VIC FORESTS AND AUSTRALIAN PAPER

Review of Issues affecting the Transition of Victoria’s Hardwood Processing Industry from Native Forest to Plantations
PREFACE

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Contact details:

John Welsford
PRINCIPAL

Michael Henson
SENIOR CONSULTANT

Poyry Management Consulting (Australia) Pty Ltd
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GLOSSARY AND SPECIES NAMES

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tr>
<td>/a</td>
<td>Per year/annum</td>
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<tr>
<td>/ha</td>
<td>Per hectare</td>
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<tr>
<td>/m³</td>
<td>Per cubic metre</td>
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<tr>
<td>ACF</td>
<td>Australian Conservation Foundation</td>
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<tr>
<td>BDt</td>
<td>Bone Dry metric tonnes</td>
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<tr>
<td>BHKP</td>
<td>Bleached Hardwood Kraft Pulp</td>
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<tr>
<td>DCF</td>
<td>Discounted cash flow</td>
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<tr>
<td>DSE</td>
<td>Department of Sustainability and Environment</td>
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<tr>
<td>FEA</td>
<td>Forest Enterprises Australia</td>
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<tr>
<td>FFORNE</td>
<td>Farm Forestry of North East Victoria</td>
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<tr>
<td>FOB</td>
<td>Free on board</td>
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<tr>
<td>FWPA</td>
<td>Forest and Wood Products Australia</td>
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<tr>
<td>GFC</td>
<td>Global Financial Crisis</td>
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<td>GTE</td>
<td>Government trading enterprise</td>
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<td>HVP</td>
<td>Hancock Victoria Plantations</td>
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<tr>
<td>IBRA</td>
<td>Interim Biogeographic Regionalisation of Australia</td>
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<tr>
<td>IRR</td>
<td>Internal rate of return</td>
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<tr>
<td>LSL</td>
<td>Laminated strand lumber</td>
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<td>LVL</td>
<td>Laminated veneer lumber</td>
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<tr>
<td>MAI</td>
<td>Mean annual increment</td>
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<td>MIS</td>
<td>Managed Investment Schemes</td>
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<td>NIEIR</td>
<td>National Institute of Economic and Industry Research</td>
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<td>NPI</td>
<td>National Plantation Inventory</td>
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<td>NPV</td>
<td>Net present value</td>
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<tr>
<td>NSA</td>
<td>Net stocked area</td>
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<tr>
<td>NSSC</td>
<td>Neutral Sulphite Semi Chemical</td>
</tr>
<tr>
<td>SEDUB</td>
<td>Small end diameter under bark</td>
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<tr>
<td>SEFE</td>
<td>South East Fibre Exports</td>
</tr>
<tr>
<td>SPH</td>
<td>Stems per hectare</td>
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<td>TRP</td>
<td>Timber release plans</td>
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<tr>
<td>TRV</td>
<td>Total recoverable volume</td>
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<tr>
<td>TSVUB</td>
<td>Total standing volume under bark</td>
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<tr>
<td>TWS</td>
<td>The Wilderness Society</td>
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<tr>
<td>VFA</td>
<td>Victorian Forest Alliance</td>
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<tr>
<td>SPECIES LATIN NAME</td>
<td>COMMON NAME</td>
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<td>--------------------------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td>Corymbia maculata</td>
<td>Spotted gum</td>
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<tr>
<td>Eucalyptus cladocalyx</td>
<td>Sugar gum</td>
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<tr>
<td>Eucalyptus delegatensis</td>
<td>Alpine ash</td>
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<tr>
<td>Eucalyptus globulus</td>
<td>Blue gum</td>
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<tr>
<td>Eucalyptus grandis</td>
<td>Flooded gum</td>
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<tr>
<td>Eucalyptus nitens</td>
<td>Shining gum</td>
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<tr>
<td>Eucalyptus regnans</td>
<td>Mountain ash</td>
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<tr>
<td>Eucalyptus saligna</td>
<td>Sydney blue gum</td>
</tr>
<tr>
<td>Eucalyptus sieberi</td>
<td>Silvertop ash</td>
</tr>
<tr>
<td>Pinus radiata</td>
<td>Radiata pine</td>
</tr>
<tr>
<td>Victorian ash</td>
<td>Trade name for E. delegatensis and E. regnans</td>
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EXECUTIVE SUMMARY

Pöyry has reviewed the report prepared by the National Institute of Economic and Industry Research titled; “Opportunities, issues and implications for the transition of Victorian wood products industry from native forests to plantations”, the “NIEIR Report”. This report examines the social and economic implications of a transition strategy put forward by the Victorian Forest Alliance.

The transition strategy proposes substituting logs from hardwood plantations established in Western Victoria\(^1\) for native forest hardwood logs used by existing forest industry processors. Most of the state’s forest industry processors are located in eastern Victoria, in close proximity to the native forest logs.

The main elements of the transition strategy evaluated in the NIEIR Report and Pöyry’s key findings in relation to each are summarised in the table below.

\(^1\) The term Western Victoria is used here to be consistent with the terminology of the NIEIR report. In fact the area of plantations referred to is the “Green Triangle” which includes plantations across the border in the south-east of South Australia as well as those in Western Victoria.
**KEY FINDINGS**

<table>
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<th>Transition Strategy</th>
<th>Pöyry's Findings</th>
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| Plantation pulpwood from Western Victoria replaces native forest pulpwood at Australian Paper's Maryvale mill. Transition period: next 5 years. Carbon credits could fund additional costs. | ▪ Hardwood plantation wood availability from Western Victoria will peak at 4 million m³/a in 2015 but is expected to decline to around 2 million m³/a after 2020 due to reduced reinvestment.  
▪ While there is less pulpwood available than the NIEIR Report suggests, it is technically feasible for Australian Paper to transition to 100% Western Victorian plantation wood. This would have significant economic and logistic impacts and wood supply security for Australian Paper would be reduced.  
▪ Significant investments are already in place in Western Victoria to export this wood. These would compete directly with Australian Paper for the plantation resource, potentially increasing prices.  
▪ The additional cost of this wood delivered to Maryvale mill compared to the current native forest supply would be AUD31 million/a. This would require a significant ongoing Government subsidy or have a major impact on Australian Paper's profitability.  
▪ REDD/REDD+ schemes, which the NIEIR Report proposes to provide funding for transition to plantations, only provides funding for developing countries. The schemes are not applicable to Australia. The recently announced Federal Government biodiversity funding, may be a potential source of funds. |

| Plantation pulpwood from Western Victoria replaces native forest pulpwood exports at SEFE in Eden and Midway in Geelong. Transition period: next 5 years. | ▪ The plantation pulpwood was intended to be exported in addition to the native forest pulpwood. Cessation of native forest pulpwood exports means the loss of the export income it generates and loss of associated jobs in these rural areas. |

| Native forest sawlog supply to be reduced by 80% with one or two sawmills remaining to produce appearance-grade timber. Transition period: next 5 years. | ▪ It is unrealistic to assume only appearance-grade timber can be harvested. A single tree produces logs of different grades, and harvesting of a stand will produce logs of different quality.  
▪ Considering the size and stem quality of the existing Western Victoria plantations, it is very optimistic to assume sufficient supply of sawlogs, suitable even for structural grades, would be available within 5 years. |

| A 500 000 m³/a sawmill to be built in Western Victoria for producing sawn timber from plantation logs. Plantation sawlogs to come from converting existing pulpwood plantations to a sawlog regime and establishing some new plantations. Transition for structural timber: 10 years. Transition for appearance-grade products: start in 5-10 years and finishing in 20-30 years. | ▪ It would be a major challenge to develop an economically viable hardwood plantation sawlog industry in Australia with its high labour cost environment, without significant Government subsidies or incentives.  
▪ It would also be difficult to convince the large number of owners of the existing plantations (including thousands of small MIS investors) to convert the plantations to sawlog regimes when there is no established market for the sawlogs today.  
▪ It is too late to convert the majority of the existing pulpwood estate to a sawlog regime as pruning should be undertaken in the first four years.  
▪ The dominant species planted, *eucalyptus globulus* (blue gum) is not a good sawlog species. Suitable sawlog species that will grow in Western Victoria are not highly valued pulpwood species.  
▪ It would take at least 25 years for new plantations to produce sawlogs, and Pöyry estimates that a subsidy of over AUD4 000/ha would be required to make the sawlog plantations viable if investors could be found to take the market risk. This equates to a subsidy of AUD16 million/a for the 100 000 ha of sawlog plantations that would be required to support a 500 000 m³/a sawmill.  
▪ Sawlogs from hardwood plantations do not have the same wood qualities or processing behaviour as native forest logs. The plantation sawlogs have smaller dimensions, inherent growth stresses and shrinkage, lower density and lighter colour. |
## Transition Strategy

<table>
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<th>Pöyry's Findings</th>
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<td>▪ There would be significant risks in building a 500,000 m³/a sawmill which would</td>
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<td>be the largest hardwood sawmill in the world. The quality of the plantation</td>
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<td>wood means there are significant technical risks and higher costs for</td>
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<tr>
<td>processing this wood.</td>
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<tr>
<td>▪ For high-quality appearance-grade products, the quality of the plantation</td>
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<td>wood is likely to be inferior. Hence, much of the output would be in</td>
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<td>structural timbers competing with the relatively more cost effective pine</td>
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<td>plantation wood. There is experience of this already in Australia at the</td>
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<td>FEA mill in Bell Bay.</td>
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<tr>
<td>▪ If native forest sawlogs are not available, it is likely that appearance grade</td>
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<td>timber would be replaced by imports which are unlikely to have better</td>
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<td>environmental credentials than the Victorian product it would replace. For</td>
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<td>structural grades, product from pine plantations will supply the market.</td>
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## Other Pöyry Findings on NIEIR Report:

- Carbon sequestration benefits in the NIEIR Report are overstated and do not take into consideration fire which accounts for a large proportion of carbon changes in Victorian forests. Harvesting has short-term effects offset by rapid growth, so assessments of carbon changes need to be made of an appropriate time and spatial scale to account for fire, harvesting and regeneration.
- The value of VicForests land and timber is significantly inflated in the NEIR Report. The Report methodology is simplistic and is not based on the mandatory Australian Accounting Standard AASB 141 which VicForests uses.
- VicForests is moving sales of native forest timber to a commercial basis. A proportion of sawlogs are sold via an auction process. The company inherited existing agreements and licences but expects to move all sawlog sales to auction in a few years. Plantation logs have different qualities and locations to native forest logs and it is not valid to expect prices to be similar.
- Contrary to what the NIEIR Report states, the forest industry receives a lower effective rate of assistance than the overall primary production industry.
- The assumption in the NIEIR Report that 60% of sawlogs could be suitable for high-value products is unrealistically high. VicForests has a policy of maximising production of sawlogs, although variable nature of forests means that harvesting of a forest will always yield a proportion of lower-value sawlogs and pulplogs.
- Closing remaining catchment areas to native forest harvesting would yield the equivalent of 1% of Melbourne's water consumption. This is a small amount in relation to the impact the regrowth after the 2009 fires will have on the catchment yield. Closure would result in loss of economically-productive rural employment to benefit Melbourne consumers who already have their water supply subsidised.
- The cessation of native forest logging means the loss of income and employment generated by the industry. The NIEIR Report does not put sufficient weight on the impact of this on Gippsland and the small towns in the region. The development of tourism and recreation in Gippsland has not kept pace with reductions in harvesting over the last decade.
Pöyry agrees that a significant quantity of hardwood logs is becoming available in Western Victoria. However, these plantations were established to supply export pulpwood markets in Asia-Pacific, mainly Japan. This means that the plantations’ locations, species and management regimes were optimised to suit this export pulpwood market. As a result, technical, economic and social issues must be addressed if the logs are to be redirected to the domestic industry and particularly the hardwood sawmill industry. While the NIEIR Report does consider many of these issues, in Pöyry’s view, it underestimates the costs, technical impediments and risks.

The availability of plantation pulpwod in Western Victoria is expected to peak in 2015, but will decline by up to half in the next decade. Investments have been made to export the pulpwod so there will be competition against the domestic uses proposed in the transition strategy.

The NIEIR Report states that the plantations in Western Victoria will provide 3.5 million m³/a of hardwood logs. In Pöyry’s view, the output will peak at 4 million m³/a in 2015. However, volumes are expected to decline significantly over the next 10 years, due to the demise of the Managed Investment Scheme (MIS) industry in Australia. Over AUD5 billion was raised by this sector between the late 1990s and mid-2000s. The MIS sector typically paid excessive amounts for land which led to plantations being established on land capable of supporting better uses. Pöyry’s view, which is shared by other industry observers, is that significant areas of plantation will not be replanted after initial harvest. Consequently, by 2020 the volume of logs produced sustainably from Western Victoria is expected to decline by up to 50%.

The Western Victorian industry has invested to process and export the projected volume of logs. Specifically, South West Fibre has invested AUD30 million in its new 1.1 million t/a woodchip mill. Gunns has contracted with the Port of Portland to develop a new hardwood woodchip export facility. This contract requires Gunns to export a minimum of 1.5 million t/a or pay a fee per tonne below this amount. Gunns has also announced its plans to ship 1 million t/a to its proposed Bell Bay pulpmill.

Consequently, there is a developing chip export sector in Western Victoria that is investing to handle the initial “bulge” volumes of available hardwood logs. Once the plantations and long-term supply of logs have stabilised, this chip export capacity is likely to be oversized. The developing chip export sector is actively marketing the growing supply of logs. However, as the supply tightens in the mid-term, Pöyry anticipates growing competition for these logs from the existing sector. In this environment, the introduction of two new competitors for the logs; Australian Paper and the proposed new sawmill, will drive up stumpage costs.

In Pöyry’s view, it is technically feasible for the domestic pulpwod processor to transition to Western Victorian pulpwod. However, in the longer term, there are significant economic and logistic impacts as well as supply risks involved.

In Pöyry’s view, the supply/demand balance for the Western Victorian hardwood logs is tighter than that suggested by the NIEIR Report. However, there should be sufficient pulpwod logs in the medium term for the Australian Paper Maryvale mill if it pays an export parity, or slightly higher, price for the pulpwod. Hence, it is technically feasible for the domestic paper industry to transition to a 100%
plantation resource in 0-5 years as suggested by the NIEIR Report. Nevertheless, such a transition would involve significant costs and logistics challenges, and in the longer term, supply risks.

The NIEIR Report has estimated the additional cost of replacing Maryvale’s native forest wood supply with plantation wood from Western Victoria to be AUD22.8 million/a. Pöyry estimates that this figure should be approximately AUD31 million/a as, in Pöyry’s view, the NIEIR Report has underestimated the amount of pulpwood to be transported to Maryvale and the transport cost. In addition, Pöyry believes the NIEIR Report overestimates the processing advantages of the plantation pulpwood compared to the native forest pulpwood currently processed.

The NIEIR Report suggests that the Government would be asked to contribute to the additional costs involved in the transition strategy, but does not specify the size of this contribution. Replacing the native forest wood with plantation pulpwood from Western Victoria would double the delivered cost to Maryvale. Since wood is the largest cost item for a pulpmill, this would significantly impact on the mill’s profitability if the cost had to be paid by Australian Paper. The additional cost is about the same order of magnitude as the earnings before interest and tax reported for the Australian Paper assets in 2007/2008 and 2008/2009. (Earnings have not been reported separately since Nippon Paper acquired the company in 2009.)

If the additional costs are to be covered by the Government, as suggested by the NIEIR Report, then this represents a significant subsidy. The suggestion is also inconsistent with other sections of the NIEIR Report, where industry subsidies are argued against.

In regard to the existing export industry of pulpwood from native forests, the NIEIR Report proposes replacing native forest pulpwood with pulpwood from hardwood plantations. In Pöyry’s view, it is likely that the companies exporting native forest hardwood would already have included any available plantation pulpwood in their planning strategies. Hence, the transition strategy means they would simply lose the sales from the native forest logs. This would result in a loss of export income and the jobs associated with this section of the industry.

The differences between plantation and native forest hardwood logs are significant, and these differences have not been fully considered in the NIEIR Report. These differences would impede the transition strategy proposed for the sawn timber industry.

Plantation-grown eucalypts are successfully processed to sawn timber and veneer products in several regions of the world. However, this is usually done in regions with higher plantation growth rates than occur in Australia, lower labour costs than Australia and with strong markets for the residue material from the sawmills. In other words, these sawmills are in areas with more favourable economic conditions than Australia.

Globally, eucalypt plantations have been established for over 150 years and today comprise approximately 19 million hectares. Despite this long history, Pöyry estimates that less than 1% of eucalypt plantations is managed for high-value sawlogs. Even Australia, which also has a long history of managing eucalypt
plantations for sawlogs, has not been able to establish a sustainable industry based only on plantation-grown eucalypts. This provides some indication of the technical and economic difficulties in growing and processing eucalypt sawlogs.

A fundamental issue which is not properly considered in the NIEIR Report is that plantation-grown eucalypt does not have the same wood properties as native forest timber. In Pöyry’s view, the key differences are:

- Relatively smaller dimensions of plantation-grown timber
- Higher inherent growth stresses and shrinkage of plantation timber
- Lower density and lighter colour of plantation timber.

These key differences of plantation-grown eucalypt result in lower productivity in the sawmill and lower-value products in the market. This means that the plantation wood is not a direct substitute for native forest wood and that sawmills processing plantation hardwood will have difficulty being competitive.

**Pöyry considers that it is too late to convert most of the pulpwood plantations in Western Victoria to sawlog plantations.**

Growing eucalypt plantations for sawlogs presents technical and economic challenges which are not fully considered in the NIEIR Report. Eucalypt sawlog plantation silvicultural regimes are managed to maximise the volume of defect-free wood suitable for high-value appearance-grade timber. This is achieved by thinning, pruning and longer rotation of the plantation. In contrast, pulpwood regimes are managed to maximise the volume of wood per hectare at the lowest cost.

Figure S-1 below shows eight-year old pulpwood plantations in Western Victoria on the right, and five-year old eucalypt sawlog plantations in Paraguay on the left. The significant difference in log quality is obvious.

**Figure S-1:**

The NIEIR Report proposes the conversion of the existing pulpwood plantations to sawlog regimes and assumes that this would yield sawlogs within a period of 10 years. In Pöyry’s view, it is technically possible to convert pulpwood plantations
to a sawlog regime when the plantations are less than three to four years old. However, planting in Western Victoria has been limited since the Global Financial Crisis and Pöyry believes that the majority of the plantations are now too old to be converted.

The majority of the hardwood plantations in Western Victoria are *Eucalyptus globulus*. This is an excellent pulpwod species, but not a premium sawlog species due to high levels of tangential and radial shrinkage. There are better sawlog species that could be grown in Western Victoria, such as *Corymbia maculata* (spotted gum) and *E. cladocalyx* (sugar gum). However, these would require longer rotations of at least 30 years. Furthermore, they are not valued as a pulpwod species, so residues from thinning and sawmilling operations would be of low value, thus impacting on the economics of processing these species.

In Australia’s environment of high labour cost, the economics of sawlog plantations are not favourable. The high cost of establishing and managing the plantations must be carried for a long period before the crop can be sold and revenue generated. The pruning in particular is a costly, manual task.

Pöyry estimates that a subsidy of approximately AUD4 000/ha would be required to encourage establishment of sawlog plantations in Victoria. This would give growers a reasonable return of 7%/a on their investment. The Victorian Government has offered incentives of up to AUD1 400/ha to establish plantations on farm land but this has failed to attract enough interested landowners to achieve the modest targets of 1 000 ha/a. Only 1 700 ha of plantations have been established since 1996.

*The proposed 500 000 m³/a plantation eucalypt sawmill would be the largest of its kind in the world. There are significant technical impediments to be overcome before this could be established as a viable commercial operation.*

The NIEIR Report recognises that the native forest sawmills in Gippsland cannot process eucalypt plantation sawlogs and, as a solution, proposes a 500 000 m³/a sawmill to be built in Western Victoria.

The NIEIR Report cites the FEA sawmill in Tasmania as an example of such a sawmill. However, Pöyry understands that this mill mostly processed pine, producing only a few batches of eucalypt timber before it went into receivership in 2010. The eucalypt timber predominantly consisted of structural grades which competed in the same structural timber market as the lower-cost pine. Hence, the FEA mill is not a good reference for a transition strategy where the objective is to produce appearance-grade product as a substitute for native forest timber.

In Pöyry’s view, there are a number of technical issues and significant risks associated with the proposed 500 000 m³/a sawmill which are not considered in the NIEIR Report.

The proposed scale of the mill would make it the largest hardwood mill in the world. Globally, the largest hardwood sawmills have capacities in the range of 100 000-200 000 m³/a, with just one mill with a capacity of 400 000 m³/a, started up in Uruguay recently. These largest mills are using conventional back-sawing technology and not the more complex quarter-sawing technology which would be required to process *E. globulus* due to its high levels of residual growth stress and tangential shrinkage.
Other key technical challenges relate to:

- **Sawing** – Plantation-grown eucalypts produce relatively small diameter logs with high levels of residual growth stress. Research shows that quarter-sawing logs is possible, but to Pöyry’s knowledge, there are no commercial-scale operations anywhere in the world. Quarter-sawing requires specialised equipment and increased handling, resulting in narrower (lower value) boards and greater operating and capital costs. Thus, large-scale production of appearance-grade timber poses a serious challenge.

- **Automated Handling** – Even with optimum sawing technology, there will be some boards with substantial bow and spring which could cause problems with the automated handling systems required to manage the high throughput of the sawmill.

- **Drying** – Eucalypt wood is one of the hardest wood types to dry. Gentle drying will be required to minimise defects and, as a result, long drying times and extensive pre-drying space and kiln-drying capacity will be required.

**Figure S-2:**
Alternative Sawing Strategies

The value that the market will pay for timber from plantation eucalypt is uncertain. The product will have a different appearance and lower density than that from native forests.

In Pöyry’s view, there are also market risks for the plantation eucalypt product. In appearance applications, where colour and grain is highly prized; for example, fine furniture, there is the risk that timber from *E. globulus* will be considered too bland. For flooring, there is the additional risk that the plantation hardwood would not have the required density and hardness.

The NIEIR Report states that high appearance grades require only about 5–10% of the logs currently produced from native forests. The transition strategy proposes that these logs continue to be sourced from native forests for up to 30 years, while other products are transitioned to plantations sawlogs.
The NIEIR Report does not take into account the fact that the product mix of logs depends on the resource being harvested. A single tree produces logs of different grades, and a stand of trees produces logs of different quality. Hence, because every harvesting operation produces a mix of log qualities, it is unrealistic to assume that all logs would be appearance-grade logs. In Pöyry’s view, this is a fundamental problem with the transition strategy analysed in the NIEIR Report.

The Australian hardwood sawn timber market has had very limited exposure to the new plantation timber, so the value that the market will ultimately put on this product is uncertain. In Pöyry’s view, it is unlikely that the plantation wood would achieve the same value as the native forest timber. However, if the plantation eucalypt timber did establish a market in Australia at the same price level as the native forest logs, as anticipated in the NIEIR Report, this would provide a strong signal for foreign competitors to enter the market.

Overall, the conclusion reached by Pöyry is that the extent to which plantation wood could substitute for native forest timber in appearance grades is uncertain, and it is unlikely that it could be a 100% substitute for the native forest timber.

It is considered more likely that the plantation eucalypt timber would be used in structural applications where it would compete with plantation softwood. Historically, the structural softwood timber has taken the structural market from the hardwood native forest timber. In Pöyry’s view, it will be challenging for the plantation eucalypt timber to win back this market.

The viability of the proposed new sawmill is uncertain, and the mill would face technical and market risks.

The economics and competitiveness of the proposed 500 000 m$^3$/a sawmill is not evaluated by the NIEIR Report. The mill size will give it some economies of scale, but additional equipment required for processing the plantation E.globulus wood will mean the mill is likely to have a higher cost structure than Australian softwood mills or eucalypt sawmills in Africa and South America.

A particular risk is that the quality of the plantation sawlogs could result in a high proportion of structural grade. The revenue from a product mix based substantially on commodity structural timber will not support a cost structure geared towards high-value appearance grades.

In addition to the uncertainty regarding product quality and market acceptance, another issue for the proposed mill is its groundbreaking size. As the largest hardwood sawmill in the world, it is reasonable to assume that there may be difficulties with commercial-scale technology that can efficiently process E.globulus.

Overall, the limited experience of growing, processing and marketing this timber in Australia results in considerable exposure to risk for potential investors. Hence, in Pöyry’s view, it is unlikely that such a mill would be built.
The carbon sequestration benefits claimed in the NIEIR Report are overestimated, and the proposed funding for the transition strategy from REDD schemes is not applicable

The NIEIR Report states that considerable savings can be made in the amount of carbon stored in native forests if harvesting of native forests ends, and that credits available under a REDD scheme could be used to fund the transition strategy.

In Pöyry’s view, the NIEIR Report overestimates the amount of carbon that can be saved if native forest harvesting ends. The study relied upon in the NIEIR Report to reach its conclusions was done on a site in Tasmania not considered representative of typical Tasmanian and Victorian state forests. In addition, this study does not take into account the impact of fire.

