Carbon Credits (Carbon Farming Initiative—Refrigeration and Ventilation Fans) Methodology Determination 2015

I, Greg Hunt, Minister for the Environment, make the following determination.

Dated 27:10:15

GREG HUNT

Greg Hunt
Minister for the Environment

Contents

Part 1—Preliminary

1 Name

This is the *Carbon Credits (Carbon Farming Initiative—Refrigeration and Ventilation Fans) Methodology Determination 2015*.

2 Commencement

This determination commences on the day after it is registered.

3 Authority

This determination is made under subsection 106(1) of the *Carbon Credits (Carbon Farming Initiative) Act 2011*.

4 Duration

This determination remains in force for the period that:

(a) begins when this instrument commences; and

(b) ends on the day before this instrument would otherwise be repealed under subsection 50(1) of the *Legislative Instruments Act 2003*.

5 Definitions

In this determination:

Act means the *Carbon Credits (Carbon Farming Initiative) Act 2011*.

ANZSIC means the Australian and New Zealand Standard Industrial Classification, jointly developed by the Australian Bureau of Statistics and Statistics New Zealand and as in force from time to time.

axial-flow fan—see section 6.

BCA means the *Building Code of Australia*, forming part of the National Construction Code, as in force from time to time.

building type of a particular building—see section 1 of Schedule 2.

Note: The building types are categorised using BCA classes and, where appropriate, primary business activities reflected in Divisions of the ANZSIC.

centrifugal backward-curved fan—see section 6.

centrifugal forward-curved fan—see section 6.

centrifugal radial bladed fan—see section 6.

CO_2-e means carbon dioxide equivalent.

cold storage warehouse means a temperature controlled warehouse for housing chilled and frozen goods.

commissioned: a fan is ***commissioned*** at the point at which the fan is first used after it has been installed, modified or replaced as part of a refrigeration and ventilation fan project and it has been established that it operates as intended.

control system, of a fan, means a system that automatically adjusts the fan speed, or turns the motor of the fan on or off, based on temperature, pressure, humidity, or feedback from carbon monoxide or carbon dioxide sensors.

cross-flow fan means a fan in which the gas path through the impeller is in a direction essentially at right angles to its axis both entering and leaving the impeller at its periphery.

declaration day, in relation to a refrigeration and ventilation fan project, means the day the project is declared to be an eligible offsets project.

driven fan: a fan is a ***driven fan*** if it is connected to a motor, whether or not the fan is connected to a transmission or a control system, and whether or not it has a housing.

ducted fan means a driven fan that:

(a) is ducted at the outlet, the inlet or both; and
(b) increases the kinetic energy of the air within the duct.

ducted or partition ventilation fan means a ducted fan or a partition fan that:

(a) provides ventilation services to a building; and
(b) is not a heating/cooling ventilation fan.

electronically commutated motor means a permanent magnet electric motor that uses an electronically controlled commutation system.

eligible fan type: each of the following is an ***eligible fan type***:

(a) an axial-flow fan;
(b) a cross-flow fan;
(c) a mixed-flow fan;
(d) a centrifugal backward-curved fan;
(e) a centrifugal radial bladed fan;
(f) a centrifugal forward-curved fan.

eligible small motor type: each of the following is an ***eligible small motor type***:

(a) a shaded pole motor;
(b) a permanent split capacitor motor.

fan air power has the same meaning as in AS/NZS ISO 12759:2013.

fan impeller power means the mechanical power transferred to the fan impeller, calculated in accordance with AS/NZS ISO 12759:2013.

fan shaft power means the mechanical power transferred to the fan shaft, calculated in accordance with AS/NZS ISO 12759:2013.

fan static air power has the same meaning as in AS/NZS ISO 12759:2013.

freezer cabinet means a cabinet that meets the definition of a refrigerated display cabinet as defined in AS 1731.6-2003, and that has a temperature class of L1 or L2.

heating/cooling ventilation fan means a fan that:

(a) services the space heating, space cooling or ventilation systems of a building; and
(b) is designed or configured to operate only when the space heating or space cooling applications are heating or cooling the spaces enclosed by the building envelope.

Note: An example is a boiler draught fan that is dedicated to providing supply air to heating or cooling system, and that does not also serve a general ventilation purpose.

high efficiency fan installation—see subsection 9(3).

housing means a casing around the impeller that guides the gas stream towards, through and from the impeller.

impeller means the part of the fan that imparts energy into the gas flow.

installation category means one of the following installation categories:
(a) installation category A;
(b) installation category B;
(c) installation category C;
(d) installation category D.

installation category A means an arrangement where the fan is installed with free inlet and outlet conditions.

installation category B means an arrangement where the fan is installed with a free inlet and with a duct fitted to its outlet.

installation category C means an arrangement where the fan is installed with a duct fitted to its inlet and with free outlet conditions.

installation category D means an arrangement where the fan is installed with a duct fitted to its inlet and outlet.

installed HE fan (short for installed high efficiency fan)—see subsection 9(5).

installed SM fan (short for installed small motor fan)—see subsection 9(7).

mixed-flow fan—see section 6.

motor efficiency has the same meaning as in AS/NZS ISO 12759:2013.

motor input power has the same meaning as in AS/NZS ISO 12759:2013.

multi-speed control means a control system where the motor is able to run at a number of discrete speeds, and is automatically changed from one speed to another according to temperature, pressure, humidity, or feedback from carbon monoxide or carbon dioxide sensors and that may or may not have switching controls.

Note: A pole amplitude modulated motor is an example of a motor with a multi-speed control.

NATA equivalent testing laboratory means:
(a) a National Association of Testing Authorities (NATA) accredited laboratory; or
(b) an equivalent laboratory accredited by an organisation included in the Mutual Recognition Arrangements published by NATA.

