



The UltraBattery (inset) may not only power hybrid electric cars – such as the red Honda shown here, driven for more than 145 000 km in a UK trial – but also smooth out short-term variations in wind energy. Advanced Lead-Acid Battery Consortium

Wind energy round the clock

A cost-effective energy storage solution that combines the best of both batteries and capacitors may be the ‘missing link’ that will help balance the variability of wind and solar inputs to the electricity grid.

While wind power is one of the most mature renewable energy sources around, it’s also still one of the most variable, in terms of 24-hour-a-day, 7-day-a-week supply.

One way of dealing with the variability is to store energy generated during windy periods in onsite batteries, to provide a smoother supply to the power grid.

Lead acid batteries such as those used in cars would be a cost-effective solution, but they take a long time to charge, and readily deplete after deep discharge. Rechargeable batteries – nickel metal hydride and lithium – are just too costly.

An Australian-designed ‘super battery’ may offer a solution. The Smart Storage battery unit – being developed jointly by CSIRO and Cleantech Ventures – leverages the technology behind CSIRO’s patented UltraBattery, designed in 2003 for use in hybrid electric cars.

The UltraBattery contains both a lead-acid battery cell and a capacitor. While the battery cell allows the unit to store

a large amount of energy, the capacitor component allows the unit to charge quickly, many times over, without affecting performance.

Dr Peter Coppin, Director of CSIRO’s Wind Energy Research Unit, is investigating how the hybrid battery can be used hand-in-hand with improved weather forecasting and smarter grid management to balance the peaks and troughs of wind and solar power at the point of generation.

‘If a forecast indicates that the wind will drop tomorrow, you can compensate by lining up additional power from elsewhere in the grid,’ says Dr Coppin.

‘The next step after that is storage. The Smart Storage solution can smooth variability over short-time scales – half-hourly intervals, for example, which are important for supplying the grid.

‘Instead of a situation where you have 100 per cent power when storms go through, then back to zero, you can buffer against short-interval variability.’

The UltraBattery’s inventor, Dr Lan Lam Trieu from CSIRO Energy Technology, says the hybrid battery can produce around 50 per cent more power than a conventional battery and last up to four times longer. It can also be manufactured on the same production lines as those used to make

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lead-acid batteries, at a comparable cost to its conventional counterpart.

The UltraBattery is close to completing a field trial in the UK, where a pack of 12 × 12V UltraBatteries has been powering a Honda Insight hybrid electric vehicle over a total of 90 000 miles (145 000 km) with, as yet, no sign of deterioration in performance.

There are other battery solutions around, such as vanadium redox, but they fill a different niche to UltraBattery, according to Dr Coppin.

‘Vanadium redox batteries bridge hourly and daily variability and are designed for bulk storage. The Smart Storage system works best at shorter time scales of less than an hour.’

Smart Storage Pty Ltd, recently formed by CSIRO and Cleantech Ventures, plans to set up grid trials to demonstrate megawatt-scale operation and is interested in talking with potential collaborators.

‘In terms of the energy required to manufacture and install the generating capacity, wind energy is very competitive,’ says Dr Coppin. ‘The energy required is payed back in only six months of operation; one year for offshore structures.’

‘Australia desperately needs renewables. Solar is currently much more expensive than wind due to the need for silicon. Wind is ready to go.

‘The main challenge for wind power is getting enough of it on the grid.

‘European countries have shown that you can get over the variability of wind – western Denmark and northern Germany have 30 per cent of their electricity requirements sourced from wind power.

‘The ultimate answer is to have a portfolio of solutions like Germany, which has set a target of 70 per cent of its energy from renewables by 2050.’

● **Mary-Lou Considine**

More information:
CSIRO UltraBattery,
www.csiro.au/science/ps15a.html
Cleantech Ventures,
www.cleantechventures.com.au