Tasmanian Forests Intergovernmental Agreement: An assessment of its carbon value

Andrew Macintosh

March 2012

ANU Centre for Climate Law and Policy

Sponsored by

BAKER & MCKENZIE

About the ANU Centre for Climate Law and Policy

The ANU Centre for Climate Law and Policy (CCLP) is part of the ANU College of Law. It was established in 2007 with the objective of providing a focal point for law and policy research related to climate change. The CCLP also runs courses in climate law and provides consulting services. Additional details of the CCLP can be found on its website: http://law.anu.edu.au/CCLP/.

The CCLP gratefully acknowledges the support of its founding sponsor, Baker & McKenzie.

Corresponding author:

Andrew Macintosh
Ph: 61 2 6125 3832
Email: macintosha@law.anu.edu.au

About Baker & McKenzie

Baker & McKenzie provides sophisticated legal advice and services to the world's most dynamic global enterprises and has done so for more than 50 years. Our network of lawyers is amongst the world's most diverse and respected. We come from more than 60 countries and speak more than five dozen languages, including a common one, English. We are guided by a culture of integrity, personal responsibility, friendship and tenacious client service. Our unique approach enables clients to call upon more than 3,600 locally qualified, globally experienced lawyers in over 38 countries. We deliver the broad scope of quality legal services required to respond to any business need —consistently, confidently and with sensitivity for cultural, social and legal practice differences.

For more information about Baker & McKenzie, including details of its climate practice, please visit: www.bakernet.com.

Executive summary

The object of this report is to assist the Independent Verification Group process by evaluating the ENGO claims that:

- Australia could count reductions in logging emissions associated with the creation of the 572,000 ha of proposed reserves (ENGO reserves) towards its climate change mitigation commitments; and

- the creation of the ENGO reserves has the potential to make a 'significant and quick' contribution to reducing Australia's greenhouse gas emissions.

The report also assesses the number and value of the carbon credits that may be associated with the creation of the ENGO reserves.

Australia could count reductions in logging emissions towards its mitigation commitments

The key findings in relation to this ENGO claim are as follows.

- Australia currently does not account for forest management (FM) under the Kyoto Protocol, meaning any changes in FM practices and net FM emissions do not count towards Australia's mitigation target for the period 2008-2012.

- At the Durban Climate Conference in December 2011, new FM rules were agreed for the Kyoto Protocol's second commitment period. The most relevant aspects of the new rules are:

    - FM accounting will be compulsory in the second commitment period;

    - FM accounting will be based on FM reference levels, where FM credits and debits will be determined on the basis of the extent to which actual net FM emissions deviate from a pre-set reference level; and

    - FM and joint implementation FM credits will be subject to a cap equal to 3.5% of base year (1990) emissions (excluding LULUCF), or 14.6 Mt CO_2-e yr^{-1} over the second commitment period.

- The Australian Government has not yet decided whether to participate in the Kyoto Protocol's second commitment period or what accounting rules it will apply to its medium-term mitigation commitments.

- Australia may not apply the rules agreed at the Durban Climate Conference and could opt instead for a framework that better suits its interests and circumstances. If Australia opts for an alternative accounting framework, it is likely that: (a) it will include FM; (b) Australian FM accounting will be based on a reference level that is similar to that described in the Durban decisions; and (c) Australian FM credits will be uncapped.

Creation of the ENGO reserves has the potential to make a 'significant and quick' contribution to reducing Australia's greenhouse gas emissions

The impact of the ENGO reserves on Australia's greenhouse gas emissions will depend on how FM is accounted for in the post-2012 regime. If Australia does not account for FM, or there is a cap on FM credits that blocks the impact of the *Tasmanian Forests Intergovernmental Agreement* (TFIGA), the creation of the ENGO reserves will have no impact on Australia's mitigation commitments. However, it should result in a reduction in national unaccounted emissions and overall global emissions.

If Australia does account for FM, and the FM cap does not exclude the effects of the TFIGA, the creation of the reserves will reduce net emissions from FM but it should not result in a reduction in national or global emissions (i.e. the associated FM credits recorded against the national total will be offsets). While the creation of the ENGO reserves should not affect the net national emissions outcome, it could have important economic impacts related to carbon markets. The associated FM credits could be sold into international compliance markets or used to facilitate an increase in revenues from the carbon pricing scheme. The creation of the ENGO reserves could also generate Australian carbon credit units (ACCUs) under the Carbon Farming Initiative (CFI). In addition, by generating FM credits and/or Kyoto ACCUs, the ENGO reserves could reduce the net economic impact of meeting Australia's mitigation commitments by decreasing reliance on imported international carbon units.

FM credit projection

Using a method derived from Australia's proposed FM reference level accounting framework, it is estimated that, if the ENGO reserves are created, Tasmania's multiple use public native forests will generate FM credits equal to:

- 8.01 (7.01-8.90) Mt CO_2-e yr^{-1} over the period 2013-2020; and
- 8.48 (7.95-9.20) Mt CO_2-e yr^{-1} over the period 2021-2030.

These results do not take account of the potential for domestic leakage. If it is assumed that the net effect of leakage within Australia is to reduce the FM credits by 15%, these averages fall to 6.81 (5.96-7.56) Mt CO_2-e yr^{-1} and 7.21 (6.76-7.82) Mt CO_2-e yr^{-1} for 2013-2020 and 2021-2030 respectively.

The estimated FM credits equate to:

- between 7.4% and 8.7% of Australia's cumulative abatement task over the period 2013-2020 if Australia has a 5% emission reduction target for 2020; and
- between 2.5% and 2.9% of Australia's cumulative abatement task over the period 2021-2030 if Australia has an 80% emission reduction target for 2050.

Kyoto ACCU projection

Provided certain pre-conditions are satisfied, the creation of the ENGO reserves could be declared an eligible offsets project under the CFI. On the assumption that this occurs, and that Australia accounts for FM in the post-2012 era, it is estimated that the project could generate:

- 1.90 (1.66-2.12) Mt CO_2-e yr^{-1} of Kyoto ACCUs over the period 2013-2020; and

- 2.01 (1.88-2.19) Mt CO_2-e yr^{-1} of Kyoto ACCUs over the period 2021-2030.

These Kyoto ACCU estimates assume a 15% deduction is made to account for the risk of leakage, and a further 5% deduction is made for the risk of reversal buffer.

Value of the FM credits

If the ENGO reserves are created, Tasmania's multiple use public native forests could generate both FM credits and Kyoto ACCUs. The Kyoto ACCUs that are issued in relation to the ENGO reserves will effectively be 'carved out' of the larger pool of FM credits associated with Tasmania's multiple use public native forests. Both the Kyoto ACCUs and the FM credits are likely to have a market value. The Kyoto ACCUs could be sold into domestic and international compliance markets. The FM credits remaining after the deduction of the Kyoto ACCUs could be used to facilitate a 1:1 increase in carbon unit sales under the *Clean Energy Act 2011* (Cth) (CE Act) or sold into international compliance markets.

Estimates of the net present value (NPV) (2013 $A) of the projected FM credits and Kyoto ACCUs are provided in Table ES1 below. These estimates are based on three carbon price paths derived from those in the Australian Treasury's *Strong Growth, Low Pollution* report, and assume 15% leakage.

Table ES1 Net present value (NPV) (2013 $A) of FM credits and Kyoto ACCUs, low, medium and high carbon price paths*

	NPV (2013 $A million)	
	FM credits	**Kyoto ACCUs**
Low carbon price path		
FM credits generated over the period 2013-2020	650	251
FM credits generated over the period 2021-2030	754	292
Clean Energy Future price path		
FM credits generated over the period 2013-2020	973	377
FM credits generated over the period 2021-2030	1660	642
High carbon price path		
FM credits generated over the period 2013-2020	1678	652
FM credits generated over the period 2021-2030	3462	1339

* Assumes a constant social time preference rate of 2.7%.

1. Introduction

On 7 August 2011, the Australian and Tasmanian Governments signed the *Tasmanian Forests Intergovernmental Agreement* (TFIGA). The Agreement established an Independent Verification Group charged with, amongst other things, assessing the claims made by environment non-government organisations (ENGOs) about the conservation values of 572,000 ha of proposed reserves. The ENGOs have made a number of claims about the carbon values associated with the proposed reserves and their potential benefits for Australia, including that:

- if Australia elected 'to account for forest management under article 3.4 of the Kyoto Protocol for the next commitment period (2012-2017) reducing emissions through increased native forest protection (with commensurate reductions in logging) would allow Australia to count reductions in logging emissions towards its Kyoto target' (ACF et al., 2011: 12); and

- '[s]ecurely protecting some of the world's most carbon dense forests in the proposed additions to the Tasmanian reserve system would clearly make a significant and quick contribution to reducing Australia's Greenhouse Gas emissions and provide a long-term path to increasing their carbon stocks (ACF et al., 2011: 12).

The object of this report is to assist the Independent Verification Group process by evaluating these ENGO claims and assessing the value of any carbon credits that could be generated by the creation of the reserves. Section 2 reviews the ENGO claims about the potential for Australia to count reductions in logging emissions towards its mitigation commitments. Section 3 provides an overview of the conceptual issues that are likely to shape the mitigation and carbon credit outcomes from the TFIGA and ENGO reserves. Section 4 analyses what impact the TFIGA and ENGO reserves could have on Australia's mitigation commitments, focusing on the number of forest management (FM) credits that could be generated from Tasmania's multiple use public native forests if the ENGO reserves are created. Section 5 estimates the number of Australian carbon credit units (ACCUs) that the ENGO reserves might generate under the Carbon Farming Initiative (CFI). Section 6 assesses the value of the carbon credits that may flow from the creation of the reserves. Section 7 discusses the implications of the findings and concludes.

2. Australia could count reductions in logging emissions towards its Kyoto target

2.1. Forest accounting during the Kyoto Protocol's first commitment period

Australia currently operates two greenhouse accounting systems, one for the purposes of the United Nations Framework Convention on Climate Change (UNFCCC) and another for the Kyoto Protocol. The major difference in the accounts relates to land use, land-use change and forestry (LULUCF). The LULUCF rules under the Kyoto Protocol differ significantly to those used for the purposes of UNFCCC accounting and have a profound effect on the reported national total. The most relevant aspects of the Protocol's LULUCF accounting rules during the first commitment period (2008-2012) are:

- Australia only accounts for emissions and removals associated with reforestation (direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources) and deforestation (direct human-induced conversion of land that was forest on 31 December 1989 to non-forested land) since 1990 (these are the Article 3.3 activities);[1]

- Article 3.4 activities, the most relevant of which is forest management (FM) (it covers the emissions and removals associated with Tasmania's multiple use public native forests, private native forests and pre-1990 plantations), have been voluntarily excluded from Australia's accounts;

- all LULUCF activities, with the exception of deforestation, are excluded from the base year (1990) emissions estimate for the purposes of determining parties' assigned amounts (i.e. they are only accounted for during the commitment period and are, therefore, the equivalent of offsets);

- Australia, and other Annex B parties who had net emissions from LULUCF activities in 1990, are allowed to include net deforestation emissions in their base year emissions estimate for the purposes of determining their assigned amount (this is the so-called 'Australia clause');

- accounting for reforestation and deforestation is done on a 'gross-net' basis, meaning credits and debits for these activities are determined on the basis of net emissions during the commitment period;

- accounting for reforestation is subject to the 'harvest sub-rule', which provides that debits accounted on a reforested land unit cannot exceed the recorded credits (i.e. net debits cannot be recorded on a reforested land unit); and

- the harvested wood products pool (i.e. the stock of carbon stored in wood products) is excluded or, put another way, all carbon stored in wood products derived from areas subject to post-1990 reforestation and deforestation is

[1] Article 3.3 activities also include afforestation. For simplicity, afforestation and reforestation are treated as the same thing for the purposes of this report.

assumed to be released into the atmosphere in the year of harvest (instantaneous oxidation).[2]

Due to these rules, the emissions and removals associated with most forestry activities in Tasmania are not recorded in Australia's Kyoto Protocol accounts. Sequestration in multiple use public native forests, private native forests and pre-1990 plantations is excluded, emissions from harvesting in these forests are excluded, carbon storage in wood products from these forests is excluded, and changes in carbon stocks associated with the conversion of native forests to plantations are excluded. The only emissions and removals that are recorded are those associated with post-1990 reforestation and deforestation (stressing that forest harvesting is not deforestation — it only constitutes deforestation if there is a permanent change to a non-forest land use). This is not the case in Australia's UNFCCC accounts, where effectively all emissions and removals from forestry activities are accounted for. However, the UNFCCC accounts are of less policy relevance because they are not used for the purposes of determining compliance with Australia's mitigation commitments.

2.2. Forest accounting in the post-2012 era

The Kyoto Protocol's first commitment period ends in 2012. At the Durban Climate Conference in December 2011 (the 17th Conference of the Parties to the UNFCCC and 7th Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol), new LULUCF accounting rules were agreed for the second commitment period of the Kyoto Protocol, which will run from 1 January 2013 to either 31 December 2017 or 31 December 2020.[3] An overview of these rules is provided in Table 1 at the end of this section.

For the purposes of the TFIGA, the most relevant aspects of the new LULUCF rules are that FM accounting will be compulsory in the second commitment period, it will be based on FM reference levels, and FM and joint implementation FM credits will be subject to a cap equal to 3.5% of base year (typically 1990) emissions (excluding LULUCF). Australia's FM reference level, as described in the Durban decisions, is an average of 4.7 Mt CO_2-e yr^{-1} over the period 2013-2020.[4] Details of how this reference level was compiled are provided in Australia's revised FM reference level submission (Australian Government, 2011a).[5] For Australia, the 3.5% cap equates to a limit of 14.6 Mt CO_2-e yr^{-1} over the commitment period.[6] It has been estimated that, if native forest harvesting remains at 2010 levels over the period 2013-2020, Australia would generate an average of 12 Mt CO_2-e yr^{-1} of FM credits over this period (Macintosh, 2011c).[7] While there are uncertainties associated with this estimate, it suggests that there is a risk that the FM cap could be binding for Australia, even in the absence of major policy changes. If the cap is reached, additional reductions in net emissions that stem from changes in FM management would not count towards

[2] See Hohne et al. (2007), Schlamadinger et al. (2007), and Macintosh (2011a; 2011b) for further details and discussion.
[3] CMP.7, *Land use, land-use change and forestry*, http://unfccc.int/files/meetings/durban_nov_2011/decisions/application/pdf/awgkp_lulucf.pdf (24 February 2012).
[4] ibid.
[5] See also Macintosh (2011b).
[6] Australia's 1990 base year estimate under the Kyoto Protocol is 416.2 Mt CO_2-e (UNFCCC, 2009).
[7] This estimate does not account for domestic leakage.

