehicles when parking, meaning that the risks of collisions is mitigated as far as is possible.

There will also be significant reductions in ongoing maintenance costs. The AHU and chiller upgrades, LED lighting and controls and BEMS upgrades will yield significant O&M savings throughout the length of the project. The lighting controls in particular giving both a cost saving and allowing the site team to perform automatic, scheduled emergency lighting tests rather than the time consuming and expensive evening/weekend manual testing.

Carbon Emissions Reduction

The carbon abatement associated with the project at present (49%) may seem low in comparison with the overall energy savings of 57%. This is due to the difference in current carbon factor between mains electricity and natural gas. At present, the carbon factor for electricity is 0.307kg/CO2e and natural gas is 0.184kg/CO2e. However, this differential is expected to reduce over time.

The Department for Business, Energy & Industrial Strategy (BEIS) predicts a continuous decarbonisation of electricity, due to the continued deployment of renewable energy and nuclear energy generation plants. Comparatively, decarbonisation of the mains gas supply is expected to be less significant in the short to medium term future. Although research is being undertaken into options such as hydrogen injection and gas from renewable sources, decarbonising is likely to be a slow process, even if successful. Hence, the prediction is that the carbon factors associated with gas will remain largely static in the years to come.

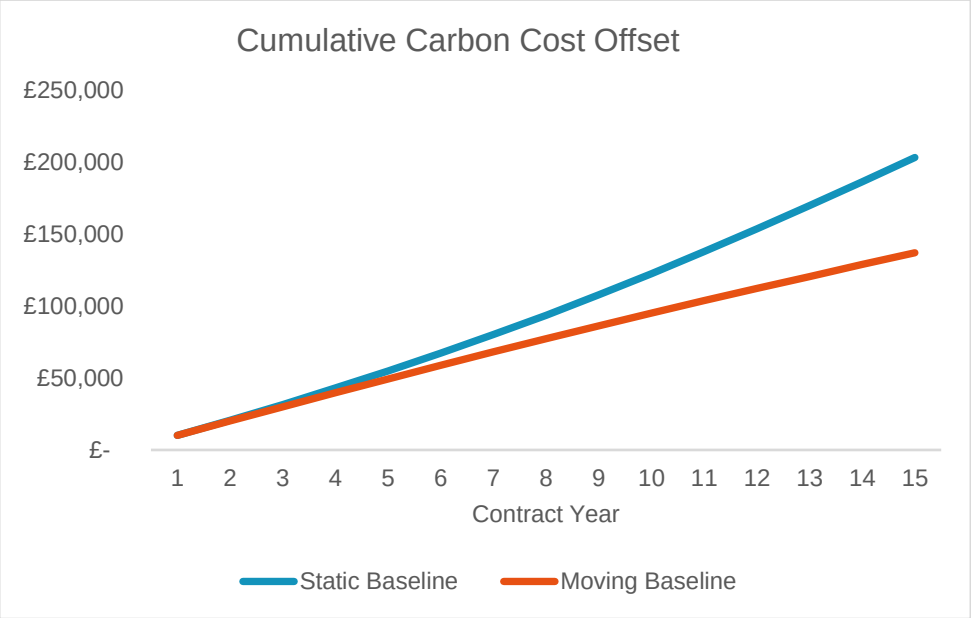


We have simulated the effect of the transition in carbon factors and have modelled South Cambs Halls' future carbon emissions. This compares the proposed performance to the existing baseline. The carbon emissions for South Cambs Hall is forecasted to decrease by over **75% by 2030** in comparison to 2019 emissions. Beyond 2030, the carbon emissions level out as the electricity grid nears decarbonisation. By 2050, CO_2 emissions of the Halls would be **90% lower than 2019 emissions**, at just 32TCO_2/annum compared with today's 341TCO_2/annum. When comparing the carbon emission reductions with a moving baseline (i.e. today's gas and electricity demands are applied to the forecasted carbon factors), the project yields a significant carbon reduction of 60% by the year 2030 and over 80% by the year 2050.

It is acknowledged that this falls short of zero carbon. However, this project certainly places such target within reach and with continued advances in low-carbon / renewable energy technologies, SCDC will be in a good position to reach this objective in future.