NCC climate zone, for a location, means the applicable climate zone for that location determined in accordance with the Climate Zone Map, prepared by the Australian Building Codes Board and as in force from time to time.

net abatement amount, of a refrigeration and ventilation fan project, means the carbon dioxide equivalent net abatement amount for the project in the reporting period for the purposes of paragraph 106(1)(c) of the Act (see also section 20).

NGA Factors document means the document titled *National Greenhouse Accounts Factors*, published by the Department and as in force from time to time.

nominal motor power has the same meaning as in AS/NZS ISO 12759:2013.

optimum efficiency, for a fan with a particular impeller size, means the motor speed, flow rate and pressure corresponding to the best efficiency point of the fan with that impeller size.

partition fan means a fan that is installed in a partition within a building and that has free inlet and outlet conditions.

permanent split capacitor motor means an electric motor that:

(a) is supplied with single phase electrical supply; and

(b) has start and run windings permanently connected to the power source through a capacitor.

refrigerated display cabinet means a cabinet that meets the definition of a refrigerated display cabinet as defined in AS 1731.6–2003, and that has a temperature class of M1 or M2.

***refrigeration and ventilation fan project*—**see subsection 9(2).

refrigeration fan means:

(a) a fan that:

(i) is a condenser fan, or another fan that removes hot air from the condenser; and

(ii) is installed primarily for the purpose of servicing a refrigeration system; or

(b) a fan that:

(i) is an evaporator fan, or another fan that circulates cool air; and

(ii) is installed primarily for the purpose of servicing a refrigeration system; or

(c) a fan that is installed in a cooling tower, where the primary purpose of the cooling tower is to provide heat rejection for a refrigeration system.

refrigeration system means any of the following types:

(a) a refrigerated display cabinet;

(b) a freezer cabinet;

(c) a walk-in cool room;

(d) a cold storage warehouse.

Note: A refrigeration system includes each part (including fans such as condenser fans, evaporator fans, and cooled air circulation fans) that operates as an integral part of the system.

shaded pole motor means an electric motor that:

(a) is supplied with single phase electrical supply; and

(b) has an alternating current induction motor with a squirrel cage rotor that uses a shading coil in the face of each field pole to delay the phase of the magnetic flux to provide a rotating magnetic field.

***small motor fan upgrade*—**see subsection 9(6).

space cooling, in relation to a building, means cooling of the spaces enclosed by the building envelope.

space heating, in relation to a building, means heating of the spaces enclosed by the building envelope.

switching control means a control system that turns a motor on or off automatically according to temperature, pressure, humidity, or feedback from carbon monoxide or carbon dioxide sensors.

variable speed drive means a control system that consists of an electronic power converter (such as a variable voltage controller for a direct current motor) that:

(a) is integrated, or functions as one system, with a motor and a fan; and

(b) adapts the electrical power supplied to the motor continuously (rather than through a series of discrete settings) in order to control the mechanical power output of the motor according to temperature, pressure, humidity, or feedback from carbon monoxide or carbon dioxide sensors.

ventilation fan means:

(a) a ducted or partition ventilation fan; or

(b) a heating/cooling ventilation fan;

that is not a refrigeration fan.

walk-in cool room means a refrigerated space formed by an insulated enclosure of walls, ceiling and, where appropriate, floor, and having a door that a person can pass through and close behind them.

Note: Other words and expressions used in this determination have the meaning given by the Act. These terms include:

Australian carbon credit unit
crediting period
eligible offsets project
emission
greenhouse gas
offsets project
offsets report
project
project proponent
Regulator
reporting period

6 Definitions for eligible fan types (other than cross-flow fan)

(1) For this determination, a reference to a fan of an eligible fan type listed in the following table is a reference to a fan that has:

(a) a fan flow angle (α); and

(b) where specified, a fan blade angle (β);

within the range specified in the table.

Fan flow angle and fan blade angle for eligible fan types

Eligible fan type	Fan flow angle (α)	Fan blade angle (β)
axial-flow fan	$\alpha \leq 20°$	(not specified)
mixed-flow fan	$20° < \alpha < 70°$	(not specified)

Fan flow angle and fan blade angle for eligible fan types

Eligible fan type	Fan flow angle (α)	Fan blade angle (β)
centrifugal backward-curved fan	$70° \leq \alpha$	$\beta \leq -1°$
centrifugal radial bladed fan	$70° \leq \alpha$	$-1° < \beta < 1°$
centrifugal forward-curved fan	$70° \leq \alpha$	$1° \leq \beta$

(2) For this section:

(a) the ***fan flow angle*** (α) is the angle between:

(i) the centre-line of the air-conducting surface of a fan blade, measured at the midpoint of its trailing edge; and

(ii) the centre-line of the rotation axis of the fan;

in a plane through the rotation axis and the midpoint of the trailing edge (illustrated in Figure 1); and

(b) the ***fan blade angle*** (β) is the angle between:

(i) the tangent of the air-conducting surface of the blade; and

(ii) the radial through the rotation axis of the fan;

at the midpoint of the blade's trailing edge, in a plane perpendicular to the fan rotation axis, and which is positive when the blade is inclined in the direction of the rotation of the impeller (illustrated in Figure 2).

