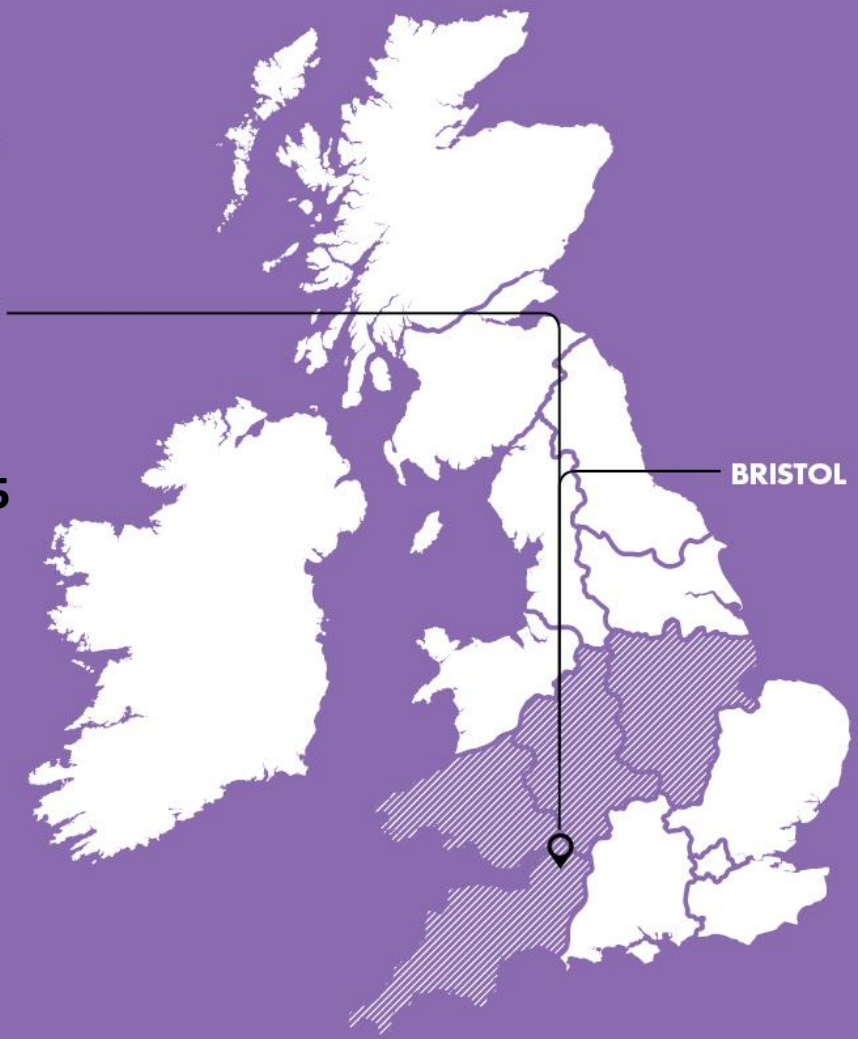
WESTERN POWER DISTRIBUTION

SOLA BRISTOL

PROJECT SOLA BRISTOL

PROJECT PROGRESS REPORT
REPORTING PERIOD:
DECEMBER 2014 – MAY 2015



LCN Fund Low Carbon Networks

BRISTOL CITY COUNCIL

UNIVERSITY OF BATH

KNOWLE WEST MEDIA CENTRE

SIEMENS

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11/06/15	V1	FINAL

Contents

Glossary

Term	Definition
BCC	Bristol City Council
KWMC	Knowle West Media Centre
UoB	University of Bath
WPD	Western Power Distribution
SOC	State of Charge
AC	Alternating Current
DC	Direct Current
LED	Light Emitting Diode
HV	High Voltage
LV	Low Voltage
PV	Photo Voltaic
SDRC	Successful Delivery Reward Criteria
LVD	Low Voltage Disconnect

1 Executive Summary

SoLa BRISTOL is funded through Ofgem's Low Carbon networks Second Tier funding mechanism. SoLa BRISTOL commenced in October 2011 and was originally planned to complete in Jan 2015.

The project aim is to address the technical constraints that DNOs expect to arise on Low Voltage networks as a result of the adoption of solar PV. The trial uses in-home battery storage to provide benefits to customers and aid the DNO with network management. Twenty six houses, five schools and an office have now been commissioned, with solar PV and a battery installed. With the domestic properties, the solar PV will be connected directly to the battery using a DC/DC converter. The AC lighting circuits in all the premises will also be converted to DC, and a set of DC outlets will be installed to enable customers to run small usb connected appliances directly from the PV/battery. The battery will be "shared" between the customer and the DNO. The customer will be provided with a pseudo variable tariff to encourage electricity use at times of high PV generation and to use electricity stored by the battery when the network is heavily loaded. The DNO will be able to communicate with the battery to charge and discharge it to help with network management.

This report details the progress of SoLa BRISTOL, focusing on the last six months December 2015 to May 2015.

During this period The Early learning report (SDRC 9.4) and the Network Benefits Report (SDRC 9.5) have both been submitted. The Power outage tests and report (SDRC 9.7) have also been completed

1.1 Business Case

The Low Voltage distribution network is designed to operate passively. We use an After Diversity Maximum Demand (ADMD) of connected customers to design the network to operate within statutory limits and technical capabilities regardless of time of day or season.

The traditional network designs and operating practices have to date been an efficient method to supply customers. However in the future with much higher distribution peaks and customers exporting generation into the network, it may no longer be the most efficient way to design and operate more complex networks. Innovation may provide improved methods.

The joint Energy Networks Association and Imperial College summary report "Benefits of Advanced Smart Metering for Demand Response based Control of Distribution Networks -version 2.0", April 2010 predicts the reinforcement of GB distribution networks with a

like for like replacement strategy using conventional reinforcement will be significantly higher than using smarter network reinforcement techniques. The report highlighted the greatest potential impact of smart appliances is at HV/LV substations and on the LV feeder. With a 50% penetration of electric vehicles and heat pumps by 2030 the predicted the scale of the LV reinforcement will be £21.8bn, compared to £9.3bn using smart grid techniques.

It is therefore appropriate to look at improving voltage profiles, reducing peaks and improving the power quality of the LV network using innovative techniques that allow the connection of significantly more micro generation and other LCTs to the distribution network without the need for conventional reinforcement

1.2 Project Progress

During this reporting period, the project has been concentrating on Data capture and analysis, and as mentioned above, two preliminary reports from the University of Bath (UoB) have been produced. In addition to this, network trials have been run in order to understand the effect of the batteries on the local network, along with outage tests and its preliminary report.

