Sunamp

An Introduction to Thermal Energy Storage

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Introduction to Sunamp

3 areas of focus

1. Using energy more efficiently
   - Efficient technology
   - Efficient fabric
   - Education and awareness

2. Providing flexibility

3. Mitigating peak demands

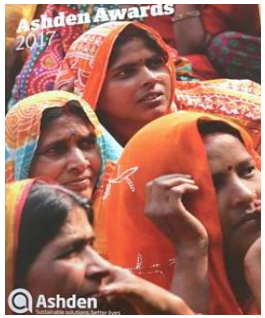
Introduction to Sunamp

- Award winning company that develop, design and manufacture heat batteries
- Employ 40+ staff and growing. HQ near Edinburgh with an additional office in Zurich.
- We are the most advanced PCM Heat Battery energy storage company in the world http://www.pcm-ral.org/pcm/en/links/
- We have rolled out over 2000 heat batteries
- Multi-fold patent protection at both material, device and system level in many countries, including UK,EU, Japan, China, Korea and India

Winner: Solar Power Portal Awards 2016

Winner: Regen Renewable Futures & Green Energy Awards 2017

Finalist: SHIFT Awards 2016



Finalist Ashden Awards 2017

Why Heat?

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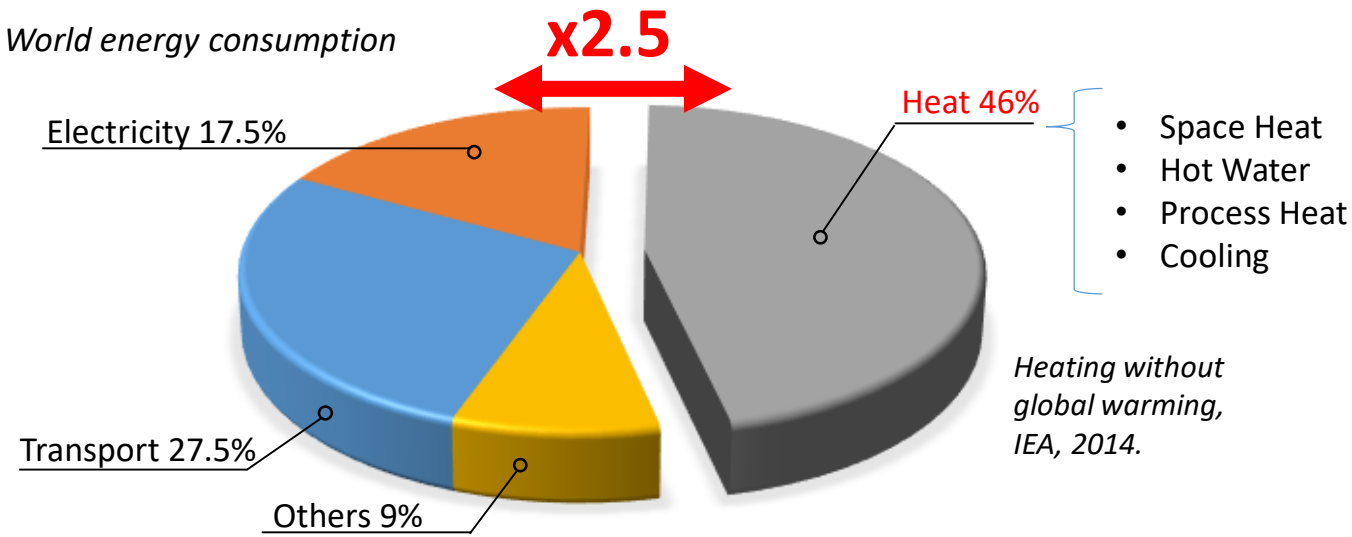

Electrical storage:

- ✗ Over invested
- ✗ Overcrowded
- ✗ High entry barriers
- ✗ Materials questions

Heat storage:

- ✓ Has not changed in centuries
- ✓ Ripe for improvement
- ✓ More heat storage needed
- ✓ Low cost, sustainable materials

Note: Sunamp can also address (Transport) and interplay with (Electricity) other Energy segments

Source: IEA

What is a heat Battery?

