

# St Gluvias Community Hall: M&S Energy Fund grant application

## A Note on the energy-saving basis of battery storage for this application

### Background

The Hall's Solar PV system, installed end September 2016, is expected to generate around 9,400kWh per year. Presently, for technical reasons, all the energy generated is exported to the national grid and annual payments of around £1,250 are expected from FIT payments for the total generation (10.67p/kWh) together with a payment on 50% of generation deemed to be exported (4.91p/kWh), totalling £1,233.75/year.

Note that these payments are index-linked for 20 years and are made regardless of the amount that might be used in the Hall.

A storage system using batteries will bring savings by enabling us to use the generated power locally at a time when it suits us. There is no financial penalty for doing this regardless of what proportion of the generated electricity is used.

The Hall has two meters on different tariffs: Meter ONE on the standard tariff serving everything except the radiant heating; and Meter THREE on a lower tariff for that heating. These tariffs are detailed here, together with the annual cost based on the usage figures taken for this study.

Supply Tariffs	Energy usage rate (incl. VAT at 5%)	Standing charge (incl. VAT at 5%)	Typical annual energy usage	Annual cost (£)	Totals
Meter ONE - Standard tariff	16.947 p/kWh	36.246 p/day	2,877 kWh	Usage: 487.57 Stdg charge: 132.30	£619.86
Meter THREE - Heating tariff	11.004 p/kWh	38.556 p/day	3,950 kWh	Usage: 434.66 Stdg charge: 140.73	£575.39
Total (annual)					£1,195.25

The focus for this application is on Meter ONE which carries the higher tariff (offering the biggest financial savings per unit of energy saved) and for which the usage on the meter is sensibly matched to solar generation during the winter half-year (2,426kWh). (Conversely the solar generation during winter is insufficient to consider its use in supporting the heating). This analysis takes account also of the unavoidable inefficiency of the usage cycle of storage and reuse (charge/invert).

### Consideration of the energy-saving potential for meter ONE using storage

This study is based on weekly meter readings showing our actual usage during the winter half-year (1 Oct – 31 Mar). It is assumed that these weekly reading are a sensible basis for the study. [See spreadsheet]

Two levels of use are explored: 'Scenario 1', the actual, present usage; and 'Scenario 2', a possible doubling of use – as could be the case with more cooked meals.

The solar generation in each case is the same: the figures are for the actual winter six months (1 Oct – 31 Mar); and the projection for generation in the full year to 30 Sept.

The source data follows with conclusions in two tables derived from the source data.

### Summary of conclusions

At the current level of annual usage on Meter ONE (2,877 kWh/year) it is estimated that all but 123kWh can be met from solar generation by installing a battery storage system of the envisaged specification. This would give a reduction in imported power of about 95.7% and a cost saving (compared with having no storage) of around £460 at present tariff rates.

If usage were to double (to 5,754 kWh/year) – as it might if we were to provide more cooked meals, then all but 863 kWh could be met from solar generation. This would give a reduction in imported power of about 85% and a cost saving (compared with no storage) of around £825 at present tariff rates.

ST GLUVIAS HALL – winter half-year (3/10/16 – 3/4/17)						GP (m_ONE	TGM minus
			<b>Solar 're-use' factor</b>			increased by (factor) of:	
			<b>0.85</b>			<b>2</b>	
	SolarPV-TGM	<b>Solar PV</b>	Solar generation	Reading	<b>GP Standard tariff m_ONE</b>	<b>Discounted solar generation LESS m_ONE usage</b>	<b>Discounted solar generation LESS m_ONE usage</b>
Date	Reading	<b>weekly generation</b>	LESS discount	m_ONE	<b>weekly usage</b>	weekly surplus	weekly surplus
26/09/16	91	reference		23997	reference		
03/10/16	278	187	159.0	24049	52	107	104
10/10/16	436	158	134.3	24093	44	90	88
17/10/16	581	145	123.3	24135	42	81	84
24/10/16	706	125	106.3	24184	49	57	98
31/10/16	769	63	53.6	24235	51	3	102
07/11/16	865	96	81.6	24276	41	41	82
14/11/16	951	86	73.1	24344	68	5	136
21/11/16	1013	62	52.7	24394	50	3	100
28/11/16	1057	44	37.4	24453	59	-22	118
05/12/16	1099	42	35.7	24497	44	-8	88
12/12/16	1134	35	29.8	24555	58	-28	116
19/12/16	1159	25	21.3	24604	49	-28	98
26/12/16	1186	27	23.0	24640	36	-13	72
02/01/17	1230	44	37.4	24656	16	21	32
09/01/17	1272	42	35.7	24689	33	3	66
16/01/17	1316	44	37.4	24733	44	-7	88
23/01/17	1357	41	34.9	24769	36	-1	72
13/02/17	1557	200	170.0	24955	186	-16	372
20/02/17	1668	111	94.4	25002	47	47	94
27/02/17	1765	97	82.5	25048	46	36	92
06/03/17	1913	148	125.8	25115	67	59	134
13/03/17	2022	109	92.7	25181	66	27	132
27/03/17	2336	314	266.9	25295	114	153	228
03/04/17	2517	181	153.9	25345	50	104	100
Totals		<b>2426</b>	<b>2062.1</b>		<b>1348</b>	<b>714.1</b>	<b>2696</b>
						<b>-122.7</b>	<b>-863</b>