There have been developments in the charging/discharging settings for the domestic customers, to react to different demand profiles, and further customer surveys. The issue of the ToU tariff savings cheques has also occurred with the customers being paid for their potential savings since their systems were commissioned through to 1st April 2015.

All of the above will be discussed in more detail in the Project Managers report below.

1.3 Project Delivery Structure

1.3.1 Project Review Group

The SoLa BRISTOL Project Review Group met twice during this reporting period.

1.3.2 Resourcing

The Project Manager for BCC has left the project and a new appointment is pending. The Original Project Manager is remaining with BCC and is covering the project in the interim period. As the project is in the data capture and analysis phase, the BCC management involvement is low at present. The new appointment will need to be in place and fully briefed prior to the de-commissioning phase.

1.3.3 Collaboration Partners

The Electrical installation company contracted to the schools has given up its NIEC accreditation, so is no longer able to support the schools or carry out the future de commissioning. A replacement contract is being drawn up with a suitable company.

1.4 Procurement

A contract for the schools support and decommissioning following the change of installer is being drawn up.

1.5 Installation

26 domestic installations are complete, and Change request CCR005 acknowledging the reduction from the proposed 30 installations has been approved see Appendix 1 for the Ofgem Approval letter.

1.6 Project Risks

The Project Manager takes a proactive role in ensuring effective risk management for SoLa BRISTOL. They ensure that processes have been put in place to review whether risks still exist, whether new risks have arisen, whether the likelihood and impact of risks has changed, and report significant changes which adjust risk priorities and deliver assurance of the effectiveness of control.

Contained within Section 0 of this report are the current top risks associated with successfully delivering SoLa BRISTOL as captured in our Risk Register along with an update on the risks captured in our last six monthly project report. Section 0 provides an update on the most prominent risks identified at the project bid phase.

1.7 Project learning and dissemination

Project lessons learned and what worked well are captured throughout the project lifecycle. These are captured through a series of on-going reviews with stakeholders and project team members, and will be shared in lessons learned workshops at the end of the project. These are reported in Section 7 of this report.

During this reporting period we have shared our learning from SoLa BRISTOL through events we have spoken at.

In addition to this we have shared our learning (where applicable), through discussions and networking at a number of knowledge sharing events hosted by other organisations.

Table 1 – Contribution to knowledge sharing events hosted by other organisations

Event Title	Date	Host	Contribution
ESOF Dissemination Event	27/01/15	ESOF	Presenter
EDF Knowledge Sharing	18/03/2015	WPD	Presenter
LGC Awards Event	12/03/2015	LGC	Attendee
Utility Week Live	22/04/2015	Utility Week	Presenter

3 Project Managers Report

2.1 Project Background

SoLa BRISTOL is an alternative method to enable high density photo voltaic solar generation to connect to the low voltage network more efficiently through using an in home battery and variable tariffs. The project aim is to address the technical constraints that DNOs expect to arise on Low Voltage networks as a result of the adoption of solar PV panels. The trial uses in-home battery storage to provide benefits to customers and aid the DNO with network management. Twenty six houses, five schools and an office will have solar PV and a battery installed. In the domestic properties, the solar PV will be connected directly to the battery using a DC connection. The AC lighting circuits in the premises will also be converted to DC to enable customers to run small appliances on DC directly from the PV/battery. The battery will be "shared" between the customer and the DNO. The customer will be provided with a pseudo variable tariff to encourage electricity use at times of high PV generation and to use electricity stored by the battery when the network is heavily loaded. The DNO will be able to communicate with the battery to charge and discharge it to help with network management.

The project will aim to:

- solve the network problems which arise when a number of customers in a local area connect PV solar panels to their house
- investigate how a battery installed in the home can help customers to manage their energy usage and save money on their bills
- test how customers respond when offered different electricity tariffs throughout the day
- explore the benefits of utilising direct current (DC) in the home, rather than the traditional alternating current (AC).

2.2 Project Progress

New updated project Plan is shown in Table 2 below.