Figure 1—Fan flow angles for eligible fan types

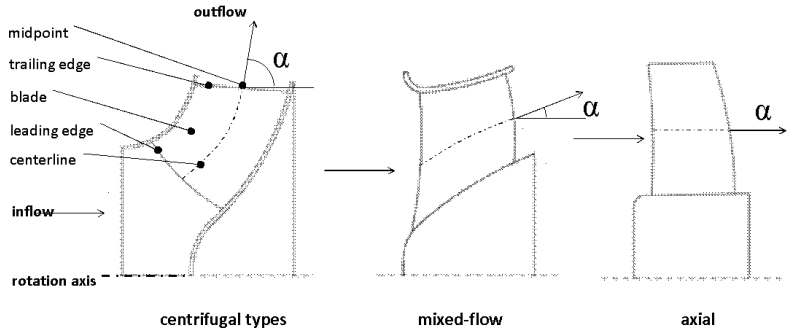
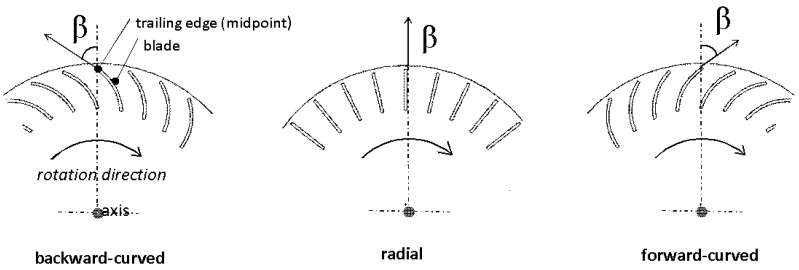


Figure 2—Fan blade angles for centrifugal fan types



Note: Figure 1 and Figure 2 are sourced from *Ecodesign Fan Review – Review Study of Commission Regulation (EU) No 327/2011 – Final report*, prepared by Van Holsteijn en Kemna B.V. for the European Commission, Directorate-General for Energy, which was accessed from http://fanreview.eu.

7 Standards referred to in this determination

(1) In this determination:

AS 1731.6-2003 means Australian Standard AS *1731.6-2003 Refrigerated display cabinets. Part 6: Classification according to temperatures* or the equivalent international standard.

AS ISO 5801–2004 means Australian Standard *AS ISO 5801-2004 Industrial fan-performance testing using standardized airways* or the equivalent international standard.

AS/NZS ISO 12759:2013 means Australian/New Zealand Standard *AS/NZS ISO 12759:2013 Fans—Efficiency classification for fans* or the equivalent international standard.

(2) The version of each standard referred to in subsection (1) is the one that existed on the date this determination came into force.

8 References to factors and parameters from external sources

(1) If a calculation in this determination includes a factor or parameter that is defined or calculated by reference to another instrument or writing, the factor or parameter to be used for a reporting period is the factor or parameter referred to in, or calculated by reference to, the instrument or writing as in force at the end of the reporting period.

(2) Subsection (1) does not apply if:

(a) this determination specifies otherwise; or

(b) it is not possible to define or calculate the factor or parameter by reference to the instrument or writing as in force at the end of the reporting period.

Part 2—Refrigeration and ventilation fan projects

9 Refrigeration and ventilation fan projects

(1) For paragraph 106(1)(a) of the Act, this determination applies to an offsets project that:

(a) relates to the installation, modification or replacement of refrigeration fans or ventilation fans or both; and

(b) involves undertaking either or both of the following:

(i) 1 or more high efficiency fan installations;

(ii) 1 or more small motor fan upgrades; and

(c) can reasonably be expected to result in eligible carbon abatement.

Note: Some activities under this determination are capable of being classified as both a high efficiency fan installation and a small motor fan upgrade. The project proponent is required to classify such activities as one or the other for the purposes of this determination, and the classification applies for the entire crediting period. See subsection 22(3).

(2) A project covered by subsection (1) is a ***refrigeration and ventilation fan project***.

High efficiency fan installations

(3) For this determination, a ***high efficiency fan installation*** involves:

(a) installing a fan as a refrigeration fan or a ventilation fan that satisfies the following:

(i) the fan has a motor input power that is:

(A) greater than or equal to 0.125 kilowatts; and

(B) less than or equal to 185 kilowatts;

(ii) the fan is an eligible fan type;

(iii) the fan has an operating efficiency that is greater than or equal to the high efficiency threshold for the fan; or

(b) modifying or replacing a fan that is installed as a refrigeration fan or a ventilation fan (whether or not the fan satisfies subparagraphs (a)(i), (ii) and (iii)) so that, after the modification or replacement, the fan:

(i) satisfies subparagraphs (a)(i), (ii) and (iii); and

(ii) has a nominal motor power that is not materially greater than that of the fan before the modification or replacement.

(4) For subparagraph (3)(a)(iii), the operating efficiency and high efficiency threshold are calculated in accordance with Schedule 1.

(5) The fan that results from a high efficiency fan installation is an ***installed HE fan***.

Small motor fan upgrades

(6) For this determination, a ***small motor fan upgrade*** involves modifying or replacing a fan that is installed as a refrigeration fan or a ventilation fan and that:

(a) has a motor input power of less than or equal to 0.175 kilowatts; and

(b) is driven by a motor that is an eligible small motor type;

so that, after the modification or replacement, the fan:

(c) satisfies paragraph (a); and

(d) is driven instead by an electronically commutated motor; and

(e) has a nominal motor power that is not materially greater than that of the fan before the modification or replacement.

(7) The fan that results from a small motor fan upgrade is an ***installed SM fan***.

Part 3—Project requirements

Division 1—General requirements for refrigeration and ventilation fan projects

10 Operation of this Part

For paragraph 106(1)(b) of the Act, this Part sets out requirements that must be met for a refrigeration and ventilation fan project to be an eligible offsets project.