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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

Phase Change Material Technology

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Phase Change Materials (PCMs) are substances that absorb and release thermal energy during the process of freezing and melting

1761 - Joseph Black discovered latent heat at the university of Edinburgh

Early 1900s – Alan Tower Waterman wrote about PCMs at Yale University

2010 – Sunamp developed the first PCM heat battery, using Sodium Acetate

Sodium Acetate is readily available and in common use in dishwasher tablets and as a flavouring for salt and vinegar crisps. It is sustainable, can be recycled and has a very long life, we have tested to over 50,000 cycles

Sunamp has taken well developed and understood learnings from the past to create the products of the future

Phase Change Material Technology

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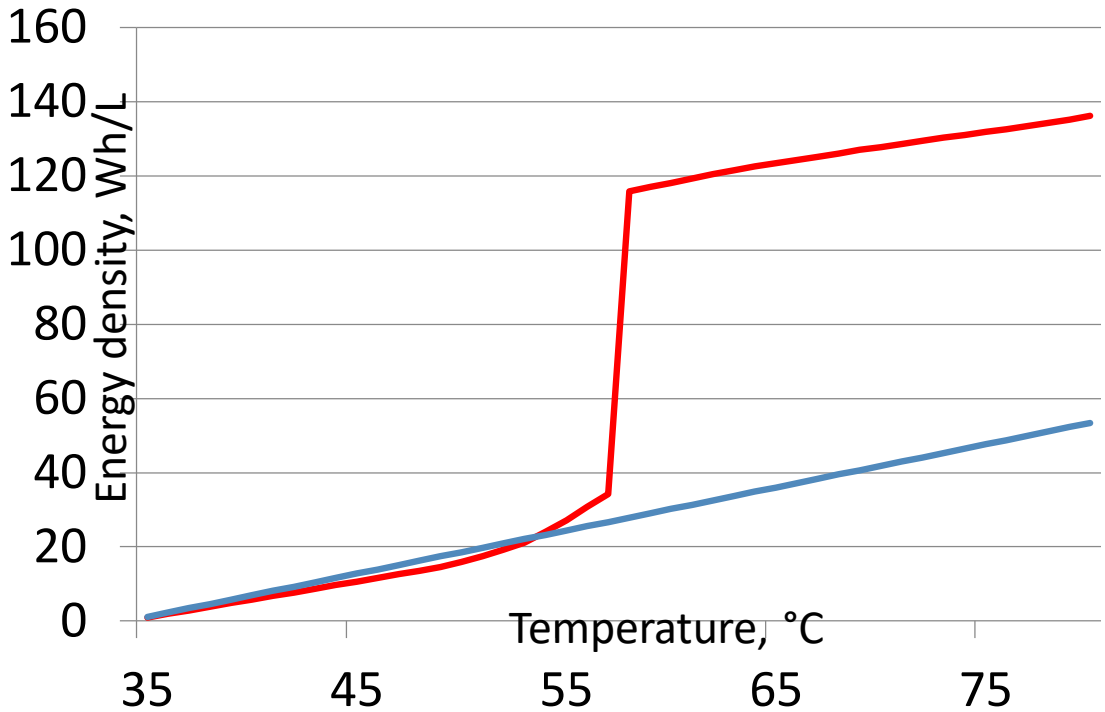
Ice (phase change at 0°C)



- **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)

