



Beyond Zero Emissions

Climate Campaign

Near Zero Emission Strategy

Victoria's Stationary Energy Sector

Purpose

To provide a feasible outline of a full transition plan for Victoria's stationary energy sector to be largely based on renewables. It is hoped this document will catalyse others to take on this important task in greater depth.

Concept

Replace Victoria's existing coal fired power generation assets with wind generation, utilisation of existing peak power, and the use of price signals to reduce power demand. This will shut down the Victorian aluminium industry to create a near zero emission stationary energy sector. Stationary Energy accounts for more than half of Victoria's greenhouse gas emissions, and the Victoria sector alone accounts for more than 12% of Australia's emissions.

Overview

Base Load Generation

- Wind 12,000 MW utilising 4,000 3 MW Turbines producing 35,000 GWh annually and securely delivering 2,400 MW 24x7x365

Peaking Power and security of supply

- Utilise existing peaking generation capacity, of 7,300 MW to completely meet the potential 6,900 MW reduced peak demand.

Reducing Demand

- Utilise price signals to close down the Aluminium Industry

Demand Management

- Upgrade customer metering to "smart meter" technology with inbuilt remotely addressable switching to manage peaks.

Grid

- Upgrade existing grid switching, extend 220 kv and 500 kv distribution to more locations, upgrade 220 kv distribution network.

Additional Factors

- Concurrent implementation of high levels of energy efficiency, solar thermal, demand management, demand side reduction.
- Fully automated centralised control system to instantly switch in and out generation and loads, based on advanced weather supply and demand monitoring.



Cost

- \$20 billion Wind
- \$1-2 billion Grid Upgrade

Discussion

Beyond Zero Emissions proposes that the Victorian Government spends \$20 billion and installs 12000 MW of wind power, resulting in Victoria running almost entirely on renewable energy for stationary energy requirements.

Current and proposed projects domestically and internationally are utilising efficient 3 MW turbines, such as the benchmark Vestas V90 onshore turbines.

12,000 MW of wind utilising Vestas V90 turbines (the turbines that are being installed in the latest stage of the Woolnorth, Tasmania, wind farm and will be utilised in the approved 550 MW Macarthur wind farm), at a cost of 20 billion dollars would generate 35,040 GW-h of electricity annually. In Victoria we are currently using around 44,000 GW-h of electricity each year. Aluminium smelting in Victoria utilises around 9,600 GW-h of this annual figure. This brings the total annual requirements for power (if we eliminate the aluminium industry) to 34,400 GW-h.

We can rely on around 20% of wind farm capacity as a reliable guaranteed base load that doesn't need any spinning reserve (conventional base load generation does). With 12,000 MW of wind this would give us 2,400 MW of secure reliable base load.

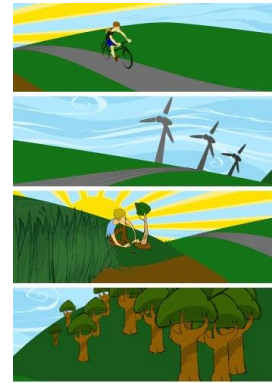
The reason we can rely on wind (with no backup at all) for 20% of base load, and one reason that variability of wind output is not a big issue as suggested by some, is the geographical diversity of our wind resource. Of course to do this we may need to invest \$1-2 billion in the Grid. (This has already started in the USA, and in Europe they are building an offshore super grid (utilising DC transmission interconnectors) to get 100,000 GW of North Sea wind resourced onshore).

Peak Loads

The current maximum peak load is 8,000 MW. With shut down of the Aluminium industry it is reduced to = 6,900 MW (8,000 MW-1,100 MW (Alcoa)). This would be largely covered by the output of the 12,000 MW of wind much of the time.

For those times when there are troughs in output that correlate with higher demand, we are fortunate to have 7,500 MW of available peaking/backup power on the grid already installed, if you include the fast ramping Mortlake CCGT gas power plant project. Adding this to the 2,400 MW of reliable power from 12,000 MW of wind capacity brings us up to 9,300 MW of capacity for peak periods. When we implement other demand reduction/ demand management measures as suggested below we would never need to approach either of these figures.

This existing available generation capacity already installed on the grid would cover any times that wind output failed to meet demand. The actual total amount of resource (water and fossil fuel (gas)) required for this peaking/backup would be quite low in the range 5-10% This fits the profile of these limited-resource backups (gas - fossil fuel and existing hydro-limited water).



Timelines

In Germany they built 12,000 MW of wind (the same amount we are proposing for Victoria in the near zero target) from 2001 to the end of 2005.

