Australian Government

Clean Energy Regulator

EMISSIONS
REDUCTION
FUND

Participating in the Emissions Reduction Fund

A guide to the reforestation by environmental or mallee plantings FullCAM method

The Emissions Reduction Fund

The Emissions Reduction Fund is a voluntary scheme that aims to reduce Australia's greenhouse gas emissions by providing incentives for a range of organisations and individuals to adopt new practices and technologies to reduce their emissions.

Emissions Reduction Fund projects must be conducted according to an approved method. A number of activities are eligible under the scheme and individuals and organisations taking part may be able to earn Australian carbon credit units (ACCUs). One ACCU is earned for each tonne of carbon dioxide equivalent (tCO_2-e) stored or avoided by a project. ACCUs may be sold to generate additional income, either to the Government through a Carbon Abatement Contract or on the secondary market.

Why participate?

As well as contributing to Australia's efforts to reduce the amount of greenhouse gas entering the atmosphere and the opportunity to earn ACCUs, running an Emissions Reduction Fund project may offer a range of other benefits for scheme participants. Examples include increases in biodiversity, better air quality, reduced energy consumption or income from electricity generation exported into the grid.

Using this guide

This guide provides an introduction to using the Carbon Credits (Carbon Farming Initiative—(Carbon Farming Initiative) (Reforestation by Environmental or Mallee Plantings—FullCAM) Methodology Determination 2014[1] (the method). Methods set out the rules for conducting activities under the Emissions Reduction Fund to earn ACCUs.

The guide is complementary to the *Carbon Credits (Carbon Farming Initiative) Act 2011*[2] (the Act), the associated legislative rules, approved method and explanatory statement, but does not replace them. It has been prepared by the Clean Energy Regulator, an independent Australian statutory

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[1] https://www.legislation.gov.au/Details/F2015C00581
[2] https://www.legislation.gov.au/Details/C2016C00727

authority responsible for administering legislation to reduce carbon emissions and increase the use of clean energy.

Overview of a reforestation by environmental or mallee plantings project

A reforestation by environmental or mallee plantings project involves establishing and maintaining vegetation such as trees or shrubs on land that has been clear of forest for at least the five years. You can plant either a mix of trees, shrubs and understory species native to the local area or species of mallee eucalypts.

The project helps to reduce the amount of greenhouse gas entering the atmosphere, because carbon is stored in the trees as they grow. The carbon stored in the trees, shrubs and debris on site is called the carbon stock, while the term 'abatement' refers to the overall reduction in greenhouse gases as a result of a project.

The carbon stock held in the project's trees, shrubs and debris (dead plant material) is calculated using a computer modelling tool called the Full Carbon Accounting Model (FullCAM). The net amount of abatement during a project's reporting period is then determined by subtracting emissions due to fires and fuel use from the amount of carbon stock. The resulting net abatement for the project can then be used to apply for ACCUs.

As a sequestration activity, that is, an activity that stores carbon in vegetation or soil, a reforestation by environmental or mallee plantings project is subject to a permanence obligation. This means the project must be maintained 'permanently'. A permanence obligation maintains carbon stores for which Australian carbon credit units have been issued. The Emissions Reduction Fund will allow sequestration projects to choose a permanence period of 25 or 100 years. If a fire or other disturbance occurs in the area during the project, causing a decline in the amount of carbon stock, regrowth must be managed to allow the carbon stock to return to previously reported values. Alternatively, ACCUs equivalent to the loss of carbon caused by the disturbance can be relinquished. More information is available on the Clean Energy Regulator website.

To conduct a reforestation by environmental or mallee plantings project and earn ACCUs make sure you read and understand the method and other legislative requirements. To do this you will need to:

- Download the Carbon Credits (Carbon Farming Initiative) (Reforestation by Environmental or Mallee Plantings—FullCAM) Methodology Determination 2014[3] and Explanatory Statement[4].

- Download and understand how the *Carbon Credits (Carbon Farming Initiative) Act 2011* (the CFI Act)[5], the Carbon credits (Carbon Farming Initiative) Regulations 2011[6] and the Carbon Credits (Carbon Farming Initiative) Rule 2015[7] apply to a project.

