

Indicative estimates of abatement from the Carbon Farming Initiative, 2012-13 to 2049-50

Treasury has commissioned the Department of Climate Change and Energy Efficiency (DCCEE) to develop estimates of annual abatement resulting from the Carbon Farming Initiative (CFI), from Kyoto-compliant non-forest-related activities, as well as Kyoto-compliant avoided deforestation and managed regrowth activities.¹

The estimates are to be used in the reference cases for Treasury's update of *Australia's Low Pollution Future* (ALPF)², and extend from 2012-13 to 2049-50.

The Department has developed indicative estimates of annual emissions reductions for two different world carbon price scenarios specified by Treasury, covering abatement from agriculture, legacy waste emissions, avoided deforestation and managed regrowth. This paper summarises those estimates and the methodology used to produce them.

Table 1

| 550 ppm stabilisation path | | | | | | | |
|--|-----------------------|---------|---------|---------|-------------|---------|-------------|
| | Mt CO ₂ -e | 2012-13 | 2013-14 | 2014-15 | 2019-20 | 2029-30 | 2049-50 |
| Legacy waste | | 1.9 | 1.7 | 1.6 | 1.1 | 0.9 | 0.6 |
| Livestock | | 1.1 | 1.2 | 1.2 | 1.3 | 1.8 | 2.9 |
| Crops | | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 |
| Savanna fire management | | 0.4 | 0.4 | 0.4 | 0.4 | 0.5 | 0.7 |
| Avoided deforestation and managed regrowth | | 3.6 | 3.7 | 3.7 | 4.0 | 5.6 | 11.5 |
| TOTAL | | 7.1 | 7.0 | 7.0 | 7.0 | 9.0 | 15.9 |
| (excluding other forest-related activities estimated by ABARES) ¹ | | | | | | | |
| 450 ppm stabilisation path | | | | | | | |
| | Mt CO ₂ -e | 2012-13 | 2013-14 | 2014-15 | 2019-20 | 2029-30 | 2049-50 |
| Legacy waste | | 2.2 | 2.7 | 2.5 | 1.8 | 1.3 | 0.8 |
| Livestock | | 1.2 | 1.5 | 1.5 | 1.7 | 2.3 | 3.6 |
| Crops | | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.3 |
| Savanna fire management | | 0.4 | 0.5 | 0.5 | 0.6 | 0.7 | 0.9 |
| Avoided deforestation and managed regrowth | | 5.6 | 5.7 | 5.8 | 6.4 | 9.1 | 18.4 |
| TOTAL | | 9.6 | 10.5 | 10.4 | 10.6 | 13.5 | 23.9 |
| (excluding other forest-related activities estimated by ABARES) ¹ | | | | | | | |

Totals may not add due to rounding.

Notes: 1. Abatement under the CFI from other forest-related activities is being estimated by ABARES and therefore is not included here.

¹ In a separate exercise for Treasury, ABARES is estimating abatement from other forest-related activities under the CFI.

² Treasury 2008, *Australia's low pollution future: the economics of climate change mitigation*.

It should be noted that these estimates are preliminary, indicative estimates and that there is a high degree of uncertainty surrounding the likely level of abatement in any given year and at any given carbon price. There is uncertainty around many key factors that will affect abatement under the CFI. The long time period over which these estimates extend also contributes to the uncertainty.

Introduction

The CFI is a carbon offsets scheme being established by the Australian Government to provide new economic opportunities for farmers, forest growers and landholders and help the environment by reducing carbon pollution. Legislation to underpin the CFI was introduced into Parliament on 24 March 2011.

A discussion paper published by the Department contains preliminary estimates of the likely range of abatement from the CFI in 2020.³ These estimates were developed through bottom-up analysis of sectors and activities.

The bottom-up approach is not suited to developing point estimates over a long time frame, as required by Treasury. Therefore the Department has developed a simple model of the relationship between abatement and the carbon price, drawing on ALPF. The model is calibrated using the published preliminary, indicative estimates for 2020.