To illustrate just how quickly wind turbine production can increase to match demand, in 2001 Global wind sales were 3,800 MW. In 2005 Global wind sales were 11,500 MW. In 2006 global sales were just under 16,000 MW. This means we can order 4000 turbines over 5 years and they will get delivered and installed. (as they did in Germany during a period of lower global production)

In terms of scale of turbines, Denmark has 6,500 MW of wind turbines, and the country (excluding Greenland) is one fifth of the size of Victoria. If we had the same density of wind integration as Denmark we would be hosting 32,500 MW. Victoria is known to have a better wind resource than Denmark in many areas throughout the state. Fortunately for us, we only need a small number which could be located in 10-40 sites, geographically distributed throughout the existing, upgraded and new electricity grid.

Landuse

We would be utilising just 1.2% of our existing agricultural land to site 4,000 turbines. The existing land use (such as horticulture, grain cropping, wool growing or dairying) would be maintained. In fact the turbines and associated service infrastructure would take away just 1% of the land. That is 1% of 1.2%, a tiny proportion, all the while adding a valuable income stream to hundreds of farmers, most of whom are doing it tough from drought, a strong Australian dollar and depressed global prices. Finally, it is fortunate that the part of a farm most suitable for wind farms is that which is least useful for agricultural purposes. Turbines would be sited on the 50% of Victorian land that has already been converted to farm land.

Areas in which additional undertakings could improve functions and reduce costs of proposed system.

Advanced demand management (which is different to overall demand side reduction) will have us using wind weather forecasts (we already use forecasts to provision generation capacity for the hot days of summer) to schedule loads that are not required instantly. For example, your light is required instantly when you switch it on at night, but Municipal water/sewage pumping can be scheduled. In California, Italy and Switzerland to name three examples, they use smart meters, the most advanced of which receive live price signals from the Grid. Remotely addressable (from the Grid central control room) switches within the power meter box can do things like notch up the thermostat on one shopping centre air conditioning system or 1 million home air conditioners, and let a control room at a large industrial user know that the price of their power has gone up so they can scale back production until an opposing price signal brings the price down. This technology can be used to flatten out the peaks in demand and compensate for the troughs in generation output - the net effect being to lower the major cost in delivering electricity in Victoria (making peak power available for very short periods of huge demand).

Energy efficiency measures, implemented across domestic, industrial and commercial sectors, can reduce our annual consumption by an additional 10-30%.

We have listed Wind Power, Demand Reduction, Demand Side Management and Energy Efficiency. Lastly we will mention Solar Thermal Power, which is the 5th and final key to fast switching to a renewable energy future and achieving near zero emissions for Victoria's electricity supply network.

A significant amount of industrial electricity is used to supply high and low temperature steam. This can be supplied through solar concentration, providing the full temperature steam required, or preheating significantly, so the additional power required to reach critical temperature requirement is minimal.

We are also seeing commercialisation of Solar Thermal and Solar PV concentrating power stations, versions of which have the ability to store power in liquids, such as salt that offer very high thermal capacity or thermochemical processes with Ammonia. This allows the power to be scheduled for dispatch to match demand peaks or troughs in renewable output.

In Conclusion

Power grids that are less geographically diverse than our own are already installed with 50-60% integration of wind. For example, Denham, WA and King Island are two Australian examples. Hawaii Electricity Company is planning 100% of energy generation to be renewable by 2020, We should match or beat this target.

Any money spent on "yet to be proven commercially" solutions like geosequestration with coal, (aka carbon capture and sequestration) or nuclear power (with 4th generation power stations that won't be out of the design phase until 2020), or large scale roll out of base load gas, will be billions of dollars wasted by adding an unnecessary intermediate step in reaching near zero and beyond zero goals. In view of the timeframes required for these technologies, they would also be outpriced by ever cheaper renewables and become superfluous.

Large scale infrastructure projects are being announced now to prop up the current coal based electricity generation sector (there is a plan to spend \$1.5-\$2 billion dollars recycling and piping water from the Eastern Treatment plant to the Latrobe Valley generators). There is another plan to build a new \$5 billion dollar 500 MW coal fired power plant, and convert Brown coal to synthetic diesel fuel. Alternatively, the money directed towards these projects could be significantly helping to build an electricity distribution and generation system run on renewable energy.

As environmentalists trying to direct policy makers who care for the environment, we must make the right decisions - that are both ethical, and that take account of the economic reality that if you spend huge capital on something such as coal power plant refurbishment or unproven nuclear technologies, then it will not only promote these technologies in a broader sense but will take money away from, and inevitably delay, the alternative options.

Renewable with the right support will be running the majority of our power grid within a decade. All we have to do is build public support and push our lawmakers into action. This problem is a lot more simple and cheaper than putting a man on the moon, or fighting a war half way around the world.

<http://www.beyondzeroemissions.org>

Beyond Zero Emissions, Suite 10, Kindness House, 288 Brunswick St, Fitzroy