A large proportion of the carbon exchanges relating to native forests are beyond human control. The catastrophic Victorian fires of 2009 provide a vivid example. Any assessment of carbon changes relating to timber harvesting need to be made on an appropriate spatial scale, Victorian or regional. An appropriate time scale is also essential for a rational assessment of carbon stocks that takes into account the impact of fire, harvesting and regeneration.

The REDD and REDD+ schemes referred to by the NIEIR Report are international schemes administered by the United Nations. The schemes encourage developing countries to reduce emissions by reducing deforestation and improving conservation and sustainable management of forests. This scheme does not apply to a developed country such as Australia, so the proposal in the NIEIR Report that forests in East Gippsland could become a working model of a REDD program is unrealistic. In Pöyry’s view, REDD and REDD+ schemes are not a potential source of funding for the transition strategy.

There may be some possibility of carbon trading in the voluntary carbon markets. However, these markets are not fully established and are expected to be volatile, and generally resulting in lower carbon prices. Uncertainty about these markets is widespread, particularly regarding how they will operate with the Australian Government’s new carbon tax plan. The carbon tax announcements did include details of a biodiversity fund which could provide some funding for cessation of native forest harvesting, however, many questions remain unanswered.

VicForests is moving towards achieving 100% competitive sales of its sawlogs in the next few years. The valuations of its estate are based on mandatory Australian Accounting Standards

The NIEIR Report argues that there is an artificial price advantage for native forest logs as VicForests charges a price that does not reflect the full cost of the logs. The report further argues this artificial price advantage has discouraged the industry from moving to the greater use of plantations. It argues that if competitive neutrality principles were applied to VicForests, the artificial price advantage would be removed and investment decisions would be made on a more rational basis.

The NIEIR Report proposes that native forest wood should move to a plantation parity price. However, Pöyry believes this approach is simplistic as plantation and native forests logs are of different quality and serve different markets.
VicForests was created in 2004 to move the timber sales from Victorian native forests to a more commercial basis. While the company inherited some existing licences and agreements, it has made progress towards a commercial basis and sells 23% of its logs through an auction system. It expects to sell 100% of its sawlogs via competitive sales within a few years, thus achieving the goal of a fully commercial basis.

The NIEIR Report claims that the forest industry receives a high rate of assistance, selectively quoting 2008 figures from the Productivity Commission. In fact, the Productivity Commission figures show that, on average, between 2003 and 2010, the forestry and logging industry received a lower rate of assistance than the entire primary industry sector. The wood and paper industry received about the same level of assistance as the entire manufacturing industry.

The NIEIR Report's argument that VicForests gets free access to Victoria's assets is invalid. The assets are managed by the Victorian Department of Sustainability and Environment (DSE) which transfers assets to be harvested to VicForests at a fair market value in accordance with Australian accounting standards. VicForests pays for the harvesting and regeneration and then transfers the assets back to the DSE after two to three years, again at a fair market value. VicForests is not a private sector entity and must operate within the constraints of a government enterprise which imposes major limitations and restrictions on procedures such as external debt limits, and contracts for harvest and haulage.

The NIEIR Report criticises the valuation methodology used on Victorian forests. However, it is surprising to note that the report then uses an FAO valuation methodology despite the fact that Australian Accounting Standard AASB 141, which conforms with International Accounting Standards, is mandatory for valuation of agricultural and biological assets. As a result, the NIEIR Report significantly inflates the value of the harvestable timber. The value of the VicForests land is also significantly overvalued by the methodology used in the NIEIR Report.

*The cessation of native forest harvesting means the loss of income and employment from the industry. The plantation industry will generate income and employment in its own right and is not an alternative to the native forest industry.*

The cessation of native forest harvesting in Gippsland means the closure of the native forest processing industry and the loss of the income it generates. It has been estimated that native forestry generates AUD150 million/a in economic activity and provides direct employment for 2 000 people. While the jobs relating to harvesting may be relocated to Western Victoria and some of the haulage contracts can remain in Gippsland, Pöyry’s view is that the NIEIR Report places insufficient weight on the impact the loss of employment would have in Gippsland, particularly on small towns in the region. The loss of employment also results in additional costs and responsibilities for Government.

In Pöyry’s view, the expectations proposed in the NIEIR Report for increased employment within nature-based tourism in Gippsland to fill the gap left by cessation of native forest processing industry are extremely optimistic. The development of tourism and recreation in Gippsland has not kept pace with the reductions in harvesting over the last decade and there is no evidence this will change.
In Pöyry’s view, continued harvesting in catchment areas provides the maximum net socio-economic value.

The argument put forward in the NIEIR Report that closing the remaining catchments to harvesting provides the maximum net socio-economic benefits is incorrect in Pöyry’s view:

- The amount of water saved is small, approximately 1%, in relation to the total consumption and in relation to the impact that the regrowth after the 2009 fires will have on water yields in catchments.
- Economically-productive rural employment will be lost to supply this small gain.
- The cost of Melbourne’s water to consumers is subsidised, possibly encouraging excess consumption. It is therefore unfair to cease the productive employment of those involved in hardwood sawmilling on the basis of providing an additional 1% of water for consumption.

The transition strategy carries technical, economic and social risks which are not fully considered in the NIEIR Report.

The proposed transition strategy would result in loss of income and employment generated by the native forest industry. The prospect of new jobs in tourism and managing the new carbon store in East Gippsland proposed in the NIEIR Report appear very optimistic.

It is technically possible for Australian Paper’s Maryvale mill to use the pulpwood from Western Victoria. However, there would be extra costs and logistic problems involved, as well as competition and supply security risks for the pulpwood. These are significant issues, which are not fully considered by the NIEIR Report.

The NIEIR Report does not fully account for the differences in wood properties between eucalypt sawlogs from plantations and native forest. The commercial viability of the 500 000 m³/a plantation sawmill proposed in the NIEIR Report is uncertain as a result of technical impediments and market risks.

The time frame proposed in the NIEIR Report is unrealistic as it is too late to convert most of the current plantations to a sawlog regime. Instead, new plantations would need to be established and these would not be available for harvesting for at least 30 years.
<table>
<thead>
<tr>
<th>Product Quality</th>
<th>NIEIR Report Transition Strategy</th>
<th>Pöyry's Conclusions</th>
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<tbody>
<tr>
<td>Chip/Pulp Logs</td>
<td></td>
<td></td>
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<tr>
<td>Export Woodchip</td>
<td>900  46  Yes</td>
<td>Plantation pulpwod will be exported anyway. Strategy would result in loss of income and employment in eastern Victoria.</td>
</tr>
<tr>
<td>Domestic Paper</td>
<td>600  31  Yes</td>
<td>Technically feasible and advantages in wood quality, but would require funding of AUD31 million/a. There are also logistic challenges and supply security risks.</td>
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<tr>
<td>Structural Low Value Sawlogs</td>
<td></td>
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<tr>
<td>Pallets and Battens</td>
<td>110  6  Yes</td>
<td>Possible, although sawmill recoveries would be lower than expected.</td>
</tr>
<tr>
<td>Green Structural</td>
<td>90   5  Commence Complete</td>
<td>Optimistic considering the size and stem quality of the current <em>E.globulus</em> plantations. Technical challenges and processing costs likely to make production uncompetitive.</td>
</tr>
<tr>
<td>Klin Dried Structural</td>
<td>75   4  Commence Complete</td>
<td></td>
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<tr>
<td>Appearance High Value Saw Logs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joinery/Flooring Standard</td>
<td>25   1  Commence Complete</td>
<td>Time frame unrealistic; current <em>E.globulus</em> plantations are not pruned and do not have good form. New plantations would need to be established and managed. Sawlogs of sufficient quality not available for at least 30 years.</td>
</tr>
<tr>
<td>Joinery/Flooring Medium</td>
<td>40   2  Commence Complete</td>
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<tr>
<td>Joinery/Flooring Select</td>
<td>110  6  Commence Progress Complete</td>
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<tr>
<td>Total ('000 m$^3$)</td>
<td>1950  100 1600 1830 1900 1950</td>
<td></td>
</tr>
<tr>
<td>Percentage</td>
<td>100  82  94  97  100</td>
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INTRODUCTION

1.1 Background

In September 2006, The Victorian Forest Alliance (VFA) released a report “Choosing a Future for Victoria’s Forests” which put forward a plan to exclude logging from 970 000 ha of Victoria’s native forest. The report proposed a transition strategy for the existing forest industry to move from use of native forests to the use of the extensive eucalypt plantation resource that has been established over the last decade in Victoria.

The Australian Conservation Foundation (ACF) and The Wilderness Society (TWS) subsequently commissioned a report to examine the social and economic implications of the proposed transition strategy. The report was prepared by the National Institute of Economic and Industry Research (NIEIR), and is titled “Opportunities, issues and implications for a transition of the Victorian wood products industry from native forests to plantations” (the NIEIR Report). This report was published in August 2009.

NIEIR is a private economic research, consulting and training group. As NIEIR is not a forest industry specialist, it has referenced a number of publicly available documents to support the technical assumptions in the report.

VicForests and Australian Paper have elected to collaborate in engaging Pöyry to comment on the technical aspects of the transition strategy proposed by the VFA and covered in the NIEIR Report. The ACF and TWS are, in particular, pressing for use of plantation wood from Western Victoria as the immediate source of all pulpwood for Australian Paper’s Maryvale mill site. Both VicForests and Australian Paper are uncertain regarding the economic, social and environmental sustainability of this wood source versus the current native forest resource.

Pöyry is a management consulting company focussing on the forest and energy industries and is thus well placed to utilise its in-depth industry knowledge to review the key assumptions in the NIEIR Report.

1.2 Terms of Reference

The objective of Pöyry’s work has been to prepare an independent review of the NIEIR Report, focussing on the key assumptions used to underpin the report’s conclusions.

1.3 Structure and Scope of Report

Pöyry’s report, which follows, is structured to analyse each of the main issues presented in the NIEIR Report including:

- The availability of the hardwood plantation logs from Western Victoria
- The transition of the pulpwood processing industry to plantation wood
- The transition of the sawmilling industry to plantation wood
- The quantity and value of carbon emissions from native forest harvesting
- The pricing of the native forest resource and regional employment issues
- The value of water collection lost through native forest harvesting.

While this report does not follow the NIEIR Report chapter by chapter, the main issues and assumptions raised in the NIEIR Report are covered. As the NIEIR model contained in the NIEIR Report appendices was not available, Pöyry did not review the model outputs.

The NIEIR Report and the “Choosing a Future for Victoria’s Forests” report which underlies the NIEIR Report are based on a desire to protect environmental values of the native forests by preventing further commercial forestry harvesting in these forests. This report does not argue the merits for or against this objective. Instead, Pöyry has focussed on reviewing the technical, economic and social assumptions and analyses used by NIEIR to conclude the feasibility of meeting this objective by requiring the Victorian forestry industry to transition from native forest wood to plantation wood.

Much of the data quoted in the NIEIR Report is now a few years old. Pöyry has provided updated data where relevant to support its arguments, but has not attempted to update all of the data put forward in the NIEIR Report. There have also been other developments in the industry in the two years since the NIEIR Report was published, such as the fact that the sawmills in Victoria and Tasmania that were processing some plantation eucalypt sawlogs for structural grades have stopped doing this, and there have been further developments with the Managed Investment Schemes (MIS) for plantations. Some new research reports and developments in Government policy are also referred to in this report which were not available to NIEIR. Hence, Pöyry has benefited from more recent information during its review of the NIEIR Report.
PLANTATION WOOD

2.1 Availability

The NIEIR Report states that the hardwood plantations, mainly in Western Victoria, will provide 3.5 million m$^3$/a of eucalypt hardwood. The report points out that this is well in excess of the quantity of native forest hardwood harvested by VicForests to supply the sawmilling and pulpwood industries in Victoria and thus can replace the native forest wood currently sold by VicForests.

VicForests’ annual report of 2009/2010 shows its total sales of native forest wood to have been 1.8 million m$^3$, of which 580 000 m$^3$ was sawlog and 1.2 million m$^3$ pulpwood. The pulpwood was sold to Australian Paper for processing into pulp and paper at its Maryvale mill site in Gippsland and to Midway and South East Fibre Exports (SEFE) for export pulpwood.

Pöyry projects the annual log supply from Western Victoria to peak at about 4 million m$^3$/a in 2015. The supply will then decline significantly driven by the area of current plantations that is not replanted after harvesting.

The plantations established in Western Victoria are *Eucalyptus globulus* (blue gum). The first crop of these plantations was mainly financed by MISs that are now largely inactive. The MIS companies significantly overpaid for some land and land leases during periods of competition for plantation development sites. With the demise of these schemes, the forecast returns for a second plantation crop will be insufficient to justify replanting or coppicing of all plantations after the first plantation crop has been harvested. This means that a proportion of harvested plantations will revert to agricultural or softwood plantation uses which will limit the long-term supply from 2020.

Pöyry has developed a financial model to estimate the maximum land-paying capacity of coppiced *E. globulus* plantations in Western Victoria. The key model assumptions and results are provided in Appendix 1. The export parity log price used in the model for land-paying capability is based on the price of pulpwood woodchip sales to Japan. Pöyry estimates that a portion of the increasing supply around the peak period of 2015 will be sold to China at much lower prices, especially if the proposed Gunns pulpmill in Tasmania does not proceed. Lower export prices would reduce the export parity price required to be paid by the Maryvale mill site. However, it would also mean that an even larger proportion of plantations are likely to revert back to agricultural or other uses.

The financial model indicates that plantations with average growth rates may not be financially viable if the land-holding cost is greater than AUD290/ha/a, equivalent to a freehold value of about AUD4 100/ha.

The exact distribution of current land costs is unknown, and there is not yet enough harvesting of *E. globulus* plantations in Western Victoria to observe a trend in any loss of plantation area. However, Pöyry expects that forest managers may lose up to half of Western Victorian plantations to other species or land uses following initial harvest. As a result of this and the lack of recent planting, Pöyry estimates that the peak pulpwood supply volume for the Green Triangle will decrease by up to 50% by 2020 from a peak of about 4 million m$^3$/a in 2015.
The plantations in Western Victoria were established to supply export pulpwood markets in Asia. Hence, any diversion for use by the domestic industry will result in loss of export income from the diverted resource.

An industry has been built up around these plantations on this basis and has been investing to process and export the project volume of wood. Specific investments include:

- South West Fibre has invested about AUD30 million in a 1.1 million m³/a capacity chipmill at Myamyn.
- Gunns has recently established an export pulpwood facility at the Port of Portland. Pöyry understands that this facility is required to pay penalty fees if it does not export a specific volume of woodchips (1.5 million t/a) through Portland.

The region’s chip exporters are actively marketing the growing supply of pulpwood logs. In addition, Gunns has announced that it will ship approximately 1 million m³/a of plantation wood from Portland to its proposed Bleached Hardwood Kraft Pulp (BHKP) mill in Tasmania to make up for the shortfall of plantation hardwood in that state. Gunns has taken over as the Responsible Entity for some of the MISs, in Western Victoria thus its supply requirements are secured.

The plantations are not a state-owned resource that can be allocated to domestic processors. The private owners of the plantations will seek to maximise the price they receive for the resource.

While there should be sufficient resource to meet the requirements of Australian Paper over the next decade, there will be competition for this resource. In the longer term, the supply will tighten and could push up prices. The need for Australian Paper to purchase the pulpwood from private investors means there is reduced security over this supply which is critical to meet the company’s requirements if native forest logs are not available.

A key issue is that Nippon Paper, who has just invested AUD600 million in purchasing Australian Paper, loses the long-term security of supply and wood price that the company now has under a State Government-backed contract and must rely on buying wood on the open market and on ongoing replanting by investors.

**Conclusion**

While Pöyry supports the NIEIR observation that, over the next 10 years, the potential supply of plantation-grown hardwood pulpwood from Western Victoria greatly exceeds the requirements of the Maryvale mill site, the available supply to Maryvale will be less than the total supply due to commitments and there will be competition for the resource. Pöyry expects that it would be possible to purchase the pulpwood required for Maryvale provided the Japanese-based export parity price is paid. After 2020, the supply from Western Victoria is expected to decline as unprofitable plantations are not replanted to *E. globulus*. This is expected to make the supply of pulpwood from Western Victoria to Maryvale more difficult and add some risk to supply in the future in terms of the amount available and/or price to be paid.
2.2 Pulpwood Quality

Pöyry agrees with the NIEIR conclusion that *E. globulus* plantation wood is a high-quality pulpwood.

*E. globulus* is recognised by the global pulp and paper industry as one of the best species of pulpwood. This is a key reason why the species has been planted in Western Victoria (and also why it is not necessarily a good species for sawlogs).

The benefits are:

- The wood has high basic density (kg dry fibre/m$^3$ of wood) for a plantation species, thus giving more dry tonnes of wood fibre per cubic metre of wood. (However, it must be noted that this factor is taken into account in the pricing of *E. globulus*. It is typically sold on a Bone Dry weight-basis so the higher basic density results in a higher price per m$^3$.)

- It has a high-pulping yield (kg dry wood/kg pulp) in the kraft pulping process compared with many other eucalypt species, meaning a higher amount of bleached kraft pulp can be produced per dry tonne of wood.

- The higher yield also means that less black liquor (wood residues and spent cooking chemicals) is produced in the kraft pulping process. For some pulpmills that have their capacity limited by the recovery boiler which burns and processes black liquor, this means there is potential to increase the pulp production.

- The pulp is considered a high-quality fibre for producing printing and writing papers.

- Compared to many native forest wood types, plantation wood is generally a much more uniform wood type to process, which results in a better-quality pulp.

One disadvantage of the smaller amount of black liquor residues to burn (due to the higher pulping yield) is that the amount of steam and electricity produced from this source decreases and must be replaced by fossil fuels.

These considerable net benefits are the reason why the market pays a higher price for hardwood pulpwood from plantations than for pulpwood from native forests.

The differences between the two wood types mean that to compare the stumpage prices paid for plantation and native forest wood is invalid. The market currently pays an FOB price of AUD207/BDt for plantation wood and AUD189/BDt for native forest wood. Since port charge, chipping, harvesting and transport costs can be similar for the two wood types, the difference in the market FOB price reflect very significant differences in the stumpage prices.
3 TRANSITION OF PULPWOOD PROCESSORS

In the transition strategy, evaluated by the NIEIR Report, the forest industry processing native forest wood from Victoria would lose access to the majority of this wood source. For the industry processing pulpwood in Victoria the implications are:

- Australian Paper’s Maryvale mill site would be required to change its log intake to 100% plantation wood. The implications of this are reviewed in sections 3.2–3.6 below.
- The two companies exporting native forest pulpwood chips, Midway from Geelong and SEFE from Eden, would only be able to export pulpwood from plantations and possibly a quantity of native forest sawmill residues from the small amount of sawlog processing still allowed under the “Choosing Our Futures” scenario. The implications of this are discussed in section 3.1 below.

3.1 Pulpwood Quantity for Maryvale

Native Forest Replacement

Australian Paper operates two pulpmills processing hardwood pulpwood at its Maryvale site:

- A BHKP mill producing a high-quality bleached pulp for printing and writing paper grades
- A Neutral Sulphite Semi Chemical (NSSC) mill producing a lower-cost unbleached pulp, to provide stiffness for packaging boards.

Pöyry’s estimates of the capacity and wood requirements for each of these mills are shown in the table below.

<table>
<thead>
<tr>
<th>Pulpmill</th>
<th>Pulp Production t/a</th>
<th>Wood Consumption</th>
<th>Wood Type current (m³/a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BHKP</td>
<td>210 000</td>
<td>3.6</td>
<td>756 000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>300 000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>456 000</td>
</tr>
<tr>
<td>NSSC</td>
<td>75 000</td>
<td>2.3</td>
<td>174 000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>285 000</td>
<td>930 000</td>
<td>300 000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>456 000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>174 000</td>
</tr>
</tbody>
</table>

Source: Pöyry estimates, Australian Paper.

The mill already gets about one third of its hardwood pulpwood from plantations, as well as all of its softwood pulpwood from plantations. Of the native forest volume used, Pöyry estimates that about 80 000 m³/a of this would come from sawmill residues.

Under the transition strategy proposed in the NIEIR Report, the availability of sawmill residues in Gippsland would decrease, with the sawn timber industry relocating to Western Victoria. Pöyry has assumed that approximately 30 000 m³/a of sawmill residues would be available after the transition strategy has been fully implemented. Hence, the amount of native forest pulpwood to be replaced by hardwood plantation pulpwood under the transition strategy would be about 600 000 m³/a.
NIEIR has assumed a figure of 500 000 m\(^3\)/a of pulpwood to be replaced. In Pöyry’s view, this is too low and therefore the cost of the transition strategy is underestimated.

**Plantation Pulpwood Requirements**

Pöyry agrees with the NIEIR’s conclusion that the plantation wood is a better-quality pulpwood than native forest pulpwood, but believes that the NIEIR Report has overestimated these benefits.

The NIEIR Report has assumed the benefit of the *E. globulus* as follows:

“For this study, an estimate has been made of the improved fibre yield from Bluegum of 15% and improved productivity from the superior processing capabilities of five per cent.”

The exact meaning of the “improved fibre yield” and “superior processing capabilities” is not provided by the NIEIR Report.

In Pöyry’s view, the benefits of *E. globulus* to Maryvale need to be considered separately for the two pulpmills.

**BHKP mill** - For the BHKP mill, the native forest wood used is the regrowth *E. regnans* (mountain ash) species. This is actually a high-quality and very uniform pulpwood for a native forest species. The table below summarises the difference in basic density and pulp yield (as measured by cooking in laboratory conditions) between *E. globulus* and regrowth *E. regnans*.

**Table 3-2:**

*Pulping Properties of Plantation E. globulus and Regrowth E. regnans*

<table>
<thead>
<tr>
<th>Property</th>
<th>Units</th>
<th><em>E.globulus</em></th>
<th><em>E.regnans</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Years</td>
<td>10</td>
<td>15 – 55</td>
</tr>
<tr>
<td>Yield (dry pulp/dry wood)</td>
<td>%</td>
<td>55</td>
<td>53 – 56</td>
</tr>
<tr>
<td>Basic density</td>
<td>BDkg/m(^3)</td>
<td>533</td>
<td>455 – 517</td>
</tr>
</tbody>
</table>

The table clearly shows the density benefits of *E. globulus*. Taking the average basic density of range quoted for the *E. regnans* species in the table above of 486 BDkg/m\(^3\) compared to the figure for plantation *E. globulus* of 533 BDkg/m\(^3\) indicates that 9% less volume of *E. globulus* is required to give an equivalent amount of bone dry fibre.

In regard to cooking yield, while some native forest eucalypt species have cooking yields of only 48%, the *E. regnans* species used at Maryvale has a significantly higher cooking yield that is only slight lower than the *E. globulus*. When the *E. regnans* is mixed with other native species such as *E. sieberi* (silvertop ash) and *E. delegatensis* (alpine ash), the yield difference would be slightly more and probably in the vicinity of 1.5%. A cooking yield difference of up to 1.5% means a yield of 55% for *E. globulus* and 53.5% for *E. regnans*. Hence, the reduced requirement of bone dry weight of pulpwood when changing to *E. globulus* is 3% (1-53.5%/55%).

Overall, in Pöyry’s view, the reduced pulpwood volume requirement of the BHKP mill as a result of changing from regrowth *E. regnans* to plantation *E. globulus* is about 12% (9% for basic density differences and 3% for cooking yield differences.)
Pöyry has also evaluated the impact of the higher yield of *E. globulus* on the mill capacity and energy requirements. The higher yield would allow a small increase in capacity of the BHKP mill in the order of 30 t/d of pulp, but would require an additional 500 GJ/d of gas to compensate for the reduction in steam generated from the renewable black liquor fuel. As this magnitude of costs is small (<AUD1 million/a), compared to the total cost impact of the change to plantation wood, it has not been included in the final cost impact analysis.

NSSC mill – For the NSSC mill, a lower-quality pulpwood of mixed eucalypt species is used. This is a high-yield pulp compared to BHKP, and the main quality parameter is its stiffness. Hence, in Pöyry’s view, the superior kraft pulping characteristics of *E. globulus* would not be fully utilised.

At the same level of pulp cooking, there is only a very marginal cooking yield difference in favour of plantation wood. However, additional cooking of the younger plantation wood is required to achieve the same strength. Therefore, in Pöyry’s opinion, any benefits in bone dry wood consumption from substituting native eucalypt with plantation wood in the NSSC plant are unlikely.

Pöyry has assumed that the same benefits relating to basic density can be achieved for the NSSC pulpwood, although some of the mixed species of eucalypt may have some high basic densities which could reduce this benefit.

**Conclusion**

The NIEIR Report has underestimated the volume of plantation pulpwood that will be required by the Maryvale mill.

The NIEIR Report’s estimate of a 20% reduction in the volume of pulpwood required if regrowth *E. regnans* is replaced by *E. globulus* plantation wood is high. In Pöyry’s view, the benefit is only a 12% reduction in volume for the BHKP mill and 9% for the NSSC mill, giving a weighed average benefit of only 11.5%. In fact, the 9% component of this reduction, which is due to the basic density difference, does not represent a real reduction of pulpwood cost as the *E. globulus* volumetric price is adjusted up to compensate for the higher density.

