Sunamp

SFHA Energy & Fuel Poverty Conference 2018

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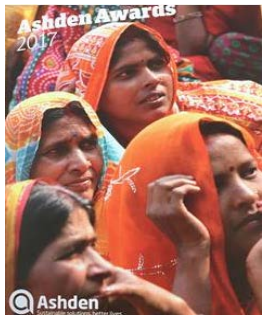
Introduction to Sunamp

- Sunamp develop, design and manufacture heat batteries here in Scotland
- We employ 28 staff and are headquartered in East Lothian
- We have just opened our new manufacturing facility in East Lothian
- We are the most advanced PCM Heat Battery energy storage company in the world http://www.pcm-ral.org/pcm/en/links/
- We have an office in Zurich to manage enquiries we receive from all over the world
- We have rolled out over 1000 heat batteries, many within the EastHeat fuel poverty reduction project
- The EastHeat project and Sunamp have won or been finalists for numerous awards

Winner: Solar Power Portal Awards 2016

Winner: Regen Renewable Futures & Green Energy Awards 2017

Finalist: SHIFT Awards 2016



Finalist Ashden Awards 2017

Market Development

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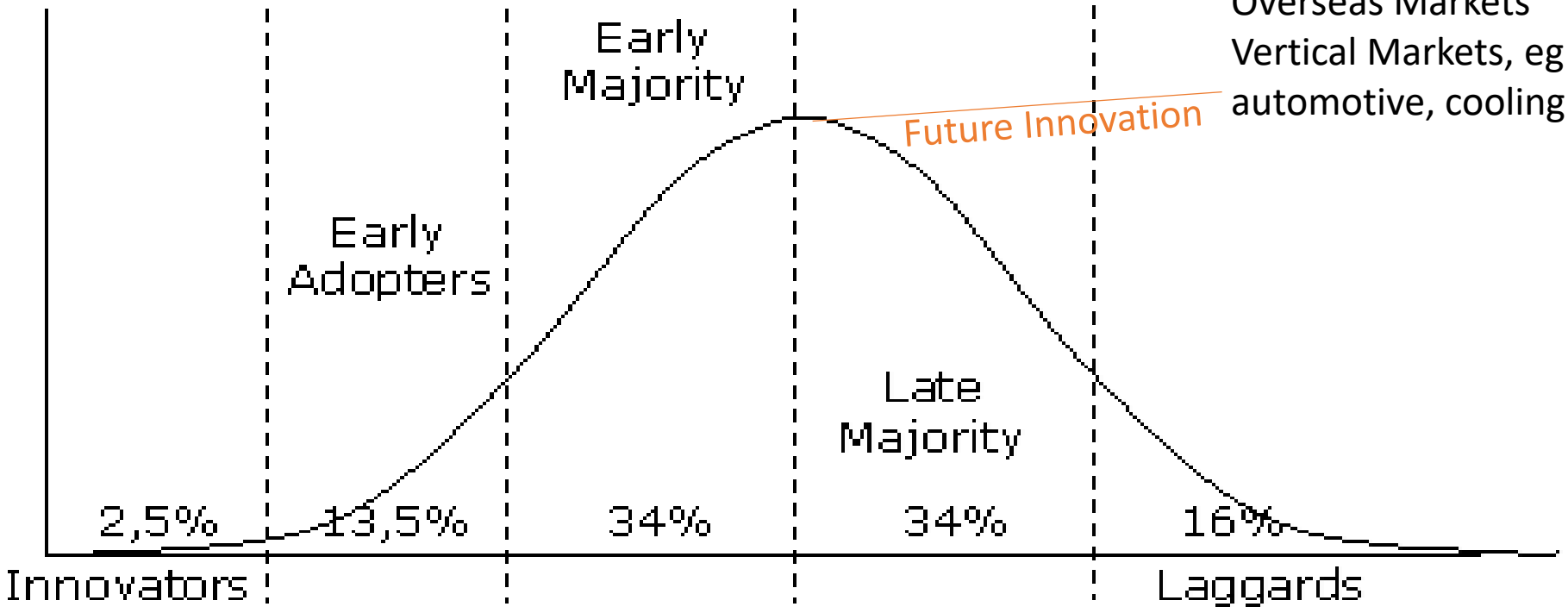
Sunamp is a well proven, low risk solution



