Working in conjunction with

Swanage Town Council Carbon Neutral Plan

Produced by: David Geddes
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Glossary

ASHPs – Air Source Heat Pumps
BAU – Business As Usual
BEIS – Department for Business, Energy and Industrial Strategy
BEMS – Building Energy Management System
BEV – Battery electric vehicle
BMS – Building Management System
CAPEX – Capital Cost
CAZ – Clean Air Zones
CCC – Committee for Climate Change
DHW – Domestic Hot Water
FCEV – Fuel cell electric vehicle
GSHPs – Ground source heat pumps
HEV – Hybrid electric vehicles
HVAC – Heating, ventilation and air conditioning
ICE – internal combustion engine
kWh – Kilowatt – hours
kWp – Kilowatt – peak
MMMF – Man Made Mineral Fibres
MWh – Megawatt – Peak
OPEX – Operational Costs
PHEV – Plu-in hybrid electric vehicles
PPM – planned preventative maintenance programmes
PV – Photovoltaics
tCO2e- Tonnes of carbon dioxide equivalent
T&D – Transport & Distributions emissions
TRVs – Thermostatics radiator values
ULEZ – Ultra Low Emissions Zones
WTT – Well to tank emissions
ZEV – Zero emissions vehicles
ZEZ – Zero Emissions Zone

Executive Summary

Swanage Town Council have made a commitment to be Net Zero by 2030.

The Council team are motivated to achieve this. Co2 Target was employed to identify a Pathway Towards a Net-Zero Future before 2030.

It was agreed that achieving Operational Net Zero, the process of procuring Carbon Credits to offset the carbon emissions, was not addressing the challenge. Net Zero would be achieved by optimising the sites to minimise energy use, removal of all gas heating and the addition of renewables to generate clean green energy.

Locations

Google Earth of Swanage

Areas to be reviewed:

- Town Hall and Annex = 250m2
- Depot (100m2) and Garage (233m2) = 333m2 (this is the same site)
- Swanage Information Centre = 75m2
- Beach Gardens Pavilion – 200m2
- Beach huts x 60 – A single beach hut is approx. 5m2, made of concrete blocks
- Toilets x 7 – A range of different sizes assume a total of 400m2

Total = approx. 1,300m2 (11 sites across Swanage), plus beach huts.

Decarbonisation and Net Zero Targets

There are two distinct ways for the Town Council to achieve their Net Zero ambitions.

Self-funding over the next 7 years as part of a planned upgrade works to the estate or doing this in conjunction with the Grants available from the Government.

The latter will require a fabric first approach, this is explained later in the report. It is now difficult to obtain grants for sites that have not been materially improved first. This work can be as part of the planned upgrades.

If the Town Council wishes to self-fund the works, it can be part of the planned upgrades and programmed to meet the Councils commitments and financial planning.

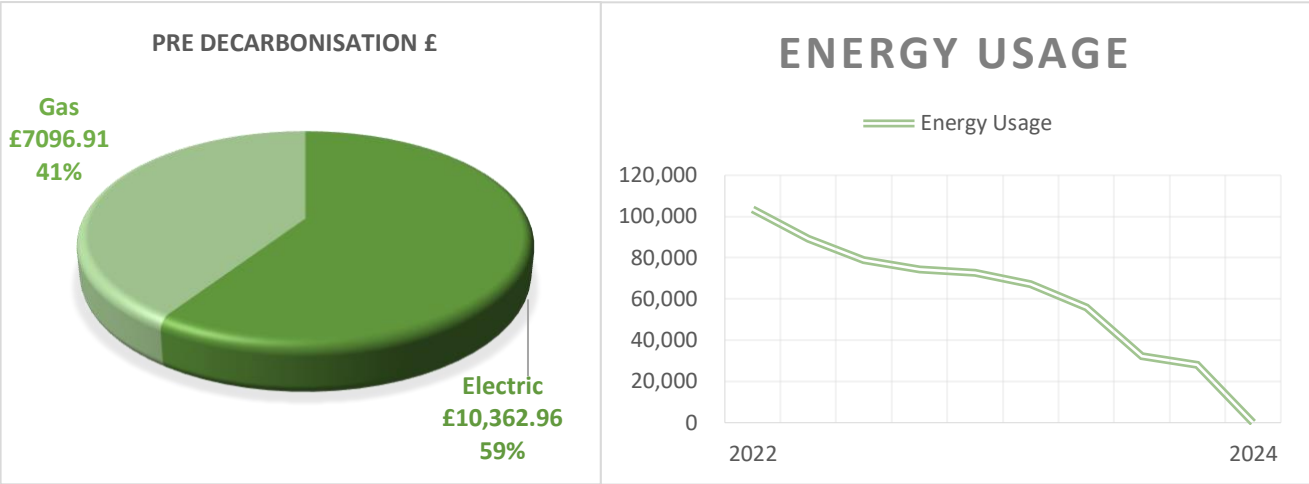
What is not possible for Grant funding is for the projects, other than the fabric upgrades to start, and retrospectively seek grant support.

If Grants are to form part of the plan, after the fabric first, it will largely rest on the decarbonisation of the sites. This is the key focus for the Government, they understand this is expensive technology and have the support for that reason. It is all dependant on the amount of gas the sites use.

The graph below shows how the sites could be Net Zero. Should there be the staff capacity and money available, it is achievable in 18 months.

This can be extended over 7 years by technology type and building if it was self-funded. If a Grant was to be obtained, the round of application would determine the scope of works and the time scales allowed. A multi-year application is possible, however can be very difficult to achieve with a lower amount. Completing these works in an 18-24 month time scale is achievable.

When the Council has decided how they would like to meet their Net Zero Targets, Co2 Target could advise how this could be achieved.

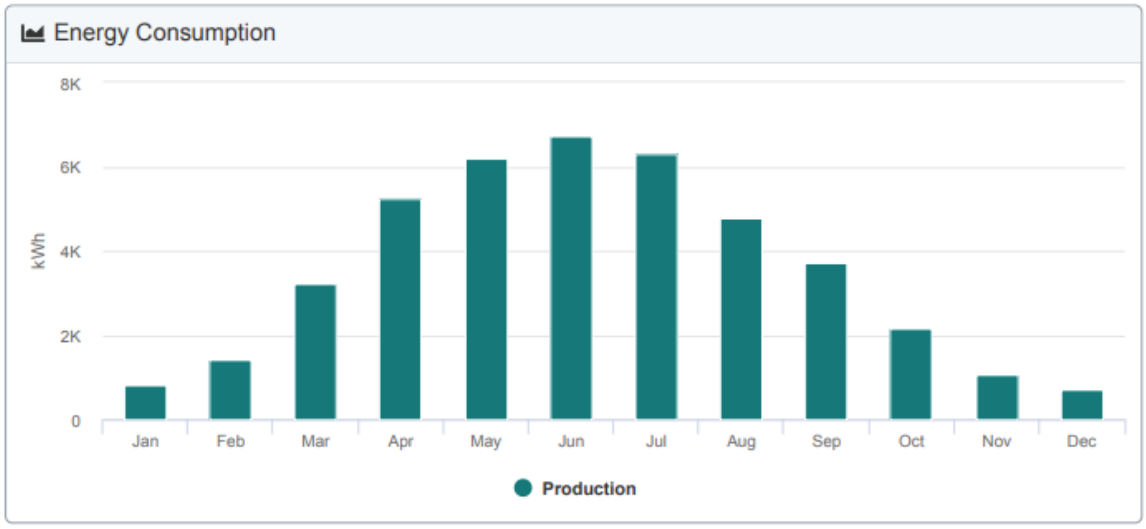


Graph one: Current Energy usage in Pounds

Current kWh Gas: 153,088 p.a
Current kWh Electric: 57,572 p.a

Graph Two: Energy Usage over time following decarbonisation recommendations

The above shows the energy production following the installation of each EMC below. Swanage Town Council (Under Salix Guidelines) will be Net Carbon Zero By 2024 following these recommendations.



Graph Three: Solar PV production over a 12-month period

The above graph demonstrates Solar PV production over a 12 month period. The majority of which is generated during the summer months. In contrast the proposed ASHP will use the majority of the energy in the winter months. The net result will be that there will be a greater requirement to precure energy from the gird in the winter and exporting excess PV energy in the summer.

The net result of this is a Carbon Neutral outcome.

Decarbonisation & Net Zero Costs

The Department for Business, Energy and Industrial Strategy (BEIS) goal is to decarbonise public assets. They are supporting this initiative with grants that is managed by Salix.

The below extract from the recent application shows the total projects costs and total grant available from Salix.

Project Cost	£471,606 est.
Eligible Grant Value	£174,705
Client Contribution	£296,901 (63% of project costs)
Contingency (Recommended)	£100,000*

*Cost to cover project delivery fees, design fees, Employer Requirements, Cost fluctuation in material, unforeseen building costs.

Total Grant Requested	Eligible Grant Value	Carbon Cost Threshold Compliant Grant Value	Total Net Financial Impact	Total Project Cost	Payback in Years	Total Annual Direct Carbon Savings	Carbon Cost Threshold	Compliance
£174,705.00	£174,705	£174,705	£796	£471,606	220	26.88	**£325.00**	**Compliant**

Technology Type	Current Grant Value Split	Grant Value Split %	Adjusted Grant Value Split if Energy Efficiency > 58%	Final Grant Split %
Energy Efficiency	£2,188	1%	£2,188	1%
Low Carbon Heating	£172,517	99%	£172,517	99%

Total Client Contribution	Client Contribution %
£296,901	63%

Extract From Salix Application

Until Salix release the next round of Grant allowance, no one knows what the guidelines are in relation to information required and support available.

This example showed the Council would have to contribute just over 60% to the project cost. It might be on the next round the Carbon Cost Threshold will increase back to £500 per ton of carbon. This would have a positive effect on the Grant achievable.

Technologies used to achieve Decarbonisation & Net Zero

- Air Source Heat Pumps and/or Ground Source Heat Pumps (ASHP/GSHP)
- Building Management Systems (BMS)
- LED Lighting
- Wireless Lighting Controls
- Solar PV

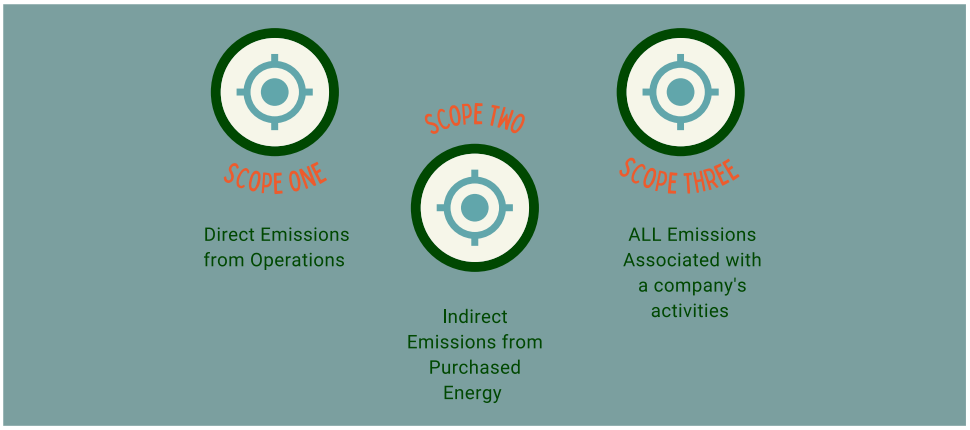
MISSION STATEMENT

To assist Swanage Town Council to reach their goal of becoming Carbon neutral. To fully Decarbonise Swanage Town Council buildings by 2030. While also reducing overall energy production across the site.

A Pathway to Net Zero

1. Prepare a Decarbonisation investment strategy
2. Reduce and phase out the carbon fuels
3. Install what renewable technology is possible on site
4. Work with supply chain partners to support the Net Zero mission
5. Encourage tenants to use less energy on site

Work within the Scope 1,2 & 3 framework to provide solutions for these elements.



Scope One	Scope Two	Scope Three
Company Facilities Company Vehicles	Purchased Energy – Result of energy use	Transportation provided by other companies Employee commuting Business Travel Waste from operations Leased Assets Purchased Good and services End of Life treatment of goods

Breakdown of Scope 1, 2 & 3

Based on 2021-2022 usage (actual bills provided by Swanage Town Council October 21-September 22) The Town Hall, Pavilion, Information Centre and Depot produce 39.2 Metric tons of CO2e. At the time of writing the report we did not have the energy use of the beach huts or toilets but based on size and usage we would estimate that this will produce a further 7 Metric tons of CO2e (electricity only).

	Description	Metric tons of CO_2e
Scope 1	Office emissions (gas)	27.1
Scope 2	Office emissions (electricity)	12.1

Table One: Annual Metric tons of CO2e

The report addresses reducing CO2e produced through Scope 1 & 2. Although Co2 Target were not asked to consider Scope 3 emissions. This area could also be considered further with regards to reducing emissions.

For example, the average petrol car in the UK produced the equivalent of 170.5 grams of CO2 per kilometer (g CO2e per km) in 2022, while diesel cars averaged roughly 170.8 CO2e per km. In comparison, the average battery electric vehicle (BEV) emits considerably less, at 51.4 g CO2e per km [1]. Swanage Town Council are converting a large proportion of their fleet to electric.

[1] https://www.statista.com/

Key plant and equipment audited

Lighting, M&E equipment, Heating / Cooling, BMS

Site	Lighting	Solar	Carports	BMS	ASHP
Town Hall	✓	✓		✓	✓
Depot 5&8	✓	✓		✓	✓
Bowling Club	✓	✓			
Tourist Information centre	✓			✓	✓
Beach Huts	✓	✓			
Public Wc's	✓				
Carparks			✓		
Greenfield			✓		

Table Two: Decarbonisation measures addressed at each site

Auditor

David Geddes – Co2 Target Ltd

Annual consumption summary

The following consumption figures have been calculated using actual energy readings obtained from online invoices. Half hourly data is not available, information has been taken from the invoices provided.

Table Three – Site Details

Site Name	Site Type	Building Name	Building Type	UPRN	Building Age	Postcode	Gross Internal Area of Heated Areas (m^2)	Existing Annual Fossil Fuel Use (kWh/year)	Existing Annual Electricity Use (kWh/year)	MPRN (Gas Meter Number)	MPAN (Electricity Meter Number)
Town Hall	Offices (public sector)	Town Hall	Town hall	0001182237	100	BH19 2NZ	750	81,169 (2019)	10,000	68194903 Not right No.	2000050419221 Npower
Tourist Information	Offices (public sector)	Tourist Information	Offices	0001182364	100	BH19 1LB	250	21,600	3,889	3917443300	2000055982512 Npower
Town Hall Annex	Police station	Town Hall Annex	Police station	0001182365	100	BH19 2NZ	300	32,403	5,912	3917492908	2000050419221 Npower
The Depot	Workshop	The Depot	Storage depot	0001519327	15	BH19 1EJ	800	17,916	17,279	7702942406	2000022420421 Npower
Beach Gardens Pavilion	Community centre	Beach Gardens Pavilion	Sports ground	1057587	20	BH19 1PG	250		8,861		2000022429489 Npower
Shore Road Beach Huts & Toilets	Other	Shore Road Beach Huts & Toilets	Other	1057598	5	BH19 1LD	500		11,631		2000022432862 Npower

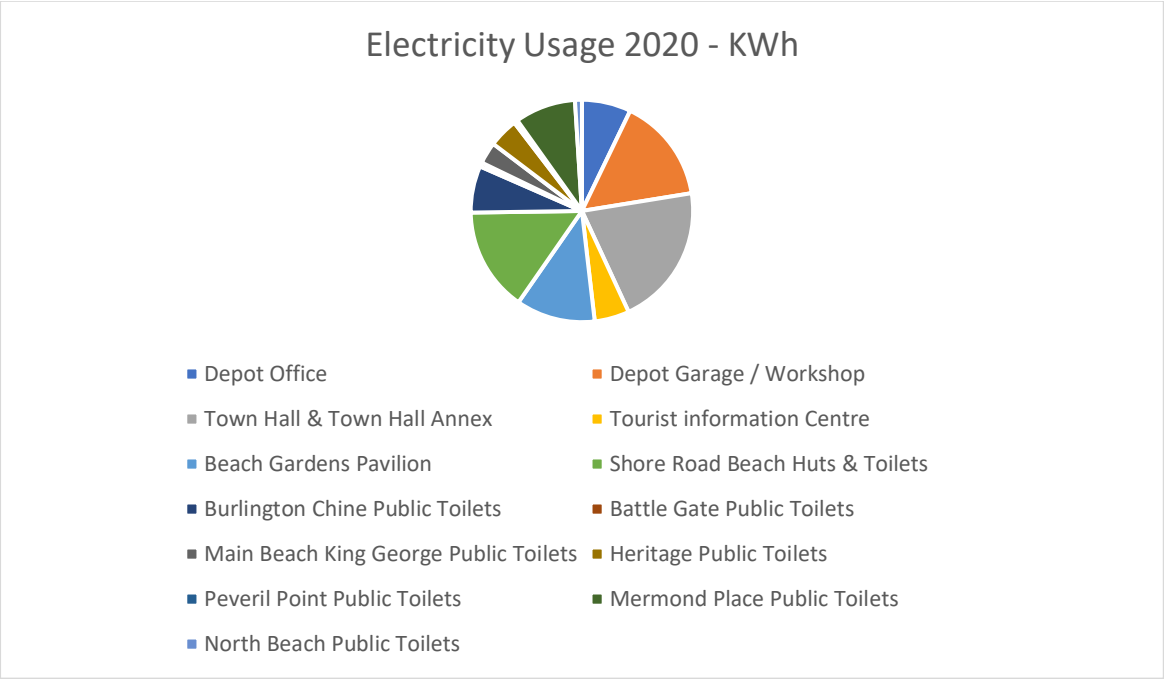
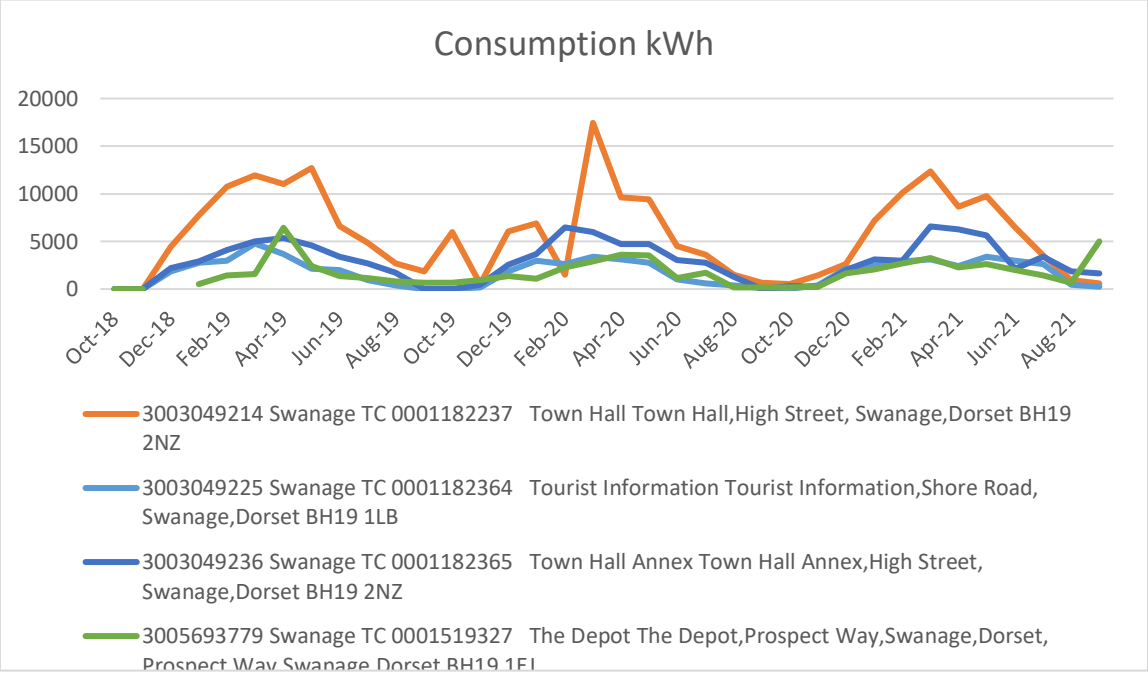