Table 2 New Project plan

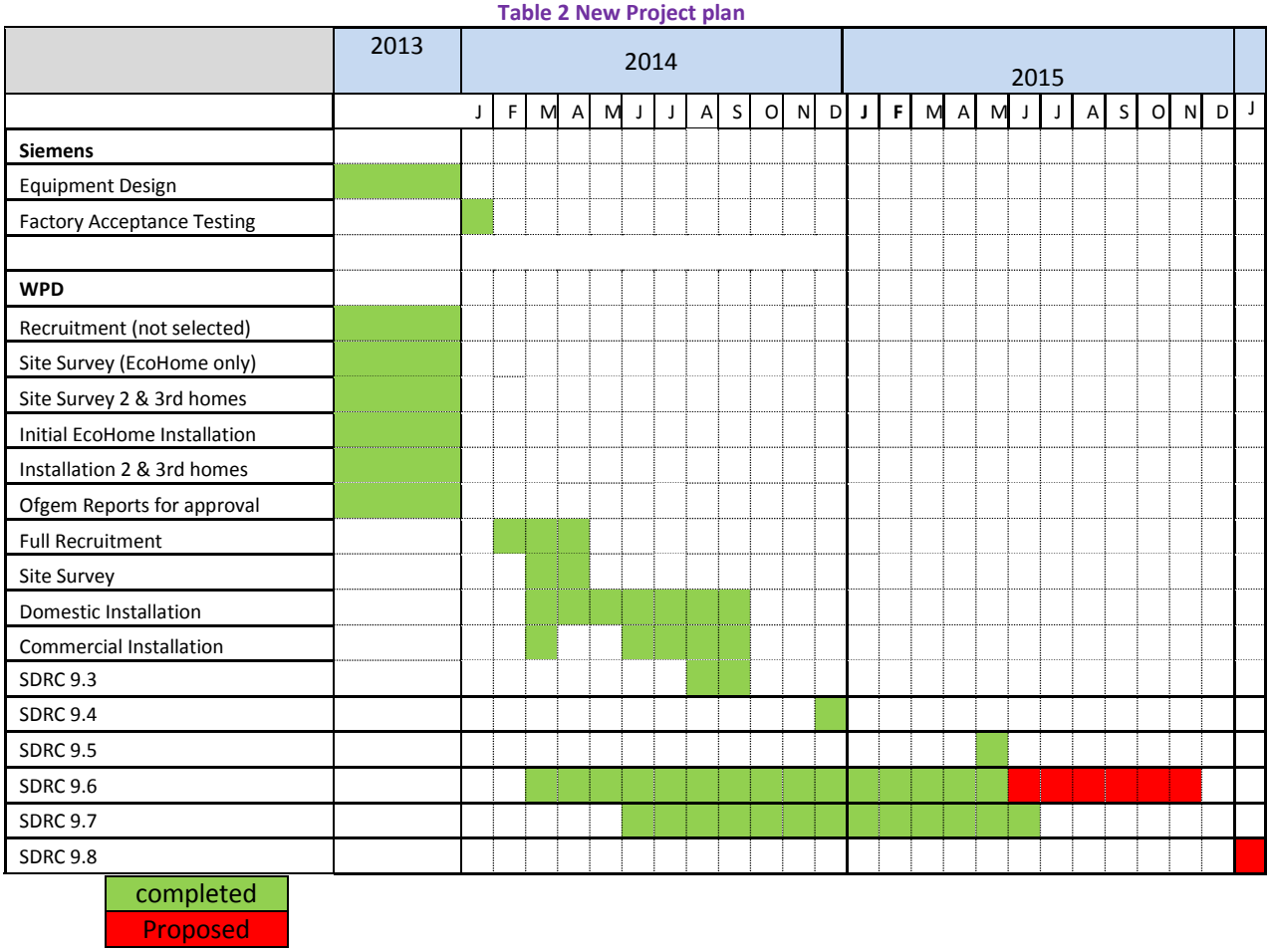

Table 3 - Progress to date - Key Outputs and Milestones

Due Date	Type	Description	Status
15/12/2012	Report	Initial Installation Report R2	Received 23/09/13
02/09/2013	Document	Data Protection Plan	Approved 17/12/13
02/09/2013	Document	Customer Engagement Plan	Approved 17/12/13
30/09/2012	Report	Combined domestic FAT report M3	Received 14/2/14
30/09/2012	Report	Commercial FAT report M3	Received 10/4/14
13/06/14	Report	6 monthly PPR	Received 13/06/14
01/09/14	Milestone	Final School commissioned	
17/11/14	Milestone	Office commissioned	
18/11/14	Milestone	Final House Commissioned	
11/12/14	Report	Change request CCR 004	Approved
31/12/14	SDRC	9.4 Early Learning Report	Received
13/03/15	Report	Change Request CCR 005	Approved
20/05/15	SDRC	9.7 Outage trials & Report	Completed
31/05/15	SDRC	9.5 Network Benefits Report	Received

2.3 Domestic Installation Progress

Continuing on from the previous 6 monthly report, further work was done on researching the load profiles of the project participants. There was a period of overcast days in mid-January that saw several homes struggle to maintain the battery volts.

This was due to a combination of very low PV charging activity and a high daytime load. The high daytime load meant that, with little PV to support it, the SOC was too low going into the high tariff evening demand period, so that the system struggled to maintain the battery voltage. The failsafe of emergency charging at 22v to a 35% SOC was still not sufficient to support the system in the evening demand period.

2.3.1 Settings & Load profiles

Due to the issues discussed in 2.3, the UoB in conjunction with Siemens introduced some new charging algorithms in association with new domestic settings. It was decided to group the participants into 3 load categories

- Normal Load
- High Load
- Economy 7

Fig 1 to 3 below show example data plots of each type

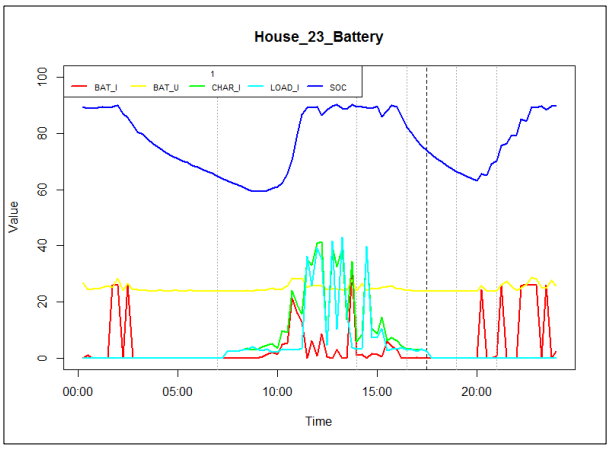

Fig 1 Normal House

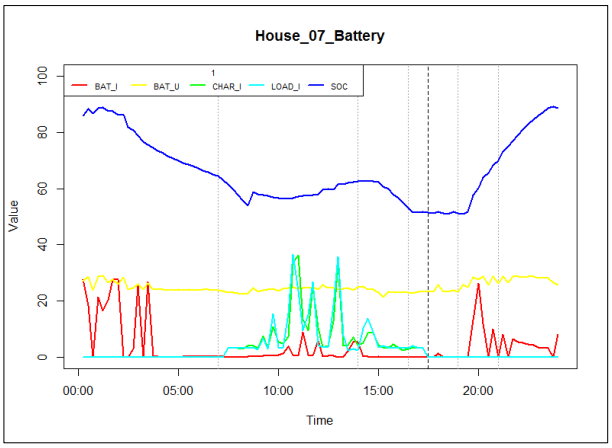

Fig 2 Economy 7 House

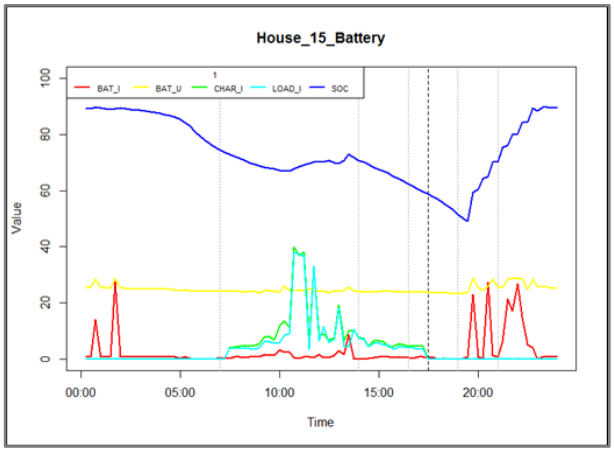

Fig 3 High Load House

The following Table 4 shows the new Target SOC for each of the categories in relation to the tariff and time of day. In addition to this the 22v failsafe now charges to 60% SOC.
It is envisaged that the Economy 7 homes will revert to a normal domestic profile in the summer once the domestic heating is switched off. The interesting learning will be predicting when this will happen, as it is dependent on individual customer preferences and the ambient temperature due to weather conditions.

