Investment Grade Proposal: LBH-002

LONDON BOROUGH OF HILLINGDON

Prepared for:

HILLINGDON
LONDON

Submission Date: 19th April 2023

Winston Churchill Hall & Theatre

Pinn Way, Ruislip HA4 7QL

Building Overview

The Winston Churchill Theatre and Hall is a 1960's purpose built community theatre and function space on the Manor Farm site in Ruislip. The theatre has a maximum capacity of is 400 standing, 346 seated theatre style (including 4 wheelchair spaces) or 210 seated at tables.

Backstage are dressing rooms with seating for around 30 artistes. The dressing rooms can either be configured as 2 small and 1 big dressing room, or with a fixed partition, can be converted into 4 smaller dressing rooms.

Front of house there is a foyer with a box office counter and toilets. Adjacent to the auditorium is the Lounge with a counter or bar leading from a large kitchen. The capacity for the lounge is 100 standing or 70 seated.

The site has a GIA of approx. 1,365m^2 and includes an upstairs kitchen, storage and private hire flat all of which is heated with electric radiators and independent of gas.

The front of house of the site included a refit in 2012 which involved alterations to toilet facilities, foyer layout and associated internal walls. The external walls of the building are cavity wall without insulation, the front of house fitted with a newer façade as seen in the image above, and the roof void over the auditorium includes for ceiling insulation between the joists. The roof void above the AHU plant and dressing rooms does not have any existing insulation.

Windows across the full site were found to be either single glazed 6mm wooden frame or metal frame, many of which struggled to remain fully shut and locked.

The plant room is located on the East side of the site within the basement with a separate room for 1no. gas incomer and meter and another room for 1no. electric incomer and meter with a separate meter for the rented flat space above the foyer and office.

Figure 57. Metal frame window unable to close

Site heating is delivered via 2no. Strebel Lugano L-15 236kWth boilers which are considered at the end of their serviceable lives. During the site visits there was no access to temperature gauges or sensors to determine boiler flow and return temperatures but it was estimated to be a 70 – 80°C flow temperature.

Figure 58. Existing poor condition boilers, pipework and AHU.

The boilers connect to a common flow manifold which feeds 1no. VT circuit and 1no. CT circuit.

The CT supplies the heater battery / AHU coil only and the VT circuit supplies the radiators across the site. There originally was an operable BMS installed pre-covid but during the lockdown period the system was replaced with a simple digital timeclock / controller. This is resulted in the VT circuit, and other typical BMS functions, out of service resulting in a VT flow temperature maintained at boiler flow temperature.

This poor control in radiator temperature in conjunction with the majority of radiators either missing or with broken TRVs resulted in overheating of rooms resulting in the need to open windows during milder days. This was noted during a site survey at ambient temperature approx. 12°C and an empty facility. The heating schedule for the site was set to 08:30 to 22:00 operating hours 7 days a week, the onsite technicians may alter this manually as and when needed.

DHW for the site is provided by other means such as point of use heaters in the dressing room adjacent toilets and 2no. direct fired gas calorifiers:

- Dressing room gas calorifier
    - Andrews, 14.7kW with 182L capacity
    - Feeds approx. 10 basin taps only
        - Oversized storage to allow for peak sink use between theatre acts for make-up removal, we have considered this surge use in our design
- Kitchen calorifier
    - A.O. Smith Innovo IR, 24kW with 245L capacity
    - Feeds kitchen sink taps and kitchen adjacent toilet basin taps

Figure 59. Existing DHW calorifier

The site includes an AHU that supplies and extracts from the auditorium only and utilises directly ducted heat recovery via a manual valve as seen in Figure 60. The supply includes a heater battery / coil that is fed from the CT circuit and is controlled by a weather compensated circuit via Satchwell Z control and a 3 port valve. The fans for the AHU are controlled by a timeclock which is set daily for 09:00 to 22:00 via belt driven fans running at fixed speed.

The fan vibrating noise is reported to be audible from the auditorium and upon investigation a lone VSD may exacerbate the issue with minor payback. Replacing the fans with efficient direct drive motors in an acoustic plenum can be suitable option but will not support a favourable project £/CO_{2e} abatement or payback and as such is currently excluded from the project. Should LBH wish to progress this option, Ameresco would be happy to quote.

Figure 60. Winston Churchill Theatre, AHU ancillary equipment

The site benefits from renewable technologies currently in the form of 4no. domestic sized air-air heat pumps serving 6no. emitters internally:

- 2no. Outdoor Panasonic S-6010PK3E
  - Serves 4no. indoor units in the auditorium
- 2no. Mitsubishi MUZ-GE35VA
  - Serves 1no. indoor unit in office
  - Serves 1no. indoor unit in server room
- 2no. Mitsubishi SUZ-KAVA2
  - Serves 2no. indoor cassette units in the foyer

These units are capable of heating and cooling.

