ECO-ACTIVE ENERGY EFFICIENCY SERVICE

Community Buildings Programme
2010-2015
Review

December 2015

States of Jersey

Jersey Electricity

Contents

1. Executive summary

This report analyses the success of the Department of the Environment's Community Buildings Programme (CBP) run by the Energy Efficiency Service between 2010 and 2015 and identifies areas of potential operational improvement that could be made in the future.

From the start of the CBP in January 2010 to the end of 2015 it has delivered energy savings and advice to **30 charities and not-for-profit organisations** that in turn provide support and assistance to **568 residents** and approximately **1345 non-residential users**. A total of just under **£600,000** of grant aid was spent on the programme during this period.

As illustrated by both the Carbon Trust modelled energy savings and the three case studies detailed below the Community Buildings Programme has proved to be a cost-effective way of delivering energy savings within the local community.

The Carbon Trust modelled the energy, cost and carbon savings for **£366,426** worth of energy saving measures implemented by the Energy Efficiency Service on **20 properties** under the CBP. The headline figures are given in the box below and the overall payback on this spend was calculated as **6 years**.

	Annual	Lifetime
Energy savings	**1,048,187 kWh**	**16,555,855 kWh**
Cost savings	**£65,389 (inc.GST)**	**£1,023,979 (inc.GST)**
Carbon savings	**260 tCO2e**	**4,116 tCO2e**

The three biggest projects funded under the programme were shown by the Carbon Trust's analysis to have achieved excellent paybacks, detailed in the box below.

	Little Sisters of the Poor	Cheshire Home	St Ouen's Parish
Annual cost savings	**£31,726**	**£8,350**	**£7,059**
Annual energy savings	**440,314 kWh**	**142,284 kWh**	**142,588 kWh**
Annual carbon savings	**116 tCO2e**	**37 tCO2e**	**37 tCO2e**
Payback	**4 years**	**6 years**	**8 years**

The energy and cost saving analysis together with feedback from applicants and the EES team has provided useful guidance for improvements to the programme going forward.

Operational Improvements

- Develop an information sheet to be given to applicants on enquiry in order to manage expectations as to what the CBP can offer and what is expected of the applicants.
- Expand the application form to gather more information from the applicant at the application stage in order to facilitate data analysis and reporting at a later date.
- Investigate the feasibility of installing oil tank meters as part of the project funded work.
- Create a simple template excel spreadsheet for organisations to record quarterly energy consumption which provides a visual comparison of year-on-year performance. All organisations should agree to complete this quarterly as a condition of funding.
- Cavity wall insulation should only be funded where a high percentage of the total external wall area can be insulated.
- Review whether storage heater upgrades should continue to be funded. The Carbon Trust calculated a 15 year payback against an estimated 10 year lifetime.
- Discontinue grant support for floor and flat roof insulation due to poor paybacks.

- Residential properties should be given priority over non-residential for funding.
- Require that all applicant organisations be a member of eco active business, or recognise that joining eco active business will be required prior to the award of any grant funding.

2. Scope of this Report

The Department of the Environment's Energy Efficiency Service administers grants for energy efficiency measures in residential and non-residential community buildings under the Community Buildings Programme.

This report aims to review the programme between 2010 and 2015. It collates and analyses data on energy use and the carbon dioxide emissions pre and post installation of the grant funded measures and evaluates the success of the programme. It addresses the benefits of the programme as delivered including metrics such as overall costs vs. energy, carbon and money saved as a result of the interventions. It also considers additional benefits such as improved comfort for building users. It identifies a number of lessons learnt from the programme and makes a series of suggested improvements for any future schemes.

3. Background to the Community Buildings Programme

3.1 Design of the Community Buildings Programme

The Energy Efficiency Service introduced the Community Buildings Programme (CBP) in 2010 in order to complement the existing Home Energy Scheme which delivered private domestic energy efficiency improvements.

The CBP aimed to provide funding for energy efficiency improvements to charities and not-for-profit organisations that provide a service within the local community to socio-economically vulnerable Islanders. The hope was that through targeting community buildings, more individuals within the socio-economically vulnerable target group could be assisted with a lower cost per person than the Home Energy Scheme by benefitting from economies of scale and a lower administrative burden.

Both residential (e.g. sheltered accommodation) and non-residential (e.g. parish community centres) buildings were assisted and the measures received by eligible organisations were in line with those provided under the Home Energy Scheme.

The measures included:

- Draught proofing to windows, letter boxes, doors
- Loft insulation quilt - top up and full
- Cavity wall insulation
- Thermal boarding
- Low energy lightbulbs
- Hot water cylinder jackets
- Pipework lagging
- New storage heaters
- New condensing boilers
- New high efficiency boilers
- Heating controls

3.2 The Application process

Charities and not-for-profit organisations were invited to apply to the CBP in the first instance through submitting an application form. Through this application form the organisation had to demonstrate to the EES that it met the following criteria:

- The organisation is a charity / not-for-profit organisation
- The organisation provides a service to vulnerable members of the local community
    - The organisation receives NO SOJ funding or if the organisation is FULLY/ PARTLY funded by the SOJ, it provides exact details
- The property occupied by the applicant is NOT maintained by the SOJ
- The EES is not covering the cost of improvement work already planned / budgeted
- The organisation agrees to media coverage and access to energy data
- The organisation agrees to assist in facilitating the works
- Funding is not being provided towards the cost of a new build
- The organisation agrees to forward energy monitoring and management plan

If the organisation met the eligibility criteria then the application was accepted.

Organisations that were accepted on the programme then undertook a formal or informal energy review in order to establish what energy efficiency improvements were appropriate for

the property. Once these had been identified and prioritised, suitable contractors were identified to provide quotes for the relevant work. Following assessment of these quotes against the benefits of the improvements the EES determined what work should be funded and what level of funding could be provided. In the early stages of the programme, the contractors were directly engaged by the EES or more latterly the EES awarded a set grant value to the organisation so that they could engage and manage the contractor themselves to complete the work. Following completion of the work, depending on the value and complexity of the work completed, a formal or informal quality assessment of the work was undertaken.

3.3 Overview of Applications

From the start of the Community Buildings Programme in January 2010 to the end of 2015 the Energy Efficiency Service has delivered energy savings and advice to **30 charities** and not-for-profit organisations that in turn provide support and assistance to **568 residents** and approximately **1345 non-residential users**. A total of just under **£600,000** of direct grant aid was spent on the programme during this period. This figure does not include the internal staff overhead for managing and reviewing the applications, providing advice and assisting applicants. On occasion this was substantial and although intermittent probably averaged 0.25 FTE.

An overview of the successful applications, summarising the application date, the type of organisation, the number of residents or users and the measures that were implemented together with the total project costs is given in the table overleaf.

