



Australian Government
Clean Energy Regulator

EMISSIONS
REDUCTION
FUND

Participating in the Emissions Reduction Fund

A guide to reducing greenhouse gas
emissions from fertiliser in irrigated
cotton method



Image courtesy of CSIRO

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. Individuals and organisations taking part in these activities may be able to earn Australian carbon credit units (ACCUs). One ACCU is earned for each tonne of carbon dioxide equivalent (tCO₂-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. A reducing greenhouse gas emissions from fertiliser in irrigated cotton method (irrigated cotton) project may help growers increase profits by optimising fertiliser costs, by increasing lint cotton yield or both.

Using this guide

This guide provides an introduction to conduct a project under the [Carbon Credits \(Carbon Farming Initiative— Reducing Greenhouse Gas Emissions from Fertiliser in Irrigated Cotton\) Methodology Determination 2015](#)¹ (the method), which you can access through the Clean Energy Regulator website. 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 authority responsible for administering legislation to reduce carbon emissions and increase the use of clean energy.

¹ <https://www.comlaw.gov.au/Series/F2015L00584>

² <https://www.comlaw.gov.au/Series/C2011A00101>

Overview of an irrigated cotton project

An irrigated cotton project involves reducing emissions from the production of cotton in areas where irrigation is used. The main sources of emissions from irrigated cotton farming are synthetic nitrogen fertilisers and green manure. Green manure is any legume crop planted between cotton crops without harvest to improve the soil and reduce the amount of fertiliser needed for the subsequent cotton crop.

An irrigated cotton project can therefore help to reduce the amount of greenhouse gas entering the atmosphere by reducing synthetic fertiliser use while maintaining or increasing yield, or by increasing yield without a proportional increase in fertiliser use. The overall reduction in greenhouse gases as a result of a project is termed 'abatement'.

The emissions avoided by the project are calculated by subtracting the emissions generated during the project from those generated in a defined period before the project began. The difference in emissions before and after the project is the net abatement, which is used to apply for ACCUs.

Due to the exponential nature of emissions produced above a certain level of nitrogen fertiliser applied, cotton growers who currently use large amounts of fertiliser can achieve good levels of abatement by making only moderate reductions in fertiliser use.

To conduct an irrigated cotton 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 - Reducing Greenhouse Gas Emissions from Fertiliser in Irrigated Cotton) Methodology Determination 2015*³ and its *Explanatory Statement*⁴.
- Download and understand how the *Carbon Credits (Carbon Farming Initiative) Act 2011 (the Act)*⁵, the *Carbon Credits (Carbon Farming Initiative) Regulations 2011*⁶ and the *Carbon Credits (Carbon Farming Initiative) Rule 2015*⁷ apply to your project.
- Download and use the *Irrigated Cotton Calculator*⁸.
- Ensure you have the legal right for conducting your project.
- Apply to register as a scheme participant, to [open an account in the Australian National Registry of Emissions Units \(ANREU\)](#)⁹ and to conduct an irrigated cotton project.
- Set up your project according to the instructions in Part 3 of the method. Set up record keeping and monitoring systems for your project as required by Part 5 of the method.
- 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.
- Estimate the average annual abatement of your project using the *Irrigated Cotton Calculator*¹⁰.
- Determine the amount of emissions avoided by your project using the Irrigated Cotton Calculator.
- Submit your project report and application for ACCUs to the Clean Energy Regulator for assessment.

³ <http://www.comlaw.gov.au/Details/F2015L00584>

⁴ <https://www.comlaw.gov.au/Details/F2015L00584/Explanatory%20Statement/Text>

⁵ <http://www.comlaw.gov.au/Series/C2011A00101>

⁶ <http://www.comlaw.gov.au/Series/F2011L02583>

⁷ <http://www.comlaw.gov.au/Details/F2015L00156>

⁸ <http://www.environment.gov.au/climate-change/emissions-reduction-fund/methods/cotton>

⁹ <http://www.cleanenergyregulator.gov.au/OSR/ANREU/Opening-an-ANREU-account>

¹⁰ <http://www.environment.gov.au/climate-change/emissions-reduction-fund/methods/cotton>

What does an irrigated cotton project look like?