Figure One – Electricity Usage

Figure Two – Gas Usage Oct 2018 – August 2021



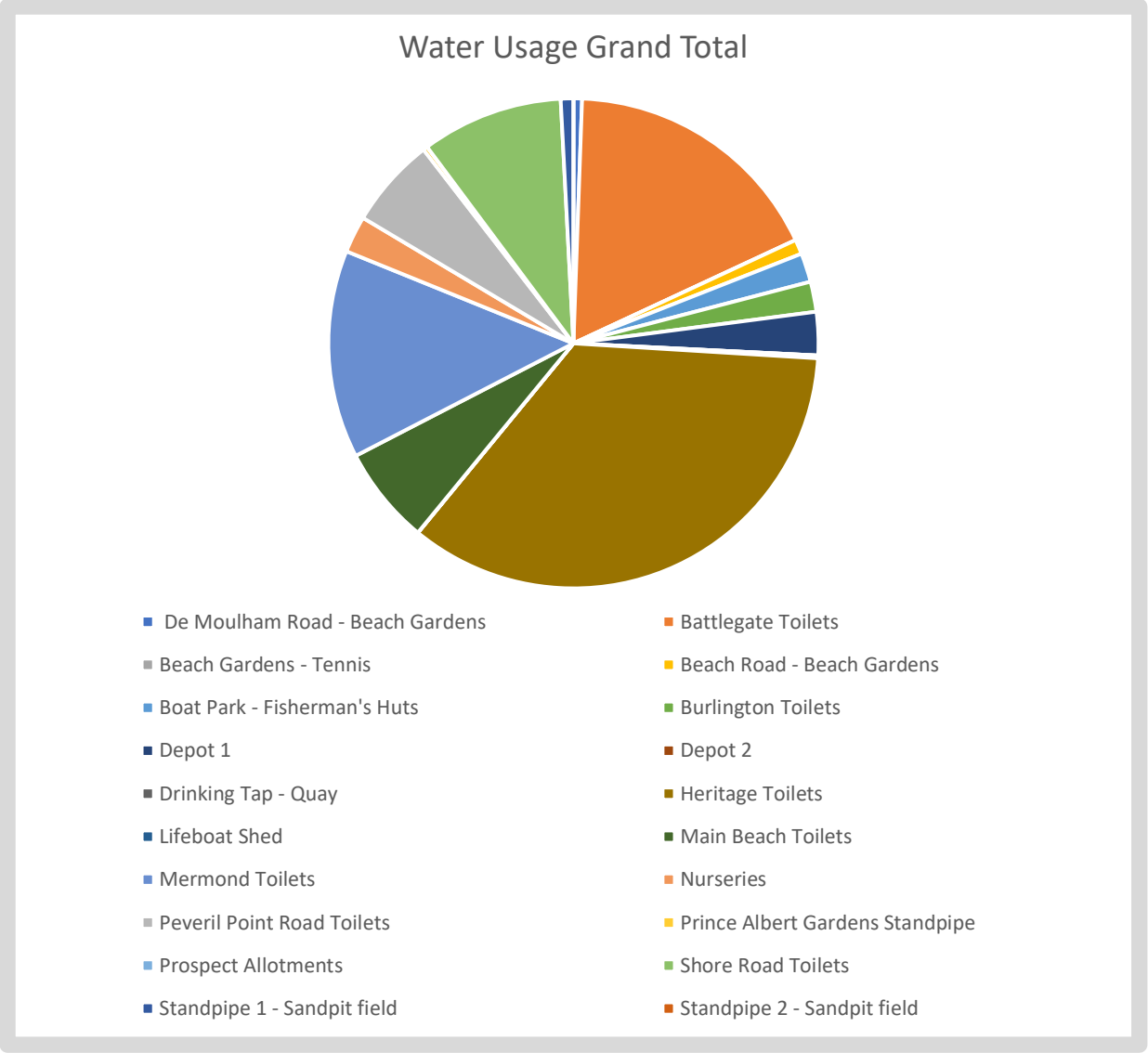


Figure Three – Water Consumption

Sum of Consumption	2020	2021	2022	Grand Total
De Moulham Road - Beach Gardens	41	0	5	46
Battlegate Toilets	288	736	404	1428
Beach Gardens - Tennis			0	0
Beach Road - Beach Gardens	59	20		79
Boat Park - Fisherman's Huts	34	92	30	156
Burlington Toilets		0	162	162
Depot 1	49	133	51	233
Depot 2	0	0	0	0
Drinking Tap - Quay	3	11	1	15
Heritage Toilets	640	1629	584	2853
Lifeboat Shed	0	1	0	1
Main Beach Toilets	0	429	98	527
Mermond Toilets	213	590	317	1120
Nurseries	32	43	123	198
Peveril Point Road Toilets	103	287	96	486
Prince Albert Gardens Standpipe	0	24	0	24
Prospect Allotments			0	0
Shore Road Toilets			763	763
Standpipe 1 - Sandpit field	22	37	9	68
Standpipe 2 - Sandpit field	0	0	0	0
Grand Total	**1484**	**4032**	**2643**	**8159**

Table Four – Data provided by water2business

The main area of use is the Heritage Toilets, it is unclear why the Heritage Toilets have used so much water. It would be Co2 recommendation to monitor this going forward and looking at options of Rain Water Harvesting – See EMC 13

Heating System

Existing Heating System

The site with the greatest challenge is the Town Hall. It is served by three boilers, one of 15 years + and two that by the time the work is completed will be 10 years old. Where servicing is possible the Council cannot continue to support outdated technology that will stop them achieving their Net Zero ambitions.

The building is vital for the operation of the Council and as such when the other two boilers reach the 10-year mark, they will be replaced, and the Council will not be able to install another set of gas boilers that will stop them decarbonising.

The other sites have similarly aged boilers and as part of the decarbonisation, the Council are seeking the Grant support to achieve the removal of fossil fuel from the Town Council. Therefore, by the time the scheme is funded and tendered, this will be in 2023, which would mean the boilers are at least 10 years old.

Technologies Considered

There were two clear goals in the decarbonisation of the heating at the Swanage Town Council sites, removal of gas and the opportunity to apply for a Government Grant to part fund the works.

The leading opportunities to heat sites are;

- Biomass Boilers
- Heat Pump - Air to Air System
- Heat Pump - Air to Water System
- Heat Pump – Ground Source
- Hydrogen Boilers

Each of the systems have their advantages and disadvantages.

<u>Recommendation on Heating</u>

We have chosen to develop the Air Source Heating solution for these sites. They offer the most economical solution to decarbonise the sites. We have explained the technologies in this reports and reasons why we think Air Source would work the best. There is one site that is of concern relating to noise and that is the Town Hall site. For that reason, Water was considered as well as Air. The findings are shown below. We are aware though that due to the timings of the heating replacement it may mean another technology should be explored further.

Biomass Boilers

Biomass energy is a renewable resource that can help to heat our buildings. By replacing our reliance on fossil fuels with biomass, we can reduce the number of emissions that we are releasing.

Like all technologies there are advantages and disadvantages of Biomass boilers.
All these were considered when assessing the sites.

Biomass is labelled as a renewable energy source because we can replace the organic matter by planting new trees in a relatively short time. Most of the wood used in biomass boilers come from leftover lumber from existing logging and sawmills.

Biomass Energy sources are considered carbon neutral. While CO2 gases do get emitted from the plant matter, it should be proportional to the CO2 it collected while living. It does not matter if the trees are burned or they decompose naturally, the same amount of carbon dioxide is going to get released into our atmosphere.

Since most of the biomass getting used in these systems can get sourced locally, the price remains more stable. Other fuels like gas and oil prices are more likely to fluctuate. Different global issues like war, natural disasters, change in country politics can all alter the price we have to pay for fossil fuels.

When we are using the system for direct heating biomass boilers they can reach efficiency levels of 90 percent. Bringing it to relatively the same efficiency of gas and oil boilers.

Biomass boilers are generally larger and need more space than gas or oil boilers.

Before you install a biomass boiler, you need to make sure that you also have enough space to store the fuel source.

Using biomass material that has gone through Torrefaction can help to reduce some of the space needed.

Not only do you need a large area to store your fuel source, but the environmental conditions it is getting stored in also matter. Many of the fuel sources that get used in the biomass boiler need to get stored in a dry environment for optimal burning of the fuel.

While items like wood logs can generally get stored outside if covered, so they stay dry. But if you are using a source like bales or wood chips, you will need to keep it in a dry and well-ventilated area.

More work is required to keep a biomass boiler system clean. On average, the system will need to get cleaned around once every week. Although with developments, these systems are reducing the amount of cleaning required.

Air Source Heat Pumps

Air source heat pumps have a high energy efficiency, can be used with air and water systems for both heating and cooling, and can provide domestic hot water. However, higher initial purchase and installation cost compared to traditional heating systems can be their biggest downside. It is the primary reason Salix offer to support installations.

They can be much more efficient compared to other more traditional forms of heating and can potentially provide all three functions of heating, cooling and hot water in one system. An air to water heat pump can be retrofitted into a home that uses such an existing heating system, such as with a gas boiler.

One of the more significant selling points for air source heat pumps can be their high energy efficiency.

This efficiency is called the Coefficient of Performance (or COP for short), and it measures the energy output compared to the energy input. Most air-source heat pumps are in the two to three coefficient range.

An ASHP can reach a COP of over 4 for the most ideal scenario, meaning that for every 1 unit of electrical energy consumed, over 4 units of heat energy can be provided.

ASHP are electrical appliances and therefore only require an electricity supply in order to work. They are ideally suited to be installed in schemes that have Solar PV and Solar Thermal panels installed. ASHP can be connected up to solar panels, helping to make it a completely green energy source.

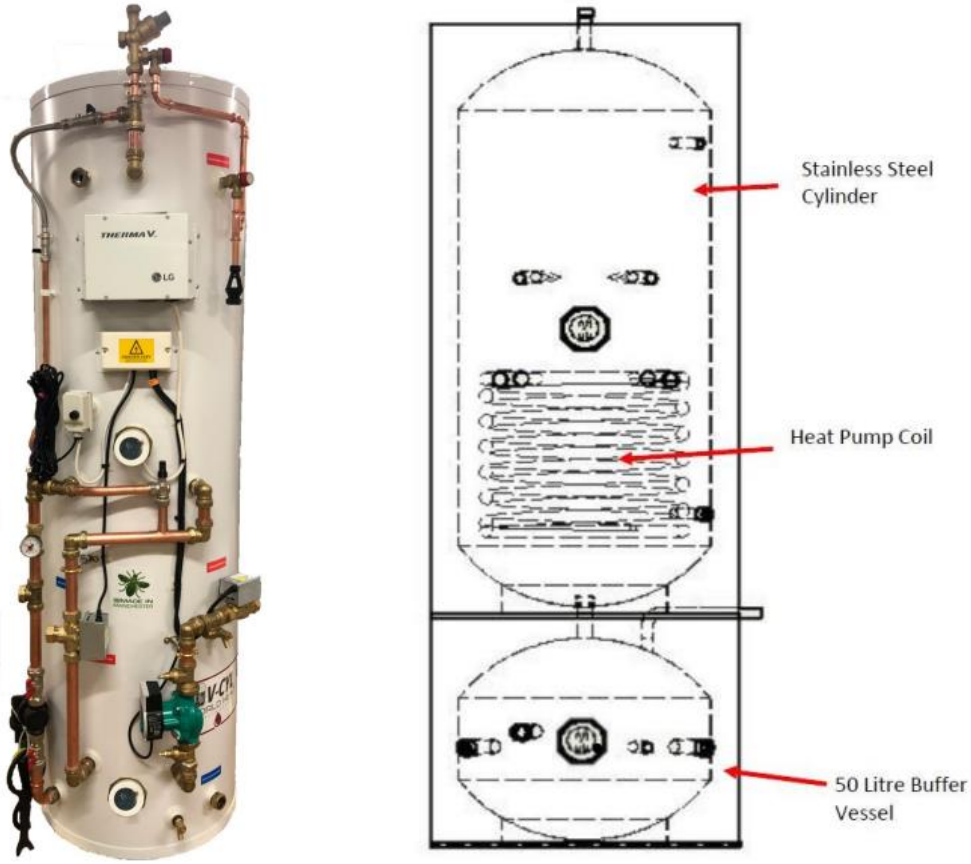
ASHP provide for Heating and Water

Air to water heat pumps can be used to provide hot water for taps, showers etc. alongside being used for space heating.

This allows an ASHP to deliver all of the heating and hot water needs, without the need for a separate system for hot water.

An ASHP will need to be used alongside a hot water storage tank if also being used for domestic hot water purposes.

A hot water tank will allow the water to be stored while the heat pump delivers the heat to warm the water up over time. Such tanks also typically have immersion heaters for when demand outweighs the supply of hot water. An example of a system is shown below;



Pre-plumbed heat pump cylinders specifically for connection to Air Source Heat Pumps

Water Source Heat Pump

Water cooled systems can use a lot of water unless there is a natural water source close to the site, in the case of Swanage, there is the sea nearby which is an advantage, however the saline water needs to be treated. This is not an issue but adds complexity and cost to the project.

They have the advantage of the solution is lower running decibels, something that is important for some locations.

Ground Source

A ground source solution requires bore holes to be drilled or a good surface area that can be lifted to lay the required pipework. Both of these add cost and require space.

Should a Ground Source Heat Pump be investigated it is recommended that a Geological report is carried out ahead of any design works. The report we'd recommend is for the purpose of gaining an understanding of the expected geological conditions and approximate borehole requirements. The initial report is aimed at providing enough information to allow budgetary pricing for the system install. Any estimated loads provided by Co2 Target are to be used as a guide only, it is the client's responsibility to provide accurate load information. This does not constitute a system design and is not warranted.

Initial Geology Scope

The report is intended to inform the very early RIBA stage. Following on from this will depend on the project. Sometimes we recommend we will go on to a more detailed feasibility study at RIBA 2 then concept design at RIBA 3 then technical/coordinated design at RIBA 4 and project oversight at RIBA 5 and the costs vary considerably depending on scope.

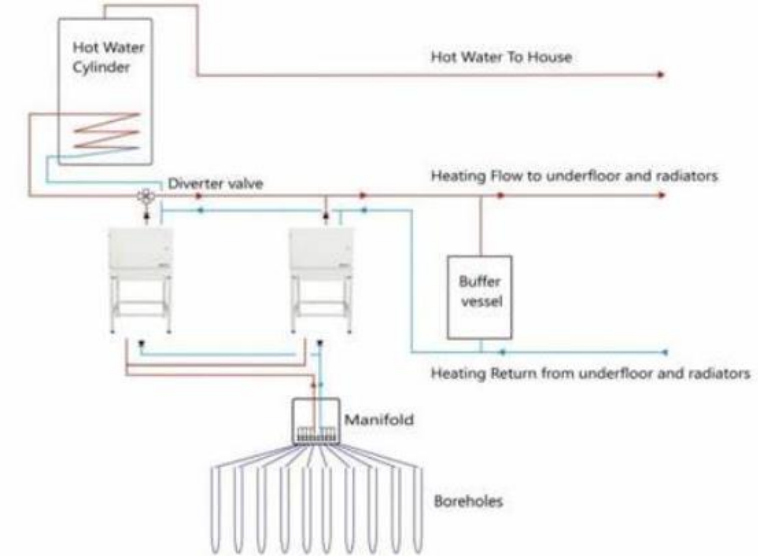
Anticipated Geological Conditions (example only)

Formation	Classification	Conductivity W/mK	Thickness m	Depth bgl m
Fluvio-Glacial	BOULDER-CLAY	1.2	15	15
Till Devensian	DIAMICTON	1.2	5	20
Mercia Mudstone Group	MUDSTONE and subordinate siltstone with thick halite units. Thin beds of gypsum/anhydrite	1.9	>70 (c.1,000 m)	>90

Notes & Comments	
Local Borehole Records to Depth	90 m
Anticipated Groundwater Depth	45 m
Expected Rest Water Level	45 m
Likelihood of Artesian Conditions	Low
Confidence in Geological Assessment	Very Good
Notes on artesian likelihood	No artesian conditions noted in the vicinity of the site on local borehole records to 90 m depth. Furthermore, no artesian conditions considered likely in these strata.

Estimated Ground Thermal Properties (example only)

Quantity	Estimated Value
Expected Drilling Depth	180m
Thermal Conductivity	1.8 $W \cdot mK^{-1}$
Diffusivity	0.100 $m^2 \cdot day^{-1}$
Undisturbed Ground Temperature	10.0 °C
Recommended Grout Conductivity	1.78 $W \cdot mK^{-1}$
Conductivity Test	Recommended



Typical Bore Hole System Layout

Disadvantages Of Air Source Heat Pumps

While air source heat pumps can have a range of positives, there are a number of downsides that can influence whether a heat pump system is installed.

ASHP requires a suitable installation location. This would be detailed on the planning application.

ASHP units can be costly to purchase and install. This install cost however is supported by Salix.

When retrofitting the heating system with a new air source heat pump, heat emitters and ductwork needs to be checked for suitability and may need to be upgraded or replaced altogether. Additional work may be required to bring a building up to a suitable standard for use with an ASHP.

For example, sufficiently large radiators may be required and if a building has older radiators with less than adequate surface area then they may need to be upgraded.

Air source heat pumps work by extracting heat energy from the outside air. To achieve this, they use fans to force air through a series of coils in which refrigerant is flowing through. This refrigerant captures the heat and is sent to be used indoors.

Air source heat pumps can be completely silent when not operating (ASHPs don't have to be running all the time) but can be relatively noisy when they're on.

When demand increases for heating, cooling or hot water, a heat pump can need to work harder, and this can mean louder fan noise.

It is for these reasons a Noise Consultant would be employed as part of the Planning Application. This is covered in a separate section.

Hydrogen Boilers

Hydrogen will be a fuel for the future. Low-carbon hydrogen has the potential to play a significant role in tackling climate change and poor air quality.

There are challenges of converting existing plants from fossil fuels to hydrogen. Systems that are designed for fossil fuels such as natural gas cannot simply switch over to hydrogen without modification. The properties of the two gases differ too much.

One of the main differences is the calorific value, or heating value. Hydrogen has a calorific value per unit volume that is about three times lower than that of natural gas. This means that three times the volume of hydrogen is needed to produce the same amount of heat in a given unit of time. Depending on the supply conditions, this can possibly have an impact on the gas supply system.

The combustion of hydrogen also gives higher combustion temperatures (about 200 °C higher), which potentially has consequences for the boiler. The higher temperatures also lead to more NOx being produced. This is because nitrogen molecules convert more easily to nitrogen oxides at higher temperatures. The problem only arises in combustion with normal outside air, which naturally contains nitrogen.

It is reported that 20% of the gas pipework would need to be upgraded to allow hydrogen to be pumped to homes and businesses. There is no official figure on this, the complexity of the upgrade, time scale to implement or where these pipes are located. Hydrogen is fourteen times lighter than air, so it dissipates immediately when it escapes, there is not an official report out that deems leakages not an issue to the public.

