WESTERN POWER DISTRIBUTION

INNOVATION

NEXT GENERATION NETWORKS

FREEDOM

WPD_NIA_023

NIA MAJOR PROJECT PROGRESS REPORT

REPORTING PERIOD: OCT 2017 – MAR 2018

Report Title	:	NIA MAJOR PROJECT PROGRESS REPORT: FREEDOM
Report Status	:	FINAL
Project Ref	:	NIA_WPD_023
Date	:	10/05/2018

Document Control

	Name	Date
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Approved (WPD):	Roger Hey	10/05/2018

Revision History

Date	Issue	Status
04/04/2018	V0.1	Initial Draft
18/04/2018	V0.2	Draft Following Review
10/05/2018	V1.0	Final

Contents

Glossary

Term	Definition
BEIS	Department for Business Energy and Industrial Strategy
DNO	Distribution Network Operator
FREEDOM	Flexible, Residential, Energy, Efficiency, Demand, Optimisation & Management
GATC	Gas Assessment and Training Ltd
HCI	Human Computer Interaction
IPR	Intellectual Property Register
ITT	Invitation to Tender
LCT	Low Carbon Technologies
LV	Low Voltage
NIA	Network Innovation Allowance
Ofgem	Office for Gas and Electricity Markets
RFI	Request for Information
SNET	Security for Network Syscalls
TWh	Terra Watt hour
WPD	Western Power Distribution
WWU	Wales & West Utilities

1 Executive Summary

Project FREEDOM is funded through Ofgem's Network Innovation Allowance (NIA). FREEDOM was registered on the 27th September and will be completed by the 31st May 2018. However, the project is registered to finish in January 2019.

FREEDOM aims to investigate the feasibility of the use of heat pumps on both Western Power Distribution's (WPD) & Wales & West Utilities' (WWU) network in order to:

- Demonstrate the ability of the hybrid heating system to switch between gas and electric load to provide fuel arbitrage and highly flexible demand response services;
- Demonstrate the consumer, network, carbon and energy system benefits of deployment of hybrid heating systems with an aggregated demand response control system; and
- Gain insights into the means of balancing the interests of the consumer, supplier, distribution and transmission network when seeking to derive value from the demand flexibility.

The project will deliver a hybrid heating system that is able to support the electricity and gas network in the discovery of sustainable alternatives to help deliver the UK's energy requirements. The project will consider whether the technology can defer network investments, remove network constraints and provide a fully flexible domestic heating load management service. The principal benefit is that hybrid systems can unlock the value of flexibility that will help consumers access lowest cost heat. Up to a maximum of 75 participants are involved in the trial.

This report details progress of the project, focusing on the last reporting period, October 2017 to March 2018.

1.1 Business Case

Initial modelling suggests that customer heating bills could be reduced by c.40%. Energy system savings result from reducing peak capacity requirements, deferral of network reinforcement due to demand response flexibility for which the Department for Business Energy and Industrial Strategy (BEIS) forecasts that £100Bn of UK network investment is required by 2020. In their report to the Committee on Climate Change (Oct 15), Imperial College forecast annual value of flexibility to the UK at between £2bn and £8bn depending on the level of decarbonisation. Heat pumps are forecast to deliver 175TWh of domestic heating load per year by 2030 and can be a major contributing factor. The market currently lacks a competitive solution to a gas boiler. A hybrid system of heat pumps used alongside existing gas boilers presents the first real future of heat response to all three challenges of

the energy trilemma i.e. Energy Sustainability, Energy Affordability and Energy Security. Installing more clusters of Low Carbon Technologies (LCTs) such as heat pumps would lead to the reinforcement of a Low Voltage (LV) feeder depending on volumes of deployment.

A hybrid heating system is designed for the future and is expected to lower the number of peak periods on the electricity distribution system and reduce the constraint levels in the long term. If we estimated the consumption to be in the region of 3.5 - 4kW per hybrid heating system then we see huge savings in overall cost compared to an all-electric air source heat pump estimated to consume in the region of 7kW. It is therefore understood that an all-electric heat pump installation would not be cost effective compared to the hybrid heating system due to inability to switch between electricity and gas and adding to more constraints on the distribution system.

1.2 Project Progress

This is the third progress report. It covers progress since from October 2017 to March 2018.