An irrigated cotton project reduces emissions by increasing synthetic nitrogen fertiliser use efficiency. A project can be run on one cotton farm or on multiple farms, and in any region of the Australian irrigated cotton industry.

During the project, you must undertake at least one new management action to improve the fertiliser use efficiency for your cotton crop. Once you have chosen a new management action, you can repeat the same action during each year of the project if you wish. Management actions are flexible, but can include changes to the rate, timing or method of fertiliser application, and the type of fertiliser used. Only emissions reductions from synthetic nitrogen fertiliser are credited in these projects.

You must not burn any crop residue remaining in the field after harvesting the cotton once you have commenced the project, but any burning conducted in the years preceding the project will not make you ineligible.

The greenhouse gas emissions generated before and after the project begins, as well as the amount of abatement resulting from the project, are calculated using a tool called the [Irrigated Cotton Calculator](#)¹¹.

Details of what is required for an irrigated cotton project to be considered eligible by the Clean Energy Regulator are in Parts 2 and 3 of the method and Explanatory Statement.

Nitrogen fertilisers

Nitrogen fertiliser is a product used to improve plant growth and soil fertility. It is applied to the soil after the previous crop has been harvested, and before the current cotton crop is harvested.

In irrigated cotton projects, emissions reductions are only credited from the use of synthetic nitrogen fertilisers. Synthetic nitrogen fertiliser has a product label with a guaranteed minimum nitrogen content. This must be at least 0.5 per cent nitrogen for solid fertiliser, and 0.1 per cent nitrogen for liquid fertiliser or solid fertiliser applied in solution.

Fertilisers such as poultry litter, beef feedlot manure and composted ginning trash are not accounted for in these projects. This is because they are waste products of other industries, and would produce the same amount of emissions whether or not they were used in these projects.

Nitrogen fertiliser use efficiency

Nitrogen fertiliser use efficiency is the lint yield of the cotton crop, divided by the amount of synthetic nitrogen fertiliser applied to the crop.

The irrigated cotton method addresses the problem of nitrogen fertiliser being applied at rates that exceed crop demand. By applying the optimum amount of fertiliser required by the crop, some growers will find they can use less fertiliser to produce the same or greater lint yield. For example, you would increase nitrogen fertiliser use efficiency if your lint yield increased by 20 per cent, while your nitrogen fertiliser use only increased by 15 per cent.

¹¹ <http://www.environment.gov.au/climate-change/emissions-reduction-fund/methods/cotton>

Setting up and running an irrigated cotton project

How an irrigated cotton project is set up and run is critical for calculating the amount of emissions produced 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 3 and 4 of the method and explanatory statement describe in detail how to set up a project and how to calculate the volume of emissions avoided, as well as the net abatement that has occurred.

Setting up and running an irrigated cotton project can be divided into the following parts. To explain the project in more detail, each part refers to the relevant sections of the method and explanatory statement.

Establish the project area

An irrigated cotton project area can be part of a farm, or a whole farm (Section 12). A project can also be made up of multiple farms, but it is recommended that each farm is identified as a separate project area, to make your record keeping easier.

Within a project area, the area of land on which cotton is planted and irrigated is known as the cotton area. Each project area must only have one cotton area for each reporting period.

The cotton area can change from year to year if required, due to factors such as water availability and rotational cropping. However, the total area must remain the same over time, and it must not include land containing residue from burning after harvest during the reporting period.

Stratify the cotton area

Each cotton area must be made up of one or more fields (Section 13). The stratification of the cotton area into fields is used to verify the yield of cotton from each field. This information is then used to calculate the project's net abatement in greenhouse gas emissions.

Fields do not need to be adjacent, and can be spread out within the cotton area.

Each field must be given a unique identifier. The cotton area (and therefore the fields) within a project area, is likely to change from year to year, depending on water availability and crop rotation. A new field identifier must be used each time a field's perimeter changes.