It is clear that switching to Hydrogen is possible but not straight forward and not possible in the immediate future. There are two predominant way of making Hydrogen, the one that would support the Councils Net Zero ambitions is Green hydrogen. This is produced through electrolysis, a process that separates water into hydrogen and oxygen, using electricity generated from renewable sources. Today it accounts for just 0.1% of global hydrogen production.

Insulation for Buildings

There is now an approach of Fabric First when installing new heating measures.

A fabric first approach to building design involves maximising the performance of the components and materials that make up the building fabric itself, before considering the use of mechanical or electrical building services systems.

We can assist in developing a fabric first solution thought material selection advice, thermal bridging analysis, U-performance review and SEM assessments. This ensures the fabric design is fully optimised from the outset.

Integrating energy efficiency into the building envelope can decrease the requirement for new technologies, reducing the reliance on the end user to achieve the desired energy performance of buildings.

As air source heat pumps deliver heat more slowly compared to traditional heating systems, a building needs to be well insulated to keep the heat in long enough for indoors temperatures to rise sufficiently.

When installing an ASHP in a building it is considered best practice to improve insulation to make the most of an ASHP, which can increase upfront costs.

Selection for Swanage Town Council

Air source heat pump have been selected for this project at all relevant sites as they offer the most economical solution to decarbonise the sites. There is only one site that is of concern relating to noise and that is the Town Hall site. For that reason, on this occasion, Water was considered as well as Air. The findings are shown below.

On these costs and a 90 % efficient boiler a heat pump that has a SCOP of more than 3.2 will cheaper run then gas.

	Energy Price Guarantee - From 1 October 2022
Electricity	£0.34 per/kWh Daily standing charge: £0. 46
Gas	£0.10 per kWh Daily standing charge: £0. 28

Table Five – Comparison charges

Water Cooled System

To convert from gas to electric heating, the existing gas usages is supplied along with the current boiler information.

From that a Design report is produced. This design report calculates the required kW required to heat the site. The design report advises of the Outdoor and Internal units required and from that an installation figure is estimated,

Below are examples of the Design report submitted to Swanage for the Town Hall.

It shows two systems, a Water cooled systema and an Air cooled system. The full design report has been supplied in separate documentation and are 60 pages long, so only extracts are included.

The report shows that the system can supply the required heat to the site and from additional work, we know the units can be located internally and externally.

They fully integrate with the proposed BSM system.

1. Outdoor Units

No.	Model Name	Quantity	Description
1	ARWM160LAS5	1	MULTI V Water 5/50,60Hz/R410A/Heat Pump/MULTI V Water 5/EU
Total		1	

2. Indoor Units

No.	Model Name	Quantity	Description
1	ARNH08GK3A4	2	Hydro Kit
Total		2	

Table Six – Proposed Units

Proposed ASHP Units

System 1 – Example

Air to Water system

System 2 – Example

Heat Pumps

The Heat Pumps have two major components, internal Hydro boxes, as shown below and external compressors, shown in the second image.

These systems vary in size and number dependant on the system load. This is communally referred to as the primary heating and the secondary system is the existing radiators.

Hydro boxes – transferring heat from outside

External Therma V units

It is common to keep the Primary and Secondary separate. There are many advantages to this and to achieve the heat transfer, a plate heat exchanger is placed between the two systems.

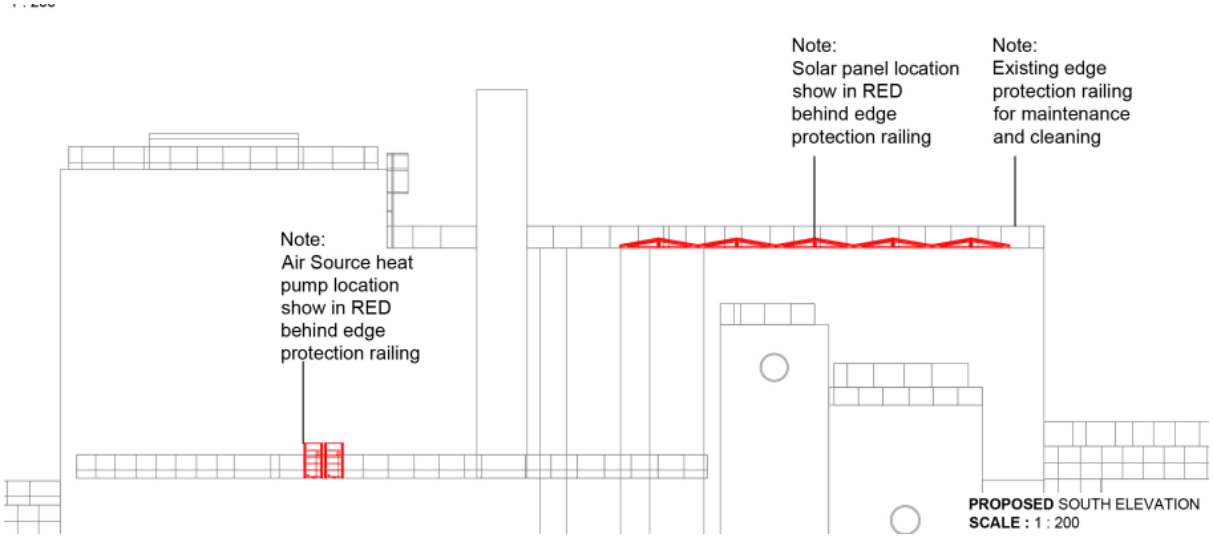
Like the systems, there vary in size, an example of one is shown below.

Plate heat exchanger

Consultancy Noise and the need for Planning approval

To decarbonise the sites at Swanage, it was vital to remove the use of fossil fuels, in this case gas, that provided heat to the buildings. The most likely solution to heat the sites is electric heating. Although gas is removed, the electrical loads will increase. To work towards the Net Zero goals, renewables would need to be installed to offset the increase in electricity of the heating system and lessen the site usage for lighting. These solutions will have external plant added to the buildings.

The external heat pump unit of an air source heat pump system can look much like a commercial air conditioning unit. Whilst it is a great solution, Air source heat pumps aren't always the most aesthetically pleasing to look at and are therefore typically installed down the sides of a buildings, roofs and out of the main views. When the planning application is submitted, drawings show where the units will be located externally and the impact on the surrounding areas.



Example of drawing submitted for planning

Planning Approvals for schemes introducing new noise sources to locations close to noise sensitive premises will often include a BS 4142 planning condition. The purpose of the resulting assessment is to determine the significance of the noise impact and, where necessary, limit the impact through the implementation of mitigation measures. Such mitigation measures might include reselection of plant, repositioning of noise sources, limiting times of use or specifying acoustic treatments.

In the planned works, the Town Hall would have required mitigations measures.
It was for that reason that two Heat Pump options were investigated, Air and Water.
Planning applications would very likely have noise implications relating to noise impacting on a proposed site, or a proposed development impacting on the surrounding area.

Included in the Heat Pump proposal was a cost for a Noise Consultant to review the Town Hall. The other sites, due to their commercial locations would have not required this service

and advising the local planning office of installation of the Heat Pumps would have been sufficient.
A typical noise assessment might include;

- Noise surveys to establish existing noise levels affecting a site, particularly important with businesses and private houses near the Town Hall.

- Prediction and assessment of noise from the proposed development impacting on the surrounding area; part of the work is to predict the decibel levels for the proposed equipment, an example is shown below.

- Prediction and assessment of existing noise impacting upon the proposed development.

- Specification of mitigation measures to ensure relevant National and Local standards and guidance levels are met.

- Preparation and issue of a technical report suitable for submission to the Local Authority.

Plant	Period	Plant noise limit, dB	
		Sound Power Level, L_{wA}	Sound pressure level at 10m, L_{pA}
Vertical MVHRs (total)	Day time (07.00-23.00 hours)	68	40
	Night-time (23.00-07.00 hours)	66	38
AHU + Low MVHR (combined)	Day time (07.00-23.00 hours)	62	34
	Night-time (23.00-07.00 hours)	59	31
Dry Air Cooler	Day time (07.00-23.00 hours)	70	42
	Night-time (23.00-07.00 hours)	66	38

Example of Plant noise limits

Plant Reference	Unit/Model	Sound power level
ASHP1-4	LG Electric ARUM120LTE5	83dB L_{wA} each
ASHP5-8	LG Electric ARUM200LTE5	90dB L_{wA} each

Table Seven – example of decibel levels of proposed equipment

Planning

When planning is applied for, part of the submission is the detail of the installation of the ASHPs, and solar PV panels and associated inverters.

When that approval is given the Council will make it a condition of the planning approval that the proposed scheme will not exceed a stated dB(A) level. An example of this statement is shown below;

03 The development hereby approved shall not operate at a level higher than 45 dB(A) at the nearest noise sensitive premises/residential property façade(s) at all times, unless prior approval has been obtained in writing from the Local Planning Authority.

With acoustic design we can ensure the planning conditions are met.

Plant noise impact assessment

The cumulative plant noise levels at the nearest noise sensitive receptors will have been predicted.
The assessment will consider distance attenuation and directivity. The predictions would be based on the proposed plant all operating at full capacity at all times. Predictions would be inclusive of the attenuation provided by an acoustic screen should one be needed.

The results of the assessment would summarise the noise at the closest residential windows. All other nearby receptors benefit from increased distance/screening to the plant such that resulting noise levels will be lower than at the receptor considered.

Vibration isolation

To control plant vibration into the building structure it is recommended that all plant is installed on suitable anti-vibration mounts. This should avoid any risk of structure borne noise from the plant into the workspace.

Noise levels of outdoor units

When the Design is finalised the noise levels for the outdoor units would be assessed.
The sound pressure level (SPL) dB(A) mentioned below in the example is measured at 1m distance at full load (100%) operating condition.

As mentioned, If the receptor location is far away at 30m distance from outdoor units it is expected there could be reduction of about 25-30dB(A) SPL.

The report assumes that the units will operate at full load for noise predictions. It is worth noting that units will not be operating at full load (100%) condition all the time, during part load (75%,50%,25% etc.) loading conditions the SPL would be variable and reduce continuously.

Furthermore, the units would hardly be operating in the night time assuming the site would only be used for day office works. So, the expected noise level would be almost zero during

the night time. It is important though to check the target sound level needed to be maintained during day/night time.

[Noise level of outdoor units]

Outdoor Units	Sound Pressure Level dB(A)		Sound Power Level dB(A)	
	distance 1m		NA	
	Cooling	Heating	Cooling	Heating
ARUM241LTE5	62	63	84	86
ARUM400LTE5	65	68	90	93

Table Eight - Example of noise levels in heating and cooling modes

The nearest site to the Town Hall is a commercial building and it was not clear if there was residential in addition to that.

If the noise suppression did not achieve the required nose levels, an oversized outdoor unit could be used or a Water based Heat Pump as detained in the report.

Proximity of buildings to Swanage Town Hall

Acoustic terminology

Parameter	Description
Ambient Noise Level	The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near (LAeq,T).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1/s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa. The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.
dB(A), LAx	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).

Table Nine - Existing Heating System

Site Name	Make/Model	Age of System (Yrs)	Output Load Per Unit (kW)	Total Output Load (kW)	Current Seasonal Efficiency (%)	Existing Flow Temperature for Space Heating (ºC)	Hot Water Temperature DHW (ºC)	Does Fossil Fuel Heating System form part of a Multi-Building System?	Removal of Existing Equipment £	Main Equipment Including Controls £	Plinth, Pipework Connections Insulation £	Installation £	Commission £	Cost of Fossil Fuel Replacement System [like-for-like]
Town Hall	Vaillant ecoTEC plus 624 R1	15	24	24	68%	80	80	No	£2,500	£5,500	£1,500	£7,500	£500	£17,500
Town Hall	Vaillant ecoTEC plus 624 R1	15	24	24	68%	80	80	No	£2,500	£5,500	£1,500	£7,500	£500	£17,500
Town Hall Annex	Potterton Promax FSB 30 HE	15	30	30	68%	80	80	No	£2,500	£5,500	£1,500	£7,500	£500	£17,500
Tourist Information	Vaillant ecoTEC plus 624 R1	9	24	24	68%	80	80	No	£2,500	£5,500	£1,500	£7,500	£500	£17,500
The Depot	Green star 28i Junior Combi MkV	9	28	56	68%	80	80	No	£2,500	£5,500	£1,500	£7,500	£500	£17,500

Table Ten - Proposed Heating System

Town Hall	ASHP	FF System 1	LG	Multi V	3.00	22	1	22	93%	65	35	Space Heating and DHW	Radiators	£50,886
Town Hall	ASHP	FF System 2	LG	Multi V	3.00	22	1	22	93%	65	35	Space Heating and DHW	Radiators	£47,886
Town Hall Annex	ASHP	FF System 3	LG	Multi V	3.00	33	1	33	110%	65	35	Space Heating and DHW	Radiators	£47,886
Tourist Information	ASHP	FF System 4	LG	Multi V	3.00	33	1	33	138%	65	35	Space Heating and DHW	Radiators	£59,859
The Depot	ASHP	FF System 5	LG	Multi V	3.00	33	1	33	59%	65	35	Space Heating and DHW	Radiators	£53,500

Lighting Considerations

Lighting and Lighting Controls Technical Specification

To support reaching Net Zero, targeting the lighting and lack of controls at the various sites should form part of the solution.

It is important to ensure the solutions to be installed utilise the current improvements in specification of LED's and incorporate controls. These two measures ensure maximise savings and offer long life cycle savings.

It is also important that any solution provided meets minimum performance specification and should controls be added, they offer the client ease of use, while delivering additional savings.

Below outlines what specifications should be met for all solutions.

There should not be a, one solution fits all approach. Each site is different in the use, occupancy and layout, as such Bespoke designs ensure the site is aesthetically improved while the detailed specification ensure uniformity of performance.

Light Fitting Performance Criteria

- Minimum performance 100 Delivered Lumens per Watt
- Minimum L80 at 50,000 hours, or L70/B10 at 60,000 hours
- MacAdam Ellipse ≤ 3
- Power Factor ≥ 0.90
- Total Harmonic Distortion ≤ 10
- Warranty of 5 years not subject to any operational hours
- LED fitting to be; UV stabilised; and TP(a) compliant supported by material datasheet
- Luminaires have option to include wireless controllers and sensors.
- Luminaires to be supplied with a DALI2 driver to allow integration with an IoT controller
- Must comply with latest IEC and BS standards
- CE (European Conformity) marked

Lighting Control Performance Criteria

- Able to offer DALI2 control system as part of solution
- A control system to control individual fittings (or small group of fittings) to allow commissioned control of luminaire profile settings to include –
    - On Level
    - Fade Time
    - Standby Time
    - Standby level

- Absence Detection
- Occupancy Sensors. Where presence detection is required, each luminaire / area / room shall be installed with an occupancy sensor.
- Digital Addressable Lighting Interface (DALI2) control system

A lighting controls system should have:

- Less than 0.5w standby
- Energy reporting
- Emergency Lighting reporting
- Remote access
- Fault identification
- Monitoring Standard for automated Emergency testing standard BS 62034

Daylight Integration

- Daylight sensors can be integrated into an individual luminaire / room / area to integrate with the device in the luminaire or,
- Be supplied as a standalone sensor with device. The sensor and device require LNE connection only and no additional wiring between luminaires.

Emergency Reporting

- When used in conjunction with compatible self-test control gear devices can monitor the status of emergency luminaires.
- All emergency luminaires require a LNE connection only and do not require an additional live feed or key switch testing
- Emergency statuses shall be capable of being viewed remotely or when on site

The system should be capable of reporting –

- A faulty luminaire
- The type of fault – battery, charge or lamp
- When the luminaire last reported
- If a luminaire has not reported in the last 28 days

Bespoke Designs

All lighting replacements or upgrades should stipulate that a Lighting Design is done. Projects, however small should not solely rely on the word of an existing supplier for solution compatibility to the specifications above. An independent assessment should be sought.

Lighting design requirements

- RELUX design (or similar) software analysis for artificial lighting scheme (if the lighting is altered)
- Able to provide a full RELUX (or similar) design software analysis including emergency and escape lighting for any project, if selected as preferred supplier and the current installation is altered.

- All lighting proposals are to meet the current CIBCE guidelines relating to each area (if altered);
    - Standard maintained illuminance lux levels
    - Uniformity ratio
    - Glare index
- Light fittings must be suitable for chosen area and outdoor fittings used to be vandal resistant if required
- LED technology must be adopted to benefit from lower power consumption.

Building Management Systems Consideration

In an ever-connected World and the digitalization of buildings becoming more connected, it is increasingly important to have sight of all building data.

From enhancing occupant comfort and productivity or to improve operational and energy efficiency, building management systems enable you to connect, monitor and operate your facility easily.

A Building Management System allows the occupier to manage and monitor equipment such as air-conditioning, heating, ventilation, lighting, power systems, among others. They can reduce energy costs and carbon and operate a greener, more sustainable building by managing energy consumption, schedule operations, detect faults, and generate reports and alerts.

The BMS can be integrated with other systems and devices, such as smart meters, sensors, cameras, and electric chargers, to create an integrated building management system (iBMS). A BMS can be accessed and controlled remotely via web or mobile applications, allowing users to adjust settings and view data from anywhere.

BMS can benefit building owners, operators, and occupants by reducing costs, improving performance, enhancing safety, and lowering environmental impact.

Optimising Proposals

The proposal is to link the buildings together and give remote access to the Town Council. The advantages have already been referred to in the opening of this section.

<u>Buildings covered</u>

Town Hall
Operations Department
Beach Gardens Pavilions
Beach Huts
Tourist Information

Our proposal covers every aspect of the required control solution from conventional HVAC control. Bespoke energy efficient BMS control software shall be created and installed within the BMS Controllers to both manage and monitor the HVAC, Environmental & Electrical systems. All projects use a hybrid approach to their control.

The physical onsite BMS control is managed by the latest Distech Eclypse equipment which is an incredibly powerful package of control solutions.

While each site can have a graphical User interface accessible via the control panel mounted Touch Screens (or via Web Servers if these controllers are added to building networks) we have also provided the latest Priva cloud based Digital Services package for the sites. This is configured to seamlessly interface with the Distech BMS equipment and provide the User(s) with a cloud based access and analytics platform that can be viewed from any PC or smart device with internet access.

To provide comprehensive environmental feedback each building has an array of new wireless sensors installed that provide temperature & humidity into the BMS.
In addition to the above should the project progress we can discuss the Priva EcoBuilding package to be included.

This are able to build a Digital Twin of the buildings within the EcoBuilding cloud package. The Digital Twin will then model live system environmental and HVAC data (as compared to geographically correct meteorological data) for the area before taking control of the BMS to make sure the building is operated in the most effective and efficient way.

The software routines will include weather compensation, summer heating hold-off, plant duty rotation and time optimisation as a minimum, which shall be applied to each of the buildings.

Proposal

The current operation is a simple central heating programmer arrangement and is far from energy efficient.

The BMS shall have the latest Priva Blue-Id controls and have wireless temperature/Humidity/Co2 sensors installed on each floor that shall stream environmental data into the BMS software.

The latest Priva Eco cloud-based AI control shall be employed to maximise energy efficiency by creating an environmental digital twin model within the secure cloud using this to profile the building. The Eco AI package will then provide real time energy efficient control command sent directly into the BMS.

Remote Priva Cloud connectivity shall also be available to the client allowing then monitor and control the building from anywhere.

If the budget would not stretch to individual systems we are proposing to link via remote controls if possible.

The existing MCC Controls Panels (where appropriate) will be re-used and converted to Priva BMS control. Where there is no existing control panel or enclosure to house the new controls then a new ABS enclosure will be supplied & installed.

User Interface

• The BMS controls equipment that is specified for this project has in-built Web-Server that will provide graphics pages that, at the Civic Centre, will be displayed on the existing 10-inch Touch Screen mounted on the fascia of Control Panel.

