

# Potential for plenty of pumped hydro sites in Australia

THE Australian National University (ANU) has completed an audit of 22,000 potential sites across Australia for pumped hydro energy storage which, according to the researchers, can be used to support a secure and cheap national electricity grid with 100 per cent renewable energy.

The zero-emissions grid would mainly rely on wind and solar photovoltaic (PV) technology, with support from pumped hydro storage, and would eliminate Australia's need for coal and gas-fired power.

Lead researcher Professor Andrew Blakers from the ANU Research School of Engineering said the short-term off-river pumped hydro energy storage (STORES) sites combined had a potential storage capacity of 67,000 Gigawatt-hours (GWh) – much more than the capacity required for a zero-emissions grid.

"Australia needs only a tiny fraction of these sites for pumped hydro storage – about 450 GWh of storage – to support a 100 per cent renewable electricity system," said Andrew.

"Fast tracking the development of a few of the best sites by

2022 could balance the grid when Liddell and other coal power stations close.

"Pumped hydro storage, including Snowy 2.0, can be developed fast enough to balance the grid with any quantity of variable wind and solar PV power generation, including 100 per cent renewable energy.

"We found so many good potential sites that only the best 0.1 per cent will be needed. We can afford to be choosy."

STORES sites require pairs of reservoirs at different altitudes, typically ranging from 10 hectares to 100 hectares, in hilly terrain and joined by a pipe with a pump and turbine. Water is pumped uphill when wind and solar energy is plentiful, and electricity is available on demand by releasing the stored water through a turbine.

Co-researcher Dr Matthew Stocks said that off-river pumped hydro storage typically delivered maximum power for five to 25 hours, depending on the size of the reservoirs.

"Like all hydro power, it can go from zero to full power in about one minute," said Matthew from the ANU Research School of Engineering.

"Annual water requirements would be much less than half that of the current fossil fuel system because wind and PV do not require cooling water."

Co-researcher Mr Bin Lu said all of the potential STORES sites were outside national parks and urban areas, and each site had a storage potential range of 1-300 GWh.

"Pumped hydro – which accounts for 97 per cent of energy storage worldwide – has a lifetime of 50 years, and is the lowest cost large-scale energy storage technology."

According to ANU, Queensland has many potential sites for pumped hydro energy storage (PHES).

## Queensland flush with sites

The number of upper storage sites located in our initial survey is 1769, with an approximate energy storage potential of 6779 GWh – approximately 100 times larger than the amount of storage required to support a 100 per cent renewable electricity grid for Queensland.

This large number provides some confidence that there will be a good number of technically feasible PHES sites. Pumped hydro energy storage is the most mature and widely deployed electricity storage technology worldwide – 97 per cent of globally installed grid storage is pumped hydro.

We are also in the process of developing a cost model that will determine the least cost option for the tunnelling between two reservoirs, and therefore the location of the lower reservoir. This information will be available in future releases of the atlas.

The Australian Renewable Energy Agency (ARENA) provided \$449,000 to support the ANU-led study.

For more information: Maps showing the locations of potential STORE sites and a report on the findings are available at <http://re100.eng.anu.edu.au/research/phes/>



Potential PHES sites in Queensland.