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[3] https://www.legislation.gov.au/Details/F2015C00581
[4] https://www.legislation.gov.au/Details/F2014L01212/Explanatory%20Statement/Text
[5] https://www.legislation.gov.au/Details/C2016C00727

- Download and use the:

  » [Carbon Farming Initiative Mapping Guidelines](#)[8]

  » [Carbon Farming Mapping Tool](#)[9] (requires Internet access)

  » [Full Carbon Accounting Model (FullCAM)](#)[10] software package (requires Internet access and a Windows-capable computer)

  » [Guidance for using FullCAM in Reforestation by Environmental or Mallee Plantings](#)[11] projects.

- Ensure you have the legal and carbon sequestration right to conduct your project as well as the as well as the consent of anyone with a legal interest in the land (eligible interest holders).

- Apply to register as a scheme participant, to open an account in the Australian National Registry of Emissions Units (ANREU) and to conduct a reforestation by environmental or mallee plantings project.

- Set up your project according to the instructions in Parts 2 and 3 of the method. Set up record keeping and monitoring systems for your project as required by Part 5 of the method.

- Estimate the average annual abatement of your project, obtain an audit schedule for your project from the Clean Energy Regulator and engage a Category 2 Greenhouse and Energy Auditor early on in your project. Submit audits of your project according to your audit schedule.

- Determine the amount of carbon your project stores using the calculations in Part 4 of the method. Convert the amount of carbon captured into carbon dioxide equivalents (CO_2-e).

- Submit your project report and application for ACCUs to the Clean Energy Regulator for assessment.

What does a reforestation by environmental or mallee plantings project look like?

A reforestation by environmental or mallee plantings project involves establishing either a mixture of native species, termed a 'mixed-species environmental planting', or a mallee eucalypt planting.

Projects can be run in any area of Australia where there is FullCAM data. However, mallee eucalypt plantings must be in areas that receive 600 millimetres or less of long-term average rainfall, unless the planting meets the requirements for a specific calibration under Section 4.9 of the method.

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[6] https://www.legislation.gov.au/Details/F2015C00658

[7] https://www.legislation.gov.au/Details/F2016C00128

[8] https://www.environment.gov.au/climate-change/emissions-reduction-fund/cfi/publications/cfi-mapping-guidelines-2015

[9] http://ncat.climatechange.gov.au/cmt/#/Home

[10] http://www.environment.gov.au/climate-change/greenhouse-gas-measurement/land-sector

[11] https://www.environment.gov.au/climate-change/emissions-reduction-fund/methods/quantifiying-carbon-sequestration-permanent-native

Plantings must be established on land that has been clear of forest cover for at least five years previously. It must not contain woody biomass or an invasive native scrub species that needs clearing before planting can occur, except for known weed species that are required or authorised by law to be cleared.

Vegetation planted as part of a reforestation by environmental or mallee plantings project are referred to as 'project trees'. Project trees can be planted as seeds or tubestock, in rows or randomly, and in areas which are either linear belts or blocks. Regardless of species, they must be planted at a density that will allow them to achieve forest cover. This means that trees must have the potential to grow to at least two metres tall and provide crown cover over at least 20 per cent of the land (see below).

Crown cover

Crown cover is the amount of land covered by the outer edges (diameter) of a tree or group of trees. It depends on the species' potential crown diameter at maturity. To work out the planting density required to reach 20 per cent crown cover, multiply the number of trees per hectare by the crown area in hectares. For example, for a tree species with a crown diameter of 3.5 to 4 metres, about 150–200 trees per hectare would be required.

Table 1 of the Explanatory Statement provides additional guidance to determine the minimum number of trees required per hectare to reach 20 per cent crown cover. You are encouraged to plant more than the minimum number of trees required, to allow a buffer for tree mortality.

Certain types of activities, such as harvesting and grazing, are restricted in these projects (see Section 3.45 to 3.49 of the method). For example, up to 10 per cent of fallen timber may be removed per year for personal use (e.g. firewood, fence posts), vegetation may be thinned for ecological purposes (but if it is, this could impact the calibration that can be used), and debris may be removed for fire management. If you allow grazing in the area, it must not affect the ability of the planting to achieve or maintain forest cover.