CT ref	Organisation name	Residential / non-residential	Property Type	No. of residents	No. users per week	Application date	Summary of work completed								Total Spend
							Energy Review	Loft insulation	Cavity wall insulation	Low energy lighting	Heating controls	Boiler upgrade	Storage heater upgrade	Other insulation	Quality Assurance assessment	
1	Jersey Cheshire Home	Residential	Charity - support / care / respite	25		05/05/2010	✓	✓	✓		✓	✓			✓	£77,968
2&3	Little Sisters of the Poor	Residential	Charity - support / care / respite	100		09/07/2010	✓	✓	✓		✓	✓		✓	✓	£199,673
4	St Ouens - Clos du Mahaut	Residential	Parish Sheltered Accommodation	23		24/05/2010		✓			✓	✓			✓	£43,324
5	St Ouens - Jardin de la Rue	Residential	Parish Sheltered Accommodation	26		24/05/2010		✓	✓		✓	✓			✓	£37,603
6	Families in Recovery	Residential	Charity - support / care / respite	12		30/07/2010		✓	✓	✓	✓	✓			✓	£13,551
7	Jersey Council on Alcoholism	Residential	Charity - support / care / respite	11		27/07/2010		✓	✓	✓	✓	✓			✓	£13,079
8	Maison Les Landes Hotel	Residential	Charity - support / care / respite	45		02/07/2010	✓				✓	✓			✓	£12,917
9	Causeway Association	Residential	Charity - support / care / respite	22		05/07/2011				✓	✓	✓			✓	£11,564
10	Trinity Youth Centre	Non-residential	Parish community hall / centre		450	29/06/2010			✓							£1,800
11	Jersey Women's Refuge	Residential	Charity - support / care / respite	90		06/07/2010		✓		✓	✓	✓			✓	£7,068
12	Age Concern	Non-residential	Charity - day centre / office		50	21/05/2010				✓	✓	✓			✓	£5,761
13	Roseneath Centre	Residential	Charity - support / care / respite	30		06/07/2010		✓		✓	✓		✓		✓	£3,758
14	Abbeyfield Society Jersey	Residential	Charity - support / care / respite	25		19/07/2010		✓		✓			✓		✓	£12,969
15	Ebenezer Methodist Church	Non-residential	Church hall		80	26/07/2010		✓							✓	£1,877
16	Jersey Focus on Mental Health	Residential	Charity - support / care / respite	8		06/09/2010		✓		✓	✓	✓			✓	£8,795
17	Parish of St Lawrence	Residential	Parish Sheltered Accommodation	12		30/08/2011	✓	✓	✓	✓	✓	✓			✓	£19,017
18	St Lawrence Community Centre	Non-residential	Parish community hall / centre		105	17/02/2012	✓	✓	✓	✓	✓	✓			✓	£2,480
19	Jersey Baptist Church	Non-residential	Church hall		160	12/04/2012	✓	✓	✓					✓	✓	£20,880
20	St Helier Methodist Centre	Non-residential	Church hall		150	30/05/2013					✓	✓			✓	£30,652
21	Parish of Grouville	Residential	Parish Sheltered Accommodation	11		03/03/2010		✓		✓	✓		✓			£13,022
22	Parish of St John	Residential	Parish Sheltered Accommodation	22		22/04/2010		✓	✓	✓						£14,520
23	ACET	Non-residential	Charity - day centre / office		20	28/06/2010	✓									£60
24	Jersey Hospice Care	Residential	Charity - support / care / respite	34		05/07/2010	✓									£1,100
25	Headway	Non-residential	Charity - day centre / office		120	19/07/2010	✓									£0
26	Jersey Blind Society	Non-residential	Charity - day centre / office		60	20/08/2010	✓	✓								£1,337
27	Les Amis	Residential	Charity - support / care / respite	24		25/08/2010	✓	✓	✓	✓	✓	✓	✓	✓	✓	£28,514
28	JAYF	Residential	Charity - support / care / respite	15		18/11/2010	✓	✓		✓	✓				✓	£8,750
29	Parish of St Martin	Residential	Parish Sheltered Accommodation	33		02/04/2012	✓									£880
30	Georgetown Methodist Church	Non-residential	Church hall		150	31/05/2015		✓							✓	£5,250
Total				**568**	**1345**											**£598,168**

Overview of successful applications to the Community Buildings Programme 2010-2015
(NB Properties references 1-20 only were analysed by the Carbon Trust)

4. Carbon Trust Data Analysis

In September 2015 the Carbon Trust was engaged to complete an energy and carbon analysis of a selection of projects completed under the Community Buildings Programme. 20 properties that had received funding under the CBP were selected covering a range of property types, residential and non-residential uses and energy saving measures.

The 10 properties that were excluded from the analysis were those where only energy reviews or very simple measures were undertaken with under £1,500 spend (ACET, Hospice, Headway, Blind Society), where the work was not yet completed (Les Amis, JAYF, St Martin, Georgetown Methodist Church) or where no energy bills were available for analysis (Parishes of Grouville and St John). In this case the individual residents of the Parish Sheltered accommodation were responsible for their energy bills. It was not feasible to get bills from all of the residents (past and present) which we anticipated was over 30 individuals. However, these properties will be included in the domestic data analysis of the Home Energy Scheme.

The Carbon Trust modelled the savings expected from the major measures that were installed. Note that they did not consider low energy light bulb installation, draught proofing, pipe lagging or heating controls as the records were insufficient to establish what had been present before the work was completed and the exact numbers / measurements / settings of those that had been installed. The full methodology used by the Carbon Trust can be found in Appendix 1.

The Carbon Trust provided estimates of the annual energy (kWh), cost (£) and carbon (tCO2e) savings for each major energy saving measure installed in the property together with the estimated payback (in years) on the implementation cost. They also provided lifetime savings for each measure based on the estimated project lifetime.

The results of the Carbon Trust modelling are given in the table overleaf.

Building	Energy saving measure	Project lifetime	Annual energy savings kWh	Annual cost savings £ (inc. GST)	Annual carbon savings tCO2e	Implementation cost (inc. GST) £	Payback years	Lifetime energy savings kWh	Lifetime cost savings £ (inc. GST)	Lifetime carbon savings tCO2e
Jersey Cheshire Home	Loft insulation	20	32,335	1,493	9	5,639	4	646,702	29,867	176
Jersey Cheshire Home	Cavity wall insulation	20	12,721	530	3	6,077	11	254,427	10,591	69
Jersey Cheshire Home	Main boiler upgrade	15	48,690	3,392	12	27,842	8	730,351	50,877	180
Jersey Cheshire Home	Hydrotherapy unit boiler upgrade	15	48,538	2,935	13	13,194	4	728,066	44,026	198
Little Sisters of the Poor - Jeanne Jugan	Loft insulation	20	22,831	1,465	6	3,722	3	456,619	29,308	113
Little Sisters of the Poor - Jeanne Jugan	Cavity wall insulation	20	8,637	554	2	8,017	14	172,747	11,088	43
Little Sisters of the Poor - Jeanne Jugan	Floor insulation	25	99	6	0	579	91	2,481	159	1
Little Sisters of the Poor - Phase 1	Boiler upgrade	15	174,938	11,873	43	30,820	3	2,624,075	178,090	647
Little Sisters of the Poor - Chapel	Boiler upgrade	15	107,364	7,247	26	28,550	4	1,610,463	108,711	397
Little Sisters of the Poor - Phase 3	Boiler upgrade	15	157,912	10,580	39	58,628	6	2,368,679	158,703	584
St Ouens - Clos du Mahaut	Loft insulation	20	27,935	1,122	8	5,536	5	558,701	22,448	152
St Ouens - Clos du Mahaut	Boiler upgrade	15	62,488	3,275	17	24,873	8	937,320	49,120	255
St Ouens - Jardin de la Rue	Loft insulation to Phase 1	20	11,460	485	3	2,609	5	229,208	9,701	57
St Ouens - Jardin de la Rue	Loft insulation to Phase 2	20	7,184	304	2	3,520	12	143,675	6,081	35
St Ouens - Jardin de la Rue	Cavity wall insulation to Phase 1	20	4,390	186	1	4,186	23	87,799	3,716	22
St Ouens - Jardin de la Rue	Boiler upgrade to Phase 1	15	29,131	1,697	7	18,892	11	436,965	25,455	108
Silkworth Lodge	Cavity wall insulation	20	2,552	174	1	2,112	12	51,031	3,482	13
Silkworth Lodge	Boiler upgrade	15	10,746	724	3	6,961	10	161,191	10,867	40
West Park Avenue	Loft insulation	20	3,188	197	1	1,035	5	63,761	3,938	16
West Park Avenue	Cavity wall insulation	20	15	1	0	190	211	302	18	0
West Park Avenue	Boiler upgrade - no. 26	15	11,092	661	3	5,296	8	166,378	9,911	41
West Park Avenue	Boiler upgrade - no. 28	15	8,263	510	2	5,900	12	123,943	7,656	31
Maison des Landes	Boiler upgrade	15	57,091	3,640	14	11,542	3	856,367	54,598	211
Causeway	Boiler upgrade	15	40,012	2,199	10	7,535	3	600,177	32,992	148
Trinity Youth Centre	Cavity wall insulation	20	1,420	183	0	1,800	10	28,408	3,655	2
Jersey Women's Refuge	Loft insulation	20	6,029	343	1	1,241	4	120,590	6,857	30
Jersey Women's Refuge	Boiler upgrade	15	8,213	467	2	1,241	3	123,190	7,005	30
Age Concern	Boiler upgrade	15	19,944	1,080	5	5,656	5	299,158	16,205	74
Roseneath	Loft insulation	20	5,053	514	1	1,926	4	101,064	10,275	15
Roseneath	Storage heater replacement	10	967	108	0	1,577	15	9,674	1,082	1
Abbeyfield Society	Loft insulation	20	503	51	0	327	6	10,051	1,011	1
Abbeyfield Society	Storage heater replacement	10	3,408	340	0	5,046	15	34,083	3,399	3
Ebenezer Methodist Church Hall	Loft insulation	20	2,718	138	1	1,787	13	54,361	2,751	13
Jersey Focus on Mental Health (Camelot	Loft insulation	20	6,625	355	2	438	1	132,501	7,097	33
Jersey Focus on Mental Health (Camelot	Boiler upgrade	15	7,212	386	0	4,574	12	108,177	5,794	6
St Lawrence Parish Accommodation	Loft insulation	20	12,040	652	3	4,748	7	240,801	13,041	59
St Lawrence Parish Accommodation	Boiler upgrade	15	21,064	1,324	5	13,798	10	315,958	19,855	78
St Lawrence Community Centre	Loft insulation	20	1,932	134	0	1,600	12	38,637	2,690	10
Jersey Baptist Church	Flat roof insulation	25	434	66	0	15,758	239	10,851	1,645	1
Jersey Baptist Church	Cavity wall insulation	20	255	39	0	1,006	26	5,107	774	0
Jersey Baptist Church	Floor insulation	25	47	7	0	6,541	917	1,176	178	0
St Helier Methodist Church	Boiler upgrade	15	60,709	3,951	15	14,108	4	910,640	59,264	225
Total			**1,048,187**	**65,389**	**260**	**366,426**	**6**	**16,555,855**	**1,023,979**	**4,116**