The amount of *E. globulus* pulpwood to be transferred from Western Victoria to Maryvale is therefore 531 000 m³/a (600 000 m³/a of native forest pulpwood to be replaced multiplied by a quality benefit of 89.5%).

**3.2 Transport**

The NIEIR Report bases the cost estimates for transporting plantation pulpwood to Maryvale on the assumption that it will be transported by truck.

The NIEIR Report states that the alternative of road transport are standard- and broad-gauge rail, but the cost of these methods is difficult to estimate. Pöyry agrees with the NIEIR Report that using standard-gauge rail is unlikely as it would require transferring logs or chips from standard- to broad-gauge at Dynon, Melbourne.

Woodchips or pulplogs could be transported using the broad-gauge railway line from Warrnambool or Dennington siding to Maryvale. The rail distance from Dennington siding to the Maryvale mill site is 425 km. The distance from the
The closest area of Bessiebelle is 66 km from Dennington siding\(^3\). The cost of establishing a log yard at Dennington or Warrnambool unloading trucks, storing logs and loading trains would imply that the rail transport costs would need to be much cheaper than the cost of transport by road only.

In Pöyry’s opinion, road is likely to be the most cost-effective method of transporting logs to Maryvale. Despite the fact that a number of pulpmills, woodchip mills and export woodchip ports have rail links today, only a very small proportion of pulpwod is transported by rail in Australia. A key difficulty in making rail competitive is the need to double-handle the pulpwod. Pulpwod has to be loaded onto trucks initially at the harvesting site, thus there will always be an additional cost of unloading the log trucks at the rail siding and then reloading them onto trains.

Pöyry has assumed AUD0.11/t/km to be a reasonable freight rate that could be achieved, with a flagfall of AUD2.30/t. This is based on earlier log haulage costs studies undertaken by Pöyry in Australia. It assumes long-term contracts and the use of high payloads of up to 45 t/vehicle, utilising major roads.

Based on these freight assumptions, Pöyry has estimated an average transport cost to deliver the Western Victorian pulpwod to Maryvale of AUD48/m\(^3\). This figure is significantly higher than the AUD30/m\(^3\) estimated in the NIEIR Report.

The pulpwod to be transferred from Western Victoria to Maryvale requires an additional 65 movements/day of large trucks from Western Victoria through Melbourne to Maryvale. This transport has implications for the maintenance of roads, regional safety and greenhouse gas emissions.

**Conclusion**

The transport of logs from Western Victoria is most likely to be achieved by road as it does not incur the costs of unloading from trucks, loading trains and maintaining a stockpile at a railway siding. The initial required volume to be transported is an estimated 531 000 m\(^3\)/a. However, this is expected to increase over time if a hardwood plantation establishment program cannot be stimulated in Gippsland.

The transport costs as estimated in the NIEIR Report are about AUD18/m\(^3\) too low.

### 3.3 Pulpwood Price at Maryvale

The NIEIR Report quotes a price for native forest pulpwod at Maryvale of AUD51.61/m\(^3\) based on VicForests reports of 2008. There is no publicly available data on the actual price paid by Maryvale, but Pöyry has calculated the average delivered pulpwod price of AUD62/m\(^3\) based on the VicForests annual report of 2009/2010. (This includes supply to Midway and SEFE but, in Pöyry’s view, can be considered a reasonable estimate for Maryvale wood costs.) The difference between the estimate stated in the NIEIR Report and the Pöyry estimate is partly explained by escalation over the last two years.

The NIEIR Report states a price for the plantation pulpwod of AUD100/m\(^3\) as woodchips at Portland. This is partly based on a quoted FOB woodchip price, but no detailed derivation of this price is provided. Adding a transport cost of

---

\(^3\) Dennington siding last used in 2002.
AUD30/m³ which the NIEIR Report has estimated (again limited details of the basis are provided) gives a total estimated delivered cost of pulpwood woodchips at Maryvale of AUD130/m³.

Pöyry has undertaken a more detailed analysis of the likely cost of Western Victorian plantation wood delivered to Maryvale. In Pöyry’s view, the pulpwood required by Maryvale could be supplied from the plantations in Western Victoria closest to Maryvale so that it is unnecessary to use Portland as the centre of the wood supply. This means that logs would be transported to Maryvale and chipped at the mill rather than pulpwood taken to Portland, chipped and then transported to Maryvale. Thus, Pöyry believes the transport distances stated in the NIEIR Report are overestimated.

There are plantations in the Otway region, south-west of Geelong which could be utilised, although they are of insufficient scale to supply all of the requirements and therefore some pulpwood will need to be purchased from further afield. The closest large area of largely uncommitted *E. globulus* plantations is surrounding Branxholme south of Hamilton. Pöyry has assumed that 25% of the pulpwood will come from the Otways and 75% from Branxholme.

Table 3-3 below shows the estimated price of logs delivered from Branxholme and the Otways region. The delivered price is derived based on the current market price for export woodchips sold FOB at Portland. This price is then adjusted for various costs relating to the processing and port costs to develop an equivalent export parity price for the pulpwood logs on a truck at the roadside beside the plantations.

The delivered cost to Maryvale is then determined by adding the transport costs.

**Table 3-3:**
**Estimated Price of Plantation Pulpwood from the Otways and Western Victoria**

<table>
<thead>
<tr>
<th>Item</th>
<th>Units</th>
<th>Ex Branxholme</th>
<th>Ex Otways Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Export woodchip price (FOB –Portland)</td>
<td>AUD/BDt</td>
<td>207.40</td>
<td>207.40</td>
</tr>
<tr>
<td>Port costs</td>
<td>AUD/BDt</td>
<td>25.00</td>
<td>25.00</td>
</tr>
<tr>
<td>Basic density</td>
<td>BDt/m³</td>
<td>0.53</td>
<td>0.53</td>
</tr>
<tr>
<td>Round wood equivalent price</td>
<td>AUD/m³</td>
<td>97.22</td>
<td>97.22</td>
</tr>
<tr>
<td>Fees</td>
<td>%</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Stock loss in processing</td>
<td>%</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Chips at port gate</td>
<td>AUD/m³</td>
<td>94.30</td>
<td>94.30</td>
</tr>
<tr>
<td>Chipping cost</td>
<td>AUD/m³</td>
<td>7.00</td>
<td>7.00</td>
</tr>
<tr>
<td>Logs delivered to port gate</td>
<td>AUD/m³</td>
<td>87.30</td>
<td>87.30</td>
</tr>
<tr>
<td>Transport to Portland</td>
<td>AUD/m³</td>
<td>9.01</td>
<td>0.00</td>
</tr>
<tr>
<td>Export Parity price at roadside</td>
<td>AUD/m³</td>
<td>78.29</td>
<td>87.30</td>
</tr>
<tr>
<td>Transport to Maryvale</td>
<td>AUD/m³</td>
<td>54.77</td>
<td>27.16</td>
</tr>
<tr>
<td>Cost delivered to Maryvale</td>
<td>AUD/m³</td>
<td>133.06</td>
<td>114.46</td>
</tr>
<tr>
<td>Cost delivered to Maryvale (average)</td>
<td>AUD/m³</td>
<td>128.41</td>
<td></td>
</tr>
</tbody>
</table>

The average weighted cost for delivery of pulpwood logs to Maryvale from Western Victoria is AUD128/m³. This is approximately twice the average price of pulpwood delivered to the mill today.
3.4 Additional Cost of Transition Strategy for Maryvale

Pöyry has estimated the total additional cost to replace the native forest pulpwood used at Maryvale with plantation pulpwood from Western Victoria using the assumptions discussed above.

The calculations are summarised in the table below, and show that this component of the proposed transition strategy would cost AUD31 million/a.

Table 3-4: Additional Annual Cost to Maryvale of Transition Strategy

<table>
<thead>
<tr>
<th>Item</th>
<th>Units</th>
<th>AUD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume of Native forest wood to be replaced</td>
<td>m³/a</td>
<td>600 000</td>
</tr>
<tr>
<td>Current delivered price</td>
<td>AUD/m³</td>
<td>62.00</td>
</tr>
<tr>
<td>Current Cost</td>
<td>AUD million</td>
<td>37.2</td>
</tr>
<tr>
<td>Volume of native forest wood to be replaced</td>
<td>m³/a</td>
<td>600 000</td>
</tr>
<tr>
<td>Basic density and yield adjustment</td>
<td>%</td>
<td>11.5</td>
</tr>
<tr>
<td>Substitute volume</td>
<td>m³/a</td>
<td>531 000</td>
</tr>
<tr>
<td>Cost of plantation pulpwood</td>
<td>AUD/m³</td>
<td>128.41</td>
</tr>
<tr>
<td>Total Cost</td>
<td>AUD million</td>
<td>68.2</td>
</tr>
<tr>
<td>Additional Cost</td>
<td>AUD million/a</td>
<td>31.0</td>
</tr>
</tbody>
</table>

The NIEIR Report estimates the cost to be AUD22.8 million/a which, in Pöyry’s view, is too low. The main reason for the differences between the Pöyry estimate and that of the NIEIR Report are:

- Pöyry has undertaken a more rigorous approach to estimating the cost per cubic metre of both the native forest pulpwood and the plantation wood. Pöyry has actually estimated a higher cost of the native wood and a lower cost for the plantation wood than that stated in the NIEIR Report.
- Pöyry has also undertaken a more rigorous approach to estimating the freight costs. The NIEIR Report has not provided details of how the freight cost of AUD30/m³ is derived from its estimate of 7 hours additional travel time. Pöyry’s calculated average freight cost is AUD48/m³, which is significantly higher.
- The NIEIR Report considers that, since Australian Paper had committed to buying 200 000 m³/a of plantation wood from plantations which Macquarie was to establish in Gippsland, the additional cost of purchasing this component should not be included in the total additional costs of the transition strategy. In Pöyry’s view, only a small proportion of these Gippsland plantations have been established and they only partly balance the decrease in plantation wood expected from HVP. This 200 000 m³/a is currently coming from native forest wood so an additional cost can be considered, to transition this to plantation pulpwood. (The reasons why the Macquarie plantations have not been established as originally intended are discussed in section 3.7.)
- As discussed earlier in this report, the estimates stated in the NIEIR Report of the efficiency savings and improved yield of E. globulus are too high.
- A cost for the ‘impact on chipper operations’ at Maryvale of AUD1.5 million was included in the NIEIR calculation. Pöyry has assumed that logs will be transported and chipped at Maryvale, consequently Pöyry has not included this cost.
The differences between the Pöyry estimate and the estimate of the NIEIR Report show that, in some cases, Pöyry believes the NIEIR has over-estimated the cost impacts, whereas in other areas, such as freight cost and volumes required, the NIEIR has under-estimated costs.

Overall, in Pöyry’s view, the cost impact of this component of the proposed transition strategy is AUD31 million/a, and not the estimated AUD22.8 million/a as stated in the NIEIR Report.

In addition, diverting the 531 000 m³/a of plantation wood to Maryvale means the loss of export income from this resource. At the current price of AUD110/m³ this equals AUD58 million/a.

3.5 Competitiveness and Profitability Impacts on Maryvale

The NIEIR Report is not specific about how the additional cost would be covered. The report states that:

“It is expected that as a result of imposing this change of circumstance on the Mill the Government would be asked to contribute to the additional costs involved, particularly the additional transport costs.”

There is also a suggestion that carbon credits may be used to cover the cost. This is discussed in section 4 of this report.

In Pöyry’s view, if Australian Paper had to cover the additional cost of pulpwood under the transition strategy, the impact on the company’s profitability and competitiveness would be significant. The company’s assets are relatively small and old by world standards. This, together with the relatively high labour costs in Australia and the high value of the AUD, means Maryvale is not in a strong competitive position, even before any additional costs of the transition strategy are imposed.

Since Nippon Paper’s acquisition of Australian Paper, the company’s profits have not been reported separately. The most recent report of earnings is in the PaperlinX 2008/2009 annual report, where the earnings before interest and tax of the assets that now make up Australian Paper are reported as:

- Year to June 2009   AUD36.5 million (11 months only)
- Year to June 2008   AUD30.8 million.

The results to June 2009 include six months of operation with the pulpmill upgrade. While a full year of operation could be expected to show increased earnings, the significant increase in the value of the AUD since 2009 is likely to have had a considerable negative impact.

While it is difficult to estimate the current level of profit of Australian Paper, the figures above indicate that imposing an additional cost of AUD31 million/a on Australian Paper would eliminate a substantial proportion, if not all, of the company’s profit.

Figure 3-1 below provides an indication of the profitability pressures that Australian Paper is under. It shows price trends for the major grade made from eucalypt pulpwood; uncoated woodfree paper (or copy paper).
Pöyry has also made its own estimates of the manufacturing costs for BHKP at Maryvale using its proprietary cost-competitiveness model. Figure 3-2 below shows the estimated cash costs of production under the current wood supply arrangements and compares them with the cash costs forecast under the transition strategy. These costs are also compared with Pöyry’s estimate of the long-term trend cost of BHKP purchased in the market and delivered to Maryvale.

Pöyry estimates that the additional wood cost will increase the cost of BHKP manufactured at Maryvale by about 22%.

Alternatively, if the costs of the plantation pulpwood are to be paid for by the Government, then this represents a significant subsidy to Australian Paper. This proposed subsidy of the Maryvale mill wood costs of AUD31 million/a is inconsistent with other sections of the NIEIR Report where it is argued that native forest wood costs are subsidised and therefore are not competitively neutral and should be stopped.
3.6 **Pulpwood Exporters**

The NIEIR Report presents only a limited explanation of how the loss of the native forest pulpwood resource used by the existing pulpwood exporters will be managed. For Midway, it is suggested that:

“The company would most likely accelerate development of its own plantation estate and estates it manages on behalf of others”.

For SEFE it is suggested that:

“The Eden plant would become more dependent on Forests NSW and private plantations in the region.”

Prior to the Global Financial Crisis (GFC), these pulpwood exporting companies were already exporting all of the pulpwood they could economically obtain. In the case of the Eden mill, there are few hardwood plantations in the region for it to rely on. Forests NSW has no commercial hardwood plantations in the region, so increased reliance on Forests NSW implies obtaining additional native forest resources from southern NSW.

For these companies, the plantation pulpwood would not be a substitute for the native forest wood as, from what Pöyry understands, they would have been planning to export all plantation pulpwood they could purchase anyway. Hence, the transition strategy means they would simply lose the sales and income from the native forest pulpwood.

In the past, all pulpwood available to pulpwood exporters could be exported. However, it is recognised that there is some uncertainty in the Asia-Pacific pulpwood markets at present. The major pulpwood market of Japan is soft and only slowly recovering from the GFC, the high value of the AUD against the USD has reduced the competitiveness of Australia’s pulpwood exports and significant volumes of additional pulpwood are becoming available in Australia. On the other hand, pulpwood demand from China is increasing rapidly and, if Gunns’ BHKP
mill proceeds, that will remove 4.7 million m$^3$/a (or 12%) of pulpwood from the Asia-Pacific markets.

Hence, at this time it is difficult to determine whether the native forest pulpwood that would be removed from the market under the transition strategy represents a loss of that export income, or whether it represents volume that would have been lost from the market anyway.

3.7 Potential to Expand Hardwood Pulpwood Plantations in Gippsland

As identified in the NIEIR Report, the proportion of pulpwood from Western Victoria could be decreased over time if hardwood plantations can be established in eastern Victoria. However, only small areas of hardwood plantations have been established in Gippsland over the previous decade.

The NIEIR Report cites from a study by the BRS\(^4\) on plantation productivity potential in Gippsland that “more than 300 000 ha of land suitable for E. nitens (shining gum) was identified with a mean annual increment (MAI) of more than 20”. The NIEIR Report also states that the sites are available to grow plantations but that a key issue is the return available to the grower compared to other potential land uses.

Current Constraints

In Pöyry’s view, the economic return is a key issue that has limited expansion of plantations in Gippsland. There has been limited expansion of plantations during the last decade, even when a lot of money for plantation investment was available from MISs.

During the period of rapid hardwood plantation expansion from 2000 to 2009, the area of plantations increased in the Green Triangle by an average of 10 947 ha/a, while the increase in Central Gippsland averaged only 1 303 ha/a over the same period.

Table 3-5: Hardwood Plantation Area in the Green Triangle and Gippsland

<table>
<thead>
<tr>
<th>NPI Region</th>
<th>2000</th>
<th>2005</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green Triangle</td>
<td>66 129</td>
<td>129 399</td>
<td>164 649</td>
</tr>
<tr>
<td>Central Gippsland</td>
<td>27 101</td>
<td>33 298</td>
<td>38 828</td>
</tr>
</tbody>
</table>

Source: BRS

Pöyry understands that the key reasons for the lack of plantation investment in Gippsland relative to the Green Triangle were:

- Increasing land costs. Land cost increased to over about AUD4 000/ha per net planted ha for freehold and over AUD250/ha/a for leased land. Consequently, the investments were not financially attractive relative to investments in the Green Triangle.

- Reduced growth expectations due to drought in East Gippsland and suspected adverse long-term climate change effects.

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Other factors that made Gippsland less attractive than the Green Triangle included:

- Smaller properties resulting in increased costs per hectare.
- Community opposition.
- Lack of access to markets. There is no established woodchip export facility in eastern Victoria. The Midway export facility at Geelong is the closest access to the export market but is not within an economic distance\(^5\) which makes Australian Paper the only competitive buyer.

The experience to date of hardwood plantations in Gippsland has not been good:

- The largest owner of hardwood plantations in Gippsland is HVP. Unsuitable soils have resulted in poor yields from some HVP hardwood plantations. Following harvest, HVP is only replanting just over half of its existing Gippsland hardwood plantations back to hardwood plantations, with the remainder replanted to pine or native forest. Consequently, the long-term supply from these plantations is expected to decline in the medium term.
- Only a small proportion of the Macquarie MIS plantations expected to be planted in Gippsland under and earlier off-take agreement with Australian Paper, were established. This lack of establishment was due to the reasons discussed above. Hence the expected production of 200 000 m\(^3\)/a which NIEIR has used in its estimates is significantly overstated. The Macquarie plantations in Gippsland may only be sufficient to partly compensate for the decline of supply from the HVP plantations.

In the past, the financial and market risks of Gippsland made it unattractive for plantation establishment. The tightening of finances following the GFC and the reduction in sales of MISs make investment in new plantations in Gippsland even less likely now than in the last decade.

**Encouraging Plantations**

Pöyry has developed a financial model for the establishment of new pulpwood plantations. The financial model assumptions and results are detailed in Appendix 2.

The model forecasts a post-tax real internal rate of return (IRR) from new hardwood plantation of 2.6\(^6\). In Pöyry’s opinion, the required IRR for corporate investment is about 7\%, implying that new plantations will not be established if current costs and prices are maintained.

However, if new plantations were subsidised sufficiently through a partial rebate in establishment costs or a guaranteed higher log price, then the subsidy would encourage new plantations at a cost less than the cost of transporting wood from Western Victoria to Maryvale. If subsidies were commenced now and plantations established at the rate of 3 200 ha/a over the next 10 years, then Maryvale could be reliant on Gippsland pulpwood from 2022. Pöyry estimates that the subsidies would need to be about AUD7 million/a. If the transition strategy were to be implemented now, the subsidy of AUD31 million/a to cover transport of pulpwood

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\(^5\) For example the distance from Geelong to Churchill is 226 km, the estimate road transport cost AUD29/m\(^3\).

\(^6\) This is less than the estimated IRR from coppiced plantations in discussed in Section 3.1 due to greater establishment costs.
from Western Victoria would still be required until 2022, when the Gippsland plantations would start producing.

Apart from the cost involved in the subsidies, there are also risks to this strategy, as new plantation establishment would still be subject to other factors restricting plantation development. These include community opposition and uncertainty surrounding potential water licenses for plantations.

Conclusion

Hardwood plantations establishment rates in Gippsland have been modest over the last decade, and the total hardwood plantation estate area is expected to decline as poor performing plantations are replanted to softwood. The limiting factor for plantation establishment has been the poor economic returns. However, if plantations were subsidised through rebating part of establishment costs or by guaranteed higher log prices, plantation establishment programs would be encouraged. If at least 3 220/ha is established, then the requirement to transport logs from Western Victoria will be negated by 2022.

This would be a challenging target to achieve and also requires Government subsidies.
TRANSITION OF THE SAWMILLING INDUSTRY

The current Victorian hardwood sawmilling is focused on the production of high-value appearance grade products from native forest sawlogs. Historically, hardwood timbers have dominated the structural timber market within Australia, but have been displaced from this market by plantation-grown softwoods that are cheaper and are less complicated to saw and dry.

Due to its ability to sell part of its production into the higher-value appearance-grade market, the Victorian hardwood processing industry is competitive. Cost efficiencies are achieved because structural products and pulpwood are also produced as secondary products in the same harvest and extraction operation as the appearance-grade material.

The transition strategy proposed for the sawmilling industry requires the industry to lose its access to the majority of its native forest wood sawlog supply. In the NIEIR Report, the conclusion is made that some sawn timber products would be available from plantation sawlogs within 0-5 years of commencement of the transition. Some “select” grade appearance products would start to be available within 5-10 years and only 5-10% currently produced from native forests would need investment in new plantations which would require 25-30 years.

The NIEIR Report bases the transition from native forest sawlog to plantation sawlog supply on a two-pronged strategy:

- Converting some of the existing hardwood pulp plantations in Western Victoria to sawlog regimes
- Establishing new sawlog plantations in Victoria.

The NIEIR Report does not clearly state an assumption about the relative contribution that converted “existing” pulp plantations and “new” sawlog plantations would make to these different product categories. However, the short time frame allowed for by the NIEIR Report implies that it is the existing pulpwood stands, which have not been pruned and thinned, that are expected to yield the first output of appearance-grade products within 5-10 years of commencement of the transition. In Pöyry’s view, this assumption is highly optimistic and contrary to any established body of research into the yield potential of plantation sawlog resources in Australia.

A fundamental issue, which is not properly considered throughout the NIEIR Report, is that the timber from plantation-grown eucalypt does not have the same wood properties or sawing behavior as native forest timber of the same species. In Pöyry’s view, the key differences are:

- The relatively small dimensions of plantation-grown timber
- High inherent growth stresses and shrinkage
- Lower density and lighter colour.

These factors result in lower productivity in the sawmill and lower-quality sawn timber for the market.

Growing eucalypt plantations for sawlogs also presents technical and economic challenges that have not been fully considered in the NIEIR Report’s evaluation of the transition strategy.
The NIEIR Report references several research studies funded by FWPA, CRC Forestry and ACIAR to demonstrate that it is technically possible to process plantation-grown eucalypts to solid wood and veneer product. However, the NIEIR Report does not analyse the economic feasibility of these strategies, and simply assumes they are viable on a commercial scale.

The NIEIR Report references two commercial examples of hardwood plantation timber being successfully processed and marketed into sawn timber in Australia:

- FEA’s production of EcoAsh from plantation-grown *E. nitens* in Tasmania
- Victorian Mills processing plantation-grown *E. regnans* timber.

Since the NIEIR Report was written, the FEA has gone into administration, and Pöyry understands its structural EcoAsh product could not compete on price with plantation pine products in the same market sector. The new owner of the FEA sawmill has chosen to only process softwood.

Pöyry understands that the *E. regnans* plantation-grown timber processed in the two Victorian sawmills had lower recoveries than the native forest material. One of the mills that accepted plantation-grown material is closing down and the other only produces low-value pallet wood and garden products from the plantation logs.

Hence, to date, the commercial experience of processing sawlogs from hardwood plantations has not been positive.

In Pöyry’s view, a number of significant technical and economic challenges have to be overcome if the proposed transition to plantation sawlogs is to be viable:

- Silvicultural issues in relation to conversion from pulpwood to sawlog regimes
- Economic viability of sawlog plantations in the Australian cost environment
- Technology for hardwood plantation sawmills
- Plantation timber properties and markets.

These issues are analysed in more detail below.

### 4.1 Silvicultural Issues

#### 4.1.1 Silvicultural Regimes

Eucalypt sawlog silvicultural regimes are managed to maximise the volume of clearwood (i.e. defect-free wood suitable for high-value appearance-grade material) in stems, with acceptable dimensions and form for milling. These objectives are achieved through the thinning and pruning of the stands. This is in contrast to pulpwood regimes that are managed to maximise volume per hectare at the lowest unit cost.

These sawlog regime objectives are achieved through the thinning and pruning of the stands.

**Thinning**

Sawlog plantations are often established at a high initial stocking of typically around 900 to 1 200 stems per hectare (sph). The number of sph is then reduced through one or more selective thinnings to maximise the diameter increment of the
final crop trees. The small areas of *E. globulus* and *E. nitens* in Victoria managed on a sawlog regime would have a non-commercial thinning or re-spacing performed when the stand is between three and four years of age. A later commercial thinning would be performed at 12 to 16 years, when a proportion of the harvest can be sold into the pulpwood market. Final stand stocking at clearfell is normally between 150 and 250 sph.