Lighting throughout the site was fluorescent tubes T5 throughout with T8 in the kitchen with exception to the areas included in the 2012 refurbishment which were noted to be LED and included PIR lighting controls.

The most recent asbestos report that could be produced was a hard copy from 2010 denoting multiple areas throughout the site that would present risk such as flash guarding, soffit boards and gaskets in the plant room.

Premises Energy Consumption Baselines and Profiles

Electricity & Gas Consumption Profile

No HH data was available for this site so it was not possible to develop or analyse the consumption profiles for this site. It was therefore not possible to identify demand outside of operational hours. Monthly gas and electricity consumption data was used to develop the site baselines.

Summary of Site Baselines

The table below shows the site annual energy baselines for gas and electricity consumptions based on 2021/2022 data. These are obtained from the client.

Energy Type	*Consumption (kWh/Yr)*	*Energy Cost (£/Yr)*	*CO2 Emission (tonnes/Yr)*
Electricity	110,880	£32,776	21
Gas	218,354	£13,691	40
Total	**329,234**	**£46,467**	**61**

Table 38. Winston Churchill Hall & Theatre energy baselines

Overview of Proposed ECM, Cost and Savings

Following our investigation of all ECMs, we have prioritised ECMs based on their maximum value to the site, including capital cost and energy savings. The proposed ECMs are shown in the following table.

ECMs	LED (new fitting)	Solar PV	Double Glazing	Secondary glazing	Cavity wall insulation (CWI)	Loft insulation	BMS (remotely managed)	Air source heat pump (ASHP)	Draught lobby (internal)	Fans - high efficiency	External wall insulation (EWI)
Winston Churchill Hall		✓	✓		✓	✓	✓	✓			

Table 39. Proposed ECMs – Winston Churchill

The table below summarises the savings and capital cost for all the proposed ECMs at this site.

ECM Description	kWh Savings (kWh/Yr)	Cost Savings (£/Yr)	CO2 Savings (te/Yr) (PSDS)	Lifetime CO2 savings (PSDS)
Solar PV	23,887	£ 7,061	-	-
Double glazing with metal or	11,665	£ 731	2	60
Cavity wall insulation (CWI)	8,177	£ 513	1	45
Loft insulation	2,897	£ 182	1	14
BMS (remotely managed)	40,127	£ 4,233	6	50
Air source heat pump (ASHP	- 16,286	-£ 42,745	30	595
DNO upgrade works	-	£ -	-	
Design costs	-	£ -	-	
Extra costs (M&V, financing)				
TOTAL	**70,467**	**-£ 30,025**	**40**	**764**

Table 40. Summary of ECM Savings and Cost - Winston Chu

Proposed ECMs

ECM: Solar Photovoltaic

To support the decarbonisation project and the increased electrical demand placed on the site in lieu of removing gas heating dependence, Ameresco are proposing the following self-generation electrical solution.

It should be noted that Winston Churchill Theatre has known asbestos throughout the site. Ameresco will require a full retrofit & demolition survey of the area to be undertaken prior to work starting. There has been no allowance made for asbestos in the price for this measure and all known or unknown Asbestos Containing Materials (ACM's) are out of Ameresco's scope.

Equipment Specifications

Full Equipment specifications can be found in Appendix C.

The proposed design will utilise QCells MLG10 series panels rated at 410W. Datasheet and information regarding declarations, production compliance and codes of conduct are appended.

The panels will be integrated with fixed voltage inverters from SolarEdge SE33.3K range, details of which are found in Appendix C.

Design Capacity

LBH submitted electrical import data for each site in which only the Civic Centre has Half Hourly (HH) metering. Ameresco solar team have reviewed monthly consumption data for this site and designed an array to maximise electrical self-consumption in order to support the decarbonization project (new demand from ASHPs).

It should be noted Ameresco are guaranteeing project performance in the form of electrical production of the system, not electricity self-consumption.