Australia's mitigation commitments under the LULUCF rules. This could mean that any reduction in net FM emissions that stems from the TFIGA will not be counted, or will only be partially counted, towards Australia's medium-term mitigation commitments.

Although the LULUCF rules agreed in Durban could limit the mitigation significance of the TFIGA, their relevance is currently unclear. The impact of the rules will depend on Australia's approach to the Kyoto Protocol. There are three broad options:

- Australia participates in the Kyoto Protocol's second commitment period and is subject to the LULUCF rules;

- Australia does not participate in the Kyoto Protocol's second commitment period but applies the LULUCF rules in accounting for its medium-term mitigation commitments; and

- Australia does not participate in the Kyoto Protocol's second commitment period and opts for an alternative LULUCF accounting structure.

At present, it is unclear which of these options Australia will choose. In the lead up to the Durban Climate Conference, Australia indicated that it would not enter into a second commitment period of the Kyoto Protocol unless all major emitters were covered by a new legal framework. At this stage, this precondition has not been satisfied. The main outcome of Durban was the establishment of the Ad Hoc Working Group on the Durban Platform for Enhanced Action that will negotiate, by 2015, a new international agreement that will take effect in 2020.[8] Prior to the commencement of the new international agreement, it is anticipated that developed countries will adopt a variety of approaches to accounting and mitigation commitments. The European Union is expected to participate in the Kyoto Protocol's second commitment period. Others, including the United States, Canada, Japan and Russia, are unlikely to participate in the second commitment period and will probably account for their medium-term mitigation commitments through the 'pledge-and-review' structure described in the Durban decisions.[9] The LULUCF rules they apply are likely to be derived from the Kyoto Protocol's accounting structure, with modifications made to suit in-country circumstances. Given these divergent approaches, Australia may not apply the Protocol's LULUCF rules and could opt instead for an alternative accounting framework.

2.3. Will Australia count reductions in logging emissions towards its mitigation commitments?

The following summary points can be made about the ENGO claim that Australia could count reductions in logging emissions towards its mitigation commitments.

- Greenhouse accounting for LULUCF is done on an activity basis. For FM in the Kyoto Protocol's first commitment period, this meant that parties electing to account for FM had to identify the lands subject to FM (defined as 'a

[8] CP.17, *Establishment of an Ad Hoc Working Group on the Durban Platform for Enhanced Action*, http://unfccc.int/2860.php (20 January 2012).
[9] CP.17, *Outcome of the work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention*, http://unfccc.int/2860.php (20 January 2012).

system of practices for stewardship and use of forest land aimed at fulfilling relevant ecological (including biological diversity), economic and social functions of the forest in a sustainable manner') and account for changes in the five carbon pools (aboveground biomass, belowground biomass, dead wood, litter, and soil organic carbon) and non-CO_2 emissions occurring on these lands.

- Australia currently does not account for FM under the Kyoto Protocol, meaning any changes in FM practices and net FM emissions do not count towards Australia's mitigation target for the period 2008-2012.

- At the Durban Climate Conference in December 2011, new LULUCF rules were agreed for the Kyoto Protocol's second commitment period. The most relevant aspects of the new LULUCF rules are:

    - FM accounting will be compulsory in the second commitment period;

    - FM accounting will be based on FM reference levels, where FM credits and debits will be determined on the basis of the extent to which actual net FM emissions deviate from a pre-set reference level; and

    - FM and joint implementation FM credits will be subject to a cap equal to 3.5% of base year emissions (excluding LULUCF), or, for Australia, 14.6 Mt CO_2-e yr^{-1} over the second commitment period.

- The Australian Government has not yet decided whether to participate in the Kyoto Protocol's second commitment period or what accounting rules it will apply to its medium-term mitigation commitments.

- Australia may not apply the Protocol's LULUCF rules and could opt instead for a framework that better suits its interests and circumstances. If Australia opts for an alternative accounting framework, it is likely that:

    - it will include FM;

    - Australian FM accounting will be based on a reference level that is similar to that described in the Durban decisions; and

    - Australian FM credits will be uncapped.

Table 1 Overview of Durban LULUCF rules

Article 3.3 activities	
Deforestation	Parties with net LULUCF emissions in 1990 will continue to be able to include net deforestation emissions in their base year for the purposes of determining their assigned amount. Deforestation accounting will remain 'gross-net' (carbon stock change plus net non-CO_2 emissions in the commitment period). Where a pre-1990 plantation is converted to a non-forest land use, the associated emissions and removals can be accounted for under the new forest management rules (i.e. the deforestation can be included within the party's FM reference level – see below). Harvested wood products from deforestation must be accounted for on the basis of instantaneous oxidation.
Reforestation	Accounting for reforestation remains gross-net. The harvest sub-rule has been removed, meaning post-1990 reforestation land units will be able to record net debits in the second commitment period. Harvested wood products from reforested land units are required to be accounted for using one of four methods: (a) instantaneous oxidation; (b) the IPCC first-order decay function with default half-lives of 2 years for paper, 25 years for wood panels and 35 years for sawn wood; (c) country-specific data as a substitute for the default half-lives; or (d) definitions and estimation methodologies in the most recently adopted IPCC guidelines and any subsequent clarifications agreed by the Conference of the Parties.
Article 3.4 activities	
Forest management (FM)	FM accounting is compulsory (it was optional in the first commitment period). A baseline-and-credit accounting system has been established for FM. Reference levels will be set for each participating country, representing an estimate of net FM emissions over the commitment period. The credits and debits recorded during the commitment period will be calculated by subtracting the reference level from the actual reported net emissions. Parties whose emissions are higher than the reference level will incur debits and those whose emissions are below the reference level will receive credits. There is an optional natural disturbance rule that allows for the exclusion of net emissions from natural disturbances on FM lands above a pre-set disturbance 'baseline'. Harvested wood products from FM lands are required to be accounted for using one of the methods described above (see reforestation). FM credits, and credits associated with FM project activities undertaken through the joint implementation (JI) mechanism, are subject to a combined cap of 3.5% of total base year emissions excluding LULUCF.
Other Article 3.4 activities	Accounting for cropland management, grazing land management, revegetation and wetland drainage and wetting is optional, unless a party accounted for them in the first commitment period. Accounting for these activities is on a net-net basis (i.e. net emissions in commitment period minus emissions in base year).

3. Carbon impacts of the ENGO reserves – conceptual issues

This section provides an overview of the conceptual issues that are likely to shape the mitigation and carbon credit outcomes from the TFIGA and ENGO reserves. It is intended to provide readers with an overview of the principles that will determine the impact of the TGIFA on Australia's mitigation commitments, how many carbon credits the agreement generates and who benefits from these credits. The section is framed around four broad questions:

- what types of carbon credits could the ENGO reserves generate?
- what is the relationship between FM credits and ACCUs?
- what is the relationship between FM accounting, the ENGO reserves and Australia's mitigation commitments?
- what are the economic linkages between the ENGO reserves, carbon pricing scheme and CFI?

3.1. What types of carbon credits could the ENGO reserves generate?

The creation of the ENGO reserves could lead to the generation of two types of carbon credits: FM credits and ACCUs. FM credits (and FM debits) are the credits (debits) that will be recorded in Australia's greenhouse accounts if Australia accounts for FM in the post-2012 era. Australia will receive FM credits when its total net FM emissions are below its reference level. These credits are offsets and will be added to Australia's mitigation target. FM debits will be recorded if total net emissions are above the reference level, and they will be subtracted from Australia's mitigation target.

ACCUs are offset credits issued under the CFI, or the *Carbon Credits (Carbon Farming Initiative) Act 2011* (Cth) (CFI Act). There are two types of ACCUs: Kyoto ACCUs and non-Kyoto ACCUs. Broadly, Kyoto ACCUs are ACCUs issued in relation to avoided emissions and removals that can be used to meet Australia's emission targets. Non-Kyoto ACCUs are those issued in relation to avoided emissions and removals that cannot be used to meet Australia's targets. As a general rule, Kyoto ACCUs can be used to meet carbon pricing scheme liabilities under the *Clean Energy Act 2011* (Cth), while non-Kyoto ACCUs cannot.[10]

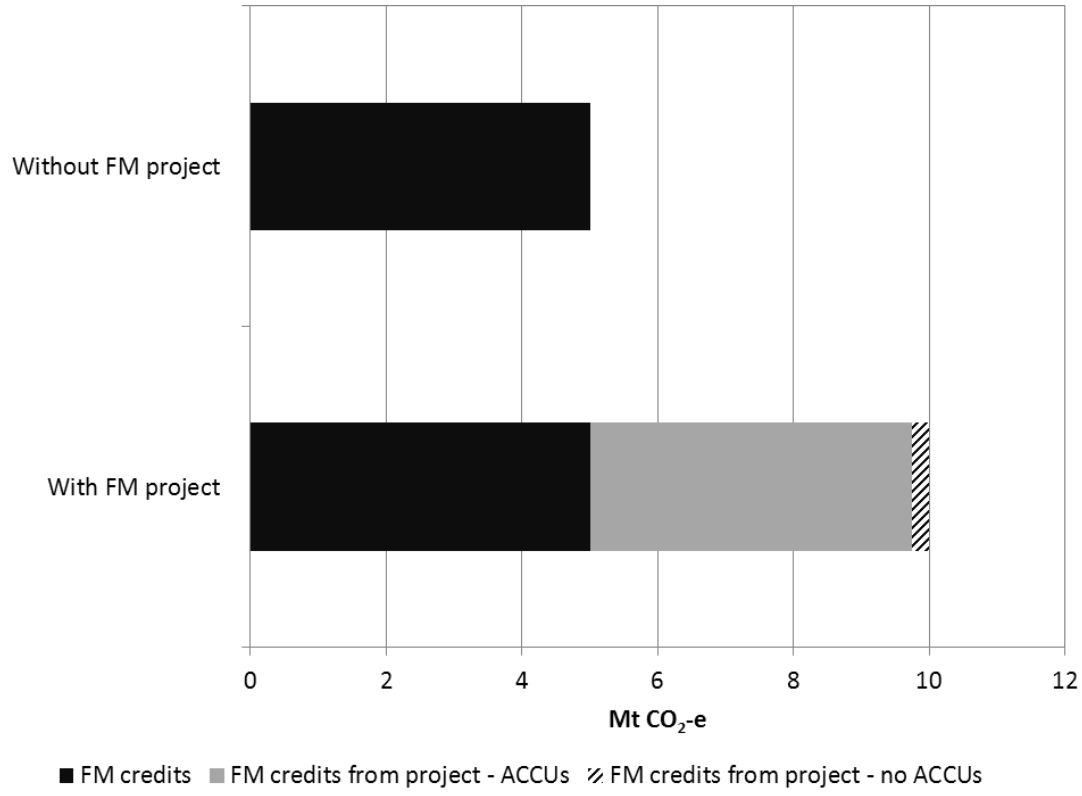
3.2. What is the relationship between FM credits and ACCUs?

The links between FM credits (and debits) and ACCUs depend on how Australia accounts for FM in the post-2012 era. If FM is not accounted for, no FM credits (or debits) will be recorded against Australia's mitigation targets and any ACCUs issued in relation to FM projects in Australia will be non-Kyoto ACCUs. On the other hand, if FM is accounted for, FM projects in Australia will contribute to the FM credits/debits recorded against Australia's mitigation targets and, provided they are eligible offsets projects, they will also lead to the generation of Kyoto ACCUs.

[10] There are exceptions to this general rule. See *Clean Energy Act 2011* (Cth), s 5.

Conceptually, where Kyoto ACCUs are issued in relation to a FM project, they can be thought of as being 'carved out' of the corresponding FM entry in the national greenhouse accounts. This is illustrated in Figure 1, which shows two hypothetical FM credit outcomes for a single year. In the first ('Without FM project'), there are no eligible offsets FM projects but Australia still generates 5 Mt CO_2-e of FM credits in the relevant year because total net FM emissions are 5 Mt CO_2-e below the reference level. In the second case ('With FM project'), Australia receives 10 Mt CO_2-e of FM credits comprising the initial 5 Mt CO_2-e plus a further 5 Mt CO_2-e that are attributable to an eligible offsets FM project. Most, but not all, of the FM credits generated by the eligible offsets FM project lead to the issuance of corresponding Kyoto ACCUs. The difference is a product of the CFI rules, particularly the risk of reversal buffer and required conservatism in methods. Ordinarily, these rules should ensure that the Kyoto ACCUs issued in relation to an eligible offsets FM project are less than the related FM credit entry.

Figure 1 Hypothetical representation of the relationship between FM credits and Kyoto ACCUs issued in relation to eligible offsets FM projects*



* All numbers included in Figure 1 are hypothetical and are not intended to reflect the actual impact of changes in FM practices or the TFIGA.

While the Kyoto ACCUs that are issued in relation to eligible offsets FM projects are drawn from the corresponding FM entry in Australia's greenhouse accounts, it is important to recognise that Australia's FM accounting framework is based on different principles to those that apply under the CFI. The FM accounting system agreed at the Durban Climate Conference is supposed to be based on reference levels that represent total net FM emissions assuming no change in policies from 31

December 2009.[11] In applying this construct, the Australian Government projected carbon stock changes in the live biomass and debris pools in native forests using the mean national harvest rate from the period 2002-2009, and carbon stock changes in the harvested wood products (HWP) pool using the 2008 wood production levels (Australian Government, 2011a). Any deviation from these levels will lead to corresponding changes in FM credits and debits.

Under the CFI, FM projects should only qualify as eligible offsets projects if they are 'additional', or would not have been undertaken in the absence of the scheme.[12] Further, the baseline that is used to determine how many ACCUs are issued to an eligible offsets project is supposed to reflect the net emissions from the project area in the absence of the project activity.[13] These additionality requirements are intended to ensure that ACCUs are not issued for emission reductions and removals that would have occurred anyway. Australia's FM accounting framework is not founded on the same additionality principles; if the harvest rate falls below the 2002-2009 average, Australia will receive FM credits irrespective of the cause of the decline. The additionality provisions under the CFI should ensure that any Kyoto ACCUs issued in relation to eligible offsets FM projects are a sub-component of the FM credits recorded against Australia's mitigation targets.