Results of the Carbon Trust's energy saving modelling on the 20 CBP properties

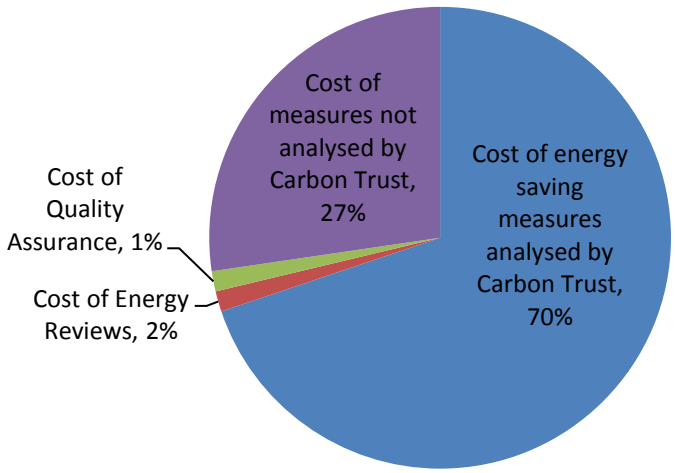
5. Interpretation of the Carbon Trust's Modelling Data

5.1 Limitations of data analysed

The Carbon Trust analysed data from 20 of the projects funded under the CBP. Note that Little Sisters of the Poor was split into two separate entities for the purposes of this analysis as the buildings, heating systems and oil deliveries were completely separate for the Jeanne Jugan Residence Apartments and the main building. St Ouen's Parish Clos du Mahaut and Jardin de la Rue developments were also considered separately.

The total cost of the measures modelled by the Carbon Trust was £366,426. This is approximately 60% of the total of £598,168 spent in total by the CBP on all 30 properties and approximately 70% of the £524,737 total costs associated with the 20 properties analysed. An overview of how the total £524,737 spend is accounted for is given in the pie chart below.

Pie chart illustrating the percentage split of total spend on the 20 analysed CBP properties (Purple - £143,359 (27%), Blue - £366,426 (70%), Red - £7,520 (1.5%), Green - £7,432 (1.5%)



The remaining £158,311 spend on these 20 properties was spent on measures that had no direct energy savings, such as Energy Reviews and Quality Assurance Reports (£14,952) and measures that were excluded from the analysis, such as heating controls, draught proofing and low energy lighting (£143,359). These exclusions are detailed in the Carbon Trust Methodology in Appendix 1. For these measures both the costs and the associated energy savings were excluded from the figures. It is important to bear this in mind when considering the results of the Carbon Trust's analysis.

5.2 Headline Achievements

The totals of the Carbon Trust modelled savings on the 20 properties are given in the box below.

	Annual	Lifetime
Energy savings	**1,048,187 kWh**	**16,555,855 kWh**
Cost savings	**£65,389 (inc.GST)**	**£1,023,979 (inc.GST)**
Carbon savings	**260 tCO2e**	**4,116 tCO2e**

Using the implementation cost of £366,426 for the measures the Carbon Trust modelled an overall **payback of 6 years** was given.

Considering this is only approximately 60% of the overall programme costs of £598,168 it is difficult to extrapolate to an accurate payback for the whole programme.

However, applying the total annual cost savings modelled by the Carbon Trust (£65,389) to the overall programme costs (£598,168) it gives a **payback of 9.1 years**. As this does not take into account any cost savings achieved by energy saving measures in the 10 properties not included in the Carbon Trust analysis or the specific measures excluded from the Carbon Trust methodology this is very conservative.

It would therefore be reasonable to estimate the overall programme payback (based on installed measures) as being between **6-9 years**.

5.3 Comparison of the different energy saving measures

The table below shows the energy, cost and carbon savings modelled by the Carbon Trust grouped into the different energy saving measure type.

Measure type	Project lifetime	Annual energy savings kWh	Annual cost savings £ (inc. GST)	Annual carbon savings tCO_2e	Implementation cost (inc. GST) £	Average Payback years	Lifetime energy savings kWh	Lifetime cost savings £ (inc. GST)	Lifetime carbon savings tCO_2e
Boiler upgrades	15	873406	55942	216.9	279410	5	13101097	839128	3253
Cavity wall insulation	20	29991	1666	7.4	23388	14	599822	33323	149
Floor and flat roof insulation	25	580	79	0.1	22878	288	14508	1983	2
Loft insulation	20	139834	7253	35.4	34129	5	2796671	145064	709
Storage heater upgrade	10	4376	448	0.4	6622	15	43757	4480	4

Comparison of the different types of measures demonstrates a huge difference in both the total energy and carbon saved and the cost effectiveness of the measures.

Boiler upgrades and loft insulation with an average 5 year payback prove to be the most cost effective way of achieving carbon savings. The data supports the continued funding of these measures.

The cavity wall insulation work with an average 14 year payback is calculated to be the next most cost effective and payback is well within the estimated 20 year lifetime of the measure. However, the energy and cost savings of cavity wall insulation were not as good as hoped. This in part was due to the nature of the properties involved – for a number of them it was only possible to insulate a proportion of the total wall area. For future projects it may be prudent to only fund cavity wall insulation work where a high percentage of the total external wall area can be completed, thought should be given to the threshold at which this is applied.