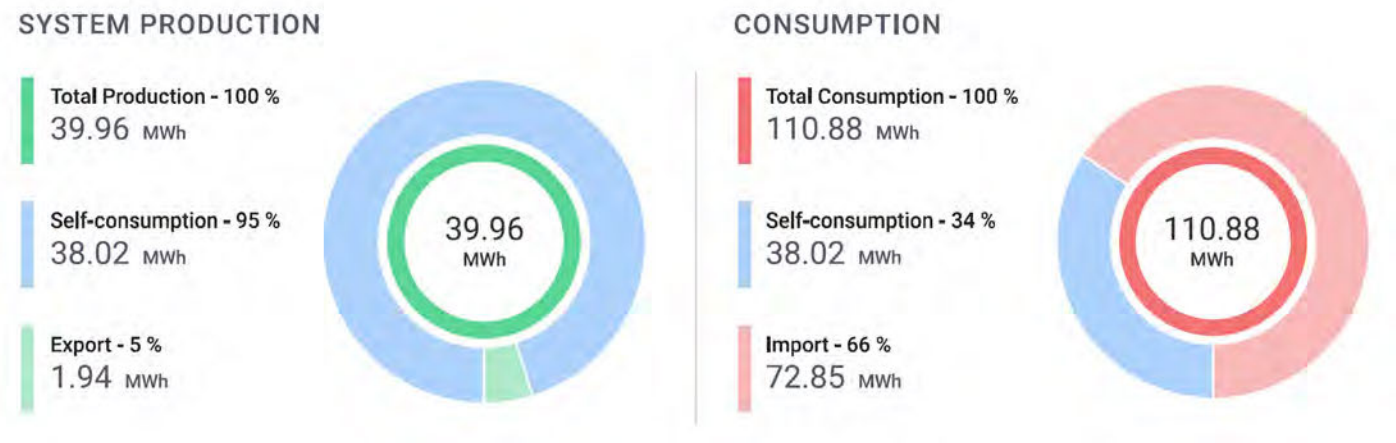

Figure 61. Winston Churchill Theatre, PV production vs. site consumption

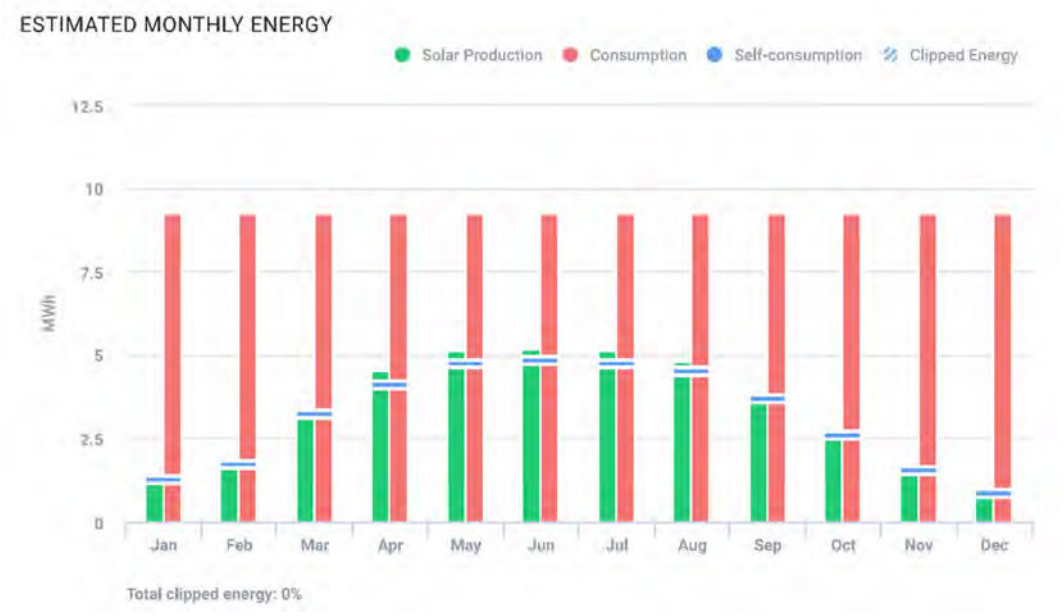

Figure 62. Site monthly electrical consumption (2021-22), PV production and est. self-consumption

*clipped energy loss % refers to the lost energy caused in a solar photovoltaic (PV) system due to the inverter derating its output to meet either its maximum power rating or the maximum allowable power at the grid connection.

Preliminary Design

Ameresco propose to install 39.77 kWp of PV system mounted to the roof with an annual yield up to 39,960 kWh/yr.
The array peak capacity is sized to maximise electrical self-consumption to support the site's decarbonisation programme. The panel layout is designed to optimise all the feasible roof space and to avoid any walking path, plant equipment, edge of the roof, safety guard rails and shading based on initial site inspection.
This design will utilise 97 modules assorted into 3 strings with each module fitted with an optimiser to ensure maximum generation per string. The inverter will be installed in the electrical incomer cupboard at the North side of the centre under the same roof where the PV is to be installed.
Ameresco have included in the design to include for LPS bonding.

