JENKS ASSOCIATES LIMITED

Energy Recovery Statement

Mechanical and Electrical Services

210-353/ENERGY/R01

PROPOSED 20 BEDROOM PREMIER INN ANNEXE

Littlehampton Premier Inn
Roundstone Lane
East Preston
Littlehampton
West Sussex
EN16 1EB

April 2015

JENKS ASSOCIATES LIMITED
EVENTUS CENTRE
SUNDERLAND ROAD
MARKET DEEPING
PETERBOROUGH
PE6 8FD
[redacted]

JENKS ASSOCIATES LIMITED
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Accredited Contractor

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1. GENERAL PROJECT DESCRIPTION

1.1 This Energy Report is to be read in conjunction with the current Planning Application for the proposed 20 Bedroom Premier Inn Hotel Annexe at Littlehampton Premier Inn, Roundstone Lane, East Preston, Littlehampton, West Sussex, BN16 1EB.

1.2 This Energy Report provides details of the energy saving technologies which will be used in connection with the Mechanical and Electrical Services for the project.

2. MECHANICAL AND ELECTRICAL SERVICES PROPOSALS

2.1 The project specific mechanical and electrical services specifications will be prepared following a review of available low and zero carbon technologies and after completion of a thermal model for compliance with the 2013 Building Regulations.

For the Premier Inn Development, It is current practice to provide cooling to these buildings and therefore the potential for using ground source heat pumps has been reviewed.

The supply/extract ventilation for the Hotel Bedrooms will be provided from air handling equipment complete with heat recovery (up to 85% efficiency) from the return air to pre-condition the supply air.

2.2 The Domestic Hot Water generation plant will provide 109 % net efficiency rates.

2.3 The complete installation will be provided with time-switch control and localised temperature controls.

2.4 The building's internal lighting will all be provided via high frequency luminaires and light emitting diode (LED) lighting.

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3. LOW/ZERO CARBON OPTIONS

3.1 This Report has been prepared to investigate the viability of the incorporation of Renewable energy systems to a Whitbread Hotel Extension.

3.2 In accordance with the EU's Renewable Energy Directive and the UK Energy Act 2008, the 2009 Renewable Energy Strategy has been prepared which incorporates Microgeneration schemes with the potential for consumers to receive guaranteed feed in tariffs to encourage energy savings and promote carbon reduction technologies.

3.3 The sources of energy listed in Section 100 of the Energy Act that are proposed to be incorporated into the Government's scheme are as follows:

- Solid Biomass
- Biogas
- Energy from the Sun (Solar PV)
- Energy from the ground (Ground source heat pumps and Geothermal)
- Energy from the Sun (Solar Thermal)
- Anaerobic Digestion
- Hydro
- Micro – CHP
- Biomethane

3.4 Although the above strategy is focused towards the domestic consumer where the tariff arrangements are very favourable, there is the potential for Whitbread Plc to take advantage of the scheme where the energy loads can be matched to the most advantageous tariffs. The Table below shows the feed-in tariffs available.

3.5 Feed in Tariffs for Electrical energy generation are available now in accordance with the attached schedule.

3.6 Renewable Heat Incentives were made available in April 2011.

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3.7 TABLE OF FEED-IN TARIFF LEVELS

Table A: Listing of all Generation Tariff levels for the current period

Energy Source	Scale	Type / Rate	Tariff (p/kWh)
Anaerobic digestion	≤250kW		14.70
Anaerobic digestion	>250kW - 500kW		13.60
Anaerobic digestion	>500kW		8.96
Hydro	≤15 kW		21.00
Hydro	>15 - 100kW		19.60
Hydro	>100kW - 500kW		15.50
Hydro	>500kW - 2MW		12.10
Hydro	>2MW - 5MW		4.48
Micro-CHP	<2 kW	(Limited)	12.50
Solar PV	≤4 kW	Higher rate	15.44
Solar PV	≤4 kW	Medium rate	13.90
Solar PV	>4 - 10kW	Higher rate	13.99
Solar PV	>4 - 10kW	Medium rate	12.59
Solar PV	>10 - 50kW	Higher rate	13.03
Solar PV	>10 - 50kW	Medium rate	11.72
Solar PV	>50 - 150kW	Higher rate	11.50
Solar PV	>50 - 150kW	Medium rate	10.35
Solar PV	>150 - 250kW	Higher rate	11.00
Solar PV	>150 - 250kW	Medium rate	9.90
Solar PV	≤250kW	Lower rate	7.10
Solar PV	>250kW - 5MW		7.10
Solar PV	≤5MW	Stand-alone	7.10
Wind	≤100kW		21.00
Wind	>100 - 500kW		17.50
Wind	>500kW - 1.5MW		9.50
Wind	>1.5MW - 5MW		4.48

Once a system has been registered, the tariff levels are guaranteed for the period of the tariff and index-linked as described above. For systems registered in future years, some tariff levels will be adjusted to account for expected reductions in system prices, as further described here.