A map of the fields making up your cotton area must be provided in any report to the Clean Energy Regulator. Maps must be in digital GIS format (Section 14). To generate maps, you can use the [Carbon Farming Mapping Tool](#)¹², or any other tool that meets the standards required by the CFI Act.

Manage your project

While running your project, you must implement management actions to increase nitrogen fertiliser use efficiency (Sections 9 and 10 in the method). The main ways to do this are to either increase lint yield without a proportional increase in the amount of synthetic fertiliser nitrogen applied, or reduce the amount of synthetic fertiliser nitrogen applied without a proportional decrease in lint yield.

Management actions are varied and flexible, meaning you can choose those that best suit your project. Any management actions you choose must meet the standards given in Section 10 of the method. They must

¹² <http://www.environment.gov.au/climate-change/emissions-reduction-fund/cfi/reforestation-tools>

also be consistent with the relevant [myBMP \(Best Management Practice\) standard¹³](#) published by the Cotton Research and Development Corporation.

Some examples of management actions include:

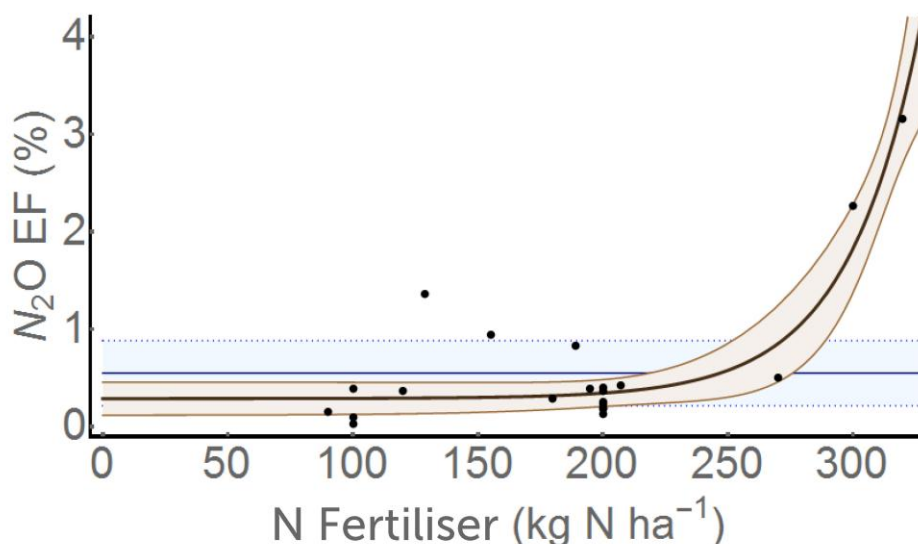
- changing the type of nitrogen fertiliser
- changing the rate, timing or placement of nitrogen fertiliser application
- improving drainage, or
- growing different crop varieties to increase yield.

You must carry out at least one new management action each time the project has a cotton area, but you can implement as many actions as you want (Section 9). The new management actions must differ from historic management actions (i.e. what you did before starting the project). Table 1 in the explanatory statement gives examples of new management actions and explains how to describe them in your project application.

Management actions can also occur in the year before planting your cotton crop. For example, you could plant legume crops to increase levels of soil nitrogen before planting the cotton.

Cotton growers who currently apply fertiliser at high rates have the greatest potential to reduce emissions by running an irrigated cotton project. In the Australian cotton industry, the average rate of nitrogen fertiliser use is about 243 kilograms of nitrogen per hectare. Figure 1 shows that at levels above about 250 kilograms of nitrogen per hectare, the amount of emissions increases in an exponential manner. Heavy users of fertilisers would therefore only need to moderately reduce their nitrogen fertiliser use to achieve good levels of abatement.