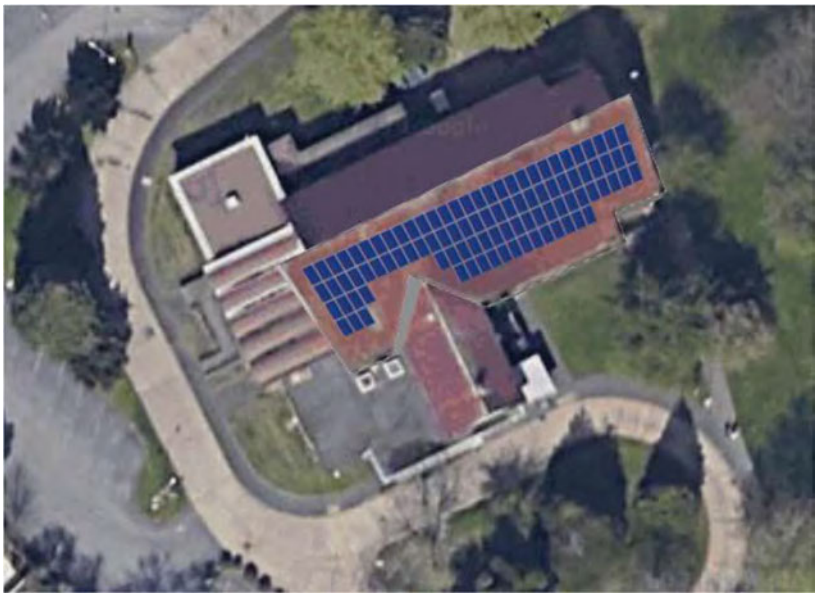

Figure 63. Winston Churchill Theatre PV panel layout

Scope of Supply

The detail scope of supply is outlined below.

Detailed mounting and electrical design	Included
Structural Assessment	Included
97 x Solar PV QCell	Included
Solar Edge 33.3K solar inverter	Included
Appropriate mounting kits required to fix the panels	Included
All accessories required for connecting the system to the Network	Included
DC cabling between panels and inverters, and AC cabling between inverters and switch boards	Included
New protection switch, to be installed in spare way of boards	Included
Total Generation kWh meter with remote monitoring capability	Included
Labour and standard materials required for the complete installation of the system	Included
Main AC and DC Cables	Included
Access and Lifting Equipment	Included
Scaffolding and Edge protection as required	Included
Solar Edge Monitoring System	Included

The solar PV system will be designed as a single unit and is proposed to be delivered in a single installation phase to minimise disruption and contractor time on site. It will be installed in compliance with all relevant health and safety regulations and designed to be in complete agreement with the latest editions of:

- ***MIS3002:*** *Requirements for Contractors Undertaking the Design, Supply, Installation, Set to Work Commissioning and Handover of Solar Photovoltaic Microgeneration Systems - published by MCS.*
- ***Photovoltaics in Buildings****: Guide to the installation of PV systems. 2nd Edition 2006: DTI.*
- ***BS EN 62548:*** *Installation and Safety Requirements for Photovoltaic (PV) Generators Guide to the Installation of Photovoltaic Systems as published by the MCS.*
- ***BS 7671:2015:*** *Requirements for Electrical Installations: IET Wiring Regulations.*
- ***BS EN 62446:2009:*** *Grid connected photovoltaic systems -Minimum requirements for system documentation, commissioning tests and inspection.*

Anticipated Savings and Other Benefits

The table below summarises the overall performance of this ECM.

Solar PV	Energy Savings		
	kWh/Yr	£/Yr	CO2 (te/Yr)
			PSDS
Electricity	23,887	£ 7,061	-
Gas	-	£ -	-
Total	**23,887**	**£ 7,061**	**-**

Table 41. Solar PV Performance Summary – Winston Churchill

All savings will be separately measured and/or verified as detailed in the M&V plan.

Cost Breakdown

[redacted]

Assumptions and Exclusions

The proposed project has the following assumptions and exclusions. If any of these are required, they will be added at an additional cost. A full risk register can be found in Appendix H.