**Pruning**

In order to maximise clearwood the trees are pruned. In most cases, to save costs, only the trees to be grown to maturity are pruned. Typically, in *E. nitens* and *E. globulus* plantations the first pruning is carried out at around three to four years of age, with one or two subsequent pruning operations before the trees reach six or seven years. The aim of the pruning is to limit the presence of knots caused by branches to the centre of tree in a zone that is known as the defect core. In most cases, plantations are managed to produce a defect core of no more than 15 cm in diameter.

Pruning operations are manual as the operation is selective and requires the careful removal of living and dead branches close to the stem without damaging the bark, allowing the tree to rapidly close the wound. In Australia, where labour costs are high, this operation is expensive. The costs are incurred early in the rotation, and must be carried by the grower until the final harvest and sale of the crop.

Figure 4-1 and Figure 4-2 below show five-year old eucalypt sawlog plantations in Paraguay and eight-year old pulpwood plantations in Western Victoria. The significant difference between plantations managed for sawlogs and pulpwood is obvious.
Figure 4-1:
Five-year old Eucalypt Sawlog Plantations in Paraguay
Rotation Length

Eucalypt sawlog rotations are invariably longer than pulpwood rotations. The NIEIR Report suggests that premium sawlogs species such as *E. regnans* can be managed on a 25-year rotation to produce high-value sawlogs. Currently, *E. regnans* is managed on a 30- to 40-year rotation to produce sawlogs in Victoria. Pöyry believes that it may be possible to grow *E. globulus* and other fast-growing species on a 25-year sawlog rotation on the best sites, but not the premium sawlog species such as *E. regnans*.

4.1.2 Potential to convert from Pulpwood to Sawlog Plantations

One of the options proposed in the NIEIR Report is to convert existing pulpwood plantations to produce sawlogs by changing their management regime.

In Pöyry’s view, this is technically possible when the trees are young, say less than three to four years old, and the plantations have acceptable form. However, the vast majority of the Green Triangle hardwood plantation estate is already over four years of age, and the benefit of pruning will be limited. In addition, *E. globulus* plantations in the region have variable stem quality and, in many cases, tree form would not be acceptable for sawlog production.
Washusen et al. (2004) estimated the difference in value between pruned and unpruned logs by assessing a sawmill’s ability to pay for E. globulus logs. The values from their report are shown in Table 4-1 and illustrate the significant increase in value of the pruned logs.

**Table 4-1:**

<table>
<thead>
<tr>
<th>Regime</th>
<th>Sawlog Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
</tr>
<tr>
<td>Pruned</td>
<td>145</td>
</tr>
<tr>
<td>Unpruned</td>
<td>80</td>
</tr>
</tbody>
</table>

If plantations are thinned too late, the remaining stems often do not respond. That is, the rate of individual stem diameter increment does not increase compared to unthinned stands. Once the trees within the stand are significantly competing with each other, some species of eucalypt will not respond to thinning. It is suspected that the majority of stands within the Green Triangle has reached this stage.

Pöyry believes that the majority of the pulpwood plantations within Victoria is currently too old to be successfully converted into economically-viable sawlog plantations.

When these pulpwood plantations are harvested and coppice regeneration allowed to develop, the resulting crop will tend to have curved butts that render them unsuited for later thinning and pruning. As a result, conversion to sawlog rotations will have the added cost of the removal of stumps or control of coppice growth prior to planting the next sawlog crop.

### 4.1.3 Experience with Eucalypt Sawlog Plantations

Plantation-grown eucalypts are successfully processed to sawn timber and veneer products in several regions of the world, but these are usually regions with high plantation productivity (fast growth), low operating costs (cheap labour) and a strong residual market (large pulp or fibre markets).

Globally, eucalypts have been established in plantation for over 150 years. Some estimates state that there are over 19 million ha of eucalypt plantations in the world today, and Pöyry estimates that less than 1% of this area is managed for high-value sawlogs. This provides some indication of the technical or economic difficulties faced in processing the resource.

Australia has a relatively long history of managing eucalypt plantations for sawlog regimes yet, to date, there is no sustainable industry based only on plantation-grown eucalypt within Australia.

A more detailed review of the global and Australian history of eucalypt sawlog plantations is contained in Appendix 3.

The NIEIR Report refers to the FFORNE (Farm Forestry of North East Victoria) Hardwood Co-Operative Ltd as providing a source of plantation-grown sawnwood timber within Victoria. Since 1996, the co-operative has established approximately 1 700 ha of eucalypt plantations in north-eastern Victoria. The group has failed to meet its establishment target of 1 000 ha/a of new planting over a 20-year period. FFORNE has mainly used the species *E. nitens, E. globulus, E. saligna* (Sydney
blue gum) and *E. grandis* in its plantations. FFORNE estimate that its plantations will achieve an MAI of 20/ha. Using the group’s optimistic growth estimates and a sawlog proportion of 40% of the harvest, the group’s current plantations only have the capacity to produce a sustainable sawlog harvest of approximately 12 800 m$^3$/a, currently all of which will be from non-premium sawlog species.

In the Green Triangle region, large-scale (>160 000 ha) eucalypt plantations have been established, almost exclusively on pulpwood regimes. The Green Triangle hardwood estate is almost exclusively *E. globulus*, with some small-scale pilot plantations and trials investigating the feasibility of sawlog regimes within the region.

### 4.1.4 Plantation Species Options and Wood Properties

The majority of the existing large-scale eucalypt plantations grown on sawlog regimes have been based on *E. grandis* and hybrids of *E. grandis* (Uruguay, Brazil and South Africa). In these cases, *E. grandis* was chosen as it had been planted in the region as pulpwood and because it grew well. It was not selected for its sawlog properties. As noted earlier, these fast-growing plantation species do not have the same wood properties and sawing behaviour as timber from native forest of the same species. This is not exclusive to eucalypts, but is also the case with other species, such as teak.

These differences mean that plantation-grown timber is not a direct substitute for native forest timber of the same species. In northern NSW, the timber from plantation-grown *E. grandis* is sold into the low-value pallet and pulp market as it does not have the hardness or strength to be sold into the higher-value flooring or structural markets that the native forest timber can be used for.

The vast majority of hardwood plantations in Western Victoria comprises *E. globulus*. This species is a high-quality eucalypt pulpwood species, but is not recognised as a premium sawlog, even from native forest as the timber typically has high levels of tangential and radial shrinkage. Bootle, (1983), states that the native forest *E. globulus* timber typically has high levels of shrinkage and needs to be dried carefully. Logs of *E. globulus* from the native forest need to be sawn using a technology known as quarter sawing to manage the high level of shrinkage. This technology has lower productivity and requires larger log sizes (and therefore longer plantation rotations) than the traditional back sawing that is typically used for processing the warm temperate and sub-tropical eucalypt species. In Pöyry’s view, the plantation-grown *E. globulus* timber is unlikely to be of a better quality than the native forest-grown wood. More likely, the quality will be lower. Studies by Yang and Waugh (1996a) on plantation-grown *E. globulus* from Tasmania indicate that it would be classified as a lower structural grade than the native forest timber based on testing using small clears.

In Gippsland, there are some mature *E. regnans* plantations, grown on 30- to 40-year rotations. It is understood that, as these are clearfelled, the sites will be re-established to *Pinus radiata* (radiata pine) or *E. nitens*. The NIEIR Report uses examples of mills in Gippsland that have processed plantation-grown *E. regnans*. Pöyry understands that one of these mills only produced low-value pallets and garden materials from the resource. The other made some structural grades, but the resource only made up a minority of log inputs to these mill and this proportion was significantly less than a third of the input that is stated in the NIEIR Report.
Pöyry understands that sawnwood recoveries and board values from the plantation logs were significantly less than from native forest logs. The mill producing the structural grades is now in the process of closing down.

The second component of the sawlog plantation strategy proposed in the NIEIR Report is to establish new plantations specifically managed on a sawlog regime. This would allow species to be selected that have improved processing properties. Species that have shown promise in similar environments to Western Victoria are *Corymbia maculata* (spotted gum) and *E. cladocalyx* (sugar gum). Both have superior wood properties and would produce high-value logs compared to *E. globulus* or *E. nitens*. It is expected that both species would have slower growth than *E. globulus* and, as a result, considerably longer rotations of at least 30 years would be required for the logs to reach sawlog dimensions. With the time value of money, this would significantly increase the costs of the timber harvested. In addition, this species is not valued as a pulpwood species, hence the residues from the sawmilling operation will be of low value. Future bioenergy markets may offer some potential, but these are yet to be established.

### 4.2 Economics of Sawlog Plantations

Australia has a business environment that results in high costs of establishment and management of sawlog plantations. Rotation length and the time value of money are two of the biggest economic constraints on the viability of eucalypt sawlog crops within Australia. In regions of the world where plantations of eucalypt are commercially managed on sawlog regimes, growth rates are higher than in Australia and operational costs lower. Most *E. grandis* sawlog plantations overseas are managed with rotations of less than 20 years, in regions where there is a strong and profitable market for thinnings and small-diameter logs. In Victoria, it is estimated that *E. globulus* and *E. nitens* plantations would need to be managed on at least a 25-year rotation for the trees to reach a minimum sawlog dimension of >35 cm diameter underbark, with longer rotations required on the majority of sites.

Pöyry has developed a post-tax financial model to examine the profitability of hardwood plantations managed on a typical sawlog regime in Australia, with *E. nitens* chosen as the example. This regime produces both pulpwood and sawlogs. The Pöyry model has used current native forest ash prices to estimate delivered prices. The price for B-grade ash logs was used for clearwood sawlogs and a price between C- and D-grade for the small sawlogs. These figures are probably optimistic considering the wood properties of plantation-grown timber compared to native forest logs discussed earlier in this report. While the NIEIR Report argues that native forest sawlogs are underpriced, Pöyry’s view is that the prices are reasonable as a reasonable proportion of sawlog prices are now based on public auctions of the resource. This issue is discussed further in section 6.

Key model assumptions and results are presented in Appendix 4.

Based on the assumptions used in the model, the predicted post-tax real IRR from the hardwood plantation is only 2.5%. The Net Present Value (NPV) of the investment is AUD-4,044/ha.

In Pöyry’s opinion, the required IRR for corporate investment is about 7%. For this return to be achieved, a subsidy for the growing costs or an increase to log prices would be required.
If a subsidy of 94% of operational costs is paid to the forest owner as they are incurred, the investment will achieve an IRR of 7%. The present value\(^7\) of the subsidy paid is AUD4,044/ha. The figure below shows the IRR of the investment for an increasing amount of subsidy.

**Figure 4-3:**
**Present Value of Subsidy and corresponding IRR of Hardwood Plantations on Sawlog Regimes**

The Victorian government has promoted the establishment of hardwood plantations for sawlog production through schemes such as FFORNE in the north-east of the state. The government offered incentives of up to AUD1,400/ha to establish hardwood plantation on private farm land. Even with the relative attractive incentives, this scheme has failed to attract sufficient land owners to establish the modest target of 1,000 ha/a, up to a total of 20,000 ha. The private land owners choose to establish fast-growing species and not premium sawlog species. This issue was highlighted in a submission to the Victorian Timber Industry strategy where Rowan Reid from Melbourne University is quoted:

“In Australia, like in most countries around the world, the vast majority of the land targeted for revegetation is controlled by farmers. For many project managers this fact alone has helped define the problem: Farmers are not growing enough of the right trees, in the right places, in the right way. Or, we could rephrase that as: Farmers are not growing enough of the trees we want, in the places we want, in the way we want.”

The NIEIR Report quotes an example of MIS programs launched for high-value, long-rotation tropical timbers to argue that rotation length is not a deterrent for investors. Pöyry understands that only small areas of these plantations were established and they were high-value timber grades, which helps to make the economics more viable. With the demise of the MISs since the NIEIR Report was published, there is unlikely to be much interest in these schemes in future.

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\(^7\) Discounted at a nominal discount rate of 9.7%.
4.3 Technology for Hardwood Plantation Sawmills

The NIEIR Report states that, owing to the proposed reduction in native hardwood supply and the fact that most hardwood sawmills in Gippsland neither have the equipment to process plantation logs nor the required access to capital to achieve the required technology transition, the solution would be to construct a new 500 000 m$^3$/a plantation hardwood sawmill in Western Victoria.

To support this concept, the NIEIR Report cites the FEA sawmill in Bell Bay as:

“...an example of the sort of initiative that the industry would need to embrace.”

(p. 53).

While the NIEIR Report cites the FEA mill as a model, it does not consider any technical issues associated with a 500 000 m$^3$/a plantation-based sawmill. In fact, FEA went into administration in 2010 and the new owners of the sawmill have elected to process only pine through the mill. This experience does not provide strong support for the proposed sawmill concept.

Prior to its demise, FEA ran two consecutive plantation hardwood sawmilling “projects” in Tasmania. Initially, the company operated a HewSaw R200 line on which small-diameter $E$. $n$itens plantation sawlogs were processed into structural products as a direct substitute for softwood structural sawn timber. The HewSaw line was eventually shut down following the commissioning of FEA’s new Bell Bay sawmill; a 600 000 /a bandsaw line that was intended to process roughly 50% softwood ($P$. $r$adiata) and 50% plantation hardwood (mostly $E$. $n$itens). Prior to FEA going into administration, the Bell Bay mill was still ramping up production volume (cutting mainly $P$. $r$adiata), and had not yet had an opportunity to produce substantial quantities of $E$. $n$itens sawn timber. Pöyry understands that, while only a few batches of $E$. $n$itens were processed in the new mill, processing and drying costs for $E$. $n$itens were significantly higher than for $P$. $r$adiata. Furthermore, the $E$. $n$itens output that was produced and marketed under the EcoAsh label predominantly consisted of structural grades, not appearance grades. The structural EcoAsh competed in the same structural timber market as the lower-cost $P$. $r$adiata.

The FEA mill therefore is not an appropriate reference for the transition strategy proposed by NIEIR with the objective for the sawmill to produce appearance-grade products as a substitute for Victorian ash$^8$.

Apart from the FEA experience and the two sawmills in Gippsland discussed earlier, recent work in Australia on large-scale eucalypt sawmill design, associated business models and financial returns has mainly been undertaken by research scientists associated with the CSIRO, CRC Forestry and various university departments. While the output is valuable in shaping a view of an emerging new forest industry sector in Australia, this work remains highly experimental, and has not been validated by any long-standing commercial-scale operations.

In Pöyry’s view, the proposed hardwood sawmill will face a number of challenges, each of which pose a substantial risk in terms of the transition from native regrowth to plantation forest:

- Yield of appearance-grade products

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$^8$ Victorian ash is a trade name for $E.delegatensis$ and $E.regnans$. 

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- Scale of operation
- Commercial production of appearance-grade products
- Large-scale automated processing
- Large-scale drying to appearance-grade standards.

4.3.1 Yield of Appearance-Grade Products

The work of former CSIRO research scientist Dr Russel Washusen (1999, 2004, 2008) is quoted extensively in the NIEIR Report. For more than a decade, Washusen and his colleagues have been doing extensive work on the product yield potential of plantation-grown eucalypts in Australia, including the application of innovative strategies and technologies for maximising the yield of appearance-grade products.

Washusen’s work on the appearance-grade yield potential of plantation-grown eucalypts generally concludes that, while plantations do have the potential to yield high proportions of appearance-grade products (even when compared to native regrowth), it is imperative that the timber is derived from well-managed plantations of sufficient age, and that the logs are processed using appropriate sawing strategies and technology, including careful drying.

As discussed earlier in this section, the existing pulpwood plantations in Western Victoria that have not been pruned or thinned cannot be converted to sawlog plantations. The implicit assumption in the NIEIR Report that unmanaged pulp stands in Western Victoria could start yielding appearance-grade product within 5-10 years of commencement of the transition is not supported by available research data.

4.3.2 Scale of Operation

In addition to work on yield potential, Washusen has done extensive work on the processing of plantation hardwood for sawn timber and associated sawmill design. In a recent report entitled “Processing plantation-grown Eucalyptus globulus and E. nitens for solid-wood products - Is it viable?”, Washusen assesses a number of technology options for hardwood sawmills in Australia with intake capacity varying from small/medium (36 000 m³/a) to comparatively large (320 000 m³/a), (Washusen, 2011a, p. 16, Table 1). However, as part of this work, Washusen concludes:

“In Australia it will be very difficult to find a supply of 260 000 - 320 000 m³ of Eucalypt sawlogs required for a sawing line in the foreseeable future.”

Hardwood sawmills around the world are generally substantially smaller than softwood sawmills, partly due to resource constraints but also due to unique challenges and complexities of processing hardwoods that are not normally encountered in softwood sawmills, in particular those related to wood drying.

Globally, large hardwood sawmills typically have intake capacities of 100 000-200 000 m³/a, although a eucalypt sawmill with an intake capacity of 400 000 m³/a was recently commissioned in Uruguay. Generally, the bulk of hardwood sawmills around the world are substantially smaller than these levels, typically operating at around 5 000-50 000 m³/a. In North America and the EU, the largest hardwood sawmills seldom exceed intake capacities of 150 000 m³/a. By comparison, the
largest hardwood sawmill in Australia has an intake capacity of 100 000 m\(^3\)/a of native regrowth sawlogs.

By contrast, there are several softwood sawmills around the world capable of processing in excess of 1 million m\(^3\)/a of logs, with some multi-line softwood sawmills in western Canada approaching intake capacities of up to 2.5 million m\(^3\)/a.

The following is a brief summary of some of the largest eucalypt sawmills in the world:

- The largest operational eucalypt sawmill in the world is the Urufor sawmill in Rivera, Uruguay, a high-speed bandsaw line that was commissioned in 2009 and is capable of processing 400 000 m\(^3\)/a (on a double-shift basis) of thinned and pruned *E. grandis* sawlogs from the COFUSA plantations in the north of Uruguay.

- In 2005, pulp and paper multi-national Mondi Ltd installed and commissioned a high-speed bandsaw line at Piggs Peak, Swaziland (southern Africa) with a 200 000 m\(^3\)/a intake capacity (on a double-shift basis), based on *E. grandis* sawlogs. (In 2007, 80% of the resource supplying this mill burnt down, so that the mill will not be operational until the plantations recover.)

- In the Brazilian state of Bahia, US forest products company Weyerhaeuser, in association with Fibria (formerly Aracruz), owns and operates a 150 000 m\(^3\)/a eucalypt sawmill commissioned in 1999 based on traditional North American carriage-band grade-sawing technology. This mill processes high quality pruned and thinned *E. grandis x urophylla* sawlogs into sawn timber products.

The above overview of large-scale eucalypt sawmills around the world (most of which are situated in the Southern Hemisphere) therefore suggests that the proposed eucalypt sawmill in Western Victoria with a capacity of 500 000 m\(^3\)/a of eucalypt sawlogs would be unprecedented globally, with the closest comparable example being the 400 000 m\(^3\)/a Urufor sawmill in Uruguay.

However, this mill and the other two mentioned above, are based on a conventional back-sawing technology and do not use the more complex quarter-sawing technology that would be required for *E. globulus*. (See discussion below and Appendix 5).

The proposed sawmill capacity stated in the NIEIR Report of 500 000 m\(^3\)/a therefore appears to be ambitious from the perspectives of both resource availability and milling technology.

### 4.3.3 Commercial Production Challenges

#### Sawing

The large-scale production of appearance-grade sawn timber (the main economic product from native sawmills), from relatively small-diameter, plantation-grown sawlogs with high levels of residual growth stress, poses a serious challenge for the sawmill proposed in the NIEIR Report.

This challenge stems from the fact that the proposed sawmill is intended to produce appearance-grade sawn timber that would be a direct substitute for Victorian ash derived from native forests in Victoria. Current practice in Australia is for the ash
species group of eucalypts to be processed into appearance-grade sawn timber products using a rather laborious process known as “quarter sawing”, mainly in an attempt to limit the negative consequences of high levels of tangential shrinkage on surface and internal checking during drying, as well as to ensure maximum in-service dimensional stability of final products produced from this material. Very few sawmills around the world, including hardwood sawmills, go to such great lengths to produce predominantly quarter-sawn products.

The reason for this emphasis on quarter sawing in Australia is probably partly related to tradition, but also to the fact that, in general, eucalypt species from Victoria and Tasmania, including native forest Victorian ash, have comparatively high levels of tangential shrinkage. Absolute shrinkage and collapse is normally greater in rapidly-grown plantation timber. The production of quarter-sawn timber requires a very different processing philosophy to conventional “back-sawing” as practiced in most softwood and hardwood sawmills around the world. The negative consequences include substantially more handling of the log during initial breakdown (which reduces throughput), specialised resawing and associated material handling equipment (which increases cost), the production of narrower boards (narrower boards generally have lower value), higher board piece count (which reduces throughput), and the increased risk of irreversible “spring” developing in boards quarter-sawn from logs with high levels of residual growth stress.

Washusen (2011b, p.2) proposes a potential solution for large-scale production of quarter-sawn boards from plantation-grown sawlogs in Tasmania, but states that the proposed mill would only be able to process up to 320 000 m³/a of plantation logs.

**Automation**

One of the key challenges of sawing plantation eucalypts is that some species have high levels of residual growth stress that are released during sawing. In traditional Australian hardwood sawmills, where logs are processed asymmetrically using a single saw at a time, this results in warping of the logs, cants and boards during processing. The proposal of employing multi-blade sawing technology that uses symmetrical sawing of logs on opposing faces (Washusen 2011a,b) will go a long way toward avoiding such distortion during log breakdown, thereby limiting negative impacts on recovery.

However, a remaining challenge is that, even with symmetrical log breakdown, some boards will have substantial bow or spring due to the release of growth stress. Such boards could cause significant problems in the automated handling systems that are employed in high throughput sawmills of the kind being proposed. These mills are typically designed around softwoods, which typically do not have residual growth stress problems and produce straight boards that are easy to handle automatically. The impact of boards with bow and spring on the throughput of such an automated sawmill system would have to be carefully considered, and adds additional risk to the technology of the proposed mill.

**Drying**

Eucalypt wood is one of the most difficult to dry of all wood types in the world. In general, eucalypt sawn timber first needs to be slowly air-dried or pre-dried down to fibre saturation point to limit drying defects associated with the first stage of
drying (mainly collapse), and then kiln dried (including a steam reconditioning treatment) to final target moisture content. This is certainly the case for *E. regnans* and *E. delegatensis*, but also for some of the main plantation eucalypt species grown in Australia.

The *E. globulus* which makes up the current plantation resource is prone to developing drying defects that are grade-limiting for appearance applications. *E. globulus* is also comparatively slow-drying, due to low permeability (largely affecting drying rate from green to fibre saturation point) and relatively high wood density (affecting drying rate from fibre saturation point to final moisture content).

It is further important to note that, while careful drying can limit the occurrence of surface and internal checking, a certain degree of this defect will be inevitable. Whereas steam reconditioning can close surface and internal checks, thereby improving its appearance, it is yet to be determined what impact such closed checks will have on secondary processing, final product quality, and hence the market acceptance of plantation hardwood (Washusen 2011a, p. 27).

At a practical level, the need to dry a large volume of *E. globulus* sawn timber to appearance-grade standards at a single site requires extensive air-drying or pre-drying space and kiln-drying capacity (including steam reconditioning capacity). Overall drying times are likely to be measured in weeks whereas, by contrast, some Australian softwood sawmills are able to dry softwood sawn timber within 12 hours of it being produced in the green mill, hence the requirement for kiln-drying capacity and associated thermal energy supply will be substantial. A further consequence will be comparatively high levels of work-in-process inventory, which will tie up substantial amounts of working capital.

4.4 **Plantation Timber Properties and Markets**

In addition to the technology risks discussed in the previous section, there are also significant risks and issues to be addressed in marketing of the plantation-grown eucalypts. Several studies on the processing and marketing of these products are based on the assumption that select and standard grade quarter-sawn boards of equal dimension would fetch prices comparable to that of native Victorian ash (Washusen 2011b, p.9). However, researchers also caution the use of this assumption:

“*There are important differences in the eucalypt sawn timber produced from native forests and plantations, in part related to species and in part to silviculture (i.e. how the trees are managed). These differences affect the potential uses of plantation eucalypts for sawn timber.*” (Harwood 2010, p.1)

“*Specific marketing of appearance-grade boards from plantation-grown *E. nitens* and *E. globulus* may be required, as their appearance differs significantly from native forest boards.*” (Washusen 2011b, p.9)

In discerning appearance applications where colour and grain is highly prized, for example fine furniture and floors, there is a risk that *E. globulus* and *E. nitens* may be perceived to be too bland to be a direct substitute for native timber. In the case of flooring, there is also the question of whether plantation hardwood would have the requisite density and hardness. For these applications, there are likely to be other better-suited eucalypt species that could be grown in plantations, based on intensive silviculture and extended rotations, for example *Corymbia maculata* or *E. cladocalyx*. However, there is not a substantial stock of these species in the
ground at present in Victoria, therefore the time frame to create commercial supplies will be at least 30-40 years.

In addition to the basic appearance of plantation-grown hardwoods compared to native forest timber, some common plantation species such as *E. nitens* and *E. globulus*, have specific wood-quality problems which will affect their market acceptance for appearance applications (Harwood 2010, p.4-6):

- *E. nitens* is prone to develop internal checks. While these can be closed up by steam conditioning, they may open again, usually in a final product.
- *E. globulus* has less of a tendency to develop internal checks, but does develop significant tension wood under some silvicultural conditions. This tension wood could affect the in-service stability of final products.