Sustainability

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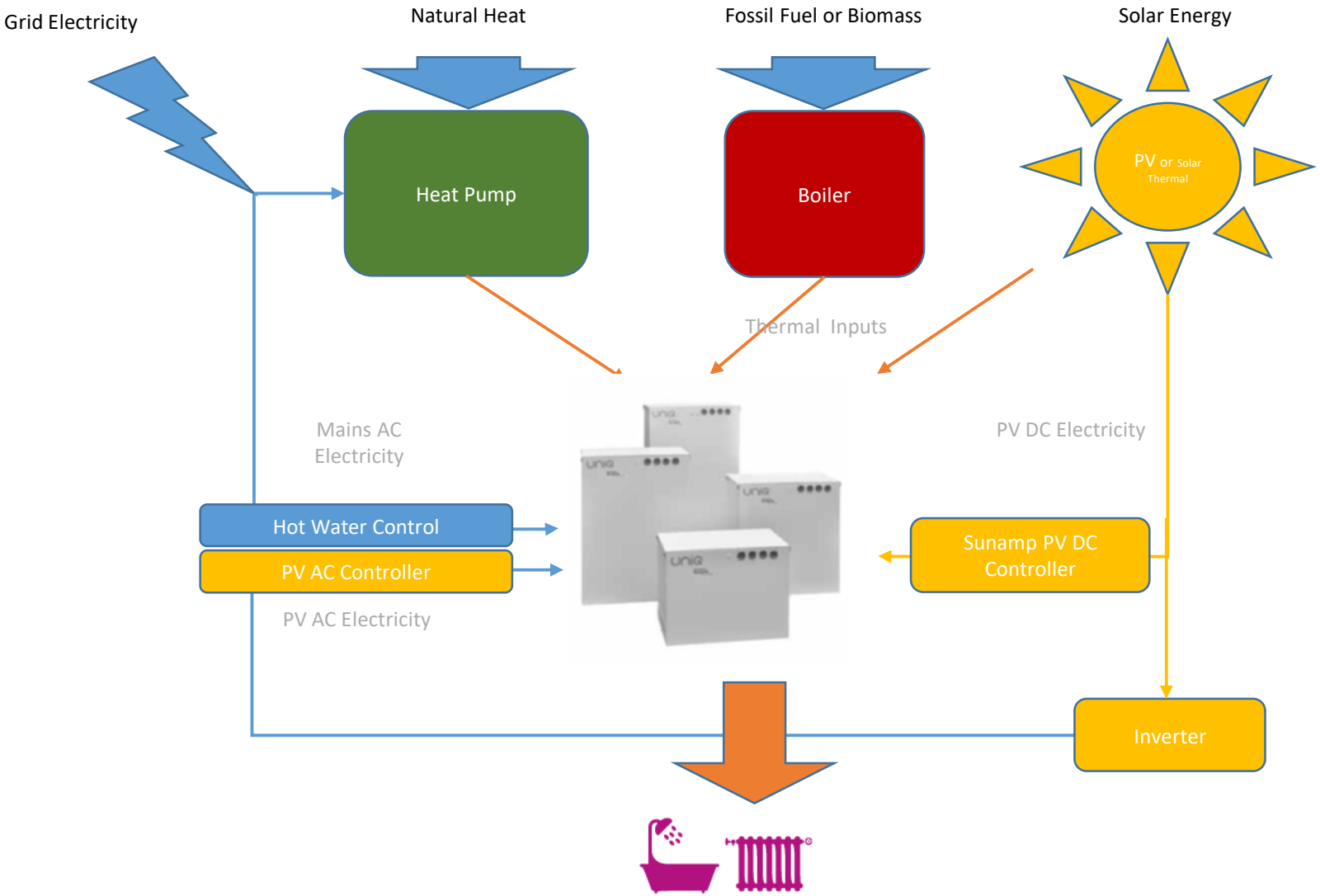
- There are many types of phase change materials
  - Organic – Paraffin & fatty Acids
  - Inorganic – Salts Hydrates & Metallics
  - Eutectic – Mixes of the above
- We use inorganic, Sodium Acetate based PCM material which is plentiful and easy to source
- Non toxic
- Non flammable
- Long life: tested to 50,000 cycles with no degradation,
- 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