The summary of the progress is explained below.

- Recruitment: We have successfully secured 75 homes to take part in the FREEDOM Project.
- By the end of October 2017, the FREEDOM Project had completed all the 75 installations: 40 social tenants and 35 private homeowners. All installations have the Passiv hybrid heat pump controls installed. All installations are adhering to the Construction Design Management process. To date we have 0 - health and safety issues, 0 - incidents/accidents and 1 - complaint.
- We have deployed three hybrid heating systems: Samsung, Daikin and MasterTherm.
- Customer Engagement: We are focused on customer engagement and ensuring that all tenants and homeowners are educated about the FREEDOM Project. The hybrid heating systems installed as part of the project were appealing to participants once they had been explained, with running cost savings viewed as the biggest advantage. Nearly 90% of respondents found the idea of hybrid heating systems appealing or very appealing. The supply of a hybrid heating system without triallists having to invest their own money in the equipment was also very appealing. Wales & West Utilities' previous research has shown that initial capital cost is the key factor that influences a decision to change to an alternative heating solution, with 80% of consumers not being able or willing to pay.
- FREEDOM Project Branding: The project branding has been carried out by Synergy.

- City University has been developing the wireframes or graphical explanations on energy consumption, demand response and budgeting
- Imperial College has continued to assess the Bridgend electrical distribution network based on information obtained from WPD. They have modelled the network to represent the 2030 energy system. Imperial College's modelling of hybrid heating system adoption indicates that the potential benefits are considerable.
- FREEDOM Interim report: In January 2018 an interim report on the project was released by PassivSystems. The interim report can be found on the following link: https://www.westernpower.co.uk/docs/Innovation/Current-projects/FREEDOM/Freedom-Project-Interim-Report-Online.aspx

1.3 Project Delivery Structure

1.3.1 Project Review Group

The FREEDOM Project Review Group meets on a bi-annual basis. The role of the Project Review Group is to:

- Ensure the project is aligned with organisational strategy;
- Ensure the project makes good use of assets;
- Assist with resolving strategic level issues and risks;
- Approve or reject changes to the project with a high impact on timelines and budget;
- Assess project progress and report on project to senior management and higher authorities;
- Provide advice and guidance on business issues facing the project;
- Use influence and authority to assist the project in achieving its outcomes;
- Review and approve final project deliverables; and
- Perform reviews at agreed stage boundaries.

1.3.2 Project Resource

Table 1: Project resource

Project Partner	Resource	Detail
Western Power Distribution	Faithful Chanda	Project Manager, WPD
Wales & West Utilities	Oliver Lancaster	Project Manager, WWU
	Lucy Mason	Innovation Manager , WWU
PassivSystems	Ian Rose	Professional Services Director, Project Lead

	Tom Veli	Professional Services Manager, Project manager
Delta - EE	Andrew Turton	Principal Analyst: Customer proposition and development of engagement framework
	Phillipa Hardy	Senior Analyst: Customer proposition and development of engagement framework
City University	Simone Stumpf	Human Computer Interaction (HCI) Design Lead
Imperial College	Goran Strbac, Dimitrios Papadaskalopoulos, Meysam Qadrdan, Predrag Djapic, Marko Aunedi	Network Modelling Team led by Prof Goran Strbac

1.4 Procurement

The following table details the current status of procurement for this project.

Table 2: Procurement Details

Provider	Services/goods	Area of project applicable to	Anticipated Delivery Dates
Samsung	Samsung heat pump system	Main FREEDOM installations in Bridgend , South Wales	February 2017 - 15 Samsung heat pumps
ThermalEarth	MasterTherm heat Pump system	Main FREEDOM installations in Bridgend , South Wales	February 2017 - 40 MasterTherm heat pumps
Daikin	Daikin heat pump system	Main FREEDOM installations in Bridgend , South Wales	February 2017 - 16 Daikin heat pumps

1.5 Project Risks

A proactive role in ensuring effective risk management for FREEDOM is taken. This ensures 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 have changed, reporting of significant changes that will affect risk priorities and deliver assurance of the effectiveness of control.

Contained within Section 7.1 of this report are the current top risks associated with successfully delivering FREEDOM as captured in our Risk Register. Section 7.2 provides an update on the most prominent risks identified at the project bid phase.

