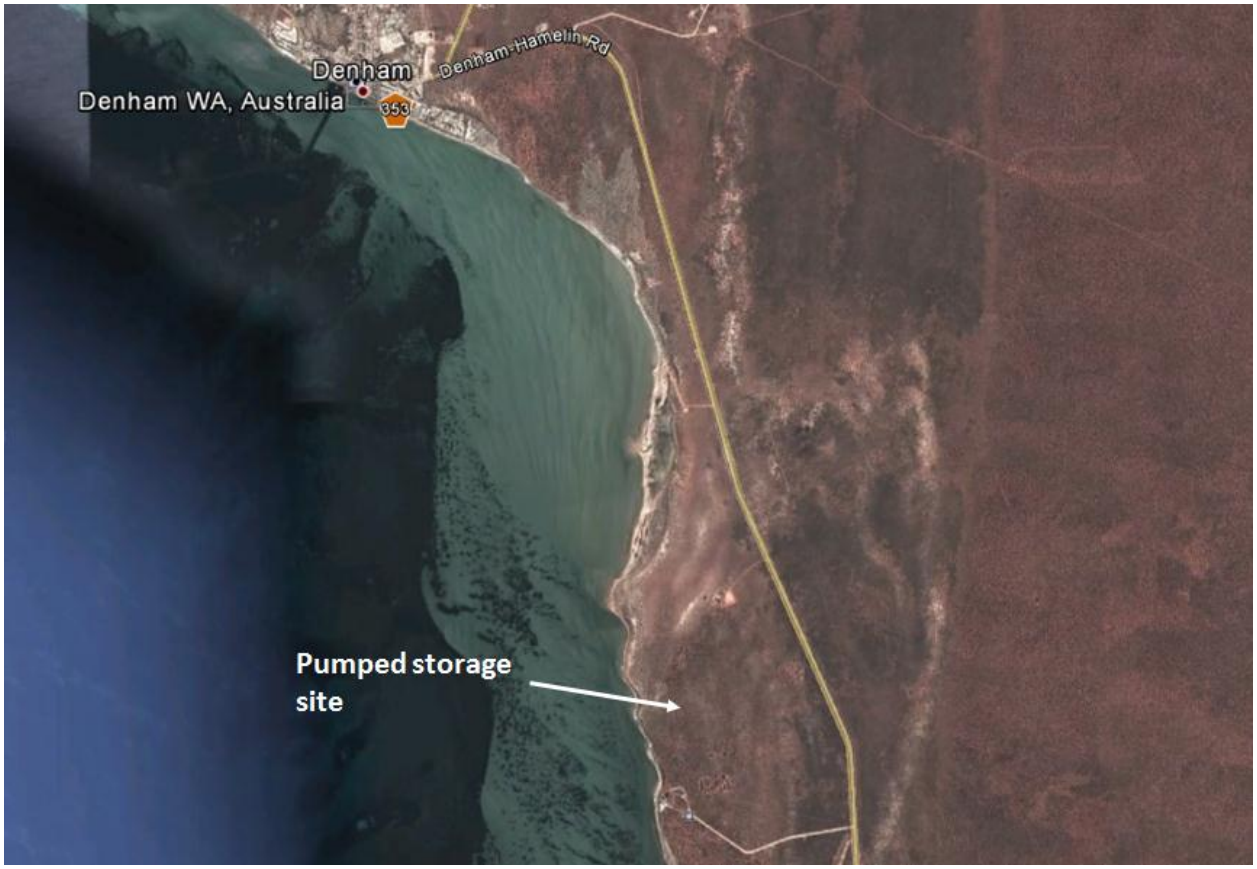
Denham Pumped Storage Project



Location of Denham Pumped Storage Project

Denham has a wind-diesel power system made up of four wind turbines and three low-load diesel generators. The wind turbines are rated at 230 kW each.

The wind turbines supply approximately 40% of Denham's power. Maximum instantaneous wind energy penetration is over 70%. The Denham power plant burns about half a million litres of diesel per annum. It would be good to displace that completely by wind as the rising oil price will make diesel-based power continually more expensive.

Denham has good wind conditions and topography that is favourable for pumped storage.

Pumped storage provides power at the rate of 0.00272 kWh per cubic metre per vertical metre.

The diesel power to be displaced is 3,000 MWh, which is a daily requirement of 8.2 MWh. There are cliffs 5 km south of the town that are over 40 metres high. To produce 8.2 MWh per day would require 75,500 cubic metres of water from storage 40 metres above sea level.

The system expansion would require $2 million for a large wind turbine (wind turbines have significant scale economies) and $1 million for earthworks for the

turkey's nest dam and pumps and piping. Seawater would be pumped up to the turkey's nest. Power would be generated by reversing the flow through the pump.

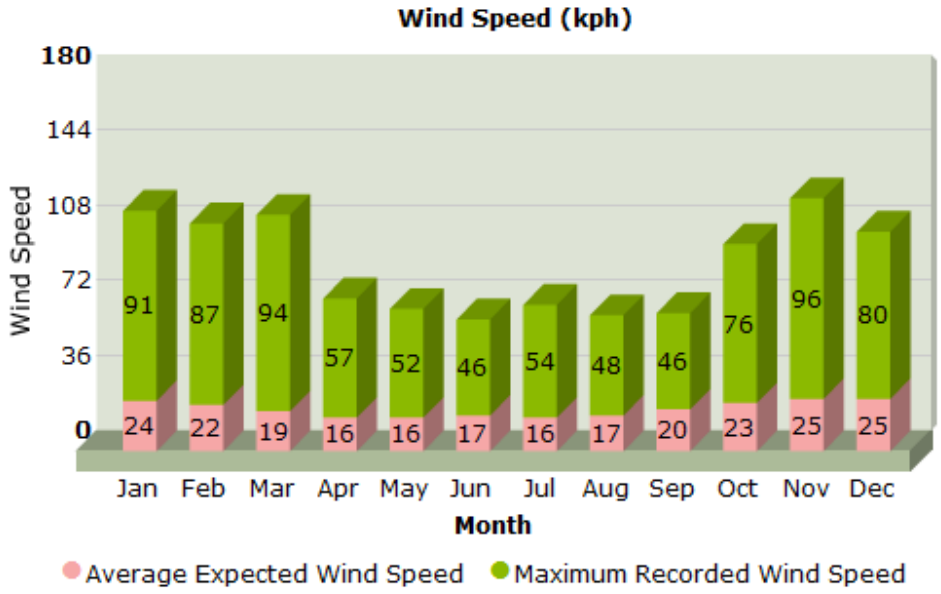
Diesel consumption is 0.26 litres per kWh. At $1.20 per litre, that results in a power price of 31 cents per KWh.

Assuming an operating cost of 8 cents per kWh for wind and an energy recovery factor through the pumped storage facility of 80%, the cost of power from pumped storage would be $0.11 per kWh including capital recovery. This equates to a diesel price of 38 cents per litre.

12 cents per kWh equates to a natural gas price of $9 per gj, which in turn equates to $56 per barrel. Gas prices for power generation are expected to be well above $9 per gj by mid-decade.

A pumped storage system at Denham would be an ideal pilot project for the southern half of Western Australia. The Darling Scarp provides 250 metres of elevation which is ideal for large scale pumped storage.

Western Australia is a large mass of land next to a large body of water. The daily temperature difference between the land mass and the water body due to the land heating and then cooling faster than the water makes the system a very large heat pump.



The above figure shows the average expected wind speed by month and the maximum recorded wind speed for Karratha. Wind power is a large resource along the West Australian coast. Pumped storage will make it useable to the point at which it might supplant all other power sources.