

Integrated tree processing - energy and co-products from wood

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Several organisations in Australia are working together to develop a new industry that combines the environmental benefits of renewable energy with commercial incentives for large scale tree planting. The commercial viability of the energy plants is enhanced by the co-production of activated carbon and natural solvents. The new tree planting also helps solve another major environmental problem in Australia - water management and salinity in dryland agricultural regions. The background to this problem and the development of integrated tree processing as one solution are discussed in this paper.

Much of the low rainfall (less than 20 inch/year) agriculture in Australia takes place in regions that were cleared of perennial vegetation over the past century to make way for annual crops such as wheat. As a result, many of these areas now face severe salt degradation unless current agricultural practice changes. Extensive tree planting in particular is advocated as a means of returning these areas to more balanced water usage that will reduce salt movement from the sub soils into the surface environment. However such large scale tree planting needs commercial drivers to offset the massive costs involved. Unfortunately the dryland areas under threat do not currently have commercial forest industries. They can not compete with conventional plantation forestry in the higher rainfall zones of coastal Australia.

Australian government authorities are working to develop new tree crops for the country's dryland regions. Particular attention has been given to mallee trees - small, robust eucalypts that coppice when harvested and produce cineole-rich, eucalyptus oil in their leaves. In the state of Western Australia, where some two million hectares of agricultural land are already salt-damaged, the Department of Conservation and Land Management (CALM) and the Oil Mallee Company have supported farmers in the planting of almost 20 million of these trees in rows across wheat and sheep farms. The eucalyptus oil recovered from mallee leaves can be used in a range of household products. It also has the potential for large scale use as a naturally derived industrial solvent, to replace environmentally damaging solvents such as trichloroethane. As such it offers a commercial incentive to plant many new mallee trees.

The commercial viability of oil production from mallees is greatly enhanced by the parallel use of the wood fraction of the tree, leading to Enecon's concept of integrated tree processing. Enecon manages technology developed by CSIRO for the production of charcoal from wood. Unlike some charcoal processes, the CSIRO technology also focuses on energy recovery during carbonisation. Heat energy from partial combustion of the wood, and from gasification of waste biomass, is captured as steam. This steam is then used to drive a steam turbine and generator to produce electricity for export to the state grid.

The mallee charcoal can be processed via additional Enecon/CSIRO technology to produce activated carbon, with diverse markets as an industrial adsorbant or "sponge". Activated carbon from wood and other feed stocks is used worldwide in many applications to remove valuable products, or contaminants, from liquid and gas streams. In the case of activated carbon from mallee wood, product tests have shown excellent, broad spectrum ability to remove contaminants from drinking water.

Thus an integrated mallee processing facility using whole tree feed offers multiple environmental benefits:

- trees planted to prevent land degradation in dryland agricultural regions
- renewable electricity generated to offset electricity from fossil fuels

- activated carbon produced for water treatment applications
- natural solvents to replace halogenated hydrocarbons.

Importantly, it is expected that this processing concept will offer a commercially viable and self sustaining new industry for many rural Australians.

Mallee tree planting and the CSIRO technology have been developed independently on opposite sides of the country for most of the last decade. The concept of integrated processing was first discussed by Enecon with CALM in 1998. In 1999 a comprehensive feasibility study was conducted, which indicated a commercially viable industry. In 2000 funding was finalised for a full scale demonstration plant, to be built south east of Perth, the capital of Western Australia. Funding for this plant has come mainly from the state electricity authority, Western Power, with support from the Federal Government via the Australian Greenhouse Office and Ausindustry. Enecon now has engineering for the plant well underway and this first facility will be operating early in 2002. It will export more than 1 MW into the Western Australian electricity grid and will provide sufficient activated carbon and eucalyptus oil for large scale market development. Based on success with this first facility, subsequent plants will be several times larger and will be built progressively through the Western Australian wheatbelt as more trees are grown and product markets increase over coming years.