Storage heater upgrades were estimated to have a 15 year payback. Consideration of this with the estimated 10 year lifetime of the measure suggests that thought is given as to whether to fund this measure going forward. It should be noted that the Carbon Trust used a 10% energy saving in their modelling which they acknowledged was conservative. Thought should also be given to benefits taken in comfort increase to residents and users of the property.

The Carbon Trust analysis demonstrates very poor savings from the floor and flat roof insulation projects. In the case of floor insulation only very small energy savings can be attributed to the measure. However, it should be noted that significant comfort increases have been observed by the occupants. The very poor payback on the flat roof insulation is due predominantly to the high cost of the measure. In the case of Jersey Baptist Church the insulation laid was 80mm which is also nearly half the recommended depth so only approximately half of the possible energy savings could be attributed to the measure.

The table below uses the Carbon Trust data to provide a comparison of the measures based on cost per kWh and per tonne of carbon saved. It is important to note that the fuel type is not consistent across the measures or properties – e.g. storage heaters are electric and the Jersey Baptist Church has electric heating therefore with a very low carbon conversion factor will result in low carbon savings and therefore disproportionately high costs per tonne of carbon saved even though the costs of energy saving may be reasonable.

Measure type	Cost per kWh saved over lifetime, £	Cost per tonne carbon saved over lifetime, £
Loft insulation	0.01	48.15
Boiler upgrades	0.02	85.89
Cavity wall insulation	0.04	157.12
Storage heater upgrade (electric system)	0.15	1891.79
Floor and flat roof insulation	1.58	14532.35

Based on this analysis it would appear that floor and flat roof insulation should not be funded in the future. However, the flat roof insulation at Jersey Baptist Church had not been installed for a full year at the time of this report. The property manager believes that the work has made a huge difference to their comfort and energy costs and it would therefore be worthwhile analysing their energy bills after the first quarter of 2016.

5.4 Comparison of the different properties

Comparison of the different properties is very difficult as there are so many variables to consider (property use, energy type, implementation cost etc). It is possible to make some generalisations about what appears to be the most cost effective types of project to fund. The table below groups the non-residential properties and the residential properties separately.

Building	Annual energy savings kWh	Annual cost savings £ (inc. GST)	Annual carbon savings tCO2e	Implementation cost (inc. GST) £	Payback years	Lifetime energy savings kWh	Lifetime cost savings £ (inc. GST)	Lifetime carbon savings tCO2e
St Helier Methodist Church	60709	3951	15	14108	4	910640	59264	225
Age Concern	19944	1080	5	5656	5	299158	16205	74
Trinity Youth Centre	1420	183	0	1800	10	28408	3655	2
St Lawrence Community Centre	1932	134	0	1600	12	38637	2690	10
Ebenezer Methodist Church Hall	2718	138	1	1787	13	54361	2751	13
Jersey Baptist Church	736	112	0	23304	209	17134	2598	1
Non-residential	**87460**	**5598**	**21**	**48255**	**9**	**1348337**	**87162**	**325**
Jersey Women's Refuge	14242	810	4	2483	3	243780	13861	60
Maison des Landes	57091	3640	14	11542	3	856367	54598	211
Causeway	40012	2199	10	7535	3	600177	32992	148
Little Sisters of the Poor	471782	31726	116	130316	4	7235065	486059	1785
Roseneath	6021	622	1	3503	6	110738	11357	16
Jersey Cheshire Home	142284	8350	37	52752	6	2359546	135361	624
Jersey Focus on Mental Health (Camelot)	13837	741	2	5012	7	240679	12891	38
St Ouens	142588	7069	37	59616	8	2393668	116521	629
West Park Avenue	22558	1369	6	12421	9	354383	21523	87
St Lawrence Parish Accommodation	33104	1976	8	18546	9	556760	32896	137
Silkworth Lodge	13298	899	3	9073	10	212222	14348	52
Abbeyfield Society	3911	390	0	5373	14	44133	4409	4
Residential	**960727**	**59791**	**239**	**318171**	**5**	**15207518**	**936817**	**3791**

Although it should be noted that the number and size of projects on non-residential properties was considerably smaller than on residential properties, the average payback on residential properties is notably shorter. As the heating requirements are generally greater for residential

properties this is no surprise and this would support prioritising residential properties for funding over non-residential.

The table below orders the projects by implementation costs.

Building	Annual energy savings kWh	Annual cost savings £ (inc. GST)	Annual carbon savings tCO2e	Implementation cost (inc. GST) £	Payback years	Lifetime energy savings kWh	Lifetime cost savings £ (inc. GST)	Lifetime carbon savings tCO2e
Little Sisters of the Poor	471782	31726	116	130316	4	7235065	486059	1785
St Ouens	142588	7069	37	59616	8	2393668	116521	629
Jersey Cheshire Home	142284	8350	37	52752	6	2359546	135361	624
Jersey Baptist Church	736	112	0	23304	209	17134	2598	1
St Lawrence Parish Accommodation	33104	1976	8	18546	9	556760	32896	137
St Helier Methodist Church	60709	3951	15	14108	4	910640	59264	225
West Park Avenue	22558	1369	6	12421	9	354383	21523	87
Maison des Landes	57091	3640	14	11542	3	856367	54598	211
Silkworth Lodge	13298	899	3	9073	10	212222	14348	52
Causeway	40012	2199	10	7535	3	600177	32992	148
Age Concern	19944	1080	5	5656	5	299158	16205	74
Abbeyfield Society	3911	390	0	5373	14	44133	4409	4
Jersey Focus on Mental Health (Camelot)	13837	741	2	5012	7	240679	12891	38
Roseneath	6021	622	1	3503	6	110738	11357	16
Jersey Women's Refuge	14242	810	4	2483	3	243780	13861	60
Trinity Youth Centre	1420	183	0	1800	10	28408	3655	2
Ebenezer Methodist Church Hall	2718	138	1	1787	13	54361	2751	13
St Lawrence Community Centre	1932	134	0	1600	12	38637	2690	10

Although the higher cost projects generally deliver the most energy and cost savings, there is a large variety in the payback times. It is therefore not possible to make any kind of generalisation about whether it would be more cost effective to fund fewer larger projects or a larger number of smaller projects.

6. Case Studies

A more detailed analysis of the three highest cost projects – Little Sisters of the Poor, Cheshire Home and St Ouen's Parish - is given in the case studies below.

6.1 Little Sisters of the Poor

6.1.1 Overview

The Little Sisters of the Poor, Jeanne Jugan Residence is a residential care home for the elderly. It has a main building and separate independent living apartments.

The Jeanne Jugan Apartments comprise four blocks of flats built in 1985 of unfilled cavity wall construction with an approximate floor area of 785m2. There are 20 flats with a maximum of 40 residents. There are boilers for each apartment block with one oil tank feeding them.

The main building comprises of the original Chapel and Convent built in 1930. In addition to this four extensions have been constructed. Phase 1 (c.1972) is a stand-alone residential building, Phase 2 is an extension to Phase 1. Phase 3 was then constructed and connected the original chapel and Convent. Phase 4 then joined Phases 1 and 2 to the Chapel. This has a floor area of 3085m2.

Within the main building there are 90 beds, however only approximately 70 residents at any one time. There are also the nuns residing in the convent and the care, maintenance and administration staff utilising the building.

There are three boiler rooms within the main building – one beneath the Chapel, one within the Phase 1 building and one within Phase 3. Each boiler room has a separate oil tank.

In 2010, the year before the Energy Efficiency Service funded any energy saving measures, the Little Sisters of the Poor spent a total of **£87,484** on oil deliveries.