Dedicated graphics pages will be created for each building that detail the BMS controlled HVAC plant and will provide the User with complete and secure (Password protected) access to the system, including access to adjustments and historic data.

Metering

While there are no meters to be BMS monitored detailed for this project, the BMS equipment selected is more than capable of undertaking any future metering requirements either by traditional pulse-point monitoring or via data integration (Mbus, Modbus, etc)

The BMS software would automatically data log the data in ½ Hourly, Hourly, Daily, Weekly and Monthly readings which will be available to the User via the BMS graphics pages. The User will also be able to extract specific meter data in a spreadsheet friendly CSV format.

Support & Maintenance

To ensure the system continues to operate correctly during the changing seasons we recommend 2 x ½ day service visits to check the system within the 12-month period leading on from practical completion.

We also advise a 4G Network VPN remote access solution so we can fully support the site remotely through the warranty and on-going maintenance periods. This approach provides a far superior service for the client as we can safely access the system and make any necessary changes from anywhere and without delay.

Projected Timeline – Via Salix

In order to comply with the Salix guidelines and for funding to be compliant all works need to be completed by March 2024, please see below projected timescales:

Milestone description	Assigned to	Progress	Start	Days
Feasibility Study				
GAS to ASHP	Co2 Target	100%	14/09/2022	3
AS to GSHP	Co2 Target	100%	14/09/2022	1
BMS review	Co2 Target	100%	14/09/2022	2
Lighting Review	Co2 Target	100%	21/09/2022	1
Solar PV Review	Co2 Target	100%	16/09/2022	3
Project Planning				
Pre Deign Stage 3		0%	01/03/2023	30
Cost Plan		0%	01/04/2023	14
Application		0%	17/04/2023	60
Stage 4 Design / Site Survey		0%	18/06/2023	90
Tender		0%	05/10/2023	30
Evaluation		0%	10/11/2023	16
Contract Award		0%	25/11/2023	7
Project Start				
Stage 4c/5 Design and Construction Drawings		0%	01/12/2023	16
Capital Equipment orders		0%	15/12/2023	7
Delivery Plan		0%	18/12/2023	7
Site Set up / Final Survey		0%	19/12/2023	7
Builders work		0%	26/12/2023	16
Pipework Installation		0%	12/01/2024	30
Electrical Installation		0%	12/01/2024	25
Capital Equipment Installation		0%	13/02/2024	16
Connections / BMS		0%	30/02/2024	16
Changeover shutdown		0%	15/03/2024	16
Remove Existing boiler		0%	15/03/2024	15
Completion of Project				
Commission of system and BMS		0%	01/03/2024	15
Clear Site		0%	01/03/2024	7
Handover documentation		0%	31/03/2024	1

Table Eleven - Projected timescales in order to comply with Salix requirements

Priority of Fixtures

If the Salix Grant is not taken up then the follow approach could be taken over the longer term.

Optimise the site with lighting and controls

This will reduce energy and FM costs to the Town Council and enhance the environment thought uniformed light etc.

BMS to optimise the running the sites

Again, reducing the overall running costs through an increased control of energy use. A properly functioning BMS should deliver energy efficiency savings of around 15-20%. Improving the operation of your BMS is probably the single most cost effective energy efficiency measure you can take.

Solar PV to generate

Heat pumps to remove Gas (please note that advances in technology over time may mean Hydrogen is a more viable option at that point)

It is of course now important to review fabric first approach. This is a new directive to helping achieve Grants from the Government.

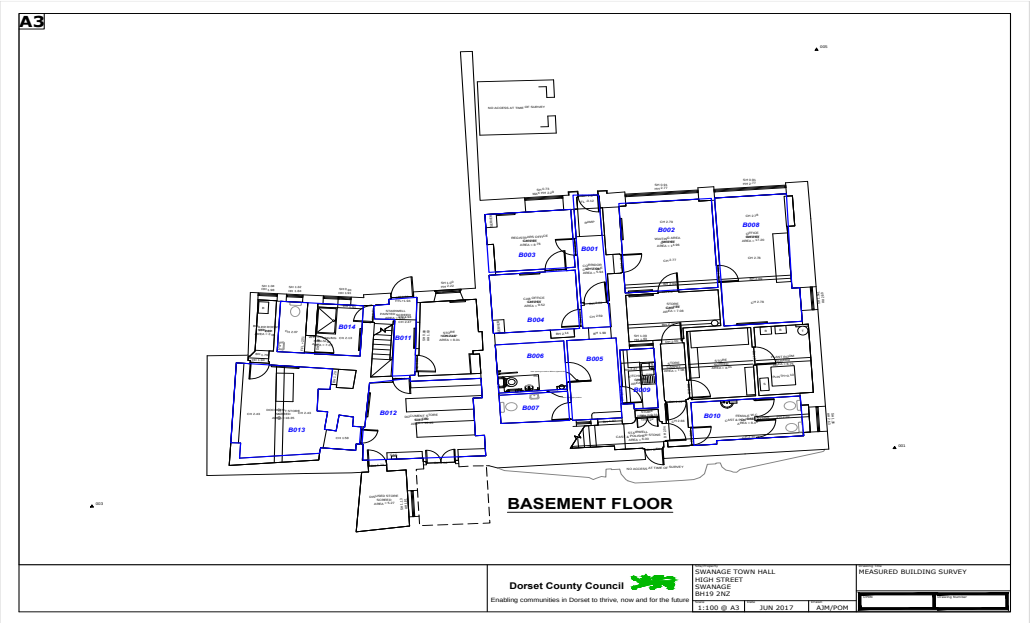
It is also worth noting that any projects started cannot be supported by the Government and decarbonisation carries the greatest weight in achieving a successful bid.

Swanage Town Council must choose a pathway forward. If the desire is to get a substantial grant for the works, fabric first and decarbonation is the best route. If this will be privately funded it might be the lower cost and good ROI's will drive decisions.

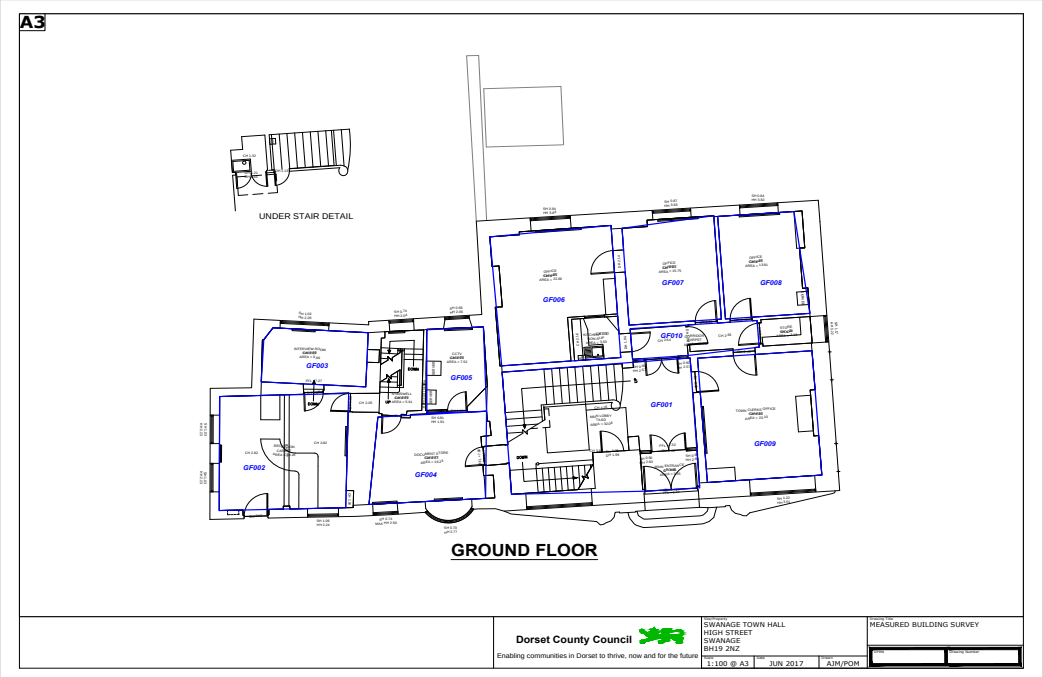
ASSESSMENT FINDINGS; ENERGY CONSERVATION MEASURES (ECMs) ENERGY GENERATION MEASURES (EGM's) INVESTMENT COST - ECM					
ECM no.	Description	Identified energy savings (kWh/annum)	Estimated Savings £	Estimated Cost £	Simple Payback (Years)
EMC 1 – 6: To Decarbonise Swanage Town Council					
1.	Town Hall & Annex				
	Heat Pump	113,572 (GAS)	-£6,133	£146,658	
	BMS	14,424	£2,596	£15000	5.78
	Lighting	10,234	£1842	£32,186	17.47
	Solar	4,700	£846	£28,095	33.21
2.	Depot				
	Heat Pump	17,916 (GAS)	-£967	£53,500	
	BMS	5,446	£980	£8,000	8.16
	Lighting	11,204	£2,017	£11,876	5.89
	Solar	23,645	£4,256	£74,647	17.54
3.	Tourist Information Site				
	Heat Pump	21,600 (GAS)	-£1,166	£59,859	
	BMS	4,635	£834	£2,500	3
	Lighting	1,533	£276	£7,560	27.40
	Solar	5,600	£1,008	£32,186	32.06
4.	Beach Garden Pavilion				
	Lighting	4,412	£794	£4,995	6.29
	Solar	35,451	£6,381	£79,040	0.78
5.	Beach Huts (70)				
	Solar	21,069	£3,792	£60,167	15.87
EMC 6-17: Additional measures discussed in this report					
6.	Car Ports				
7.	Solar Farm				
8.	Battery				
9.	Water Harvesting				
10.	Peer to Peer Assessments				
11.	Waste Management				
12.	Pavegen				
13.	Repurposing				

ECM 1 – Town Hall & Annex

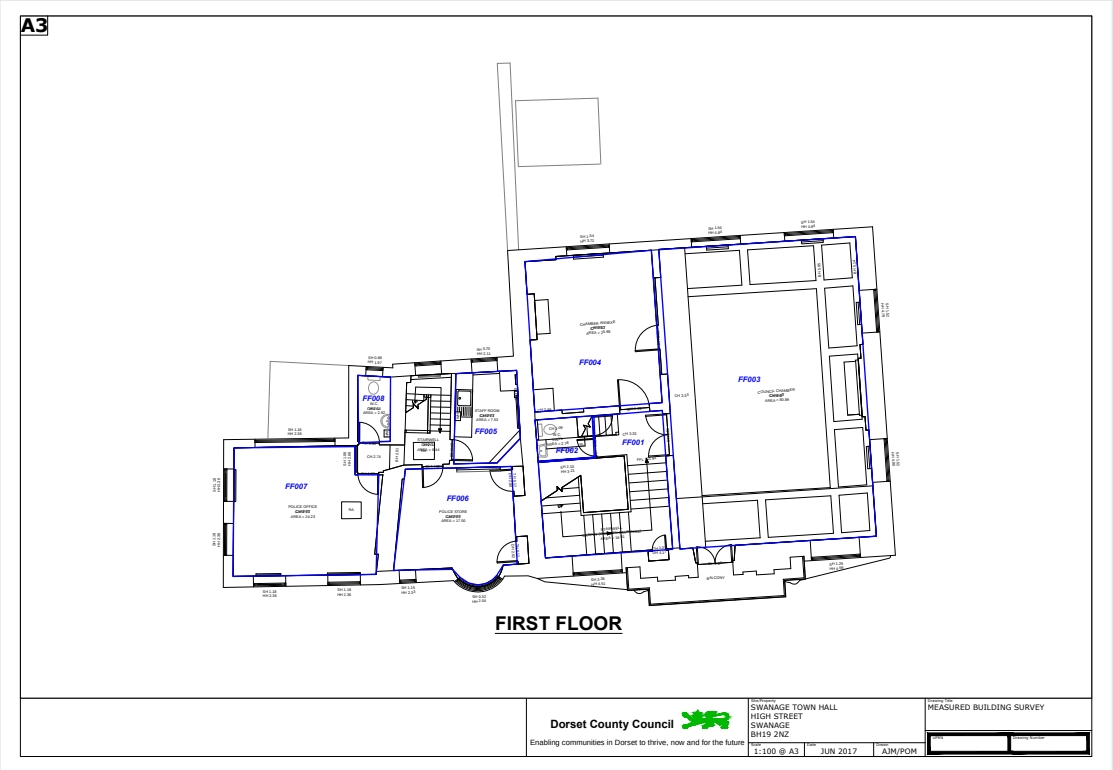
Observed



Basement Plan of Town Hall & Annex



Ground Floor of Town Hall an Annex



First Floor of Town Hall and Annex

Plans

- Completely eradicate Gas usage
- Analysis of data to optimise energy production and storage
- Look into options of ASHP and battery storage
- Solar recommendations
- Lighting redesign

Outcome

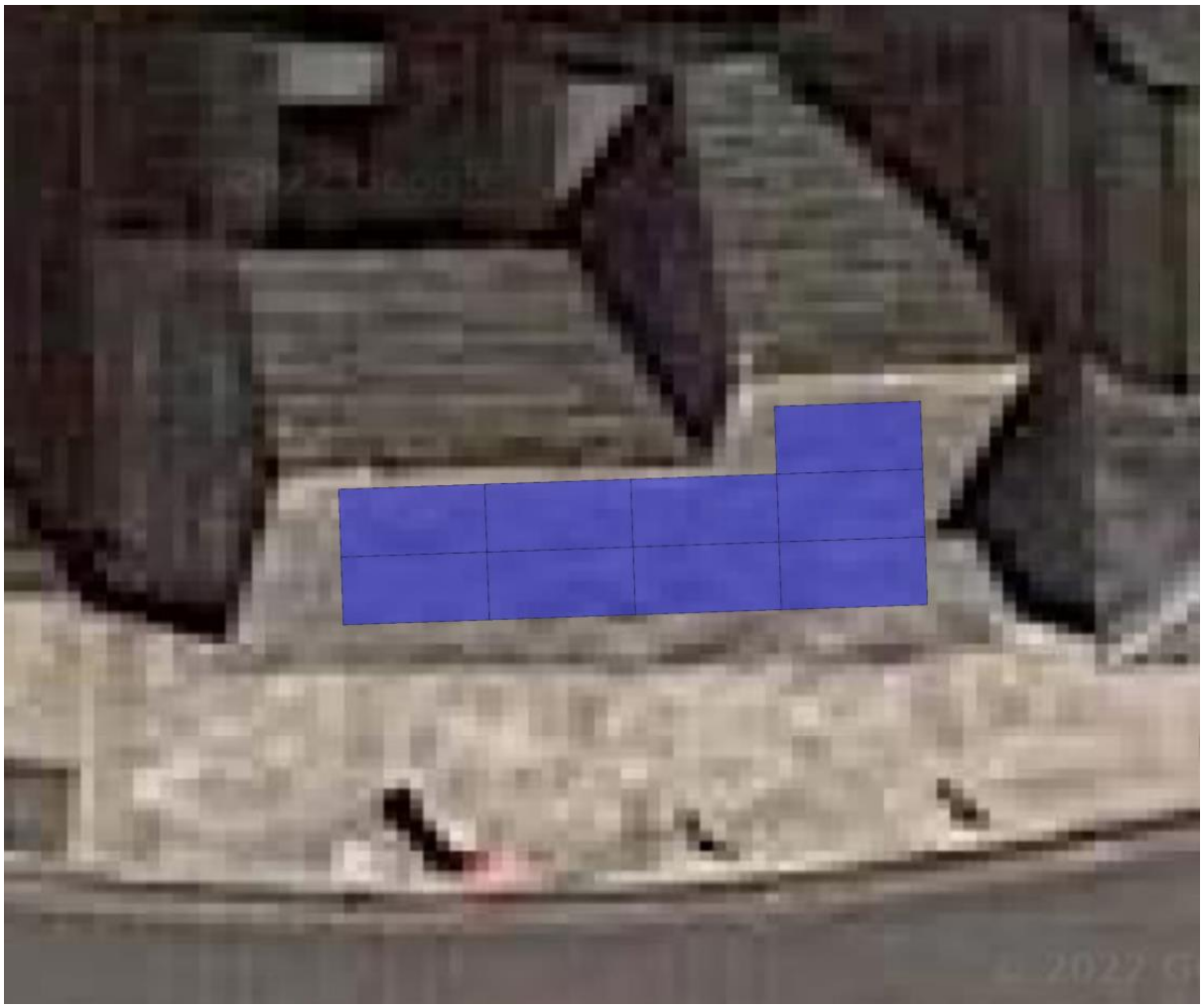
Eradicate gas usage and proposed ASHP

Currently serviced by 3 Boilers, one 15 year + old and the other 2 nearing 10 years old. Proposed to remove existing boilers and becoming completely carbon natural. Install of Air Source Heat Pumps as discussed above.

Current controls pre recommendations

Solar Considered

System Metrics	
Design	Design 1
Module DC Nameplate	4.1 kW
Inverter AC Nameplate	24.1 kW Load Ratio: 0.17
Annual Production	4.7 MWh
Performance Ratio	82.3%
kWh/kWp	1,141.0
Weather Dataset	TMY, 10km Grid, meteonorm (meteonorm)
Simulator Version	26c513b886-2f17bc8804-b418a4e336-5b608c73c1



Lighting

There have been some upgrades to the lighting at the sites. Where they have already been converted to LED, wireless controls will be retrofitted, and where light fitting are fluorescent, these will be converted to LED with integral wireless controls. This will give the site occupancy, presences, and day light diming. As discussed in the section above.

The conversion to LED lighting with integral wireless controls or the addition of wireless controls, would have a positive impact on the lighting quality for the staff and visitors and energy consumption.

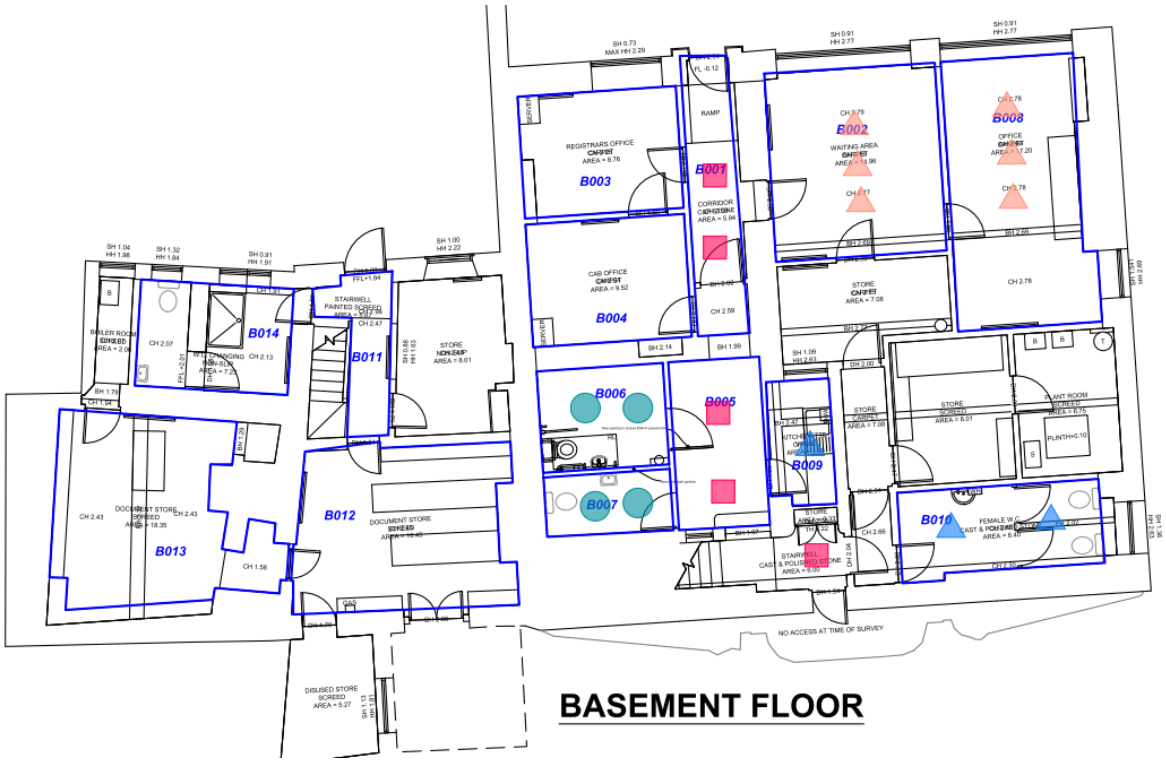
All costs shown below include for new LED lighting where required and or the retrofit of wireless controls.