Beyond small supplies of lower-grade plantation eucalypt sawn timber (e.g. for structural applications or pallets), the more discerning sectors of the Australian hardwood sawn timber market have had very limited exposure to the new plantation material, mostly confined to small trial batches. Ultimately, the perception of the market and its willingness to pay will determine the value of these plantation products. Even if native sawn timber supplies from public forests were to decrease drastically, local hardwood consumers will always have the option of using imported hardwood as substitutes for Victorian ash.

Of significance is the fact that several Southern Hemisphere producers are scaling up the production of plantation-grown eucalypt sawn timber from intensively managed plantations. Some producers are already capable of producing relatively high-quality, mature sawn timber products. In general, these producers enjoy significant competitive advantages over Australian producers, including substantially lower land and labour cost, and higher growth rates.

In the unlikely event that plantation-grown eucalypt sawn timber did indeed achieve prices comparable to native forest sawn timber on the Australian market, typically selling within a range of AUD500-1 000/m³ at the wholesale level, as anticipated in the NIEIR Report, this will provide a very strong encouragement to other competitors to enter the Australian market, especially if the AUD remains relatively strong.

By contrast, users of structural sawn timber are unlikely to be overly concerned about the issue of vertical grain, and would likely even be willing to tolerate a degree of drying and other degrade, provided the product has the requisite strength and stiffness properties. Despite the demise of FEA, the company was able to market small volumes of mostly *E. nitens* sawn timber under the EcoAsh label to structural users in Australia from its Tasmanian operations, thereby creating a precedent for structural plantation eucalypt products in this market segment.

Pöyry therefore concludes that the extent to which plantation timber could substitute for native Victorian ash in appearance applications remains uncertain. It is unlikely that plantation timber could provide a 100% substitute for appearance-grade Victorian ash within a time frame of less than 25 years, if at all. The more likely scenario is that plantation timber would be complementary to Victorian ash, possibly with some overlap in certain applications.

In fact, from a technical point of view, it is more likely that plantation hardwood timber would substitute for plantation softwood timber, particularly in structural applications. However, the economics of such a substitution remain to be tested in
practice. Historically, hardwood structural-grade timbers from native forest in Australia have been substituted by cheaper softwood products. Hence, in Pöyry’s view, it will be challenging for the plantation hardwood product to win back this market from softwood.

FEA experienced this competition from softwood when marketing its structural EcoAsh product.

4.5 Sawn Timber Product Mix

The transition policy proposed in the NIEIR Report states that the high appearance-grade products require only about 5 to 10% of the logs currently produced from native forests. This reflects the high specifications for logs that are accepted by this market. Only 5 to 10% of the harvested timber has the dimensions, form and low levels of defect (knots, gum veins, borer holes) suitable to produce high-value appearance-grade product. In the modelling of the strategy, the NIEIR Report assumes that more of the log volume (approx. 14%) will be used for high-value products by 2015. However, the report does not elaborate on how this would be achieved.

The sawmilling industry will naturally maximise the production of the highest-value products that provide the industry with the highest margin. The NIEIR Report does not account for the fact that the product mix is dependent on the resource that is being harvested:

- A single tree stem will produce logs of different grades that will be sold into different markets.
- At a stand level, trees within the stand will produce logs of different quality.

Hence, any harvesting operation will produce a mix of logs of varying quality. As the proportion of product mix depends on the stand of trees being harvested it is unrealistic to increase the proportion of a single log quality. The transition strategy assumes a quicker transition for woodchip and lower-quality sawn timber products than it does for the appearance-grade products. It is unrealistic to assume that appearance-grade products can continue to be harvested from native forest without the production of pulplogs and lower-quality sawlogs in proportions similar to the current product mix. Pöyry believes that this is a fundamental problem with the transition strategy analysed in the NIEIR Report.

Although products from plantation wood could be expected to be more uniform, the proportion of logs suitable for the highest-grade appearance logs would be expected to be lower as a result of the small log dimensions and inherent wood properties of plantation logs. The product mix from plantations would be expected to have higher proportions of structural sawlogs and pulplogs and a lower proportion of appearance-grade, than current native forest mix.

4.6 Engineered Wood Production and Markets

Laminated veneer lumber (LVL) produced from either softwood or hardwood plantations is a potential substitute for F17-grade Victorian ash structural hardwood. Producing LVL of this grade requires veneer of the requisite strength and stiffness, which can usually only be obtained from relatively mature plantation-grown sawlogs or veneer logs.
Growing a suitable hardwood resource would require further research and time to produce a resource of sufficient quality. Limited work has been done in Australia on the production of LVL from plantation-grown eucalypts. A recent report by Blakemore et al. (2010, p.17) is not optimistic, concluding that:

“…products manufactured from (plantation grown) E. nitens veneers would be of low-to-moderate stiffness and strength.”

Another proposal has been the production of laminated strand lumber (LSL) from young eucalypt plantations. LSL has structural properties in between high-grade structural sawn timber and LVL, and requires a lower quality feedstock compared to LVL. An LSL plant was planned built in Western Australia by Lignor, but the plant never materialised due to economic considerations. Both the glue cost and capital expenditure for such a plant which, of necessity, has to be of a very large scale, were considered too high to be viable.

The more likely scenario, should F17 hardwood structural timber supplies from the Victorian ash native resource diminish, is that these will be replaced over time with imported LVL, rather than with LVL from local plantation wood.

4.7 Economics of Processing

The proposed sawmill concept involves constructing at least one sawmill in Western Victoria with an intake capacity of 500 000 m$^3$/a of plantation-grown sawlogs, as a direct substitute for Victorian ash. It is anticipated that the sawmill workforce will total 200 staff.

The proposed scale of operation would, in principle, have a positive impact on fixed manufacturing cost per unit, as the mill would be five times the size of the largest hardwood sawmill in Australia (which has an intake capacity of 100 000 m$^3$/a). In fact, the proposed scale falls well within the range of Australia’s typical structural softwood sawmills, which range between 150 000 and 800 000 m$^3$/a.

However, any direct comparison with softwood sawmills ends there. If the concept is to produce appearance-grade sawn timber, a quarter-sawing approach will be required, which means the log breakdown process in the green mill will deviate substantially from the linear, single-pass, back-sawing philosophy employed in softwood sawmills. Extensive resawing systems and associated materials-handling systems will be required.

It should be noted that the quarter sawing of plantation eucalypt logs is still in the concept phase. To Pöyry’s knowledge, there are no commercial-scale operations anywhere in the world. This uncertainty poses unknown risks, which makes an assessment of likely manufacturing cost even more difficult.

In addition to differences in log breakdown philosophy, the drying concept is likely to differ substantially from softwood sawmills, involving, among other factors, the inclusion of air-drying and/or pre-drying capacity, as well as extensive kiln-drying capacity (including steam reconditioning). These will all add significantly to the capital requirement.

The consequence of the aforementioned factors is that the proposed sawmill is likely to have a high cost structure compared to Australian softwood mills, and also compared to eucalypt sawmills in Africa and South America.
Given the large scale of operation, the sawmill is likely to have a lower fixed manufacturing cost per unit than a typical hardwood sawmill in Australia, and variable manufacturing cost (excluding wood cost) should not be vastly different. On the other hand, wood cost would need to be substantially higher for plantation-grown sawlogs than for sawlogs from native forests if the grower is to be ensured a reasonable return on investment, particularly given the long sawlog rotations.

On balance, the overall unit cost is likely to be equal to, or higher than that of a typical Australian hardwood sawmill. Therefore, achieving an acceptable margin, and by extension an acceptable return on invested capital, will hinge on the value of the basket of products produced. This value will be affected by several factors:

- The mix of appearance-, structural- and utility-grade products
- The price discount (if any) for plantation-grown appearance-grade timber relative to Victorian ash
- The relative attractiveness of import substitutes.

A particular risk is that the quality of the plantation sawlogs could result in a high proportion of structural grade which impacts on the key objective of the proposed new sawmill which is to substitute appearance-grade sawn timber from native forests. The revenue from a product mix based substantially on a commodity structural timber will not support a cost structure geared towards production of high-value appearance-grade timber.

How these product mix factors would pan out in the future can only be speculated about at this stage given the limited experience with the processing and marketing of plantation-grown eucalypt sawn timber in Australia. This uncertainty results in considerable exposure to risk for any potential investor wishing to enter the plantation or processing industries.

### 4.8 Conclusions on Transition Strategy

In Pöyry’s view, the strategy proposed in the NIEIR Report to transition the Victorian hardwood sawmill industry into an exclusively plantation-based resource fails to account for significant technical and economic constraints:

- Currently, large commercial plantation eucalypt sawlog regimes and processing industries are located only in regions of the world where there is high plantation productivity, low operational cost structures and strong residual markets. Pöyry believes it would be a significant challenge to develop an economically-viable hardwood plantation sawlog industry within Australia, considering the business environment.

- The NIEIR Report does not fully consider the changes in silviculture and cost structures for the management of longer-rotation sawlog regimes required to achieve the proposed transition strategy.

- It would be difficult to convince the large number of owners of the existing plantations (including thousands of small MIS investors) to convert the plantations to sawlog regimes when there is no established market for the sawlogs today.

- Logs sourced from plantation do not have the same wood qualities or processing behaviour as native forest logs. Sawn timber products from
plantation-grown eucalypts would not directly substitute for sawn timber products from native forest.

- Pöyry believes that it is too late to convert the majority of the existing pulpwood estate to a meaningful sawlog regime that is economically viable.

- A rotation length of 25 years for sawlog regimes suggested in the report are unrealistic for *E. regnans* and other recognised sawlog species. The growth rates of these species would result in the trees being of insufficient size for economically-viable processing within 25 years. Pöyry believes it may be possible to grow *E. nitens* and *E. globulus* plantations on high-quality sites on a 25-year sawlog rotation. However, the timber from these species presents considerable product development and marketing challenges.

- In Pöyry view growing plantation eucalypts on sawlog rotations in Victoria would require significant government subsidies or incentives to make it economically viable to a grower. Historically, government schemes to promote investment into sawlog regimes within Victoria have failed to meet their planting targets, and growers have typically chosen fast-growing species over the slower-growing premium sawlog species preferred by the industry.

- Considerable technical issues would have to be overcome in the processing of eucalypt logs from plantation. The 500 000 m$^3$/a sawmill proposed in the transition strategy is unprecedented on a global scale, and would present significant challenges to be technically and economically feasible.

- The majority of Victorian native forest eucalypt species are quarter sawn to overcome inherent high levels of shrinkage. It is expected that the plantation resource would also require quarter sawing. This would require logs of larger dimensions and, as a result, increased growing and processing costs compared to an industry based on back-sawn boards. Pöyry believes that these higher costs will result in the products requiring higher market prices which will result in increased competition from imported timber and alternative products.

- The transition strategy timeframe is unrealistic as a new plantation-based industry would require the development of purpose-grown plantations on at least a 25-year rotation, with longer rotations of 30–40 years required for more valuable recognised sawlog species. The first significant volumes of appearance-grade logs would not be available to the industry for at least 25-30 years, significantly later that the 10 years suggested in the NIER Report.

- It is impossible to harvest only appearance-grade sawlogs from native forests as an interim step before appearance-grade plantations are available, as proposed by the transition strategy. The nature of native forests is such that harvesting of these will provide a mix of pulplogs and various grades of sawlogs.

- The transition strategy would need to be supported by significant investments in research and development, in both the silvicultural and processing industries. Significant product development and marketing would be required to place the final products of plantation-grown eucalypt in the market as they would not directly substitute for the products from native forest timber.

- Pöyry believes that if hardwood plantation sawlogs were available and processed, a high proportion of the sawn timber and engineered timber products produced would enter the structural-grade markets. These products
would need to compete against softwood products that dominate the Australian market.

- Pöyry believes that the production of sawn timber from plantation-grown material would not result in the production of high volumes of appearance-grade products. As a direct result of the strategy, Pöyry expects that imported hardwood products sourced mainly from Asian native forests would be the likely replacement for the appearance-grade products from native Australian hardwoods. A high proportion of these imports would likely be sourced from non-sustainable operations.

4.9 Impediments to the Implementation of the proposed NIEIR Transition Strategy

While the NIEIR Report presents a high level overview of the proposed transition strategy, it does not specifically outline how numerous technical, political and economic issues are to be addressed. The assumptions underlying the implementation of the transition strategy and the significant impediments to these are summarised below:

The transition strategy assumes that the current plantation owners in Western Victoria will convert their plantations from a pulpwood regime to a sawlog regime.

- Current ownership of the Western Victoria plantation resources is complex, with the majority of the estate being owned by individual investors who participated in a range of MISs. The strategy would require the agreement of a range of stake holders; the individual investors in the trees, the Responsible Entities for these MISs, the landowners and potentially the Australian Tax Office, for the conversion of the management regime from a pulpwood regime to a sawlog regime. Pöyry believes that this would be a complicated, time-consuming and difficult task, further complicated by the fact that some of the MIS companies are in administration or receivership and some of the resource has existing offtake agreements.

The transition strategy assumes that the current plantation in Western Victoria can technically be converted into plantations that are capable of producing high-value sawlogs.

- The transition strategy’s success is dependent on the modification of the silvicultural regime currently used in the majority of Western Victorian plantations from one designed to maximise pulpwood production to one that produces sawlogs. Effective pruning and thinning of sawlog plantations depend on these being performed from early in the rotation. In Pöyry’s view, the majority of the plantations in Western Victoria are already too old for pruning and thinning to be effective. The complex ownership structure of the plantations would introduce further delays to performing any thinning and pruning activities.

The transition strategy assumes the establishment of new plantations that are managed to produce high-quality sawlogs.

- Based on Pöyry’s economic modelling, significant subsidies would be required to make the growing of eucalypt plantations on a sawlog regime financially attractive to an investor/landowner. The NIEIR Report has not accounted for
this cost (estimated to be approximately AUD16 million/a) in its financial model and the report is expressively critical of subsidies it believes are being paid to the forest industry.

*The transition strategy presented in the NIEIR Report assumes that it is technically and economically feasible to process plantation sawlogs into high-value products.*

- Significant advances in sawmilling technology will be required for the processing of *E. globulus* to be technically and economically viable. Experience of processing plantation-grown eucalypts within Australia has not been positive;
  - FEA’s structural EcoAsh product was unable to compete with pine products
  - In NSW, the majority of the *E. grandis* plantation timber is sold only into the low-value pallet and pulpwood markets
  - Victorian mills processing plantation *E. regnans* report lower recoveries, and the majority of the production is only low-value products.

The current Western Victorian plantations are a low-grade resource for sawlogs: unpruned, unthinned and often with poor form. The majority of the plantations are *E. globulus* that is known to have poor dimensional stability, a major issue for the production of kiln-dried boards. Pöyry believes that a sawmill project based exclusively on the logs from the Western Victorian plantation resource would struggle to attract investment as a result of the very significant technical and financial risks. The proposed size of the sawmill suggested in the report is unprecedented globally for a eucalypt sawmill. Further compounding these issues is the fact that in early September 2011 the Federal Government announced it would not fund an extension to the Cooperative Research Centre for Forestry which was the main organisation conducting research into plantation sawlog production.

*The transition strategy assumes that products produced from plantation sawlogs will be a direct substitute for product produced from native forest logs.*

- If the mill was built and could successfully process plantation-grown eucalypts, Pöyry believes that the resultant product would not be a direct replacement for appearance-grade timber from native forest. The inherent wood properties of plantation-grown eucalypts would result in the end products mostly entering into the structural and lower-value markets where they would face tough competition from existing softwood products. Pöyry believes significant product and market development would be required for any plantation-based sawmill venture to be successful in Western Victoria.

- Pöyry believes that the most likely outcome of the transition strategy would be that appearance-grade products currently produced from native forests sawlogs, would be replaced with imported products produced from native forest sawlogs. Pöyry expects that a large proportion of these imports would be sourced from unsustainable operations in Asia.
5  CARBON CONTRIBUTION

The NIEIR Report places considerable weight on the study by Mackey et al. (2008) that argues that:

‘conversion of mature and over mature forest to commercial forestry results in a 40% diminution of the carbon stored in those forests’.

It goes on to calculate a value of the carbon fluxes based on the proposed cessation of native forest harvesting and transition to E. globulus plantation supply.

In Pöyry’s opinion, there are a number of fundamental issues which the NIEIR Report does not fully consider in developing its arguments. These relate to:

- Quantities of carbon sequestered
- Value and markets for carbon sequestered.

5.1 Quantities of Carbon Sequestered

Moroni (2011) observes that the data used by Mackey et al., (2008) from a study site in Tasmania is considered unrepresentative of the typical Tasmanian and Victorian State forests. As a result, the study overestimates the depletion of carbon attributed to timber harvesting. The biosphere is also fragmented, complex and diverse, making it difficult to generalise and apply the conclusion by Mackey et al., (2008) across Victoria.

The study also does not account for the high risks posed by fire in the Victorian forests. Pöyry would like to point out that a large proportion of carbon exchanges within the biosphere is outside of human control (Keenan, 2009, Moroni, 2011), with the catastrophic Victorian fires of 2009 providing a vivid example. Keenan (2009) points out that:

“at a national scale, native forest timber harvesting and associated regeneration in managed native forests is not resulting in a long-term decline in forest carbon stocks compared with any recent baseline period.”

He goes on to note that:

“At a local scale, carbon stock reductions may be occurring in situations where old growth or mature forest is being converted to regrowth through clearfelling or where more intensive management of regrowth is being applied through thinning and shorter rotations.”

Keenan (2009) also cites studies and estimates of carbon emissions from recent Victorian fires as follows:

“In south eastern Australia, there has been a relatively high incidence of large scale wildfires since 2000, with major events in the summers of 2002-03, 2006-07 and in February 2009 partly as a result of prolonged period of below average rainfall. Over 2.6 million ha have been burnt in these events with significant consequences for forest carbon stocks. Estimates of carbon dioxide emissions associated with these fires range from 40 Mt for the first (MIG 2008) to 600 Mt for both (Attiwill and Adams 2008). The most recent events on
February 2009 that resulted in the deaths of 173 people and the loss of over 2,000 homes may have resulted in carbon emissions of over 50-100 Mt of CO₂.”

In any comparison of timber harvesting and cessation of harvesting, the changes in carbon over time need to be assessed at an appropriate spatial scale, Victorian or regional in this case, as well as time scale, if we are to make any rational assessment of the impact on carbon stocks, taking into account the impact of fire, harvesting and regeneration. The recognition of fire, which Mackey et al. (2008) does not address, is critical to this comparison.

Norris et al. (2010) have recently published a Victorian analysis of carbon fluxes that:

- Is based on a best approximation to the geographic distribution of vegetation types at 1930
- Imposes known major fire events and harvesting up to the current date
- Simulates the further occurrence of major fires and harvesting over a 400-year period ahead.

Given the difficulties involved in a regional spatially-based analysis, one should not read too much into the fine detail of the results. Nevertheless, from their simulations, Norris et al. (2010) note that:

"Simulations also showed that carbon stocks were most influenced by wildfire events, with more than 16 million tonne of carbon\(^\text{10}\), or ~2% of the total stock, emitted by fires during the period from 2000 to 2009. Furthermore, the total carbon stocks of Victoria are highly correlated with large-extent wildfire events, yet even so the effect is largely transient. Corresponding emissions are significant. Harvesting has a significant, short-term effect on onsite carbon stocks, with a reduction in tree stem volume and a change in nutrient and carbon cycling rates of soil and debris (Hopmans et al. 1993; Dyck et al. 1994). The significant reduction of onsite carbon is quickly replaced by accelerated growth and biomass accumulation in the early years post-harvest, with a general levelling off at 80–100 y (Attiwill 1992; Polglase et al.1994)."

They conclude (inter alia):

"Complete carbon mass, which includes carbon stored offsite such as harvested wood products, is initially reduced by harvesting and wildfire to about 80% and 85% respectively of unaffected forest, yet recovers to pre-disturbance levels within 100 years. Onsite carbon mass is reduced to ~70% (by harvesting) and ~90% (by wildfire) of undisturbed forest post-fire and remained at 90–95% of predisturbance levels (yet still increasing) at the end of the modeling period."

More research is required to provide an authoritative answer to how fire and harvesting influence forest management for carbon. However, present knowledge is sufficient to assert that the Mackey et al. (2008) thesis is much overstated. Indeed, a mosaic of different ages, in which sustainably-managed harvesting and regeneration could play an important role, may be the best way to maximise complete carbon mass (see Dean, et al., 2004 and Norris et al., 2010).

\(^{10}\) Equivalent to about 59 Mt of CO₂
5.2 Carbon Prices and Risks

The NIEIR Report notes that the transition to supply Maryvale with pulpwood from the Western Victorian plantations would increase the delivered cost of Maryvale wood by an estimated AUD22 million/a. The report suggests that the Government could contribute to this additional cost either by a direct subsidy or by using the net benefits that might flow from the carbon sequestration in native forests.

In the latter case, the NIEIR Report suggests that ‘carbon credits may have greater value to Australian Paper than cash credits’. The NIEIR Report goes on to argue that such a scheme could be a working model for a the Reduced Emissions from Deforestation and Forest Degradation (REDD) program and links this initiative with tourism promotion in terms of ‘opportunities for people to visit a working carbon store’.

Pöyry notes that REDD and REDD+ programs are international schemes administered by the United Nations. These schemes are specifically designed to encourage developing countries ‘to reduce emissions from forested lands and invest in low-carbon paths to sustainable development. REDD+ goes beyond deforestation and forest degradation, and includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks.’ There are currently 13 developing countries receiving support under this program.

The REDD/REDD+ schemes are focused entirely on minimising the impact of forestry activities in developing countries. Australia is not classified as a developing country so there would be no possibility of Victoria receiving any carbon credits under the REDD/REDD+ program. Hence, the proposals in the NIEIR Report that forests in East Gippsland could become a working model for a REDD program, and that this could provide a source of funding for the transition strategy, are not tenable.

There may be some possibility of the carbon trading in the voluntary carbon markets. These markets are still young, not fully established, and are expected to be more volatile and, in general, result in lower carbon prices. There is considerable uncertainty about these markets, particularly in regard to the recently-legislated Australian Government carbon tax.

It is noted that this recently legislated tax, relating to managing carbon emissions, includes a biodiversity funding for a range of initiatives including “to support conservation and management actions associated with cessation of logging in publicly-owned native forests”. The amount of funding which may be available to Victoria in regard to native forest management is unclear.

The NIEIR Report also does not take into account the risks and uncertainties, or the impact of the Australian carbon tax/carbon trading scheme. Current information published on the carbon tax suggests there will be an allocation of funds to a biodiversity fund which may have the mandate to support the cessation of logging in public native forest.

However, in the current policy framework of both Australia and the United Nations, there is no basis for funding the transition strategy on the basis of carbon credits.

11 UN REDD Program Website: www.un-redd.org
12 Biodiversity Fund fact sheet – Australian Government Clean Energy Future program.
Pöyry believes that a sustainably-harvested forest may also be considered ‘a working carbon store’, as later summaries of research will show, so tourism promotion could presumably equally promote harvesting of native forests on this basis.

The NIEIR Report’s approach to calculating the carbon saved is very simplistic. It aggregates the area to be harvested over the 15-year transition and, using estimates of carbon stocks in a Tasmanian forest (Mackey et al., 2008), it estimates 40% of the average standing carbon stock as the aggregate depletion, and applies AUD25/t CO₂ equivalent to that value.

In Pöyry’s view, this approach is flawed as it fails to account for the risks associated with fire, nor does it address the risks attached to the volumes and prices of carbon emissions.

5.3 Carbon and Biodiversity


As noted earlier, the 2009 fires and the carbon study by Norris et al. (2010) completely undermine their carbon arguments.

As Norris et al. (2010) point out, catastrophic fires largely control the age/geographic profile of the ash-type species, whereas harvesting has a much smaller and widely dispersed effect over time. Ash-type forest that has long been undisturbed is limited in extent and fragmented in distribution, with much of it having been killed in the 2009 fire. Provided the regeneration is not burnt again while less than 20 years of age (see Ferguson, 2009), it relatively quickly restores the long-term carbon sequestration levels, whether the regeneration arose from wildfire or following harvesting.

Arguably (see Dean et al., 2004; VAFI, 2010), harvested forest may confer advantages in terms of the reduction of risk to biodiversity by dint of geographic diversity of small areas of different ages and the associated road network and skills base for improved fire management and protection.

5.4 Carbon Conclusions

In Pöyry’s view, the carbon benefits proposed by the NIEIR Report to fund the transition strategy overestimates the carbon stock contribution of ceasing harvesting of native forest, fails to account for the risks of catastrophic events such as fire and incorrectly interprets the applicability of REDD schemes to Victorian forests.

However, it is noted that the Australian Government’s recently announced proposal to create a biodiversity fund as part of the Emission Trading Scheme may allow some funding to be obtained for cessation of native forest logging.
6 COMPETITIVE NEUTRALITY

The NIEIR Report (Chapter 4) places great importance on the application of competitive neutrality to ensure that a government trading enterprise, in this case VicForests, does not receive an unfair advantage in competition against private enterprise.