While it is not possible to quantify the uncertainty surrounding the level of abatement in any year, the analysis for the discussion paper indicates that it is high even in 2020. The uncertainty would be magnified over a long time frame, as well as by the relatively high carbon prices assumed by 2050.

Abatement potential

Potential sources of abatement and the uncertainties surrounding the uptake of CFI opportunities are considered in detail in the Department's discussion paper on CFI abatement in 2020.⁴

The indicative estimates in that document are of abatement that may be achieved given economic and other uptake constraints, including the incentive posed by a particular carbon price. For this reason the estimates are much lower than the various estimates of 'technical' potential that are in the public domain.⁵

³ DCCEE 2011, *Carbon Farming Initiative preliminary estimates of abatement*, Discussion Paper. <http://www.climatechange.gov.au/~media/publications/carbon-farming-initiative/CFI-Preliminary-estimates-of-abatement.pdf>

⁴ DCCEE 2011, *Carbon Farming Initiative preliminary estimates of abatement*, Discussion Paper. <http://www.climatechange.gov.au/~media/publications/carbon-farming-initiative/CFI-Preliminary-estimates-of-abatement.pdf>

⁵ See for example Garnaut 2011, *Update Paper #4 Transforming Rural Land Use*; CSIRO 2009, *An Analysis of Greenhouse Gas Mitigation and Carbon Biosequestration Opportunities from Rural Land Use*.

These estimates for Treasury draw on the estimates in the discussion paper of potential emissions abatement from agriculture, legacy waste management, avoided deforestation and managed regrowth. The six agricultural subsectors considered in the discussion paper are aggregated to three subsectors: livestock; crops; and savanna fire management. Avoided deforestation and managed regrowth are also aggregated to one subsector.

Uncertainty surrounding abatement estimates

The Department's discussion paper noted that many of the key factors that will influence the level of abatement from the CFI are currently uncertain. In response to this uncertainty, the Department constructed indicative ranges to illustrate the likely magnitude of abatement that could be achieved.

The amount of abatement that will be generated by the CFI will depend on various factors including:

- final eligibility rules of the CFI;
- international accounting rules that apply to Australia;
- technical potential of the relevant sources;
- cost of generating the abatement credits;
- levels of participation by the relevant sectors;
- other relevant policies; and
- the price at which the CFI credits can be sold.

In the current exercise, the long time period and the relatively high carbon price assumptions add to the uncertainty.

Projected baseline emissions

The estimates of abatement from the CFI draw on estimates of baseline emissions (emissions in the absence of the CFI). Baseline emissions from 2012-13 to 2029-30 are from *Australia's emissions projections 2010* (DCCEE 2011). DCCEE does not produce emissions projections beyond 2029-30.

To obtain estimates out to 2049-50, the sectoral emissions projections for non-forest-related activities have been extrapolated to provide baseline emissions estimates out to 2049-50. For avoided deforestation and managed regrowth, the relevant baseline emissions (from deforestation) are projected to be 49 million tonnes of carbon dioxide equivalent (Mt CO₂-e) per year over the Kyoto period (2008-2012). No further declines in land clearing are projected, so baseline emissions are estimated to remain at around 49 Mt CO₂-e per year out to 2049-50.

Carbon price assumptions

The Treasury has modelled two global action scenarios—'medium' global action scenario and 'ambitious' global action scenario—corresponding to the stabilisation of atmospheric greenhouse gases at 550 parts per million (ppm) and 450 ppm, respectively, by around 2100.

This report provides estimates of CFI abatement for two different world carbon price series necessary to achieve these stabilisation targets. In the medium global action (550 ppm) scenario, the world carbon price is projected to begin at around \$23 per tonne of carbon dioxide equivalent (t CO₂-e) in 2012–13, and in the ambitious global action (450 ppm) scenario, the world carbon price is projected to begin at around \$47/ t CO₂-e in 2012–13. In both scenarios, the carbon price, expressed in 2009–10 Australian dollars, is projected to increase at an average rate of about 5 per cent a year to 2049–50.