3.3. What is the relationship between FM accounting, the ENGO reserves and Australia's mitigation commitments?

The impact of the TFIGA and ENGO reserves on Australia's mitigation commitments will depend on how FM is accounted for in the post-2012 regime. If Australia does not account for FM, or there is a cap on FM credits that blocks the impact of the TFIGA, the creation of the ENGO reserves will have no impact on Australia's mitigation commitments. However, it should result in a reduction in national unaccounted emissions and overall global emissions.

If Australia does account for FM, and the FM cap does not exclude the effects of the TFIGA, the creation of the reserves will reduce net emissions from FM but they should not result in a reduction in national or global emissions (i.e. the associated FM credits recorded against the national total will be offsets). This is because Australia's mitigation commitments involve the setting of a cap on net national emissions for the period 2013-2020, and ultimately through to 2050. Due to the existence of this net emissions limit, abatement actions in sectors that count towards the national total will not usually result in overall national emissions reductions; a reduction in emissions in one sector merely allows for greater emissions in another. Reductions in absolute emissions should only occur if the abatement actions lead directly to the lowering of the national target (e.g. cancellation of assigned amount units or other equivalent units) or, in the event that national emissions end up being below the target in one

[11] Decision 2/CMP.6, *The Cancun Agreements: Land use, land-use change and forestry* (FCCC/KP/CMP/2010/12/Add.1). See also Macintosh (2011b).
[12] CFI Act, s 41(1) and *Explanatory Memorandum, Carbon Credits (Carbon Farming Initiative) Bill 2011 (Cth)*, at para. 5.43-5.51.
[13] CFI Act, ss 106-107. See also *Explanatory Memorandum, Carbon Credits (Carbon Farming Initiative) Bill 2011 (Cth)*, at para. 5.38.

accounting period, the Australian Government decides not to carry-over the surplus into the next period.[14]

3.4. What are the economic linkages between the ENGO reserves, carbon pricing scheme and CFI?

While the creation of the ENGO reserves should not affect the net national emissions outcome, it will have important economic impacts related to the operation of the carbon pricing scheme and the CFI, and the capital flows associated with international emissions units. Once the carbon pricing scheme reaches the flexible charge years (1 July 2015), the carbon pollution cap under the scheme is likely to be determined by the equation:

$$CPC_t = NT_t - USE_t \quad (1)$$

Where:

CPC_t means the carbon pollution cap in year t (emissions subject to a carbon price under the carbon pricing scheme, or the 'covered sector emissions');[15]

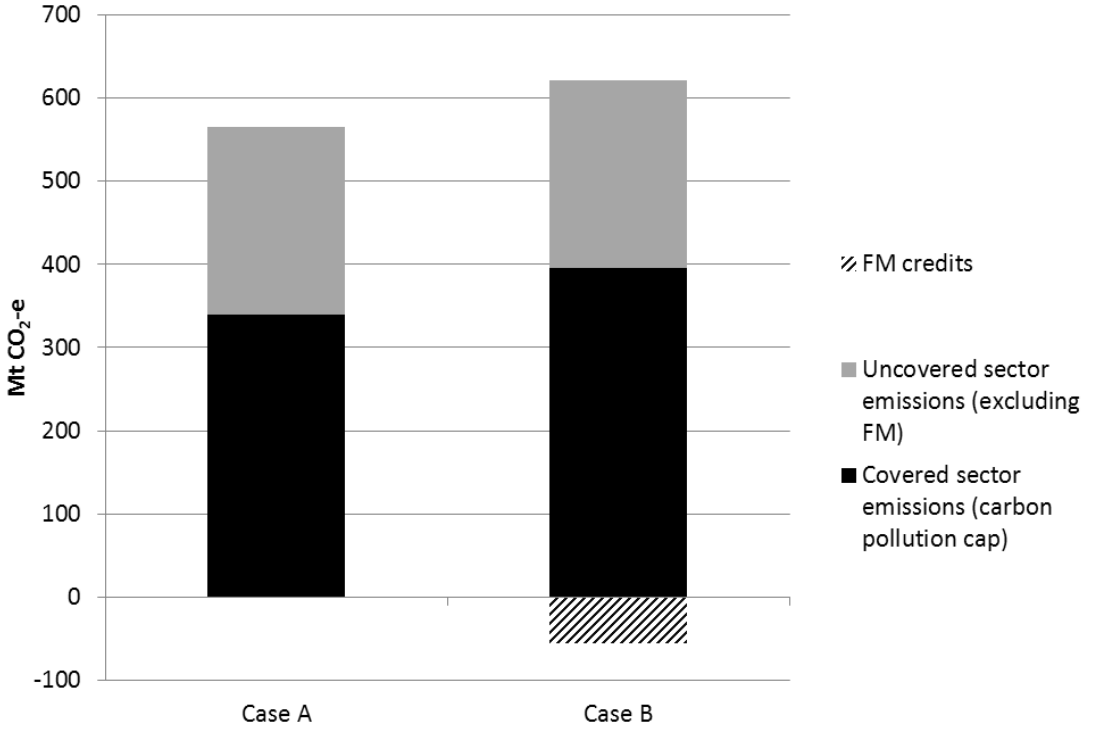
NT_t means the national target in year t; and

USE_t means the 'uncovered sector emissions' in year t (emissions and removals counted toward the national target but not subject to a carbon price under the carbon pricing scheme).[16]

If Australia accounts for FM, the associated FM credits or debits will form part of the uncovered sector emissions, meaning forestry operators and owners will not be liable entities for the purposes of the carbon pricing scheme but the credits/debits recorded for FM will count towards Australia's national mitigation target. As a general rule, reductions in net FM emissions below the FM reference level will generate FM credits that will decrease net emissions in the uncovered sectors, thereby allowing for an increase in emissions from the covered sectors (i.e. an increase in the carbon pollution cap). This is illustrated in Figure 2. The increase in the carbon pollution cap translates into an increase in carbon units able to be auctioned by the Australian Government, which increases the revenue generated by the scheme. The reverse is also true; if FM emissions are above the FM reference level it should lower the carbon pollution cap and the scheme revenues.

[14] The Australian Government is currently deciding whether to carry-over a surplus of ~100 $MtCO_2$-e from the Kyoto Protocol's first commitment period into the post-2012 regime.
[15] The phrase 'covered emission' has a specific meaning under the *Clean Energy Act 2011* (Cth) — a scope 1 emission released in Australia as the direct result of the operation of a facility, where there is a method for the measurement of the emission under the *National Greenhouse and Energy Reporting Act 2007* (Cth). The phrase 'covered sector emissions', as used here, is narrower than 'covered emissions' as it is confined to the covered emissions that are subject to a carbon price under the carbon pricing scheme (i.e. it only includes covered emissions from a liable entity).
[16] Technically, net LULUCF credits (debits) are added to (subtracted from) the national target (the assigned amount). For simplicity, they are treated here as part of the uncovered sector emissions, consistent with the approach described in the *Carbon Pollution Reduction Scheme White Paper* (Australian Government, 2008) and the *Explanatory Memorandum, Clean Energy Bill 2011 (Cth)*.

Figure 2 Hypothetical impact of FM abatement on the carbon pollution cap*



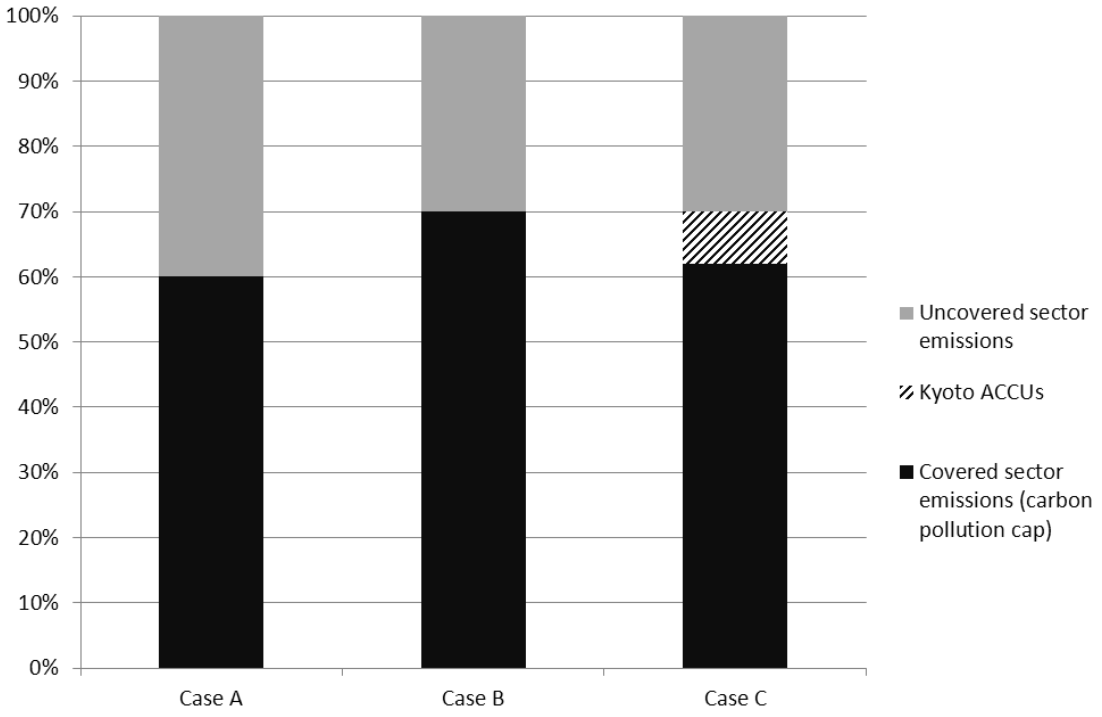
* All numbers included in Figure 2 are hypothetical and are not intended to reflect the actual impact of changes in FM practices or the TFIGA.

During the fixed charge period of the carbon pricing scheme (1 July 2012 to 30 June 2015), there is no carbon pollution cap. Covered sector emissions face a set carbon price but there is no absolute limit on emissions from these sectors. Despite this, the changes in net FM emissions associated with the ENGO reserves could still affect scheme revenues. This is because Australia's medium-term mitigation commitments are likely to be cumulative. That is, there will be a national target (or national emissions limit) for the entire accounting period (e.g. 2013 to 2020) rather than a single year (2020) and the targets will be transferrable within the period. Due to this, reductions in uncovered sector emissions in the fixed charge years should allow for higher relative national targets in the flexible charge years, leading to higher carbon pollution caps and greater scheme revenues.

These general principles concerning the interaction between the national target, FM credits and the carbon pricing scheme are modified by the operation of the CFI. If there is a reduction in uncovered sector emissions that is attributable to an eligible offsets FM project under the CFI, any increase in the carbon pollution cap must take into account the number of Kyoto ACCUs that are issued in relation to the project. How the issuance of Kyoto ACCUs affects the operation of the carbon pricing scheme and the setting of the carbon pollution cap is illustrated in Figure 3. In Case A, there are no FM credits or debits, and covered sector emissions account for 60% of the national total and uncovered sector emissions the remaining 40%. In Case B, it is hypothetically assumed that a decline in native forest harvesting leads to the generation of FM credits equal to 10% of the national total but no ACCUs are issued in relation to the associated reduction in net FM emissions. As a result, uncovered sector emissions are reduced to 30% of the national total, allowing covered sector

emissions to rise to 70%, bringing with it an increase in scheme revenues. Case C is the same as Case B, only Kyoto ACCUs are issued in relation to the reduction in native forest harvesting. Here it is assumed that the relevant recognised offsets entities behind the eligible offsets FM projects receive Kyoto ACCUs that represent 8/10^{ths} of the total number of FM credits. As a result, covered sector emissions increase to 62% of the national total. Uncovered sector emissions remain at 30% of the national total, the same as in Case B. The difference (8%) represents the Kyoto ACCUs issued in relation to the eligible offsets FM projects. In this case, the eligible offsets FM projects (an example of which might be the creation of the ENGO reserves) would lead to an increase in revenues from the carbon pricing scheme and provide a potential source of income for the recognised offsets entities that receive the Kyoto ACCUs (assuming they sell the units rather than voluntarily cancelling them).

Figure 3 Hypothetical representation of the relationship between the carbon pollution cap, uncovered sector emissions and Kyoto ACCUs issued in relation to eligible offsets FM projects*



* All numbers included in Figure 3 are hypothetical and are not intended to reflect the actual impact of changes in FM practices or the TFIGA.

In addition to affecting scheme revenues, the creation of the ENGO reserves could reduce the net economic impact of meeting Australia's mitigation commitments by decreasing reliance on imported carbon units. This is largely a by-product of the fact that any associated change in net FM emissions would result in an increase in the carbon pollution cap and/or the issuance of Kyoto ACCUs. As a general rule, the greater the number of units the Australian Government distributes under the carbon pricing scheme the fewer have to be imported by liable entities from overseas providers. The same applies to Kyoto ACCUs — if there is a greater supply of Kyoto ACCUs, fewer international emissions units have to be imported to ensure Australia

meets its mitigation commitments. In addition, by lowering net FM emissions, the ENGO reserves could:

- allow for the sale of surplus national units by the Australian Government or their carry-over into subsequent accounting periods; or

- reduce the extent to which the Australian Government may have to import international units if Australia exceeds its mitigation commitments over the accounting period.

While the ENGO reserves could have a positive impact on government carbon revenues, allow for the generation and sale of Kyoto ACCUs and lower the economic cost associated with meeting Australia's mitigation commitments, there is uncertainty surrounding these issues. Australia may not account for FM or the FM cap could exclude the impact of the TFIGA, meaning the benefits related to the carbon pricing scheme would be lost and any associated units issued under the CFI would be non-Kyoto ACCUs that could only be sold in voluntary markets (or purchased by the Australian Government through the CFI Non-Kyoto Carbon Fund). Similarly, under the future accounting framework, the Australian Government may not be able to transfer or carry-over surplus national units. Further, under the CE Act, it is not mandatory for the carbon pollution cap to be set in accordance with equation (1) above and it is possible that an alternative approach could be adopted. The carbon pollution cap is also made by regulations, which are subject to disallowance by Parliament. In the event that the regulations are not made or are disallowed, a default cap will apply. The application of the default cap would stop the Government from altering it to account for changes in uncovered sector emissions.