2013 – 2014 DECC Project

2015-2017 Eastheat Project

2018 – Huge growth expected, with key drivers in building standards

Heat Trilemma

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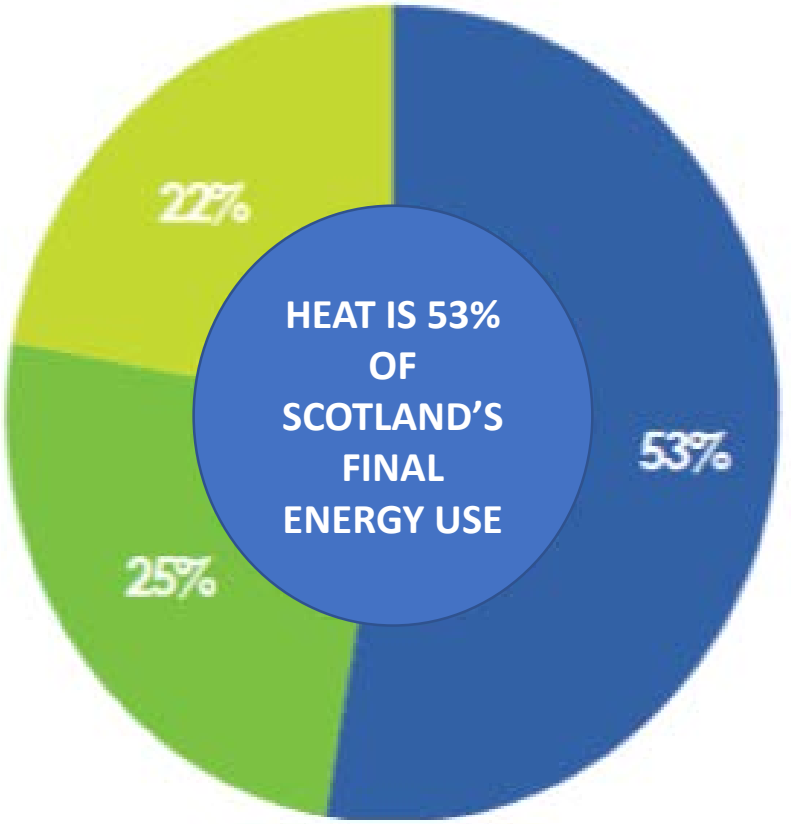
Electrification of heat can address many of the challenges faced in the heat markets

1. REDUCING EMISSIONS
Heat is estimated to be responsible for 47% of Scotland's greenhouse gas emissions

2. COSTS & FUNDING
Scotland spends £26 Billion annually on heating and cooling

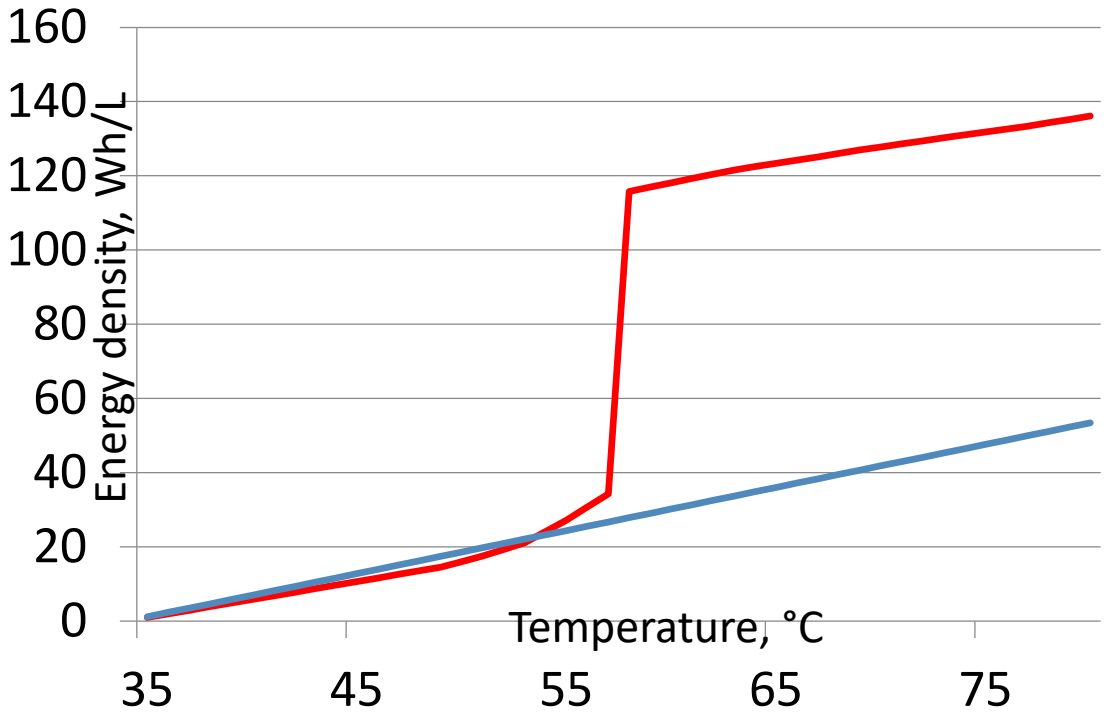
3. FUEL POVERTY
Around 26.5% of our population are in fuel poverty