Table 4 Domestic settings

				Target SOC		
				Domestic	Domestic/ High Load	Domestic/ E7
Target State of Charge Profile	Target state of Charge 00:01 - 00:30hrs = T1	MV	%	31	51	51
.	Target state of Charge 00:31 - 01:00hrs = T2	MV	%	31	51	51
.	Target state of Charge 01:01 - 01:30hrs = T3	MV	%	31	51	51
.	Target state of Charge 01:31 - 02:00hrs = T4	MV	%	31	51	51
.	Target state of Charge 02:01 - 02:30hrs = T5	MV	%	31	51	51
.	Target state of Charge 02:31 - 03:00hrs = T6	MV	%	31	51	51
.	Target state of Charge 03:01 - 03:30hrs = T7	MV	%	31	51	51
.	Target state of Charge 03:31 - 04:00hrs = T8	MV	%	31	51	51
.	Target state of Charge 04:01 - 04:30hrs = T9	MV	%	31	51	51
.	Target state of Charge 04:31 - 05:00hrs = T10	MV	%	31	51	51
.	Target state of Charge 05:01 - 05:30hrs = T11	MV	%	31	51	51
.	Target state of Charge 05:31 - 06:00hrs = T12	MV	%	31	51	51
.	Target state of Charge 06:01 - 06:30hrs = T13	MV	%	31	51	51
.	Target state of Charge 06:31 - 07:00hrs = T14	MV	%	31	51	51
.	Target state of Charge 07:01 - 07:30hrs = T15	MV	%	31	51	51
.	Target state of Charge 07:31 - 08:00hrs = T16	MV	%	35	51	51
.	Target state of Charge 08:01 - 08:30hrs = T17	MV	%	40	51	51
.	Target state of Charge 08:31 - 09:00hrs = T18	MV	%	45	51	51
.	Target state of Charge 09:01 - 09:30hrs = T19	MV	%	50	50	50
.	Target state of Charge 09:31 - 10:00hrs = T20	MV	%	55	55	55
.	Target state of Charge 10:01 - 10:30hrs = T21	MV	%	60	60	60
.	Target state of Charge 10:31 - 11:00hrs = T22	MV	%	65	65	65
.	Target state of Charge 11:01 - 11:30hrs = T23	MV	%	70	70	70
.	Target state of Charge 11:31 - 12:00hrs = T24	MV	%	75	75	75
.	Target state of Charge 12:01 - 12:30hrs = T25	MV	%	80	80	80
.	Target state of Charge 12:31 - 13:00hrs = T26	MV	%	85	85	85
.	Target state of Charge 13:01 - 13:30hrs = T27	MV	%	89	89	89
.	Target state of Charge 13:31 - 14:00hrs = T28	MV	%	89	89	89
.	Target state of Charge 14:01 -14:30hrs = T29	MV	%	89	89	89
.	Target state of Charge 14:31 - 15:00hrs = T30	MV	%	89	89	89
.	Target state of Charge 15:01 - 15:30hrs = T31	MV	%	89	89	89
.	Target state of Charge 15:31 - 16:00hrs = T32	MV	%	89	89	89
.	Target state of Charge 16:01 - 16:30hrs = T33	MV	%	89	89	89
.	Target state of Charge 16:31 - 17:00hrs = T34	MV	%	85	85	85
.	Target state of Charge 17:01 - 17:30hrs = T35	MV	%	80	80	80
.	Target state of Charge 17:31 - 18:00hrs = T36	MV	%	75	75	75
.	Target state of Charge 18:01 - 18:30hrs = T37	MV	%	70	70	70
.	Target state of Charge 18:31 - 19:00hrs = T38	MV	%	65	65	65
.	Target state of Charge 19:01 - 19:30hrs = T39	MV	%	60	60	60
.	Target state of Charge 19:31 - 20:00hrs = T40	MV	%	55	55	55
.	Target state of Charge 20:01 - 20:30hrs = T41	MV	%	50	51	51
.	Target state of Charge 20:31 - 21:00hrs = T42	MV	%	45	51	51
.	Target state of Charge 21:01 - 21:30hrs = T43	MV	%	40	51	60
.	Target state of Charge 21:31 - 22:00hrs = T44	MV	%	35	51	70
.	Target state of Charge 22:01 - 22:30hrs = T45	MV	%	31	51	80
.	Target state of Charge 22:31 - 23:00hrs = T46	MV	%	31	51	51
.	Target state of Charge 23:01 - 23:30hrs = T47	MV	%	31	51	51
.	Target state of Charge 23:31 - 24:00hrs = T48	MV	%	31	51	51

2.3.2 ToU Savings

The first calculation on ToU savings has been completed, and cheques issued to the customers. This initial calculation is from the date the system was commissioned up to 1st April 2015. As the installations were phased over 2014, the qualifying period for each house will vary, along with the demand and Time of use for each property. The amounts vary from £181 at the highest down to £6.24 at the lowest. The average amount was £64.

The next period will be from 1st April 2015 up to 1st July 2015. This will be an equal time for all houses, so will give a better understanding of savings per participant.

2.3.3 Customer Surveys

Interim surveys have been conducted with all continuing households. The findings suggest that the households are continuing to see a financial benefit from the solar PV. While the perceived financial benefits of the battery are minimal with households reporting that they spend about the same on electricity this year as they did during the 2014 interviews, as energy prices have increased[1] it is likely that there is a saving but it is not large enough to be detected by the householders in their everyday life.

The interim surveys focussed on householder characteristics and behaviour. We now know that our houses, although similar in physical size support a wide range of occupants with the number of householders ranging from 1 to 8 (see figure 4). This may help explain why some houses have shown a higher load than anticipated.

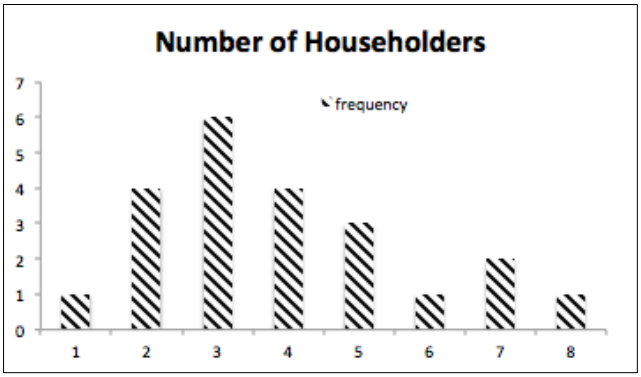

Fig 4 Number of occupants

Opinions on the lighting vary dramatically across the group with some reporting a better quality of light from the DC LED bulbs, while others have reported that the lights are too bright, or too dim. Within some of the houses the householders could not reach a consensus on whether the lights were too bright or too dim, suggesting that this is an intrinsically personal opinion and the project would struggle to find acceptable lighting conditions for all the householders.

