Submission on the proposed Biomass-fired power station for Edrom, Twofold Bay. Mick Harewood, April 2010.

<u>Upstream Emissions.</u>

The Director General's requirements for the power station Environmental Assessment include, under Greenhouse Gas/Climate change, the requirement to quantify "upstream" emissions and emissions associated with biomass harvesting.

To date, the public has never seen a comprehensive greenhouse gas balance for the Eden woodchipping operation. Not in any State Forests or Harris-Daishowa EIS, nor the Comprehensive Regional Assessment of Forests, nor in any management plan have the greenhouse gas emissions associated with logging and regenerating native forests been comprehensively assessed.

There are serious knowledge gaps which could lead to perverse and unfortunate outcomes from what seems to be a "sustainable" source of energy. The important knowledge gaps relate to changes in stored carbon in forests and plantations throughout the cycle of oldgrowth or multi-aged forest logging, burning (pre-logging, post logging and under regeneration), sawn timber and woodchip production and transport, thinning operations and the long-term fate of forest products.

Very little is known about changes in soil carbon stores in the Australian context, although soil organic matter has been listed as an important parameter for assessing changes in site quality that may be associated with logging and burning. (Montreal Implementation Group, 1998)

The official view from the public forest manager in NSW is outlined in brief in the ESFM Plan (Ecologically Sustainable Forest Management Plan, Eden NSW, Forests NSW 2005). Under "Carbon Cycle" (page 13 of the ESFM Plan) the following statements are made:

"Decomposition of plant and animal matter in mature and over-mature forests adds to the carbon dioxide produced in normal growth processes such that there is no net impact on oxygen and carbon dioxide levels in the atmosphere.
Decomposition in regrowth forests is relatively little resulting in a net accumulation of about 5 tonnes per hectare per annum of carbon in the tissues of the trees, and the actively growing forest becomes a sink for atmospheric carbon. The cycle is prolonged if the timber containing carbon and obtained from regrowth forests is then put into service."

These paragraphs gloss over the release of GHG associated with process of converting oldgrowth or multi-aged forest to regrowth. The 1982 Eden Native Forest Management Plan (SF NSW 1983) contains estimates of 11 cubic meters of sawlogs, 100 tons of pulp-logs and 230 tons (range 200 to 300) per hectare of "coarse fuels" left behind in a typical logging operation. The "coarse fuels" and fine logging slash are substantially consumed in post-logging burns, the autumn or winter following logging, although some of the coarse fuel components may slowly decompose or be consumed by termites over many years.

The life of these forest products will vary according to use. Typically, about 60% of the sawlog mass will be converted into square sawn timber, which may have an average life of, say, 40 years or so. The remaining 40% is generally converted to woodchips, along with the 100 tph of pulpwood. The main product from Eden woodchips is copy paper, which has an estimated life of 3 years on average. It may subsequently be recycled but this would require additional energy inputs.

In order to compile a rough balance, let us consider a regrowth stand at age 40, just prior to the first thinning operation (e.g. Compartment 9, East Boyd State Forest.) The initial logging operation would have released GHG associated with ~11 plus 100 plus 230 tons of forest soon after logging or gradually over the next 40 years. At best a small proportion of the 6 tons of sawn timber might still be intact in some higher value product. The rate of sequestration of carbon in the regenerating forest might be up to 5 tons per hectare per annum (as estimated from assessments of 1952 fire regeneration) although Bruskin and Horne measure growth rates of 1 to 3 cubic meters per hectare per annum in this type of coastal forest. Thus about 335 tons per hectare have gone and about 120 tons per hectare have accumulated by age 40.

This represents a massive net GHG emission associated with logging and regeneration of Eden native forests. It is difficult to see how converting a tiny proportion of the pulp-wood, which is the "waste" from converting pulp-logs to woodchips into electricity, can do much to ameliorate this impact.

The situation with pine plantations is a bit complicated depending on the site condition before they were established. Much of the State Forests pine estate was established by clear-felling oldgrowth or multi-aged native forest with a Federal Government subsidy. Some of the State Forests estate was purchased from the Kapunda Development Corporation, who cleared native forest regrowth in the upper Towamba and Wog Wog valleys to plant pines with a generous tax concession. Some of the private pines on the southern Monaro have been established on previously cleared grazing land, but it is not clear that any of the waste from this material will find its way to Edrom, since Wilmott Forests has been investigating the viability of producing ethanol from cellulose waste.

Overall, there is likely to be a massive net emission greenhouse gases associated with the production and transport to Edrom of the raw materials for the proposed biomass power station, be they woodchip fines or shards or pine bark. The failure of the Environmental Assessment to quantify these net emissions is contrary to the Director General's requirements.

Air Quality.
The modelling in the EA seems to have been conducted in total ignorance of the behaviour of smoke from the sporadic waste burns conducted at the chip mill. Quite commonly, foul smelling smoke from these burns-offs travels up the Towamba Valley, with typical afternoon sea breezes. The basis of the modelling seems to be wind direction observations only, with little regard to the effects of local topography.

Project Justification.
This section of the EA notes that NSW peak summer demand for electricity has been increasing by 3.8% per annum ((Dec. 2004 green Paper) and that new base load power may be required from 2012/13 (my emphasis.)

The NEMMCO statement of Opportunities has projected 10 year summer peak load growth of 2.3%. However, for the next 3 to 4 years the Allocated Installed Capacity greatly exceeds the Capacity for Reliability. These facts give an insight into the temporal fluctuation in demand for electricity and the value of short and long-term storage.