Phase Change Material Technology

Sunamp

Ice (phase change at 0°C)



- **Sunamp Phase Change Material (PCM)**
- Stable – We can control how we charge and release
- High Energy density
- Non-flammable
- Sunamp have industrialised PCM energy storage for space heating and hot water

Hand warmer (melts at 58°C)

What is a heat Battery?

A high-powered, high flow-rate heat exchanger is immersed in phase change material and encapsulated in a red moulded, polypropylene cell

The red cell is surrounded by non-flammable vacuum insulation panels. These offer superior insulation, in minimal space. As a result the *whole* range is ErP A or A+ with SAP benefits

Finished in a cuboid, white powder-coated aluminium case, which offers pipework knockouts on any face for very easy installation

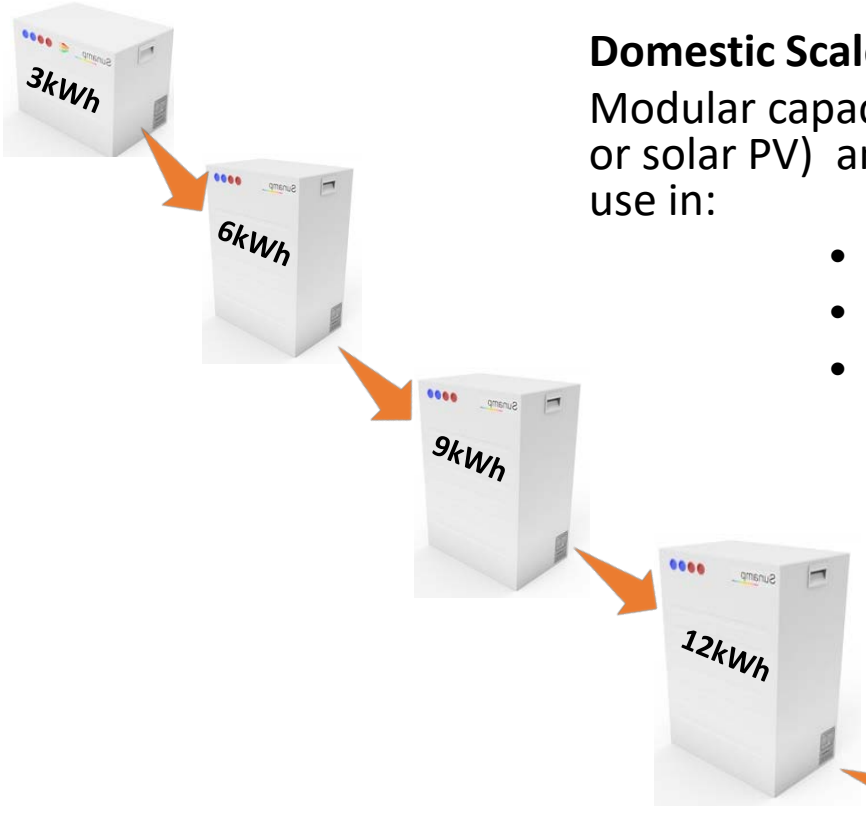
Our new factory facility enables us to ramp up our current production quickly

Sustainability

Sunamp

- There are many types of phase change materials
  - Organic – Paraffin & fatty Acids
  - Inorganic – Salts Hydrates & Metallics
  - Eutectic – Mixes of the above
- We use inorganic, Sodium Acetate based PCM material which is plentiful and easy to source
- Non toxic
- Non flammable
- Long life: tested to 37,000 cycles with no degradation, at one cycle per day that's around 100 years
- We are able to fully re-use or re-cycle every component at end-of-life
  - Either reformulated into new cells or as a de-icer for example

