Energy storage devices that capture solar thermal energy and release this energy for use when required. The technology offers the possibility of sustainable energy storage in a range of environments, as well as self-contained, decentralized energy supply.

- Renewable energy storage
- Low temperature phase change materials
- High energy conversion

THE CHALLENGE

The current challenge to move away from carbon-based energy generation has shifted towards renewable, sustainable energy sources.

Most renewable energy sources such as solar or wind, are intermittent and require energy storage to provide power in times where energy generation is low. Traditional methods of energy storage are not cost effective.

While significant advances have been made in the efficiency of solar generation and other renewable energies, advances in energy storage have been slow and incremental since the early 90s. Recent advances have included Tesla’s home battery unit, which has made a significant jump in the economics of energy storage; however these solutions remain relatively expensive compared with on-the-grid energy costs.

To move ahead of the incremental gains of traditional energy storage, game-changing technologies are needed that offer better efficiencies and better economic performance.

Thermal energy storage systems are one such solution. They offer:

- Reduction in peak load demand
- Lowering of CO₂ emissions and maximised green energy
- Improvement in the overall efficiency of the energy system by balancing the fluctuating demand for energy
- Minimised usage of expensive ‘peak high cost’ energy

THE TECHNOLOGY

Our technology aims to utilize the energy involved when our Phase Change Materials (PCMs) melt or freeze. The energy is used to power a low temperature Organic Rankine Engine, producing electricity.

We have developed materials that release a large amount of energy when they undergo a transition, e.g. on melting. Since the solid-liquid phase change temperature of a material is a fundamental property, this technology offers a stable, reusable and dependable energy storage medium.

Unlike other thermal storage materials such as molten salts, our PCMs are low temperature (with phase changes in the range 75-200°C). This increases the potential uses for both domestic and industrial applications, with minimized safety concerns.

Our novel patented PCMs for thermal energy storage are potentially more cost effective than batteries and can be modular to suit the energy needs of different size applications.

Intellectual property: Two Australian provisional patents filed in 2016.

THE OPPORTUNITY

The global thermal energy storage market was valued at more than US$0.6 bn in 2013 and is expected to reach US$1.8 bn by 2020. (http://www.transparencymarketresearch.com/thermal-energy-storage-market.html).

Monash seeks a partner to license and/or to carry out scale-up demonstration of the technology.

The Monash research team is led by Prof Doug MacFarlane (Australian Research Council Laureate Fellow; ARC Centre for Electromaterials Science – Energy Program Leader). Prof MacFarlane and his team are experts in the development of new chemical entities for energy and other uses.

Table 1: Thermal properties of promising Phase Change Materials (PCMs)

<table>
<thead>
<tr>
<th>PCM</th>
<th>Tm (°C)</th>
<th>ΔHf (J/g)</th>
<th>ΔHv (J/cm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCM 1</td>
<td>164</td>
<td>145</td>
<td>204</td>
</tr>
<tr>
<td>PCM 2</td>
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<td>PCM 7</td>
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</table>

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Reference