Carbon Cost Savings

There are many ways to fiscally evaluate carbon emissions reductions. The Greater London Authority's carbon offset fund values carbon savings at £60 per tonne, which accounts for the cost to human health and wellbeing and the costs in managing the impacts of climate change. By using this figure and applying it to the guaranteed savings associated with this project, we can financially quantify the carbon emissions savings that will be achieved via this project. There is an annual inflationary factor of 1.5% added to this to signify the rising value of carbon savings.



We have compared the static and moving baselines mentioned above to the annual carbon cost savings which has calculated the monetary value of the Carbon savings that we have guaranteed for South Cambs Hall.

The moving baseline scenario which is modelled using the updated annual carbon factors shows a carbon cost of the project at the project's completion of over £135,000. The carbon offset savings associated with the static 2019 baseline is even greater, over £200,000 offset over the duration of the project.

Since there is no way for the council to formally recognise this revenue stream we have not factored this into our payback models. Should we do so then the moving baseline revenues would reduce the payback by almost a year, from 16.05 to 15.10. The static baseline would reduce the payback even further to 14.68 years.

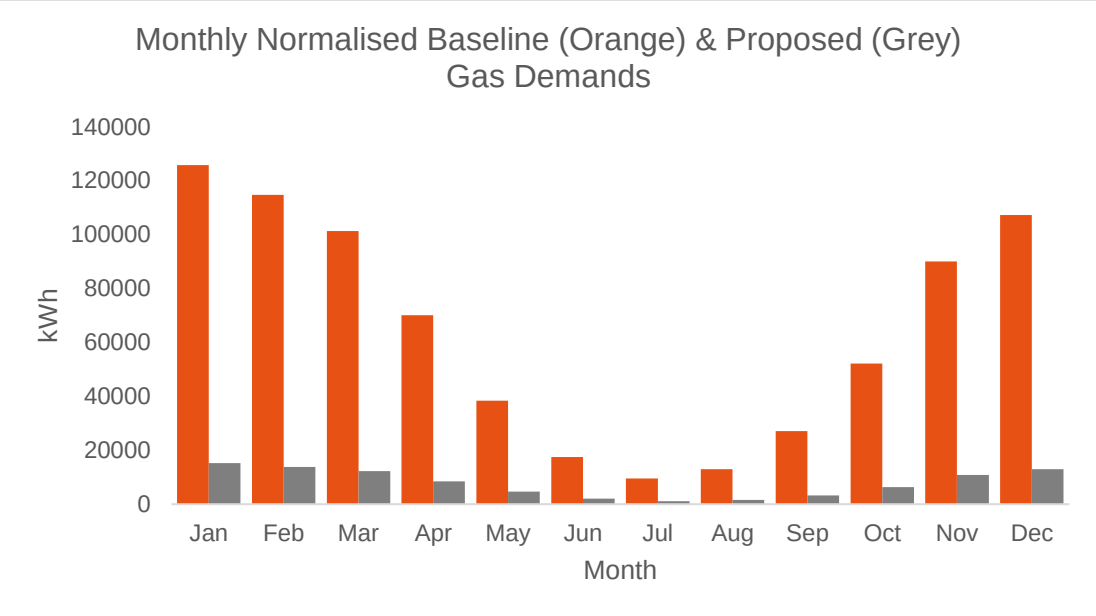
Alternative carbon cost calculations include The Department of Business, Energy and Industrial Strategy's short term traded carbon values, which are available for use in public policy appraisal in accordance with the greenbook accounting method. Although this values carbon significantly lower in the short term, the inflationary factor applied is significantly higher meaning that, in either case, there is considerable value not being accounted for in the business case for the abatement of carbon.