- No allowance made for DNO reinforcement related improvements.
- No allowance for export limitation device.
- No allowance for a new LPS system installations however we will carry out bonding to existing LPS.
- No allowance made for external SPD installation, only built-in Type 2 SPDs inside the inverters.
- Given the age of this site it is assume there is no asbestos present and as such no provision has been made for asbestos at the installation areas (i.e. roof, cable routes, inverter location, etc.)
- If during the construction phase asbestos is discovered, it is at the responsibility of LBH to safely remove and dispose of before work can continue.
- No allowance made for fire alarm integration.
- Assumed electrical infrastructure in good condition and spare ways at existing sub DBs can be used.
- Assumed working only during standard weekday working hours.
- No allowance has been made for out of hours working or outdoor lighting.
- Assume we will have full and unrestrained access to site to complete works.
- Assume we will have access to welfare facilities. There is no provision for separate welfare units.
- Assumed we will have access to the site Wi-Fi. If not possible, client will need to arrange and provide a SIM card and router.
- Assumed roofs do not have any ongoing warranty.
- Make/model of panels subject to client's approval with Ameresco providing forced labour declaration.

ECM: BMS

As previously mentioned, Winston Churchill theatre originally included a JEL BMS but it has been downgraded to a simple time schedule controller which has severely limited control over the site utilities.

Figure 64. Obsolete BMS and simple time schedule controllers

Ameresco proposes to install a Trend IQ4 Building Energy Management System with 2no. MCCs, one for the main heating plant room and one for the AHU plant room. The new system will allow for internal and external temperature monitoring, weather compensation and a control philosophy to ensure efficient management of the controlled utilities (new ASHP).

The BMS install will also allow for a touch screen panel in both of the plant rooms with a remote user interface linked back to the ground floor office at the front of house to ensure adequate operator access during busy periods.

The measure is a necessity to ensure a holistic building control of heating and cooling plant across site. This is particularly impactful in a room such as the auditorium which contains:

- 4no. LTHW radiators
- 1no. 3" LTHW pipe that runs the perimeter of the building under the windows
- 4no. air – air heat pump emitters from existing Panasonic units
- AHU supply and extract grills distributed across the full auditorium

The current equipment setup results in some system disagreement between heating and cooling and during manual intervention still requires in overshoot in heating the largest area in the site, followed by immediately cooling as occupancy approaches full capacity (i.e. warming the room up for a show, filling with audience members, struggling to cool the room to ensure audience comfort).

The new BMS will allow the LTHW radiators, existing Panasonic heat pumps and AHU to all communicate with a cognisant room temperature goal and profile. This is further aided with BMS P/I/D control.

Additionally, Ameresco have included to strip out and replace the existing power and controls for equipment located in the boiler room and similar for the AHU supply and extract fans in the upper plant room. This currently houses power and controls for the following:

- 2no. gas boilers
- CT and VT circuit pumps
- Gas valve
- Sump pump
- AHU supply fan
- AHU extract fan

Anticipated Savings and Other Benefits

The table below summarises the overall performance of this ECM.

BMS (remotely managed)	Energy Savings			
	kWh/Yr	£/Yr	CO2 (te/Yr)	PSDS
Electricity	7,374	£ 2,180	-	
Gas	32,753	£ 2,054	5.98	
Total	**40,127**	**£ 4,233**	**5.98**	

Table 43. BMS Performance Summary – Winston Churchill

All savings will be separately measured and/or verified as detailed in the M&V plan.

Cost Breakdown

[redacted]

ECM: Air Source Heat Pump (ASHP)

Heat Loss Analysis

Ameresco attended site to carry out laser measurements of all windows and doors and selected internal rooms to cross reference against general arrangement floor plans throughout all sections of the building. Note was taken of building materials and glazing, as well as estimates of air change factors given the building's expected configuration and use.

An external temperature of - 3°C which was considered appropriate for the Hillingdon area was used for peak load analysis. Internal design temperatures and ventilation rates were used following BS EN12831.

A room-by-room simulation was derived for the entire building to assess building fabric heat loss and appropriateness of current heat emitters. Given the building's construction being uninsulated cavity wall and single glazing windows, building fabric upgrades have been included to consider cavity wall insulation (CWI) and double glazing with uPVC frames.

Detailed heat loss analysis can be found in Appendix F.

System Sizing and Building Limitations

The building electrical supply is rated at 58A and the max demand occurring in the past 12 months is 58A, 100% utilisation. Substantial upgrades are needed to the electrical network to integrate the new HP system. Pending on the DNO proposal we will be able to confirm the final electrical integration costs.

Scope of ECM Work Proposed

Ameresco has undertaken a diligent review the site, including site surveys to establish space availability inside plantrooms, as well as outside areas for the outdoor evaporator units. Areas identified for the location of the external units have not been agreed with LBH at this time. Ameresco has allowed costs for preparation of planning permission, which are required for the evaporator units and heat pump unit installations placed externally. Ameresco would seek approval from the LBH to proceed with the works concurrently to the planning submission to limit any impact to the project timeline.