4. FM credits associated with the ENGO reserves

In order to evaluate the carbon credit implications of the TFIGA and ENGO reserves, it was assumed that:

- Australia accounts for FM in the post-2012 era using a FM reference level accounting framework;
- the carbon pollution cap is set in accordance with equation (1) on page 14 during the flexible charge years;
- the Australian Government is able to sell surplus national units on international carbon markets and/or carry them over to subsequent accounting periods; and
- the creation of the ENGO reserves is approved as an eligible offsets project under the CFI and leads to the generation of Kyoto ACCUs.

The assessment of the credits associated with the ENGO reserves was then divided into two parts: an analysis of the FM credits that could be generated by Tasmania's multiple use public native forests if the ENGO reserves are created, and a projection of the Kyoto ACCUs that could be generated by an eligible offsets project involving the creation of the ENGO reserves. This section contains the analysis of the FM credit outcomes. Section 5 contains the Kyoto ACCU analysis.

4.1. Rationale behind the FM credit method

To estimate the number of FM credits that could be generated as a result of the creation of the reserves, two scenarios were devised for the period 2013-2030 (the 'projection period'):

- a reference scenario, where it was assumed that neither the TFIGA nor the reserves were created; and
- the ENGO scenario, where the TFIGA and proposed reserves proceed as planned.

There are three broad approaches that could be used to devise the reference and ENGO scenarios.

- Method 1 – apply the Australian Government's FM reference level methodology and datasets to generate the reference and ENGO scenarios.
- Method 2 – apply the Australian Government's FM reference level methodology and datasets to generate the reference scenario but use an alternative method and/or datasets for the ENGO scenario.
- Method 3 – ignore the Australian Government's FM reference level methodology and datasets and apply an alternative method and datasets for both the reference and ENGO scenarios.

There is a significant degree of uncertainty associated with the models and data used to devise Australia's FM reference level. This is a product of a number of factors, including a lack of data on carbon stocks and fluxes in native forests, data gaps concerning the age-class distribution of native forests and the silviculture practices used in them, and the counter-factual nature of reference levels (MPIG, 2008; Australian Government, 2011a; 2011b; Macintosh, 2011b). With improved data and models, it may be possible to devise a more accurate method that better reflects 'what the atmosphere sees', a fact acknowledged by the Australian Government (Australian Government, 2011a; 2011b).

While improvements in the Australian Government's method are possible, and the Government has flagged its intent to make changes in the future, the use of either Method 2 or Method 3 for current purposes would increase the risk of invalid results. Method 3 would involve the use of methods and data sets unrelated to the Australian Government's accounting framework. The results may better reflect 'what the atmosphere sees' but are unlikely to better reflect the entries made in Australia's greenhouse accounts. Method 2 could ultimately be used by the Australian Government – the reference level may be treated as a fixed number, while the annual actual FM emissions are accounted for using evolving methods and datasets. Although this is a possibility, the Australian Government has repeatedly stated that it has no intention of doing this due to the potential for 'false' debits and credits (debits and credits that arise from method or data changes rather than changes in management practices). For example, in its September 2011 FM reference level submission to the UNFCCC, the Australian Government stated:

> Provision should be made for the option to recalculate the forest reference level for technical reasons, should the estimation methods evolve over the course of the reporting period. This will ensure time-series consistency and ensure that any net benefit obtained from Forest Management is due to changed activities rather than methodological changes (Australian Government, 2011a: 27).

Due to these issues, Method 1 was preferred here because it provides the best approximation of what will be recorded against Australia's mitigation commitments over the projection period. Accordingly, in devising the reference and ENGO scenarios, the objective was to mirror, to the greatest extent possible, the methods and data sets used to generate the Australian Government's FM reference level.

4.2. The reference scenario

The Australian Government's FM reference level is a projection of net FM emissions over the period 2013-2020 assuming no change in policies from December 2009. Here, the reference scenario was confined to a projection of net emissions from Tasmania's multiple use public native forests. The projection period was also extended to 2030 to provide a more complete picture of the FM credit implications of the TFIGA and ENGO reserves.

In the Australian Government's FM reference level, the carbon pools are confined to live above- and below-ground biomass, debris and harvested wood products (HWP). The soil carbon pool is assumed to be stable, providing no net emissions or removals. The same approach was adopted here. Consistent with the Australian Government's

method, the calculation of the reference level was split into two parts on the basis of the carbon pools:

- carbon stock changes in the live biomass and debris pools; and
- carbon stock changes in the HWP pool.

Carbon stock changes in the live biomass and debris pools

In the Australian Government's FM reference level, the projected carbon stock changes in the live biomass and debris pools were modelled using the non-spatially explicit Tier 2 capabilities of *FullCAM* (Richards and Evans, 2004; Richards and Brack, 2004; Brack et al., 2006; Australian Government, 2011a; 2011b). Within the model, the forest area (Australia's multiple use public forests and Tasmanian private native forests) was divided into six broad forest types (rainforest, tall dense eucalypt forest, medium dense eucalypt forest, medium sparse eucalypt forest, cypress pine forest and other forest), ten silvicultural systems and eight age classes, producing 73 forest type/silviculture/age class combinations. The carbon stock changes were modelled on the basis of the estimated area in each forest type/silviculture/age class combination using assumed forest type growth, turnover and decomposition rates. Harvest slash emissions over the period 2013-2020 were calculated using the forest type/silviculture/age class combinations and an assumption that the national harvest rate would equal the mean from the period 2002-2009.

To devise the reference scenario, a modified version of the approach adopted by the Australian Government was used.

- The scenario was generated using the Tier 2 capabilities of *FullCAM* (version 3.30.1).
- The *FullCAM* representative plot file data used to calculate net emissions from 'Harvested Native Forests' in Australia's *National Inventory Report 2009* were obtained from the Australian Government (Australian Government, 2011a; 2011b). These representative plot files cover the same 73 forest type/silviculture/age class combinations used to devise Australia's FM reference level.
- Of the 73 representative plot files, harvesting occurred in 55 of them over the period 2002-2009. To devise the reference scenario, the mean harvest rate for the period 2002-2009 in these 55 representative plot files was used. That is, it was assumed that, over the projection period, harvesting occurred on the same plot types, employing the same harvest techniques as occurred between 2002 and 2009. To isolate the proportion attributable to Tasmania's multiple use public native forests, 19 of the 55 harvested plot files were identified as representing harvesting in these forests.[17] An annual mean harvest area for the period 2002-2009 was obtained from Forestry Tasmania's annual reports (14,174 ha^{-1} yr^{-1}) (Forestry Tasmania, 2003-2011) and then assigned to these 'Tasmanian plots' on the basis of data obtained from the Australian Bureau of

[17] Consistent with the Australian Government's method, harvesting of cool temperate rainforest for special timbers was modeled as Medium Dense Eucalypt Forest (Australian Government, 2011b).

Agricultural and Resource Economics and Sciences (ABARES, 2011a; 2011b), Department of Climate Change and Energy Efficiency (Australian Government, 2011b) and Felmingham et al. (2004).[18] In assigning the harvest area, it was ensured that the modelled log removals from the plots equalled the ABARES estimate of the mean removals from Tasmania's public native forests for the period 2002-2009 (3,083,854 m^3 yr^{-1}).[19] Details of the 19 Tasmanian plots and the assigned harvest area are provided in Appendix A.

- The Tasmanian plots were assumed to form part of a single estate and the carbon stock changes on the estate were modelled using an estate simulation start date of 1960 and an end date of 2030.

- Carbon stock changes on the parts of Tasmania's multiple use public native forests that are not subject to harvest over the projection period were not modelled. This is due to the fact that carbon stock changes in these areas are the same in all scenarios, thereby cancelling each other out under the FM reference level accounting system. For the same reason, the impacts of wildfires were excluded from all scenarios.[20] Similarly, non-harvest related fuelwood removals were assumed to be the same in the reference and ENGO scenarios, and were therefore not modelled.

Details of the key parameters used in *FullCAM* in the reference and ENGO scenarios are available in Macintosh (2011c).

Carbon stock changes in the HWP pool

In the Australian Government's FM reference level, projected carbon stock changes in the HWP pool were estimated using the harvested wood products model that is used for the purposes of Australia's *National Inventory Reports* (Richards et al., 2007; Australian Government, 2011a; 2011b). When used for the purpose of *National Inventory Reports*, the model estimates carbon stocks and flows from all wood products in Australia, regardless of their origin. The model was adjusted for the purposes of the FM reference level to exclude imports and include exports to ensure consistency with the proposed accounting framework. Adjustments were also made to the decay rate assumptions. For all domestically produced and consumed wood products, the standard decay rates in the model were used. With exports, the model was used to classify exported products into decay class pools but losses from the pools were determined in accordance with the default decay rates set out in the 'Revised proposal by the Chair, Draft decision -/CMP.6 (Land use, land-use change and forestry)'.[21]

[18] The mean harvest area consists of 13,987 ha^{-1} yr^{-1} of commercial harvesting and 185 ha^{-1} yr^{-1} of non-commercial thinning.
[19] In reconciling the modeled log removals with actual wood production data, the carbon fraction and basic density of stemwood were assumed to be 52% and 750 kg m^3 respectively (Australian Government, 2011b).
[20] It is currently unclear how the Australian Government will account for wildfires. Since 2007, the Australian Government has repeatedly stated that it wants to exclude the impacts of wildfires on the basis that the effects are non-anthropogenic. It is assumed for the purposes of this report that Australia's LULUCF accounting rules reflect this intent.
[21] FCCC/KP/AWG/2010/18/Add.1.

In estimating HWP emissions in its FM reference level and the *National Inventory Reports*, the Australian Government did not use the log removal estimates generated by *FullCAM*. Separate ABARES wood production data were used for this purpose. For the FM reference level, the Government assumed that annual wood production and the proportion of production allocated to end-use categories remain stable at 2008 levels throughout the period through to 2020 (Australian Government, 2011a).

For current purposes, the reference scenario carbon stock changes in the HWP pool were modelled using a simplified wood flow model and the IPCC first-order decay function,[22] assuming half-lives of 2 years for paper, 25 years for wood panels and 35 years for sawn wood (consistent with the default option in the Durban LULUCF decision (see Table 1)). It was necessary to use this method because the Australian Government's harvested wood products model was not available. The wood flow model was based on the flows described in Attachment 7.I1 in Australia's *National Inventory Report 2009* (Australian Government, 2011b). The log data for the period 1990-2008 that was used in the wood flow model were obtained from ABARES (ABARES, 2011a; 2011b), Ryan et al. (2002) and Forestry Tasmania (2003-2011). As in the Australian Government's FM reference level, it was assumed for the purposes of the reference scenario that wood production from Tasmania's multiple use public native forests remains constant at 2008 levels over the projection period.

4.3. The ENGO scenario

The method used to generate the ENGO scenario was the same as that applied for the reference scenario, only with adjusted harvest and wood production projections. The projections used for the purpose of the ENGO scenario were based on the Forestry Tasmania report, *Evaluation of Wood Resource Scenarios relevant to the Tasmanian Forests Statement of Principles to lead to an Agreement – Final Report to Signatories*, which provides an assessment of the impacts that the proposed reserves are likely to have on wood production from Tasmania's multiple use public native forests (hereafter referred to as the 'FT report') (Forestry Tasmania, 2011). The assessment compared three scenarios: a Base Case Scenario with no new reserves, an Industry Scenario where harvesting is excluded from an additional 140,350 ha, and an ENGO scenario where harvesting is excluded from the 572,040 ha of proposed reserves. The results were presented for two periods: 2011-2030 and 2031-2050. A summary of the main conclusions are provided in Table 2.

[22] Eggleston et al. (2006), Vol 4, Chpt 12, Equation 12.1 (p 12.11).

Table 2 Forestry Tasmania *Wood Resource Scenario* conclusions, thousand m^3*

	Base Case	Industry Scenario	ENGO scenario
Period 1	**2011-2030**		
High quality eucalypt sawlogs	204	199	117
Peeler billets**	265	265	191
Native forest arisings (pulpwood and low quality eucalypt sawlogs)***	1281	1247	764
Special timbers	12.5	11.5	6.7
Period 2	**2031-2050**		
High quality eucalypt sawlogs	166	164	130
Peeler billets	93	92	71
Native forest arisings (pulpwood and low quality eucalypt sawlogs)	703	690	534
Special timbers	12.5	11.5	6.7

* All of the wood supply projections, with the exception of those concerning special timbers, include a notional 10% discount to account for un-modelled operational, policy and regulatory constraints.
** Includes supply of 39,000 m^3 yr^{-1} from non-multiple use public native forests (i.e. plantation and/or private native forests in northern Tasmania).
*** Native forest arisings have been converted from mass (green metric tonnes (gmt)) to volume (m^3) using a conversion factor of 1 m^3 = 1.1 gmt.
Source: Forestry Tasmania, *Evaluation of Wood Resource Scenarios relevant to the Tasmanian Forests Statement of Principles to lead to an Agreement – Final Report to Signatories* (Forestry Tasmania, 2011).

The wood production estimates from the FT report were used as the basis for the ENGO scenario. In particular, it was assumed that the creation of the ENGO reserves results in log removals from Tasmania's multiple use public native forests falling to the levels identified in the FT report's ENGO scenario for the period 2011-2030.[23]

To estimate the carbon stock changes in the live biomass and debris pools, the 19 harvested Tasmanian plots used in the reference scenario were replicated and the harvest events removed. This provided a total of 38 representative plot files for the ENGO scenario (19 harvest plots and 19 no harvest plots). The area allocated to each representative harvest plot was reduced on a pro-rata basis to account for the assumed reduction in native forest harvesting identified in the FT report's ENGO scenario. The FT report suggests that, if the ENGO reserves are created, special timber log removals will be 62% below, and non-special timber log removals 69% below, the 2002-2009 average. Accordingly, the harvest rate in harvest plots representing special timbers and non-special timbers were reduced by 62% and 69% respectively. The areas subtracted from each representative harvest plot were then added to the corresponding no harvest plot, thereby ensuring the modelled estate covered the same area in the reference and ENGO scenarios (details of the plot types and assumed annual harvest rate in each plot type under the ENGO scenario are provided in Appendix A).