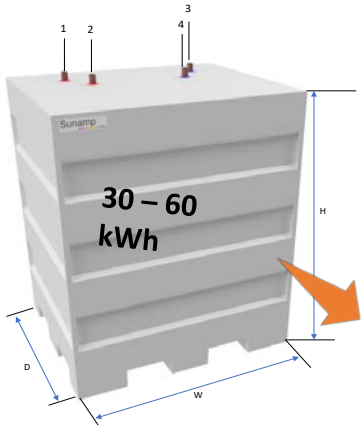
Modular and Flexible



Domestic Scale

Modular capacity storage with charging from Electricity (grid or solar PV) and Multiple heat sources e.g Heat pumps for use in:

- Instant hot water
- Space heating & Cooling
- New build & retrofit



Commercial & industrial

Modular up to MW scale

Charging Electricity and Multiple heat sources

To supply communal heating, hot water or to improve the efficiency of plant by introducing a buffer store

Sunamp and Lithium batteries

Lithium Battery

13.2kWh
5kW
135dm^3
10,000 cycle life
(less capacity)
Materials issues

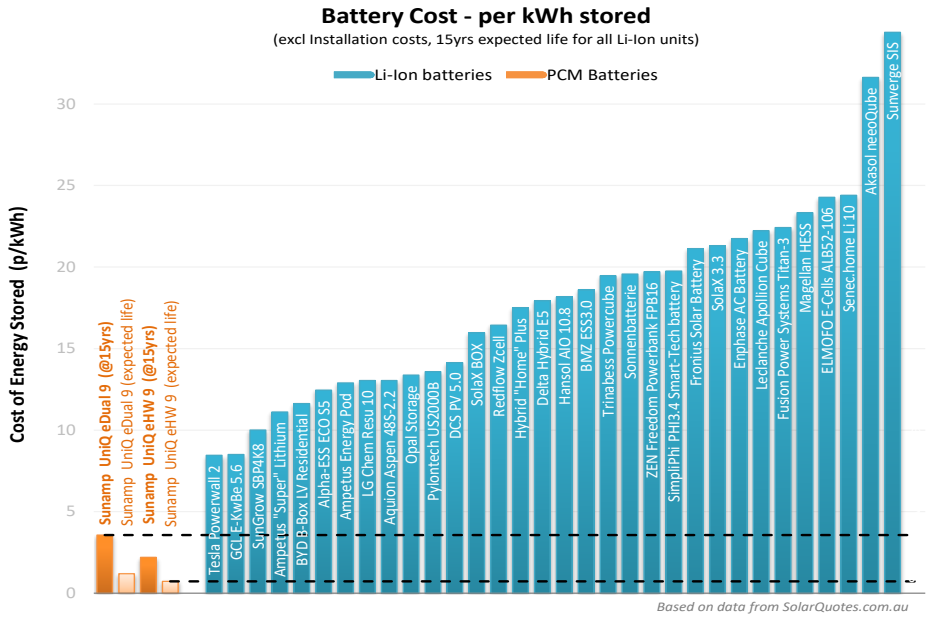
16% of household final energy consumption

Sunamp Heat Battery

10kWh
50kW
185dm^3
>36,000 cycle life
70% lower cost*

81% final energy consumption

- We have compared the Sunamp storage with a large range of electrical batteries and we are 30% less expensive than the lowest priced.
- Due to our higher lifespan the round trip cost of energy storage is 60-90% less than electrical batteries



% household final energy consumption in UK *United Kingdom housing energy fact file, 2012*

Sunamp Installations & Case studies

Installation Gallery

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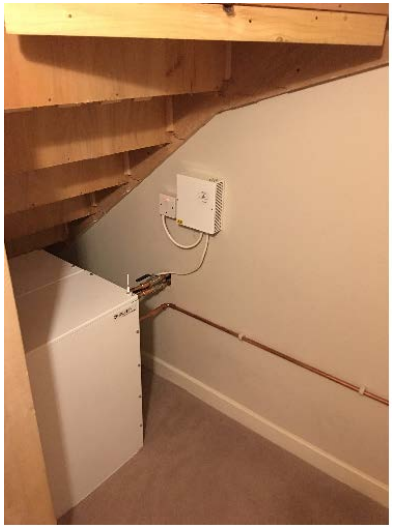