The Product


Grid Electricity
Natural Heat
Fossil Fuel or Biomass
Solar Energy
Heat Pump
Boiler
PV or Solar Thermal
Thermal Inputs
Mains AC Electricity
PV DC Electricity
Hot Water Control
PV AC Controller
Sunamp PV DC Controller
PV AC Electricity
Inverter

Modular, scalable, compact, efficient

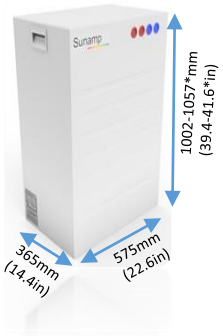
Sunamp

UniQ 3

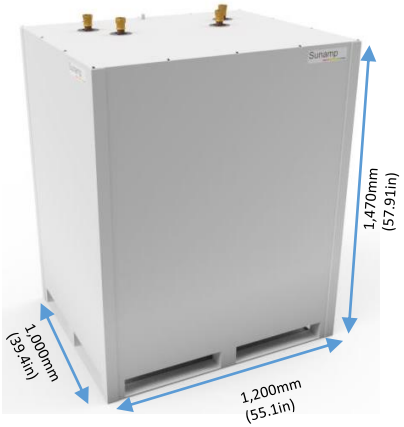
UniQ 6

UniQ 9

UniQ 12



UniQ 80



Key benefit:

- Extremely low heat loss
- Highest efficiency on the market
- Nearest competitor at 210L capacity is water tank with B rating

ErP A+

Other benefits:

- Minimised pipework
- Lower installation cost
- Space saving (70%)
- Price similar to water storage

*height for models including stand-by electric heaters

Model Example	Measured kWh	Equivalent cylinder (L)	Heat Loss (kWh/24h)	Comments	ErP Rating
UniQ HW 3	3.5	70	0.449		A+
UniQ Heat 6	7	140	0.649	Stackable two high	A+
UniQ HW 9	10.5	210	0.738	for larger storage	A+
UniQ Dual 12	14	280	0.809		A+
UniQ Heat 80	90	1800	2.2 (provisional)	Palletised, 1.5 Tonnes	Non ErP

Published Worldwide PCT Applications:
WO 2009/138771, WO 2011/058383, WO 2014/202974,
WO 2014/195691, WO 2014/191778, WO 2015/025175, WO 2017/221025

Cylinders Vs Heat battery

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Albin Trotter ATI E-305L

UniQ eHW 12

-71% in volume

Equal energy stored
Greater amount of usable hot water.

→ ½ →

½ in both height and depth

→ ½ →

Cylinder vs Heat Battery replacement benefits – compact, safe, ERP A+ efficient (reduced heat loss)

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Installation, Maintenance & Warranty

Installation – We have built a customer experience room, with multiple installations – customers welcome for training days (pre booking required). Hands on training, technical support at site and on going updates and assistance.

Maintenance – Fit and Forget. No regulatory or mandatory maintenance required.

Warranty – Every part of our Heat Battery benefits from 2 years warranty, with extensions to 5 years for embedded electric elements and a full 10 years for the thermal storage core.

uniQ®

Installations








2000+ Installations
Completed and Operational

- Communal Heating Systems
- Assisted Living Flats
- Large Luxury homes
- Social Housing
- High Rise Flats
- Modular Factory Fitted
- Village Halls
- Commercial CHP
- External Housing
  - Garages, out houses

DECC Trials ASHP with Sunamp

Sunamp

Department of Energy & Climate Change

- **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**

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 $KgCO_2$

Vented Cylinder Replacement

Sunamp

Linstone Housing Association

- Single occupancy
- Savings of £51 PA, Increased comfort, higher water pressure
- Building saving 174 x £51 +£8874.00PA
- 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 over 20 years
- Reduced maintenance
- Lower scalding risk, temperature can be blended down to 35c – 55c