11 Information to be included in application for declaration

(1) The application under section 22 of the Act in relation to the project must include a description of the following:

(a) for each fan to be installed, modified or replaced that is identified at the time of the application:

(i) whether the fan will be installed, modified or replaced; and

(ii) whether the fan is, or is suitable for use as, a refrigeration fan or a ventilation fan; and

(iii) the motor input power; and

(iv) for a refrigeration fan—whether the type of refrigeration system in which it is or will be installed is:

(A) a refrigerated display cabinet; or

(B) a freezer cabinet; or

(C) a walk-in cool room; or

(D) a cold storage warehouse; and

(v) for a ventilation fan:

(A) whether it is or will be a ducted or partition ventilation fan or a heating/cooling ventilation fan; and

(B) the building type of the building the fan will service; and

(C) for a heating/cooling ventilation fan—the NCC climate zone for the building's location; and

(vi) for a high efficiency fan installation:

(A) the installation category; and

(B) the eligible fan type; and

(C) in the case of a modification or replacement—the nominal motor power of the fan, before and after the modification or replacement; and

(vii) for a small motor fan upgrade:

(A) the eligible small motor type; and

(B) the nominal motor power of the fan, before and after the modification or replacement; and

(C) how any fan or other component that is to be removed as part of the project, or in association with it, will be disposed of; and

(viii) the following details about the fan to be installed, the replacement motor or the replacement fan, as appropriate:

(A) the brand;

(B) the manufacturer;
(C) the model number;

(b) for each fan to be installed, modified or replaced that is not identified at the time of the application—the class of installation, modification or replacement.

(2) For paragraph (1)(b), a class must relate to:

(a) either refrigeration fans or ventilation fans (but not both); and

(b) for refrigeration fans—refrigeration systems of the same type; and

(c) for ventilation fans:

(i) buildings of the same building type; and

(ii) for heating/cooling ventilation fans—buildings that are in the same NCC climate zone; and

(d) for high efficiency fan installations:

(i) one only of installations, modifications and replacements; and

(ii) fans of the same installation category; and

(iii) fans with the same eligible fan type; and

(e) for small motor fan upgrades:

(i) one only of modifications and replacements; and

(ii) fans with the same eligible small motor type; and

(f) fans or motors with:

(i) the same brand; and

(ii) the same manufacturer; and

(iii) the same model number; and

(iv) the same motor input power.

12 Fans excluded from determination

(1) A refrigeration and ventilation fan project is not an eligible offsets project if it involves, as part of the project, installing, modifying or replacing a fan that is used:

(a) in the case of a ventilation fan—as part of an industrial process (other than a fan that is used only for ventilating the space enclosed by the building envelope); or

(b) exclusively for smoke extraction or emergency smoke extraction; or

(c) exclusively for applications for which the operation is infrequent (other than a heating/cooling ventilation fan); or

Note: An example of a fan excluded by paragraph (c) is a fan that is used only in emergency operations.

(d) exclusively for pressurising 1 or more stairwells; or

(e) in a fume cupboard; or

(f) for a potentially explosive atmosphere; or

(g) as a jet fan in car parking or tunnel applications; or

(h) as a ventilation fan in a building or structure that is not of a building type listed in Schedule 2; or

(i) in a building with a building type of BCA class 2 (multi-unit dwellings), other than a fan that:

(i) provides services to the common areas of the building; or

(ii) is otherwise operated or maintained by the body corporate or building owner.

(2) A refrigeration and ventilation fan project is not an eligible offsets project if it involves an installed HE fan that is:

(a) a cross-flow fan of installation category A or installation category C; or
(b) a centrifugal backward-curved fan without a housing of installation category B or installation category D.

Note: This section does not prevent a project proponent from installing, modifying or replacing any of the above while undertaking the project. However, the project proponent is not able to attribute any such installation, modification or replacement to the project, and is not able to calculate abatement in relation to any such installation, modification or replacement.

13 Requirement for fans and components to be new

The following must, at the date of commission, be new:
(a) each fan that is installed (whether as an installation or a replacement);
(b) each component that is used in the modification of a fan.

Division 2—Additional requirements for high efficiency fan installations

14 General requirements for high efficiency fan installation

(1) Each installed HE fan must, at the date of commission, be a driven fan.

(2) Installation or replacement of a fan as part of a high efficiency fan installation must not consist only of the installation or replacement of an appliance that is purchased as a complete, stand-alone unit.

Note: Examples of complete, stand-alone units for subsection (2) include complete, stand-alone refrigerative air conditioning units and complete, stand-alone refrigerated display or freezer cabinets.

Subsection (2) does not prevent the replacement of a fan in such an appliance, so long as the replacement does not consist only of replacing the entire appliance.

(3) Subsection (2) does not apply in relation to an appliance for which the primary energy consumption is from the fan.

15 Efficiency requirement for replacement fans

(1) If, as part of a high efficiency fan installation:
(a) a fan (the ***replacement*** fan) is replacing a refrigeration fan or a ventilation fan that is already installed (the ***original*** fan); and
(b) the original fan is of one of the eligible fan types;
then the market average efficiency grade of the fan type of the replacement fan must not be less than the market average efficiency grade of the fan type of the original fan.

(2) For subsection (1), the ***market average efficiency grade*** of a particular fan type means the market average efficiency grade $N_{ave,i}$ specified in Schedule 5 for that fan type.

16 Requirement relating to testing for high efficiency fan installations

(1) The model of each installed HE fan must be tested in accordance with this section to determine the parameters referred to in this section.

Requirement relating to conduct of testing

(2) The testing may be done by or on behalf of:
(a) the manufacturer or supplier of the fan; or

(b) the project proponent.

(3) The testing must be done by:
  (a) a NATA equivalent testing laboratory in accordance with AS ISO 5801-2004; or
  (b) a testing laboratory with ISO 9001 certification for testing in accordance with AS ISO 5801-2004.

Example: A testing laboratory that is certified under *AS/NZS ISO 9001:2008 Quality Management systems – Requirements* or *ISO 9001:2015 Quality management systems – Requirements* for testing in accordance with AS ISO 5801-2004.