3.8 TABLE OF PLANNED RENEWABLE HEAT INCENTIVE TARIFF LEVELS

Tariff name	Eligible technology	Eligible sizes	Tariff rate (p/kWh)
Small biomass	Solid biomass; Municipal Solid Waste (including CHP)	Less than 200 kWth	7.9
Medium biomass		200 kWth and above; less than 1000 kWth	4.9
Large biomass		1000 kWth and above	1.0
Small ground source	Ground-source heat pumps; Water-source heat pumps; Deep geothermal	Less than 100 kWth	4.5
Large ground source		100 kWth and above	3.2
Solar thermal	Solar thermal	Less than 200 kWth	8.5
Biomethane	Biomethane injection and biogas combustion, except landfill gas	Biomethane all scales; biogas < 200 kWth	6.8

3.9 PHOTOVOLTAIC CELLS

The performance of solar PV systems is impossible to predict with certainty due to the variability on the amount of solar radiation (Sunlight) from location to location and from year to year. This estimate is based upon the Government's standard assessment procedure for energy of buildings (Domestic) SAP ratings and is given as guidance only. It should not be considered as a guarantee for performance.

The panels need to be installed on a sloping south facing roof for the best potential for generation effectiveness. The location and orientation of the building is determined by the arrangement of the site and the planning and trading requirements. The potential for siting solar photo voltaic cells varies with the space available on the roof.

The feed-in tariff for 4 -10kW is 13.99p/kWh and this will generate a total of £1503.82 per annum. The costs below are based on national current rates for electricity, not the standard Whitbread rate.

The capital cost of such an installation will be of the order of £20,000.00. So the payback will be Circa 12 years.

Estimated Payback Calculation

Total Installed Cost	£19,230.00
Estimated Annual Performance (kWh)	9260
FIT Rate - Generation	13.99p
FIT generation - Export	4.5p
Estimated annual income FIT (Generation)	13.99p
Estimated annual income FIT (Export)	4.5p
TOTAL	£1,503.82
Return on investment	7.82%
Payback Period	13 Years
ESTIMATED EARNINGS OVER 20 YEARS	£30,076.48
ESTIMATED PROFIT OVER 20 YEARS	£10,846.48

3.10 WIND TURBINE

The alternative for electrical generation available is wind driven turbines. There are some environmental problems associated with the siting of wind turbines:

Electromagnetic interference which may be a problem for neighbouring properties, particularly television reception

Noise from wind rotors, gearboxes and generators

Visual impact

The siting of wind turbines needs to be carefully considered to take account of the issues raised above but also to ensure that the potential for electrical generation. There needs to be a free unimpeded path for the wind, therefore it is likely that the unit will need to be located away from the building and remote from adjoining properties. It is also necessary to ensure that the prevailing climate is such that windy conditions exist for much of the year. See the following UK climate map for average annual wind speeds, and it will be noted that the best areas for installation of wind turbines are in coastal areas and on high ground.

Therefore the selection of a site suitable for wind generation is governed by all the above factors, but that said the potential for generation periods is not limited to bright sky days as is the case with solar photovoltaic cells generation.

Using a 10kWe wind turbine with a rotor diameter of about 8m it will need to be sited away from the building on a pole at least 12m high.

A 10kW wind turbine will generate of the order of 26000kWh.

The feed in tariff for wind generation is 26.7p/kWh and this will generate a total of £5,462.00. The installation of a wind turbine will cost of the order of £45,000.00.

So the pay-back period would be 8.2 years. So the system will generate a surplus over 20 years of £109,240.00 provided the equipment is maintained in serviceable condition (Currently c£850.00 per annum).