DECC Trials ASHP with Sunamp

- **Running successfully since 2013**
- **Running costs savings 45% to 57% , carbon emission reductions 17% to 36%**
- **Replicated at ONGO homes in 2016/2017, installing in old coal cellars, funded by NEA**

Department of Energy & Climate Change

CASE A

This is a 2-bedroomed house with 2 working occupants. They are heavy hot water users having 2 deep baths in the morning and 2 deep baths in the evenings

Annual Savings on Heat and Hot Water		
Energy saving	**Bill saving**	**CO_2 Saving**
59%	56%	29.1%
8,404 KWh	£602.17	1259 $KgCO_2$

CASE B

This is a 3 bedroomed house lived in by a young working couple, their heat and hot water usage is normal. This household had night storage heater. Comfort has improved.

Annual Savings on Heat and Hot Water		
Energy saving	**Bill saving**	**CO_2 Saving**
40%	45%	36%
4,921KWh	£414.78	1596 $KgCO_2$

CASE C

This is a one-bedroom house, semi detached bungalow. The occupier is an retired man who looks after his grandchildren in the early evening so the house must be warm - Achieved

Annual Savings on Heat and Hot Water		
Energy saving	**Bill saving**	**CO_2 Saving**
49%	57%	Not Available
3,291 KWh	£325.91	Not Available

CASE D

This is a 5-bedroomed house with 2 working occupants and 1 teenager child and 1 visiting young adult

Annual Savings on Heat and Hot Water		
Energy saving	**Bill saving**	**CO_2 Saving**
77%	50%	46%
28,476 KWh	£926.77	3645 $KgCO_2$

Project Summary

- LECF – EastHeat Fuel Poverty Reduction Plan
- Installations across Stirling, Falkirk, Livingstone, Edinburgh and East Lothian
- The project was completed on time and slightly under budget
- 100 people employed on project, new skills and manufacturing in local area

850 PV homes 410 with PV and SunampPV	**100 All electric properties**	**Newcarron Court 29 apartments** 3 floors with 3 different solutions compared	**Salisbury View, Lauderdale** 90 Sunamp Heat Batteries replacing old inefficient immersion heaters
ELHA/CRE	ELHA/CRE	CRE (Places for People Scotland)	CRE

Objective achieved: 20% reduction in cost of fuel used for heating/hot water.

Retrofit Properties

Table 1: EastHeat Property Count, by Property Type

Bedrooms:	1	2	3	4	--	Total
Flat	181	49		1	4	**235**
Bungalow - Mid-terrace	12	19				**31**
Bungalow - End-terrace	10	8	1			**19**
Bungalow - Semi-detached		24	3	1		**28**
Bungalow - Detached		3	2		1	**6**
House		34	62	6		**102**
House - Mid-terrace		16	44	6		**66**
House - End-terrace		14	29	1		**44**
House - Semi-detached		31	49	6		**86**
House - Detached	1		1			**2**
--		1			5	**6**
Total	**204**	**199**	**191**	**21**	**10**	**625**

New Build Requirements

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Affordable Housing

- Meeting Building standards and EEESH (Scotland)
- Lower tenants fuel bills
- Alleviate fuel poverty
- Reduce carbon emissions
- Simple Control Systems
- Reduce Maintenance
- Move away from gas
- Make good use of charitable status

Luxury Housing

- Meet building standards, zero carbon homes
- Compact so frees up space
- High levels of Comfort & Convenience
- Cutting edge technology
- High Spec Finish
- Good Control Systems, NEST, HIVE
- Sustainable and Green solutions

Unvented Cylinder Replacement

Linstone HA

- Savings of £51 PA, single occupancy
- Increased comfort, higher pressure
- Increased space in cylinder cupboard
- Annual HW cylinder inspection avoided, no G3 regulation, no P&T pipework required
- Legionella risk and treatment avoided
- Sunamp expected to last 20 plus years
- Reduced maintenance
- Lower scalding risk, temp can be blended down v's HWC 60oC +

Tenant Comments

"Water pressure is unbelievably brilliant. Not noisy, More space freed up in the cupboard. Pressure has vastly improved things, notably in the kitchen sink, previously I could start the water running walk away and come back to it, now I get the hot water instantly which is great"

