AGRICULTURE VICTORIA

Ellinbank SmartFarm
PUMPED HYDRO
FACTSHEET

PUMPED HYDRO

The energy demonstrations at the Ellinbank SmartFarm includes a mini hydroelectric system. From a storage tank at the top of a hill, water is released downhill and into another storage tank at the bottom of the hill, generating energy through a hydro turbine.

This system is a closed loop and uses solar energy to pump the water back up the hill from where it is released again. The recycled water is used to generate energy over and over again, each time it is released downhill. The stored water becomes a form of stored energy.

When water flows through a hydro turbine it causes a wheel of blades or the turbine 'runner' to rotate. This rotating runner drives a generator, turning mechanical energy into electrical energy.

There are different types of hydro turbines, each with their pros and cons, and suited to different conditions. The type of turbine selected depends on factors such as the height or 'head' of standing water.

Ellinbank Configuration

Storage tanks	2 x 61,000 Litres 5.9m diameter x 2.2m height
Gross head (elevation)	37 metres
Pipeline	425 metres long 150mm pressure pipe
Inverter	24 kW
Solar array	2.7 kW (6 panels x 450W)

The hydro turbine at Ellinbank is a Francis turbine. In pump mode (uphill) the water flow rate is 7.5 Litres per second. In hydro turbine mode (downhill), the flow rate is 8.4 Litres per second.

The water pump requires at least 2 kW of energy to start running. A small ground mounted solar array provides some power for recycling water back to the top tank. Currently the system is also supplemented with grid power. It has potential to be developed further into a self-sufficient system.

The inverter converts power for both the solar and hydro energy. It also provides an emergency output power point which will operate in the event of a blackout of the mains power.

As a small demonstration, the net result is a power outlet that can support a load of up to 3 kW while there is sufficient solar energy to run the pump. The cheapest and most efficient use of this energy is a nearby office.

Photo: Solar array and water tank at the bottom of hill

LEARNINGS

1. When installing the storage tanks, partly fill each one with water to hold the liner in position and help keep the tank's shape in bad weather.

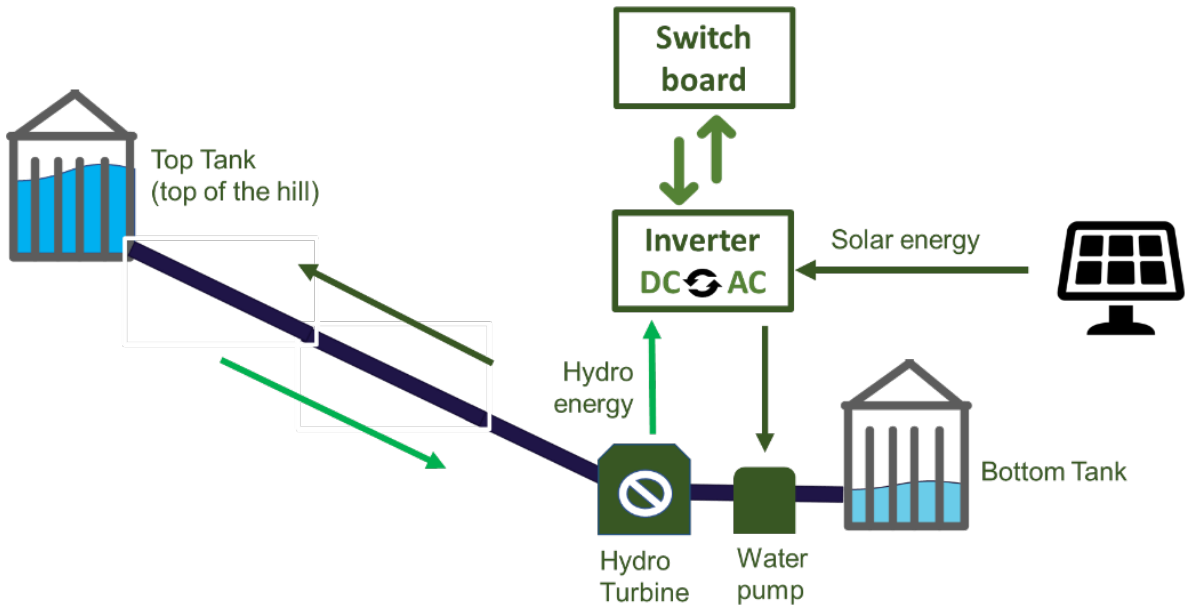
2. Have a budget in mind. Note that items such as fences and monitoring usually cost extra.

3. Find out about the expected life of the equipment, likely returns and payback. Consider potential maintenance and interest costs

Agriculture Victoria updates are available on the Energy Smart Farming website at https://extensionaus.com.au/energysmartfarming

See the Ellinbank Dashboard for more details.

Ellinbank SmartFarm Pumped Hydro



The Ellinbank SmartFarm in Gippsland is Australia's leading dairy innovation facility, fast-tracking innovative technology solutions in a research environment and showcasing them to the dairy industry. The Ellinbank SmartFarm has a target of becoming a carbon-neutral dairy farm and generating electricity through a range of alternative energy generation options including solar, wind and hydro energy will help achieve this goal.

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