1.6 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 5 of this report.

Table 3: Dissemination Details

Event	Date	Attended by/ To be attended by	Location
Future of Gas, IGEM South West	09/11/16	WPD, WWU, PassivSystems and the wider gas and electricity industry	Bristol
Carbon Connect	08/02/17	WWU	Westminster, London
Low-carbon Heating Technical Innovation Workshop	14/02/17	PassivSystems & BEIS	BEIS
Wales Energy Conference	16/05/17	WPD, WWU and the wider gas and electricity industry	Cardiff
IEA Heat Pump Conference	15/05/17 – 18/05/17	WWU,PassivSystems and the rest of the world	Rotterdam, The Netherlands

IEA Heat Pump Conference	26/09/2017	WPD, WWU, PassivSystems and the wider gas and electricity industry	BEIS, London
IEA Annex 45	05/10/2017	WWU & PassivSystems and the rest of the world	Utrecht, The Netherlands
WPD Balancing ACT	05/10/2017	WPD, WWU, PassivSystems and the wider gas and electricity industry	Westminster, London
FREEDOM Workshop	07/02/18 – 08/02/18	WPD, WWU, PassivSystems and the wider gas and electricity industry	Cardiff

2 Project Manager's Report

2.1 Project Background

WPD and WWU put together a proposal to deliver an innovation project to realise the benefits of using the hybrid heating system (heat pump and gas boiler) for the electricity and gas networks and their customers. PassivSystems were engaged to deliver the project. The trial is being conducted in domestic housing units in the Bridgend area.

The proposed project runs for 27 months and has been broken down into two phases, defined in 14 work packages. The phasing reflects the contractual break clause prior to installations commencing. Phase 1 covers all work required to produce the models, hypotheses, plans and recruitment actions required for the heat pump procurement and installation activity to commence. Phase 1 also includes a 4 home pilot installation which assess the hardware and installation risk and collect the baseline data required for the advanced control development. Phase 2 covers the work of installation, commissioning, aggregated control development, field experiments, data capture and analysis, reporting and knowledge dissemination.

2.2 Project Progress

2.2.1 Main installation

This reporting period has mainly been focussed on the delivery of Phase 2 of the project.

The FREEDOM Project completed all the 75 installations. The final split of customer types is 40 social tenants and 35 private homeowners. There are 43 MasterTherm/Vaillant hybrid systems, 16 Samsung/Worcester hybrid systems and 16 Daikin Altherma hybrid systems. All completed installations have the Passiv hybrid heat pump controls installed. However, during this reporting period we also experienced loss of communication with 7 Samsung units though this was not affecting the homes as the boiler was providing heat but it meant that we were not able to control the unit and consequently did have a bearing on the project's results. The issue was eventually resolved following the installation of additional hardware to the Samsung heat pumps at the end of January 2018.

Below is a typical configuration of a hybrid heating system:

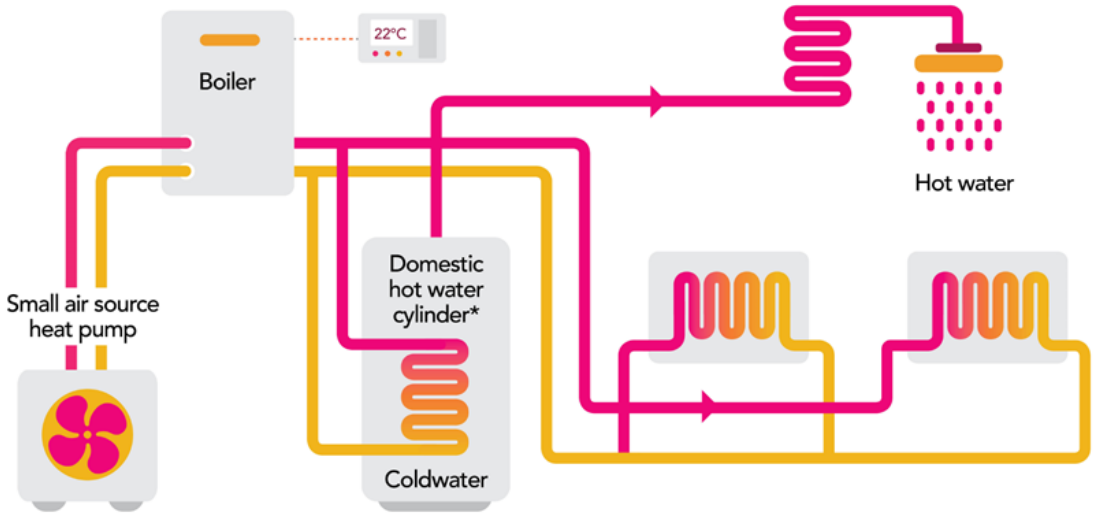


Figure 1: Configuration of a hybrid heating system

Below are some of the installations from the main trial:

- Daikin - 5kW

Figure 2: Daikin units installation

The Daikin Combined unit were all installed by WDS Green Energy.

- MasterTherm Heat pumps - 8kW

The MasterTherm and the Vaillant boiler were all installed by Thermal Earth.

Figure 3: MasterTherm installation

- Samsung Heat Pump – 5kW

The Samsung heat pumps and the associated Worcester Bosch boiler were all installed by Spire Renewables.

Figure 4: Samsung installation

2.2.2 Branding

The Project identity, including the branding, style and naming options was completed in May 2017 by Synergy. This activity was essential to support the recruitment for the project. Branding was also a vital tool to help with project marketing, customer literature, and setting the terms and conditions for household recruitment.

The branding logo for the project is shown below.

Figure 5: FREEDOM logo

2.2.3 Customer Engagement

The project team delivered 75 installations during 2017, with a focus on ensuring the portfolio of residential properties were representative of UK housing stock that will be around in 2050:

- flats, bungalows, terraced, semi-detached and detached properties
- homes with one to five bedrooms
- an age range from pre-1900 to new build
- an almost equal split between privately owned and social tenanted
- three off-gas-grid properties with Calor storage.

The hybrid heating systems installed as part of the project were appealing to participants once they had been explained, with running cost savings viewed as the biggest advantage. Nearly 90% of respondents found the idea of hybrid heating systems appealing or very appealing.

2.2.4 Next steps

- The solution is suitable for installation and immediate benefit in areas off the gas grid and where the electricity networks are also most constrained, with hybridisation of oil and LPG boilers and replacement of direct electric and solid fuel heating providing financial savings now, as well as being future ready for smart control and heat as a service. With a higher proportion of fuel poor homes located off the gas grid, there is a strong case for this to be implemented now.

- Develop potential follow-on projects, such as deeper exploration of viable pathways to market and use of different appliances and technologies that also offer fuel vector switching benefits, such as using gas heat pumps in non-domestic hybrid systems and smart hybrid heat networks.

- Continue running aggregated controls in all 75 homes using signals to switch between both appliances, using future fuel price ratios, tariffs, frequency response services and electricity network constraints. The hybrid benefit to potential hydrogen cities will also be explored.

- Independent assessments of all hybrid installations: Gas Assessment and Training Ltd are reviewing and assessing all installations. Currently 40 assessments have taken place. To date all installations have passed the assessment We will continue to work with the triallists to complete all 75 homes.

- Resolving a complaint from one of the triallists in the project: We received a complaint from an unhappy FREEDOM Triallist. Unhappy about poor communications, unsafe cabling, and broken financial promises and unsure his system was working properly. This Home, I.D 171102 (anonymous), has now been excluded from all FREEDOM Project experiments and surveys. The complaint has now reached the area Member of Parliament. We continue to help with investigations and have provided answers to questions that were of us, with the last correspondence being on the 29th of March.

- Final report: As the project will be finishing in May, we are now working with PassivSystems and other project partners to develop the final report structure and content. However, the project is registered to complete in January 2019.

- Balancing Act, 20th June 2018: Dissemination of the FREEDOM project in London.

3 Progress against Budget

Table 5: Progress against budget

Spend Area	Budget (£k)	Expected Spend to Date (£k)	Actual Spend to Date (£k)	Variance to expected (£k)	Variance to expected %
WPD Project Management	70	50.076	50.076	19.924	28
Project Partner Project Costs	1,562.447	1,558.093	1,558.093	4.355	0
BRANDING FEES	4	3.495	3.495	0.506	-13
DISSEMINATION MODEL – LCNI	8	8.35	8.35	0.35	-4
TOTAL	**1,644.447**	**1,620.014**	**1,620.014**	**24.434**	**1**

3.1 Explanation in variance

Spend is below the expected value as the project is delivering in accordance to the project plan - on time and on budget. We have had to spend less on branding fees, project partner costs are paid in line with the agreed schedule, and so are the project management fees.