Where householders reported the lights being too dim, additional bulb adaptors have been fitted to allow for a dual light fitting as seen in the picture to the right.

[1] According to government statistics the cost of electricity for prepayment meter customers in the UK increased by 1.2% between 2013 and 2014
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/388121/qep_dec_14.pdf pg 17

Some houses are unable to connect to the SoLa tablet interface; this is primarily due to signal issues, which are outside of the project's control. In houses where the interface is accessible householders are continuing to check their system, and one householder was able to predict the value of her ToU savings cheque as she regular checks the savings aspect of the interface.

In cases where houses have faced disruption through battery issues, the majority reported that KWMC handled the situation well, and despite an occasional delay with technical support the householders were aware that this is a R&D project and issues are to be expected. Additional BCC staff have now been trained in SoLa Bristol to minimise delays. Interestingly households with children often reported the children enjoying the experience and commented that the family had to get together and make their own entertainment.

The USB sockets are well used with most participants using them to charge their tablets, and their mobile phones. Some commented that they would use them more if they were located in different places, for instance upstairs to allow mobile phone charging overnight.

Customers remain positive about the project with the majority reporting that they would take part in the project again.

2.4 Commercial Installation Progress

All commercial Installations are complete and providing data to UoB

2.5 Sub Station Installation Progress

All Substation installations are complete and providing data to UoB

4 Business Case Update

No changes to the business case have been forecast at this stage. However, the increasing interest in energy storage beyond the meter has led to the IET investigating the requirement for standards / guides. This will significantly help the adoption of energy storage beyond the meter.

Data is now available for the UoB to commence the Business case analysis.

5 Progress against Budget

	Total Budget	Expected spend May 2015	Actual Spend May 2015	Variance over period	Variance over period %	Notes
BCC Project Management	**60**	54	50	4	-7%	See note 1
Detailed Installation Survey and Planning	**50**	50	50	0	1%	
Training and Installations	**166**	166	197	31	19%	See note 2
Trial Property Recruitment, equip, maintenance and ongoing support	**160**	133	116	17	-13%	See note 3
Equipment Decommissioning	**161**				0%	
Scope Change Contingency	**49**	41	37	4	-9%	
Data Communications Manager and LV Network Manager	**20**	20	19	1	-5%	
Distribution Sensing Equipment	**11**	11	11	0	4%	
Customer Sensors Equipment	**2**	2	3	1	43%	See note 4
Overall Project Manager	**151**	132	164	32	25%	See note 5
Substation Installation	**29**	21	16	5	-22%	See note 6
Battery Charging Costs	**9**	4		4	-100%	See note 7
Variable Tarriffs						See note 8
DC Meters	**5**	4	4	0	-9%	See note 10
System Design and Engineering	**173**	173	187	14	8%	See note 9
Domestic Premises Equipment	**358**	358	425	67	19%	See note 9
School Equipment	**165**	165	179	15	9%	See note 9
Office Equipment	**31**	31	32	0	1%	
Substation Equipment	**161**	161	173	12	7%	See note 9
Data archiving and Access equipment	**98**	98	106	8	8%	See note 9
Installation, commissioning and operation support	**142**	142	168	27	19%	See note 9
Smart Appliances ICT Equipment	**30**	30	32	2	7%	See note 10
Input to smart tariff	**123**	123	133	10	8%	See note 5
input to network design	**230**	230	248	18	8%	See note 5
Dissemination planning	**118**	118	126	7	6%	See note 5
Workshops	**12**	12	12	0	-2%	
School engagement	**24**	24	24	0	-2%	
TOTAL	**2548**	**2307**	**2514**	**208**	**9%**	

Explanations for lines with a variance in excess of 5%:

Note 1 – Awaiting invoice from BCC (Excess costs associated with project extension will be moved to "Additional WPD Contribution" if approved)
Note 2 – Protracted phased roll out of domestic installations increased costs (Excess costs associated with project extension will be moved to "Additional WPD Contribution" if approved)
Note 3 – Awaiting Invoice from KWMC, some support costs fell on Siemens (Line 21) As BCC were unwilling to provide some on-site support. (Excess costs associated with project extension will be moved to "Additional WPD Contribution" if approved)
Note 4 – CT's cost a little more than initially thought.
Note 5 - Excess costs associated with project extension will be moved to "Additional WPD Contribution" if approved
Note 6 – Civils in substation installations were less than expected
Note 7 – Battery Charging costs will be calculated in the last 6 monthly reporting period.
Note 8 – Variable Tariff savings varied due to phased installations and customer load profiles
Note 9 – Variances for unforeseen system updates in Domestic/commercial and Substation equipment, and associated design and support costs. (Excess costs will be moved to "Additional WPD Contribution" if approved)
Note 10 - DC Meters for commercial installations not required

Explanatory Note:

Due to the extension of the project time line, approved in CCR 04, project partners' contracts have needed to be extended. The impact of the excess costs associated with this is now becoming apparent. WPD will not be requesting any further LCNF funding outside of that agreed in the original bid, and will cover the excess costs themselves.
With this in mind, during the next 6 monthly reporting period, WPD will agree with Ofgem how best to show these costs. Our preferred proposal would be to add an extra budget line for an "additional WPD contribution" so that these costs can be monitored and recorded.
Some variances for unforeseen additional Equipment and design costs will also be included in this line.

6 Successful Delivery Reward Criteria (SDRC)

In the previous 6 monthly report it was proposed to reschedule the SDRC's to reflect the change in the project timeline due to the delays explained in the proposed change request. The latest updated SDRC situation is reported below:

5.1 SDRC 9.3 Installation and Commissioning of equipment

The original due date from the full submission was 30th April 2013 for the domestic and office properties and the 31st August 2013 for the schools. This SDRC is now complete with 26 domestic properties, 4 Schools and the training room at KWMC and 1 office installed and commissioned.