Sunamp and Hot Water cylinders

- Price competitive with equivalent hot water cylinder
- More efficient heat storage, due to low heat loss
- More compact, freeing up space in the home
- High hot water pressure
- Holds less than 15 litres of water, so no P&T pipework or annual checks
- Reduced legionella risk
- Low Carbon Ready, support the transition to renewable energy, can be charged with Solar PV, Heat Pumps or hybrid heat Pump
- Can be integrated with a combi boilers, reducing the use of gas

SAP INPUTS

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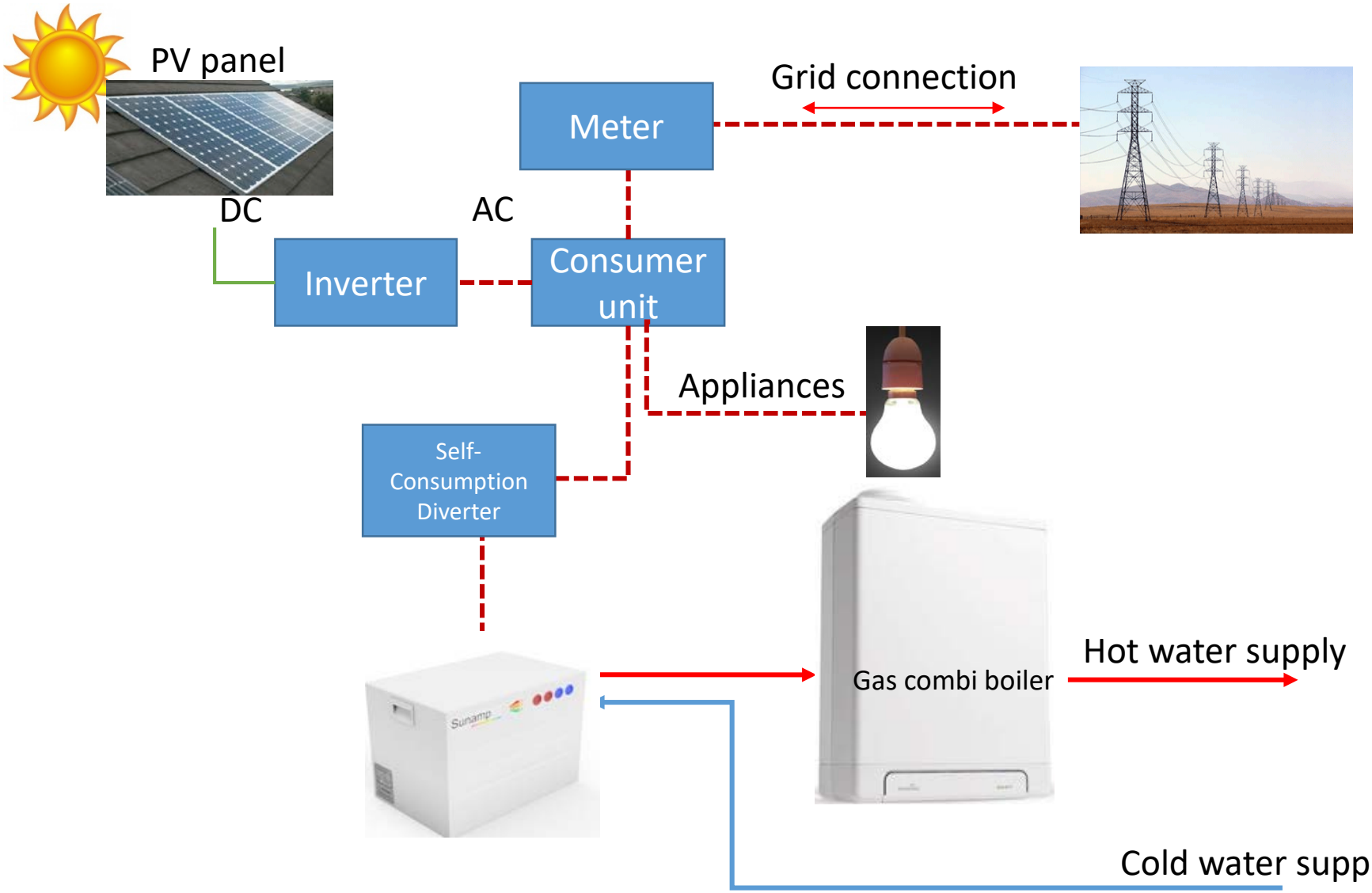
- **SUNAMP HOT WATER ONLY**
- Classified as hot water only – Hot Water thermal store, the heat loss factor in next slide for size of cylinder needs to be added to SAP calculations

- **SUNAMP HOT WATER plus** – Will be entered into SAP as an integrated thermal store and will provide rapid heat up for the heating system. the heat loss factor in next slide for size of cylinder needs to be added to SAP calculations

Sunamp with Solar PV



EastHeat

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Solar PV, combi boilers and Sunamp Storage

Electric shower limits potential to use saved PV electricity for hot water, moving to mixer shower is recommended.