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"

Grand Designs All Electric House

Sunamp

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

Commercial Retrofit – Village Hall

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

Installation

- 12kWp Solar PV Array was already installed
- We retrofitted 2 Daikin Heat Pumps & 1 Stack
- 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

Wide Range of Storage Temperatures

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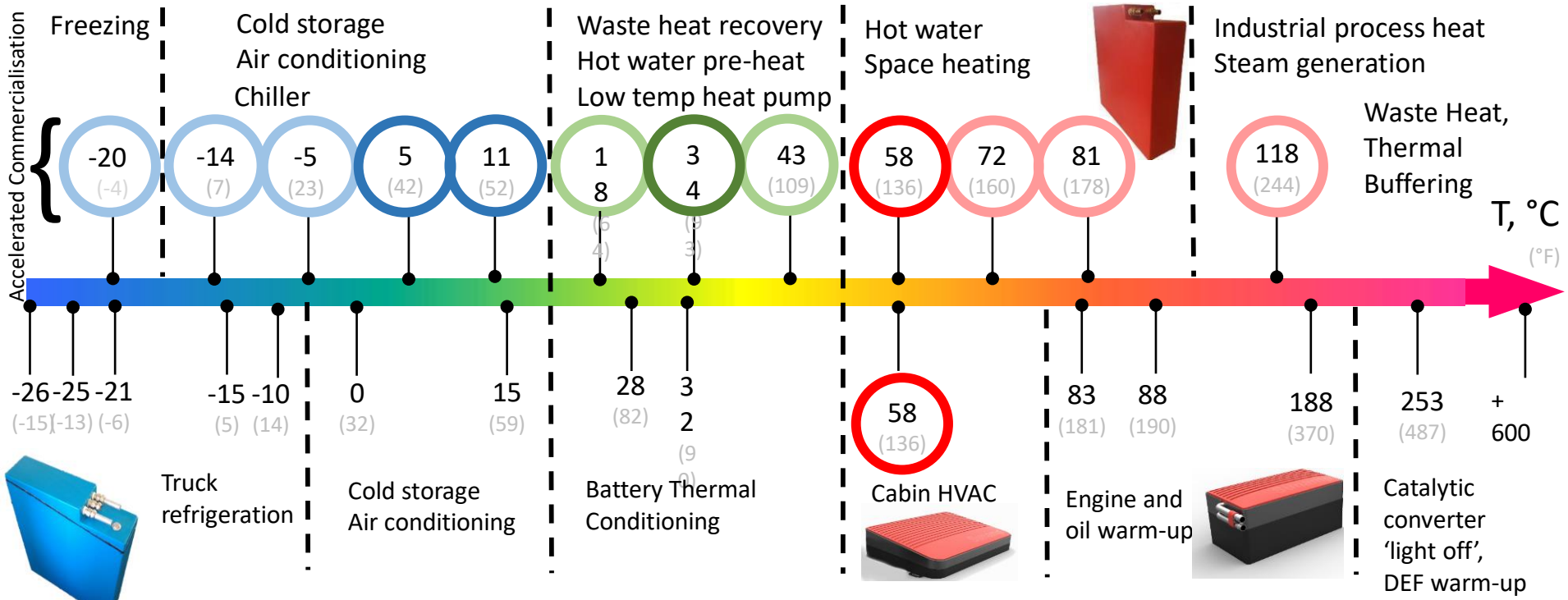
Sunamp Heat and Cool Batteries can be filled with different PCMs to optimise each application



Sunamp PCMs are internally developed, and generally inorganic, non-flammable materials. Values indicate phase change temperature. Operating temperature range typically 40 … >100 °C (90 … >200 °F) around phase change temperature - consult Sunamp.

Current commercial products (Space Heat & Hot Water)

Near-term introduction (Q2 … Q4 2019)

Note: PCMs at different level of development and not all commercially available today

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