

# A new energy gold mine: storage from solar and pumped hydro

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By Giles Parkinson

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Australia's biggest renewables-based energy storage project could be up and running in a few years, and will be unique in the world – a pumped hydro plant exploiting the sheer vertical drop an old open pit gold mine and the biggest storage installation connected to a solar plant.

That, at least, is the plan hatched by Genex Power, a small listed start-up in Sydney that spotted a likely need in a high renewable energy market, and had the foresight, or maybe just chutzpah, to come to the market with a different solution.

Genex last week secured an \$8.85 million grant from the Australian Renewable Energy Agency, and a 20 year power purchase agreement from the Queensland government, to build a 50MW solar farm on top of the tailings dump left by the operators of the former Kidston gold mine in north Queensland.

That is a major step forward for the Queensland energy market. But is not the main game for Genex. In a few weeks, a report looking at the feasibility of using the mine pit for a huge pumped hydro power station, and a much bigger 200MW solar farm to provide the original power, will be released.

That study, also supported by a grant from ARENA, is expected to pave the way for Genex to seek funding for the ambitious project, which will also include some 180kms of transmission.

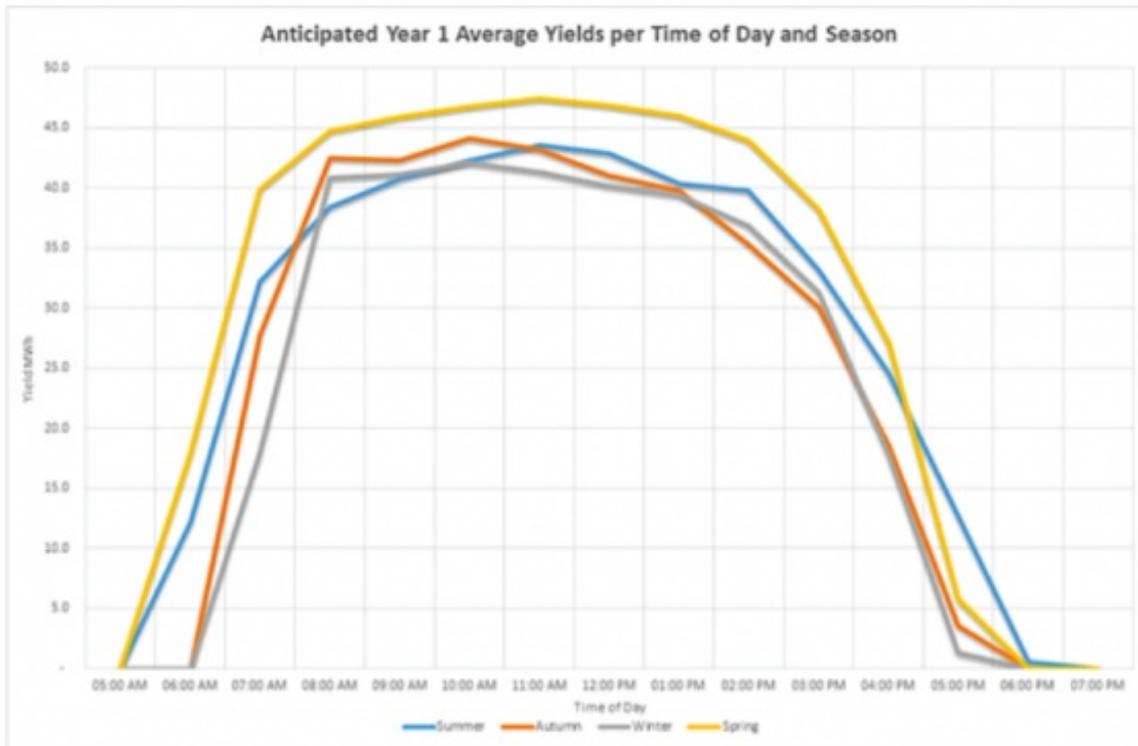
Executive director Simon Kinston just happens to be the great great grandson of the former Queensland premier after whom the mine was named. He says the family never had any equity in the mine and his involvement is just a coincidence.

Kidston is a former investment banker who had investments in the metallurgical coal industry. When he sold that interest to Chinese parties in 2013, he stood back and saw the changes in the energy market.