6.1.2 Energy Efficiency Improvements under the Community Buildings Programme

The Energy Efficiency Service received the Little Sisters of the Poor's application to the Community Buildings Programme in July 2010. In August 2010 Jersey Energy were engaged to complete an Energy Review of the property. Over the winter of 2010 and spring 2011 the cavity wall and loft insulation identified in the energy review were undertaken and during the summer of 2012 the boilers in the main building were upgraded. The table below details the measures undertaken and their cost.

Energy efficiency improvement	**Date of installation**	**Cost**
Energy Review	Aug-10	£3,085
Jeanne Jugan Apartments – Cavity wall insulation Loft insulation Thermal boarding to the flats	Apr-11	£11,739
Boiler upgrades to Phase 1	Nov-12	£43,650
Boiler upgrades to Chapel	Nov-12	£56,840
Boiler upgrades to Phase 3	Nov-12	£82,820
Quality Assurance		£1,539
Total cost		**£199,673**

6.1.3 Modelled Energy and Cost Savings

The Carbon Trust modelled the energy and cost savings for the energy saving measures funded by the CBP at the Little Sisters of the Poor. These are given in the table below.

Energy saving measure	Building	Project lifetime	Annual energy savings kWh	Annual cost savings £ (inc. GST)	Annual carbon savings tCO 2e	Implementation cost (inc. GST) £	Payback years	Lifetime energy savings kWh	Lifetime cost savings £ (inc. GST)	Lifetime carbon savings tCO 2e
Loft insulation	Jeanne Jugan Residence	20	22,831	1,465	6	3,722	3	456,619	29,308	113
Cavity wall insulation	Jeanne Jugan Residence	20	8,637	554	2	8,017	14	172,747	11,088	43
Floor insulation	Jeanne Jugan Residence	25	99	6	0	579	91	2,481	159	1
Boiler upgrade	Phase 1	15	174,938	11,873	43	30,820	3	2,624,075	178,090	647
Boiler upgrade	Chapel	15	107,364	7,247	26	28,550	4	1,610,463	108,711	397
Boiler upgrade	Phase 3	15	157,912	10,580	39	58,628	6	2,368,679	158,703	584
Total			440,314	31,726	116	130,316	4	7,235,065	486,059	1,785

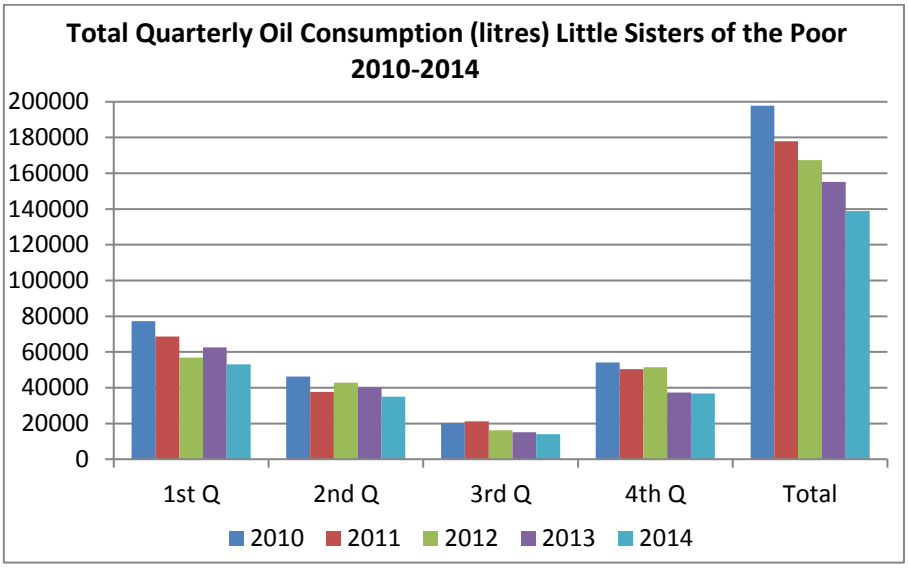
Note that the total implementation costs of these measures is given as £130,316 compared to the overall total project costs of £199,673. The difference between these figures is the Energy Review and Quality Assurance costs (£3,085 and £1,539 respectively) and the boiler upgrade work excluded from the modelling (£64,733). The Carbon Trust Methodology is given in Appendix 1 and explains what is excluded from the modelling.

Annual cost savings - £31,726
Annual energy savings - 440,314 kWh
Annual carbon savings - 116 tCO2e
Payback - 4 years

Using the overall project costs of £199,673 and the total modelled annual cost savings of £31,726 the **payback is 6.3 years**.

6.1.4 Oil bill savings

The graph below shows the quarterly oil deliveries for all the Little Sisters of the Poor tanks for 2010-2014. Note that this data has not been weather corrected.



The cavity wall and loft insulation was completed in the 1st Quarter of 2011 and the boiler upgrades in the 3rd Quarter of 2012.

If oil consumption had been maintained at 2010 levels in 2011, 2012, 2013 and 2014 then Little Sisters would have consumed a total of 151,886 litres more oil (note that this does not take into account any variability in weather or property occupancy patterns).

In 2014 Little Sisters consumed **58,961 litres less oil than in 2010**. Using the cost per litre of £0.64 (average 2014 price to Little Sisters of the Poor) this equates to **a saving of £37,735 over the year**.

6.2 Cheshire Home

6.2.1 Overview

The Jersey Cheshire Home is based at Eric Young House, St Helier. The facilities comprise a single building opened in 1983 with an extension incorporating a hydrotherapy pool constructed in 1994. It covers approximately 1460m2 (whole building), of which approximately 1095m2 is the main building and 365m2 is the hydrotherapy unit.

The property is a residential home for the care of disabled individuals. The property houses 25 disabled residents but is open to other members of the public to use. There are 21 rooms within the main property as well as two independent living units attached to the main property.

In 2010 the Cheshire Home spent a total of **£19,049 on oil deliveries**.

6.2.2 Energy Efficiency Improvements under the Community Buildings Programme

The Energy Efficiency Service received the application from Cheshire Home in May 2010. Loft and cavity wall insulation were initially completed on the main building over the summer of 2010, however due to an issue with the contractor this was not completed until spring 2011. Jersey Energy was engaged to complete a review of the heating in the property in November 2010. The boiler in the main building was replaced in May 2012. Following a second application to the programme the hydrotherapy unit boiler was replaced in September 2015. The table below details the measures undertaken and their cost.

Energy efficiency improvement	**Date of installation**	**Cost to EES**
Energy Review	November 2010	£1300
692m2 Cavity Wall Insulation to main building	February 2011	£6,077
682m2 200mm Loft Insulation to main building	February 2011	£5,640
Main boiler replacement	May 2012	£51,497
Hydrotherapy boiler replacement	September 2015	£12,566
Quality Assurance Report		£890
Total Cost		**£77,968**

6.2.3 Modelled Energy and Cost Savings

The Carbon Trust modelled the energy and cost savings for the energy saving measures funded by the CBP at the Cheshire Home. These are given in the table below.