(4) The model:
  (a) must be tested:
    (i) as a driven fan; and
    (ii) when the impeller is operating at optimum efficiency; and
    (iii) using the installation category that most closely resembles the configuration of the fan to be installed; and
    (iv) so that the motor input power at optimum efficiency for the impeller being tested is not materially different from the motor input power at optimum efficiency of the impeller of the fan as installed as part of the project; and
  (b) may be tested using the same drive, motor and transmission as will be used by the installed HE fan.

Parameters determined by testing

(5) For subsection (1), the parameters are the following:
  (a) for a model that has a shaft—fan shaft power ($P_{M,i}$);
  (b) for a model that does not have a shaft—fan impeller power ($P_{M,i}$);
  (c) the motor efficiency of the model ($\eta_{M,i}$);
  (d) if the model is tested using:
    (i) installation category B or installation category D—fan air power ($P_{U,i}$); or
    (ii) installation category A or installation category C—fan static air power ($P_{U,i}$);
  (e) if the model is tested in accordance with paragraph (4)(b)—the motor input power ($P_{E,i}$).

Note: The fan air power referred to in subparagraph (d)(i) is also referred to as the total fan air power or the total air power.

Division 3—Additional requirements for small motor fan upgrades

17 Additional requirements for small motor fan upgrades

Requirements for both modifications and replacements

(1) A fan that is modified or replaced in each small motor fan upgrade must:
  (a) be in working order; and
  (b) be providing refrigeration or ventilation services.

(2) The space refrigerated or ventilated by the fan must not:
  (a) be undergoing a structural change that requires development approval under State or Territory law; or
  (b) be part of a reconstruction project that requires development approval under State or Territory law.

(3) Subsection (2) does not apply if the development approval is required only because of the refrigeration and ventilation fan project.

Additional requirement for modifications

(4) If a fan is modified as part of a small motor fan upgrade, all parts used in the modification must be compatible with the electronically commutated motor.

(5) Other parts of the fan may, if necessary, be modified or replaced to meet the requirement of subsection (4).

Additional requirement for replacements

(6) The project proponent must not replace a fan as part of a small motor fan upgrade only by installing:

(a) an appliance that is purchased as a complete, stand-alone unit; or

(b) a product that is purchased as a complete air handling unit.

Note: Subsection (6) does not prevent a project proponent from undertaking a small motor fan upgrade by installing a complete, stand-alone unit and additionally replacing the fan in the unit.

18 Disposal of fans and other components for small motor fan upgrades

(1) A refrigeration and ventilation fan project is not an eligible offsets project unless each fan and other component that is removed as part of a small motor fan upgrade, or in association with it, is disposed of and is not re-used or refurbished.

(2) Subsection (1) does not prevent a fan or other component that is removed from being broken down into other components and those other components being recycled, other than for use as or in a fan.

Note: The project proponent may comply with this section by, for example, rendering the fan or other component not usable or refurbishable before disposing of it.

19 Requirement relating to testing for small motor fan upgrades

For each installed SM fan and each replacement motor used in a small motor fan upgrade, the project proponent must possess:

(a) standard test reports that comply with AS ISO 5801–2004; or

(b) supplier product specifications that are based on such tests;

that indicate the motor input power ($P_{E,i}$) of the fan or the motor, as appropriate.

Part 4—Net abatement amount

Division 1—Preliminary

20 Operation of this Part

For paragraph 106(1)(c) of the Act, this Part specifies the method for working out the carbon dioxide equivalent net abatement amount for a reporting period for a refrigeration and ventilation fan project that is an eligible offsets project.

Note: This is called the ***net abatement amount*** in this determination (see section 5).

21 Overview of gases accounted for in abatement calculations

The following table provides an overview of the greenhouse gases and emissions sources that are relevant to working out the net abatement amount for a refrigeration and ventilation fan project.

Greenhouse gases and emissions sources

Item	Relevant emissions calculation	Emissions source	Greenhouse gas
1	Baseline emissions Project emissions	Electricity consumption	Carbon dioxide (CO_2) Methane (CH_4) Nitrous oxide (N_2O)

22 Fans to be used in calculations

(1) The project proponent may undertake calculations in accordance with this Part only for installed HE fans and installed SM fans.

Exclusion of fans from calculations

(2) In calculating the net abatement amount for the project for a reporting period, the project proponent:

(a) may exclude any fan; and

(b) must exclude a fan if:

(i) the fan is not in commission before the end of the reporting period; or

(ii) at any time during the reporting period, the fan was decommissioned or removed from the building or refrigeration system; or

(iii) in the case of a high efficiency fan installation—the model of the fan has not been tested in accordance with section 16.

Requirement to classify fan as either installed HE fan or installed SM fan

(3) For each fan that can be classified as both an installed HE fan and an installed SM fan for the purposes of calculation of the net abatement amount, the project proponent must:

(a) choose one of the classifications for the first offsets report that calculates the net abatement amount in relation to the fan; and

(b) apply the same classification to the fan in subsequent offsets reports.

Division 2—Calculating net abatement amount

23 Summary of this Division

The net abatement amount for a refrigeration and ventilation fan project is calculated by summing:

- the net abatement from all installed HE fans (A_{HE}); and
- the net abatement from all installed SM fans (A_{SM}).

24 Equation 1—net abatement amount (*A*)

The net abatement amount for a reporting period in tonnes CO_2-e (***A***) is worked out using the equation (***equation 1***):

$$A = A_{HE} + A_{SM}$$

where:

$\boldsymbol{A_{HE}}$ is the net abatement for the reporting period from all installed HE fans, in tonnes CO_2-e, and is calculated in accordance with Division 3 (see equation 2, section 26).