Competitive neutrality policies aim to promote efficient competition between public and private businesses. Specifically, they seek to ensure that government businesses do not enjoy competitive advantages over their private-sector competitors simply by virtue of their public-sector ownership.

The Australian, State and Territory Governments have agreed to implement competitive neutrality principles. The approach is set out in its Competitive Neutrality Policy Statement of June 1996 and Competitive Neutrality Guidelines for Managers. In essence, the principles require government businesses to:

- Charge prices that fully reflect costs
- Pay, or include an allowance for, government taxes and charges such as Goods and Services tax, payroll tax, stamp duties and local government rates
- Pay commercial rates of interest on borrowings
- Generate commercially-acceptable profits
- Comply with the same regulations that apply to private businesses (such as the Trade Practices Act and planning and environmental laws).

The policy statement also specifies that Australian Government businesses are not to be commercially disadvantaged (or advantaged) by requirements to deliver 'non-commercial' services or to provide services at subsidised rates to particular groups of consumers.

6.1 VicForests and Competitive Neutrality

The basis of the argument in the NIEIR Report is that competitive neutrality would be a driver for change as competitive neutrality will mean:

“that the price differential (that currently favours wood from public forests) will reflect the full cost of resources used. It will mean that the artificial price advantage of wood from public forest lands is removed; that investment decisions will be made on the basis of competitive neutrality between public forests and commercial plantations, are commercially more sustainable and provide greater resource security. It will strengthen a focus on high value products rather than low value pulp; it will ensure public land is used efficiently, and; it will remove the ambiguity over what land is available for commercial forestry.”

The NIEIR Report then goes on to present an example of a two-stage adoption scenario in which the first move is to a plantation parity price (based on current plantation hardwood prices) and then on to a “commercial return” model, the details and assumptions of which are not provided in the NIEIR Report.

Pöyry believes that this approach is artificial as timber from the current plantation resource in Victoria is not servicing the same market as timber from native forest as a result of quality and location of the market.
VicForests was created in 2004 as a government trading enterprise GTE, with the specific function to:

- Undertake sale and supply of timber resources in Victorian state forest, and related management activities, as agreed by the Treasurer and the Minister on a commercial basis.
- Develop and manage an open competitive sales system for timber resources.
- Pursue other commercial activities as agreed by the Treasurer and the Minister.

This statement clearly demonstrates that the function of VicForests is to move the harvest and sales of timber from state-owned native forest towards a competitive sales system.

When it was created, VicForests inherited existing short- and medium-term timber agreements, licenses, and other contracts. Some of these have expired and others will expire over the next few years. The only exception to this is the pulpwood supply agreement with Australian Paper which extends over a longer period. This was negotiated between Australian Paper (then Amcor) and the Victorian Government to give Australian Paper the required security over its pulpwood resource to enable it to obtain funding for a significant development of its Maryvale site.

Table 6-1 demonstrates that since VicForests was created, the company has been increasing the proportion of timber sales that are made through open auctions as existing agreements expire.

URS, in its 2010 review of VicForests, notes that the auction system has resulted in good prices being obtained for sawlogs, whereas the auction sales have not delivered high prices for pulpwood, where the level of competition is less.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Auctioned agreements</td>
<td>AUD million</td>
<td>0.7</td>
<td>3.1</td>
<td>4.7</td>
<td>9.1</td>
<td>7.3</td>
<td>9.4</td>
<td></td>
</tr>
<tr>
<td>Administered agreements, licenses and other contracts</td>
<td>AUD million</td>
<td>34.4</td>
<td>34.3</td>
<td>29.7</td>
<td>33.7</td>
<td>30.5</td>
<td>29.3</td>
<td>31.6</td>
</tr>
<tr>
<td>Total stumpage revenue</td>
<td>AUD million</td>
<td>34.4</td>
<td>35.0</td>
<td>32.8</td>
<td>38.4</td>
<td>39.6</td>
<td>36.6</td>
<td>41.0</td>
</tr>
</tbody>
</table>

Table 6-1: VicForests Stumpage Sales by Sales Method

Source: URS 2010/VicForests.

As a result of the 2009 fires in Victoria, the proportion of sales in 2009/2010 dropped to 20% from a level of 23% in 2008/2009. The proportion of competitive sales returned to 2008/2009 levels in 2010/2011 and is expected to rise in 2011/2012 (VicForests, pers comm).

In Pöyry’s view, it is clear that VicForests is in a period of transition to achieve full competitive pricing of sawlogs, in line with the goals proposed in the NIEIR Report.

A component of competitive neutrality is that prices should fully reflect costs. The NIEIR Report uses selected data from the Productivity Commission (PV) Trade
and Assistance Review in 2008 to demonstrate that the forestry sector received “one of the highest” rates of assistance in 2006/2007\(^\text{13}\).

While there is some volatility in levels of assistance, taken over the last seven years, there is no evidence to support the NIEIR claim of high rates of assistance. As shown in Table 6-2 below, the average level of assistance provided to the forestry and logging sector between 2003 and 2010 is lower at 4.5% than the average level of assistance provided to the primary production sector as a whole (5.6%). The volatility of the assistance levels to forestry and logging is due in part to the tax incentives to encourage plantations through the MIS.

Similarly, the level of assistance provided to the wood and paper industries between 2003 and 2010 at 4.9% is comparable to the overall level of assistance provided to manufacturing industry over the same period.

Table 6-2: Effective Rate of combined Assistance By Industry Grouping, 2003/2004 to 2009/2010 (%)

<table>
<thead>
<tr>
<th>Sector</th>
<th>03/04</th>
<th>04/05</th>
<th>05/06</th>
<th>06/07</th>
<th>07/08</th>
<th>08/09</th>
<th>09/10</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Production</td>
<td>4.9</td>
<td>4.6</td>
<td>4.9</td>
<td>7.1</td>
<td>7.6</td>
<td>5.3</td>
<td>4.7</td>
<td>5.6</td>
</tr>
<tr>
<td>Forestry &amp; Logging</td>
<td>4.7</td>
<td>8.2</td>
<td>7.2</td>
<td>5.1</td>
<td>4.7</td>
<td>-2.4</td>
<td>3.8</td>
<td>4.5</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>5.1</td>
<td>4.7</td>
<td>4.6</td>
<td>4.6</td>
<td>4.6</td>
<td>4.4</td>
<td>4.7</td>
<td>4.7</td>
</tr>
<tr>
<td>Wood Paper Production</td>
<td>4.7</td>
<td>4.7</td>
<td>4.9</td>
<td>4.9</td>
<td>5.2</td>
<td>5.2</td>
<td>4.7</td>
<td>4.9</td>
</tr>
</tbody>
</table>


The NIEIR Report states that ‘VicForests gets free access to Victoria’s assets’.

The assets (including standing timber) in Victoria’s state forests are managed by the Victorian Department of Sustainability and Environment (DSE), who also account for the asset. DSE releases forests that can be harvested by VicForests as Timber Release Plans (TRP). These areas are transferred to VicForests as an asset. Pöyry understands that the TRP areas are transferred at a fair market value calculated using a Discounted Cash Flow (DCF) analysis that conforms to Australian Accounting Standard 141 (AASB141). VicForests then pays for the harvest and regenerations of the areas before returning them to the DSE, normally after a period of two to three years. Pöyry understands that the TRP assets are returned back to the DSE at fair market value using the same valuation methodology. During the period VicForests controls the timber asset, the organisation depreciates the biological asset; this amortisation cost is accounted in the VicForests P&L statement.

In 2009 and 2010, VicForests’ amortisation of biological assets was AUD3.478 and 3.543 million respectively. VicForests, as a GTE, pays a dividend to the state government. Dividends of AUD3.024 million and AUD2.062 million were paid in 2006 and 2007. In the period 2008 to 2010, a zero-dividend was paid as a result of the organisation recovering from the impact of severe fires. As a GTE, VicForests is required to pay tax.

The NIEIR Report argues that VicForests is not adhering to competitive neutrality because it does not pay local government rates. Pöyry understands that VicForests does not pay rates because its harvesting operations are entirely on Crown land that

\(^{13}\) The Productivity Commissions historical figures appear to be revised annually. In its 2010 report the assistance for the Forestry and Logging sector in 2006/2007 was revised down to 5.1% from the 6% quoted in the NIEIR Report.
is not subject to LGA rates. In addition to the taxes and stipulated share of profits paid to the Government, Pöyry understands that it makes Cost of Road Access Fee payments to the Government via the DSE for its share of costs relating to roads on Crown lands, based on the volume of timber and distance hauled over the road network.

The argument that VicForests does not carry the costs of normal commercial forestry operations is a false premise that undermines the conclusions of the NIEIR Report concerning competitive neutrality. VicForests, as a GTE, is attempting to emulate a commercial company with the constraints associated with being a government entity. The organisation is moving towards a more commercial and transparent system of timber sales. At an operational and cost level, VicForests does not have the freedom to act as a fully commercial enterprise, and has the following constraints:

- The company is subject to major limitations on external debt, requiring the approval of the treasurer to borrow in excess of AUD1.1 million in any one year
- The company is subject to more restrictive conditions on harvesting and haulage arrangements compared with the private sector
- The company has to conform to public service employment policies
- The company has to seek Treasurer and Ministerial approval for major commercial and policy changes.

VicForests has been created to manage the harvest and sale of the timber from Victoria’s state forests. However, it is not the long-term land manager, a role that is fulfilled by the DSE. Pöyry believes that the premise presented in the NIEIR Report that the organisation does not account for the cost of land is misleading. VicForests has limited security over its future timber supplies. The ‘lease’ providing access to standing timber through the allocation process has limited certainty for the first five years, less for the second five years, and very little certainty for the last five-year tranche. The DSE has significant input into the release and management of areas of state forests for commercial timber extraction.

Taken together, VicForests and the DSE operate in a market environment in which both market and non-market goods and services are jointly produced. The latter, including biodiversity conservation, water, recreation and carbon sequestration, all of which are currently un-priced, return no revenue to VicForests, yet rightly influence the amount and manner in which timber production and sale can proceed. The NIEIR Report does not take into consideration the established economic concept of joint production (see Carlson, 1965) and the complexity that it engenders when both market and non-market goods and services are being supplied (Ferguson, 1996), an issue critical to any application of competitive neutrality.

In applied welfare economics, the optimum mix of two complementary and jointly produced goods is determined by the point at which the ratio of the prices is equal to the marginal rate of product transformation. However, if one of those goods is not traded in markets and is therefore un-priced, the identification of the optimum mix can, at best, only be identified qualitatively (see Ferguson, 1996). Where several goods and services are jointly produced, as is generally the case for publicly-owned native forests (e.g. wood, biodiversity conservation, water, recreation in varying combinations), and some are un-priced, the optimum mix
cannot be identified analytically and has to be set by regulation through codes of forest practice. The necessity for government intervention detracts from the notion of competitive neutrality, which is entirely predicated on neutrality between enterprises that are producing priced goods for competitive markets.

The NIEIR Report suggests that the outcome of competitive neutrality would be that Victoria would focus on the extraction of high-value appearance-grade timber from its native forests. VicForests has a policy of optimising its timber harvest to maximise the production of sawlogs (D+ logs) which is in line with the proposal in the NIEIR Report.

The NIEIR Report makes an assumption that 60% of Victorian sawnwood will be used for high-value products by 2015. As mentioned earlier, it needs to be noted that the harvest of any forest results in the production of a range of products as log quality is variable between trees and within a single tree’s stem. It is impossible to harvest only high-quality sawlogs and, as a result, lower-quality sawlogs and pulplogs are also produced. The sale of all products produced in the harvest results in the lower unit cost of production and maximises the sustainable use of the resource. Pöyry believes that the NIEIR assumption that 60% of the sawlogs are of the suitable quality to produce high-value timber is unrealistic owing to the variable nature of native forest logs and stands.

6.2 Valuation and Accounting Standards

The NIEIR Report presents a simplified valuation of Victoria’s commercially harvestable state forests. It uses an observation from a South Australian Parliamentary Inquiry in 1998 to suggest that Victoria’s valuation of state forests did not comply with AAS35 (a standard that has subsequently been superseded by AASB 141 which conforms with IAS 41). This reference to an old 1998 enquiry is irrelevant as it is now mandatory for financial reporting of agricultural industries within Australia to use AASB 141, as is done by VicForests.

Despite criticising VicForests for not using AAS35 (or AASB 141), the NIEIR Report then elects to use an FAO (2004) method of valuation rather than the mandatory AASB 141. In Pöyry’s view, the valuation methodology in the NIEIR Report is simplistic and, as a consequence, results in inflated values for both the standing timber resource and the underlying land.

The NIEIR Report uses the simplest of three FAO methodologies to complete its valuation. The NIEIR Report recognises that the results of the three valuation methodologies can result in widely differing valuations.

The Standing Value of the Timber

The NIEIR Report values standing timber in the VicForests estate on the basis of the current standing volume times the average price for that volume.

In Pöyry’s view, AASB 141 that conforms with IAS 41 would be the appropriate methodology for valuing the state’s standing timber. AASB 141 outlines the standard methodology for agriculture and the valuation of a biological asset, stating:

“There is a presumption that fair value can be measured reliably for a biological asset. However, that presumption can be rebutted only on initial recognition for a biological asset for which market-determined prices or values
are not available and for which alternative estimates of fair value are determined to be clearly unreliable. In such a case, that biological asset shall be measured at its cost less any accumulated depreciation and any accumulated impairment losses. Once the fair value of such a biological asset becomes reliably measurable, an entity shall measure it at its fair value less estimated point-of-sale costs.”

The valuation in the NIEIR Report is based on the assumption that the standing inventory could be harvested and sold in a single year. In Pöyry’s view, this does not meet the criteria outlined in AASB 141, for the following reasons:

- An active and liquid market does not exist for the complete Victorian native forest timber inventory to be sold in a single year.
- It would be technically impossible to harvest the complete Victorian native forest timber inventory to be harvested in a single year.
- The NIEIR price assumptions would not hold if all the timber entered the market in a single year.
- The purpose of the VicForests allocation system is to maintain a sustainable basis for harvesting over the next 15 years, and notionally beyond. The Victorian Government would not be meeting its sustainability criteria if it allowed completed harvesting of its native forest timber resource in a single year.

AASB 141 requires that the valuation should be based on a DCF basis for the volumes of presently-standing trees that will be sold over the 15 years. That discounting would result in a major reduction in the estimated value.

In Pöyry’s view, any valuation should reduce estimates of harvestable volume in the second and third five-year periods to account for the level of uncertainty and risk in harvestable yields in these periods.

The NIEIR Report goes on to apply ‘a plantation parity price’ to the standing volume of timber in order to estimate its value. The current stumpage price for plantation hardwood is used as a parity price. As noted earlier in this report and in the NIEIR Report, plantation *E. globulus* and *E. nitens* have different properties to the various other native forest hardwoods, whether used for pulping or timber.

These differences are not factored into the calculation of the parity price in the NIEIR Report. Also, at present, there is no market for Gippsland plantation hardwood sawlogs as the last mill that accepted plantation logs has now been closed. In Pöyry’s view, the plantation parity price calculation is simplistic and results in an overstatement of the values that might be obtained for native forest wood.

Pöyry believes the valuation of standing timber in the NIEIR Report is inappropriate, and overestimates the fair value of the standing timber.

**The Value of the Land underpinning the VicForests Estate**

In estimating the aggregate value of the capital tied up in the land underpinning the Victorian native forest estate, the NIEIR Report (Chapter 4) makes estimates of the potential area of state land available for commercial timber extraction in Victoria and an average value per hectare to be applied to these areas.
**Land Area**

The NIEIR Report uses two alternative estate sizes; 600 000 and 1 020 040 ha, for the area of land.

In Pöyry’s view, the areas of forest available for harvesting are clearly defined and identified in the State of the Forests Report (DSE, 2009), and total 929 000 ha of ‘suitable and available’ less 157 000 ha of forest of ‘low value and generally not contributing to sawlog production’. Hence, the appropriate area to use in any valuation of land is 772 000 ha, in line with the State of the Forests Report.

**Land Value**

The NIEIR Report (p 42) uses the average value of private land across ten Timber Town municipalities in eastern Victoria (AUD11 599/ha) as an initial base, and then reduces that value by an arbitrary 75% and 50% to yield a range from AUD5 799 to 2 890/ha.

In Pöyry’s view, this approach is not appropriate considering the nature of the estate and the level of encumbrance on the land. The historical reasons that state forests and national parks exist is that they were the areas with high clearing costs, poor soils, and poor or difficult growing conditions, that were not suitable, or sufficiently attractive for agriculture. Much of the state forest estate is too steep to permit profitable and non-eroding agriculture. These are also forests that provide other products, many of which are non-market goods or services (e.g. biodiversity conservation, water, recreation and carbon sequestration in various combinations with timber), and which rightly impose limitations on timber production and other commercial uses.

The NIEIR Report justifies the values cited by reference to the average price paid for MIS plantation land (AUD1 000 to 8 000/ha) as a comparator. However, it must be noted note that these values are for cleared agricultural land in an overheated market as the MIS companies competed for land. They are not representative of highly encumbered native forest land.

Pöyry believes an appropriate source for land values is provided in the DSE (2010) Annual Report:

> “In accordance with FRD 103D Non-Current Physical Assets, all land holdings are measured at their fair value at the date of revaluation. Revaluations of all land parcels, both Crown and freehold, were conducted by the Valuer-General Victoria as at 30 June 2008.

> The fair value of the land was determined from market based evidence by appraisal undertaken by professionally qualified valuers. The land is valued by direct comparison with sales of land in the surrounding area and then adjusted to account for factors such as land size, site attributes, topography, shape and location. A discount is also applied for the notional community service obligation (or restricted use) associated with the land.”

The final sentence of this quote is critical because of the jointly produced non-market goods and services in both national parks and state forests. The resulting values (DSE, 2010), corresponding approximate areas (DSE, 2008), and

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14 The Annual Report of Parks Victoria (2010) attributes zero value in its accounts to National Parks because of the restrictions and limitations that apply.
approximate average values for state forests and national parks are presented in Table 6-3.

Table 6-3: Valuation of Victoria's Forest Assets

<table>
<thead>
<tr>
<th>Asset</th>
<th>Value (AUD million)</th>
<th>Area (million ha)</th>
<th>Average Value AUD/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>National parks</td>
<td>306</td>
<td>3.515</td>
<td>373</td>
</tr>
<tr>
<td>State forests</td>
<td>383</td>
<td>3.2</td>
<td>432</td>
</tr>
</tbody>
</table>

Given the similarity of the areas involved in extent and the provision of non-wood goods and services, any rational allocation of the average capital cost between jointly produced timber and the non-wood goods and services on state forests and the jointly produced non-market goods and services on national parks would seem to yield a value for timber in the order of AUD59/ha, compared with the NIEIR Report estimate of AUD5 799 to 2 890/ha.

However, like all forest valuations, the issue is complicated by the fact that, as a commercial entity, standing timber and land are inseparable and cannot be valued separately in any simple and consistent manner. For large forest areas where arms-length transactions data on land and trees combined are unavailable, AASB = 141 therefore prescribes a somewhat arbitrary discounted cash flow basis (see Ferguson and Leech, 2007) in which the value of the trees (‘the biological asset’) is taken to be the net present value less the value of the land in its highest and best alternative use, the latter presumably being AUD373/ha, given the restrictions regarding the continued provision of non-market goods and services. This is much less than the range stated in the NIEIR Report, of AUD5 799 to 2 890/ha.

Pöyry believes the NIEIR Report over-estimates the opportunity cost of Victorian native forest state land and does not take into account the full implications of the joint production involved.

6.3 Conclusions on Competitive Neutrality and Valuation

Pöyry has made the following conclusions regarding the content of the NIEIR Report on competitive neutrality and the valuation of Victoria’s native forest asset.

- VicForests was created in 2004 to manage the timber harvesting and sales from Victoria’s state-owned native forest on a more commercial basis. The company has made some progress, with a significant proportion of timber being sold by open auction. VicForests still has a few years for existing licences and agreements to run out prior to achieving 100% competitive sales for its sawlogs. The open and transparent sale of logs by VicForests is consistent with the approach proposed in the NIEIR Report.

- VicForests optimises its harvest to maximise the harvest and sale of sawlogs, again in line with the approach proposed in the NIEIR Report to focus the native forest business on high-value products. The NIEIR Report fails to recognise that, owing to the variable nature of native forest and individual tree stems, a range of products will inevitably be produced from any harvesting.

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15 The areas from the State of the Forests Report (DSE, 2008) are a little outdated, state forests having decreased and national parks increased somewhat. Furthermore, the figure for national parks is the total for protected areas and include additional areas of formal reserves that are not national parks. However, this is unlikely to change materially the relativity and approximate average values.
operation. It is Pöyry’s view that the assumption that 60% of sawlogs harvested can be used for high-value products by 2015 is unachievable considering the nature of the resource.

- The level of assistance paid to the forest and logging industry is lower than the average paid to the entire primary producer sector. The level of assistance paid to the wood processing industry is in line with the average paid to manufacturing industries. The claim in the NIEIR Report that forestry and logging receives one of the highest levels of assistance is incorrect. Some volatility in the figures are caused by the levels of assistance to MIS tax incentives to encourage the establishment of plantations.

- Pöyry believes the valuation of Victoria’s commercial native forest estate in the NIEIR Report is simplistic and does not conform to the mandatory AASB 141 standard for agricultural (biological asset) valuation. This results in inflated values being assigned to the harvestable timber and underlying land.
7 REGIONAL AND RURAL EMPLOYMENT

7.1 Rural Employment

The NIEIR Report envisages replacing the employment lost in ceasing native forest harvesting by new employment in further processing of *E. globulus* plantations, or their replacement species in Western Victoria, and in managing the proposed new Victorian carbon stores in eastern Victoria.

Furthermore, while the NIEIR Report portrays the transition strategy as a gradual change, it is Pöyry’s view that, in practice, this would have to occur as a sequence of large changes that relate to:

- The cessation of native forest harvesting by 2020
- The start-up of new hardwood processing facilities no earlier than 2040.

This is because, as pointed out earlier, the transition to plantations sawlogs is not technically viable until 2040 at earliest, when new plantations managed for sawlogs can come on line in sufficient volume to support a new sawmill. Even then, it is uncertain if this mill is economically viable. There is considerable risk involved, and much research remains to be done to achieve economic development of hardwood plantations and dependent processing industry.

In the NIEIR Report, the cessation of native forest harvesting is scheduled to take place over a 15-year period. However, the effect of the announcement of such a policy would precipitate much more rapid closure of sawmills and attendant operations as the markets shift more to importing hardwood timber and the investment appetite and skills base in the existing native forest industry decline.

**Cessation of Native Forest Harvesting**

Harvesting and haulage contractors are potentially mobile because their equipment is easy to relocate. However, much of the current equipment inventory will be inappropriate for the harvesting of small-dimension *E. globulus* pulpwod logs, and will require new investment in the purchase of new equipment or modification of existing equipment. The Government would presumably have to bear the cost of new investment for these small businesses, if the transition as stated in the NIEIR Report was to be implemented. This would increase the level of assistance provided to the forestry and logging sector, something the NIEIR Report is critical of.

The current sawmill infrastructure is not mobile because it was designed for the processing of large-diameter native forest logs, a different resource to plantation hardwood (which the NIEIR Report acknowledges). In Pöyry’s view, the supply of plantation sawlogs of appropriate scale and quality to support a viable sawmilling industry will not be available until 2040 at the earliest.

Pöyry believes the NIEIR Report does not give sufficient weight to the impact of the loss of employment in Gippsland from 2015 to 2020, many in small towns, as native forest log supply in the region ceases. Coakes (2009) estimates that native forestry generates AUD150 million/a of economic activity in East Gippsland alone, and supports the livelihoods of some 2 000 people in the region.
The potential loss of employment to the Gippsland region would be especially damaging to the viability of small Gippsland sawmilling towns. About 15 towns located in East Gippsland are highly sensitive to change in employment in the forestry sector (Coakes, 2009), notably Cann River, Orbost, Nowa Nowa, Heyfield, Bendoc, Buchan, Benambra, and Newmerella and, to a slightly lesser extent, Bairnsdale and Lakes Entrance. The towns of Traralgon, Morwell, Moe, and Noojee would also be sensitive to any reduction in harvesting and haulage employment that services the Maryvale pulpmill and the hardwood sawmills in the Latrobe region (Bull and Bren, 2001; Cameron, 2006; Schirmer, 2010).

While the employment involved in the log haulage industry might well stay domiciled in Gippsland, given the need to travel between Western Victoria and Gippsland anyway, the harvesting employment will not, as location relative to work is important and the travel times from Gippsland to Western Victoria are substantial.

**Start-up of new Processing Facilities**

The native forest sawmilling industry cannot move immediately to further processing of *E. globulus* plantations. Sufficient supply of plantation hardwood sawlog of the quality required will not be available until 2040 to support investment in processing facilities that are competitive with imports from interstate or overseas.