Methodology

A top-down approach is used to estimate proportional reductions in emissions in response to carbon prices. It is assumed that the cost of abatement increases more rapidly than the level of abatement (that is, the marginal cost of emissions reductions is an increasing, convex function of the proportional reduction in emissions).

The price-emissions reduction relationship is estimated using a similar functional form to that used for the marginal abatement cost (MAC) curves for non-energy emissions in ALPF modelling. Section B.9.7 of Annex B of ALPF describes the functional form and parameter values.⁶ A lag function is set out in Section 2.3.2 of the report by Centre of Policy Studies for ALPF.⁷

For non-forest-related activities, carbon price is the determining variable, and there is a lagged response to the price. For each subsector, parameters are defined for the no regrets level of abatement and the responsiveness to the price. This second parameter accounts for factors such as technical potential, direct and indirect costs, and the voluntary nature of the CFI.^{8, 9}

⁶ Annex B: Treasury Climate change mitigation policy modelling assumptions.

http://www.treasury.gov.au/lowpollutionfuture/report/html/09_AnnexB.asp

⁷ Centre of Policy Studies 2008, *Model development and Scenario design: MMRF modelling to support a study of the economic impacts of climate change mitigation*, report to the Australian Treasury.

http://www.treasury.gov.au/lowpollutionfuture/consultants_report/downloads/Model_Development_and_Scenario_Design.pdf

⁸ The abatement response to a given carbon price would also be expected to depend on when that price occurs. The longer the time taken to reach a given carbon price, the larger the expected response to that price would be. These estimates do not include this effect as insufficient information is available.

⁹ These factors are examined in detail in DCCEE (2011) for each sector, and underpin the bottom-up estimate range presented there.

For avoided deforestation and managed regrowth, carbon price is the determining variable; and an elasticity of 0.5 has been used, meaning that a 1 per cent increase in the (real) carbon price leads to a 0.5 per cent increase in abatement from these activities.

The parameters for all sectors were calibrated to DCCEE's bottom-up preliminary estimates of CFI abatement in 2020. The bottom-up estimates assumed a real (2009-10 A\$) carbon price in 2020 of \$26¹⁰, slightly lower than the 2020 price in the 550ppm scenario. For each subsector, the functional form was calibrated so that at a \$26 carbon price in 2020 it delivers a level of abatement close to the mid-point of the bottom-up estimate range.

For each of the 550ppm and 450ppm price series, the proportional reduction in baseline emissions in each year is estimated using the calibrated functions. The level of abatement is estimated by multiplying projected baseline emissions by the estimate of proportional emissions reductions.

Summary of abatement estimates, 2012-13 to 2049-50

In all sectors, a rising carbon price drives increases in the proportion of baseline emissions that are abated.

In the 550ppm scenario, abatement in agricultural subsectors (livestock and crops) more than doubles between 2012-13 and 2049-50, from 1.2 Mt CO₂-e to 3.1 Mt CO₂-e, as the carbon price grows six-fold. In the 450ppm scenario abatement almost triples over the same period, reaching 3.8 Mt CO₂-e.¹¹ The carbon price drives these increases, with a growing proportion of baseline emissions abated.

Although agricultural sector abatement grows substantially the assumed level of abatement remains modest by 2049-50, even with the higher carbon prices of the 450ppm scenario. As the discussion paper sets out, there are significant non-price barriers to uptake of abatement opportunities. To some extent, many are likely to present a persistent barrier to uptake.