All the details of what is required for a project to be considered eligible by the Clean Energy Regulator, including evidence showing how the project area meets those requirements, are in Part 2 of the method.

Setting up and running a reforestation by environmental or mallee plantings project

How a reforestation by environmental or mallee plantings project is set up and run is critical for calculating how much carbon is stored as a result of a project, which in turn determines the amount of abatement that has occurred and how many ACCUs may be issued for a project. Parts 2, 3 and 4

of the method and explanatory statement describe in detail how to set up a project, how to calculate changes in carbon stock as well as the net abatement that has occurred.
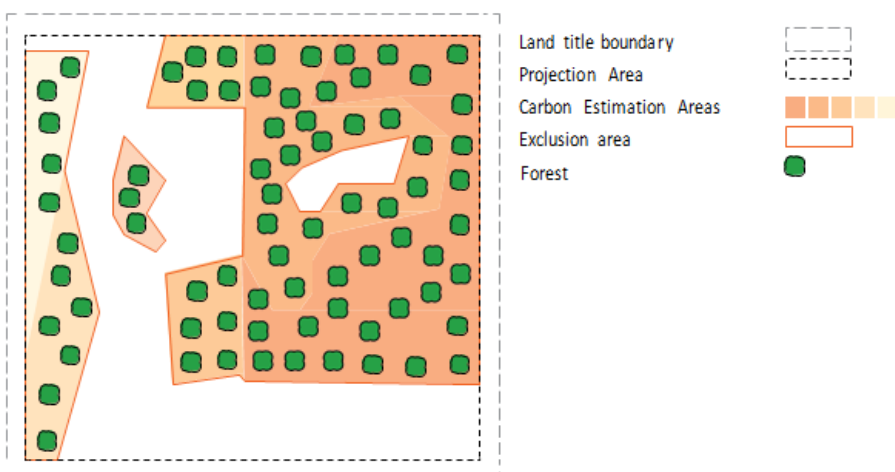
The main steps involved in setting up and running a reforestation by environmental or mallee plantings project are described in the following sections.

Establish the project area

Identify the area in which your project will occur using the CFI Mapping Tool (or a geographic information system that meets the requirements of the CFI Mapping Guidelines) and CFI Mapping Guidelines. Then divide or stratify the project area into a combination of carbon estimation areas (CEAs) and exclusion zones using the CFI Mapping Guidelines and the instructions in Division 3.2 of the method.

CEAs are the areas of your project where carbon will be stored and for which ACCUs may be issued. CEAs must have uniform site characteristics such as soil type, aspect and slope, and must include either a mixed-species environmental planting or a mallee planting. Exclusion zones are those parts of your project area that will not store carbon and where project activities will not be conducted. Examples of exclusion zones are a road, building or dam. The boundary of each CEA and exclusion zone must be defined using the CFI Mapping Guidelines (see Figure 1). For defining CEA boundaries you will also need either field surveys or aerial photographs, date-stamped, geo-referenced remotely sensed imagery, including derived vegetation cover data, or soil, vegetation and landform maps.

Figure 1: Example of a project area, carbon estimation areas and exclusion areas for a reforestation by environmental or mallee plantings project

The boundaries of a CEA will vary depending on whether plants are established in belts or blocks. Following the rules regarding boundaries is important because FullCAM uses data on boundary limits to accurately measure carbon stocks in your project (see Section 3.4 of the method).

You may need to re-stratify (re-define) CEAs and exclusion zones if the area is disturbed for example by fire, or if a site's characteristics are no longer uniform. This will need to be done before submitting your next offsets report.

Choose a planting type and FullCAM model calibration

Plantings can take the form of either a mixed-species environmental planting or a mallee eucalypt planting.

If you choose a mixed-species environmental planting, the species must be native to the local area. They must be grown from tubestock or seeds that are from the natural distribution of the species, and can be a mix of tree, shrub and understory plants that reflects the structure and composition of the local native vegetation community. For mallee eucalypt plantings, any species of the genus *Eucalyptus* that has multiple stems can be used. However, the species chosen will affect the FullCAM modelling criteria, as explained below.