“We recognised that changes were happening in the energy industry. They were building LNG plants (for the export market) and we saw that the gas price was going to go up, and we did some research and saw that if renewables were to take off, their intermittency would cause increased volatility in the markets.

Hence the search for storage, which led to the idea of pumped hydro, and then the former mine.

The idea is quite simple. Genex will use the cheap power from solar, or from the grid overnight, to pump water up to a dam at the top of the mine. When electricity is needed, the water will flow back down, spinning a turbine and generating power along the way.



It's how the company uses that power that will make or break the project. Up till now the pumped hydro site has been mooted for up to 450MW of nameplate capacity and five hours of storage, but the suggestion is that to fit into the Queensland market, it may go for a smaller nameplate capacity and more storage time.

During the day, the output of solar follows an inverted curve that looks like a dome – (see the graph above from a Genex presentation). It starts low in the morning before quickly rising to its peak in the middle of the day and tailing off towards sunset.

Wholesale electricity prices tend to follow a curve that goes in the opposite direction, starting high in the day, easing off as other solar plants come into play – particularly in Queensland which has more than 1.5GW of rooftop solar – and then rising again as demand increases into the late afternoon peak.

Genex is looking to build two pillars of output at the start and end of the day: the first drawn from low overnight prices, and the second from the output of the solar plant, which will feature tracking technology to maximise output and extend its reach into the morning and evening.

Of course, pumped hydro is not the only form of storage we will see in the Australian market, although many of its proponents insist it is the cheapest.

Networks are likely to install battery storage to offset the need for grid upgrades, or even replace the poles and wires altogether. Households will put in battery storage to maximise the use of their solar panels, or quit the grid.

Utilities and other service providers will pool the battery storage of many homes and businesses to create “virtual power plants” or simply to share solar electricity.

Others will put battery storage with large scale solar PV plants, which could smooth their output and offer more grid stability, while still others will build solar tower and molten salt storage plants that can offer dispatchable power throughout the day or night.

Kidston says that pumped hydro is “an order of magnitude cheaper than battery storage”, and locating it in a mine means that it will have no environmental approval issues.

“Traditionally hydro gets built in pristine mountains. We wanted to minimise environmental approval risks. That is one of the strong features of this project. In fact, it is the reverse of being difficult to get approval – it is a net

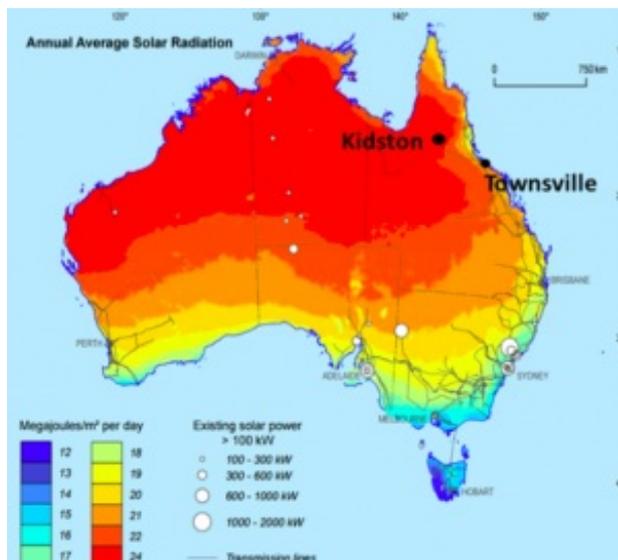
positive.”

Kidston says that the contract for the first 50MW is a win for all parties. Genex gets a 20 year contract with a guaranteed minimum price. That price has not been disclosed but it is thought to be between \$80 and \$100/MWh.

Because it is the only grid-connected solar plant in the highest solar radiation area in Australia, it expects to be among the lowest cost projects per megawatt hour. It will use tracking technology (First Solar) and expects a capacity factor of 33 per cent

The Queensland government, under a contract for difference, will make up the price if the wholesale market price is less than the contract price. But the government will also take the renewable energy certificates, which will mean it will be able to more than offset the cost.

“It’s a good deal for them and it’s a fantastic deal for us,” Kidston says. It will help the company secure debt at good prices. And the turnaround will be quick. Finance is expected to be secured by the end of the year and the plant will be producing electricity before the end of 2017.



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