Each site had a lighting layout marked up. These are shown below and for reference only. they allow Co2 to know where fittings were placed and what type should a retrofit be required.

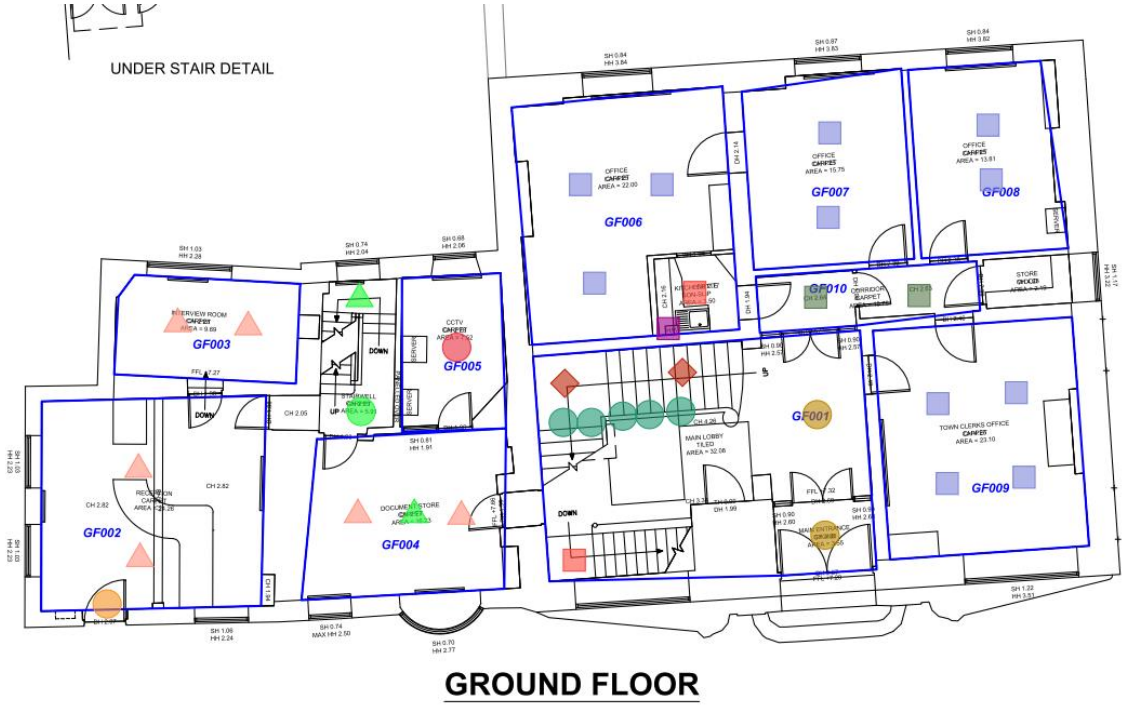
Greater explanations can be requested on each site.

Emergency lighting should be reviewed on all sites and to be confirmed that it meets the current CIBSE guidelines.

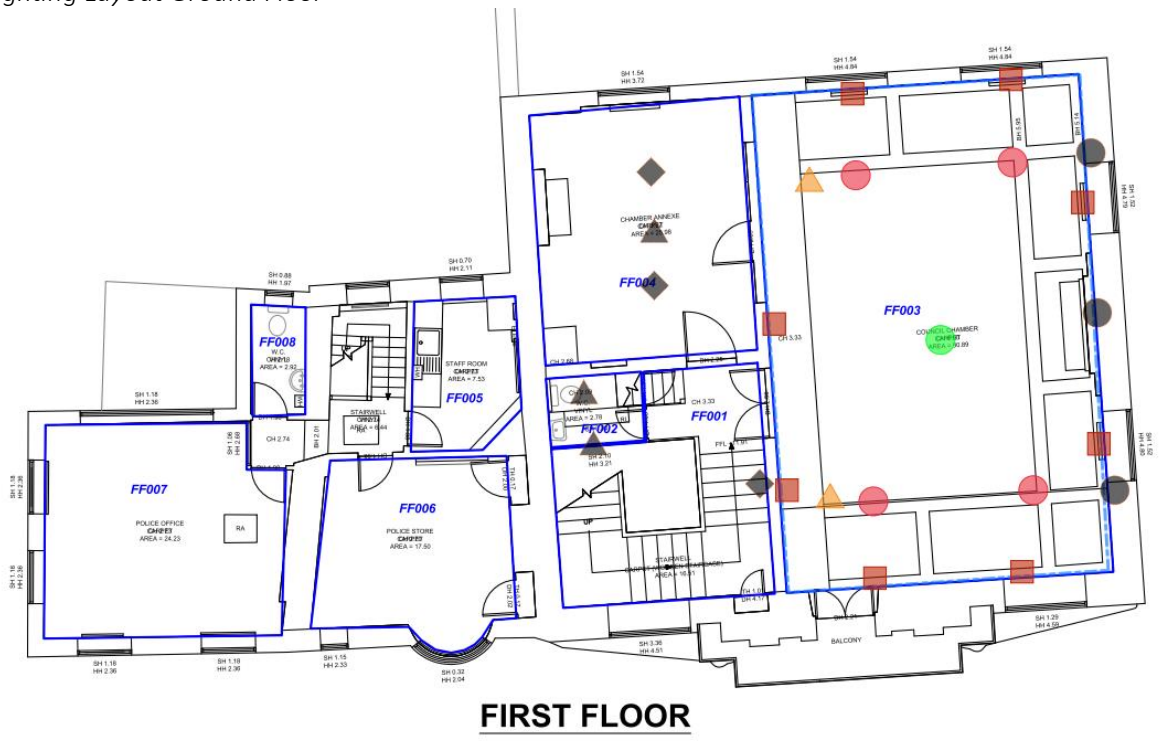
<u>Town Hall</u>



Lighting Layout Basement Level



Lighting Layout Ground Floor



Lighting Layout First Floor

Swanage Town Council - Town Hall

Town Hall

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Measure	Type	Swanage Town Council - Plans - BASEMENT Entire Drawing No multiplier No scale	Swanage Town Council - Plans - FIRST FLOOR Council Chamber No multiplier No scale	Swanage Town Council - Plans - GROUND FLOOR Entire Drawing No multiplier No scale	Total
		Quantity	Quantity	Quantity	
2d 16w Traditional Flu	Point	0	0	1	1
6x6 led recessed panel	Point	0	0	2	2
Emergency 8w bulkhead	Point	0	0	2	2
Emergency Exit box	Point	0	0	1	1
Emergency Twin Spot	Point	0	2	0	2
Glass chandelier - 4 small 1 big	Point	0	1	0	1
Glass globe on rod	Point	0	0	2	2
Glass pendant on chain 3m drop from ceiling	Point	0	4	0	4
LED 2d square	Point	5	0	0	5
LED 2D roundswith internal sensor	Point	4	0	0	4
LED direct down not dir indir on wire suspension	Point	0	0	11	11
LED surface 1500x300	Point	0	0	1	1
LED tube retrofit	Point	3	0	0	3
PL recessed 26w?	Point	0	0	2	2
Radiator	Point	0	8	0	8
Spots on track	Point	0	0	5	5
twin 5ft 58w cat2	Point	6	0	6	12
twin pl recessed	Point	0	0	2	2
zip hydro tap	Point	0	0	1	1

Lighting at the Town Hall

The lighting at the Town Hall has had some upgrades. The offices have suspended LED and the chandeliers have LED lamps installed. There are areas that need an upgrade, namely the Stairwell light. There are some areas with PIR control in the basement.

The site would benefit from new LED Lighting and retrofitting of wireless controls.

Town Hall Lighting

Cost of the projects	15,030	Pre kW	10,221
Material	11,030	Post kW	3,066
Labour (UK estimate)	4,000	Saving	7,155
Energy Saving p.a.	1,288	ROI	12

Project costs	7,515
Total cost of the light	22,545

Proposed cost of Upgrades – Town Hall

Police

Although we could not access the Police section, from the layout we could see, we have made an estimate for the cost of replacing the lighting if the specification was the same as seen through the windows.

Town Hall Annex

Cost of the projects	6,427.50	Pre kW	3,931.20
Material	4,927.50	Post kW	851.76
Labour (UK estimate)	1,500.00	Saving	3,079.44
Energy Saving p.a.	554.30	ROI	11.60

Project costs	3,213.75
Total cost of the light	9,641.25

Proposed cost of Upgrades – Police Department

There seemed to be less LED fittings on this site and as a result the site would benefit from new LED Lighting and incorporating wireless controls.

ECM 2 – Depot & Garage

Plans

- Eradicate Gas usage
- Analysis of data to optimise energy production and storage
- Look into options of ASHP and battery storage
- Lighting redesign
- Review Solar options

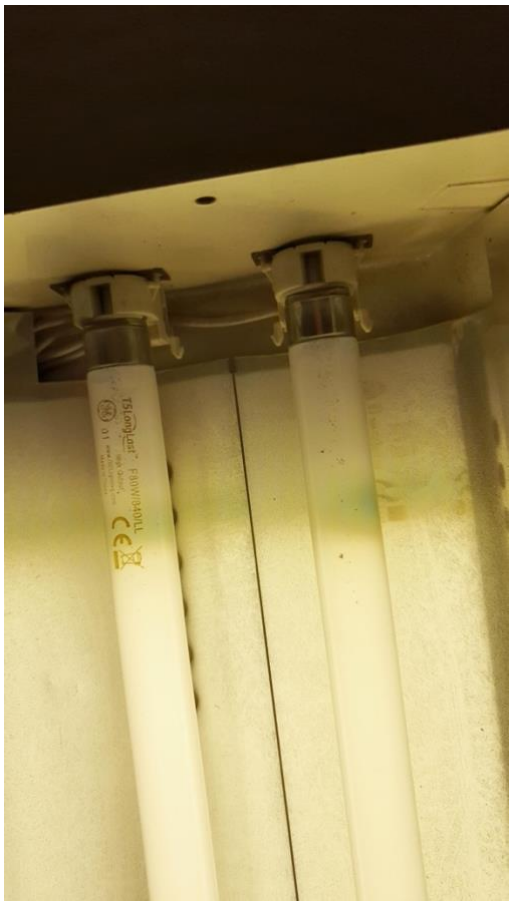
Proposed Outcome

Eradicate Gas and proposed ASHP

Current controls and systems

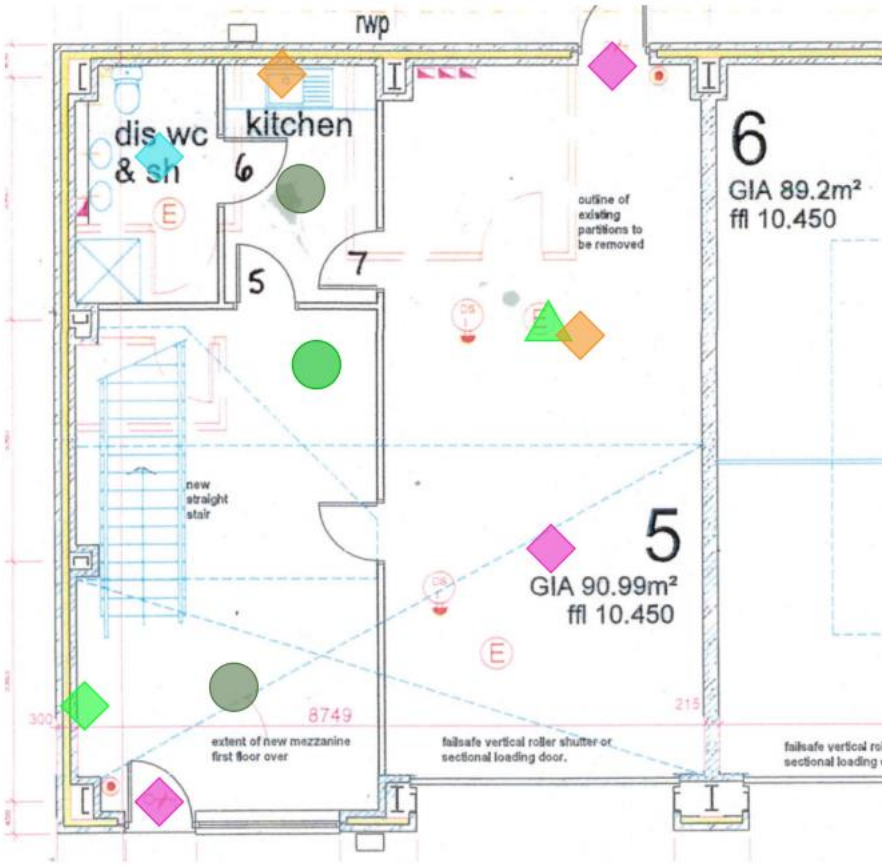
Current heating and controls pre recommendations

Lighting

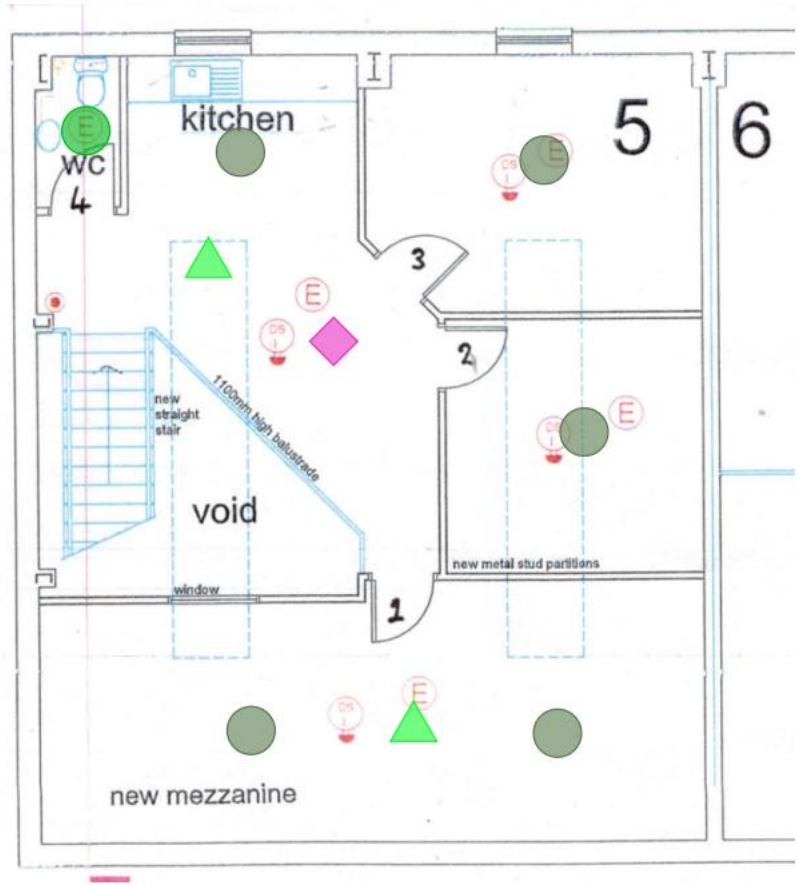


Current lighting at depot

There seemed to be no LED fittings on this site and only lit by T5 fluorescent highbays as a result the site would benefit from new LED Lighting and incorporating wireless controls.



Lighting Layout at Operations Department



Lighting Layout at Operations Department

Swanage Town Council - Operation Department

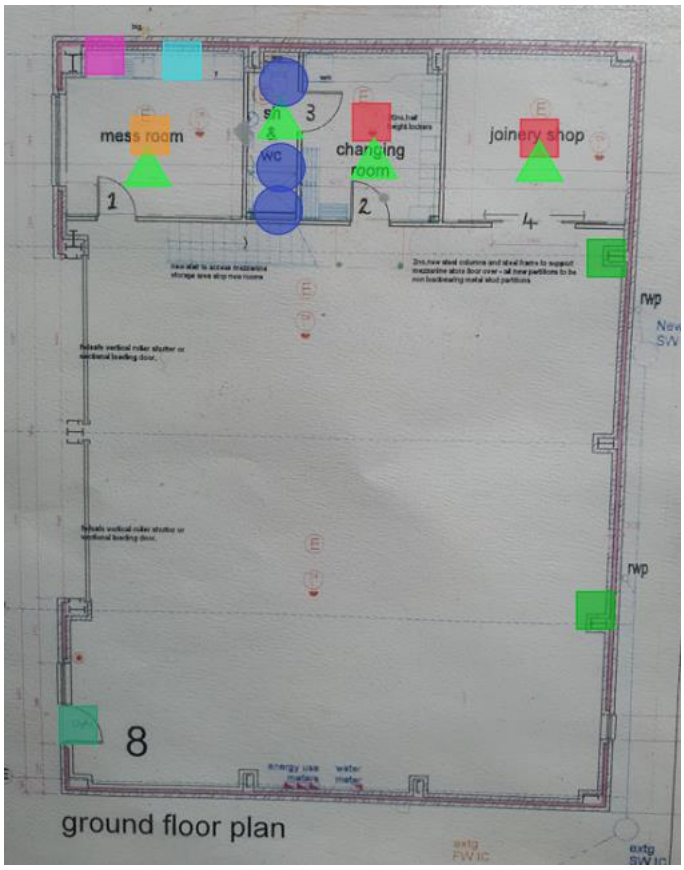
Lighting

Output created: 2023-03-27 07:58

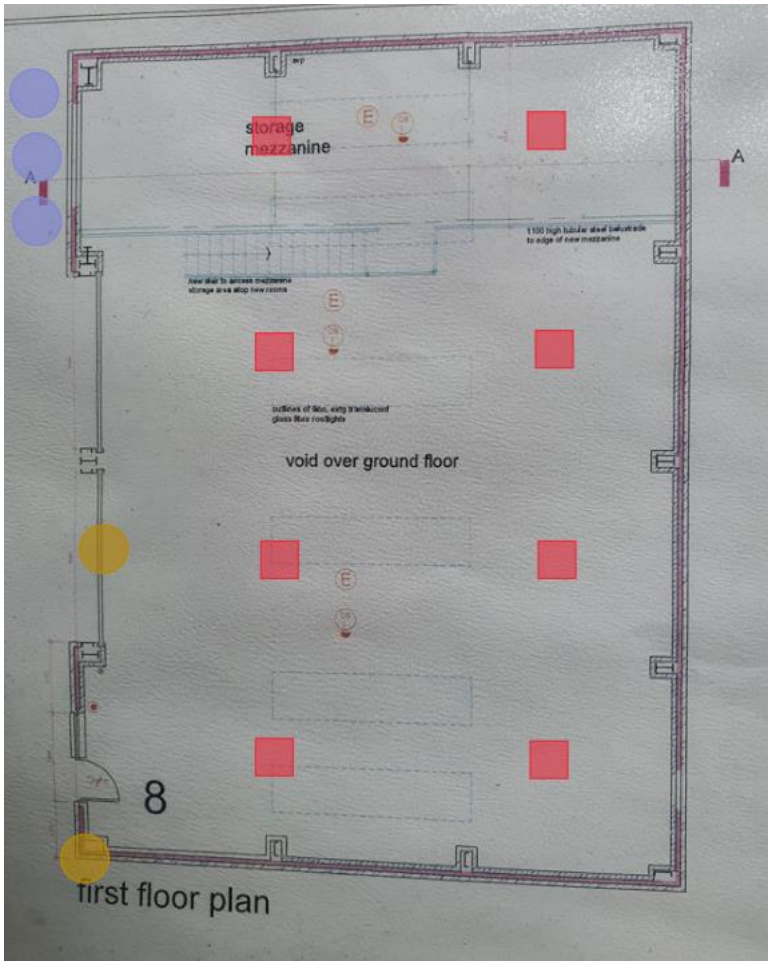
Measure	Type	Depot Office FF Entire Drawing No multiplier No scale Quantity	Depot Office GF Entire Drawing No multiplier No scale Quantity	Total
2D Style LED	Point	1	1	2
2D Style LED emg	Point	1	0	1
2x35w T5 with wire basket reflector	Point	2	5	7
4x80w high bay surface	Point	1	1	2
Emergency Bulkhead 8w style LED 3w	Point	1	2	3
Emergency Exit Box	Point	2	0	2
Emergency Twin Spot	Point	1	0	1
Greenstar 28i	Point	1	0	1
LUES VP LED surface 5ft 60w?	Point	1	0	1

Lighting at The Operations Department

Depot



Lighting Layout – Depot



Lighting layout – Depot

Swanage Town Council - Work Shop - beside Ops Department

Lighting

Output created: 2023-03-27 07:57

Measure	Type	Workshop First Floor Plans Entire Drawing No multiplier No scale Quantity	Workshop Ground Floor Plans Entire Drawing No multiplier No scale Quantity	Total
2x58w in porta cabin	Point	3	0	3
2x58w T8 Surface CAT2	Point	0	1	1
4x80w T5 Hight Bay	Point	8	2	10
Emergency Bulkhead 8w version but LED	Point	0	4	4
Emergency Exit Box LED	Point	0	1	1
Emergency Twin Spot Channel	Point	0	2	2
Greenstar 28i Combi boiler	Point	0	1	1
LED Flood light	Point	2	0	2
Redring 3kw tap	Point	0	1	1
Single LED Down light	Point	0	3	3

Lighting at The Depot

There seemed to be no LED fittings on this site and only lit by T5 fluorescent highbays as a result the site would benefit from new LED Lighting and incorporating wireless controls.