$\boldsymbol{A_{SM}}$ is the net abatement for the reporting period from all installed SM fans, in tonnes CO_2-e, and is calculated in accordance with Division 4 (see equation 10, section 34).

Division 3—Calculating net abatement from installed HE fans

Note: The definitions of several parameters used in this Division mirror the corresponding definitions in Schedule 1. The project proponent will have already worked out values for these parameters when determining whether the fan complies with subparagraph 9(3)(a)(iii), and can re-use the values so calculated for the purposes of this Division.

25 Summary of this Division

The net abatement for each reporting period from all installed HE fans is the sum of the abatement amounts during the reporting period from each such fan.

The abatement amount for each fan is determined by comparing the energy consumption of that fan with the energy consumption of a market average fan of the same type and power, and is proportional to the reduction in energy consumption of the fan as compared to this benchmark.

26 Equation 2—net abatement from installed HE fans (A_{HE})

For equation 1, A_{HE} is worked out using the equation (***equation 2***):

$$A_{HE} = \sum_{i=1}^{n} A_{HE,i}$$

where:

$\boldsymbol{A_{HE,i}}$ is the abatement amount for the reporting period from the i^{th} installed HE fan, in tonnes CO_2-e.

n is the number of installed HE fans over which abatement is calculated for the reporting period.

Note: See section 22 for the fans to be used in the calculations.

27 Equation 3—abatement amount from each installed HE fan ($A_{HE,i}$)

(1) For equation 2, $A_{HE,i}$ is worked out using the equation (***equation 3***):

$$A_{HE,i} = \frac{P_{E,i}}{1000} \times \left(\frac{\eta_i \times CM_i}{\eta_{B,i}} - \frac{1}{C_{C,i}} \right) \times (1 + H_i) \times DF_i \times t_i \times 24 \times CF_i \times EF_{Elec,i}$$

where, for the i^{th} installed HE fan:

$P_{E,i}$ is the motor input power, in kilowatts, and is:

(a) if the model of the fan was tested using the same drive, motor and transmission as the fan as installed—the motor input power measured in that test; and

Note: See paragraphs 16(4)(b) and (5)(e).

(b) otherwise—the motor input power given by equation 4 (section 28).

η_i is the overall driven fan efficiency, and is:

(a) if the model of the fan was tested using the same drive, motor and transmission as the fan as installed—the overall driven fan efficiency given by equation 5 (section 29); and

Note: See paragraph 16(4)(b).

(b) otherwise—the overall driven fan efficiency given by equation 6 (section 30).

CM_i is the component mismatch factor, and is:

(a) if the model of the fan was tested using the same drive, motor and transmission as the fan as installed—1; and

Note: See paragraph 16(4)(b).

(b) otherwise—0.9.

$\eta_{B,i}$ is the baseline overall energy efficiency, given by equation 7 (section 31).

$C_{C,i}$ is the part load compensation factor for the controller of the fan, and is:

(a) if the motor is controlled by a variable speed drive that was installed as part of the project—the value given by equation 8 (subsection 32(1)); and

(b) if the motor is controlled by a multi-speed control or a switching control that was installed as part of the project—the value given by equation 9 (subsection 32(2)); and

(c) otherwise—1.

H_i is the heat load adjustment for the fan, and is:

(a) for a ventilation fan—0; and

(b) for a refrigeration fan that is:

(i) a condenser fan, or another fan that removes hot air from the condenser—0; and

(ii) unless subparagraph (iii) is applicable—an evaporator fan, or another fan that circulates cool air, that services:

(A) a refrigerated display cabinet—0.44; or

(B) a freezer cabinet—0.44; or

(C) a walk-in cool room—0.44; or

(D) a cold storage warehouse—0.26; and

(iii) a fan that is installed in a cooling tower, where the primary purpose of the cooling tower is to provide heat rejection for a refrigeration system—0.

Note: When not equal to zero, the heat load adjustment for a refrigeration fan is the inverse of the coefficient of performance. This adjustment provides for abatement as a result of the reduced heat load on the refrigeration system for evaporator fans and other fans that circulate cool air.

$\boldsymbol{DF_i}$ is the discount factor for sub-optimal operation, and is:

(a) for an axial-flow fan—0.9; and

(b) otherwise—1.

$\boldsymbol{t_i}$ is the number of days in the reporting period for the fan after it is commissioned.

$\boldsymbol{CF_i}$ is the capacity factor, and is:

(a) for a refrigeration fan that is:

(i) a condenser fan, or another fan that removes hot air from the condenser—0.58; and

(ii) unless subparagraph (iii) is applicable—an evaporator fan, or another fan that circulates cool air—0.9; and

(iii) a fan that is installed in a cooling tower, where the primary purpose of the cooling tower is to provide heat rejection for a refrigeration system—0.29; and

(b) for a ventilation fan—determined in accordance with Schedule 2.

$\boldsymbol{EF_{Elec,i}}$ is the emissions factor for electricity, and is:

(a) for electricity obtained from an electricity grid in relation to which the NGA Factors document in force on the declaration day includes an emissions factor—that factor, in kilograms CO_2-e per kilowatt hour; or

(b) for electricity obtained from an electricity grid not covered by paragraph (a) or from a source other than an electricity grid:

(i) if the supplier of the electricity is able to provide an emissions factor that reflects the emissions intensity of the electricity and is applicable on the declaration day—that factor, in kilograms CO_2-e per kilowatt hour; or

(ii) otherwise—the emissions factor, in kilograms CO_2-e per kilowatt hour, for off-grid electricity included in the NGA Factors document in force on the declaration day.

(2) For subparagraph (b)(i) of the definition of $EF_{Elec,i}$, the emissions factor must be worked out:

(a) on a sent-out basis; and

(b) using a measurement or estimation approach that is consistent with the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*.