Energy saving measure	Building	Project lifetime	Annual energy savings kWh	Annual cost savings £ (inc. GST)	Annual carbon savings tCO 2e	Implementation cost (inc. GST) £	Payback years	Lifetime energy savings kWh	Lifetime cost savings £ (inc. GST)	Lifetime carbon savings tCO 2e
Loft insulation	Main Building	20	32,335	1,493	9	5,639	4	646,702	29,867	176
Cavity wall insulation	Main Building	20	12,721	530	3	6,077	11	254,427	10,591	69
Main boiler upgrade	Main Building	15	48,690	3,392	12	27,842	8	730,351	50,877	180
Hydrotherapy unit boiler upgrade	Hydrotherapy unit	15	48,538	2,935	13	13,194	4	728,066	44,026	198
Total			142,284	8,350	37	52,752	6	2,359,546	135,361	624

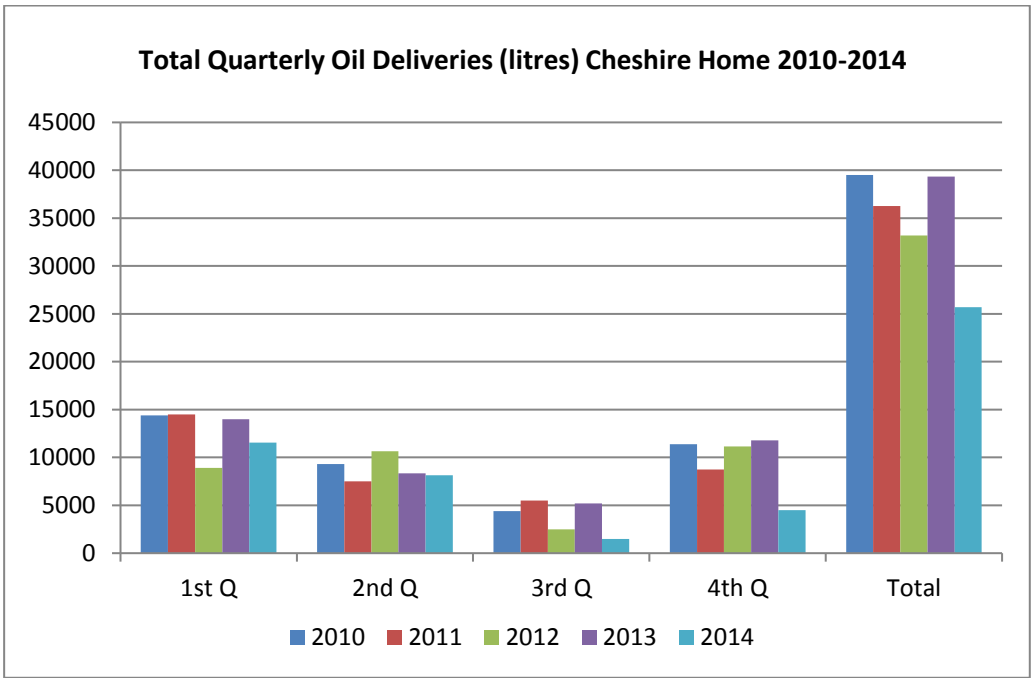
Note that the total implementation costs of these measures is given as £52,752 compared to the overall total project costs of £77,968. The difference between these figures is the Energy Review and Quality Assurance costs (£1,300 and £890 respectively) and the boiler upgrade work excluded from the modelling. The Carbon Trust Methodology is given in Appendix 1 and explains what is excluded from the modelling.

Annual cost savings - £8,350
Annual energy savings – 142,284 kWh
Annual carbon savings - 37 tCO2e
Payback - 6 years

Using the overall project costs of £77,968 and the total modelled **annual cost savings of £8,350** the resulting **payback is 9.3 years.**

6.2.4 Oil bill data analysis

The graph below shows the quarterly oil deliveries for all the Cheshire Home tanks for 2010-2014. Note that this data has not been weather corrected.



The cavity wall and loft insulation was completed in the 1st Quarter of 2011 and the main boiler upgrade in the 2nd Quarter of 2012. The hydrotherapy boiler was not upgraded until September 2015.

In 2014 Cheshire Home consumed **13,799 litres less oil** than in 2010. Using the cost per litre of £0.64 (average 2014 price to Cheshire Home) this equates to **a saving of £8,806 over the year**.

6.3 St Ouen's Parish Sheltered Accommodation

6.3.1 Overview

St Ouen's Parish Sheltered Accommodation comprises 39 sheltered homes for the elderly split over two separate developments – Clos de Mahaut and Jardin de la Rue.

Clos de Mahaut comprises 10 flats and 10 bungalows built in 1975. These are bedsits or one bedroom units housing 23 residents with a floor area of 950m2. There is one boiler room providing the heating for all the units within the Clos.

Jardin de la Rue comprises 19 homes built in two phases. Phase 1 is 4 flats and 6 bungalows built in 1986 housing 13 residents with a floor area of 520m2. Phase 2 is 9 bungalows built in 1996 housing 13 residents over a floor area of 710m2. There is one boiler room providing heating for all the units in Jardin de la Rue.

The properties provided sheltered housing to residents over the age of 60 (women) and 65 (men). This affordable accommodation is prioritised to the sick and less mobile that require easy access to local amenities.

In 2009 St Ouen's Parish paid a total of **£21,425** for oil deliveries to the Clos du Mahaut and Jardin de La Rue boilers rooms.

6.3.2 Energy Efficiency Improvements under the Community Buildings Programme

The Energy Efficiency Service received the two applications from St Ouen's Parish in May 2010. The table below details the measures undertaken and their cost.

Energy efficiency improvement	Date of installation	Amount paid by EES
Loft insulation across all 39 units Clos De Mahaut – 200mm Jardin de la Rue Phase 1 – 200mm Jardin de la Rue Phase 2 – 100mm top up	August 2010	£11,665 (£5536) (£2609) (£3520)
Cavity wall insulation in Jardin de la Rue Phase 1, 10 units	August 2010	£4,186
Clos de Mahaut Boiler house - Replace existing 2, 20 year old, Boulter oil boilers with high efficiency equivalents. All associated works to flues, pipework, insulation, electrics, pump and controls. Dwellings Install time clocks, room and cylinder thermostats, pipe lagging and motorized valves to all 20 dwellings.	December 2011	£37,000
Jardin de la Rue Phase 1 Boiler house - Replace existing 2, 24 year old, Boulter oil boilers with high efficiency equivalents. All associated works to flues, pipework, insulation, electrics, pump and controls. Dwellings Install time clocks, room and cylinder thermostats, pipe lagging and motorized valves to all 10 dwellings.	December 2011	£26,500
Quality Assurance Report		£1576
Total cost		**£80,927**

6.3.3 Modelled Energy and Cost Savings

The Carbon Trust modelled the energy and cost savings for the energy saving measures funded by the CBP at Clos de Mahaut and Jardin de la Rue. These are given in the table below.

Energy saving measure	Building	Project lifetime	Annual energy savings kWh	Annual cost savings £ (inc. GST)	Annual carbon savings tCO 2e	Implementation cost (inc. GST) £	Payback years	Lifetime energy savings kWh	Lifetime cost savings £ (inc. GST)	Lifetime carbon savings tCO 2e
Loft insulation	Clos du Mahaut	20	27,935	1,122	8	5,536	5	558,701	22,448	152
Boiler upgrade	Clos du Mahaut	15	62,488	3,275	17	24,873	8	937,320	49,120	255
Loft insulation to Phase 1	Jardin de la Rue	20	11,460	485	3	2,609	5	229,208	9,701	57
Loft insulation to Phase 2	Jardin de la Rue	20	7,184	304	2	3,520	12	143,675	6,081	35
Cavity wall insulation to Phase 1	Jardin de la Rue	20	4,390	186	1	4,186	23	87,799	3,716	22
Boiler upgrade to Phase 1	Jardin de la Rue	15	29,131	1,697	7	18,892	11	436,965	25,455	108
Total			142,588	7,069	37	59,616	8	2,393,668	116,521	629