FullCAM uses a variety of settings, called 'calibrations', to model and estimate the amount of carbon stored in different types of plantings. Plantings can fall under either a range of specific calibrations or a generic calibration (see Schedule 1 in the method). Maps are provided in the FullCAM guidance document for these projects to show the general areas in which the different specific calibrations can be used.

Specific vs generic calibrations

Choosing a specific calibration over the generic calibration can be advantageous. If you are able to follow the requirements of a specific calibration, your plantings may deliver a faster growth yield than they would under the generic calibration. If you can use a specific calibration which does deliver a faster growth yield, the effect is that you can apply for and receive ACCUs earlier.

Some of the specific calibrations require field data to be collected and samples taken to measure stocking (planting) density and/or the proportion of trees to shrubs. The costs of collecting these data for smaller projects may outweigh the advantages of applying a specific calibration. For medium to larger plantings, however, applying a specific calibration may be worthwhile.

Each calibration has a 'domain group', which is a set of requirements that must be followed to enable the use of any of the specific calibrations (see Division 3.3 in the method). The domain group determines:

- the type of planting (i.e. mixed-species or mallee eucalypt)
- the geometry (i.e. whether plantings are in belts or blocks)
- the spacing of plants within plantings and the distance between adjacent plantings
- if relevant, whether or not you need to estimate tree stocking rates and/or the proportion of trees to shrubs (see subdivision 3.5.2 Stocking density and tree proportion requirements for more details).

Determining the appropriate FullCAM calibration for your project depends on whether or not your planting is already established. If you are establishing a new planting, you can determine which specific calibrations are available to your area, and then plant according to the requirements. For a project with existing plantings, you can instead determine if any plantings satisfy the requirements for any of the specific calibrations.

Management practices will affect your choice of FullCAM calibration. For example, if you carry out thinning for ecological purposes, or apply lime or fertiliser in your planting area, you cannot use a specific calibration and must use the generic calibration.

Establish planting

Plantings can be established using tubestock or seeds in either belts or blocks, depending on which FullCAM calibration you aim to meet (see Schedule 1 in method).

Belt geometry can be of two types: narrow linear or wide linear. Block planting geometry is any shape other than a single row, which meets the spacing requirements given in the CFI Mapping Guidelines. Table 1 below summarises the planting and spacing requirements for belts of mixed-species environmental plantings and mallee eucalypt plantings. Schedule 2 in the method contains further information on planting in belts and blocks.

When establishing a planting in belts, competition from adjacent trees must be taken into account, because they can affect the growth rates of your project trees, and therefore the amount of carbon stored in your project.

Table 1: Summary of belt planting and spacing requirements

Planting type	Narrow linear planting geometry	Wide linear planting geometry
Mallee eucalypt plantings	Belt of 2 rows of trees Tubestock or direct seeding Rows less than 4 metres apart	Belt of 3–8 rows of trees Tubestock or direct seeding Rows less than 4 metres apart
Mixed-species environmental plantings	In rows using tubestock or direct seeding, or randomly using tubestock or broadcast seeding or both Up to 20 metres wide	In rows using tubestock or direct seeding, or randomly using tubestock or broadcast seeding or both From 20–40 metres wide

Competition from adjacent trees

An adjacent tree is classified as a non-project tree growing within 20 metres of one of the long edges of a narrow or wide linear planting, with a crown of at least 3 metres wide at the time of FullCAM modelling.

You must determine whether there is any 'material competition' from adjacent trees, because this can result in FullCAM overestimating your carbon stocks. Sections 3.43 and 3.44 in the method describe how to determine the presence or absence of material competition.

If you identify material competition from adjacent trees, you can re-stratify the area and use a different FullCAM calibration to account for the material competition. You can apply either a block planting or generic calibration to any areas that are affected by material competition, while still using a specific calibration for those areas that are not affected.