Figure 1. Above about 250 kilograms of nitrogen fertiliser applied per hectare, the emissions of nitrous oxide (N₂O) rise exponentially. N₂O is a potent greenhouse gas with 298 times the global warming potential of CO₂. So, reducing N₂O emissions by even a small amount can have a big impact on the levels of abatement a project can achieve. Note: EF = emissions factor, which is equivalent to emissions. Source [Fertilisers in irrigated cotton: final equations¹⁴](#).



¹³ <http://www.mybmp.com.au/>

¹⁴ <http://www.environment.gov.au/system/files/pages/aaa6eddbb-e4d7-4690-a8c1-e951db165bc0/files/irrigated-cotton-calculator-equations.pdf>

Calculate baseline emissions

The baseline represents what would happen if your project did not occur. It provides a point against which any changes in the amount of emissions generated by a project in a reporting period are measured. For irrigated cotton projects, the baseline emissions are calculated using the [Irrigated Cotton Calculator](#)¹⁵ (Section 20). Instructions for using the calculator, which is in a Microsoft Excel spreadsheet, can be found on the first page of the calculator. [Fertiliser in irrigated cotton: final equations](#)¹⁶ is a guide describing all the equations used by the calculator.

Baseline emissions are determined during a set period of time known as the emissions intensity reference period. To work out the baseline emissions, first calculate the emissions intensity of both synthetic nitrogen fertiliser use and green manure residue incorporation.

Emissions intensity is a measure of the amount of greenhouse gas emissions released for each kilogram of cotton lint produced. It is measured in tonnes of CO₂-e per kilogram of lint yield. As the efficiency of nitrogen fertiliser use is improved, the emissions intensity of nitrogen fertiliser use is decreased.

Once you have calculated the emissions intensity of synthetic nitrogen fertiliser and green manure in the emissions intensity reference period, the result is multiplied by the lint yield (in tonnes) in each year of the reporting period. This gives you the baseline emissions for your project. Section 17 of the method and explanatory statement explain how to do this.

The last step in calculating baseline emissions is to apply a variance discount (Section 18). The variance discount is 6.5 per cent of total baseline emissions. It is automatically applied in the [Irrigated Cotton Calculator](#)¹⁷. This discount is applied to take into account natural variation in environmental conditions that could affect your nitrogen fertiliser use efficiency (and therefore emissions intensity). Examples include weather conditions such as too much or too little rainfall, or changes in temperature.

Emissions intensity reference period

Data about previous cotton and green manure crops from the emissions intensity reference period is used to calculate the baseline emission intensity for your project (Section 11).

The default reference period covers the six years before the first day of your project's crediting period. The baseline emissions intensity is calculated for each year that cotton was grown in the emissions intensity reference period. Although the method states that you may not burn crop residue during the project, you will still be eligible even if you burned residue in the emissions intensity reference period.

Within the emissions intensity reference period, at least three years of cotton crop data must be included to calculate a reasonable estimate of emissions (Sections 23–28). For any one year to count as a reference year, the lint yield for that year must not be zero. If data for at least three years is not available within the six year period, then the reference period can be extended, one year at a time, until three years' worth of data can be obtained. The maximum time allowed is nine years.

For example, if 2015 is the year your crediting period begins, the emissions intensity reference period is the six years before this date (2009 to 2014). You only have all the required cotton crop data for 2007, 2010 and 2012. You can extend the reference period back by two years to 2007, giving you a reference period of eight years, because this falls into the maximum allowable time of nine years.

¹⁵ <http://www.environment.gov.au/climate-change/emissions-reduction-fund/methods/cotton>

¹⁶ <http://www.environment.gov.au/system/files/pages/aaa6edbb-e4d7-4690-a8c1-e951db165bc0/files/irrigated-cotton-calculator-equations.pdf>

¹⁷ <http://www.environment.gov.au/climate-change/emissions-reduction-fund/methods/cotton>

Green manure emissions

To reduce the use and cost of nitrogen fertilisers, you can grow a green manure crop, such as legumes. Bacteria in the root nodules of these plants naturally produce nitrogen, thereby improving the nitrogen levels of the soil.