The general scope of works is to provide a solution including supply, installation, testing and commissioning of 1no. air source heat pump package.

Detailed design includes for all electrical, mechanical, controls and civils work.

- *DNO connection and Planning applications.*
- *Civil works.*
- *Foundations for external units.*
- *Trenching, excavation works, where applicable.*
- *Inclusion/modification to existing concrete plinths to accommodate equipment, where applicable.*
- *Roof structural surveys*
- *Fencing around the external units, where applicable.*
- *Mechanical works.*
- *Wiring and heat transfer pipework between indoor and outdoor units.*
- *Buffer tanks and interconnection and integration pipework connections.*
- *Insulation to pipework, valves etc. that we installed in plantrooms.*
- *Electrical works.*
- *Connection of heat pumps to site electrical supply.*
- *Integration of the new heat pump systems to newly proposed BMS.*
- *Supply and installation of heat pump units to be located in external area.*
- *Thermal and hydraulic integration of the heat pump into the existing heating system which includes correct pump and pipe sizing.*
- *Hydraulic separation of new installed heat pump and associated equipment from existing distribution system.*
- *Site training and handover.*
- *Removal of 2no. gas boilers located in the plant room.*

Equipment Positioning and Detailed ECM Schedule

Ameresco have investigated two options for Winston Churchill Theatre:

- *Rooftop based ASHP*
- *Carpark based ASHP*

As with all rooftop installations it would be subject to a structural survey and planning approval, however we believe the ASHP will achieve the best operating efficiencies in this location. As such Ameresco propose a solution installing the AHSP on the kitchen roof at the North East side of site.

This package would require the installation of 1no. ThermoNova NOVA 220 heat pump and require pipework running along the building (or trenching if required by LBH) to the plantroom located at the North East side of the building where we propose to install a thermal store.

If during detailed design the roof structure above the kitchen is assessed to be in appropriate to support the weight the ASHP, Ameresco propose a secondary location in the grass area South of the auditorium. Both of these options are illustrated in Figure 65.

Figure 65. Indicative locations for Winston Churchill Theatre ASHP units showing both possible locations

Figure 65 shows the ASHP package location to ensure ample space for airflow and space to fit the units. This package is capable of providing flow temperatures up to 68°C, however, Ameresco propose to run this package at a lower flow temperature (yet maintaining DHW at 60°C in storage) in order to achieve higher efficiencies and lower electrical consumption. This will necessitate the upgrading of existing heat emitters including AHU heating coils which is included in the pricing. The ASHP package will include an enclosure to dampen acoustic noise from the fans and ensure there is a suitable exclusion zone around the package to allow for maintenance when required.

System Design and Schematics

To be produced as part of the detailed design.

Equipment Selection (Preliminary)

Ameresco propose at this site ThermoNova products for the following reasons:

- High flow temperatures available to cover DHW requirements
- Flexible return temperature solution.
- Very Low Global Warming Potential Refrigerant – R290 GWP of 3.0.
- Small compact size vs thermal output – monobloc approach means evaporators combined with compressors.
- Excellent coefficient of performance (COP).
- Simple hydraulic connection.
- Modular frame based design to enable expansion and quick installation.
- Strong remote monitoring capabilities.
- Great for integrating into existing buildings.
- Reliable construction techniques.

The nature of the monobloc units having combined compressors means we are able to allow for great redundancy across each installation i.e. NOVA 440 will have 4 compressors which are able to continue operating should a compressor fail. The expectation would be a drop in efficiency from a cascade unit due to a failed compressor and a balance would be struck between flow temperature and rate of heat delivery if the unit was at maximum load.

A NOVA 110 unit is considered a singular modular unit which can be incorporated up to a NOVA 880. For each package up to 4 units, a control panel will be included e.g. a NOVA 660 would include 2no. control panels for that associated package.

Figure 66. ThermoNova, NOVA 110 ASHP

Figure 67. ThermoNova, NOVA 440 AHSP

This is a preliminary selection of equipment for this measure as decided upon surveying the site. As an outcome of the detailed design the type and number of units will be confirmed which may vary from the preliminary selection.

Assessment of Existing Heat Distribution System

As part of the installation of the heat pump package, Ameresco will include for the upgrade to existing heat emitters on site. This includes radiators throughout the site* and 1no. AHU coils located in the plant room (this includes the 3-port mixing valve and isolation valves local to the AHU coil).