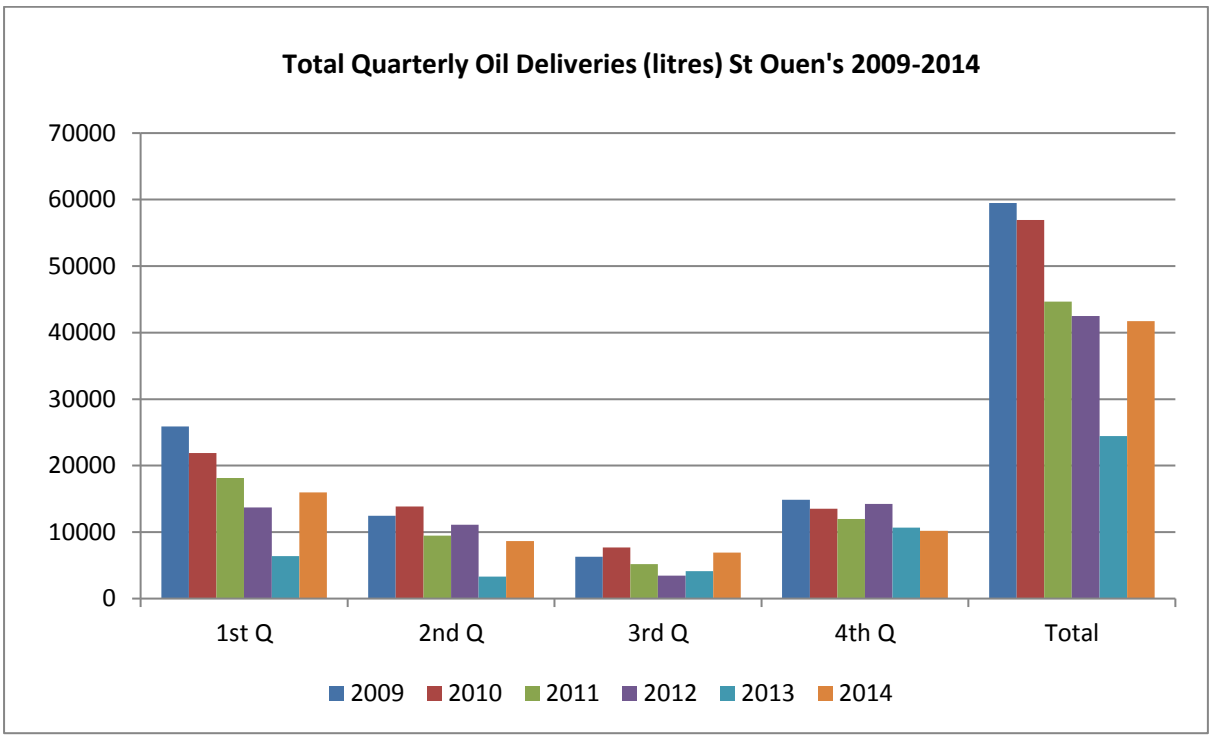
Note that the total implementation costs of these measures is given as £59,616 compared to the overall total project costs of £80,927. The difference between these figures is the Quality Assurance costs (£1,576) and the boiler upgrade work excluded from the modelling. The Carbon Trust Methodology is given in Appendix 1 and explains what is excluded from the modelling.

Annual cost savings - £7,059
Annual energy savings – 142,588 kWh
Annual carbon savings - 37 tCO2e
Payback - 8 years

Using the overall project costs of £80,927 and the total modelled **annual cost savings of £7,059 the payback is 11.5 years**.

6.3.4 Oil bill data analysis

The graph below shows the quarterly oil deliveries for the Clos de Mahaut and Jardin de la Rue tanks for 2009-2014. Note that this data has not been weather corrected.



The cavity wall and loft insulation was completed in the 3rd Quarter of 2010 and the boiler upgrades in the 4th Quarter of 2011.

In 2014 St Ouen's consumed **17,764 litres less oil** than in 2009. Using the cost per litre of £0.58 (average 2014 price to St Ouen's) this equates to **a saving of £10,302** over the year.

7. Successes, failures and operational improvements to the Community Buildings Programme

As illustrated by both the Carbon Trust modelled energy savings and the three case studies above, the Community Buildings Programme has proved to be a cost-effective way of delivering energy savings within the local community. As with all projects there are potential improvements that could be made that could reduce the administrative burden to the EES and increase the overall programme paybacks. These are detailed below.

7.1 Administration of applications

The administration of the Community Buildings Programme has been an evolving process since it started in 2010. Initially it proved very labour intensive for the EES, when it managed the work and the contractors. Due to priority being given to the Home Energy Scheme this meant that applications often took a long time to go through to completion of work. The shift to awarding grants to the organisation and them taking on responsibility for appointing and managing the contractors significantly reduced the administrative burden on the EES.

Going forward the programme would benefit from an information sheet that could be given to potential applicants at the time of enquiry clearly detailing the eligibility criteria, the amount of grant funding available, what types of measures the funding can support, the application process, what the organisation will be expected to do with regard to organising the work and providing the EES with information. There would be clear benefits of managing expectations at the outset.

Through this review process it has been necessary to contact all the organisations who have received funding over the last 5 years in order to obtain the necessary information to complete the data analysis. This proved to be a very time consuming process. To facilitate any future reporting it would be beneficial to gather more information from the organisation at the application stage, working on the basis that it is far easier to obtain information from an organisation hoping to get funding than one that has already received it. The revised application could include:

- More details on the state of building pre-work – e.g. age of building, any extensions and dates, number and type of rooms, size of building footprint, description of building, type of construction, age of boiler, type of boiler, details of hot water heating, details of existing heating and hot water controls, name of energy suppliers, numbers of loft spaces, details of any existing insulation, any major energy consuming features – e.g. laundry, swimming pool
- Photographs of significant aspects of building – e.g. boiler, hot water cylinder, loft, heating controls, radiators
- Details on the building usage – how many people use the property and for what hours on what days of the week
- Details on how the heating and hot water are controlled and their operating hours, who is responsible for maintaining and checking this
- 12 months of energy data provided with application in spreadsheet format including date, amount consumed, unit price, total price net, total price plus GST
- Signed permission for the EES to obtain energy consumption data from their energy companies from 12 months prior to the date of the application to 5 years after the final sign off on the last piece of grant funded work.
- Contact details of one appointed employee of the organisation who will manage the grant work and will liaise with the EES.
- Details on how the organisation currently monitors its energy use.

- Contact details of one appointed employee of the organisation who will take on responsibility for the ongoing monitoring of the property's energy consumption and will regularly feedback this data to the EES.
- A specific, regular requirement to provide energy bill data to the EES – e.g. at the end of each year the organisation will provide the EES with all energy bill data for the previous 12 months.
- The organisation should be required to join the eco active business scheme to ensure ongoing holistic sustainability improvements to the organisation.

An application to the scheme should not be accepted until a satisfactory level of detail has been provided on the application form.

7.2 Organisations that receive funding

The data analysis indicated that energy saving measures were more cost effective in residential properties than in non-residential. It could therefore be argued that priority should be given to residential organisations.

7.3 Energy saving measures funded

The modelled energy savings from the Carbon Trust indicated that the floor and flat roof insulation projects resulted in relatively low energy savings and had very poor paybacks. This would suggest that such measures should not be funded in the future.

The data analysis also raised questions over cavity wall insulation in certain circumstances. Where only a small proportion of the property's external walls can be insulated it may be prudent not to fund the work.

7.4 Follow up with the organisation

The EES commissioned the design and delivery of a computer based Energy Management Tool and worked in partnership with 14 organisations to provide quarterly updates on fuel consumption as well as an ongoing energy management plan. The consumption figures are inserted into the monitoring part of the tool, and various graphs and tables depict the savings which the new energy efficiency measures have achieved. These are compared to historic consumption and predictions of consumption without the improved measures.

When contacting the organisations in late 2015 in order to obtain information for the review, they were asked about the EMT and whether it had been useful. A number of the people were new to the organisation since the EMT was introduced and had not seen it and of the others only one seemed to still be using it regularly and inputting the energy data.

The EMT is a useful tool, but only if the data is inputted and most organisations need reminding to do this. The EMT provided to the organisations is now out of date and would need updating and re-circulating to the organisations. This would be an additional ongoing cost to the CBP.