- **Electricity consumption reduced due to PV on roof** **£101 SAVED**
- **Gas consumption reduced as a result of SunampPV** **£74 SAVED**

The Lynne Family

"Our hot water is plentiful, comes out of the taps quickly and is an excellent temperature"

Alec & Joan

"In comparison to the old system, the new system performs to a much higher standard, providing a larger quantity of hot water for a much cheaper price."

John and Jayne

"It gets a bit to getting used to, switching on the hot tap normally you would hear the sound of the gas boiler that doesn't happen any more"

Solar PV & Sunamp DC storage

Sunamp

PV panel

Meter

Grid connection

Consumer unit

Appliances

Inverter

DC

Self-Consumption Diverter

Gas combi boiler

Hot water supply

Cold water supply

SAP INPUTS

Sunamp

SAP 2012 – Sunamp Guide

SUNAMP PV (AC Connection)

- We do not affect the SAP rating. SAP assumes 50% of energy generated is used in the house and 50% is exported. The benefit is energy savings.
- There has been some talk of SAP changing to assume a 30/70 split with no self consumption

SUNAMP DC

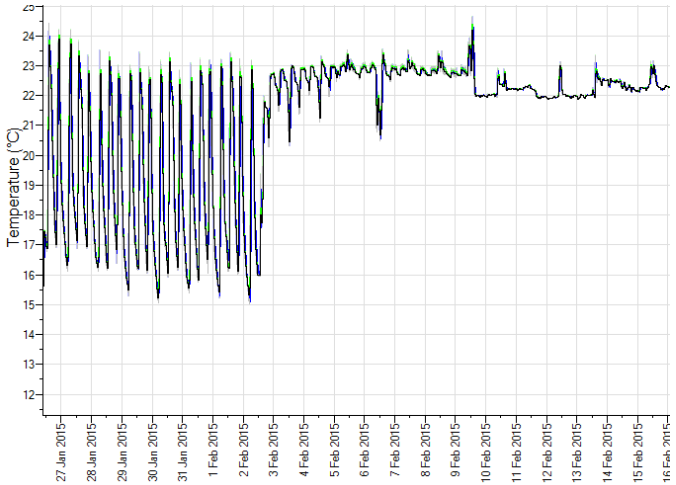
- 95% of generation is diverted to the Sunamp, there is no current procedure in SAP, however it can be dealt with under waste heat recovery, as it provides a pre-feed to the combi boiler. We've calculated the input is equivalent to 2M of solar thermal. (comply with appendix J. (which has still to be written)
- It must be stored but can be used for space heating and hot water

All Electric Homes

Balfour Court Assisted Living - 2015

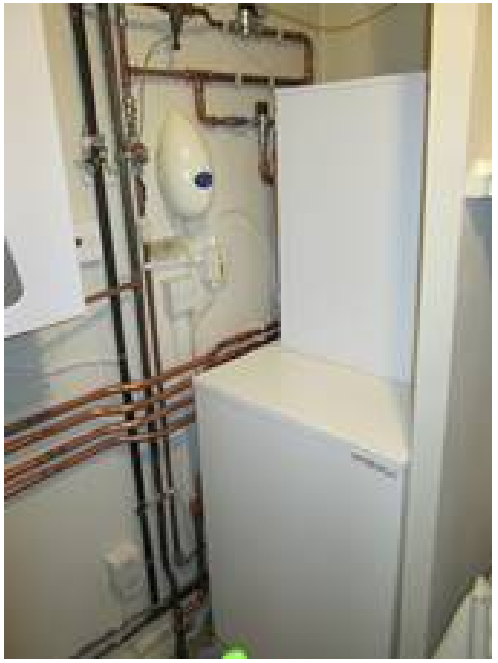
The challenge was in changing the heating so the huge swings in temperature did not occur, the objective was to improve comfort without increasing costs. We did this with minimal disruption, creating a centrally controlled heating system