An alternative of starting the proposed new sawmill early in say 2020 to produce only structural and lower-quality timber grades would not be economic as the revenues from these lower-value grades and reduced output will not support a cost structure based on a sawmill designed to produce appearance-quality grades.

The present employment and households dependent on the native forest industry are likely to relocate to other areas, to the disadvantage of the already fragile Gippsland communities.

Pöyry recognises that employment in growing, harvesting and processing of native forest products will not remain static in the future and that some small towns will be affected as individual enterprises adapt to new technologies and/or upscale. However, provided the environment for investment is encouraging and free from arbitrary changes in supply, these adjustments can be made progressively, to the advantage of those involved in terms of job security and skills, and to the economic viability of the region and its population.

**7.2 The Role of the Tourism Industry**

The NIEIR Report argues that employment lost in the native forest industry can be replaced by employment in tourism focussing on the carbon storage contribution of the forest once harvesting ceases.

As Pöyry notes in Section 5, the carbon storage and nature-based properties can equally well be attributed to harvested forest. However, the historical evidence does not support them as a great attraction for tourists. The development of employment in tourism and recreation in Gippsland has almost certainly not kept pace with past reductions in harvesting, based on data for annual average growth rates for domestic and international visitors in the East Gippsland Strategic Tourism Plan (Tourism Destination Management Pty Ltd & Quercus Marketing, 2006).
Table 7-1:
Tourism Growth Rates

<table>
<thead>
<tr>
<th>Type of Visitor</th>
<th>Annual Average Growth Rate (1999-2005) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Overnight Visitors</td>
<td>+0.6</td>
</tr>
<tr>
<td>Domestic Visitor Nights</td>
<td>+1.0</td>
</tr>
<tr>
<td>Domestic Daytrip Visitors</td>
<td>-1.2</td>
</tr>
<tr>
<td>International Overnight</td>
<td>-1.5</td>
</tr>
</tbody>
</table>

The overall annual average growth in tourism over that period has clearly been very modest.

Most Gippsland tourism has been associated with beach and water-based recreation, with only 15% being nature-based (Tourism Destination Management Pty Ltd & Quercus Marketing, 2006). In any event, much of the associated employment in tourism is seasonally based, and does not provide year-round employment.

Furthermore, native forest harvest activities can be organised to have minimal impact on nature-based recreational activities. Given the substantial areas of national parks and reserves already available, there is no evidence to support the view that continued harvesting would have any significant impact on what may be a very small future growth in nature-based tourism in Gippsland.

In Pöyry’s view, the NIEIR Report’s aspirations for nature-based tourism development in Gippsland to fill the transition gap created by the cessation of harvesting are overstated based on available data.

The NIEIR Report (Table 10.14(c)) shows that, under the proposed transition, resident employment (direct and flow-on) in Victoria would decline by 1,608 jobs over the period from 2011 to 2014 before being progressively offset by new plantation-based industry, carbon credits, and tourism.

The only specific references in the NIEIR Report to additional jobs created over this period stem from the AUD$104 million five-year investment in regional tourism, economic and employment initiatives creating 132 jobs, and AUD$32.5 million in recurrent funding for National Parks to create 292 new jobs for rangers and other parks workers – a total of 414 direct jobs. These jobs are presumably already built into Table 10.14 (c).

Gippsland tourism would therefore have to supply about 1,600 (direct and flow-on) jobs to offset the transition effects over this period. The crude multipliers for direct to direct plus flow-on employment in Table 10.14(c) range from about 1.5 to 2.0, so allowing for the upper level of multiplier, this equates to approximately 800 direct jobs which would be required. This could not be attained on the basis of the recent statistics for increases in total Gippsland tourism, much less for nature-based tourism. Thus, even if the very optimistic projections stated in the NIEIR Report of growth in employment after 2015 could be realised, the effects of the transition would be very damaging to the Gippsland regional economy from 2011 to 2015.

The potential shift in private employment from Gippsland to Western Victoria involved in the NIEIR Report’s proposal might well be welcomed in Western Victoria, but the depopulation of towns in the Gippsland region brings with it added costs and responsibilities for the Government (Coakes, 2009) and the capacity to service and protect the native forest, not least in respect to fire (VAFI, 2010). Pöyry believes that the NIEIR Report has not fully addressed or accounted for these issues.
WATER VERSUS WOOD

The NIEIR Report cites studies by Ferguson (1996) that support the thesis that the social net benefit from ceasing timber production in the water catchments servicing Melbourne would exceed those from the current practice of joint timber and water production because of increases in water yields. The argument and conclusions of Ferguson (1996) quoted in the NIEIR Report, states that, in principle, if the net social benefit to be gained by the cessation of timber harvesting is greater than allowing it to continue, then the change should be valid.

However, Pöyry does not believe that the net social benefit associated with the cessation of harvesting in the major water catchment areas is greater than the socio-economic benefits associated with native forest logging in these areas.

The NIEIR Report also links the Ferguson (1996) findings with financial analyses by Creedy and Wurzacher (2001) that supports the same conclusion. However, in Pöyry’s view, the coupling is inappropriate as there is a major distinction to be made between a social net benefit and a financial analysis, especially in this case of a business environment where a monopoly exists with a single supplier such as is the case with Melbourne Water. The notion of net social benefit as an efficiency criterion in such choices is well established in applied welfare economics (e.g. Brent, 1996; Boardman et al., 2010). However, net social benefit is not simply a reproduction of the net financial benefits. It also involves evaluating costs and benefits at their social, rather than private values. Shadow prices are therefore often used to remove the distortions that are created by imperfect market structures and governments. If they are not removed, as in this case, the financial analysis is likely to be misleading.

Account also needs to be taken of the distribution of the financial benefits and costs in terms of the equity of income distribution; ‘the fairness criterion’. This is implicit in the evaluation of net social benefit and is important in this case, as discussed below.

Finally, the stochastic nature of these benefits and costs, especially of the exposure to natural disasters such as fire, need to be taken into account. These caveats were made in Ferguson (1995 and 1996) but are not reflected in the NIEIR Report.

The NIEIR Report fails to take account of the following issues:

1. Inefficiency
2. Fairness
3. Fire.

An MBAC (2006) report notes that:

“Melbourne has 156 760 ha of water catchments. Over half of these are closed to any use and only a small area (18 560 ha) or 12% of the ‘open’ catchments are available for timber harvesting under special conditions. The area harvested in the four open catchments –Thomson, Yarra Tributaries, Tarago and Bunyip – is no more than 340 ha pa with future clearfell area declining to 127-220 ha pa.”

Furthermore, the MBAC (2006) report notes that:

“A previous Melbourne Water Review indicated that phasing out timber
harvesting by 2020 in the Thomson catchment could provide an additional 20,000 ML pa by 2050 (Water Resources Strategy Committee, 2002).”

The additional water yield from closing the remaining open catchments amounts to an increase of approximately 1%/a over the next 40 years. (DSE, 2004).

8.1 Inefficiency

Data on the economics of Melbourne metropolitan water supply are sparse and, like the NIEIR Report, this review must initially rely on the now dated study by Read, Sturgess and Associates (1992, 1994) and the Ferguson (1995) analysis based on that data. The central point of Ferguson’s (1995) argument is that, in an efficient economy, Melbourne Water should be charging the long-run marginal cost of water to consumers. Ferguson (1995) states that this was not the case in 1995 and, in Pöyry’s view, this is still not the case. If Melbourne Water consumers pay any amount less than the long-run marginal cost of water supply then it is a subsidy, the additional cost having to be met by the state through taxes or other revenues.

The advent of the desalination plant will vastly increase the extent of that subsidy. The long-run marginal cost of the plant was stated to be AUD1.37/kl (Partnerships Victoria, 2009). However, Davidson (2010) has pointed out that additional costs need to be factored in, such as the price to be paid per unit of water actually purchased by Melbourne Water (similar in magnitude per unit to the long-run marginal cost of the plant), plus the retail distribution costs to consumers. When these costs are added to the long-run marginal cost of the plant, the total (AUD7.05/kl) according to Davidson, 2010) is much in excess of the proposed residential price of water (AUD1.20/kl now, rising to AUD2.20/kl in 2012, Essential Services Commission, as cited by Davidson, 2010). This represents a very large subsidy and an even greater unit subsidy for commercial consumers. There is not enough transparency in the data available to estimate the aggregate subsidy accurately, but there can be little doubt that the subsidy is a matter of billions of dollars annually to Melbourne Water consumers.

The NIEIR Report therefore promotes inefficiency in that it implicitly maintains a major subsidy to Melbourne Water consumers that encourages consumers to use more water than they would do if charged the appropriate price.

8.2 Fairness

The NIEIR Report references survey results from small towns that suggest industry employee expectations of residence there are short term. However, this sort of employment is often the starting point for longer-term productive employment for previously disadvantaged rural dwellers that often have relatively low levels of education and few other opportunities, unlike many of their urban analogues. These employees pay their taxes and thus contribute to supporting some of the subsidies given to Melbourne Water consumers, as well as supporting local rural businesses and communities.

As discussed earlier in this report, timber production by VicForests operates within a competitive environment. The effective rate of assistance to the forestry and logging sector is reasonably low by general standards (PC, 2010) and VicForests is moving toward the competitive pricing of all of its sawlogs through competitive sales. There are some government-imposed constraints on competition in terms of harvesting and haulage, terms of employment, and external debt levels for
VicForests that cloud this picture, but the dependent sawmilling industry is highly competitive. Competition at this level comes in part from softwood timbers and pulpwod, in part from imports of those products, and in part from substitute materials such as steel and cement.

Importantly, as noted earlier, the majority of that economically-productive employment partly or wholly dependent on timber production from the open catchments is rural or regionally-based and includes the Maryvale pulpmill and many Gippsland towns (Schirmer 2010, Coakes, 2011). This highlights the issue of lack of fairness in the proposal stated in the NIEIR Report to cease productive and wealth-producing activities in order to supply a small amount of additional water to an urban population that is already being subsidised and therefore using more water than it would under economically-rational pricing.

8.3 Fire

The importance of accounting for fire scarcely needs emphasis in the light of the sequence of 2003, 2006-2007 and especially the 2009 fires in Victoria. Most of the old-growth ash (E. regnans and E. nitens) forests protected within the metropolitan catchments were burnt and killed. They will regenerate and impose greater demands on the Melbourne Water supply over the next 50 years, as did the 1939 fire regrowth, on which the often-quoted Kuczera (1987) study of water yields was based.

The fires also posed a very difficult problem for water quality in the short term as barrier measures had to be installed to reduce sediment inflow into the reservoirs, and water from the burnt catchments had to be held long enough in the reservoirs for the majority of any sediments to settle (Melbourne Water, 2010).

The NIEIR Report states that closed catchments ensure water quality is maintained and that further harvesting ‘will see these values irretrievably damaged’. However, closed catchments are damaged by other causes; they can suffer from landslips and/or erosion as a result of extreme rainfall events, especially following fires. Melbourne Water has established reservoir management practices to ameliorate these water quality issues (Melbourne Water, 2009), with the assistance of some chemical treatment (ACH dosing) immediately after the 2009 fire.

Our knowledge of the return periods for catastrophic fires in Victoria is limited by the recorded history. Nevertheless, studies by Ferguson (2011) suggest mean intervals between catastrophic fires of 40 to 100 years (depending on forest type) are decreasing as a result of climate change. These findings imply that much less old growth will survive in protected areas, and highlight Ashton’s (2000) now prophetic statement about the much-studied Wallaby Creek catchment ‘Whether the Big Ash will be spared from fire in future centuries is very doubtful’ proved all too accurate.

Thus, in addition to the immediate impact of the 2009 fires on Melbourne’s water supply over the next 50 years, any longer-term analysis of net social benefit of timber and water production needs to account for the probability of catastrophic fires. That accounting will probably lead to a much reduced cycle length of fire and
regeneration compared to that assumed in the deterministic\textsuperscript{16} financial analyses of Creedy and Wurzbacher (2001).

8.4 Balance between Taxation-Subsidised Services and Wealth-Generating Activity

In Pöyry’s view, the argument posed by Creedy and Wurzbacher (2001) and the NIEIR Report that closing the remaining catchments to harvesting would provide the maximum socio-economic benefits is incorrect. It would reduce them.

- The additional water yield from cessation of timber production is small relative to current annual consumption, or in relation to the impact of the regrowth that will arise from the 2009 fires, because it involves harvesting small areas annually relative to the total resource (approx. 265 ha/a over the past 20 years according to VAFI, 2011).

- On the other hand, if the NIEIR proposal is adopted, economically-productive rural employment would be sacrificed to supply a very small gain in water supply to Melbourne Water consumers who are already being significantly subsidised from state taxation sources.

- The NIEIR proposal promotes inefficiency because the subsidies create a lower price of water to consumers and so encourage consumers to use more water than they otherwise would, if charged the appropriate price. It is unfair because it would cease the economically-productive employment of those involved in the hardwood sawmilling and seriously threaten the viability of a regional enterprise, with contingent impacts on the dependent rural towns and region.

Given these circumstances, Pöyry considers it reasonable to accept a small loss of water from harvesting in exchange for productive rural employment.

\textsuperscript{16} Deterministic analyses assume certainty and do not account for stochastic elements such as fires. They often attempt to compensate partially for this by using sensitivity analysis but no such analyses of the effects of catastrophic fire were carried out.
9

BIBLIOGRAPHY


Biodiversity Fund Fact Sheet – Australian Government Clean Energy Future Program.


UN REDD Program Website: www.un-redd.org


Washusen (2004b): “Processing Pruned and UnPruned Eucalyptus globulus Managed for Sawlog Production to Produce High Value Products”. FWPRDC PN03.1315


17 Not “Washursen” as referenced in the NIEIR Report.
APPENDIX 1

Pulpwood Plantation Model Assumptions
Pöyry has developed a post-tax financial model to examine the profitability of replanting hardwood pulpwood plantations in Western Victoria following clearfell. Key model assumptions are shown in Table 1.

Pöyry has estimated the average growth rate of pulpwood hardwood plantations to be 17.7 m$^3$/ha/a over the 10-year rotation.

It is Pöyry’s opinion that corporations will not invest in new plantations unless the NPV is positive when a post-tax real discount rate of 7%/a is applied. The assumed lease or land holding cost is AUD250/ha/a, this is equivalent to a freehold value of between about AUD3 600/ha and AUD5 000/ha$^1$.

**Table 1: Model Assumptions**

<table>
<thead>
<tr>
<th>Assumption</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rate (mean annual increment (MAI)) of 25 years (total standing volume under bark).</td>
<td>m$^3$/ha/a</td>
<td>17.7</td>
</tr>
<tr>
<td>MAI for total recoverable volume (TRV)</td>
<td>m$^3$/ha/a</td>
<td>16.5</td>
</tr>
<tr>
<td>Yield at age 10</td>
<td>m$^3$/ha/a</td>
<td>165</td>
</tr>
<tr>
<td>Delivered Chip Price (to Port)</td>
<td>m$^3$/ha/a$^2$</td>
<td>92</td>
</tr>
<tr>
<td>Stumpage Price</td>
<td>AUD/m$^3$</td>
<td>48</td>
</tr>
<tr>
<td>Taxation</td>
<td>%</td>
<td>30</td>
</tr>
<tr>
<td>Discount Rate (Real Post-tax)</td>
<td>%</td>
<td>7</td>
</tr>
<tr>
<td>Inflation</td>
<td>%</td>
<td>2.5</td>
</tr>
<tr>
<td>Nominal Discount Rate</td>
<td>%</td>
<td>9.7</td>
</tr>
<tr>
<td>Land cost (Lease or land holding cost on a net stocked area basis)</td>
<td>AUD/ha/a</td>
<td>250</td>
</tr>
<tr>
<td>Overhead Cost</td>
<td>AUD/ha</td>
<td>75</td>
</tr>
<tr>
<td>Distance to Port</td>
<td>km</td>
<td>100</td>
</tr>
</tbody>
</table>

The operational costs applied in the model are shown in Table 2.

**Table 2: Operational Cost**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Age (years)</th>
<th>Cost (AUD/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal Control</td>
<td>0</td>
<td>35</td>
</tr>
<tr>
<td>Animal Control</td>
<td>1</td>
<td>35</td>
</tr>
<tr>
<td>Weed Control</td>
<td>1</td>
<td>180</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>2</td>
<td>150</td>
</tr>
<tr>
<td>Coppice Prune</td>
<td>3</td>
<td>600</td>
</tr>
<tr>
<td>Roads</td>
<td>9</td>
<td>200</td>
</tr>
<tr>
<td>Clearfell Supervision</td>
<td>10</td>
<td>160</td>
</tr>
</tbody>
</table>

The model indicates that the post-tax real internal rate of return (IRR) from of the hardwood plantation is 8.4%/a. The Net Present Value (NPV) of the investment is AUD210/ha. In Pöyry’s opinion, this exceeds the required IRR for corporate investment which is about 7%/a.

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$^1$ The land holding cost divided by the discount rate (7%/a) gives the lower value (AUD3 600/a) however lease rates are typically about 5%/a of freehold value.

$^2$ m$^3$ round wood equivalent, Pöyry has assumed at 1:1 ratio of GMt:m$^3$ for pulpwood.
However, the model also shows that plantations with average growth rates may not be financially viable if the land holding cost is greater than AUD290/ha/a, this is equivalent to a freehold value of about AUD4 100/ha.

Pöyry has provided a sensitivity analysis on the affect of land prices on investment returns (see Table 3 below). A 40% increase in land cost from AUD250/ha/a to AUD350/ha/a results in a drop in NPV of AUD562/ha from AUD210/ha to AUD-352/ha and a reduction in the forecast IRR from 8.4%/a to 4.9%/a.

The land holding costs is either the lease cost for leased properties or the opportunity cost of ownership for freehold properties. Table 3 implies that plantations with a land holding cost of AUD350/ha/a and are unlikely to be maintained as plantations following clearfell. Plantations with either greater yields or shorter transport distances than that assumed in the model can absorb higher land holding costs and still achieve the required returns. Similarly, those further from the port or with lower yields can only afford lower land costs.

Table 3
Land Costs and Corresponding Forecast Real Post-tax IRR

<table>
<thead>
<tr>
<th>Land Holding Costs (AUD/ha/a)</th>
<th>Equivalent Freehold Cost (AUD/ha)</th>
<th>IRR (%/a)</th>
<th>NPV (AUD/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>1 400</td>
<td>15.1</td>
<td>1 052</td>
</tr>
<tr>
<td>150</td>
<td>2 100</td>
<td>12.6</td>
<td>771</td>
</tr>
<tr>
<td>200</td>
<td>2 900</td>
<td>10.4</td>
<td>490</td>
</tr>
<tr>
<td>250</td>
<td>3 600</td>
<td>8.4</td>
<td>210</td>
</tr>
<tr>
<td>300</td>
<td>4 300</td>
<td>6.5</td>
<td>- 71</td>
</tr>
<tr>
<td>350</td>
<td>5 000</td>
<td>4.9</td>
<td>- 352</td>
</tr>
<tr>
<td>400</td>
<td>5 700</td>
<td>3.3</td>
<td>- 633</td>
</tr>
<tr>
<td>450</td>
<td>6 400</td>
<td>1.8</td>
<td>- 914</td>
</tr>
</tbody>
</table>
APPENDIX 2

Gippsland Pulpwood Plantation Model Assumptions
Pöyry has developed a post-tax financial model to examine the profitability of establishing new hardwood pulpwood plantations on agricultural land in Gippsland. Key model assumptions are shown in Table 1.

Pöyry has estimated the average growth rate of pulpwood hardwood plantations to be 17.7 m³/ha/a over the 10-year rotation.

It is Pöyry’s opinion that corporations will not invest in new plantations unless the NPV is positive when a post-tax real discount rate of 7% is applied. The assumed lease or land-holding cost is AUD250/ha/a. This is equivalent to a freehold value of about AUD3 600 - 5 000/ha.

**Table 1: Model Assumptions**

<table>
<thead>
<tr>
<th>Assumption</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rate (MAI) of 25 years TSVUB (total standing volume under bark).</td>
<td>m³/ha/a</td>
<td>17.7</td>
</tr>
<tr>
<td>MAI for total recoverable volume (TRV)</td>
<td>m³/ha/a</td>
<td>16.5</td>
</tr>
<tr>
<td>Yield at age 10</td>
<td>m³/ha/a</td>
<td>165</td>
</tr>
<tr>
<td>Stumpage price</td>
<td>AUD/m³</td>
<td>40.00</td>
</tr>
<tr>
<td>Taxation</td>
<td>%</td>
<td>30</td>
</tr>
<tr>
<td>Discount rate (real post-tax)</td>
<td>%</td>
<td>7</td>
</tr>
<tr>
<td>Inflation</td>
<td>%</td>
<td>2.5</td>
</tr>
<tr>
<td>Nominal discount rate</td>
<td>%</td>
<td>9.7</td>
</tr>
<tr>
<td>Land cost (lease or land holding cost)</td>
<td>AUD/ha/a</td>
<td>250</td>
</tr>
<tr>
<td>Overhead cost</td>
<td>AUD/ha</td>
<td>75</td>
</tr>
<tr>
<td>Distance to mill</td>
<td>km</td>
<td>100</td>
</tr>
</tbody>
</table>

The operational costs applied in the model are shown in Table 2.

**Table 2: Operational Cost**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Age (years)</th>
<th>Cost (AUD/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site preparation</td>
<td>0</td>
<td>800</td>
</tr>
<tr>
<td>Pre plant weed control</td>
<td>0</td>
<td>150</td>
</tr>
<tr>
<td>Seedlings</td>
<td>0</td>
<td>200</td>
</tr>
<tr>
<td>Planting</td>
<td>0</td>
<td>250</td>
</tr>
<tr>
<td>Fertiliser</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Age 1 maintenance costs</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Age 2 maintenance costs</td>
<td>2</td>
<td>70</td>
</tr>
<tr>
<td>Rooding</td>
<td>9</td>
<td>200</td>
</tr>
<tr>
<td>Clearfell supervision</td>
<td>10</td>
<td>160</td>
</tr>
</tbody>
</table>

Pöyry has estimated a stumpage price for pulplogs sold to the Maryvale mill based on the estimated price received selling logs for export from Geelong. Pöyry has assumed that the Maryvale mill has to pay a stumpage price marginally higher than the export-equivalent stumpage price in order to secure the supply. Consequently, Pöyry has applied a stumpage price of AUD40/m³ for plantation-grown hardwood logs delivered to the Maryvale mill.
Table 3
Estimated Price of Plantation Pulpwood delivered from Gippsland to Geelong

<table>
<thead>
<tr>
<th>Item</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free on board price</td>
<td>AUD/BDt</td>
<td>207.40</td>
</tr>
<tr>
<td>Port costs</td>
<td>AUD/BDt</td>
<td>25.00</td>
</tr>
<tr>
<td>Basic density</td>
<td>BDt/m³</td>
<td>0.533</td>
</tr>
<tr>
<td>Round wood equivalent price</td>
<td>AUD/m³</td>
<td>97.22</td>
</tr>
<tr>
<td>Fees</td>
<td>%</td>
<td>2</td>
</tr>
<tr>
<td>Stock loss</td>
<td>%</td>
<td>1</td>
</tr>
<tr>
<td>Chips at port gate</td>
<td>AUD/m³</td>
<td>94.30</td>
</tr>
<tr>
<td>Chipping cost</td>
<td>AUD/m³</td>
<td>7.00</td>
</tr>
<tr>
<td>Logs at port gate</td>
<td>AUD/m³</td>
<td>87.30</td>
</tr>
<tr>
<td>Transport cost</td>
<td>AUD/m³</td>
<td>24.86</td>
</tr>
<tr>
<td>Harvesting cost</td>
<td>AUD/m³</td>
<td>23.00</td>
</tr>
<tr>
<td>Stumpage value export sale</td>
<td>AUD/m³</td>
<td>39.44</td>
</tr>
<tr>
<td>Stumpage value sale to Maryvale</td>
<td>AUD/m³</td>
<td>40.00</td>
</tr>
</tbody>
</table>

The model forecasts a post-tax real internal rate of return (IRR) from new hardwood plantation of 2.6%\(^1\). In Pöyry’s opinion, the required IRR for corporate investment is about 7%, implying that new plantations will not be established if current costs and prices are maintained. The NPV of the investment is negative AUD763/ha.

A large plantation expansion program would be expected to put upward pressure on land prices. Consequently, Pöyry has provided a sensitivity analysis of the effect of land prices on investment returns (see Figure 1). A 40% increase in land cost, from AUD250/ha/a to AUD350/ha/a results in a drop in NPV from negative AUD763/ha to negative AUD1 325/ha and a reduction in the forecast IRR from 2.6% to -0.2%. The target IRR of 7% is only achieved if the land holding cost is below AUD115/ha/a. This equates to a land price of about AUD1 640\(^2\) per net stocked ha. In Pöyry’s opinion, there is not enough land available in Gippsland at this cost with a productivity potential of 17.7 m³/ha/a to establish plantations to produce enough pulpwood to serve as a substitute for native forest pulpwood at the Maryvale mill.

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\(^1\) This is less than the estimated IRR from coppiced plantations in discussed in Section Error! Reference source not found. due to greater establishment costs.