5.2 SDRC 9.4 Early Operational performance

In line with the new project plan (table 2) this SDRC was submitted before 31st December 2014.

5.3 SDRC 9.5 Measured Impact on the LV Network

In line with the new project plan (table 2) this SDRC was submitted before 31st May 2015.

5.4 SDRC 9.7 Power Outage Trials

In line with the new project plan (table 2) Outage trials and the associated customer feedback interviews were all completed by 1st June 2015. The preliminary report on this is attached as **Appendix 2**

5.5 Future SDRCs

Table 6 captures the remaining SDRCs for completion in line with the new project plan (table 2)

Table 6 – SDRCs to be completed

SDRC	Status	Due Date	Comments
9.6 Customer Opinions	Green	30/11/2015	Change request proposed new due date 30/11/2015
9.7 Power Outages	Green	01/06/2015	**Completed**. Change request proposed new due date 01/06/2015, completed by 20/05/15
9.8 Final Report	Green	31/01/2016	Change request proposed new due date 15/01/2016

Status Key:	
Red	<Major issues – unlikely to be completed by due date>
Amber	<Minor issues – expected to be completed by due date >
Green	<On track – expected to be completed by due date>

7 Learning Outcomes

Two SDRC reports have been submitted in this reporting period SDRC 9.4 (Early Operational Learning and SDRC 9.5 Network Benefits) Links to these reports can be found below:

http://www.westernpowerinnovation.co.uk/Document-library/2014/Sola-Bristol-Operational-early-learning-report-fin.aspx

http://www.westernpowerinnovation.co.uk/Document-library/2015/SDRC-9-5-REPORT-Final.aspx

8 Intellectual Property Rights

No relevant foreground IP has been identified and recorded in this reporting period

9 Risk Management

Our risk management objectives are to:

- ensure that risk management is clearly and consistently integrated into the project management activities and evidenced through the project documentation;
- comply with WPDs risk management processes and any governance requirements as specified by Ofgem; and
- anticipate and respond to changing project requirements.

These objectives will be achieved by:

- ✓ defining the roles, responsibilities and reporting lines within the team for risk management
- ✓ including risk management issues when writing reports and considering decisions
- ✓ maintaining a risk register
- ✓ communicating risks and ensuring suitable training and supervision is provided
- ✓ preparing mitigation action plans
- ✓ preparing contingency action plans
- ✓ regular monitoring and updating of risks and the risk controls

8.1 Current Risks

The SoLa BRISTOL risk register is a live document and is updated regularly. There are currently eleven live project related risks. Mitigation action plans are identified when raising a risk and the appropriate steps then taken to ensure risks do not become issues wherever possible. In Table 7, we give details of our top five current risks by category. For each of these risks, a mitigation action plan has been identified and the progress of these are tracked and reported.

Fig 6 overview of current risks

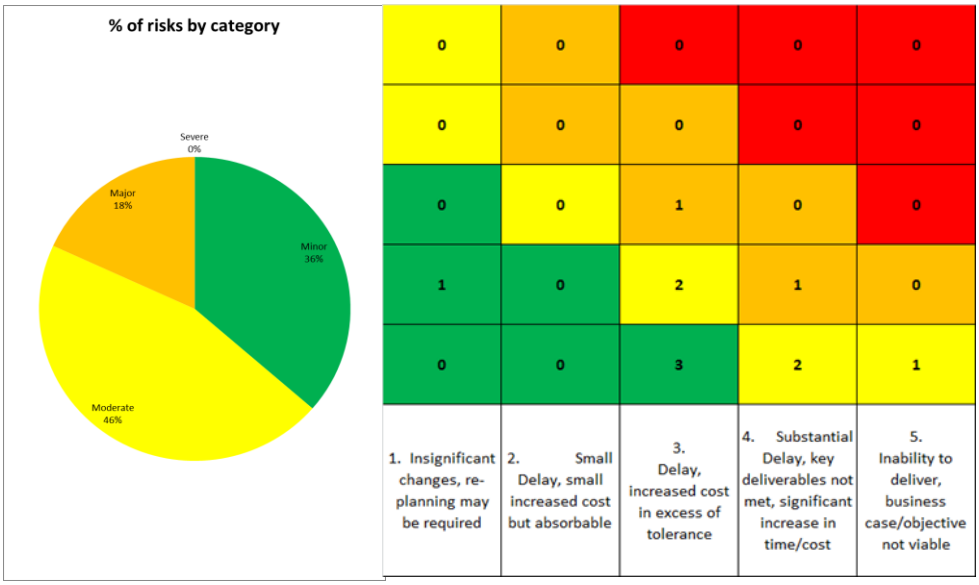

Table 7 – Top five current risks (by rating)

Risk	Risk Rating	Mitigation Action Plan	Progress
R033 Avonline not able to decommission schools	Major	New contractor to take over contract and complete work	**New Risk** Contract being set up with Smokeless Energy
R031 communication between the LV network manager and the data repository is unreliable causing holes in data capture	Major	Early identification of any issues reported by UoB and acted upon	No major issues at present
R30 Critical component failure on 5 or more properties, causing system shutdown	Moderate	every failure to be diagnosed to pre-empt any patterns	System components reasonably reliable No patterns emerging of repetitive problems
R022 Communications between the LV connection manager and LV network manager is unreliable	Moderate	A robust communications network will be installed and tested before installation.	Comms working but a few issues with reliable connection
R005 Our partners and supporters perceptions on the project may change	Moderate	Work with all project partners and supporters throughout the design and development of the project. Ensure communications are clear and the objectives are known.	BCC project Manager being replaced. Assurances given on continued project support

8.2 Update for risks previously identified

Descriptions of the most significant risks, identified in the previous six monthly progress report, are provided in Table 8 with updates on their current risk status.

Table 8 – Top five risks identified in previous six monthly report

Risk	Risk Rating	Current Risk Rating	Progress
R005 Our partners and supporters perceptions on the project may change	Major	Moderate	BCC project Manager being replaced. Assurances given on continued project support
R018 Over 25% of customer/s wish to terminate the trial before 18 months	Major	Moderate	Ongoing risk as project develops. No indication of this becoming an issue
R029 Access to homes denied, to make system changes following early learning	Major	Minor	Required setting changes were tested at UoB and uploaded remotely
R031 communication between the LV network manager and the data repository is unreliable causing holes in data capture	Major	Major	No major issues at present
R022 Communications between the LV connection manager and LV network manager is unreliable	Moderate	Moderate	Comms working but a few issues with reliable connection

Descriptions of the most prominent risks, identified at the project bid phase, are provided in Table 9 with updates on their current risk status.