The Depot and Ops Building

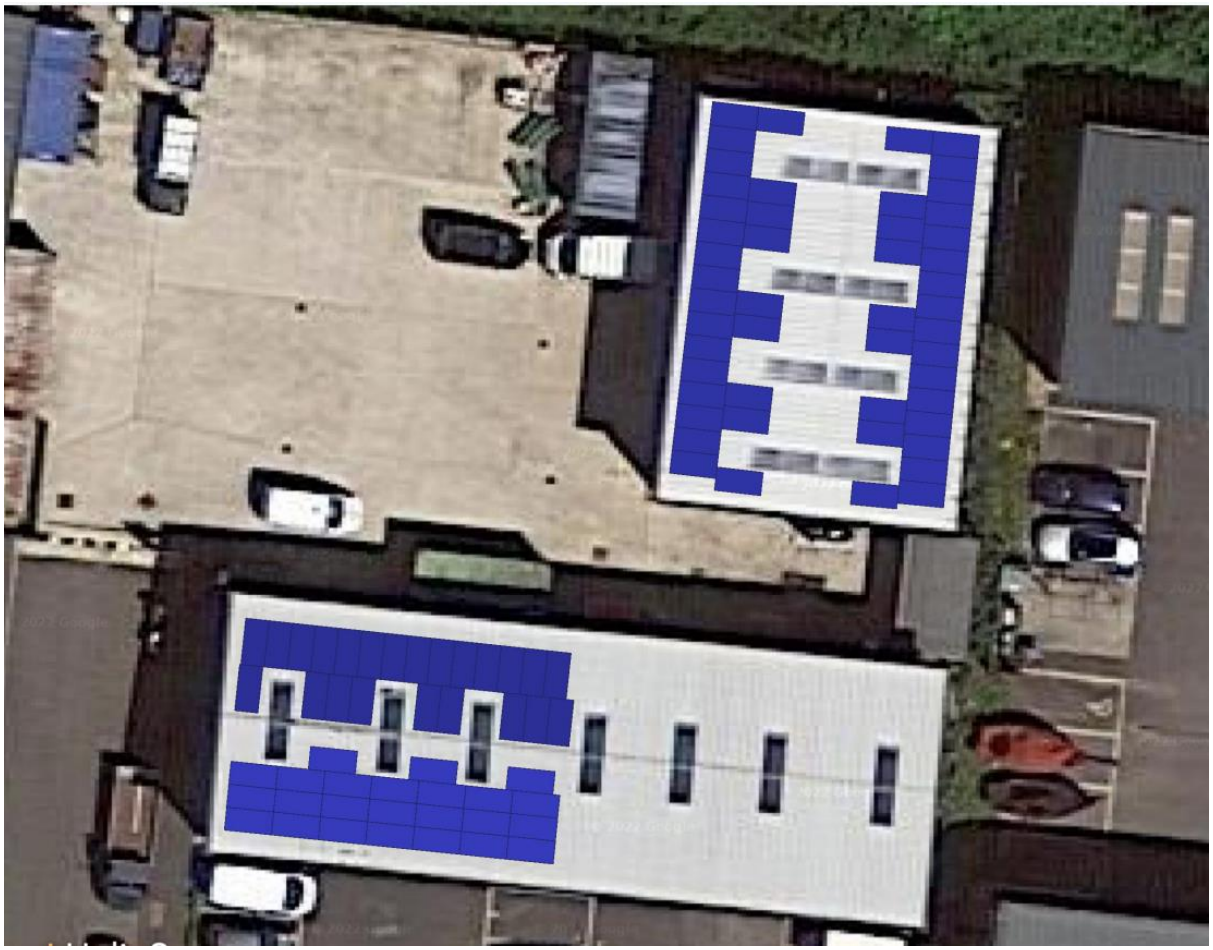
Cost of the projects	7,918	Pre kW	14,895
Material	6,668	Post kW	3,691
Labour (UK estimate)	1,250	Saving	11,204
Energy Saving p.a.	2,017	ROI	4

Project costs	3,959
Total cost of the lighting	11,876.25

Proposed cost of Upgrades – Depot & Operations Department

Solar Recommendations

System Metrics	
Design	Design 1
Module DC Nameplate	44.1 kW
Inverter AC Nameplate	40.0 kW Load Ratio: 1.10
Annual Production	42.4 MWh
Performance Ratio	80.3%
kWh/kWp	959.9
Weather Dataset	TMY, 10km Grid, meteonorm (meteonorm)
Simulator Version	26c513b886-2f17bc8804-b418a4e336-5b608c73c1



ECM 3- Swanage Information Centre

Plans

- Eradicate Gas usage
- Look at efficiency – cold in winter/ hot in summer
- Look into options of ASHP and battery storage
- Solar Options
- Lighting redesign

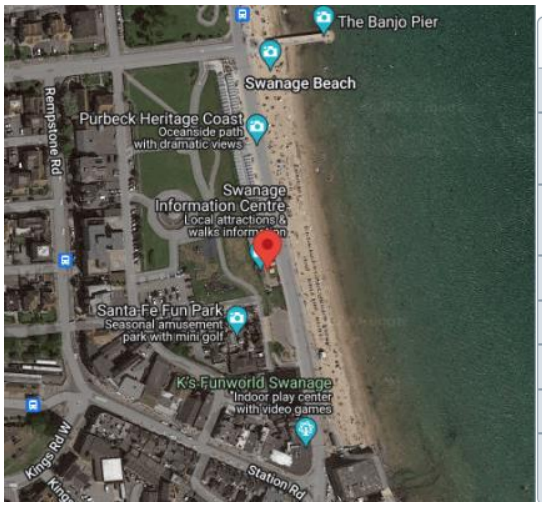
Proposed Outcome

Eradicate Gas Usage

This has been discussed in the section above

Existing Boiler

Solar Considered

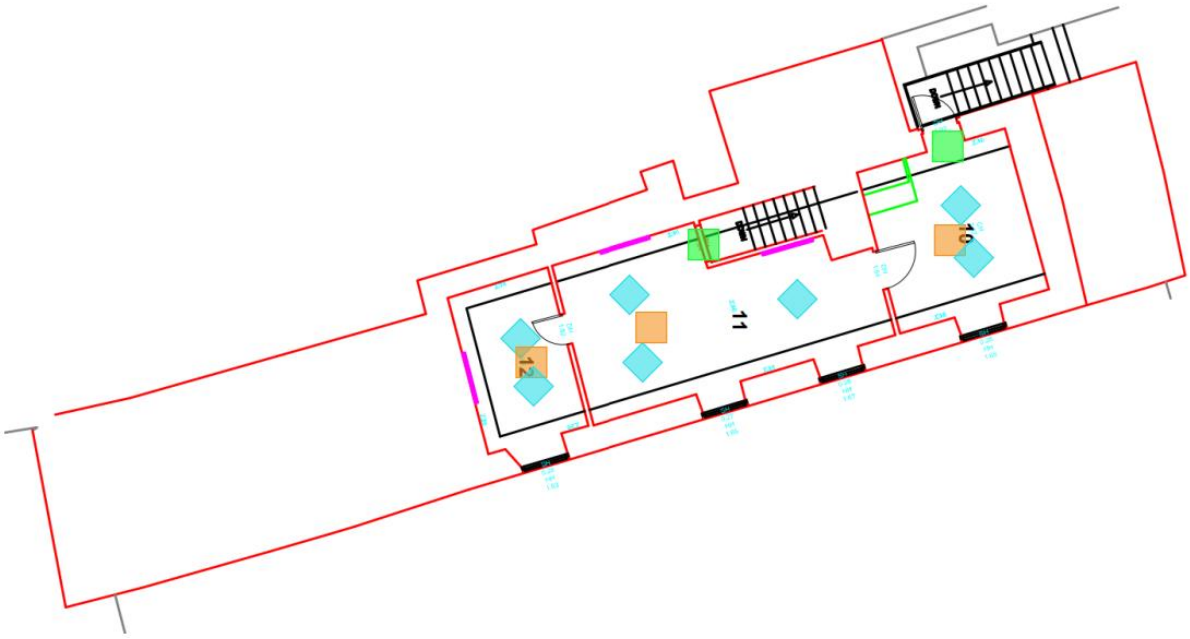


System Metrics	
Design	Design 1
Module DC Nameplate	6.4 kW
Inverter AC Nameplate	24.1 kW Load Ratio: 0.27
Annual Production	5.6 MWh
Performance Ratio	70.8%
kWh/kWp	872.2
Weather Dataset	TMY, 10km Grid, meteonorm (meteonorm)
Simulator Version	26c513b886-2f17bc8804-b418a4e336-5b608c73c1

Lighting

The site will be remodelled so that all light fittings incorporate wireless controls. Where they have already been converted to LED, wireless controls will be retrofitted, and where light fitting are fluorescent, these will be converted to LED with integral wireless controls. This will give the site occupancy, presences, and day light diming. As discussed in the section above

Lighting layout – Tourist Information Centre



Lighting layout – Tourist Information Centre

Lighting layout – Tourist Information Centre

Swanage Town Council - Town Hall

Town Hall

Output created: 2022-09-06 09:06

Measure	Type	Swanage Town Council - Plans - BASEMENT Entire Drawing No multiplier No scale	Swanage Town Council - Plans - FIRST FLOOR Council Chamber No multiplier No scale	Swanage Town Council - Plans - GROUND FLOOR Entire Drawing No multiplier No scale	Total
2d 16w Traditional Flu	Point	0	0	1	1
6x6 led recessed panel	Point	0	0	2	2
Emergency 8w bulkhead	Point	0	0	2	2
Emergency Exit box	Point	0	0	1	1
Emergency Twin Spot	Point	0	2	0	2
Glass chandelier - 4 small 1 big	Point	0	1	0	1
Glass globe on rod	Point	0	0	2	2
Glass pendant on chain 3m drop from ceiling	Point	0	4	0	4
LED 2d square	Point	5	0	0	5
LED 2D roundswith internal sensor	Point	4	0	0	4
LED direct down not dir indir on wire suspension	Point	0	0	11	11
LED surface 1500x300	Point	0	0	1	1
LED tube retrofit	Point	3	0	0	3
PL recessed 26w?	Point	0	0	2	2
Radiator	Point	0	8	0	8
Spots on track	Point	0	0	5	5
twin 5ft 58w cat2	Point	6	0	6	12
twin pl recessed	Point	0	0	2	2
zip hydro tap	Point	0	0	1	1

Lighting at The Tourist Information Centre

Tourist Information Centre Lighting

Cost of the projects	5,040	Pre kW	3,066
Material	4,040	Post kW	1,533
Labour (UK estimate)	1,000	Saving	1,533
Energy Saving p.a.	276	ROI	18

Project costs	2,520
Total cost of the lighting	7,560.00

Proposed cost of Upgrades – Tourist Information Centre

ECM 4 – Beach Gardens Pavilion & Bowling Club

Observed

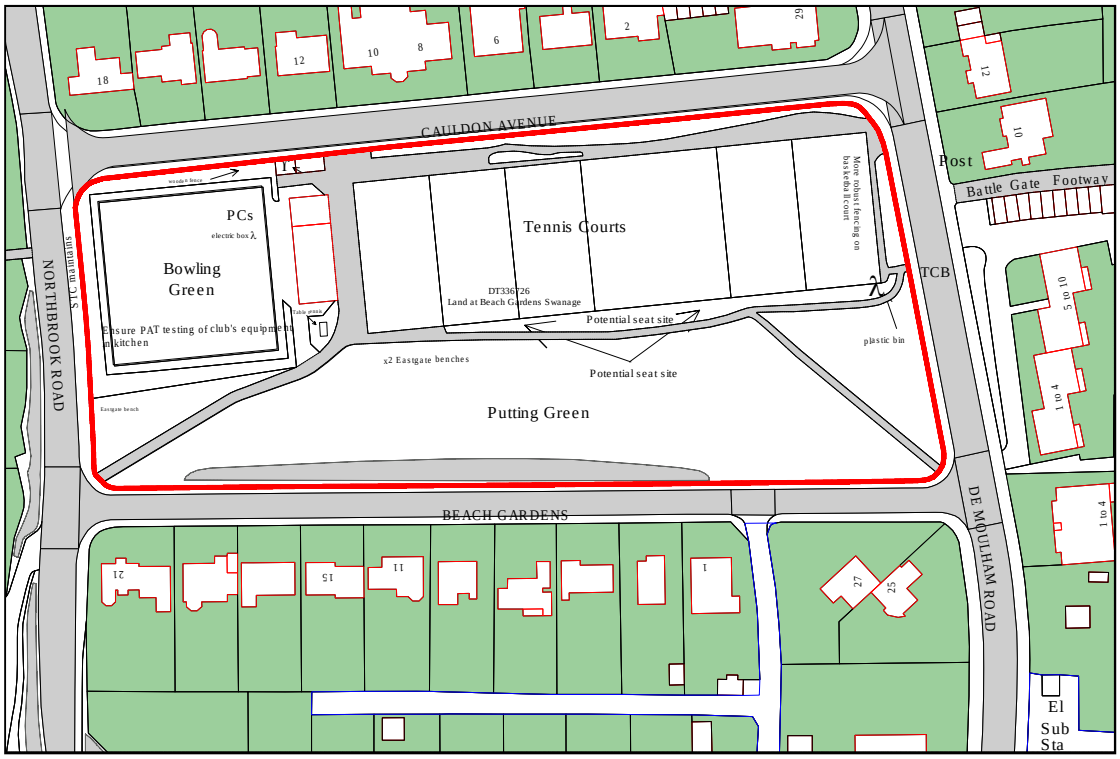


Image six – Proposed Plans at the Beach Garden & Pavilion

Plans

- Review Solar options
- Lighting Redesign

Proposed Outcome

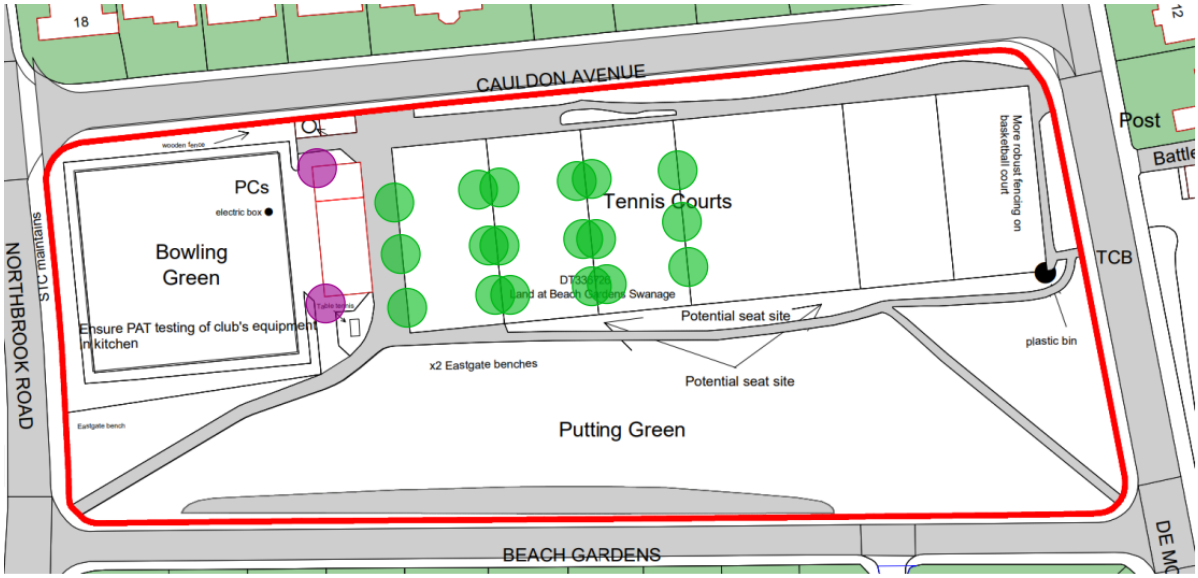
Solar Considered

System Metrics

Design	Design 1
Module DC Nameplate	40.0 kW
Inverter AC Nameplate	48.1 kW Load Ratio: 0.83
Annual Production	39.9 MWh
Performance Ratio	83.5%
kWh/kWp	997.4
Weather Dataset	TMY, 10km Grid, meteonorm (meteonorm)
Simulator Version	26c513b886-2f17bc8804-b418a4e336-5b608c73c1

Lighting

Lighting Layout Beach Gardens Pavilion



Lighting Layout Beach Gardens Pavilion

Swanage Town Council - Tennis and Bowling Club, with golf

Lighting

Output created: 2023-03-27 07:59

Measure	Type	Beach Gardens Bowling and Tennis grounds Entire Drawing No multiplier No scale Quantity	Beach Gardens Club House Entire Drawing No multiplier No scale Quantity	Total
5ft 2x58w Lin surface fitting	Point	0	7	7
16w 2d small dsurface	Point	0	2	2
28w 2d SquARE	Point	0	1	1
Corner light on bracket	Point	2	0	2
Dimplex Wall Blow heater	Point	0	2	2
Dimplex Wall convestion 3kw heater	Point	0	2	2
Emergency 8w Style T5	Point	0	9	9
Emergency Exit Box	Point	0	2	2
Extrenal blukhead 60w?	Point	0	2	2
Flood Light for Tennis Court	Point	18	0	18
LED lamp downlight	Point	0	3	3
Prismatic 2x36w	Point	0	2	2
Single PP158	Point	0	5	5
Tripple spot on track	Point	0	1	1

Lighting at Bowling Club

The lighting project would be to replace the internal lighting with new LED, emergency lighting, this has not been included but can be and a proportion of the cost is included in the project costs.