4 Progress towards Success Criteria

Table 6: Progress towards success criteria

Expected success	How this is being achieved
Deploy trials subscribed to by up to 75 participants.	By the end of October 2017, the FREEDOM Project had completed all the 75 installations: 40 social tenants and 35 private homeowners.
Produce a proven architecture for the hybrid heating system.	All completed installations have the Passiv hybrid heat pump controls installed. To date, all installations have the Passiv hybrid heat pump controls installed and working correctly.
Present a comprehensive review of the technology.	With support from Delta-ee and through a thorough procurement process which includes a Request For Information, an assessment, Invitation To Tender (ITT) and a pilot trial review we were able to assess the heat pump performance of our chosen three heat pump technologies.

Produce a case study of how the technology contributes to the reduction of carbon emissions and compares with previous energy bills for domestic consumers through increased heating system efficiencies and a reduced unit cost.	This is yet to be determined. A series of hybrid heat pump experiments were scheduled for the 2017/2018 heating season and we are collating the results from this period.
Identify if the solution can bring benefits to WPD's & WWU's networks.	This is yet to be determined.
Develop a business process (polices, standard techniques etc.) for the use of hybrid heating system.	This is yet to be determined.

5 Learning Outcomes

Hybrid heating systems have significant potential for decarbonising UK domestic heating, including electrical heating systems, in a cost-effective manner while ensuring grid congestion is kept manageable. Presented below is some of the learning from the project:

- Different technologies: The project has completed installations of three hybrid systems with a system boiler setup, three hybrid systems not on the gas grid (using Calor gas storage) and one property with a new ASHP connected to an existing boiler as a retrofitted hybrid system.

- Switching of Fuel sources: The project has demonstrated that it is feasible to install optimised hybrid heating systems and smart controls on three different hybrid heating systems in a range of different house types (broadly representative of UK housing stock) using the wet heating systems and with no in-home disruption from additional insulation measures in 35 private homes and 40 social homes.

- Smart controlled hybrid heating between an air source heat pump and a boiler currently offers lower cost, lower carbon domestic heat, when compared to electrified heat through air source heat pumps alone. The system avoids inefficient, costly and carbon intensive use of gas peaking or coal generation to power heat pumps.

- Winter testing and future simulations indicate that using renewable wind electricity in a hybrid system could result in 70% carbon reduction, with minimal investment.

- The addition of renewable gases to the network, such as hydrogen blends, biomethane or BioSNG, significantly improves the carbon reduction when the boiler operates and could achieve full decarbonisation of domestic heating.

- When there is insufficient renewable electricity generation, when it is very cold and/or when there are capacity constraints in the electricity network, the heat load can shift across to the gas network, and vice-versa, to provide uncompromised heat, flexibly using the vast energy storage within the gas network (210TWh seasonally).

- Imperial College's modelling of hybrid heating system adoption indicates that the potential benefits are considerable. Modelling the 2030 energy system, their analysis shows that an increased annual spend of £178 million on the gas system as a substitute to electricity in air source heat pump-only scenarios, the whole system is able to achieve gross savings in total cost of more than £1.3 billion per year.

- Modelling has highlighted that conventional approaches to controlling hybrid systems with a simple transition between fuels based on external temperature are likely to perform poorly compared to a fully optimised system; controls should focus on the heating water temperature, which closely determines efficiency.

- The decision to switch fuel between gas and electricity can be determined automatically based on learned thermal house properties (combined with current conditions and occupant thermal requirements), without any need to manually choose a transition temperature. PassivSystems controls learn the detailed thermal response of a property and build a physics model of the house and heating system. Using this model, it can optimise the performance of the heating system over the upcoming day, and predict the control strategy that is required to minimise energy consumption while meeting the comfort demands of the occupiers.

- Smart home energy management system, such as that provided by PassivSystems, can be used to interface with the smart grid to provide a realistic representation of the demand flexibility of the household.

