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Building 9 - Coombs Building
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Subject Renewable Energy

Attention Professor Ross Garnaut

Dear Sir

An article in the AGE newspaper 30 November by Tim Colebatch gave me considerable cause for concern in that his question "Do we need renewable schemes? " brought your response "In the transition period, a case can be made. But if the carbon price is established at the right level, there is no need for other policy measures to tip the balance towards low-emissions technology." Does this mean that you believe all countries, developed and undeveloped, can happily steam ahead with building as many coal (and gas) fired thermal stations as required for their predicted rapid industrial expansion and depend purely on the carbon price to "tip the balance towards low-emissions technologies". Please tell me what you believe to be low emissions technologies at what cost and what is your solution for reducing the emissions from the transport section of the economy.

Please find attached a copy of a paper I have written on renewable energy in response to many requests for a short listing of what might be available in Australia for us to effectively reduce our high level of CO2 emissions (on a per capita basis). There are of course other solutions for reducing emissions but you must agree it is difficult beat zero emission of renewables as the ultimate target.

I have already sent a copy of the paper to the Ministers concerned and of course am intensely interested in the final approach of the new Government to the stated objective of meeting International decisions on climate change. No doubt your report will have a major effect on Government action. I would certainly appreciate an opportunity to discuss carbon trading, renewables et al when convenient but as soon as possible.

Yours sincerely

R.H.Paterson

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Renewable Energy for Australia

Wind Water Sun Rocks

What renewable energy resources are available in the worlds driest continent ?

WIND

Wind Power

As of now in Australia, wind power is the only industrial size, readily available renewable energy resource, relatively economically competitive to our thermal, coal fired power stations which make up our base load supply and will no doubt continue to do so into the foreseeable future.
Energy costs -Without any allowance for potential carbon tax, the inclusion of CO2 abatement conditions or for the potentially high cost of new thermal power stations, energy cost is 4.0 cents per kwhr for black and brown coal fuelled power stations. Wind power is currently 7.0 cents per kwhr considerably improved from early smaller, noisier, relatively unreliable and not very beautiful machines. Unit size has increased from initial Australian installations with 250 to 500 kw units, through 1.5 MW and now 2.0 MW, with increased efficiency. Size is continuing to increase along with efficiency. European countries, particularly Denmark and Germany, have wind power for 10 to 20% of demand with 20% of rated capacity of the generators acceptable. In southern Victoria 35 to 40% of rated capacity is being achieved. With the use of modern met data, operation of wind farms can be accurately determined and working in conjunction with hydro (Snowy and Tasmanian hydro with Bass Link) and increasing availability of gas turbine stations, all of these on rapid availability, there should be no real problem providing flexible back up for wind power. There is no doubt that wind power could be immediately boosted to 10% of the east coast grid capacity without further base load and without any real problem. Then, with operating data available, wind power could probably be expanded to 20%.

If various wind power developers followed Pacific Hydro's example of community involvement with meetings, exhibitions and free transport etc for whoever wanted to visit an operating wind farm community support would be gained. With independent surveys taken, it becomes obvious there is considerable support for this form of renewable energy. Around Portland there is 88% approval rating and for Ararat/Ballarat area the figure is an amazing 95%. Opposition is negligible but vocal and has been successful in Gippsland for fomenting stiff opposition, in many instances based on false information with respect of noise, bird kills and "visual pollution". However the now large percentage of our population who do agree that we must take immediate purposeful action would I believe, accept a 2.5 to 3.0 cents per kwhr addition to their electricity power bill. Heavy industrial users could potentially reduce power consumption so that any additional charge could be largely balanced without loss of production. It is also essential that the community becomes involved with saving of power as demonstrated in the recent ABC "Carbon Cops' production. All of us must contribute but it will continue to be essential that Government, both Federal and State, support well researched renewable energy projects to build up the percentage of renewable energy feeding the grid with commensurate reduction of emissions.

Back to Pacific Hydro, initially a small public company, showed that Australian expertise could be exported internationally with hydro stations being built by the company in the Philippines, Fiji and Chile plus wind power in Brazil. The potential for Australia to lead the way is huge.

Victoria 3146 Australia

Government support Some years ago the Federal Government introduced the MRET (Mandatory Renewable Energy Target) which was a good start but then after two years or so a considerable percentage of the committed funds were slipped across to "clean coal" study. There is no argument that reducing CO2 emissions from coal fired stations, yet to be built and hopefully those already operating is a top priority but not at the expense of renewable energy development. Recently there was a concentrated attack on a planned wind farm development in Gippsland by three Federal Government Ministers leading to abandonment of the scheme. In the meantime the State Governments have introduced their separate MRETs with wind farms on the move again.

Hopefully the new Government will really "rev things up" and first off the rank - Get more wind farms up and operating!