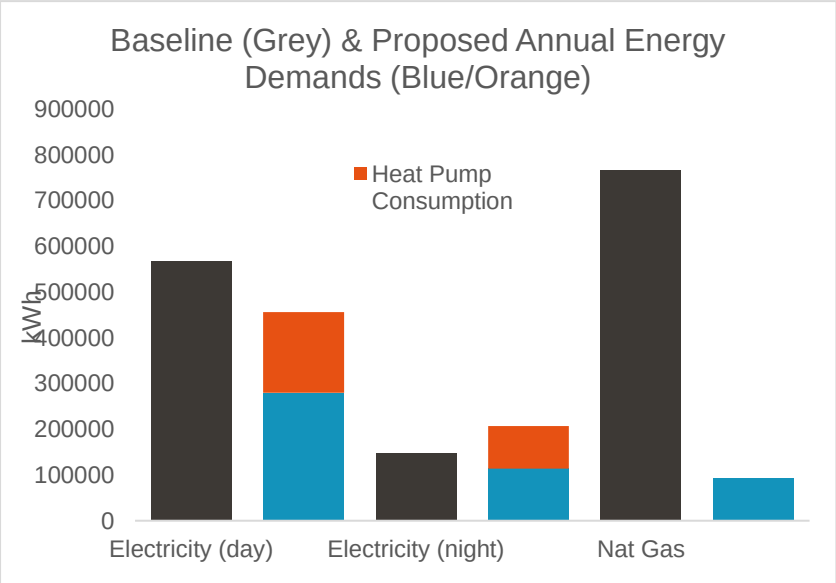
Graphical Report:

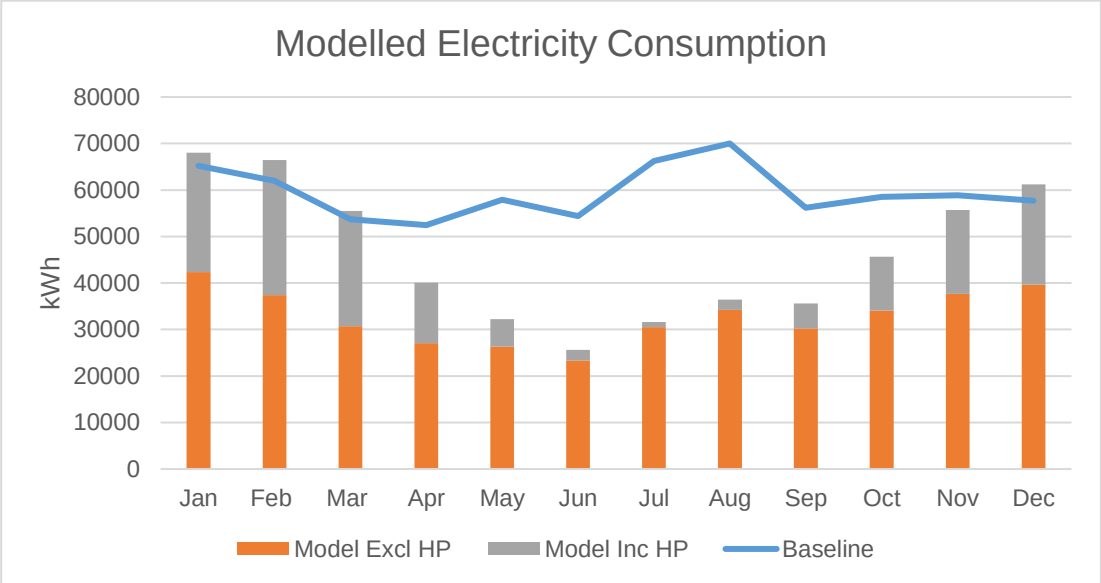
Comparison of Baseline & Reporting

Energy Consumption

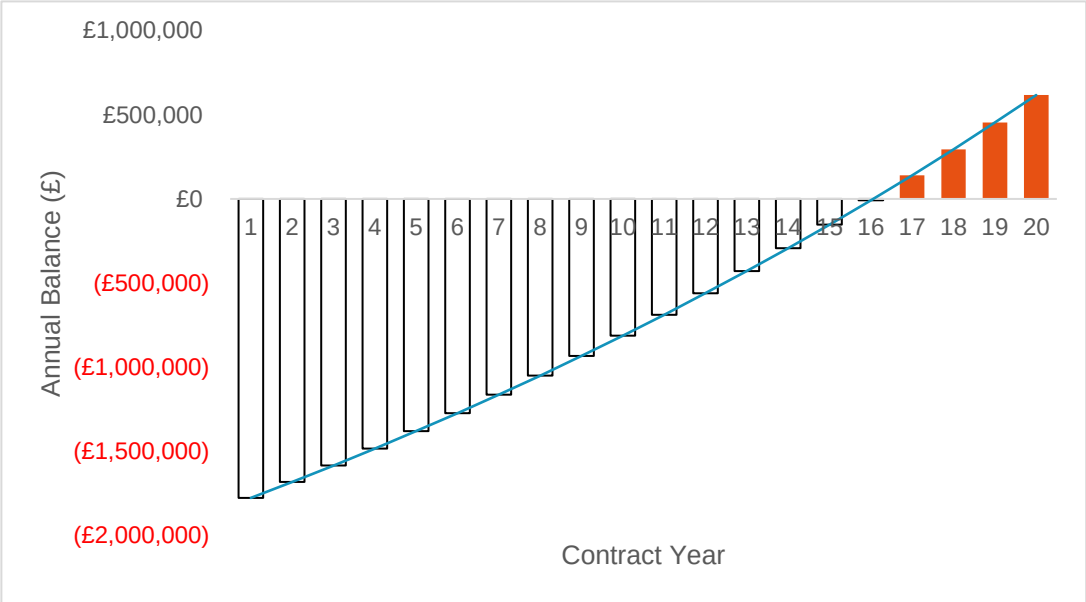
	Consumption			
	Baseline	Reporting	Saving	
Peak Electricity	551647	329649	221997	40%
O-P Electricity	138777	207847	-69071	-50%
Nat Gas	767104	92699	674405	88%
Totals	1457527	644630	812897	56%