The green manure crops still produce emissions of nitrous oxide (N_2O). However, only the emissions from the above ground parts of the green manure crop (stems and leaves) are accounted for by this method. The emissions from the underground parts of the plant (roots and nodules) are not required to be accounted for.

As a result, growing a green manure crop accounts for less emissions than if you had instead used extra nitrogen fertiliser instead. The method only requires you to account for emissions from the green manure crop grown in the cotton area immediately before the cotton crop (Section 16). Green manure crops grown before any other crop are not taken into account.

Calculate emissions from the project

Every project needs to take into account emissions that arise from running it (Section 19). This is to ensure these emissions are included in calculations that determine net CO_2 -e abatement for a reporting period and crediting period.

The emissions are calculated using the [Irrigated Cotton Calculator](#)¹⁸ for each year of the reporting period. The gases that are accounted for in the emissions calculations are described in Section 16 of the method.

The sources of emissions accounted for in the method are:

- synthetic nitrogen fertiliser and urea (a nitrogen fertiliser that contains carbon) applied to the cotton area
- green manure residues from crops planted on the cotton area immediately before the cotton crop.

The emissions from these sources can be either direct or indirect. The emissions for each year in the reporting period in a project area are added together to reach the total emissions for the project.

Direct and indirect emission sources

Direct emissions are a result of nitrogen fertiliser application and green manure residue. They are the result of a chemical process called denitrification. Denitrification is the loss of oxygen (O) from nitrate (NO_3^-), resulting in nitrous oxide (N_2O). This is released directly into the air. N_2O is described as a potent greenhouse gas, because it has 298 times the global warming potential of carbon dioxide (CO_2). In other words, emitting one kilogram of N_2O has the same effect on the atmosphere as emitting 298 kilograms of CO_2 .

The use of urea can also contribute to direct CO_2 emissions when it dissolves in the soil.

Indirect N_2O emissions from synthetic nitrogen fertiliser and green manure occur from leaching through the soil into waterways, and runoff over the soil surface. They also occur when fertiliser is converted into ammonia (NH_3) gas by the process of volatilisation (a solid turning directly into a gas), followed by redeposition onto land and water as solid NH_3 or ammonium (NH_4^+).

¹⁸ <http://www.environment.gov.au/climate-change/emissions-reduction-fund/methods/cotton>

Calculate the net amount of abatement and number of ACCUs

This is the final step in the calculations to determine the number of ACCUs that may be issued for a reporting period. At this stage the total emissions from the project area are calculated and then converted to tonnes of carbon dioxide equivalents (tCO₂-e).

The [Irrigated Cotton Calculator](#)¹⁹ will automatically calculate the net abatement amount for the reporting period once you have entered the required data. The calculator uses the following inputs (Section 20):

- region of the project area
- nitrogen fertiliser amount and concentration
- area of cotton and green manure planted
- cotton lint yield.

The calculator determines the net abatement by subtracting the project emissions from the baseline emissions over the reporting period (Section 15).

What's CO₂-e?

CO₂-e is a measure of the warming effect of different greenhouse gases that allows them to be compared to the equivalent amount of carbon dioxide. It refers to the amount of carbon dioxide that would give the same warming effect as each greenhouse gas that is emitted or stored by an activity.

Monitoring and record keeping

The Clean Energy Regulator recommends you draw up a plan for the monitoring, data collecting and record keeping required for an offsets report as specified in Part 5 of the method. The means of collecting and recording data will need to be in place from the start of the project. Should an offsets report and associated audit show that data collecting and record keeping has not been in place for the entire reporting period, ACCUs may not be issued for some or all of that reporting period.

When developing your plan, make sure you have the right controls and processes around your data. Are you collecting your data efficiently? Will you be able to maintain your data in the event of an emergency such as a fire?

Record keeping

An irrigated cotton project requires you to keep records of the version of the [myBMP standard](#)²⁰ that applies to your management actions, and the name, amount and nitrogen content of each nitrogen fertiliser product purchased (Section 23).