The important thing is that someone within the organisation regularly looks at the energy consumption and that this is made as easy for them as possible. This could be achieved through a simple template excel spreadsheet that requires them to record quarterly consumption in both units and cost which is displayed in a bar chart that provides a visual comparison of year-on-year performance. Although by no means a sophisticated analysis it could be created simply and quickly by the EES and be provided to the organisation when they apply for funding. The EES could sit down with the designated Energy Manager for the organisation at the initial site visit and complete it for the last 12 months of energy data. It

would be a condition of their application that they update it on a quarterly basis. The EES could send out an email reminder through the CRM to all CBP organisations on a quarterly basis and at the end of the final quarter could request the data for the year.

7.5 Reporting

As part of the data gathering for this report it was necessary to obtain a minimum of 24 months of energy bills from each organisation. The easiest way to get this data was directly from the energy companies and to simplify this in the future signed permission to do so for each organisation should be part of the application process.

During their energy saving modelling the Carbon Trust were only able to analyse the benefits of 70% of the overall costs of the CBP. Some of the remaining 30% can be attributed to costs for the Energy Reviews and Quality Assurance reports that had no direct energy savings. However, the Carbon Trust had to exclude a number of energy saving measures from their analysis due to the lack of data available on them. For example, heating controls had to be excluded due to lack of information on the heating system operating hours pre-installation. The programme therefore has not been able to gain recognition for a certain proportion of the energy savings it has facilitated. In order to minimise this in the future reports it would be beneficial to obtain more details on the pre-installation set up in the property (this was addressed above in the changes to the application form). More detailed records of all work completed also need to be obtained from the organisation and their appointed contractors (measurements, quantities, materials, brands etc) and recorded. In additional any other work carried out on the property should be similarly documented and reported.

Another difficulty that the Carbon Trust faced was that as the majority of the properties had oil heating and no monitoring of direct oil use and the only record of oil consumption were the oil deliveries. The Carbon Trust suggested that for any future projects that meters are installed on oil tanks to get more accurate details on oil consumption.

7.6 Conclusion

The results of the Carbon Trust's modelling of the energy, carbon and cost savings achieved by the Community Buildings Programme's grant funded work from 2010-2015 demonstrate excellent paybacks on the investment. Introduction of a number of administrative improvements to the programme identified in this report will hopefully help reduce the administrative burden of the programme on the EES team and further improve the cost effectiveness of the scheme.

Lisette Jones
December 2015

8. Appendix 1 - Carbon Trust Methodology (Extracted from Carbon Trust Report)

Overview

In response to the States of Jersey's request to produce a report summarising the results of the work carried out under the Community Buildings Programme (CBP), Carbon Trust have produced a report of the lifetime energy, cost and carbon savings achieved by the programme.

To arrive at these outputs, Carbon Trust modelled the energy savings made as a result of the measures installed. This was achieved by isolating the effect of the measure and assumed other factors affecting energy consumption remained constant. This approach was taken as it was the most appropriate method for the level and quality of detail available. The level of data available meant Carbon Trust had to apply certain estimations and assumptions sourced from respected reference guides (e.g. CIBSE Guide F) and a wealth of prior knowledge. The effect measures had upon each other were also taken into account. For example if loft insulation was put in at the same time as a new boiler, the energy savings from the boiler upgrade took into account the reduction in heat demand loft insulation would bring about.

Energy savings from roof insulation, cavity wall insulation, floor insulation, boiler replacements and storage heater replacements have been calculated. These savings have been calculated on an annual basis and on a project lifetime basis. Lifetime savings for boiler upgrades do not take into account ongoing maintenance costs. The annual and lifetime cost savings as well as the implementation costs all include GST. The methodology for calculating savings for each measure is provided below.

Roof insulation

To calculate the energy savings generated by placing insulation in the loft/roof, we first of all calculated the energy consumed in the year preceding the insulation. Given the data consisted mostly of oil deliveries, it was necessary to approximate the energy consumed during this year period in most cases. The kWh consumed formed the basis against which savings were modelled. DECC Housing Fact File 2012 and CIBSE Guide F 2012 were used to reasonably estimate the percentage of total energy used for heating in the absence of real data. The percentage reduction in heat loss from the roof insulation (put in under the CBP) was calculated using the expected improvement in u-value a material of a certain thickness would bring given the thickness of insulation there beforehand. Such u-value improvements were sourced from Carbon Trust Building Fabric Guide given insufficient information was available to be able to calculate building-specific improvements in u-value. In some cases, only part of the total roof space was insulated. Where this was the case, savings were calculated in proportion to the percentage roof area insulated. It was also assumed contractors insulated to a maximum of 300mm so for example, where 200mm of insulation was applied and the thickness of insulation already in place was not stated, it was assumed 100mm was there.

Cavity Wall insulation

To calculate the energy savings generated by placing insulation in the wall cavities, we first of all calculated the energy consumed in the year preceding the insulation. Given the data consisted mostly of oil deliveries, it was necessary to approximate the energy consumed during this year period in most cases. The kWh consumed formed the basis against which savings were modelled. DECC Housing Fact File 2012 and CIBSE Guide F 2012 were used to reasonably estimate the percentage of total energy used for heating in the absence of real data. The percentage reduction in heat loss from the cavity wall insulation (put in under the CBP) was calculated using the expected improvement in u-value. Such u-value improvements were sourced from Carbon Trust Building Fabric Guide given insufficient information was

available to be able to calculate building-specific improvements in u-value. It was assumed a minimal amount of cavity wall insulation was in place prior to the CBP.

Floor insulation

As above. It was assumed no floor insulation was in place prior to the CBP.

Boiler replacement

To calculate the energy savings generated by replacing a boiler with a more efficient version, we first of all calculated the oil consumed before the replacement. Given the data consisted of oil deliveries and not oil consumption patterns, it was necessary to approximate the oil consumed during this year period in some cases. The kWh consumed formed the basis against which savings were modelled. To calculate the effect of the replacement boiler, the improvement in efficiency was used to calculate savings. This calculation assumed all other variables affecting consumption remained constant; namely heat demand, the boiler's operating load, the boiler's operating hours, outside temperatures, zones in which the heating system operated and temperature to which the thermostat was set. Additional works carried out at the time of the boiler replacement (e.g. pipe lagging, addition of controls, pump replacements etc...) were excluded from the calculations given the data quality was not sufficient to carry out an analysis of this depth. The costs associated with replacing the boiler in most cases included these other accompanying measures so where information was available, the costs associated with the new boiler were isolated. The costs associated with the new boiler were the ones deemed necessary for ensuring the boiler was installed properly (it included flue work and associated changes to pipework but not work done to pumps, programmers, timers, insulation, valves etc). Where information was not available to isolate the cost of the boiler upgrade, the average cost per kW was calculated using available data and applied to ensure calculations were consistent.

Storage heater replacement

The kWh consumed in the year preceding the measure formed the basis against which savings were modelled. An automatic charging system (this means the heater automatically takes the correct charge needed to compensate for the external weather conditions) was a feature of the new storage heaters and it was assumed this feature was not present on existing storage heaters. Manufacturers claimed 15% could be saved on running costs by replacing storage heaters with the automatic charging system type. To be conservative, it was assumed these heaters would save 10% on running costs. The savings calculation assumed all other variables affecting consumption remained constant; namely heat demand, operating hours, outside temperatures, zones in which the heating system operated and temperature to which the thermostat was set.

Carbon conversion factors

Emission source	kg CO2e per kWh	Source
Electricity	0.08	Jersey Building Bye Laws 2011
Kerosene	0.25	Defra Conversion Factor Repository, 2015 v1
Gas oil	0.27	Defra Conversion Factor Repository, 2015 v1
LPG	0.21	Defra Conversion Factor Repository, 2015 v1

Carbon Trust, December 2015