[23] The estimated peeler billet removals were adjusted to exclude the 39,000 m^{-1} yr^{-1} supply from non-multiple use public native forests.

To project carbon stock changes in the HWP pool, the simplified wood flow model and IPCC first-order decay function were used with modified wood supply estimates. Again, the wood supply was derived from the FT report. In the FT report's ENGO scenario, high quality sawlog removals (Category 1&3) are 61% below, peeler billets 30% below, and pulpwood 69% below the levels reported in 2008. On this basis, log supply for sawlogs (Categories 1, 2, 3, 4 and 8), peelers and pulpwood was assumed to be 61%, 30% and 69% below the 2008 levels.

There is the potential for the creation of the ENGO reserves to result in 'leakage', or the transfer of wood production from Tasmania's multiple use public native forests to other areas, both in Australia and overseas. Any leakage to forests in other countries is irrelevant for current purposes because it will have no impact on Australia's mitigation commitments. While international leakage would negate the climate benefits of the ENGO reserves it would not alter the impact that the agreement has on Australia's mitigation commitments because the accounts are not required to be adjusted for these effects. In contrast, leakage within Australia will alter the accounted mitigation impacts of the ENGO reserves. Leakage to other FM lands within Australia (e.g. increasing the intensity of harvesting in Tasmanian native forests that are not in reserves or in other multiple use public native forests or private native forests) will reduce the FM credits associated with the creation of the ENGO reserves. Another possibility is that the exclusion of harvesting from the reserve areas could prompt increased reforestation as the forestry sector looks for alternative sources of long-term wood supply. This form of leakage would increase recorded LULUCF credits.

Projecting the likely rate of leakage within Australia is difficult. The capacity to increase log removals in multiple use public native forests and private native forests differs between jurisdictions because of resource constraints, state regulations and commitments under the Regional Forest Agreements. There may also be community resistance to any plans to increase the intensity of harvesting in native forests in response to the TFIGA. How these resource, regulatory and political factors might interact to facilitate or constrain leakage is unclear. Due to this, the ENGO scenario was split into two sub-scenarios on the basis of two simple assumptions. In the first, it was assumed that the creation of the reserves does not result in any leakage within Australia ('ENGO (no leakage)'). In the second, it was arbitrarily assumed that the net effect of leakage within Australia is to reduce the FM credits associated with the reserves by 15% ('ENGO (15% leakage)').

Readers should note that the above method assumes that the entire difference between the reference and ENGO scenarios is attributable solely to the creation of the reserves. In reality, a proportion of the difference is likely to be due to market and management factors unrelated to the TFIGA, particularly the depressed state of key export markets and projected increases in plantation wood supply (Forestry Tasmania, 2007). However, as explained in Section 3.1, the method uses the 2002-2009 average as the basis of the reference scenario to ensure consistency with the Australian Government's FM reference level methodology. The use of this reference case also ensures that the results provide an approximation of the FM credits generated from Tasmania's multiple use public native forests if the ENGO reserves are created (i.e. even if the FM credits are not directly attributable to the creation of the reserves, they are attributable to changes in harvesting and other management practices in Tasmania's multiple use public native forests post-2009). Due to this, the FM credit

results should not be taken to represent the Kyoto ACCUs that might be issued in relation to the ENGO reserves.

4.4. Sensitivity analysis

As discussed, there is a degree of uncertainty associated with the models and data used to devise Australia's FM reference level. Due to this, the Government's estimates of emissions and removals from native forests are subject to a significant margin of error and, as the method used here is a replica of the Australian Government's, it embodies all of the same uncertainties. To account for this, and the potential for future modifications of the method and data sets to alter the FM credit outcomes, sensitivity analysis was undertaken by changing two of the key parameters in *FullCAM*: the above-ground live biomass yield increment rates and the age-class distribution of the forests subject to harvest.

The margin of error associated with the above-ground live biomass yield increment rates was assumed to be ±25%. To account for this range, replica representative plot files were created with +25% and -25% yield increments. The reference and ENGO scenarios were then re-run to test how the lower and higher yield increments affected the credit outcomes. In relation to the uncertainties associated with the age-class distribution of the forests, the estate simulation start date was adjusted ±10 years. In the standard runs, the estate simulation start date was 1 January 1960, meaning that in the sensitivity analysis the simulation start dates were 1 January 1950 and 1 January 1970.

4.5. Results and discussion

The net emissions (carbon stock changes in the live biomass, debris and HWP pools) in the reference and ENGO scenarios are shown in Figure 4. The net emissions under the reference, ENGO (no leakage) and ENGO (15% leakage) scenarios, and the FM credits generated under the ENGO (no leakage) and ENGO (15% leakage) scenarios, are shown in Table 3.

Figure 4 Carbon stock change (live biomass, debris, harvested wood product pools) in reference and ENGO scenarios, Mt CO_2-e yr^{-1}, 2013-2030

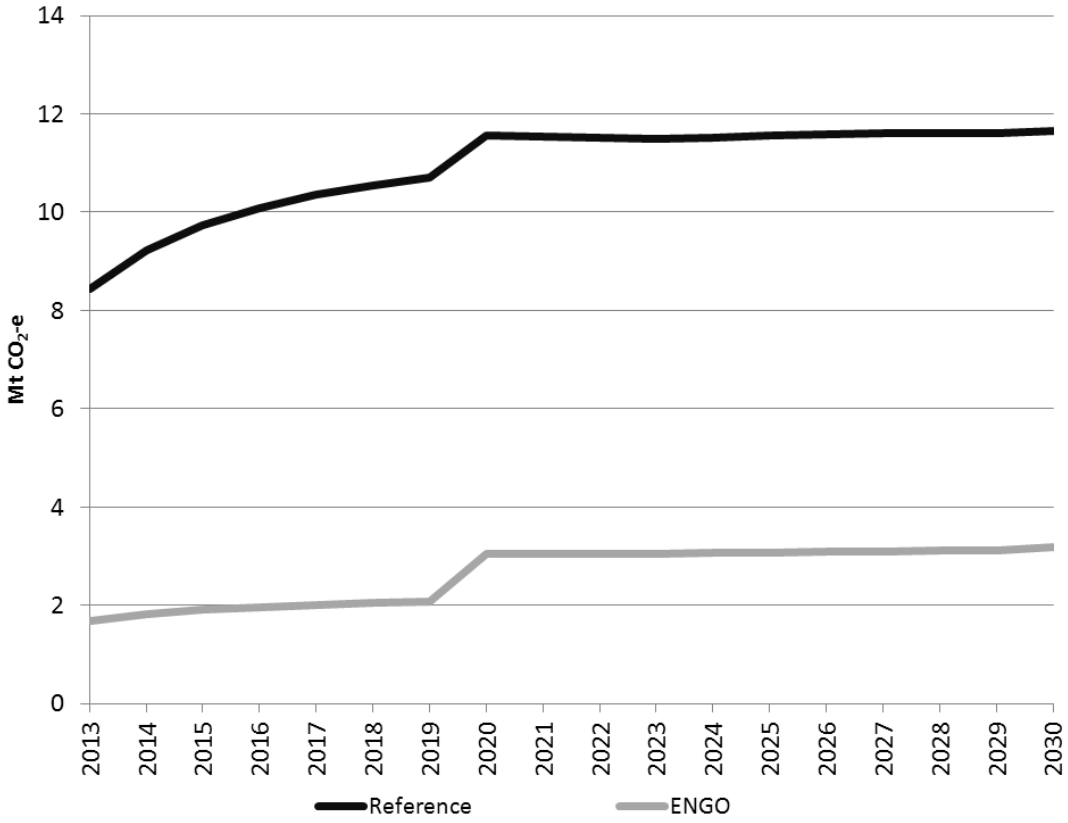


Table 3 Net emissions and FM credit outcomes under the reference, ENGO (no leakage) and ENGO (15% leakage) scenarios, Mt CO_2-e yr^{-1}, 2013-2030

Year	Reference	ENGO	Annual FM credits	
			ENGO (no leakage)	ENGO (15% leakage)
2013	8.43	1.68	6.74	5.73
2014	9.22	1.82	7.40	6.29
2015	9.73	1.91	7.82	6.65
2016	10.08	1.96	8.12	6.90
2017	10.35	2.01	8.34	7.09
2018	10.55	2.04	8.51	7.23
2019	10.71	2.08	8.64	7.34
2020	11.55	3.04	8.51	7.23
2021	11.54	3.06	8.49	7.21
2022	11.52	3.06	8.47	7.20
2023	11.49	3.05	8.44	7.18
2024	11.52	3.06	8.46	7.19
2025	11.56	3.08	8.48	7.21
2026	11.58	3.09	8.49	7.22
2027	11.60	3.10	8.50	7.22
2028	11.61	3.11	8.50	7.23
2029	11.62	3.11	8.50	7.23
2030	11.65	3.19	8.46	7.19
Averages				
2013-2020	10.08	2.07	8.01	6.81
2021-2030	11.57	3.09	8.48	7.21
2013-2030	10.91	2.64	8.27	7.03

The results suggest the FM credits associated with the creation of the reserves are likely to be significant. Under the ENGO (no leakage) scenario, the mean over the period 2013-2020 is 8.01 Mt CO_2-e yr^{-1}, rising to 8.48 Mt CO_2-e yr^{-1} for the period 2021-2030. Under the ENGO (15% leakage) scenario, the impacts of the leakage to other FM areas reduces these averages to 6.81 Mt CO_2-e yr^{-1} and 7.21 Mt CO_2-e yr^{-1} for 2013-2020 and 2021-2030 respectively.

To put these annual FM credit numbers in perspective, they are more than the total annual emissions from a 1400-1500 MW capacity black coal-fired power station. For example, in 2009-10, the 1434 MW capacity Stanwell Power Station in Queensland generated 8063 GWh of electricity and emitted approximately 6.2 MtCO_2-e of greenhouse gases (Stanwell Corporation Ltd, 2011).[24] Similarly, in the same year, the 1400 MW capacity Tarong Power Station, also in Queensland, generated 7124 GWh

[24] The emission estimate was devised using the Queensland black coal energy content factor from ABARES (2011c) and the black coal emission factors from DCCEE (2011).

of electricity and emitted roughly 6 $MtCO_2$-e (Tarong Energy Corporation Ltd, 2010).[25]

Another way of illustrating the magnitude of the potential FM credits associated with the ENGO reserves is to compare them to Australia's abatement task (the amount by which emissions have to be reduced compared to a 'no policy change' reference case to meet Australia's mitigation commitments). In the *Strong Growth, Low Pollution* report, the Australian Treasury estimated that Australia's cumulative abatement task with a 5% emission reduction target for 2020 over the period 2013-2020 was 737 Mt CO_2-e (Australian Treasury, 2011).[26] The results here suggest that the FM credits under the ENGO scenario would equate to between 7.4% and 8.7% of this task (Table 4). For the period 2021-2030, the Treasury estimate of the abatement task increases to 2916 Mt CO_2-e as Australia heads towards an 80% emission reduction target for 2050. The credits under the ENGO scenario over this period would constitute 2.5-2.9% of this task.

Table 4 ENGO scenario FM credits compared to Australia's cumulative abatement task, 2013-2030

Period	Cumulative abatement task (Mt CO_2-e)	Cumulative FM credits (Mt CO_2-e)		Proportion of abatement task	
		ENGO (no leakage)	ENGO (leakage)	ENGO (no leakage)	ENGO (leakage)
2013-2020	737.3	64.07	54.46	8.7%	7.4%
2021-2030	2916.3	84.79	72.07	2.9%	2.5%
2013-2030	3653.6	148.86	126.54	4.1%	3.5%

Source: Australian Treasury (2011) and author estimates.

4.6. Sensitivity analysis results

The results from the sensitivity analysis can be summarised in two simple points:

- the higher biomass yield increment scenarios generate more emissions from harvest (and hence FM credits) than equivalent lower biomass yield increment scenarios; and

- older forest estate scenarios generate more emissions from harvest (and hence FM credits) than equivalent young estate scenarios.

These trends can be seen in the results from the sensitivity analysis scenarios that generate the most and least credits (1950 estate simulation start date with +25% biomass yield increment rates and 1970 estate with -25% yield rate) (Table 5). The explanation for these trends relates to the effects of the yield and estate age on biomass. Higher biomass growth rates will generally result in higher onsite biomass.

[25] The emission estimate was devised using the carbon intensity factor reported by Tarong Energy Corporation Ltd (2010).
[26] This estimate assumes all abatement associated with the Carbon Farming Initiative is exported.

Where plots are harvested, this produces higher harvest emissions, all things being equal. Similarly, older forests generally contain more biomass than younger forests of the same type. Therefore, if the forest estate is dominated by old forests, the emissions from harvest will be more than in an equivalent younger estate. This is of particular relevance to the proposed ENGO reserves, as they are likely to be dominated by older, high biomass forests.

Table 5 Mean emission and FM credit outcomes under the sensitivity analysis scenarios with the most and least credits, Mt CO_2-e yr^{-1}, 2013-2030

Year	Reference	ENGO	Average annual credits	
			ENGO (no leakage)	ENGO (15% leakage)
1950 estate simulation start date with +25% biomass yield increment rates				
2013-2020	12.18	3.28	8.90	7.56
2021-2030	12.60	3.40	9.20	7.82
2013-2030	12.42	3.35	9.07	7.71
1970 estate simulation start date with -25% biomass yield increment rates				
2013-2020	9.01	1.99	7.01	5.96
2021-2030	10.24	2.29	7.95	6.76
2013-2030	9.69	2.16	7.53	6.40

5. Estimating the Kyoto ACCUs associated with the creation of the ENGO reserves

This section provides an assessment of the Kyoto ACCUs that could be generated by an eligible offsets project involving the creation of the ENGO reserves.