WATER

Hydro Power This is of course a prime renewable energy resource. In the long term it can effectively compete with low cost thermal power. However as of now, virtually all Australia's available hydro power has been utilised unless we tap into those rivers in the monsoon areas which are unfortunately far from cities and industrial areas where the power can be used. In addition to our large hydro resource, the Snowy Mountain Scheme and Tasmania's group of hydro stations coupled to the eastern States grid via the Bass Link, there are the recent additions of small hydro stations utilising the previously waste energy from mainly large irrigation dams. The largest of these is a 30MW station at the Ord River Dam in north west Western Australia -The total rated power of at least 26 new small hydro stations built to date is in excess of 200MW – A small but significant contribution. One must however now note "when the water is available".

Wave Power Many are the wondrous wave power machines that have been designed, of which few have been built, even fewer that have actually worked and to my knowledge only one that is currently producing commercial electric power. This a 400kw oscillating water column unit on the Isle of Islay in the Irish Sea out from Belfast.

Victoria can boast of a very early 1903 wave power machine which utilised a riveted spherical steel buoy attached by a line to a weighted recoil generator, in a water tight container on the sea floor. Wave action lifted buoy so pulling the line which in turn rotated the generator and which had a recoil return of the line when the buoy dropped. I understand it lit a light bulb for some 30 minutes before failing. You may not believe it, but there is a present day plan for a number of large floats again linked to sea floor generators to be installed in Port Philip Bay – With modern materials and greater knowledge of wave action leading to better design maybe this new proposal could actually work (for longer than 30 minutes). I have no information on the estimated cost of power.

Back to the oscillating water column. In its simplest form the oscillating column consist of a large diameter steel tube, say 3-4metres, the lower end of which is submerged whilst the upper section is above the water with sufficient height to keep the generating unit on top of the column dry. The best operating condition is a regular swell which creates an oscillating water column within the tube. The action of the water rising and falling within the column creates up and down air flows. These in turn drive a unidirectional wind turbine at the top of the column which powers a generator.

The ocean is unforgiving and destroyed two OWC pilot plants that I know of. The first was a Kvaener experimental machine north of Bergen (Norway) which was torn from its cliff supports by a North Sea gale. The other was the first Islay machine, later replaced by the current one which is obviously much stronger and has survived for a number of years.

An Australian invention, namely a parabolic reflector which directs incoming waves, parallel to the central axis, to a common point, has the potential to dramatically improve the efficiency by increasing the amplitude and therefore the energy of the wave within the column. This concept of Dr Tom Denniss of Sydney University which has been successfully tested offshore in Port Kembla also incorporates an improved unidirectional turbine design by Denniss and Auld which has continually oscillating blades to extract maximum power from the wind. The technology has been named by the International Academy of Science as one of the world's 10 most outstanding technologies of 2006.

.A survey which Water Power Consultants carried out some years ago down the south east coast then along the southern coast of Victoria showed the latter area, out of the lee of Tasmania, has wave power potential to supply Australia. Roll on Tom Denniss.

Government support I note that Denniss had to go to Europe for funding of his pilot plant – the Federal Government was not interested.

Tidal Power As with wave power, tidal power has been extensively studied and promoted but to date there has been very little development. One operating tidal station is on the west coast of France at St Malo. This is the La Rance station which has 24 off 10MW low head propeller turbines which operate in both flow directions. To my knowledge there is only one other tidal power station, a 17 to 19 MW station operating at Annapolis, Nova Scotia.

Providing the moon behaves itself, tidal power is very reliable but does suffer from unusually high construction costs. potential environmental problems and the fact that there is no action when the tide changes four times a day creates a further problem. The latter could be overcome by using the power generated to pump water to a high level dam from which it could be released at a regular rate to a turbine to provide continuous power.

The north west coast of Western Australia with a tidal range up to 9 metres has huge power generating potential with Cambridge Bay and King George Sound capacity estimated at 270,000MW. Unfortunately the Kimberley area is quite isolated and some thousands of kilometres from any large power requirement which adds to the above general problems associated with tidal power. However with global warming putting on pressure for more renewable CO2 free power there could be potential for developing high power usage industries such as bauxite to alumina to aluminium smelters to be located close to this power source. As there are large bauxite deposits in the area the idea could possibly be developed.

There is another tidal concept that utilises the flow of the tide through a narrow opening such as the Sydney and Melbourne "Heads." Interesting but to date untried.

Unfortunately I do not have any cost estimates of cents per kwhr for wave and tidal power but it is no secret that construction costs are high for both technologies.

SUN

Quite the reverse to hydro resources, Australia is certainly blessed with large quantities of sunshine.

Domestic Solar

Solar Water Heaters Immediately available solar water heaters should be mandatory for all new houses and subject to common sense and suitability of site, include all houses. Solar tube (rather than flat plate) hot water heaters are now available with 40% improvement in efficiency. State and

connected to the grid. Power production costs for a solar tower station is estimated to be 7 cents per kwhr for a 200MW station and 8 cents for 50 mw. Not bad at all!

Government assistance. To my knowledge Government both Federal and State long term assistance has been largely limited to rebates on domestic sized solar panel installations and solar water heaters. Assistance, both Federal and State has been given to the Solar Systems station. Once again, as in the case of the industrial size boiler feed water solar heating, an excellent Australian invention (with its inventor) has been forced to go overseas to be fully developed and at a very fast rate which underlines the seriousness of the situation as perceived by two big power corporations in the USA with their eye definitely fixed on the future.