Table 9 – Top risks identified at the project bid phase in addition to those mentioned above

Risk	Previous Risk Rating	Current Risk Rating	Comments
R014 There is no suitable location to store the equipment in homes, schools and an office.	Major	closed	Risk closed. All properties surveyed and suitable locations found. External cabinet designed for commercial properties.
R015 The AC wiring in homes, schools and the office cannot be converted to DC operation	Major	closed	Risk closed. ERA report commissioned and AC wiring deemed suitable for DC.

10 Consistency with Full Submission

Formal Change Requests (CCR 04) and (CCR05) have been approved.

11 Accuracy Assurance Statement

This report has been prepared by the SoLa BRISTOL Project Manager (Mark Dale), reviewed by the Future Networks Team Manager (Roger Hey), recommended by the Policy Manager (Paul Jewell) and approved by the Operations Director (Philip Swift).

All efforts have been made to ensure that the information contained within this report is accurate. WPD confirms that this report has been produced, reviewed and approved following our quality assurance process for external documents and reports.

Appendix 1 Ofgem Approval letter CCR005

ofgem
Making a positive difference for energy consumers

Mark Dale
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Avonbank
Feeder Road
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Date: 13 March 2015

Dear Mark

Low Carbon Networks Fund – amendments to Western Power Distribution's Sola Bristol project

This letter contains our[1] decision to approve the requested amendments to certain sections of the Project Direction[2] dated 19 December 2011 for Western Power Distribution's (WPD's) Sola Bristol project (the project). The amendments are set out in the amended Project Direction in the schedule to this letter.

Background

On 19 December 2011, we issued a Project Direction to WPD.[3] The Project Direction contains the terms to be followed by WPD in relation to the project as a condition of it being funded under the Second Tier and Discretionary Funding Mechanism.[4]

On 11 December 2014, we amended the Project Direction to:

- revise the project deliverable dates due to delays in the installation of equipment, and
- reduce the sample size of schools taking part in the project.[5]

On 6 February 2015 WPD requested further amendments to be made by the Authority to the Project Direction (the change request).[6] The amendments requested in the change request relate to two areas:

1) a reduction in the sample size of domestic properties taking part in the project; and
2) re-use and re-deployment of surplus Sola Bristol domestic units.

[1] The terms 'the Authority', 'Ofgem', 'we' and 'us' are used interchangeably in this letter. The Authority is the Gas and Electricity Markets Authority. Ofgem is the Office of the Gas and Electricity Markets Authority.
[2] All capitalised terms not otherwise defined in this letter have the meaning given to them in the Project Direction.
[3] The Authority issued a Project Direction to WPD pursuant to the LCN Fund Governance Document issued pursuant to Part E of Charge Restriction Condition 13 (Low Carbon Networks Fund) (CRC13) of the Electricity Distribution Licence setting out the terms to be followed in relation to the project as a condition of it being funded under the Second Tier and Discretionary Funding Mechanism. The Project Direction can be found at: https://www.ofgem.gov.uk/publications-and-updates/low-carbon-network-fund-project-direction-bristol
[4] Second Tier and Discretionary Funding Mechanism has the meaning given in CRC 13.3(b).
[5] https://www.ofgem.gov.uk/publications-and-updates/low-carbon-networks-fund-%E2%80%93-amendments-western-power-distribution%E2%80%99s-sola-bristol-project
[6] WPD's change request and associated documents are published alongside this letter and can be found here – https://www.ofgem.gov.uk/publications-and-updates/low-carbon-networks-fund-amendments-wpd-s-sola-bristol-project-household-sample

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The rest of this letter sets out our analysis of the two areas of proposed change to the project put forward by WPD in the change request, followed by our decision to approve WPD's change request.

Change 1: SDRC 9.3 – reduction in the project's domestic properties sample size

The change request is to reduce the sample size of domestic properties used in the project from 30 to 26. WPD is unable to secure 30 domestic properties to take part in the project which was set out in its original Full Submission and in Successful Delivery Reward Criteria (SDRC) 9.3 of the Project Direction.

The reasons for the proposal for a reduced sample size noted by WPD in its change request include:

- one property being found to have insufficient PV array capacity on the property; and
- households changing their mind about taking part in project (eg because of changes in personal circumstances).

Based on the evidence provided, and further discussions with WPD, we are not fully convinced that WPD took all reasonable steps to manage the risk of the domestic properties sample size falling below 30. There was no planned contingency for this and having one domestic property as backup appears risky. This may be an important area of project learning that WPD should consider when reviewing the project at its conclusion.

Nevertheless, based on the evidence presented in the change request we are satisfied that a reduction in the sample size is not expected to fundamentally alter the project's learning. This is based on evidence in the change request including:

- a letter from the University of Bath – confirming that a reduction in the sample size is not expected to alter the project's learning, and
- feedback from other Distribution Network Operators (DNOs) that the changes are valid.

Schedule 1 below sets out the change to the domestic property sample size in SDRC 9.3.

Change 2: SDRC 9.3 – re-use and re-deployment of surplus Sola Bristol domestic units

The change request is to re-use and re-deploy the surplus domestic units that have not been installed in domestic properties, by using:

- two units for spares (one replacing a water damaged unit; the other for ongoing repairs); and
- two units for testing at the Universities of Bath and Newcastle.

We accept WPD's justification in the change request to use two of the units for spares. This appears to be prudent use of the units to ensure the timely resolution of faults, without extra cost to the project. However, we have some concerns that given the innovative nature of the project, the issue of potential faults to units does not appear to have been adequately considered as part of the project's contingency budget. WPD should reflect on this as part of its project learning.

We are reasonably content with WPD's re-deployment of domestic units to two universities, with the primary benefit being the ability to test, and implement, new equipment settings, minimising disruption to domestic premises. Feedback from other DNOs as part of WPD's change request also indicates support for this change. However, we are not fully convinced that there is no potential additional project learning from the re-deployment of the units. While no specific changes have been made to WPD's SDRCs to reflect any potential project learning, we request that WPD explicitly consider whether there has been any additional

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learning as part of the project's remaining six month reports and in the Close-Down Report.[7]

It is currently unclear whether WPD should return any installation and decommissioning costs to consumers because of the reduced sample of domestic premises. For example, it is currently uncertain whether the two domestic units re-deployed to the universities will be decommissioned by WPD after the project ends. As part of the project's Close-Down Report we request that WPD explicitly review its actual installation and decommissioning costs associated with the re-use and re-deployment of the domestic units. If warranted, we would expect some of these costs to be returned to customers.