Budget Installed Capital Cost	£45,000.00
Annual Energy Saving	26000kWh
Annual Energy Cost Saving	£2,600.00
Feed In Tariff	21p/kWh
Incentive	£5,462.00

3.11 The above reviews are for the generation of electricity on site and to qualify for other proposed credits for the MGC scheme, a number of technologies can be used to convert low grade heat energy into usable energy for buildings. Apart from biogas and biomass boilers, the remainder of the technologies require there to be a cooling as well as a heating load. For all heat pump technology the performance of the energy efficiency improves if heating of domestic hot water in the summer comes as a by-product of the heat rejected during the cooling cycle. Coefficients of performance for heating only are typically 3.5 to 4, marginally better than gas fired heating, but with summer cooling the Coefficient of Performance will increase to around 6.

3.12 Ground source heat pump technology relies upon deriving energy from a cool water source below the ground and converting it to cooling or heating energy through an electrically driven heat pump. The process relies upon there being the capability of the ground geology to permit the strata to relinquish or absorb energy to/from pipework looped below the ground either in trenches or boreholes. Of necessity in the geology of most areas, there is a need to allow the ground to recover from withdrawing energy in the winter for heating by allowing the ground to reheat in the winter with rejected heat from the heat pump condenser in the summer. This is a fine balance as the benefit of GSHP technology is that waste heat from the condenser can also be used to pre-heat the domestic hot water.

Although we have considered the use of a GSHP system we feel this is cost prohibitive to our client and we will not make any further recommendations for this type of technology

3.13 The alternative to the ground source heat pump for the new Premier Inn development would be an air source heat pump system. The Air Source Heat Pump Solution is generally the Model solution for heating and cooling Premier Inn Hotels.

This is a more cost effective option and would provide all year round heating and cooling to the new Premier Inn development.

The proposed VRF installation for the Premier Inn has a heating seasonal efficiency of 5.4305 and a cooling seasonal energy efficiency ratio of 4.9842.

3.14 Solar heating can be used very usefully for preheating the domestic hot water demand. As with the photovoltaic cell technology, south facing roofs are the most advantageous for deriving energy. However, the demand for hot water is not

constant. The back-up system to heat the stored water when insufficient energy cannot be derived from the sun would be from small gas fired low temperature hot water condensing boilers. The cost of solar pre-heat is likely to be of the order of £15,650.00 for a 16m^2 array.

As described above, as the hot water demand is not constant we will discount this source of technology for the Extension.

3.15 The other alternative technologies of biomass, biogas and hydro-electric power have not been considered relevant to this study, due to lack of space for fuel storage and location of the site.

4. DISCUSSION AND RECOMMENDATIONS

4.1 It will be seen that the proposals for on-site generation result in some savings over time assuming that the FIT payout is retained at current levels. The wind turbine will provide a good return, but its use will be impractical due to problems with location on such a small site, and the poor impact this would create on neighbouring external properties, trading areas and to the proposed Hotel. It is also technology Whitbread Plc does not utilise for their buildings.

4.2 The Renewable Heat Incentive offers options for various types of plant. However this building's systems do not warrant utilising certain types, namely Ground source heat pumps. We would anticipate actual paybacks based on previously installed schemes on similar Whitbread properties to be in the region of 25/30 years.

4.3 We have not considered combined heat and power as a technology due to Whitbread Plc concerns on reliability, ongoing maintenance costs, and also the fact that the building use is not constant.

4.4 We have not considered solar hot water, as again, the hot water usage is not constant and therefore large amounts of storage would be required.

4.5 The Photo Voltaic array on the Restaurant provides the best solution and practical potential for payback, (for a 54m² array, a payback of circa 12 Years can be achieved in the best climatic conditions within the UK). However, the payback is considered high and the technology expensive.

4.6 Therefore the best solution would be a high Coefficient of Performance air source heat pump solution. This will provide a saving on energy compared against the SBEM calculated notional building.

The air source heat pump arrangements will be used for the heating/cooling of the new Extension.

5. CONCLUSION

5.1 By utilising the high COP air source heat pumps for the heating and cooling of the proposed Extension we have calculated the following:

Notional Building Energy Consumption by End Use	=	256.00 kWh/m²/Annum
Actual Building Energy Consumption by End Use	=	218.73 kWh/m²/Annum
Therefore, predicted Energy Consumption saving	=	**15.0%**
Notional Building Carbon Emissions Rate	=	68.50 kg CO_2/m²/Annum
Actual Building Carbon Emissions Rate	=	59.50 kg CO_2/m²/Annum
Therefore, predicted Carbon Emissions saving	=	**13.0%**