The flood lighting on the tennis courts has been proposed and would improve the playability of the courts. This could increase revenues for the site. The lighting would comply to be to County level of Lumens and Glare index, important to achieve.

Costs

Sports Pavillion

Cost of the projects	£ 7,902	Pre kW	12,733
Material	£ 6,758	Post kW	2,811
Labour (UK estimate)	£ 1,144	Saving	9,922
Energy Saving p.a.	£ 1,786	ROI	4.424733

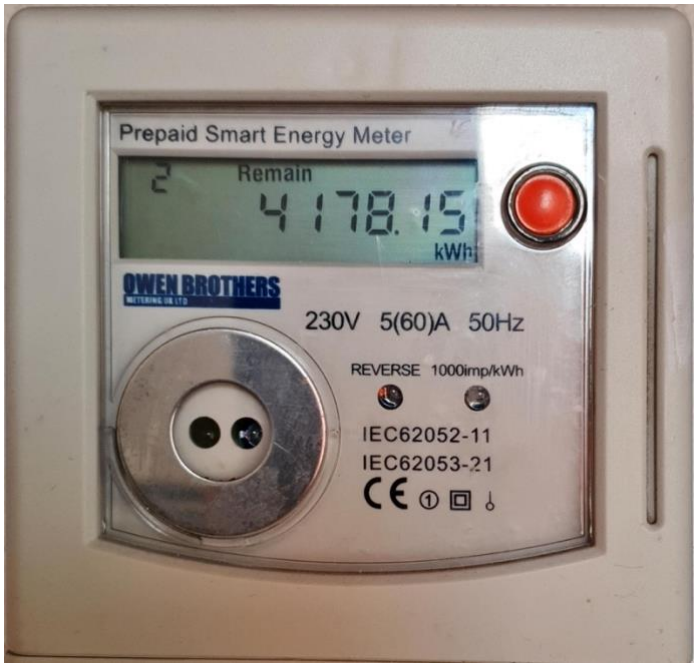
Project costs	£ 3,951
Total cost of the lighting	£ 11,853

Proposed cost of Upgrades – Beach Garden Pavilion & Bowling Club

EMC 5 – Beach Huts (70)

Observed

The Beach huts are rented out and energy used by the public as and when in use.
Also used as a crafts fair periodically.

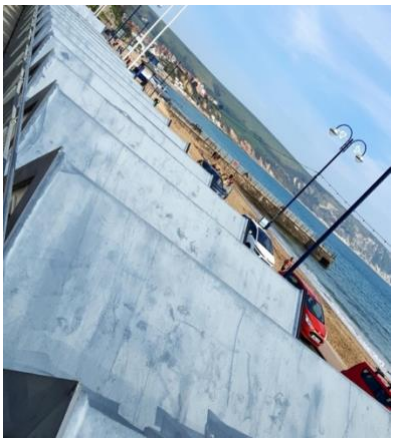


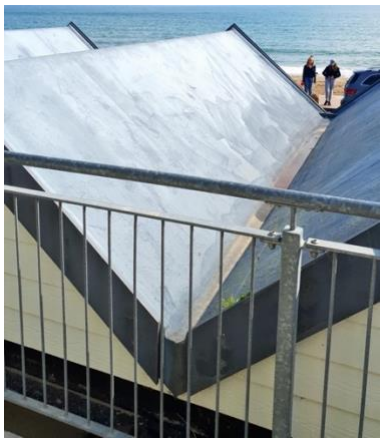
Prepaid Smart Meter

Proposed Outcome

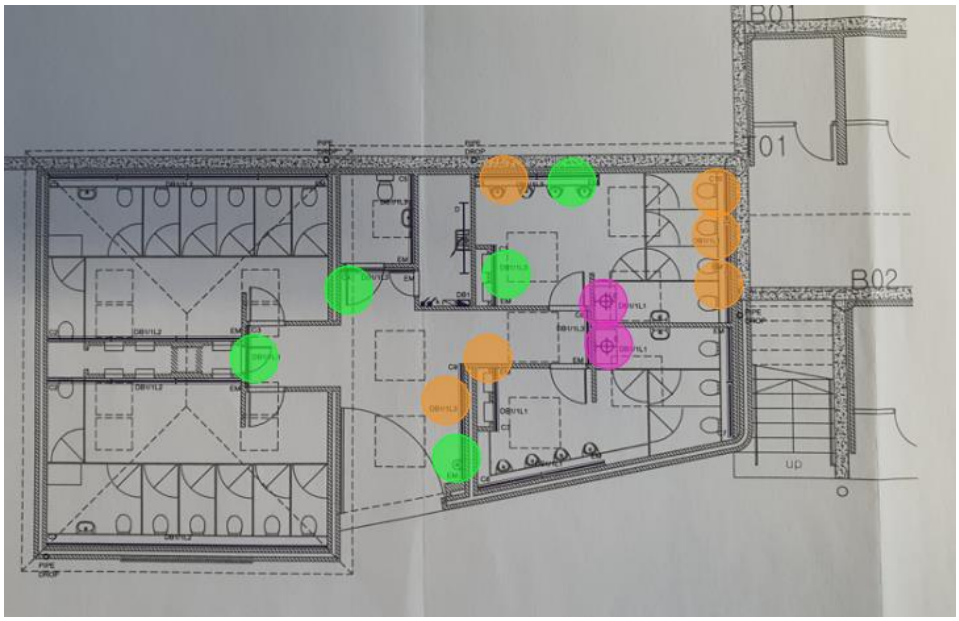
Solar Recommendations

System Metrics	
Design	Design 1
Module DC Nameplate	27.3 kW
Inverter AC Nameplate	24.1 kW Load Ratio: 1.13
Annual Production	32.7 MWh
Performance Ratio	82.7%
kWh/kWp	1,196.4
Weather Dataset	TMY, 10km Grid, meteonorm (meteonorm)
Simulator Version	26c513b886-2f17bc8804-b418a4e336-5b608c73c1





Lighting



Lighting Layout – Beach Huts

Swanage Town Council - Beach Huts

Lighting

Output created: 2023-03-27 07:58

Measure	Type	Beach Huts plans Entire Drawing No multiplier No scale Quantity	Toilets at Beach Hut Entire Drawing No multiplier No scale Quantity	Total
2D style black fins	Point	0	2	2
LED Twin as std	Point	0	6	6
LED Twin Style fitting 5ft emergency	Point	0	5	5

Lighting – Beach Huts

The take off is just for the areas we could access at the site visits.

The total lighting upgrades and savings account for the whole Toilet area and the Beach Hut lighting.

The Beach Huts and Toilets

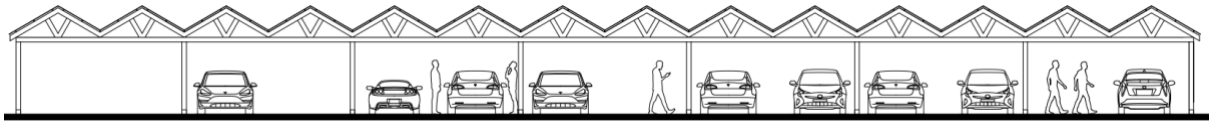
Cost of the projects	£ 13,490	Pre kW	7,522
Material	£ 10,590	Post kW	4,062
Labour (UK estimate)	£ 2,900	Saving	3,459
Energy Saving p.a.	£ 623	ROI	21.66365

Project costs	£ 6,745
Total cost of the lighting	£ 20,235

Proposed cost of Upgrades – Beach Huts & Toilets

EMC 6 – Car Ports

Car parks can be utilised to produce a vast amount of solar energy which can then be stored into batteries for later use or channelled back to the grid for revenue.
Below are examples of Car ports:



Front Elevation example

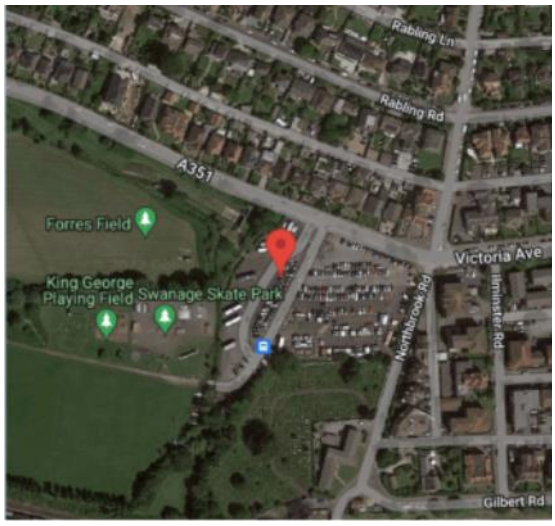
Solar car ports can be utilised to power charging hubs. With sustainability is front-of-mind for consumers, with many going out of their way to seek environmentally friendly options. Enhance reputation and achieve your sustainability targets.

Also, creating an additional revenue stream by setting charging fees for your EV-driving customers.

Image: https://ehv.mydigitalpublication.co.uk/

Image: www.autocars.co.uk

Main Beach Car Park

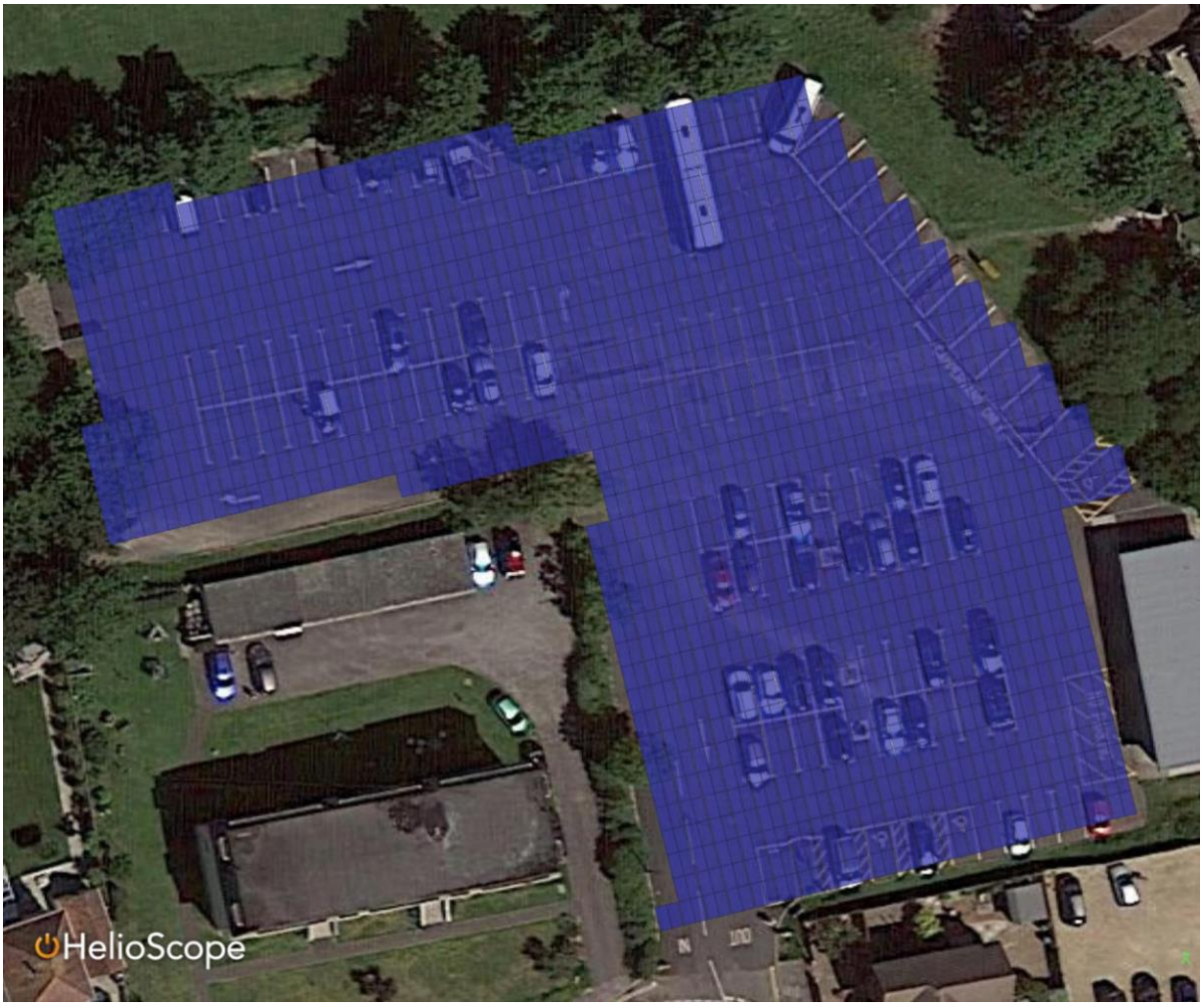


System Metrics

Design	Design 1
Module DC Nameplate	1.7 MW
Inverter AC Nameplate	1.3 MW Load Ratio: 1.25
Annual Production	1.7 GWh
Performance Ratio	85.8%
kWh/kWp	1,024.3
Weather Dataset	TMY, 10km Grid, meteonorm (meteonorm)
Simulator Version	26c513b886-2f17bc8804-b418a4e336-5b608c73c1

North Beach Car Park

System Metrics	
Design	Design 1
Module DC Nameplate	770.8 kW
Inverter AC Nameplate	673.7 kW Load Ratio: 1.14
Annual Production	783.7 MWh
Performance Ratio	85.1%
kWh/kWp	1,016.8
Weather Dataset	TMY, 10km Grid, meteonorm (meteonorm)
Simulator Version	26c513b886-2f17bc8804-b418a4e336-5b608c73c1



EMC 7 - Battery Storage Solution

Battery storage solutions are increasingly important as a renewable energy enabling technology in the drive to Net Zero. With industry leading suppliers the investment will offer a return for the life of the asset, an estimated 20 years.

The maximum Solar PV that the site can install is circa 1.2MW across three areas of the site. There are two areas that are practical, and included those in our proposal, the third although possible is not perhaps practical.

The smaller PV scheme there is an estimated 8% of the power generated exported before any energy savings measures are implemented.

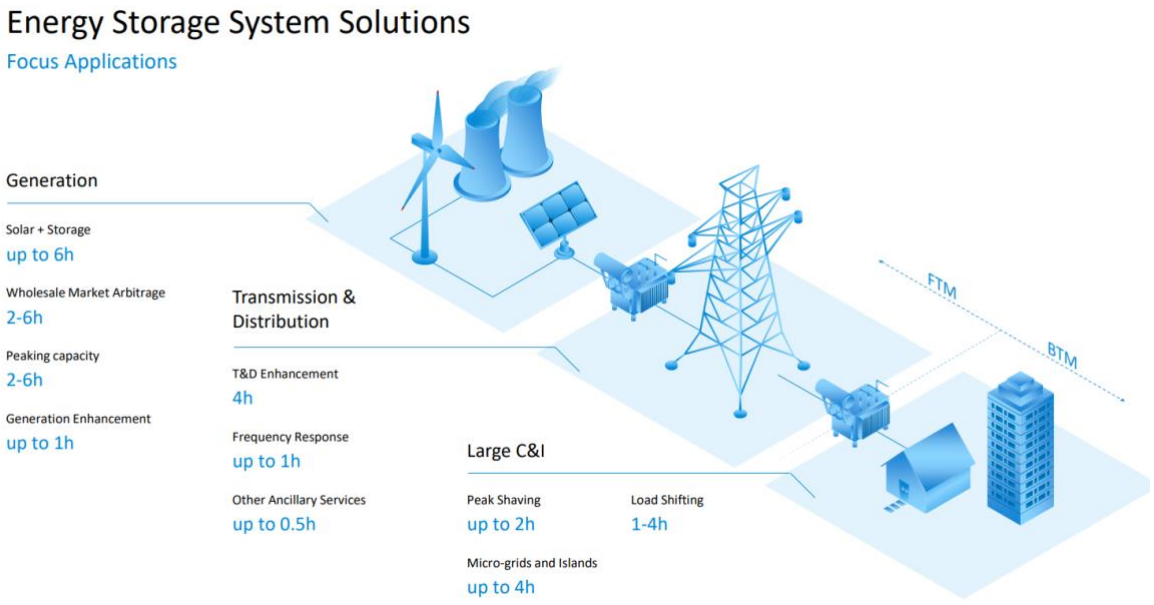
The energy savings measures would affect the weekly operation of the site and the export is manly at the weekends, so the 8% figure will rise but not much.

Due to the low export a battery storage solution to optimise the PV further would not be an effective proposal, as such we did not include these figures.

If the site was fully optimised, that export figure would rise, and it might be that a ESS would make financial sense.

An outline of the opportunities a ESS would offer is listed below.

It might be a standalone solution before or after the meter would provide an attractive investment. This is an area we can look to implement in the future.



A battery storage project would aim to provide access to all National Grid schemes, including Dynamic Containment, Frequency Regulation, Peak Shaving

and Renewable Integration, as well as fully supported trading and optimisation services in wholesale energy markets.

At the time this report was submitted, a battery proposal to further optimise the PV was not feasible, when it becomes feasible, when it is we can discuss this option. To give some background to the options available with a battery storage solution, we have expanded on the income streams available.

Dynamic Containment

It increases the grid's ability to respond rapidly to disturbances in the flow of electricity around the grid.

Ideally supply and demand (the energy in and out of the electricity system) would be in perfect balance, and the power network would always be operating at a steady frequency of 50Hz. The near perfect balance when interrupted, needs to have a system than in a second, will kick in to manage the imbalance in the frequency.

Frequency Regulation

Gird Assistance System: Provide emergency reserve. Operates the grid system operation in a more stable manner thanks to quicker response and improves power quality

Power Quality Improvement: Adjust frequency of generated power

System operator: operates the grid system operation in a more stable manner thanks to quicker response and improves power quality.

Peak Shaving

Ensure profitability by charging electricity when the cost (rate) is low and discharging it when cost is high. Shifting of maximum electricity demand time (Peak shifting).

EMC 8 – Rain Water Harvesting

Rain water harvesting:

This would let the site use some of the rain water collected from the roof.

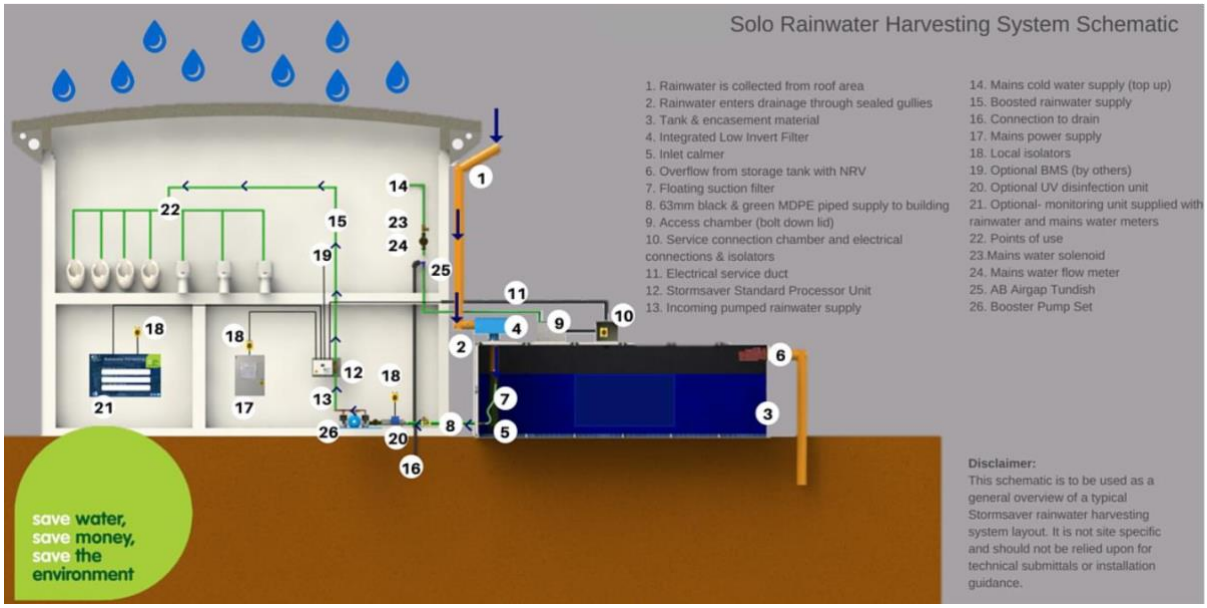
Rainwater harvesting is increasing in importance within the sustainability sector. We have systems that deliver reliable storage to be used by the end customer.