5.1. Method of estimating Kyoto ACCUs

As discussed in section 2, the CFI is based on different accounting principles to those that apply under Australia's FM reference level framework. In order for a FM project to be an eligible offsets project, it must satisfy the additionality requirements specified in s 41 of the CFI Act. The author understands that regulations will be made to ensure the creation of the ENGO reserves satisfies these requirements, allowing it to be declared an eligible offsets project.[27] Once the project becomes an eligible offset project, the issuance of ACCUs will be determined on the basis of a baseline set in accordance with an approved methodology. At the time of writing, a relevant methodology had not been published for a FM project involving the avoidance or cessation of harvesting of native forests. However, the principle that is intended to guide the setting of the baseline is that it should represent an estimate of net emissions in the absence of the project activity.[28] The CFI Act's 'offsets integrity standards' also require that the method should provide for a deduction to be made from the project's net sequestration amount to account for leakage.[29] In addition, a 5% risk of reversal buffer is required to be deducted from the net sequestration number of a native forest protection project (and any other sequestration offsets project) to account for permanence risks (risks related to the fact that biologically sequestered carbon could be released back into the atmosphere at a later date).[30]

To estimate the Kyoto ACCUs that could be generated from the creation of the ENGO reserves, two additional scenarios were developed that incorporated these CFI requirements:

- CFI baseline scenario, which approximates the baseline that would apply under the CFI; and
- CFI-ENGO scenario, which provides the basis on which to estimate the project's net sequestration number.

CFI baseline scenario

Given the requirements governing the setting of CFI baselines, the use of the reference level described in section 4 would be inappropriate as it would suggest that ACCUs could be issued for reductions in emissions and removals that would have occurred in the absence of the ENGO reserves. The best available information on what would happen in the absence of the TFIGA is that contained in the FT report's

[27] A relevant project type will have to be added to the 'positive list' for the purposes of s 41(1)(a). It may also be necessary to make regulations to exempt the project from the requirements contained in s 41(1)(b).
[28] CFI Act, ss 106-107. See also *Explanatory Memorandum, Carbon Credits (Carbon Farming Initiative) Bill 2011 (Cth)*, at para. 5.38.
[29] CFI Act, s 133(1)(e).
[30] CFI Act, ss 16-17.

base case scenario, which provides an estimate of log removals from Tasmania's multiple use public native forests if the ENGO reserves are not created. Accordingly, in order to provide an approximation of the CFI baseline, it was assumed that, in the absence of the reserves, log removals from Tasmania's multiple use public native forests would equal the levels identified in the FT report's base case scenario for the period 2011-2030.[31]

The method used to estimate carbon stock changes in the live biomass and debris pools in the CFI baseline scenario was a replica of that employed in the reference and ENGO scenarios in section 4, except for the fact that the harvest and wood production projections were derived from the FT report base case. The 19 Tasmanian plot files were used and the areas allocated to each plot were determined on the basis of the FT report base case log removal estimates. In the FT report base case, special timber log removals were projected to be 28% below, and non-special timber log removals 48% below, the 2002-2009 average. Therefore, the harvest rate in the harvest plots representing special timbers and non-special timbers were reduced by 28% and 48% respectively, compared to those in the reference case scenario.[32]

To project carbon stock changes in the HWP pool, the simplified wood flow model and IPCC first-order decay function were used with modified wood supply estimates. In the FT report's base case scenario, high quality sawlog removals (Category 1&3) are 32% below, peeler billets 3% above, and pulpwood 48% below the levels reported in 2008. On this basis, log supply for sawlogs (Categories 1, 2, 3, 4 and 8) and pulpwood was assumed to be 32% and 48% below the 2008 levels respectively, and log supply for peelers was assumed to be 3% above the 2008 levels.

CFI-ENGO scenario

The CFI-ENGO scenario was developed using the same method as that described for the ENGO scenario in section 4.[33] Again, two sub-scenarios were used to account for leakage, one with zero leakage ('CFI-ENGO scenario (no leakage)') and another than assumes 15% leakage ('CFI-ENGO scenario (15% leakage)'). It should be emphasised that these are arbitrary leakage assumptions and that the leakage deduction applied under the CFI may exceed 15%, particularly if there is evidence of intent to increase the harvest intensity in those parts of the Tasmanian native forest estate that lie outside of reserves.

To estimate the Kyoto ACCUs from the project, net emissions under the CFI-ENGO scenario were deducted from the CFI baseline. A 5% risk of reversal buffer was then applied.

Sensitivity analysis

Sensitivity analysis was undertaken using the methods described in section 4.4.

[31] The estimated peeler billet removals were adjusted to exclude the 39,000 m^{-1} yr^{-1} supply from non-multiple use public native forests.
[32] Details of the plot types and assumed annual harvest rate in each plot type under the CFI baseline scenario are provided in Appendix A.
[33] Details of the plot types and assumed annual harvest rate in each plot type under the CFI-ENGO scenario are provided in Appendix A.

5.2. Kyoto ACCU results and discussion

Net emissions (carbon stock changes in the live biomass, debris and HWP pools) in the CFI baseline and CFI-ENGO scenarios are shown in Figure 5. Net emissions under the CFI baseline, CFI-ENGO (no leakage) and CFI-ENGO (15% leakage) scenarios, and the associated Kyoto ACCUs, are shown in Table 6. The results from the sensitivity analysis scenarios that generate the most and least Kyoto ACCUs (1950 estate simulation start date with +25% biomass yield increment rates and 1970 estate with -25% yield rate) are shown in Table 7.

The net emissions under the CFI-ENGO scenario are less those in the ENGO scenario. This is primarily because the two scenarios model different estates. The CFI-ENGO scenario estate is smaller than the ENGO scenario estate, reflecting the relative sizes (i.e. harvesting rate) of the estates in the CFI baseline and reference scenarios. While harvest slash emissions are the same in the CFI-ENGO and ENGO scenarios, the smaller estate in the CFI-ENGO scenario means it has less removals (and hence higher net emissions).

Figure 5 Carbon stock change (live biomass, debris, harvested wood product pools) in CFI baseline and CFI-ENGO scenarios, Mt CO_2-e yr^{-1}, 2013-2030

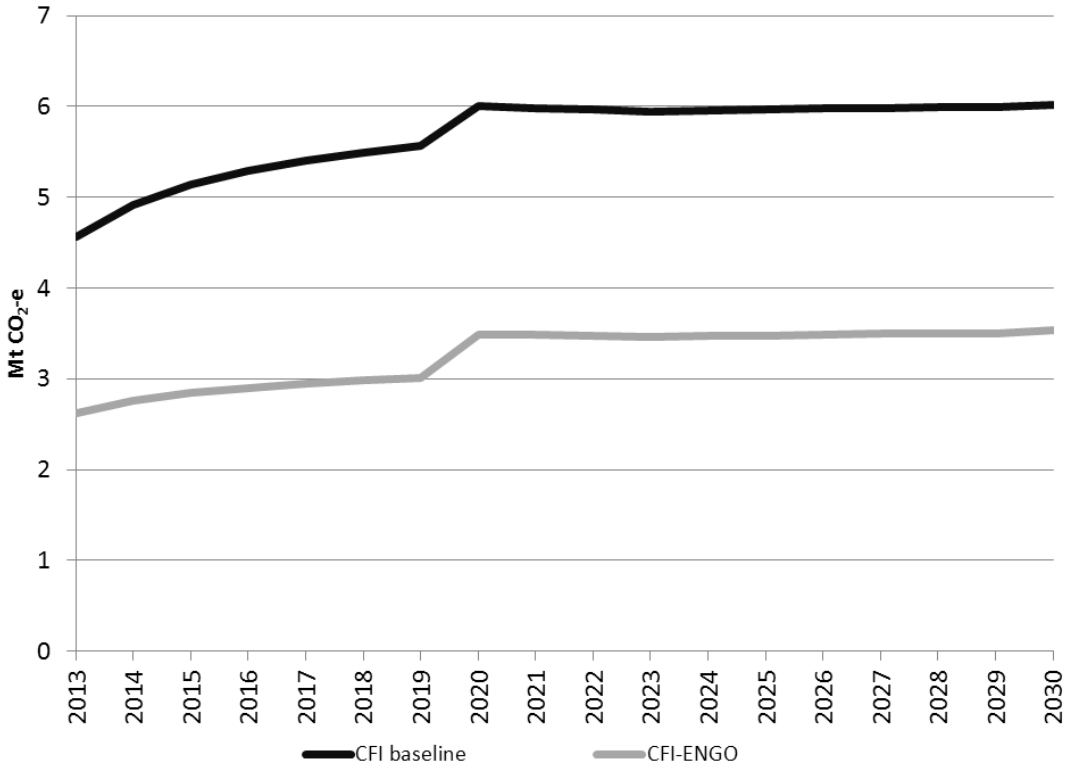


Table 6 Net emissions and Kyoto ACCU outcomes under the CFI baseline, CFI-ENGO (no leakage) and CFI-ENGO (15% leakage) scenarios, Mt CO_2-e yr^{-1}, 2013-2030

Year	CFI baseline	CFI-ENGO	Kyoto ACCUs	
			CFI-ENGO (no leakage)	CFI-ENGO (15% leakage)
2013	4.57	2.62	1.85	1.57
2014	4.92	2.76	2.05	1.74
2015	5.14	2.84	2.18	1.85
2016	5.29	2.90	2.27	1.93
2017	5.41	2.95	2.34	1.99
2018	5.50	2.98	2.39	2.03
2019	5.57	3.02	2.43	2.06
2020	6.00	3.48	2.39	2.03
2021	5.98	3.48	2.38	2.02
2022	5.96	3.47	2.36	2.01
2023	5.94	3.46	2.35	2.00
2024	5.95	3.47	2.36	2.00
2025	5.96	3.48	2.36	2.01
2026	5.98	3.49	2.37	2.01
2027	5.99	3.49	2.37	2.01
2028	5.99	3.50	2.37	2.01
2029	6.00	3.50	2.37	2.02
2030	6.02	3.53	2.36	2.01
Averages				
2013-2020	5.30	2.94	2.24	1.90
2021-2030	5.98	3.49	2.37	2.01
2013-2030	5.68	3.25	2.31	1.96

Table 7 Mean emission and Kyoto ACCU outcomes under the sensitivity analysis scenarios with the most and least credits, Mt CO_2-e yr^{-1}, 2013-2030

Year	Reference	ENGO	Average annual credits	
			ENGO (no leakage)	ENGO (15% leakage)
1950 estate simulation start date with +25% biomass yield increment rates				
2013-2020	6.39	3.77	2.49	2.12
2021-2030	6.52	3.81	2.57	2.19
2013-2030	6.46	3.79	2.54	2.16
1970 estate simulation start date with -25% biomass yield increment rates				
2013-2020	4.74	2.69	1.95	1.66
2021-2030	5.28	2.95	2.21	1.88
2013-2030	5.04	2.84	2.10	1.78

One of the most notable aspects of the Kyoto ACCU results is that they are significantly below those related to FM credits. This is due to the different baselines that apply under the FM and CFI accounting rules. The reference level that was used to calculate the FM credits is based on the mean 2002-2009 harvest rate and 2008 log removals from Tasmania's multiple use public native forests. As is evident from the FT report's base case, even without additional policy changes, harvesting rates in Tasmania's public native forests were likely to be significantly lower than the levels seen over the period 2002-2009.[34] Under the international accounting rules, Australia is likely to be able to claim the FM credits associated with harvesting reductions that would have occurred under 'normal circumstances'. The same rules do not apply to the CFI. The requirement that the CFI baseline represent an estimate of net emissions in the absence of the project activity means that the scope for ACCUs is more restricted — credits are only granted for avoided emissions and removals that would not have otherwise occurred.

It should also be emphasised that the estimates of the Kyoto ACCUs associated with the ENGO reserves are likely to change with improved data. The results here are based on the limited wood production data contained in the FT report. Improved data on the base case and mitigation scenarios, particularly harvest areas, forest types, disturbance histories and wood production, would allow for a more robust ACCU projection. At the very least, the distribution of the Kyoto ACCUs could be different from that projected here, with more being available in the short-term and less in the longer-term, reflecting 'business-as-usual' wood production intentions announced in 2007 (Forestry Tasmania, 2007).

[34] See also Forestry Tasmania (2007).

6. What is the potential financial value of the FM credits and Kyoto ACCUs associated with the ENGO reserves?

6.1. Method

To estimate the financial value of the carbon credits, the two credit types (FM credits and Kyoto ACCUs) were separated. The number of Kyoto ACCUs was simply the estimate from section 5. The number of FM credits was calculated by subtracting the projected Kyoto ACCUs from the total estimated FM credits in the corresponding scenario.[35] This adjustment was necessary to prevent double counting (the ACCUs are 'carved out' of the larger pool of FM credits that may be attributable to Tasmania's multiple use public native forests under the ENGO scenario). The resulting breakdown of credits is shown in Table 8.