ROCKS

Hot Rock Technology This is something new in renewable power potential for Australia. Recent exploration has determined that we are blessed with huge areas of extremely hot geological stable granite formations at depths around 4000m plus. In the one trial well to date which has reached target depth, there was an unexpected discovery of hot salty water within the structure. This water at around 240 degrees C is at high pressure. It will be piped to the surface then passed through a heat exchanger which brings the purer boiler feed water up to operating temperature and pressure. This steam then passes through a standard turbine which drives the generator. It can be noted that there is no wastage of water as both hot water loops are closed, with the hot rock water pumped back into the formation and exhaust turbine steam is condensed by air fans and the condensate is pumped back through the heat exchanger.

There a number of companies already formed to take advantage of this resource with Geodynamics to the fore in an area in the north east of South Australia near Innaminka which has the disadvantage of being some hundreds of kilometres from the grid or a major user. The company was experiencing considerable difficulties in completing its second exploratory well which was abandoned about a year ago. A large new rig was purchased and has recently arrived and started drilling. It is currently within some 800m from target depth with a production diameter hole. The plan is to complete this hole and conduct bore hole circulation tests prior to the end of 2007. If these tests are satisfactory as hoped a 1.0MW pilot turbine/generator will be immediately installed followed by drilling an additional 8 holes suitable for a 50MW unit. 500MW in 50MW nodules is planned to be completed by 2015.

There are other registered geothermal power companies with varying technologies at varying points of development who could no doubt succeed but Geodynamics is the furthest advanced.

Initial estimates indicate that our hot rock resource is some 250,000 MW which could generate all or most of Australia's ever increasing power requirements without any CO2 discharge and when required could provide the necessary power replacements as the older thermal stations are demolished. Australia's current total generating capacity is I believe approaching 50,000MW.

Initial costing indicates power production costs could be in the 4.5 to 5.0 cents per kwhr range plus of course the long distance transmission costs which could bring the cost into the grid at around 12 to 13 cents per kwhr.

Government Assistance I understand that Geodynamics did receive some early financial assistance but its operation have been largely funded by investors plus input by Origin Energy. I am sure further Government assistance, particularly on the construction of the necessary power lines would be most welcome and allow rapid utilisation of this resource.

ADDENDUM

Technical terms used

kilowatt kw A unit of power
kilowatt hour kwhr Use of a kilowatt for one hour. What the generator supplies and you pay for.
megawatt MW 1000kw
Industrial size generating capacity. This is measured in megawatts and as a marker we can use the Loy Yang A thermal power station in the Latrobe Valley. It has four 500MW brown coal fired steam turbine powered generators. The Ord River hydro station 30MW.

Currently the largest wind farm in Victoria is at Chowlicom Hills with 35 units which at rated capacity supplies 52 MW of power. Average power over the course of a year will be at 35 to 40% of the rated capacity. Under construction is the Portland wind farm which will have 125 units over 4 sites to produce 250MW at rated capacity. Both are Pacific Hydro installations.

The largest solar power station under construction in Australia is the 154MW station in NW Victoria. It is being built by Solar Systems.

As you can see renewable energy is definitely into industrial size generating capacity and increasing.

Robert Paterson Background of renewable experience

1983 Applied for and won a NERD&D (National Energy Research Development & Demonstration Council) Grant to "Survey the Small Hydro Potential of Large Dams Operating in Australia

1984 – 1985 Carried out the Survey which was published late 1985. This became the base from which 26 small hydro power stations have been built. All were noted in the Survey as good potential which identified 32 such sites. NERD&D advised this was the best commercial result of a grant.

1986 – 1988 Informally linked with Philip van der Riet (Civil Engineer and Hydrologist) and Bryan Leyland (NZ Mechanical and Electrical Engineer) examining and carrying out feasibility studies for several small hydro stations in NSW. Proceeding on some to full engineering and saw the establishment of the Wyangala 15MW station. In 12 months of 1987/88 I studied the commercial treatment of small hydro in connection to major grids and turbine and alternator manufacturers around the world.

1988 November- Water Power Consultants was formed with the three above engineers as directors. The Victorian Government introduced attractive buyback rates for renewables and cogeneration.

1988 – 1993 Many diverse projects were tackled by WPC including the survey of wave power potential of the south east and southern coasts of Victoria, the grass roots Koetong 1.0 MW hydro scheme and the feasibility studies for small hydro on 10 Victorian dams.

1993 – 2005 All the necessary preliminary work required to set in motion the formation of the first Australian public company to build, own and operate hydro power stations fitted to dams already operating. Pacific Hydro was floated successfully in 1995 and rapidly expanded its presence in Australia first in hydro then swinging to wind power after they had run out of dams. It has expanded internationally into the Philippines, Fiji Chile and Brazil. In 2005 the company was sold to an Australian superannuation fund IFM which already held 32% of the company and is still expanding.