**with exception of 4no. radiators within the auditorium. These radiators were determined to be appropriate size for lower flow temperatures excluding additional heating provided by AHU and 4no. air - air heat pump emitters. During site survey it was noted that larger surface area radiators may inhibit emergency egress route from the auditorium between retractable seating and the radiators. As an alternative Ameresco will provide new robust 28mm isolation valves to the 4no. radiators in lieu of TRVs which regularly suffer accidental damage by viewers during show intermissions.*

Heat pump integration to the Winston Churchill Theatre will include for a hydraulic break via 1no. plate heat exchanger to protect newly installed equipment which will connect with the existing pipework distribution. It is not standard engineering practice to install a standby plate heat exchanger due to the additional cost and space requirements involved and their low failure rate. Significant redundancy is already built into the proposed solution through the use of modular compressors and heat pump units.

Ameresco strongly recommend existing distribution system is flushed and inspected to ensure adequate delivery of low temperature hot water from heating plant.

Electrical Requirements and DNO Application

Ameresco have applied for DNO approval but are currently awaiting connection / upgrade costs. As previously mentioned, UKPN have not provided a budgetary cost at this stage. Ameresco has allocated a provisional sum of £150k on this stage and will inform LBH upon receiving a budgetary cost from UKPN. Full DNO connection costs have not been included within this proposal and will be quoted as part of the DNO full assessment, the cost of which is included in the Ameresco Detailed Design proposal. Should the DNO come back stating a cost beyond the allocated amount, then LBH will be responsible for the additional costs.

As part of this project, and included within the project costings for this ECM, Ameresco has allocated a cost for connecting the new heating equipment, including the heat pumps themselves and any ancillary equipment, to an identified distribution board or isolator that is unused. Ameresco has assumed all existing on-site electrical systems comply with current regulations and any upgrade to bring up to standard are out of our scope. The exception is Ameresco has included to strip out and replace the existing power and controls for equipment located in the boiler room and the AHU supply and extract fans in the upper plant room.

Noise Assessment

Ameresco will appoint an acoustic consultant to carry out noise surveys and assess the noise impact to the neighbouring buildings once confirming heat pump locations. Ameresco will share the information with the council following completion of the survey and its noise assessment report.

Anticipated Savings and Other Benefits

The table below summarises the overall performance of this ECM.

Air source heat pump (ASHP)	Energy Savings		
	kWh/Yr	£/Yr	CO2 (te/Yr)
			PSDS
Electricity	- 179,148	-£ 52,956	-
Gas	162,862	£ 10,211	29.73
Total	**- 16,286**	**-£ 42,745**	**29.73**

Table 45. ASHP Performance Summary – Winston Churchill

All savings will be separately measured and/or verified as detailed in the M&V plan.

Assumptions and Exclusions

The boilers and associated obsolete plant will be removed from site, as necessary. During the site construction a temporary boiler will be used to transition from the existing boiler system to ASHPs. We have included costs for this temporary boiler to be on site for 3 weeks. If a temporary boiler is required for more than 3 weeks, due to reasons outside of our control, this will be an additional cost to the Council.

We have not priced in asbestos removal, Ameresco require LBH to conduct retrofit & demolition asbestos surveys in all areas to be affected by work prior to Ameresco starting work. In the case of asbestos discovery during construction phase previously not known, LBH take full responsibility in the safe removal and disposal before work can continue.

We have not priced for removing the gas pipes or gas Meters from site and DNO upgrade costs are outside of our scope.

We have not priced in upgrades to existing distribution system including pipework, pumps, valves and existing metering. AHU coil upgrades excludes works to associated plant including fan motors, belts and bearings

Ameresco have not included for decoration works around radiators due to sizes being changed from imperial to metric.

ECM: Building Fabric Improvement

Windows

Winston Churchill Theatre includes 54 single glazed windows for varying sizes and styles made from wood and metal frames.

Ameresco propose to replace all windows, including those in the upstairs leased flat / office with uPVC double glazing in order to improve the associated heat loss through windows by as much as 60%.

Figure 68. Winston Churchill Theatre, various windows across the site

As part of this measure Ameresco have included for replacing the existing window mounted extract / supply fans with 2no. Xpelair commercial window extractor fan units including a new electrical supply and connections.

Anticipated Savings and Other Benefits

The table below summarises the overall performance of this ECM.

Double glazing with metal or plastic frames	Energy Savings			
	kWh/Yr	£/Yr		CO2 (te/Yr)
				PSDS
Electricity	-	£	-	-
Gas	11,665	£	731	2.13
Total	**11,665**	**£**	**731**	**2.13**

Table 47. ECM 2 Performance Summary – Winston Churchill

All savings will be separately measured and/or verified as detailed in the M&V plan.