- The value between purchase of fuels and sale of heat could be grown further by reducing heat demand in the home, with the aggregator and investor incentivised to install insulation measures which pay back at no further cost to the consumer. The leakiest homes and those properties with higher occupancy and, therefore, higher heat demand would attract the quickest financial return from lowering demand in a heat service world.

- Coordination between installation teams is always vital to prevent making multiple visits to the property: Coordination between different teams was identified as a key element to reduce the number of visits to a property. It was essential to understand the dependencies of the different teams during the installation and commissioning process.

- Customer engagement – During the earlier part of the trial we learnt that consumers needed to know about the project to a comfortable level of detail. We have continued to engage with them throughout the trial period to ensure that sufficient information was made available to them.

- Incompatibility with equipment during installation: Sontex heat meter used was not compatible with the Daikin unit. The installation contractor attempted to fit the Sontex heat meter to the Daikin unit, however, could not fit the final temperature sensor probe as it was too big to integrate with the unit. A Danfoss heat meter was eventually used and this required a second visit for the installer to fit the unit and a second visit for PassivSystems to connect to the hub, which was an inconvenience for the homeowner.

- Loss of Communication: 7 of the Samsung heat pumps went offline in November 2017. Working with Samsung we identified a solution requiring the installation of an additional piece of hardware, SNET module (for serial communication), to each of the affected Samsung heat pumps. All Samsung heat pumps are now online. The SNET module was installed in February 2018.

6 Intellectual Property Rights

A complete list of all background IPR from all project partners has been compiled. The IP register is reviewed on a quarterly basis.
The Freedom Project has generated IPR in a variety of areas.
PassivSystems developed the Customer Interfaces for the control of the heat pumps. The controls will be owned by PassivSystems.
The foreground IPR for the Wireframes where developed by City University and will be retained by the university.

7 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 Project Delivery 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; and
- ✓ Monitoring and updating of risks and the risk controls.

7.1 Current Risks

The FREEDOM risk register is a live document and is updated regularly. There are currently 18 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 **Error! Reference source not found.**, 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.

Table 7-1: Top five current risks (by rating)

Details of the Risk	Risk Rating	Mitigation Action Plan	Progress
Ability to recruit sufficient homes	Completed	Passiv and Delta-ee will create a thorough recruitment strategy and engagement strategy which we will plan to. Invest significant time and resource in customer engagement.	Completed
Poor hybrid heat pump technology used	Completed	PassivSystems (with support from Delta-ee) will deliver a thorough procurement process which will include an Request For Information (RFI), an assessment, ITT and a pilot trial review. Based on these activities we	Completed

		will be able asses the heat pump performance. The aim is to have more than one hybrid supplier which will mean that the project will have a second or third supplier available if the chosen hybrid systems are not performing well.	
Field trial results fall short of model expectations	Minor	Robust System Design specification and Development plan to be implemented.	In progress
Poor consumer understanding of project aims and interventions	Minor	PassivSystems, Delta-ee and City University are designing and implementing a customer engagement plan which will incorporate learnings from previous projects, learnings and the pilot trial. This should provide substantial education. In the event that this does not work, the project partners will visit Bridgend and conduct workshops.	Consumer engagements and surveys taking place to review ability to use the equipment and obtain feedback on performance.
Increase in consumer heating bills	Minor	PassivSystems to hold meetings with all triallists to ensure they are clear on project aims and the planned customer journey.	In progress