Table 8 FM and Kyoto ACCUs associated with the ENGO reserves

	No leakage		15% Leakage	
	FM credits	**Kyoto ACCUs**	**FM credits**	**Kyoto ACCUs**
2013	4.89	1.85	4.16	1.57
2014	5.35	2.05	4.55	1.74
2015	5.64	2.18	4.80	1.85
2016	5.85	2.27	4.97	1.93
2017	6.00	2.34	5.10	1.99
2018	6.12	2.39	5.20	2.03
2019	6.21	2.43	5.28	2.06
2020	6.12	2.39	5.20	2.03
2021	6.11	2.38	5.19	2.02
2022	6.10	2.36	5.19	2.01
2023	6.09	2.35	5.18	2.00
2024	6.10	2.36	5.19	2.00
2025	6.12	2.36	5.20	2.01
2026	6.13	2.37	5.21	2.01
2027	6.13	2.37	5.21	2.01
2028	6.13	2.37	5.21	2.01
2029	6.13	2.37	5.21	2.02
2030	6.10	2.36	5.18	2.01

It was assumed that all Kyoto ACCUs associated with the creation of the ENGO reserves are sold into domestic or international compliance markets in the year of generation (i.e. they are not banked). Similarly, it was assumed that the remaining FM credits after the deduction of the corresponding Kyoto ACCUs were either used to

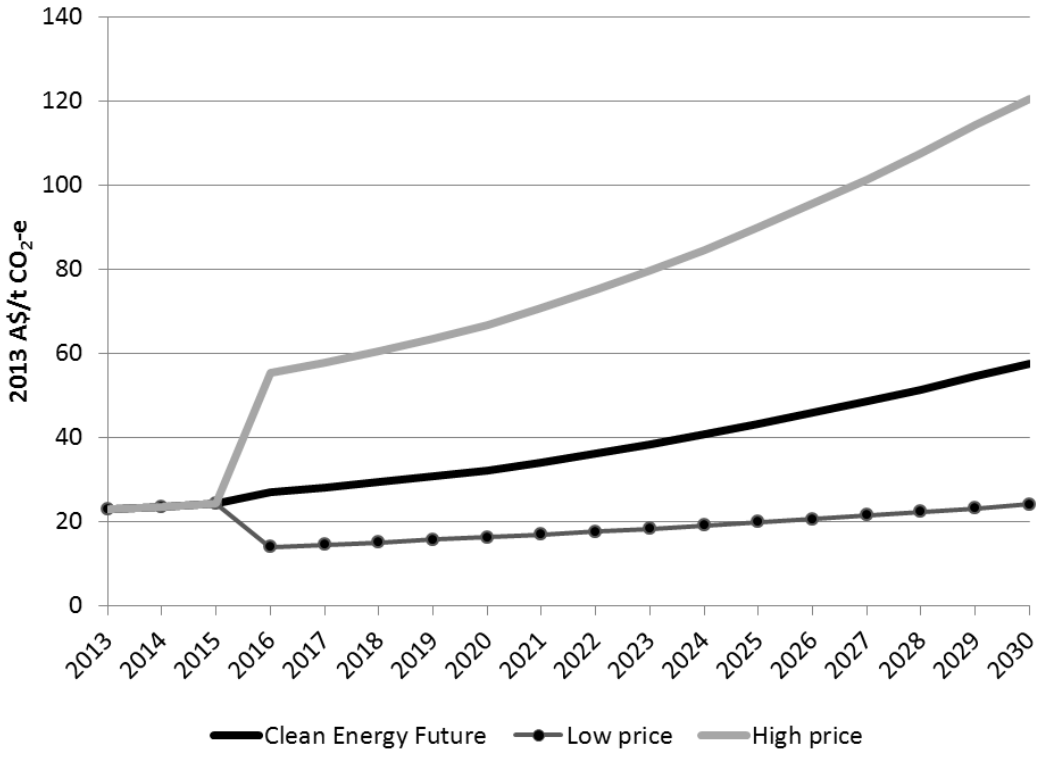
[35] For simplicity, it was assumed that, if there is a 15% deduction for leakage under the CFI, actual leakage is 15%. In reality, it is unlikely that the CFI leakage deduction will exactly match the outcome. If the CFI deduction is greater than actual leakage, there will be more FM credits than projected here (and vice versa).

facilitate a 1:1 increase in carbon unit sales under the CE Act or sold into international compliance markets in the year of generation. To assign a value to both the FM credits and Kyoto ACCUs, three carbon price paths were used:

- the Clean Energy Future price path from the Australian Treasury's *Strong Growth, Low Pollution* report (Australian Treasury, 2011);
- a low price path, where the carbon price follows the Clean Energy Future path until the end of 2014-15, falls to the minimum price prescribed under the CE Act (floor price) over the period 2015-16 to 2017-18, and then grows at 4% real through to 2029-30;[36] and
- a high price path, where the carbon price follows the Clean Energy Future path until the end of 2014-15 and then follows the *Strong Growth, Low Pollution* report's high price path through to 2029-30.

These three price paths are shown in Figure 6 below.

Figure 6 Clean Energy Future, Low and High carbon price scenarios, real 2013 $A/t CO_2-e



Source: Australian Treasury (2011) and author estimates.

To calculate the net present value (NPV) of the revenues from the credits, a social time preference rate of 2.7% was used, based on a pure time preference rate of 1.5% (including catastrophic risk), an elasticity of marginal utility of consumption of 1 and

[36] The 4% growth rate is based on Hotelling's rule (Hotelling, 1931).

a per capita consumption growth rate of 1.2% for the projection period.[37] The choice of social time preference rate is a controversial issue and one that has been subject to extensive debate within the economic and environmental literature.[38] The rate chosen here is the author's preference but there are valid reasons for using higher or lower alternatives. The use of a higher (lower) social time preference rate would decrease (increase) the net present value estimates.

6.2. Results

The annual value and NPV (2013 A$) of the credits generated under the ENGO/CFI-ENGO (no leakage) and ENGO/CFI-ENGO (15% leakage) scenarios with the Clean Energy Future price path are shown in Table 9. The equivalent results for the low and high price paths, and for the sensitivity analysis scenarios that generate the lowest and highest NPVs (1950 estate simulation start date with +25% biomass yield increment rates under the high price path and the 1970 estate with -25% yield rate under the low price path) are provided in Appendices B and C.

[37] The pure time preference rate and elasticity of marginal utility of consumption were taken from the HM Treasury *Green Book* (HM Treasury, 2003). The per capita consumption growth rate was taken from the *Strong Growth, Low Pollution* report's Clean Energy Future scenario (Chart 5.38) (Australian Treasury, 2011).

[38] Feldstein (1964); Olson and Bailey (1981); Lind (1982); Cline (1992; 1993); Birdsall and Steer (1993); Weitzman (1994); Portney and Weyant (1999); Nordhaus and Boyer (2000); Pearce (2003); Tol and Yohe (2006); Stern (2007); Weitzman (2007); Nordhaus (2007); Dietz and Stern (2008).

Table 9 Annual value and net present value of the credits generated under the ENGO/CFI-ENGO (no leakage) and ENGO/CFI-ENGO (15% leakage) scenarios, Clean Energy Future price path (2013 A$ million)

	No leakage		15% Leakage	
	FM credits	Kyoto ACCUs	FM credits	Kyoto ACCUs
Annual value (2013 $A million)				
2013	113	43	96	36
2014	126	48	107	41
2015	137	53	116	45
2016	158	61	134	52
2017	168	65	143	56
2018	180	70	153	60
2019	190	74	162	63
2020	197	77	167	66
2021	208	81	177	69
2022	221	85	187	73
2023	233	90	198	77
2024	248	96	211	81
2025	264	102	224	87
2026	280	108	238	92
2027	297	115	253	98
2028	315	122	268	103
2029	334	129	284	110
2030	351	136	299	116
NPV (2013 $A million)				
2013-2020	1145	444	973	377
2021-2030	1953	756	1660	642
2013-2030	3098	1199	2633	1019

7. Conclusion

The aim of this report was to assess the ENGO claims about the potential carbon-related benefits of the proposed reserves. The key conclusions are as follows.

- There is uncertainty about the nature of the FM accounting framework that will apply in the post-2012 era but there is a reasonable likelihood that Australia will count FM towards its national mitigation commitments after 2012. The inclusion of FM will mean that changes in harvesting and management practices in Tasmania's multiple use public native forests have the potential to generate FM credits that can be used to offset emissions in other areas.

- The creation of the ENGO reserves is likely to be associated with the generation of a significant quantity of FM credits. In the absence of leakage, the FM credits under the ENGO scenario are estimated at 8.01 (7.01-8.90) Mt CO_2-e yr^{-1} over the period 2013-2020, and 8.48 (7.95-9.20) Mt CO_2-e yr^{-1} over the period 2021-2030. In the ENGO (15% leakage) scenario, these averages fall to 6.81 (5.96-7.56) Mt CO_2-e yr^{-1} and 7.21 (6.76-7.82) Mt CO_2-e yr^{-1} for 2013-2020 and 2021-2030 respectively.

- The estimated FM credits under the ENGO scenarios equate to:

    - between 7.4% and 8.7% of Australia's cumulative abatement task over the period 2013-2020 if Australia has a 5% emission reduction target for 2020; and

    - between 2.5% and 2.9% of Australia's cumulative abatement task over the period 2021-2030 if Australia has an 80% emission reduction target for 2050.

- The creation of the ENGO reserves could be declared an eligible offsets project under the CFI. On the basis this occurs, it was estimated here that:

    - under the CFI-ENGO (no leakage) scenario, the project could generate 2.24 (1.95-2.49) Mt CO_2-e yr^{-1} of Kyoto ACCUs over the period 2013-2020, and 2.37 (2.21-2.57) Mt CO_2-e yr^{-1} of Kyoto ACCUs over the period 2021-2030; and

    - under the CFI-ENGO (15% leakage) scenario, the project could generate 1.90 (1.66-2.12) Mt CO_2-e yr^{-1} of Kyoto ACCUs over the period 2013-2020, and 2.01 (1.88-2.19) Mt CO_2-e yr^{-1} of Kyoto ACCUs over the period 2021-2030.

  Because the CFI-ENGO (15% leakage) scenario incorporates a leakage deduction, it is likely to provide a better approximation of the Kyoto ACCUs that could be generated from the project. The CFI-ENGO (no leakage) scenario is included for information purposes.

- On the basis of three carbon price paths, it was estimated here that:

- the NPV (2013 $A) of the Kyoto ACCUs generated over the period 2013-2020, assuming 15% leakage, is likely to be between $251 million and $652 million (range under the sensitivity analysis scenarios of $219-$722 million); and

- the NPV (2013 $A) of the Kyoto ACCUs generated over the period 2021-2030, assuming 15% leakage, is likely to be between $292 million and $1339 million (range under the sensitivity analysis scenarios of $273-$1456 million).

- Any Kyoto ACCUs that are issued in relation to the ENGO reserves will be effectively carved out of the larger pool of FM credits generated by Tasmania's multiple use public native forests. The remaining FM credits could be used to facilitate a 1:1 increase in carbon unit sales under the CE Act or sold into international compliance markets. The estimated value of the FM credits remaining after the deduction of the Kyoto ACCUs is as follows.

    - The NPV (2013 $A) of the remaining FM credits generated over the period 2013-2020, assuming no leakage, is likely to be between $765 million and $1974 million (range under the sensitivity analysis scenarios of $669-$2179 million).

    - The NPV (2013 $A) of the remaining FM credits generated over the period 2021-2030, assuming no leakage, is likely to be between $887 million and $4073 million (range under the sensitivity analysis scenarios of $832-$4415 million).

    - The NPV (2013 $A) of the remaining FM credits generated over the period 2013-2020, assuming 15% leakage, is likely to be between $650 million and $1678 million (range under the sensitivity analysis scenarios of $569-$1853 million).

    - The NPV (2013 $A) of the remaining FM credits generated over the period 2021-2030, assuming 15% leakage, is likely to be between 754$ million and $3462 million (range under the sensitivity analysis scenarios of $707-$3753 million).

Appendix A Tasmanian plots – assigned areas

Table A1 Reference scenario plot types and assumed annual harvest rates, 2013-2030 (ha^{-1} yr^{-1})

Plot file*	Area (ha^{-1} yr^{-1})
MDEF 31-100 CF PW.plo	129
MDEF 31-100 PH NPW.plo	47
MDEF 31-100 PH PW TAS.plo	252
MDEF 31-100_non_com_thin.plo	185
MDEF mature CF PW .plo	224
MDEF mature PH NPW.plo	99
MDEF mature PH PW TAS.plo	503
MDEF senescent CF PW.plo	103
MDEF senescent PH NPW.plo	70
MDEF senescent PH PW TAS.plo	252
MDEF three aged CF PW.plo	448
MDEF three aged PH PW TAS.plo	1006
MDEF unknown age CF PW.plo	1345
MDEF unknown age PH NPW.plo	86
MDEF unknown age PH PW TAS.plo	3018
TDEF 31-100 CF PW.plo	374
TDEF mature CF PW.plo	601
TDEF senescent CF PW.plo	269
TDEF unknown age CF PW.plo	5161
Total	14,172

* Plot descriptions: forest type (Medium Dense Eucalypt Forest (MDEF) or Tall Dense Eucalypt Forest (TDEF)); age-class; harvest type (partial harvest (PH), clearfell (CF) or non-commercial thin (non_com_thin)); pulpwood (PW) or no pulpwood (NPW); and state (if applicable).

Table A2 ENGO scenario plot types and assumed annual harvest rates, 2013-2030 (ha^{-1} yr^{-1})

Plot file*	Area (ha^{-1} yr^{-1})	Plot file*	Area (ha^{-1} yr^{-1})
MDEF 31-100 CF PW.plo	41	MDEF 31-100 CF PW NH.plo	89
MDEF 31-100 PH NPW.plo	18	MDEF 31-100 PH NPW NH.plo	29
MDEF 31-100 PH PW TAS.plo	79	MDEF 31-100 PH PW TAS NH.plo	173
MDEF 31-100_non_com_thin.plo	57	MDEF 31-100_non_com_thin NH.plo	128
MDEF mature CF PW .plo	70	MDEF mature CF PW NH.plo	154
MDEF mature PH NPW.plo	38	MDEF mature PH NPW NH.plo	61
MDEF mature PH PW TAS.plo	158	MDEF mature PH PW TAS NH.plo	345
MDEF senescent CF PW.plo	32	MDEF senescent CF PW NH.plo	71
MDEF senescent PH NPW.plo	27	MDEF senescent PH NPW NH.plo	43
MDEF senescent PH PW TAS.plo	79	MDEF senescent PH PW TAS NH.plo	173
MDEF three aged CF PW.plo	141	MDEF three aged CF PW NH.plo	307
MDEF three aged PH PW TAS.plo	316	MDEF three aged PH PW TAS NH.plo	690
MDEF unknown age CF PW.plo	422	MDEF unknown age CF PW NH.plo	922
MDEF unknown age PH NPW.plo	33	MDEF unknown age PH NPW NH.plo	53
MDEF unknown age PH PW TAS.plo	948	MDEF unknown age PH PW TAS NH.plo	2070
TDEF 31-100 CF PW.plo	117	TDEF 31-100 CF PW NH.plo	256
TDEF mature CF PW.plo	189	TDEF mature CF PW NH.plo	412
TDEF senescent CF PW.plo	85	TDEF senescent CF PW NH.plo	185
TDEF unknown age CF PW.plo	1621	TDEF unknown age CF PW NH.plo	3540
Total			14,172

* Plot descriptions: forest type (Medium Dense Eucalypt Forest (MDEF) or Tall Dense Eucalypt Forest (TDEF)); age-class; harvest type (partial harvest (PH), clearfell (CF) or non-commercial thin (non_com_thin)); pulpwood (PW) or no pulpwood (NPW); state (if applicable); and no harvest (NH) (if applicable).