[redacted]

Assumptions and Exclusions

Ameresco have not included any remedial works to areas local to windows to be replaced and will “make good” areas of work to the same standard as before starting work. This includes existing fabric or decorative damage. In the case that fabric may be of condition that it is expected to suffer from the measure install, Ameresco will require LBH undertake remedial works prior to starting work.

Figure 69. Female bathroom adjacent to kitchen window, showing cracked plaster

Due to the age of this building and the presence of asbestos on site, Ameresco require full retrofit & demolition asbestos surveys of all window openings and adjacent areas affected within the scope of this measure to be carried out. Any, and all, asbestos found during these surveys must be safely removed and disposed of, as required, prior to Ameresco starting work at LBH’s cost. If during the construction phase of this project previously unknown asbestos is discovered, it is the responsibility of LBH to safely remove and make the area safe for work.

Cavity wall insulation

A building with inadequate insulation stands to suffer significant heat losses which could result in increased electric and heating costs. One of the ways to reduce the movement of heat and minimise losses through the building fabric is to ensure that these areas are insulated against unnecessary heat losses.

Winston Churchill Theatre external walls are cavity wall 50mm gap, uninsulated. Ameresco propose to include cavity wall insulation as a measure to improve the building thermal envelope resulting in less heat loss through the building walls.

Anticipated Savings and Other Benefits

The table below summarises the overall performance of this ECM.

Cavity wall insulation (CWI)	Energy Savings			
	kWh/Yr	£/Yr		CO2 (te/Yr)
				PSDS
Electricity	-	£	-	-
Gas	8,177	£	513	1.49
Total	**8,177**	**£**	**513**	**1.49**

Table 49. CWI Performance Summary – Winston Churchill

All savings will be separately measured and/or verified as detailed in the M&V plan.

[redacted]

Assumptions and Exclusions

Ameresco have included for repointing areas of significant mortar degradation as part of this measure however areas of damaged brickwork, such as the delivery to stage bay show in Figure 70, would either be at additional cost or must be completed by LBH prior to Ameresco starting work.

Figure 70. Winston Churchill Theatre, brickwork damage during stage deliveries

Loft insulation top-up

Similar to the benefit of cavity wall insulation, a building without insulation either along the ceiling or the roof can result in significant heat losses. Winston Churchill Theatre have existing 100mm mineral wool insulation within the loft area above the auditorium but not in the area above the changing rooms and changing room hallway.

Insulation that has been laid above the auditorium was noted to be cross laid over joists without separation to allow joists to sit neatly within the insulation. This can result in moisture trapping and associated issues that may arise. Ameresco propose to remove existing insulation and replace with double lay 300mm insulation including protective cones over the 28no. existing downlights towards the East side of the loft.

In the area above the changing rooms, Ameresco will propose to lay 300mm of insulation. Remedial works to ceilings have been excluded at this stage and will be at an agreed additional cost where required.

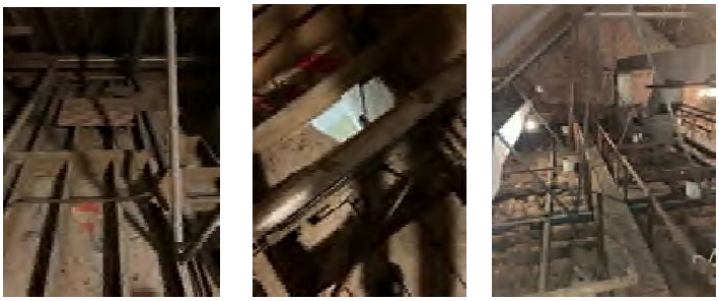

Figure 71. Winston Churchill Theatre, loft area above changing rooms (left, middle), above auditorium (right)

Anticipated Savings and Other Benefits

The table below summarises the overall performance of this ECM.

Loft insulation	Energy Savings		
	kWh/Yr	£/Yr	CO2 (te/Yr) PSDS
Electricity	-	£ -	-
Gas	2,897	£ 182	0.53
Total	**2,897**	**£ 182**	**0.53**

Table 51. Loft Insulation Performance Summary – Winston Churchill

All savings will be separately measured and/or verified as detailed in the M&V plan.

Cost Breakdown

[redacted]

Assumptions and Exclusions

Auditorium loft installation will be subject to risk assessment and a fall arrest system of working to ensure safe installation above the auditorium. The fall arrest system of working will be carried out as part of the detailed design and currently not included in the costs.