For other record keeping requirements, refer to the [Carbon Credits \(Carbon Farming Initiative\) Rule 2015](#)²¹.

Monitoring

The monitoring requirements for irrigated cotton projects are described in Sections 24 to 28 of the method. You must monitor the:

- cotton area, seed planting density and irrigation status in each field in the cotton area
- lint yield for each field in the cotton area
- amount and nitrogen content of synthetic nitrogen fertiliser used in the cotton area
- area and planting density of green manure crops planted prior to the cotton crop.

¹⁹ <http://www.environment.gov.au/climate-change/emissions-reduction-fund/methods/cotton>

²⁰ <http://www.mybmp.com.au/>

²¹ <http://www.comlaw.gov.au/Details/F2015L00156>

Project and audit reports

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 Regulator will provide following registration of your project.

For emissions avoidance projects, the first report must be made between six months to two years from the date the project was registered and then up to every two years thereafter.

Section 22 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 reports using the Certificate of entitlement including offsets report form. 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 ACCUs 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 Act. The crediting period for an irrigated cotton project is seven 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 Reporting²²](#).

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 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 the Irrigated Cotton Calculator input and output pages.

Making changes to your 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. You must seek approval from the Clean Energy Regulator if you intend to make a significant change from the project as outlined in the application.

²² <http://www.cleanenergyregulator.gov.au/NGER/For-auditors/Register-of-auditors>

Resources

- For more information on participating in the Emissions Reduction Fund – www.cleanenergyregulator.gov.au²³
- For more information regarding [method development](#)²⁴
- www.comlaw.gov.au²⁵ is the site where you can find all legislative instruments, including the:
 - » [Carbon credits \(Carbon Farming Initiative\) Act 2011 \(current version\)](#)²⁶
 - » [Carbon credits \(Carbon Farming Initiative\) Regulations 2011](#)²⁷
 - » [Carbon Credits \(Carbon Farming Initiative\) Rule 2015](#)²⁸
 - » [Carbon Farming Initiative - Reducing Greenhouse Gas Emissions from Fertiliser in Irrigated Cotton\) Methodology Determination 2015](#)²⁹
 - » [Explanatory Statement](#)³⁰
- Enquiries on participating in the Emissions Reduction Fund – 1300 553 542; enquiries@cleanenergyregulator.gov.au³¹
- [Department of the Environment information on irrigated cotton projects](#)³²
- [National Greenhouse and Energy Reporting – Register of auditors](#)³³
- [Irrigated Cotton Calculator](#)³⁴
- [Fertiliser in irrigated cotton: final equations](#)³⁵
- [myBMP \(Best Management Practice\) standard](#)³⁶
- [Carbon Farming mapping tool](#)³⁷

²³ <http://www.cleanenergyregulator.gov.au/>

²⁴ <http://www.environment.gov.au/climate-change/emissions-reduction-fund/methods/cotton>

²⁵ <http://www.comlaw.gov.au/>

²⁶ <http://www.comlaw.gov.au/Series/C2011A00101>

²⁷ <http://www.comlaw.gov.au/Series/F2011L02583>

²⁸ <http://www.comlaw.gov.au/Details/F2015L00156>

²⁹ <http://www.comlaw.gov.au/Details/F2015L00584>

³⁰ <https://www.comlaw.gov.au/Details/F2015L00584/Explanatory%20Statement/Text>

³¹ <mailto:enquiries@cleanenergyregulator.gov.au>

³² <http://www.environment.gov.au/climate-change/emissions-reduction-fund/methods/cotton>

³³ <http://www.cleanenergyregulator.gov.au/NGER/For-auditors/Register-of-auditors>

³⁴ <http://www.environment.gov.au/climate-change/emissions-reduction-fund/methods/cotton>

³⁵ <http://www.environment.gov.au/climate-change/emissions-reduction-fund/methods/cotton>

³⁶ <http://www.mybmp.com.au/>

³⁷ <http://www.environment.gov.au/climate-change/emissions-reduction-fund/cfi/reforestation-tools>