Schedule 1 below sets out the changes in SDRC 9.3 to reflect the re-use and re-deployment of surplus Sola Bristol domestic units.

Decision

We consider that with WPD's proposed amendments set out in its change request, the project will still deliver the benefits outlined in the original Full Submission and that these amendments are in the interests of customers.

Our assessment in this letter does not in any way fetter our discretion with respect to any future decision on the Second Tier Successful Delivery Reward, should WPD make a submission after the completion of the project. The Second Tier Successful Delivery Reward is intended to incentivise the DNOs to manage their projects well. When change requests are assessed, consideration is given to whether there has been a material change in circumstances and whether any proposed changes are in the interests of customers. By approving this change request, we are not making an evaluation of WPD's management of change.

In accordance with Section 14 of the Project Direction, the Authority hereby amends the Schedule to the Project Direction in the manner set out in Schedule 1 to this letter.

This letter constitutes notice of reasons for the Authority's decision pursuant to section 49A of the Electricity Act 1989.

If you would like to discuss any of the issues raised in this letter, please contact Tom Mackenzie at thomas.mackenzie@ofgem.gov.uk or 020 7901 7406.

Yours sincerely

Dora Guzeleva,
Head of Networks Policy, Local Grids
For and on behalf of the Authority

[7] A Close-Down Report is required under the Low Carbon Networks Fund Governance Document to provide information for third parties to understand what has been learnt from the Project. See - https://www.ofgem.gov.uk/ofgem-publications/45703/low-carbon-networks-fund-governance-document-version-6.pdf

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Appendix 2 Power outage report

WESTERN POWER DISTRIBUTION
SOLA BRISTOL
Sola Bristol
Householder Outage Report

Householder Outage Report

Dr Susanna Martin
Dr Ian Walker

UNIVERSITY OF BATH

1 Executive Summary

Twenty houses took part in the outage study, over a period of three days[1].

Each of the houses were contacted in advance to arrange a suitable 30-minute appointment. The houses were visited by the SoLa team and experienced their power outage for approximately 10 minutes. During this visit system checks were made and a short outage survey was conducted, 19 of the 20 houses chose to take part in the survey.

In the following report we summarize the main findings from the qualitative outage survey.

2 Power Outage Experiences

There were a variety of experiences from the householders with some having experienced complete power outages before, some experiencing power outage with the lights staying on, and some who have not had a power outage.

"We haven't had a power cut since the 80s"

In the cases where the power turned off, but the lights stayed on the householders were generally aware that this was due to them forgetting to top up their meter, often they reported that this situation actually reminded them to top up their meter. It was rare that this situation would last long.

As previously reported some participants have experienced complete power outages, these tend to occur overnight, and householders reported that the issue was quickly resolved.

3 Behaviours

The householders were all tested during day light hours to minimize disruption, we asked them to report the types of activities that they would typically be doing at this time of day.

11 different appliance behaviors were mentioned, with 14 households reporting the TV would normally be on. Most householders reported 2 items, e.g. TV and Washing Machine. Some households reported four or five different devices. Interestingly only two householders mentioned the fridge/freezer, although this

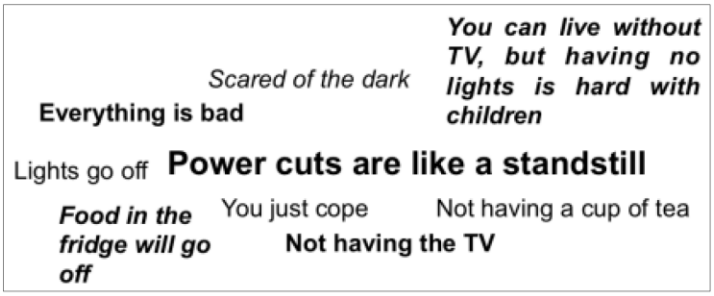
[1] Friday 15th, Wednesday 20th, Thursday 21st May 2015.

may be due to the wording of the question "what would you normally be doing at this moment".

	Householder																			Total
TV	1	1	1		1	1		1	1	1	1	1		1	1	1			1	14
Washing Machine	1		1			1		1	1	1		1	1	1	1	1		1		12
Laptop/Computer			1										1			1				3
Hoover			1																	1
Kettle			1				1													2
Fridge/Freezer				1												1				2
Oven										1				1						2
Shower										1										1
Tumble Dryer											1			1						2
Microwave											1									1
Dishwasher						1														1
Not normally in																	1			1
Total Appliance Behaviours	2	1	5	1	1	2	1	2	2	2	3	4	2	2	4	4	1	1	1	

4 Power Cut Experiences

We asked the householders to tell us the worst thing about having a power cut, and which appliance behaviours would they struggle to perform if a power cut occurred for longer than 24 hours.



4.1 Appliance Behaviours

These questions led to concern around perishables, noting that if the power cut went on too long they would lose their food. The primary issue with power cuts was lighting. Often those with children talked about the issue of entertaining children and the risk of using candles with young children. Despite this there was

a general feeling that they would manage, with some saying they would go and visit family for the duration, while others talked of turning it into a game with the family working together; using camping gas stoves, and doing craft activities.

4.2 Future System

Some people commented on the value of having DC lighting, as it would make the situation easier to handle, especially in rooms such as the bathroom.

A number of people confirmed that if a future system could help keep other appliances 'online' during a power cut it would be useful, however the required devices varied with some focusing on fridge/freezer while others felt TV/internet would be more useful.

We spoke to the householders about their ability to plan and almost all reported that in the case of a planned power cut they would be happy to use less energy during the day to ensure that they had power for lights in the evening. It was noted by some that this would be more important during the wintertime.

4.3 Alternative Lighting

Availability of alternative lighting sources varied from house to house, some had candles and torches easy to hand, while others commented that their mobile phone had a light on it. Some did not have candles/torches commenting that power cuts were rare and they did not need them. Others had them, but kept them in awkward locations such as outside in the shed.

5 Discussion

The social interview provided an insight in to the wide-ranging impact a power cut can have on our householders. It was interesting to learn that many felt a power cut was manageable if it was planned, and indeed some would find a way to make it an enjoyable experience for the family. The advantages of lighting during a power cut is clear, but further discussions would be required to understand which other behavioural appliances would provide the most benefit to the average house if the system was to be further developed.