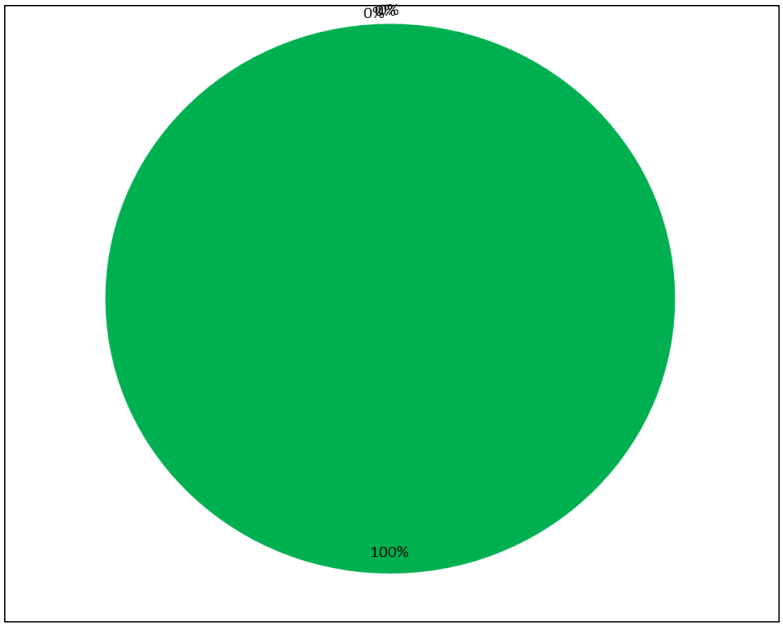
Error! Reference source not found. provides a snapshot of the risk register, detailed graphically, to provide an on-going understanding of the projects' risks.

Table 7-2: Graphical view of Risk Register

Likelihood = Probability x Proximity						
	Certain/Imminent (21-25)	0	0	0	0	0
	More likely to occur than not/Likely to be near future (16-20)	0	0	0	0	0
	50/50 chance of occuring/ Mid to short term (11-15)	0	0	0	0	0
	Less likely to occur/Mid to long term (6-10)	0	0	0	0	0
	Very unlikely to occur/Far in the future (1-5)	4	7	7	0	0
		1. Insignificant changes, re-planning may be required	2. Small Delay, small increased cost but absorbable	3. Delay, increased cost in excess of tolerance	4. Substantial Delay, key deliverables not met, significant increase in time/cost	5. Inability to deliver, business case/objective not viable
		Impact				
	Minor	Moderate	Major	Severe		
Legend	18	0	0	0	**No of instances**	
Total	18				No of live risks	

Table 7-3 provides an overview of the risks by category, minor, moderate, major and severe.This information is used to understand the complete risk level of the project.

Table 7-3: Percentage of Risk by category



7.2 Update for risks previously identified

Descriptions of the most significant risks, identified in the previous six monthly progress report are provided in **Error! Reference source not found.** with updates on their current risk status.

Table 7-4: Risks identified in the previous progress report

Details of the Risk	Previous Risk Rating	Current Risk Rating	Mitigation Action Plan	Progress
Ability to recruit sufficient homes	Moderate	Closed	Passiv and Delta-ee will create a thorough recruitment strategy and engagement strategy which we will plan to. Invest significant time and resource in customer engagement. Offer incentives (e.g. Free tablets) if necessary to boost	Completed

			numbers.	
Field trial results fall short of model expectations	Minor	Minor	Robust System Design specification and Development plan to be implemented. Commercial exploitation plan can't be achieved and further re-work required at PassivSystems cost	Completed. Three systems have been installed: Daikin, Samsung and MasterTherm
Poor consumer understanding of project aims and interventions	Minor	Minor	Early engagement with partners and suppliers has provided support for the timely need for the project.	Consumer engagements and surveys taking place to review ability to use the equipment and obtain feedback on performance.
Poor hybrid heat pump technology used	Minor	Closed	Will have a second or third supplier available if the hybrid systems are not performing well.	Performance of the installed units has been good. We lost communication with 7 of the Samsung units but this was quickly restored following the installation of additional hardware.
Customer Engagement Plan Delays	Minor	Closed	Customer Engagement Plan approved by Ofgem. Decision letter received on 17th January 2017	Completed. Decision letter from Ofgem gave authorisation to contact customers

8 Consistency with Project Registration Document

The scale and timeframe of the project has remained consistent with the registration document, a copy of which can be found here: www.westernpowerinnovation.co.uk/Document-library/2016/Registration-Forms/NIA_WPD_023_5128_Project-Registeration.aspx

However, the scope of the project has been extended to develop 3 hybrid systems instead of 1 as initially agreed. PassivSystems and WWU will provide the financial contribution to allow the project extension to take place. They will contribute £15,000 and £45,000 respectively. WPD will not be contributing to the cost of the project extension.

9 Accuracy Assurance Statement

This report has been prepared by the FREEDOM Project Manager Faithful Chanda, reviewed and approved by the Future Networks Manager (Roger Hey).

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.