## St Gluvias Community Hall – Energy generation, usage & potential for saving – DATA SUMMARY

This document summarises the data presented for a battery energy storage system for the Hall.

Two scenarios are considered, both concerning the usage that passes through Meter ONE which supplies the demand of all but the radiant heating in the main hall.

The first scenario is for the present level of usage. The second assumes a possible doubling of that usage.

Note that in these calculations a prudent 'discount factor' is applied to the level of solar generation to account for the estimated inefficiency in the charge-invert reuse cycle.

<b>SCENARIO 1 – Meter ONE (Standard Rate) based on the present level of use</b>	<b>Row ref</b>	<b>Winter half-year (Actual data)</b>	<b>Summer half-year (forecast data)</b>	<b>Row Totals</b>	<b>units</b>
		<b>01/10/2016 to 31/03/2017</b>	<b>01/04/2017 to 30/09/2017</b>		
Standard Rate Tariff [Good Energy, 01/03/2017]	r1	0.16947	0.16947	0.16947	£/kWh
Solar Generation (discounted to allow for reuse inefficiency)	A	2,062	5,980	8,042	kWh
Meter ONE usage at current level of usage	B	1,348	1,529	2,877	kWh
Solar Generation (discounted) LESS Meter ONE usage	C = A – B	714	4,451	5,165	kWh
Shortfall in weeks when usage exceeds generation. (Assumed to be zero in summer half-year)	D	-123	0	-123	kWh
<b>Estimated saving in energy use. See Assumptions below</b>	E = B + D	1,225	1,529	<b>2,754</b>	kWh
<b>Percentage reduction in usage (saving/usage)</b>	F = E/B	90.9%	100.0%	<b>95.7%</b>	
Possible financial saving (Scenario 1)	G = F x r1			<b>£466.77</b>	<b>per year</b>
(Relative to a full cost with no storage of:	H = r1 x B			£487.57	per year)

<b>SCENARIO 2 – Meter ONE (Standard Rate) based on DOUBLE the present level of use</b>	<b>Row ref</b>	<b>Winter half-year (Actual data)</b>	<b>Summer half-year (forecast data)</b>	<b>Row Totals</b>	<b>units</b>
		<b>01/10/2016 to 31/03/2017</b>	<b>01/04/2017 to 30/09/2017</b>		
Standard Rate Tariff [Good Energy, 01/03/2017]	r1	0.16947	0.16947	0.16947	£/kWh
Meter ONE usage at DOUBLE the current level of usage	H	2,696	3,058	5,754	kWh
Solar Generation LESS Meter ONE usage	J = A – H	-2,696	-3,058	-5,754	kWh
Shortfall in weeks when usage exceeds generation. (Assumed to be zero in summer half-year)	K	-863	0	-863	kWh
<b>Estimated saving in energy use. See Assumptions below</b>	L = H + K	1,833	3,058	<b>4,891</b>	kWh
<b>Percentage reduction in usage (saving/usage)</b>	M = L/H	68.0%	100.0%	<b>85.0%</b>	
Possible financial saving if Meter ONE usage were to double (Scenario 2)	N = L x r1			<b>£828.88</b>	<b>per year</b>
(Relative to a full cost with no storage of:	P = r1 x H			£975.13	per year)

### Assumptions

1. That the efficiency of the charge-invert cycle required for storage and reuse is prudently represented by the figure of 85%. (Whereas the specified figure is 95%). This factor is incorporated by discounting the level of solar power available.
2. That the weekly Solar PV meter readings (used to create the base data) are indicative of the typical daily level of available stored energy.

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**Source file:** SGCH-MandS\_EnergyFundApp\_Calculations-2017-0604.ods