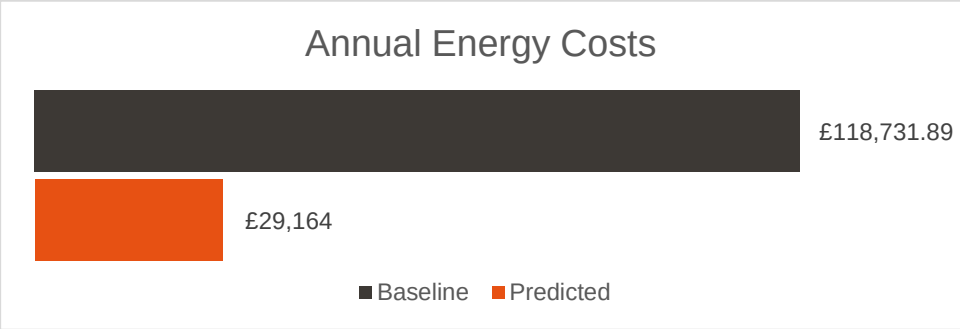


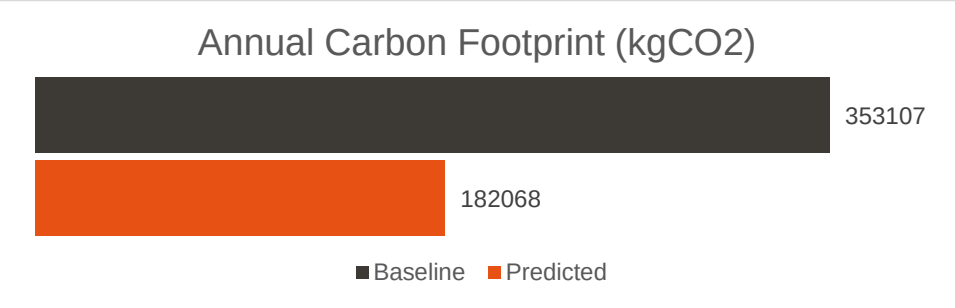


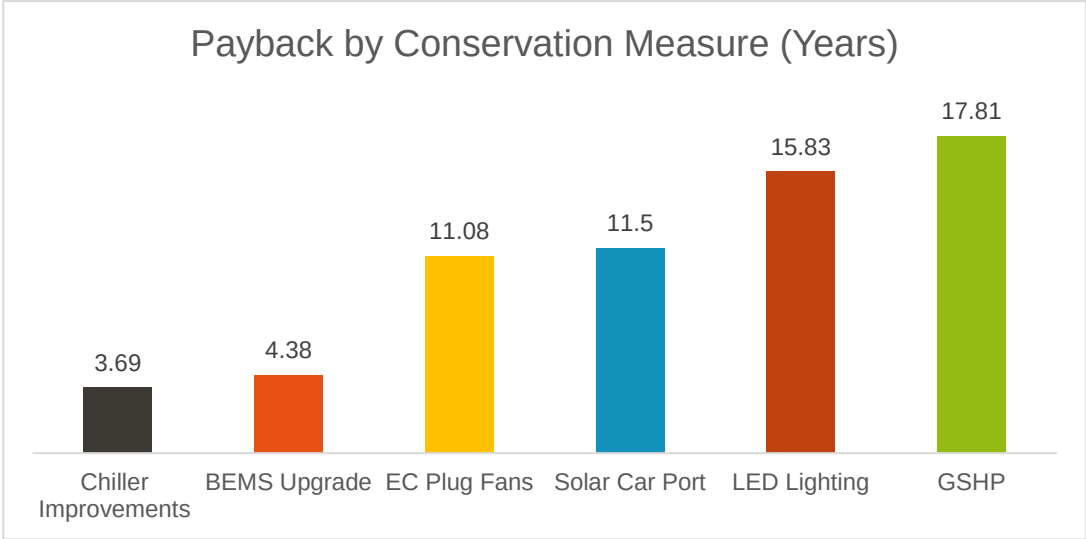


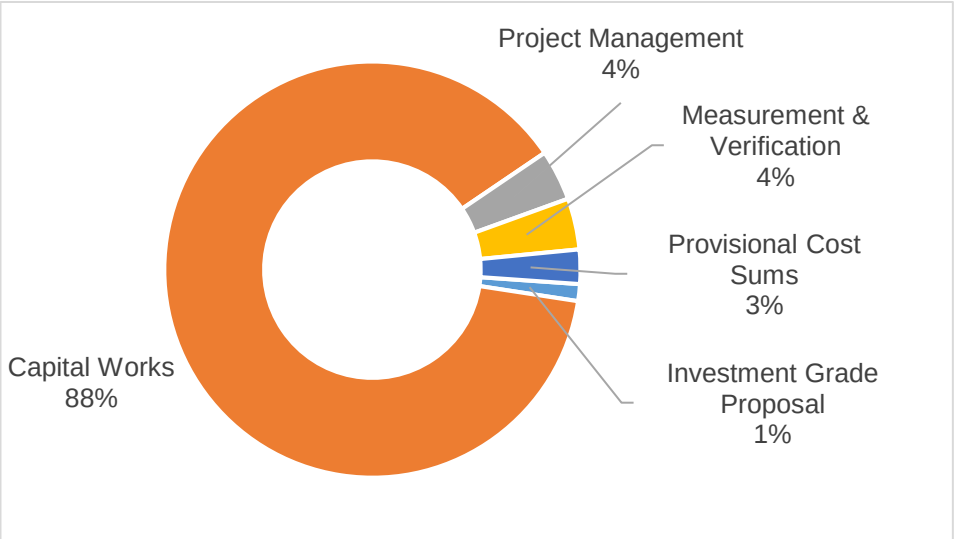
Carbon & Cost Performance Summaries











Cost Analysis

Contract Year	SCDC savings & Revenue
1	£96,836
2	£99,718
3	£102,694
4	£105,768
5	£108,944
6	£112,226
7	£115,617
8	£119,122
9	£122,743
10	£126,486
11	£130,355
12	£134,355
13	£138,489
14	£142,764
15	£147,184
16	£151,754
17	£156,480
18	£161,368
19	£166,423
20	£171,652
Total	£2,610,977
Average 20 yrs	£130,549

Item	Cost	Energy Savings	Carbon Savings	Payback
	£	*kWh*	*kg/CO2E*	*Years*
136.5kWp Solar Car Port	£281,092	111204	34140	13.48
350kWt GSHP	£922,758	463836	67608	17.92
BEMS Upgrades	£36,795	107440	24822	4.38
EC Fan Upgrades	£22,601	11067	3398	11.08
Chiller Efficiency Works	£28,114	49099	15073	3.69
LED Lighting Upgrade	£168,121	70251	21567	12.52
Lighting Controls	£106,997	14434	4431	>25 years
EV Chargers	£34,244	N/A	N/A	N/A
Planning/Design	£22,224			
IGP	£24,270			
Project Management	£72,871			
Measurement & Verificati	£73,283			
Provisional Cost Sums	£49,083			
Total	£1,842,453	827331	171039	16.05

The above graph displays various metrics to assess the individual merit of the Energy Conservation measures proposed in this IGP. Above we can see a breakdown of individual measure costs, energy savings, carbon savings and paybacks. To the left we can see the annual revenues, these progressively increase as prices of gas and electricity increase in line with inflation and RHI increases in line with CPI. We can also see the average annual revenues over both the project payback and over 20 years.