28 Equation 4—motor input power of installed HE fan ($P_{E,i}$)

For equation 3, if paragraph (b) of the definition of $P_{E,i}$ is applicable, $P_{E,i}$ is worked out using the equation (***equation 4***):

$$P_{E,i} = \frac{P_{M,i}}{\eta_{T,i} \times \eta_{M,i} \times \eta_{C,i}}$$

where, for the i^{th} installed HE fan:

$P_{M,i}$ is the mechanical power supplied to the fan impeller, being:

(a) for a fan that has a shaft—the fan shaft power of the fan, in kilowatts; and

(b) for a fan that does not have a shaft—the fan impeller power of the fan, in kilowatts;

as determined from test results in accordance with section 16.

$\eta_{T,i}$ is the transmission efficiency of the transmission of the fan, and is determined in accordance with Schedule 3.

$\eta_{M,i}$ is the motor efficiency of the motor of the fan, as determined from test results in accordance with section 16.

$\eta_{C,i}$ is the electrical drive efficiency of the controller of the fan, and is:

(a) if a variable speed drive is installed (whether or not as part of the project) and:

(i) the manufacturer or supplier has publicly released data in Australia relating to the electrical drive efficiency of the controller—the electrical drive efficiency ascertained in accordance with that data that corresponds to the point at which the impeller is operating at optimum efficiency; and

(ii) if subparagraph (i) does not apply—0.95; and

(b) if a variable speed drive is not installed—1.

29 Equation 5—overall driven fan efficiency of installed HE fan (η_i) for components tested as installed

For equation 3, if paragraph (a) of the definition of η_i is applicable, η_i is worked out using the equation (***equation 5***):

$$\eta_i = \frac{P_{U,i}}{P_{E,i}}$$

where, for the i^{th} installed HE fan:

$P_{U,i}$ is the fan air power or fan static air power (as appropriate) in kilowatts, as measured in testing using the same drive, motor and transmission as the fan as installed.

$P_{E,i}$ is the motor input power of the fan in kilowatts, as measured in testing using the same drive, motor and transmission as the fan as installed.

Note: For the testing for $P_{U,i}$ and $P_{E,i}$, see paragraphs 16(4)(b) and (5)(d) and (e).

30 Equation 6—overall driven fan efficiency of installed HE fan (η_i) for components tested separately

For equation 3, if paragraph (b) of the definition of η_i is applicable, η_i is worked out using the equation (***equation 6***):

$$\eta_i = \frac{P_{U,i}}{P_{M,i}} \times \eta_{T,i} \times \eta_{M,i} \times \eta_{C,i}$$

where, for the i^{th} installed HE fan:

$P_{U,i}$ is the fan air power or fan static air power (as appropriate) in kilowatts as determined from test results in accordance with section 16.

$P_{M,i}$ is the mechanical power supplied to the impeller of the fan, and has the same meaning as in section 28.

$\eta_{T,i}$ is the transmission efficiency of the transmission of the fan, and has the same meaning as in section 28.

$\eta_{M,i}$ is the motor efficiency of the motor of the fan, and has the same meaning as in section 28.

$\eta_{C,i}$ is the electrical drive efficiency of the controller of the fan, and has the same meaning as in section 28.

31 Equation 7—baseline overall energy efficiency of installed HE fan ($\eta_{B,i}$)

For equation 3, $\eta_{B,i}$ is worked out using the equation (***equation 7***):

$$\eta_{B,i} = \frac{1}{100} \times C_{B,i} \times \left(a_i \times \ln\left(P_{E,i}\right) - b_i + N_{Ave,i}\right)$$

where, for the i^{th} installed HE fan:

$C_{B,i}$ is the part-load compensation factor for the baseline fan control system, and is:

(a) if a variable speed drive was already installed—equal to $C_{C,i}$ as given by equation 8 (subsection 32(1)); and

(b) if a multi-speed or switching control was already installed—equal to $C_{C,i}$ as given by equation 9 (subsection 32(2)); and

(c) otherwise—equal to 1.

a_i is a regression coefficient, and is determined in accordance with Schedule 4.

$ln(P_{E,i})$ is the natural log of the motor input power ($P_{E,i}$), in kilowatts, of the fan, where $P_{E,i}$ has the same meaning as in section 27.

b_i is a regression constant, and is determined in accordance with Schedule 4.

$N_{Ave,i}$ is the market average efficiency grade of the fan, and is determined in accordance with Schedule 5.

32 Equations 8 and 9—part load compensation factor of installed HE fan ($C_{C,i}$)

(1) For equation 3 and equation 7, if paragraph (a) of the definition of $C_{C,i}$ or paragraph (a) of the definition of $C_{B,i}$ is applicable, $C_{C,i}$ is worked out using the equation (***equation 8***):

$$C_{C,i} = -a_i \times ln\left(P_{E,i}\right) + b_i$$

(2) For equation 3 and equation 7, if paragraph (b) of the definition of $C_{C,i}$ or paragraph (b) of the definition of $C_{B,i}$ is applicable, $C_{C,i}$ is worked out using the equation (***equation 9***):

$$C_{C,i} = \frac{1}{2} \times \left(1 - a_i \times \ln\left(P_{E,i}\right) + b_i\right)$$

(3) For this section, for the i^{th} installed HE fan:

a_i is a regression coefficient, and is:

(a) if the motor input power ($P_{E,i}$) of the fan is less than 5 kilowatts—0.030; and

(b) otherwise—0.

$ln(P_{E,i})$ is the natural log of the motor input power ($P_{E,i}$), in kilowatts, of the fan, where $P_{E,i}$ has the same meaning as in section 27.

b_i is a regression constant, and is:

(a) if the motor input power ($P_{E,i}$) of the fan is less than 5 kilowatts—1.088; and

(b) otherwise—1.04.