The Challenge



Old System

New System



All Electric Homes

Channel 4, 25th Oct 2017

- Passiv Standard
- Heat load 800 watts per day
- All electric
- No Solar PV or Heat Pump
- Three stores in basement
- One store in kitchen
- Heating and hot water, could have been achieved with 3 units, but he has four to ensure he always has plenty of heating and hot water

Comparison with Storage Heaters

- Based on costs we have been supplied with for storage heaters, the Sunamp and boiler system is comparable
- Installation costs will be similar in a new build, however if refurbing consider the costs of electrical points versus wet system pipework, i.e. what if anything is already there

Storage Heaters	1 Bedroom Flat (£)
Storage heater in hall, Living room and bedroom	1800
Panel heater in kitchen	250
Electric towel rail in bathroom	140
Hot water cylinder	600
	2790
Sunamp Solution	
4 Wet radiators & TRV	400
Hydronic Towel rail	60
12 kWh Sunamp UniQ eDual	2097
	2557

- All Sunamp stores can be charged with direct electric, so you can use off peak electricity and then use stores to provide heating and hot water
- Running costs estimated to be 10% cheaper, partly due to the hot water provision and rapid warm up of radiators

SAP INPUTS

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The SAP 2012 categorises these types of systems as electric '*Combined Primary Storage Unit*' i.e. CPSU and are designed for use with E10 or better electricity tariffs. The procedures for calculating high rate and low rate electricity consumptions are defined in appendix F of SAP 2012. The technical specification relevant to SAP 2012 of the hot water vessel based electric CPSUs currently in the market is summarised below in table 5.4.

SAP Consideration

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In SAP the requirements of a “High Heat Retention Storage Heater” e.g. is that they have:

a) low heat losses, user time control, Electronic room temperature control, Charging control function of predicted weather forecast

An electric boiler, with heat store would give similar SAP ratings, with additional benefits:

- Heat can be discharged quickly to radiators for rapid warm up
- Boiler would run on off peak only with the Sunamp providing heating and hot water during on peak times (we have this installed in social housing)
- High levels of comfort as you have a centrally controlled wet radiator system, with simple controls
- Storage for heating and hot water takes the same space as a single hot water cylinder
- Additional SAP benefits if we can shift more of the heat and hot water to off peak
- Additional SAP benefit potential on lower heat losses & reduced cost of operation*

Mini District Heating System

Newcarron Court, Falkirk
28 Assisted Living Apartments, over three floors with a different solution on each floor

3 Floors, three scenarios

FLOOR	PLANT ROOM EQUIPMENT	PER FLAT
Ground Floor	Gas Boiler & 500 litre buffer tank	Danfoss Flat Station
First Floor	6kW mCHP, 11kW Heat Pump & 120kWh Sunamp Store	Danfloss Flat Station
Second Floor	Gas Boiler	5kWh Sunamp store

Commercial Retrofit – Village Hall

Brief was to remove gas – They wanted to be the greenest village hall in Scotland

Installation

- 12kWp Solar PV Array was already installed
- We retrofitted 2 Daikin Heat Pumps & 1 Sunamp Heat Battery
- Removed gas boiler
- Replaced the old inefficient radiators
- Have now added EV Charging for community

Savings and Payback

- The committee have been monitoring their savings and estimate they will save over £3000 PA which is over 50% of their fuel costs
- Payback in 10 years
- Have not switched to off peak tariff yet, which could increase savings

Benefits

- Very easy to control & sets back automatically
- Can heat the 2000 Sq Ft room very quickly
- Radiators replaced with no redecoration required
- Better water pressure

Barriers & Challenges

There are always challenges, however we are seeing a lot of positives steps:

- Revised EESSH Guidance now states that where there is new technology that has not been accredited for SAP, landlords can get the same score/pass if they can demonstrate that it achieves the same outcomes as accredited technology
- EST have announced that energy storage can qualify for an interest free loan
- We are engaged with Warmworks to look at how the Sunamp products could be included in the Warmer Homes Scotland scheme
- New housebuilders are putting up minimal solar panels to meet their SAP requirements/building regulations, however we know one that plans to install storage with panels, to give householders a benefit, without increasing their build costs
- Latest RHI review has more focus on waste heat
- Energy Efficiency Scotland Program – Decarbonisation Fund for Social Housing Expression of Interest 8th June 2018

Sunamp

Thank you

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