\(^2\) As estimated by the land-holding cost divided by the real post-tax discount rate (7%).
Figure 1:
Estimated IRR for Hardwood Pulpwood Plantation and Land Holding Cost

If a subsidy of 51% of operational costs is paid to the forest owner as they are incurred, the investment will achieve a 7% IRR. The present value\(^3\) of the subsidy paid is AUD763/ha.

Alternatively, if no subsidy of operational costs was available, the delivered prices would need to increase by 17% for the investment to achieve a 7% post-tax real IRR. The required log prices are shown in Table 4.

### Table 4:
Log Prices required for a 7% IRR

<table>
<thead>
<tr>
<th>Price Point</th>
<th>Estimated Price (AUD/m(^3))</th>
<th>Price Required to achieve a 7% IRR (AUD/m(^3))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logs delivered to Maryvale</td>
<td>77.00</td>
<td>90.09</td>
</tr>
<tr>
<td>Stumpage</td>
<td>40.00</td>
<td>53.09</td>
</tr>
</tbody>
</table>

The Choosing Our Future scenario assumes that pulpwood will be transported from the Green Triangle to Maryvale as a substitute for the native forest pulpwood that Maryvale will no longer receive. In Section 3.4 of the main report, Pöyry estimates the delivered cost of plantations logs from Western Victoria to be AUD128/m\(^3\). This assumes that 75% will come from Western Victoria, with a transport distance equivalent to that of Branxholme and the remaining 25% coming from south west of Geelong.

Given a delivered log price of AUD128, new plantations in Gippsland would earn an IRR of 15.1% and have an NPV of AUD2,231/ha. At this price, the break-even land-holding cost is AUD645/ha/a for a 7% post-tax IRR. The favourable returns imply that, in the long term, it would be cheaper to subsidise the establishment of new plantations in Gippsland than to subsidise the transport of log from Western Victoria. Given the required volume of 531,000 m\(^3\)/a and the estimated yield of 165 m\(^3\)/ha at age 10, an additional 3,220 ha of plantations would need to be harvested each year. The total area of expansion required is 32,200 ha in order to substitute the Maryvale mill’s native forest pulpwood supply.

\(^3\) Discounted at a nominal discount rate of 9.7%
The delivered log price required for new plantation investments to earn a post-tax real IRR of 7% is AUD99.09/m$^3$. Given the required substitute volume of AUD531 000m$^3$/a, the total required subsidy would be AUD6.95 million/a which is AUD24 million/a less than the estimated cost of transporting logs from Western Victoria (AUD31 million/a). However, this reduction in cost only occurs after these new Gippsland plantations come on line 10 years after the plantation program is begun.
APPENDIX 3

Global and Australian Experience with Sawlog Plantations
Global Eucalypt Sawlog Plantations

Owing to the rapid growth of eucalypts as exotic plantations in warm–temperate and sub-tropical regions of the world, there has been considerable interest in processing the plantation eucalypts for solid wood products. Eucalypts were first established in plantation in the late 1800s in California and Morocco, and in both cases *E. globulus* (Tasmanian blue gum) was the main species. The plantations were originally planted to provide fuelwood; the Brazilians started planting eucalypts in the early 1900s to provide a source of fuelwood for their growing rail network. There has since been a rapid expansion of the eucalypt plantation estate across South America, Asia, the Iberian Peninsula and southern Africa. Large pulp industries have developed in Iberia, South America, Southern Africa and China that use eucalypt as their primary wood source.

There has been interest in growing eucalypt plantations for solid wood, with the majority of the interest in regions where there are existing eucalypt pulpwood/fuelwood (charcoal) plantations. The development of silvicultural regimes is often an attempt to capture additional value from the plantation resource. Eucalypt sawing industries have developed around the Klabin plantations close to the town of Telêmaco Borba, Parana state Brazil. The industry is based on *E. grandis* and *E. dunnii* plantations that were originally planted to feed the pulpmill located in the same town. In South Africa, Hans Merensky pioneered the management and processing of *E. grandis* for sawn wood in the north of the country. Large sawmills have now been established in Southern Africa, Uruguay and Brazil to process plantation-grown eucalypt

Small-scale *E. globulus* plantations managed for sawlog and veneer production have been established in northern Spain, and there is some interest and trials in processing of *E. nitens* into sawn timber in Chile. In both cases interest has arisen as the species performed well in pulpwood regimes in the same region.

Australian Eucalypt Sawlog Plantations

Within Australia, the first eucalypt plantations specifically managed for solid wood were established close to the town of Lismore in 1938 by the New South Wales Forestry Commission. In the 1960s and 1970s, the Forestry Commission of NSW established eucalyptus plantations for solid wood, predominantly *E. pilularis* and *E. grandis* around Coffs Harbour on the north coast of NSW. The organisation later took over pulp plantations established by APM in the same region which they managed on a “sawlog” regime with multiple thinning. As part of the regional forest agreement (RFA), sawlog eucalypt plantations were further expanded in the late 1990s on the north coast of NSW. The Queensland government established small areas of eucalypt plantations for solid wood in the south-eastern part of the state. FEA established approximately 43 000 ha of MIS-funded plantations in northern NSW and southern Queensland before it went into administration. These plantations were being managed to produce a mixture of pulp and solid wood products.

Elders Forest Management established approximately 4 000 ha of *E. pellita* (Red Mahogany) in northern Queensland on a sawlog regime that was thinned and pruned. This estate is the only example to date of a eucalypt plantation exclusively managed for solid wood, in isolation of an existing native forest processing
industry. In February 2011, Cyclone Yasi destroyed the majority of the red mahogany estate in northern Queensland. Pöyry understands the estate will not be re-established to eucalypt plantations.

The majority of eucalypt plantations in southern Australia have been established and managed for the production of pulpwood. Within Tasmania, the state-owned enterprise Forestry Tasmania, FEA and Gunns managed a small proportion of their *E. nitens* estates on sawlog regimes with pruning and thinning. However, to date, the majority of the eucalypt plantations in Tasmania are managed for pulpwood. FEA has gone into administration and Gunns has now abandoned pruning and thinning in its hardwood plantations in order to focus exclusively on pulpwood production for export pulpwood or to feed its planned pulpmill.

**Victorian Eucalypt Sawlog Plantations**

The majority of the Victorian hardwood estate is managed for pulp production. In Gippsland Victoria, HVP manages approximately 19 000 ha of hardwood plantations. There is also a small area of *E. regnans* that has been managed sawlog plantations grown on to 30 – 40 year rotations. However, it is understood that HVP has decided that these plantations will be replanted to pine or *E. nitens* after they have been harvested.

The NIEIR report refers to the FFORNE (Farm Forestry of North East Victoria) Hardwood Co-Operative Ltd as providing a source of plantation-grown sawn wood timber with in Victoria. Since 1996, the co-operative has established approximately 1 700 ha of eucalyptus plantations in north-eastern Victoria. This is well below its target of 1000 ha/a. FFORNE has mainly used the species *E. nitens, E. globulus, E. saligna* and *E. grandis* in its plantations, all of which are considered non-premium sawlog species.

In the Green Triangle region, large-scale (>160 000 ha) eucalypt plantations have been established, almost exclusively on pulpwod regimes. The Green Triangle hardwood estate is almost exclusively *E. globulus*, with some small-scale pilot plantations and trials investigating the feasibility of sawlog regimes within the region.
APPENDIX 4

Financial Viability of a Hardwood Sawlog Regime
Pöyry has developed a post-tax financial model to examine the profitability of hardwood plantations managed on a sawlog regime. This regime produces both pulpwood and sawlogs. Key model assumptions are shown in Table 1.

Pöyry has assumed a high average growth rate of 14.9 m$^3$/ha/a over the 32-year rotation relative to its understanding of average growth rates for eucalyptus plantations grown for sawlog.

It is Pöyry’s opinion that corporations will not invest in new plantations unless the NPV is positive when a post-tax real discount rate of 7% is applied. The assumed lease or land-holding cost is AUD250/ha/a. This is equivalent to a freehold value of between about AUD3 600/ha and AUD5 000/ha.

**Table 1: Model Assumptions**

<table>
<thead>
<tr>
<th>Assumption</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rate (MAI) of 25 years TSVUB</td>
<td>m$^3$/ha/a</td>
<td>14.9</td>
</tr>
<tr>
<td>MAI for total recoverable volume (TRV)</td>
<td>m$^3$/ha/a</td>
<td>14.3</td>
</tr>
<tr>
<td>Taxation</td>
<td>%</td>
<td>30</td>
</tr>
<tr>
<td>Discount rate (real post-tax)</td>
<td>%</td>
<td>7</td>
</tr>
<tr>
<td>Inflation</td>
<td>%</td>
<td>2.5</td>
</tr>
<tr>
<td>Nominal discount rate</td>
<td>%</td>
<td>9.7</td>
</tr>
<tr>
<td>Land cost (lease or land-holding cost)</td>
<td>AUD/ha/a</td>
<td>250</td>
</tr>
<tr>
<td>Overhead cost</td>
<td>AUD/ha/a</td>
<td>75</td>
</tr>
</tbody>
</table>

The operational costs applied in the model are shown in Table 2.

**Table 2: Operational Cost**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Age (years)</th>
<th>Cost (AUD/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning and establishment</td>
<td>0</td>
<td>1600</td>
</tr>
<tr>
<td>Age 1 maintenance</td>
<td>1</td>
<td>400</td>
</tr>
<tr>
<td>Age 2 maintenance</td>
<td>2</td>
<td>130</td>
</tr>
<tr>
<td>Fertiliser</td>
<td>3</td>
<td>200</td>
</tr>
<tr>
<td>Lift prune 1 (450 sph, 2.1 m)</td>
<td>3</td>
<td>600</td>
</tr>
<tr>
<td>Thin to waste (to 500 sph)</td>
<td>4</td>
<td>150</td>
</tr>
<tr>
<td>Lift prune 2 (400 sph, 4.2 m)</td>
<td>4.1</td>
<td>600</td>
</tr>
<tr>
<td>Lift prune 3 (350 sph, 6.4 m)</td>
<td>5.5</td>
<td>800</td>
</tr>
<tr>
<td>Roading</td>
<td>2</td>
<td>450</td>
</tr>
<tr>
<td>First thinning supervision</td>
<td>13</td>
<td>160</td>
</tr>
<tr>
<td>Post thin fertilizer</td>
<td>13</td>
<td>400</td>
</tr>
<tr>
<td>Clearfell supervision</td>
<td>32</td>
<td>160</td>
</tr>
</tbody>
</table>

The log specifications applied are those shown in Table 3.
Table 3: Log Specification

<table>
<thead>
<tr>
<th>Log Grade</th>
<th>Minimum Length (m)</th>
<th>Maximum Length (m)</th>
<th>SEDUB (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearwood sawlog</td>
<td>2.6</td>
<td>11.0</td>
<td>35</td>
</tr>
<tr>
<td>Knotty sawlog</td>
<td>2.4</td>
<td>5.5</td>
<td>25</td>
</tr>
<tr>
<td>Pulpwood</td>
<td>2.4</td>
<td>11.0</td>
<td>10</td>
</tr>
</tbody>
</table>

The yield table was produced using the Farm Forestry Toolbox \(^2\) with *Eucalyptus nitens* as the species, Vic_Plantation_[24] as the growth model and an unmanaged peak MAI of 20 m\(^3\)/ha/a. The forecast yields are shown in Table 4.

Table 4: Forecasts of Total Recoverable Yield

<table>
<thead>
<tr>
<th>Operation</th>
<th>Age (years)</th>
<th>Clearwood Sawlog (m(^3)/ha)</th>
<th>Small Sawlog (m(^3)/ha)</th>
<th>Pulpwood (m(^3)/ha)</th>
<th>Total (m(^3)/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First thinning</td>
<td>13</td>
<td>-</td>
<td>-</td>
<td>51</td>
<td>51</td>
</tr>
<tr>
<td>Clearfell</td>
<td>32</td>
<td>87</td>
<td>212</td>
<td>106</td>
<td>405</td>
</tr>
</tbody>
</table>

Pöyry has estimated the costs of harvesting and transport as shown in Table 5. The transport cost is based on a transport distance of 100 km.

Table 5: Estimated Production Costs

<table>
<thead>
<tr>
<th>Log Grade</th>
<th>Harvesting and Loading (AUD/m(^3))</th>
<th>Transport (AUD/m(^3))</th>
<th>Total (AUD/m(^3))</th>
</tr>
</thead>
<tbody>
<tr>
<td>First thinning</td>
<td>25.00</td>
<td>14.00</td>
<td>39.00</td>
</tr>
<tr>
<td>Clearfell</td>
<td>17.00</td>
<td>14.00</td>
<td>31.00</td>
</tr>
</tbody>
</table>

The forecast delivered prices are shown in Table 6.

Table 6: Forecast Delivered Log Prices

<table>
<thead>
<tr>
<th>Log Grade</th>
<th>Price (AUD/m(^3))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulplogs</td>
<td>69.00</td>
</tr>
<tr>
<td>Small sawlog</td>
<td>99.00</td>
</tr>
<tr>
<td>Clearwood sawlog</td>
<td>130.00</td>
</tr>
</tbody>
</table>

The stumpage prices applied in the financial model are shown in Table 7. Pulpwood thinning stumpages are lower than typical short-rotation pulpwood regime stumpages due to the higher per-cubic metre cost of thinning relative to clearfell.

Table 7: Forecast Stumpage Price

<table>
<thead>
<tr>
<th>Operation</th>
<th>Age</th>
<th>Clearwood Sawlog (AUD/m(^3))</th>
<th>Small Sawlog (AUD/m(^3))</th>
<th>Pulpwood (AUD/m(^3))</th>
</tr>
</thead>
<tbody>
<tr>
<td>First thinning</td>
<td>13</td>
<td>-</td>
<td>-</td>
<td>30.00</td>
</tr>
<tr>
<td>Clearfell</td>
<td>25</td>
<td>99.00</td>
<td>66.50</td>
<td>38.00</td>
</tr>
</tbody>
</table>

---

1. Small End Diameter Under Bark
Model Results

Given the assumptions detailed above, the predicted post-tax real IRR from of the hardwood plantation is only 2.5%. The NPV of the investment is negative AUD4 044/ha. In Pöyry’s opinion, the required IRR for corporate investment is about 7%. A 7% return can only be achieved by subsidising growing costs or by increased log prices.

If a subsidy of 94% of operational costs (see Table 2) is paid to the forest owner as they are incurred, then the investment will achieve a 7%. The present value
 of the subsidy paid is AUD4 044/ha. Figure 1 shows the IRR of the investment for an increasing amount of subsidy.

Figure 1: Present Value of Subsidy and corresponding IRR of Hardwood Plantations on Sawlog Regimes

Alternatively, without any subsidy of operational costs, the delivered prices would need to increase by 46.5% for the investment to achieve a 7% post-tax real IRR. The required log prices are shown in Table 8.

Table 8: Delivered Log Prices required for a 7% IRR

<table>
<thead>
<tr>
<th>Log Grade</th>
<th>Current Price (AUD/m³)</th>
<th>Price Required to achieve a 7% IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulplogs</td>
<td>69.00</td>
<td>101.09</td>
</tr>
<tr>
<td>Small sawlog</td>
<td>99.00</td>
<td>145.04</td>
</tr>
<tr>
<td>Large pruned sawlog</td>
<td>130.00</td>
<td>190.45</td>
</tr>
</tbody>
</table>

A large plantation expansion program would be expected to purchase a large proportion of available land and available leases which would put upward pressure on land prices. Consequently, Pöyry has provided a sensitivity analysis on the effect of land prices on investment returns (see Table 9). A 40% increase in land cost from AUD250/ha/a to AUD350/ha/a results in a drop in NPV of AUD955/ha,
from negative AUD4 044/ha to negative AUD4 999/ha and a reduction in the IRR from 2.5% to 1.7%.

A decrease in land price of 40% to AUD150/ha/a results in an increase in NPV from negative AUD5 325/ha to negative AUD4 370.

Table 9: Land Costs and corresponding forecast Real Post-tax IRR

<table>
<thead>
<tr>
<th>Land Costs (AUD/ha/a)</th>
<th>IRR (%)</th>
<th>NPV (AUD/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4.9</td>
<td>-1 656</td>
</tr>
<tr>
<td>50</td>
<td>4.3</td>
<td>-2 133</td>
</tr>
<tr>
<td>100</td>
<td>3.8</td>
<td>-2 611</td>
</tr>
<tr>
<td>150</td>
<td>3.4</td>
<td>-3 089</td>
</tr>
<tr>
<td>200</td>
<td>2.9</td>
<td>-3 566</td>
</tr>
<tr>
<td>250</td>
<td>2.5</td>
<td>-4 044</td>
</tr>
<tr>
<td>300</td>
<td>2.1</td>
<td>-4 522</td>
</tr>
<tr>
<td>350</td>
<td>1.7</td>
<td>-4 999</td>
</tr>
</tbody>
</table>
SAWING PATTERNS: BACK-SAWN VS QUARTER-SAWN

The structure of wood at the anatomical level basically consists of individual fibres or cells. The cells are elongated, with relatively thin walls, and are hollow. The walls of the cell are made up predominantly of long chains of cellulose macromolecules (which is what is used to make paper) while the cells are “glued” together by lignin. Wood could therefore be pictured as trillions of straws bundled together with an orientation generally in the direction of the tree’s height (see Figure 1).

Figure 1:
Scanning Electron Microscope View of the anatomical Structure of Wood

The cells serve a variety of purposes including the provision of structural strength to keep the tree’s stem upright and orientated to the sun and rooted in the soil, the transport of water up the stem, and the transport and storage of nutrients.

The cell cavities, as well as the cell walls, are generally completely saturated with water while the tree is alive. However, when the tree is cut down, the wood starts to dry and moisture content decreases, first from the cell cavities (free water) and then from the cell walls (bound water). The removal of water from wood through drying can cause substantial changes to the wood, the cause of the changes being different for the removal of free and bound water. When free water is removed, in most
species of wood, no change happens. Generally, for almost all species of wood most of the change occurs during the final stages of drying, when the bound water is being removed. The reason change occurs at this stage is that, as the bound water is removed, the cell walls, and therefore the wood itself, start to shrink as the water molecules are removed from in between the cellulose molecules making up the cell wall. In a piece of wood cut from a tree, such as a sawn board, this shrinkage does not take place evenly: the surface of the board dries out before its core. But as the board’s surface dries out and tries to shrink it is restrained by the wet inner core of the board (which does not yet want to shrink) resulting in stress. The moment this stress exceeds the elastic limit of the wood, the individual fibres are torn apart, which manifests on the surface of the sawn board as cracks or checks.

As mentioned above, most timbers are only at risk of drying changes during the final stage of drying, when bound water is removed from the cell walls, causing differential shrinkage and stress build-up. However, the eucalypts (and a few other timber species) are quite unique in this regard: some species of eucalypts are extremely prone to drying changes during the initial stages of drying. This change is called “cell collapse” and is the result of extreme surface tension of water causing the walls of the cells to collapse as the free water is removed. All species of timber have small cavities (called “pits”) that connect cells together, through which water and nutrients can move freely from one cell to the next while the tree is alive, and generally do not cause problems during drying. However, in the case of some eucalypt species, these cavities are so microscopically small that, as the free water moves through them during wood drying, a very substantial stress is built up on the inside of the cell due to the extreme surface tension of the water as it moves through this small cavity. The result is that some cells collapse, and if a sufficiently large number of adjacent cells collapse, the entire surface of a sawn board can collapse, causing what is known as “washboarding” (see Figure 2). In most species of eucalypt this collapse can be recovered again through steam reconditioning, but in severe cases it may cause checks in the timber, either on the surface or internally (see Figure 3). While reconditioning closes these checks up again, they could reappear in the final product once the wood dries out slightly.

Figure 2:
“Washboarding” caused by massive Cell Collapse in E. nitens (before and after Reconditioning)

All wood has the fundamental property that it “behaves” differently in each of the three main anatomical “directions”; longitudinal, tangential and radial. Importantly, from the perspective of wood drying, these behavioural differences include a) the rate at which free moisture moves during drying, b) and the extent to which the wood shrinks during drying.

Along the longitudinal, or length-wise direction, of a piece of wood (i.e. orientated to the direction of tree height) shrinkage during drying is negligible. Due to the anatomical structure of wood the most significant shrinkage occurs in the so-called “tangential” direction, i.e. tangential to the surface of the stem, whereas the shrinkage in the radial direction is usually about half of that in the tangential direction. Boards cut in the tangential direction are called “flat-sawn”, while boards cut in the radial direction are called “quarter-sawn”, as illustrated below.
The impact of differential shrinkage between the tangential and radial directions is illustrated in Figure 5. Due to the substantially higher shrinkage in the tangential direction, sections of wood cut square when green (with the annual growth rings orientated diagonally across the end of the board) tend to develop a diamond shape after drying. Likewise, round sections tend to form an oval shape, while rectangular sections tend to “cup” after drying. It is noticeable that the most stable form after drying is achieved by those sections with vertical grain (with the annual growth rings orientated non-diagonally across the end of the board). While these sections shrink more in the tangential direction, as could be expected, they do not become distorted. It therefore follows that producing vertical-grain sawn timber has distinct advantages when it comes to the distortion of boards during drying, as well as during in-service use (since wood changes moisture content with changes in ambient conditions, for example due to changes in season, or the use of air-conditioning or heating in a room, products produced from wood will continue to “move” in service, which could cause problems.) Vertical-grain sawn timber is undoubtedly the most stable during drying and in-service. (However, it is also more time consuming and costly to produce, as will be discussed later on in this section.)

Eucalypts have particularly high levels of tangential shrinkage, which make them more prone to drying degrade related to collapse and differential shrinkage than most species of timber in the world. For this reason, a strategy of quarter-sawing eucalyptus has developed in Australia, particularly in Victoria and Tasmania, since the ash-eucalypts are particularly prone to drying degrade related to collapse and differential shrinkage.

Figure 5: Impact of Shrinkage during drying on the Shape on Sections of Wood cut from a Log (the quarter-sawn piece, in the center on the right has the the most stable form after drying)

Due to the anatomical structure of wood, free water generally moves fastest in the longitudinal direction and slowest in the radial direction, with the rate of water movement in the tangential direction being intermediate. Producing vertical-grain sawn timber therefore has the effect of slowing down the rate of moisture movement since most of the water has to move in the radial direction, both during drying and in-service, which has distinct advantages over flat-sawn timber. By
slowing down the rate of moisture movement during drying, catastrophic degrade due to collapse and differential shrinkage can be reduced while, during in-service use, it has the benefit that the timber “moves” slower and is therefore less likely to become distorted.

Figure 6 and Figure 7 illustrate how flat-grain boards are produced using a so-called “back-sawing” strategy, whereas vertical-grain boards are produced using a so-called “quarter-sawing” strategy. In general, quarter-sawing involves more handling of the log and sections of the log than back-sawing, requires more equipment and operators and produces narrower products (which have lower value).

Figure 6:
A back-sawing Strategy


Figure 7:
A quarter-sawing Strategy


Figure 8 shows alternative sawing strategies for producing flat-sawn and vertical-grain sawn timber. The strategy on the left produces a mix of flat-grain and vertical-grain, while the strategy on the right produces only vertical-grain.
Quarter-sawing plantation eucalypts presents two particular challenges:

1. Fast-grown plantation logs typically have high levels of residual growth-stress. When logs are cut into halves or quarters as illustrated above, the halves or quarters tend to curve into a “banana” shape which is difficult to handle and produces misshapen boards (in particular boards with spring, a defect which cannot be removed through flat drying as is the case with bow). Consequently, quarter-sawing generally causes a lower level of product recovery.

2. Due to the time value of money, plantation logs cannot be grown to the same size as native logs. The challenge for the sawmill quarter-sawing plantation logs is to produce quarter-sawn boards consisting of reasonable width and with a high proportion of heartwood content between the defective core in the centre of the log and the sapwood on the outside of the log. For example, if the diameter of a log is 40 cm (typical of plantation-grown sawlog regimes), there is only a distance of 20 cm from the pith (the defective center of the log) and the bark (where the sapwood is situated). If the sapwood has a radial extent of, say 2 cm, and the defective core has a radial extent of, say 2 cm, there is a maximum of only 16 cm of wood left to produce a “clean” quarter-sawn board. Once the irregular shape of the log itself is factored in, the effective board-width potential is reduced further, to around 14 cm. It should also be noted that this is the maximum width potential. Other boards will be even narrower. The result is a product mix consisting of narrow boards (lower value) and high piece-count (high production cost).

Therefore, while quarter-sawing plantation-grown eucalypts will undoubtedly have advantages, it is necessary to better understand the following aspects:

- Do the added value outweigh the added costs in terms of equipment, manpower, throughput and recovery?
- Does the market really value the attributes of quarter-sawn material? Would they buy flat-sawn material if the price was lower?
- Will it be feasible to do quarter-sawing on relatively small-diameter plantation-grown logs?
- Will it be possible to quarter-saw the proposed volume of plantation-grown logs (500 000 m$^3$/a), which has never been done before on such a scale anywhere in the world.
- Can quarter-sawn plantation-grown eucalyptus timber be produced at an internationally competitive cost in Australia?