Estimate stocking density and tree proportion

Depending on the specific calibration you have chosen in FullCAM, you may be required to estimate stocking density and the proportion of trees to shrubs in your planting (see Division 3.5 in the method). If you choose any of the calibrations in Schedule 1 that state 'no sampling required', then you do not need to do this.

Stocking density is the number of trees or shrubs per hectare for established plantings, or the number of seedlings or seeds per hectare at establishment for new plantings. Tree:shrub proportion is the proportion of trees relative to the total number of trees and shrubs.

To estimate stocking density, you can count every tree and shrub and divide the total by the area of the CEA. Counting can be done by either on-ground measurements or using remotely sensed imagery. Alternatively, you can carry out systematic random sampling (see Subdivision 3.5.2 in the method). Systematic random sampling involves establishing at least 10 sampling plots in each CEA. The stocking density is then estimated by using Equations 1–5 as per Division 3.6 of the method.

To estimate tree:shrub proportion, you can either calculate the proportion after counting all the trees and shrubs, or as discussed above, undertake a systematic random sampling. The tree:shrub proportion is calculated using Equations 6–10 as per Division 3.6 of the method.

Where applicable for use of a specific calibration stocking density and tree proportion need to be estimated once during the crediting period of the project. Otherwise, the default values as specified in Subdivision 3.5.1 of the method can be used. However, it must be re-estimated if any events, such as fires, affect the stocking density or tree proportion and cause the planting to fail the specific calibration requirements.

Calculate the project baseline

The project baseline represents what would happen if your project did not occur. It provides a point against which any changes in the amount of carbon stored by a project in a reporting period is measured. For reforestation by environmental or mallee plantings projects, the baseline is taken to be zero.

Model carbon stocks with FullCAM

To model the carbon stocks of your project with FullCAM either a specific or generic calibration needs to be applied to each CEA. The data used as inputs to FullCAM includes the project's location, planting dates, and domain group information. Domain group includes planting type (EP/Mallee and species), planting geometry (wide linear belt, narrow linear belt, block), plant spacing (distance between rows within a planting, distance between adjacent plantings), stocking density and tree proportion, where relevant.

As described earlier, if a planting doesn't satisfy all the requirements of a specific calibration, then a generic calibration must be selected.

The carbon stocks modelled by FullCAM are counted as those held within the stems, crowns and roots of project trees (known as above-ground and below-ground biomass), and within dead plant material (debris). FullCAM is used to model and estimate initial carbon stocks, monthly carbon stocks for a reporting period, and the carbon stocks at the end of a reporting period.
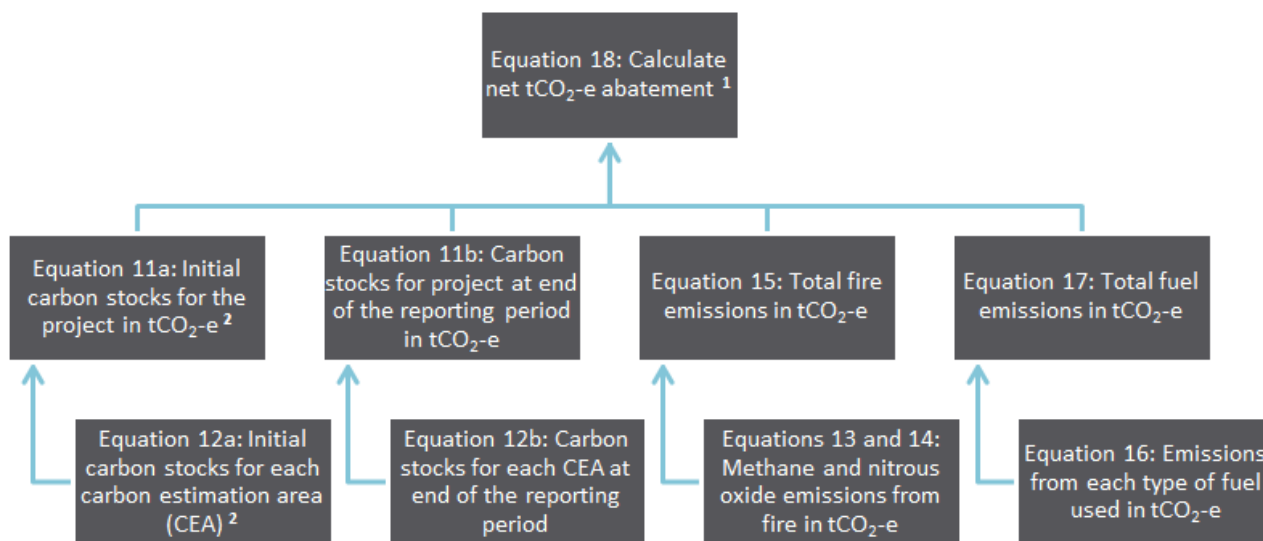
The initial carbon stock is the carbon stock at the declaration date for plantings that were already established. For new plantings, the initial carbon stock is counted as zero.