Rainwater harvesting has many benefits but the main one is that it is a sustainable water management practice that can be implemented by anyone on many different levels, from a simple rain barrel to a comprehensive rainwater harvesting system that integrates with a commercial building.

It is an excellent source of water for plants and landscape irrigation since it has no chemicals added to treat the water.

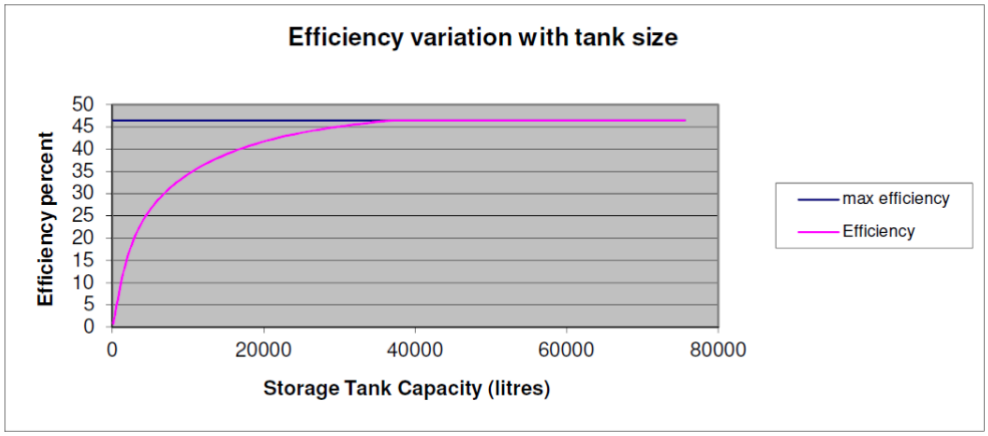
There are a number of factors to consider, the four primary ones are; Collection - can we collect enough water, Where can the tank be located? Can we divert the water from the roof to the tank and can we pump this water to the Toilets.

The cost will depend on a number of factors, but we expect a system to deliver 40% efficiency. The example below is for a Shopping Centre in Reading. The system cost circa £15,000 to £20,000



Client: Shopping Centre		**Reference:**	
Site Postcode:	RG		
Local Annual Rainfall (mm)	656	**Total Collection m^3**	462
Roof Area Square meters	782	**Demand days**	365
Occupation	2016	**Demand cubic meters**	1103.76

Design tank size	20,000 litres	Efficiency %	42
Water Saving / annum	458 cubic meters	Storage Days	6.6
Water Rate £ /m^3	2.39	£ saving / annum	1094.62



Water Control

There are key reasons to address water usage.

There are increasing costs of treatment and redistribution, in parts of the UK water is being pumped to areas to satisfy demand.

The average water consumption per person has increased over the last 30 years. The average consumption figure in commercial environments can be 50% higher than that of a domestic environment. It is for two primary reasons, in these environments the users' behaviour is different as they are not the ones who pay and any malfunctions or leaks take longer to be reported and fixed than in a domestic household.

Toilets

To compliment rainwater harvesting or as a stand-alone water saving option, it is recommended that Waterless Urinals are installed across the estate.

When assessed at a commercial site installing a waterless urinal can save as much as 150,000 litres (33,000 gallons) of fresh water per year. It is not uncommon for the current water flush system to be on a timer, regardless of frequency of visitors to the space, this uses a huge

amount of water. Also common are leaks in the system, a small steady leak from a cistern can waste up to 227,000 litres (50,000 gallons) of water per year.

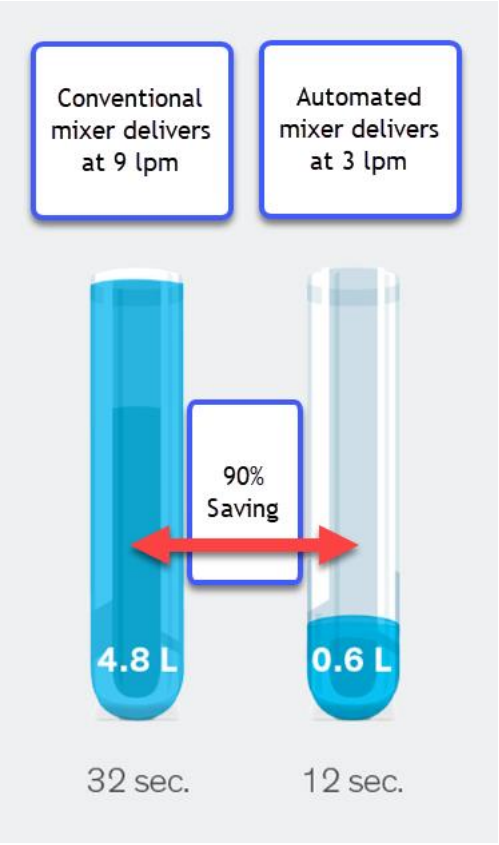
In addition to the reduced waste of fresh water, waterless urinals have other benefits;

- With no flushing mechanism, the purchase of the product is less and replacement cartridges are not expensive.
- No water means you save 100% of water charges as well as reduced sewage charges.
- Reduced maintenance costs. No flush means no stuck or broken valves and as no hard water runs through the sewage lines they remain free of calcification, this in turn means a reduced cost of pipe cleaning.

Wash Basin Taps - Lowering water consumption

For better control of water consumption in the wash basins, the flow rates must be controlled. The example below shows a conventional mixer delivering water at 9 litres per minute. A target should be 3 litres per minute. The achieve this Split delivery and automatic shut-off systems are to be incorporate into the solution, this reduces the risk of waste through user negligence.

To optimise water consumption, it would be our recommendation to limit the flow to 7 seconds. Automation solutions and systems ensure significant water and energy savings, without compromising efficiency or user comfort.



EMC 9 – Peer to Peer Assessment

We found that while buildings data is often collected, the information is typically used by individual stakeholders and not shared for broader use.
It would be important for the peer-to-peer assessment in the Public Sector so that;

- A collaborative approach to developing building stock data sets to identify and share lessons learnt
- Establish best practice in methods used for gathering and analysing real building energy use
- Evaluate the scope for using that data to inform policy making an support the company in development of low carbon energy solution to be use in the building.

Larger properties occupied by a public authority and visited by the public must display a Display Energy Certificate (DEC). DECs show the actual energy consumption of a building.

The distribution of DECs by Energy Performance Operational Ratings is shown in figure 4. The highest proportion of DECs (35%) were in band D.

We had Energy Rating information for The Depot and the Operations Department, both of which were B rating and so performed well compared to the national average. Energy rating information were not provided for The Beach Huts, Tourist Information Centre, Town Hall or Pavilion. This would provide valuable information and advise that these be carried out.

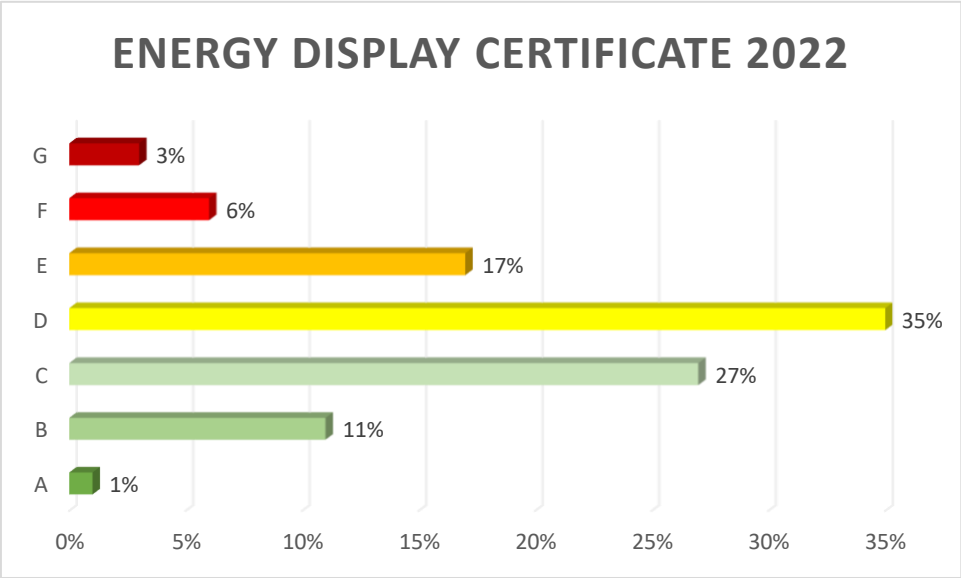


Figure 4 – Energy Performance ratings England 2022

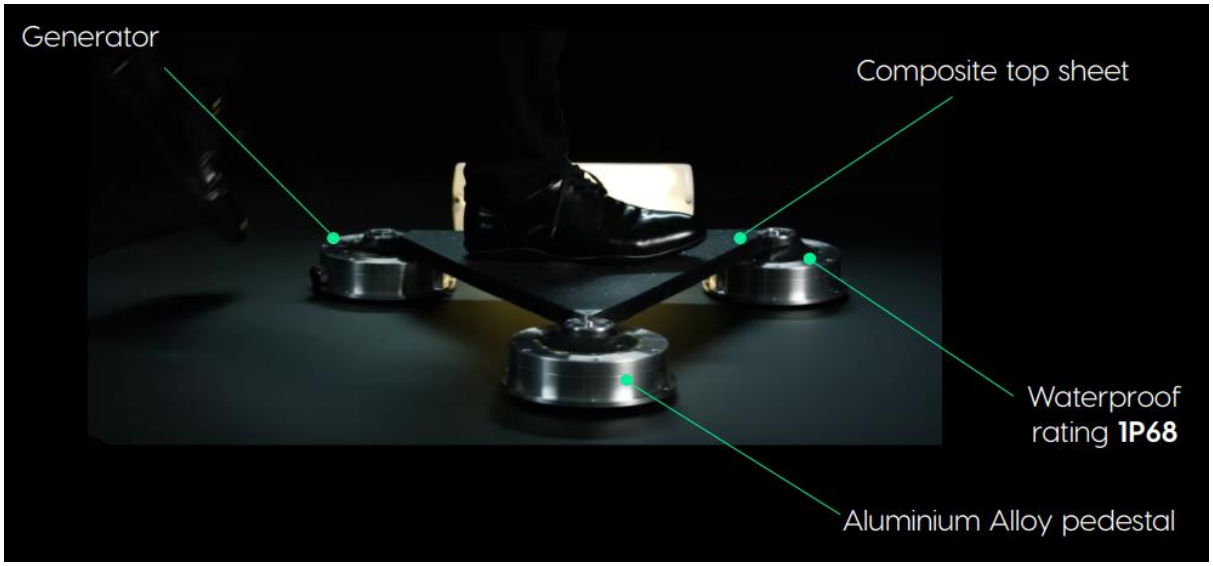
EMC 10 – Waste Management

EMC 11 – Pavegen

It is rewarding to be driving efficiencies though a site. Sometimes these efforts cannot be seen by the staff and visitors to a site.

Something that is visual, and you can interact with, offers people a connection to the company's commitment to energy savings.

One such product that bridges that gap is Pavegen. It is a floor that when you walk on it, it depresses and it produces a small amount of energy, 1w for 1 second per tile generator.



Footsteps could potentially power the air quality sensors proposed in optimising the AHU's. The system is more than just supplying an amount of energy. The Pavegen LED Walkway enables interactivity and engagement with the users.

iBeacons can be placed in the floor and when someone walks over the floor they get reward points to be collected and used in the café or for a draw to take part in a team event or tickets to the cinema. The possibilities are limitless in how people can interact with the system.

The technology is able to trigger a messaging application on to a tv screen in reception. The screen could also be linked to the PV the building is generating.

We installed a system in the Mercury Shopping Centre, the size is below, and an image of the installed system is also shown below.

The shopping centre has had a huge amount of interest in the installation, and it continues to drive footfall and interest in the centre.

The company have installed system round the world and work with global brands like ……..

The typical cost of a system that is 3x1.8m £55,000 - £65,000

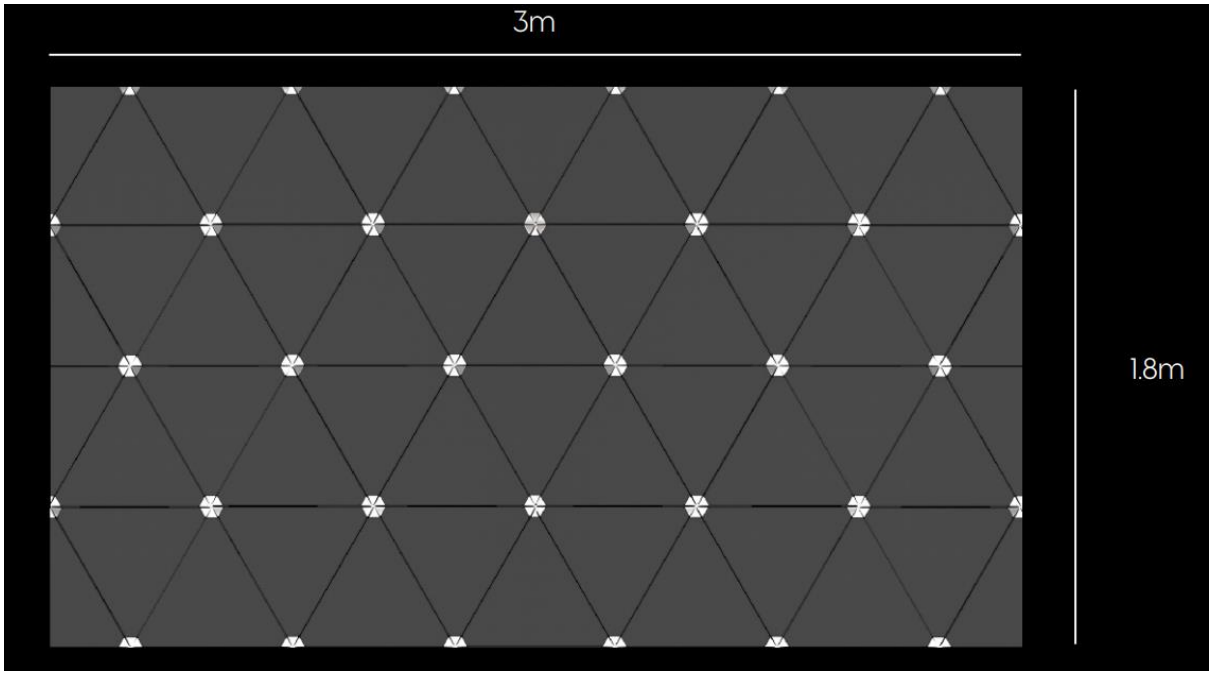


Image of a Pavegen floor that would provide enough surface area to cover an entrance area

Image if an installation at Romford Shopping Centre

EMC 12 – Repurposing

Town Hall - Repurposing Options

Repurposing

Option 1

Consider the option of placing a lift in the stairwell and revolving door in order to make the building more accessible to the general public

Proposed Plans

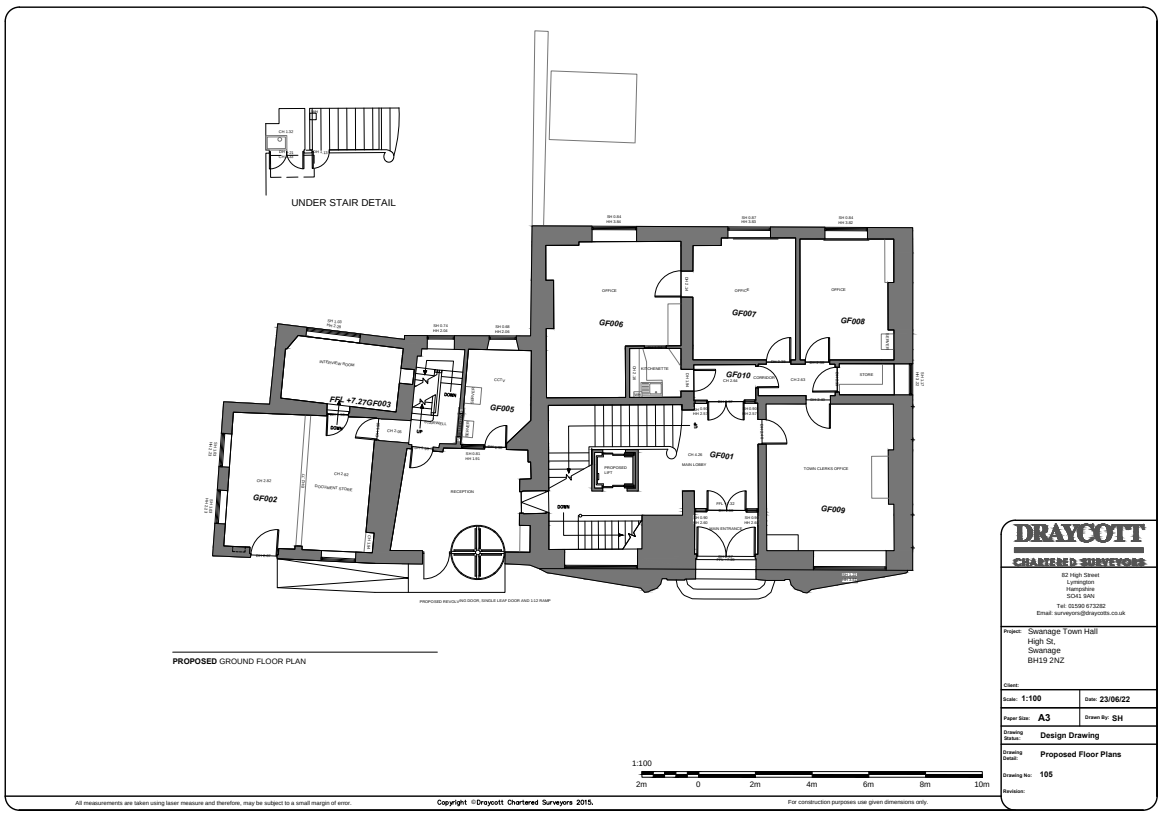


Image Six – Proposed ground Floor plans

Image Seven – Proposed Elevation

Further investigation and planning required to make the alternations required to make the Town Hall more accessible

Option 2

Outsource to external event companies to provide corporate events, craft and public events and weddings. Events companies can fully facilitate events, companies locally include Blue Bay Events https://bluebayevents.co.uk and Chique marquees https://chiquemarquees.co.uk who provide a bespoke service to fully manage corporate and wedding events.

There is a huge demand for licenced beach weddings locally. These used to be held at Bournemouth beach which no longer provide this service. This is something Swanage Town Council could look into further. Events and Weddings could be held at all sites that Swanage Town Council own.