Electrical energy in the form of alternating current cannot be stored. It has to be used immediately it is generated or converted to another form of energy for storage and later retrieval. Coal fired power plants are not good at rapid response to fluctuations in demand, and a biomass-fired plant would be no different. The challenge for electricity generation is to meet the short-term summer peak demands, which are growing as more people adopt air-conditioning, as well as the fluctuations in demand throughout the day. While ever baseload power is provided primarily from coal-fired power stations, there will be an excess capacity overnight which is reflected in very cheap "off-peak" power prices that do not take into account the external costs of greenhouse gas emissions.

There is a natural fit between solar-thermal power generation and the summer peak demand, especially if a few hours storage can be incorporated into the system. The peak daily solar thermal energy availability is in the mid afternoon, while there are peak household consumption times in the evening and early morning. Industry demand is mainly during the typical working day for most enterprises.

Long-term storage of electrical energy can be achieved through hydro pump-back schemes, and several are in operation to provide for demand peaks in the eastern states grid. However, drought and competing demands for water resources place a limit on this option.

Solar-thermal power generation has been coupled with short-term heat storage to better-match peak energy availability with peak demand. Storing heat as steam seems to be the preferred option in California, but it requires a very large volume of storage for a relatively modest amount of electrical energy generating capacity. Molten salt has been used in Spain, but one wonders about the capital cost and maintenance cost of safely storing and exchanging heat with molten salt reservoirs. Lloyd energy of Cooma have used liquid graphite to store heat energy captured by a heliostat system. This offers the advantage of storing a very large amount of heat energy per unit volume. However, the fire risk of any breach in the system must be considerable.

There may be potential to store energy as compressed or liquefied air to balance demand within the daily cycle or longer. Compressed air has been investigated as a potential "zero emissions" transport fuel, although the range of vehicles using such a fuel is limited. The possible economic driver for storing liquid air might come in part from the ability to fractionate-off liquid CO2 for use in algal ponds which grow hydrocarbon-producing algae as a potential source of transport fuels (RIRDC 2005).

Compressed or liquid air can store energy in a relatively dense form with relative safety and no restriction on the supply of raw material. There would need to be some heat storage and exchange, in order to balance the latent heat of vaporisation of air gases during the compression and decompression stages, if liquid air is the form chosen.

The CPRS strategy and timing outlined in the Federal Government's White Paper are meaningless now that the Coalition Opposition has blocked the scheme in the Senate. Few Global Warming believers ("alarmists") have any enthusiasm for the proposed CPRS because of its modest targets and the huge free permits given to large emitters, locked in as a compensable right into the future. The prospect for an international agreement is at least as dismal as the prospect for agreement on an effective scheme in the Australian Senate.

The best hope we have is to develop low-emission alternative technologies which are commercially competitive with polluting technologies. The critical edge to work on is short-term and long-term storage of energy in a form that is readily exchangeable with alternating current electricity. If there is a potential to create transport fuels as well, the chances of commercial viability are greatly enhanced, since the "peak oil" problem is looming as just as big a challenge to the sustainability of civilisation as global overheating.

The SEFE biomass power station has the same problems with coupling supply with demand that coal-fired power has. This is exacerbated by the very high temperature of discharge cooling water into the sea in summer, when peak demand for electricity is increasing.

A better use for waste such as pine bark might be to convert it into cellulotic ethanol for use as a transport fuel.

Overall, the project justification has not identified a definite need for increased base-load electricity generating capacity, just an increase in summer peak-load demand. A biomass fired power plant is no better at meeting this true increase in demand than a new coal-fired plant.

The amount of solar radiation reaching the earth has been estimated at 8000 to 10000 times the total human energy consumption for households and industry.[1] If a small proportion can be captured as solar photovoltaic, solar thermal, wind or wave power, there is a prospect for ending the use of fossil fuels. However, the intermittent nature of the availability of these energy sources means that storage for short and long term periods is a crucial problem. The SEFE site has excellent prospects for capturing wind, solar and wave energy. I urge SEFE to look again at storage technologies and the looming shortage of transport fuels if it is serious about sustainability.

References:

Bruskin S and Horne R (1990) An analysis of growth data from eucalypt stands in the coastal forests of the Eden Region. Technical Paper No. 53. Wood technology and Research Division, Forestry Commission of NSW Sydney 1990

RIRDC (2005) Bio-hydrocarbons from Algae. Impact of temperature, light and salinity on algae growth. Jian Qin. Rural Industries Research and Development Corporation. RIRDC publication 05/025.

[1] Heat energy from the sun has been reliable measured at 1360 Watts/square meter (the solar constant.) In order to estimate the total solar radiation received by the earth we can assume the earth is a flat disc at right angles to the sun with a radius equal to the radius of the earth (6 million meters). We also need to take into account the albedo of the earth-that is, the amount of direct reflection of light, estimated at 0.3 (that is, 30% is reflected and 70% absorbed).

This gives an estimate of absorbed energy from the sun of 9.4×10^{20} watt-hours/year or 3.4×10^{9} peta-joules per year.

Estimates of global industrial and domestic energy production from fossil fuel and nuclear sources are available from the International Energy Agency. For 2004, total global energy use was 11,059 Mega-tons of oil equivalent or 4.6×10^{5} peta-joules per year. If one assumes a 25% efficiency in this energy production and use, the waste heat generated would be about 3.6×10^{6} peta-joules per year.

Therefore, the total solar radiation absorbed by the earth is still several orders of magnitude (perhaps ten thousand times) greater than industrial energy production from fossil and nuclear sources.