Table A3 CFI baseline scenario plot types and assumed annual harvest rates, 2013-2030 (ha^{-1} yr^{-1})

Plot file*	Area (ha^{-1} yr^{-1})
MDEF 31-100 CF PW.plo	67
MDEF 31-100 PH NPW.plo	34
MDEF 31-100 PH PW TAS.plo	131
MDEF 31-100_non_com_thin.plo	96
MDEF mature CF PW .plo	116
MDEF mature PH NPW.plo	71
MDEF mature PH PW TAS.plo	261
MDEF senescent CF PW.plo	54
MDEF senescent PH NPW.plo	51
MDEF senescent PH PW TAS.plo	131
MDEF three aged CF PW.plo	233
MDEF three aged PH PW TAS.plo	523
MDEF unknown age CF PW.plo	699
MDEF unknown age PH NPW.plo	62
MDEF unknown age PH PW TAS.plo	1569
TDEF 31-100 CF PW.plo	194
TDEF mature CF PW.plo	312
TDEF senescent CF PW.plo	140
TDEF unknown age CF PW.plo	2683
Total	7428

* Plot descriptions: forest type (Medium Dense Eucalypt Forest (MDEF) or Tall Dense Eucalypt Forest (TDEF)); age-class; harvest type (partial harvest (PH), clearfell (CF) or non-commercial thin (non_com_thin)); pulpwood (PW) or no pulpwood (NPW); and state (if applicable).

Table A4 CFI-ENGO scenario plot types and assumed annual harvest rates, 2013-2030 (ha^{-1} yr^{-1})

Plot file*	Area (ha^{-1} yr^{-1})	Plot file*	Area (ha^{-1} yr^{-1})
MDEF 31-100 CF PW.plo	41	MDEF 31-100 CF PW NH.plo	27
MDEF 31-100 PH NPW.plo	18	MDEF 31-100 PH NPW NH.plo	16
MDEF 31-100 PH PW TAS.plo	79	MDEF 31-100 PH PW TAS NH.plo	52
MDEF 31-100_non_com_thin.plo	57	MDEF 31-100_non_com_thin NH.plo	39
MDEF mature CF PW .plo	70	MDEF mature CF PW NH.plo	46
MDEF mature PH NPW.plo	38	MDEF mature PH NPW NH.plo	33
MDEF mature PH PW TAS.plo	158	MDEF mature PH PW TAS NH.plo	104
MDEF senescent CF PW.plo	32	MDEF senescent CF PW NH.plo	21
MDEF senescent PH NPW.plo	27	MDEF senescent PH NPW NH.plo	23
MDEF senescent PH PW TAS.plo	79	MDEF senescent PH PW TAS NH.plo	52
MDEF three aged CF PW.plo	141	MDEF three aged CF PW NH.plo	92
MDEF three aged PH PW TAS.plo	316	MDEF three aged PH PW TAS NH.plo	207
MDEF unknown age CF PW.plo	422	MDEF unknown age CF PW NH.plo	277
MDEF unknown age PH NPW.plo	33	MDEF unknown age PH NPW NH.plo	29
MDEF unknown age PH PW TAS.plo	948	MDEF unknown age PH PW TAS NH.plo	621
TDEF 31-100 CF PW.plo	117	TDEF 31-100 CF PW NH.plo	77
TDEF mature CF PW.plo	189	TDEF mature CF PW NH.plo	124
TDEF senescent CF PW.plo	85	TDEF senescent CF PW NH.plo	55
TDEF unknown age CF PW.plo	1621	TDEF unknown age CF PW NH.plo	1062
Total			7428

* Plot descriptions: forest type (Medium Dense Eucalypt Forest (MDEF) or Tall Dense Eucalypt Forest (TDEF)); age-class; harvest type (partial harvest (PH), clearfell (CF) or non-commercial thin (non_com_thin)); pulpwood (PW) or no pulpwood (NPW); state (if applicable); and no harvest (NH) (if applicable).

Appendix B Estimated credit value

Annual value and net present value of the credits generated under the ENGO/CFI-ENGO (no leakage) and ENGO/CFI-ENGO (15% leakage) scenarios, low and high price paths (2013 A$ million)

B1 Low price path (2013 A$ million)

	No leakage		15% Leakage	
	FM credits	**Kyoto ACCUs**	**FM credits**	**Kyoto ACCUs**
Annual value (2013 $A million)				
2013	113	43	96	36
2014	126	48	107	41
2015	137	53	116	45
2016	82	32	69	27
2017	87	34	74	29
2018	92	36	78	31
2019	97	38	83	32
2020	100	39	85	33
2021	104	40	88	34
2022	108	42	91	35
2023	112	43	95	37
2024	116	45	99	38
2025	121	47	103	40
2026	126	49	107	41
2027	132	51	112	43
2028	137	53	116	45
2029	142	55	121	47
2030	147	57	125	48
NPV (2013 $A million)				
2013-2020	765	295	650	251
2021-2030	887	343	754	292
2013-2030	1651	638	1404	543

B2 High price path (2013 A$ million)

	No leakage		15% Leakage	
	FM credits	**Kyoto ACCUs**	**FM credits**	**Kyoto ACCUs**
Annual value (2013 $A million)				
2013	113	43	96	36
2014	126	48	107	41
2015	137	53	116	45
2016	324	126	276	107
2017	346	135	295	115
2018	370	144	315	123
2019	393	154	334	131
2020	408	160	347	136
2021	432	168	367	143
2022	458	177	389	151
2023	485	188	412	159
2024	517	200	439	170
2025	550	212	468	180
2026	585	226	497	192
2027	621	240	528	204
2028	658	254	560	216
2029	700	271	595	230
2030	735	285	625	242
NPV (2013 $A million)				
2013-2020	1974	767	1678	652
2021-2030	4073	1575	3462	1339
2013-2030	6047	2342	5140	1991

Appendix C Estimated credit value, lowest and highest sensitivity analysis scenario results

Table C1 Annual value and net present value of the credits generated under the lowest sensitivity analysis scenario (1970 estate simulation start date with -25% biomass yield increment rates under low price path), ENGO/CFI-ENGO (no leakage) and ENGO/CFI-ENGO (15% leakage), 2013 A$ million

	No leakage		15% Leakage	
	FM credits	Kyoto ACCUs	FM credits	Kyoto ACCUs
Annual value (2013 $A million)				
2013	97	37	83	31
2014	109	42	93	35
2015	119	46	101	39
2016	71	27	61	23
2017	76	30	65	25
2018	81	31	69	27
2019	85	33	73	28
2020	90	35	76	30
2021	94	37	80	31
2022	99	38	84	32
2023	103	40	88	34
2024	108	42	92	35
2025	114	44	97	37
2026	119	46	102	39
2027	125	48	106	41
2028	131	51	112	43
2029	138	53	117	45
2030	137	53	117	45
NPV (2013 $A million)				
2013-2020	669	257	569	219
2021-2030	832	321	707	273
2013-2030	1502	578	1276	492

Table C2 Annual value and net present value of the credits generated under the highest sensitivity analysis scenario (1950 estate simulation start date with +25% biomass yield increment rates under high price path), ENGO/CFI-ENGO (no leakage) and ENGO/CFI-ENGO (15% leakage), 2013 A$ million

	No leakage		15% Leakage	
	FM credits	Kyoto ACCUs	FM credits	Kyoto ACCUs
Annual value (2013 $A million)				
2013	129	49	110	42
2014	143	55	121	47
2015	153	59	130	51
2016	361	140	307	119
2017	382	149	325	127
2018	404	158	344	134
2019	425	167	362	142
2020	449	176	381	150
2021	473	184	402	157
2022	500	195	425	165
2023	529	205	449	174
2024	562	218	477	185
2025	597	231	507	196
2026	634	245	539	209
2027	671	260	571	221
2028	710	275	603	234
2029	753	292	640	248
2030	792	308	674	261
NPV (2013 $A million)				
2013-2020	2179	849	1853	722
2021-2030	4415	1713	3753	1456
2013-2030	6595	2562	5605	2177

References

Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) (2011a). *Australian Forest and Wood Products Statistics*. Australian Government, Canberra.

Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) (2011b). *Log removals – public and private forests, unpublished data*. Australian Government, Canberra.

Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) (2011c). *Energy in Australia – 2011*. Australian Government, Canberra.

Australian Conservation Foundation (ACF), Environment Tasmania (ET) and The Wilderness Society (TWS) (2011). *Tasmania's Native Forests: Places for Protection – A background on the ENGO identified high conservation value reserve areas*. ACF, ET and TWS, Tasmania.

Australian Government (2008). *Carbon Pollution Reduction Scheme: Australia's Low Pollution Future: White Paper*. Australian Government, Canberra.

Australian Government (2011a). *Submission to the AWG-KP, September 2011, Forest Management Reference Level Submission*. UNFCCC Secretariat, Bonn, Germany. Available at: http://unfccc.int/bodies/awg-kp/items/5896.php.

Australian Government (2011b). *National Inventory Report 2009*. Australian Government, Canberra.

Australian Treasury (2011). *Strong Growth, Low Pollution: Modelling a Carbon Price*. Australian Government, Canberra.

Birdsall N, Steer A (1993). Act Now on Global Warming – But Don't Cook the Books. Finance & Development 30(1), 6–8.

Brack C, Richards G, Waterworth R (2006). Integrated and comprehensive emissions estimation for greenhouse gases. Sustain. Sci. 1, 91–106.

Cline W (1992). *The Economics of Global Warming*. Institute for International Economics, Washington DC.

Cline W (1993). Give greenhouse abatement a fair chance. Finance & Development 30(1), 3–5.

Department of Climate Change and Energy Efficiency (2011). *National Greenhouse Accounts Factors, July 2011*. Australian Government, Canberra.

Dietz S, Stern N (2008). Why Economic Analysis Supports Strong Action on Climate Change: A Response to the Stern Review's Critics. Review of Environmental Economics and Policy 2(1), 94–113.

Feldstein M (1964). The Social Time Preference Discount Rate in Cost Benefit Analysis. The Economic Journal 74(294), 360–379.

Forestry Tasmania (2003-2011). *Annual Reports 2002/03 to 2010/2011*. Forestry Tasmania, Tasmania.

Forestry Tasmania (2007). *Sustainable High Quality Eucalypt Sawlog Supply from Tasmanian State Forest: Review No.3*. Forestry Tasmania, Tasmania.

Forestry Tasmania (2011). *Evaluation of Wood Resource Scenarios relevant to the Tasmanian Forests Statement of Principles to lead to an Agreement – Final Report to Signatories*. Forestry Tasmania, Tasmania.

HM Treasury (2003). *The Green Book: Appraisal and Evaluation in Central Government*. Government of the United Kingdom, London, England.

Höhne N, Wartman S, Herold A, Freibauer A (2007). The rules for land use, land use change and forestry under the Kyoto Protocol – lessons learned for the future climate negotiations. Environ. Sci. Policy 10, 353–369.

Hotelling H (1931). The Economics of Exhaustible Resources. Journal of Political Economy 39(2), 137–175.

Lind R (ed.) (1982). *Discounting for Time and Risk in Energy Policy*. Johns Hopkins University Press, Baltimore.

Macintosh A (2011a). The Australia clause and REDD: a cautionary tale. Climatic Change, DOI 10.1007/s10584-011-0210-x.

Macintosh A (2011b). Are forest management reference levels incompatible with robust climate outcomes? A case study on Australia. Carbon Management 2(6), 691-707.

Macintosh A (2011c). *Potential carbon credits from reducing native forest harvesting in Australia*. Australian National University Centre for Climate Law & Policy, Working Paper No. 2011/1. ANU, Canberra.

Montreal Process Implementation Group (MPIG) (2008). *Australia's State of the Forests Report: Five-yearly Report 2008*. Australian Government, Canberra, Australia.

Nordhaus W (2007). A Review of the Stern Review on the Economics of Climate Change. Journal of Economic Literature 45, 686–702.

Nordhaus W, Boyer J (2000). *Warming the World: Economic Models of Global Warming*. MIT Press, Cambridge MA.

Olson M, Bailey M (1981). Positive Time Preference. Journal of Political Economy 89(1), 1–25.

Pearce D (2003). The Social Cost of Carbon and its Policy Implications. Oxford Review of Economic Policy 19(3), 362–384.

Portney P, Weyant J (eds.) (1999). *Discounting and Intergenerational Equity*. Resources for the Future, Washington DC.

Richards G, Borough C, Evans D, Reddin A, Ximenes F, Gardner D (2007). Developing a carbon stocks and flows model for Australian wood products. *Australian Forestry* 70(2), 108–119.

Richards G, Brack C (2004). A modelled carbon account for Australia's post-1990 plantation estate. Australian Forestry 67(4), 289–300.

Richards G, Evans D (2004). Development of a carbon accounting model (FullCAM vers. 1.0) for the Australian continent. Australian Forestry 67(4), 277–283.

Ryan M, Spencer R, Keenan R (2002). Private native forests in Australia: What did we learn from the Regional Forest Agreement program? Australian Forestry 65(3), 141–152.

Schlamadinger B, et al (2007). A synopsis of land use, land-use change and forestry (LULUCF) under the Kyoto Protocol and Marrakech Accords. Environ. Sci. Policy 10, 271–282.

Stanwell Corporation Ltd (2011). *Annual Report 2011*. Stanwell Corporation Ltd, Queensland.

Stern N (2007). *The Economics of Climate Change: The Stern Review*. Cambridge University Press, Cambridge.

Tarong Energy Corporation Ltd (2010). *Investing in the Future 09-10: Annual Report*. Tarong Energy Corporation Ltd, Queensland.

Tol R, Yohe G (2006). A review of the Stern Review. World Economics 7(4), 233–250.

UNFCCC (2009). *Report of the review of the initial report of Australia*. FCCC/IRR/2007/AUS. UNFCCC Secretariat, Bonn, Germany.

West J (2011). *Tasmanian Forest Agreement Verification: Advice to Intergovernmental Taskforce on the independent verification process and agreement by the Reference Group of Signatories*. Australian Government, Canberra.

Weitzman M (1994). On the "Environmental" Discount Rate. Journal of Environmental Economics and Management 26, 200–209.

Weitzman M (2007) A Review of The Stern Review on the Economics of Climate Change. Journal of Economic Literature 45, 703–724.

ANU Centre for Climate Law and Policy
ANU College of Law
The Australian National University
Canberra ACT 0200
Ph: 61 2 6125 3832

http://law.anu.edu.au/CCLP/