Equation 12a is used to calculate the initial carbon stock for each CEA, and Equation 12b is used to calculate the carbon stock at the end of the reporting period for each CEA (see the equation tree in Figure 2). Equations 11a and 11b then calculate the stocks in tCO_2-e for the whole project area.

A full explanation of how to use FullCAM to model your project's carbon stocks can be found in the 'Guidance for using FullCAM in Reforestation by Environmental or Mallee Plantings' document.

The FullCAM modelling of the carbon stock at the end of any reporting period must take place within the final month of that reporting period.

Figure 2: Equation tree for calculating net abatement achieved by a project

Note: [1] Equation 18 includes the input of *Cv* – carbon stock from the previous offsets report

[2] Equation 11a and 12a are only relevant for projects that commenced before the declaration date

See Figure 2: Equation tree for calculating net abatement achieved by a project

To calculate the net CO_2-e abatement from a reforestation by environmental or mallee plantings project, you need to follow a sequence of equations.

The initial carbon stocks and the carbon stocks at end of period are modelled using FullCAM and calculated using Equations 11–12.

To determine the project's net CO_2-e abatement for a reporting period, the initial carbon stock, any carbon stock from the previous offsets report, plus emissions from fuel and fire during the reporting period (Equations 13–17) are subtracted from the carbon stocks at the end of the reporting period using Equation 18. The resulting amount of abatement, in tCO_2-e, is used to apply for ACCUs.

Data to complete these equations are drawn from a number of sources, which include:

- physical measurements and FullCAM

- data readily available from the National Greenhouse and Energy Reporting (NGER) Measurement Determination[12]

- NGER Regulations[13], and

- information recorded by the person responsible for the project, such as fuel use.

Note: Equations 1-10 are not shown in the figure, because they are only used for calculating stocking density and tree proportion where required to satisfy compliance with particular specific calibrations. They do not feed in to any of the equations shown in the figure.

Calculate emissions from the project

Every project needs to take into account emissions that arise from running it (see Division 4.4 in the method). This is to ensure these emissions are included in calculations that determine changes in carbon stock and net CO_2-e abatement (see Figure 2).

FullCAM is used to model emissions from fires (described in the methodology as 'biomass burning'). Emissions are calculated separately for methane (Equation13) and nitrous oxide (Equation 14) in tCO_2-e. Equation 15 is then used to calculate total fire emissions in tCO_2-e.

Emissions from the project's fuel usage are calculated separately for each fuel type and greenhouse gas type (carbon dioxide, nitrous oxide and methane) by using Equation 16. Total fuel emissions in tCO_2-e are then determined using Equation 17.

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[12] https://www.legislation.gov.au/Details/F2016C00691
[13] https://www.legislation.gov.au/Details/F2016C00722

Calculate the net amount of abatement and number of ACCUs

The final step in the calculations is to measure the effectiveness of a project and to determine the number of ACCUs that may be issued.

At this stage, the total amount of carbon stored in your plantings at the end of the reporting period is calculated in tCO_2-e (See Equation 11b in Figure 2). The initial carbon stock and the emissions from fires and from fuel used in the running of the project are then subtracted from the total amount of CO_2-e abatement. To ensure ACCUs are issued for individual reporting periods only and not cumulatively, any carbon stock from the most recent previous offsets report is also subtracted to arrive at the net abatement amount in tCO_2-e.