In addition, while the carbon prices appear high by 2049-50, the increase in the price of carbon has been assumed to be less than the increase in agricultural commodity prices. This increase in agricultural commodity prices is driven by the assumption of strong growth in demand in Australia's agricultural export markets, which also underpins the baseline emissions projection. This demand growth is driven by population and income growth projections for these markets. In these circumstances, the return carbon prices would offer to farmers would remain below the return from continuing business-as-usual farming activities. That is, the relative price of carbon is insufficient to generate substantial switching out of livestock production into carbon production.

Savanna fire management abatement is assumed to be less price sensitive than agriculture, with abatement doubling between 2012-13 and 2049-50 in the 550ppm scenario, to 0.7 Mt CO₂-e in 2049-50. In the 450ppm scenario abatement reaches 0.9 Mt CO₂-e at the higher carbon price in 2049-50. Non-price barriers are an even more significant constraint to increasing the scope of savanna fire management than to agricultural uptake.

¹⁰ The assumed nominal price was \$33/t CO₂-e.

¹¹ Some totals differ from the sums of livestock and cropland abatement in Table 1 due to rounding error.

Legacy waste emissions abatement falls over time. This is because baseline legacy waste emissions fall from 11 Mt CO₂-e in 2012-13 to 1 Mt CO₂-e in 2049-50. Proportionally, uptake is in fact high in the legacy waste sector. In the 550ppm scenario, nearly half of baseline legacy waste emissions are captured by 2049-50, and this rises to two thirds in the 450ppm scenario. In the 550ppm scenario, legacy waste abatement falls from 1.9 Mt CO₂-e in 2012-13 to 0.6 Mt CO₂-e in 2049-50. In the 450ppm scenario initial abatement is 2.2 Mt CO₂-e in 2012-13 and falls to 0.8 Mt CO₂-e in 2049-50.

Abatement from avoided deforestation and managed regrowth more than triples between 2012-13 and 2049-50, from 3.6 Mt CO₂-e to 11.5 Mt CO₂-e in the 550ppm scenario, and from 5.6 Mt CO₂-e to 18.4 Mt CO₂-e in the 450ppm scenario. However, although abatement grows substantially, the level of abatement in both scenarios remains significantly below baseline emissions from deforestation of around 49 Mt CO₂-e in 2049-50. This is due to the assumption that agricultural commodity prices (in particular beef) grow faster than the price of carbon by 2049-50. Therefore, the relative price of carbon is insufficient to result in a complete cessation of deforestation activities, especially in areas with highly productive land.

Comparison with bottom-up estimates of CFI abatement

As discussed above, the abatement function was calibrated to deliver abatement that is consistent with the bottom-up abatement estimate ranges, at the carbon price used for those estimates.

For non-forest-related activities, the abatement estimates obtained using the top-down approach, for both stabilisation paths, fall within the bottom-up estimate range despite the higher carbon prices they assume. For avoided deforestation and managed regrowth, the estimates from the top-down approach fall within the bottom-up estimate range for the 550ppm path, and slightly above it for the 450ppm path. This seems reasonable, as the broad range for the bottom-up estimate reflects the high level of uncertainty around potential abatement.

Table 2

| Abatement in 2020 (Mt CO₂-e) | | | |
|---|-----------------------------|------------------------------|------------------------------|
| | Bottom-up estimate range | 550ppm stabilisation path | 450ppm stabilisation path |
| Legacy waste | 0.7 - 3.5 | 1.1 | 1.8 |
| Livestock | 0.2 - 2.4 | 1.3 | 1.7 |
| Crops | 0 - 0.2 | 0.1 | 0.1 |
| Savanna fire management | 0.3 - 0.6 | 0.4 | 0.6 |
| Avoided deforestation and managed regrowth | 1.5 - 6.0 | 4.0 | 6.4 |
| TOTAL (excluding other forest-related activities estimated by ABARES) ¹ | 2.7 - 12.7 | 7.0 | 10.6 |

Totals may not add due to rounding.

Notes: 1. Abatement under the CFI from other forest-related activities is being estimated by ABARES and therefore is not included here.