Monitoring and record keeping

You need to report on your project to the Clean Energy Regulator and may report as frequently as every six months where allowed for in the legislative rules made under the *Carbon Farming Initiative Act (2011).* Audits are required where indicated in your project's audit schedule, which the Clean Energy will provide following registration of your project.

For sequestration projects, the first report must be made between six months to five years from the date the project was declared eligible and then up to every five years thereafter

Division 4.6 of the method lists the information that must be included in your project reports. Applications for ACCUs can be made at the same time as you submit your project and audit reports using the electronic ERF Project Reporting and Crediting Application form through the Clean Energy Regulator Client Portal[14]. Full reporting, record keeping and monitoring requirements are set out in regulations and rules made under the Act. You should familiarise yourself with these requirements.

The Clean Energy Regulator will not issue Australian carbon credit units automatically on receipt of a project report.

Emissions Reduction Fund projects are able to generate credits throughout their crediting period. Crediting periods for each type of project are set out in Part 5 of the *CFI Act*. The crediting period for a reforestation by environmental or mallee plantings project is 25 years.

The role of audit

Audits assess whether a project complies with the project registration, the relevant method and legislative requirements. Audit reports must be prepared by a registered Category 2 Greenhouse and Energy Auditor; a list of auditors is available on the Clean Energy Regulator website under National Greenhouse and Energy Reporting[15].

The Clean Energy Regulator recommends you engage your auditor early when developing your project to ensure the project is auditable and to assist the auditor to plan activities throughout the

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[14] http://www.cleanenergyregulator.gov.au/OSR/CP
[15] http://www.cleanenergyregulator.gov.au/NGER/For-auditors/Register-of-auditors

reporting and post-reporting periods. The costs of any audit are your responsibility or the responsibility of your organisation. You must make available to the auditor all necessary documents and information, including data records, receipts and other supporting documentation, and calculation spread sheets.

Making changes to my project

You must notify the Clean Energy Regulator of any changes to your or your project's circumstances or operations that may affect project ownership, the project's eligibility or the amount of abatement reported and the number of ACCUs claimed. A project owner must seek approval from the Clean Energy Regulator if they intend to make a significant change from the project as outlined in the application.

Resources

- For more information on participating in the ERF - www.cleanenergyregulator.gov.au[16]

- For more information regarding method development – www.environment.gov.au[17]

- www.legislation.gov.au[18] is the site where you can find all legislative instruments including the:
  - » Carbon credits (Carbon Farming Initiative) Act 2011[19]

  - » Carbon credits (Carbon Farming Initiative) Regulations 2011[20]

  - » Carbon Credits (Carbon Farming Initiative) Rule 2015[21]

  - » Carbon Credits (Carbon Farming Initiative—(Carbon Farming Initiative) (Reforestation by Environmental or Mallee Plantings—FullCAM) Methodology Determination 2015[22]

  - » Explanatory statement[23]

- Enquiries on participating in the ERF - 1300 553 542; enquiries@cleanenergyregulator.gov.au

- FullCAM technical support: DCCEE-FullCAM@environment.gov.au

- Queries relating to using FullCAM for the reforestation by environmental or mallee plantings methodology: CFI@environment.gov.au

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[16] http://www.cleanenergyregulator.gov.au/ERF/Forms-and-resources/apply-to-participate
[17] http://www.environment.gov.au/
[18] https://www.legislation.gov.au/
[19] https://www.legislation.gov.au/Details/C2016C00727
[20] https://www.legislation.gov.au/Details/F2015C00658
[21] https://www.legislation.gov.au/Details/F2016C00128
[22] https://www.legislation.gov.au/Details/F2015C00581
[23] https://www.legislation.gov.au/Details/F2014L01212/Explanatory%20Statement/Text

IMPORTANT INFORMATION ABOUT THIS GUIDE

The Clean Energy Regulator is updating the information in this guide to align it with the Emissions Reduction Fund.

While the information in this guide about the reforestation by environmental or mallee plantings FullCAM method is current, and may be used to help you read and understand the method and its explanatory statement, general information about how to participate requires updating.