Division 4—Calculating net abatement from installed SM fans

33 Summary of this Division

The net abatement for each reporting period from all installed SM fans is the sum of the abatement amounts during the reporting period from each such fan.

34 Equation 10—net abatement from installed SM fans (A_{SM})

For equation 1, A_{SM} is worked out using the equation (***equation 10***):

$$A_{SM} = \sum_{i=1}^{n} A_{SM,i}$$

where:

$A_{SM,i}$ is the abatement amount for the reporting period from the i^{th} installed SM fan, calculated using equation 11 (section 35).

n is the number of installed SM fans over which abatement is calculated for the reporting period.

Note: See section 22 for fans to be used in the calculations.

35 Equation 11—abatement amount from each installed SM fan ($A_{SM,i}$)

For equation 10, $A_{SM,i}$ is worked out using the equation (***equation 11***):

$$A_{SM,i} = \left(P_{E,i} \times (a_i - CP_i) + b_i\right) \times t_i \times CF_i \times (1 + H_i) \times EF_{Elec,i} \times 0.9 \times 24 \times 10^{-6}$$

where, for the i^{th} installed SM fan:

$P_{E,i}$ is the motor input power, in watts, and is determined in accordance with section 19.

a_i is a regression coefficient and is determined in accordance with Schedule 6.

CP_i is the control parameter of the fan, and is determined in accordance with Schedule 7.

b_i is a regression constant, and is and is determined in accordance with Schedule 6.

t_i is the number of days in the reporting period for the fan after it is commissioned.

CF_i is the capacity factor for the fan, and has the same meaning as in section 27.

H_i is the heat load adjustment for the fan, and has the same meaning as in section 27.

$EF_{Elec,i}$ is the emissions factor for electricity, and has the same meaning as in section 27.

Note: The factor 0.9, in equation 11, is a fan mismatch factor that accounts for the loss of efficiency due to mismatch of the components of the fan, after modification or replacement, with other components of the refrigeration or ventilation system.

Part 5—Reporting, notification and record-keeping requirements

Note Other reporting, notification, record-keeping, and monitoring requirements are set out in regulations and rules made under the Act.

Division 1—Offsets report requirements

36 Operation of this Division

For paragraph 106(3)(a) of the Act, this Division sets out information that must be included in an offsets report about a refrigeration and ventilation fan project that is an eligible offsets project.

37 Information that must be included in an offsets report

(1) An offsets report for a reporting period must identify each installed HE fan and each installed SM fan that was included in a calculation undertaken in accordance with Part 4 for the reporting period, in the form approved by the Regulator.

(2) Each fan must be identified by:
  (a) whether the fan is an installed HE fan or an installed SM fan; and
  (b) the street address of the building where the fan is installed; and
  (c) whether the fan:
    (i) was included in the most recent previous offsets report; or
    (ii) is an old installation that was excluded from the most recent previous report; or
    (iii) is a new installation that has not been included in a previous report; and
  (d) if the fan is one that can be classified as both an installed HE fan and an installed SM fan (see subsection 22(3))—that fact.

(3) For each fan or motor that was installed as part of the project, the offsets report must indicate:
  (a) the brand; and
  (b) the manufacturer; and
  (c) the model number.

(4) For a fan that was included in calculations for an earlier reporting period, but is not included in calculations for the reporting period to which the offsets report relates, the report must state:
  (a) the reason for the exclusion; and
  (b) whether the exclusion is expected to be temporary or permanent.

(5) In addition, each fan must be identified by:
  (a) the location of the fan in the form and detail required by the Regulator; and
  (b) whether the fan is a refrigeration fan or a ventilation fan; and
  (c) for a refrigeration fan—the type of refrigeration system; and
  (d) for a ventilation fan:
    (i) whether the fan is a heating/cooling ventilation fan or a ducted or partition ventilation fan; and
    (ii) the building type of the building serviced by the fan; and

(iii) in the case of a heating/cooling ventilation fan—the NCC climate zone of the building's location; and

(e) the motor input power of the fan; and

(f) for each installed HE fan:

(i) the installation category; and

(ii) the eligible fan type; and

(g) for each installed SM fan—whether a control system has been fitted to the electronically commutated motor of the fan.

(6) If, in the circumstances described in paragraph 8(2)(b), a factor or parameter is defined or calculated for a reporting period by reference to an instrument or writing as in force from time to time, the offsets report about the project for the reporting period must describe the reasons why it was not possible to define or calculate the factor or parameter by reference to the instrument or writing as in force at the end of the reporting period.

Division 2—Notification requirements

38 Operation of this Division

For paragraph 106(3)(b) of the Act, this Division sets out requirements to notify certain matters relating to a refrigeration and ventilation fan project that is an eligible offsets project to the Regulator.

39 Notification requirements

(1) The project proponent must notify the Regulator of any safety issue that has been identified with any project component as soon as practicable after becoming aware of the issue.

(2) The project proponent must notify the Regulator of any product performance issue that has been identified with any project component, within 30 days after becoming aware of the issue, if:

(a) a product recall notice has been issued in relation to the issue; or

(b) the sum of the motor input powers of all of the fans that are affected by the issue is more than 5 per cent of the sum of the motor input powers of all of the fans that are installed, modified or replaced as part of the project; or

(c) the issue affects more than 50 of the fans that are installed, modified or replaced as part of the project.

(3) For this section, the following are ***project components***:

(a) a fan installed or proposed to be installed (whether as an installation or as a replacement) as part of the project;

(b) a component used or proposed to be used to modify a fan.

Division 3—Record-keeping requirements

40 Operation of this Division

For paragraph 106(3)(c) of the Act, this Division sets out record-keeping requirements for a refrigeration and ventilation fan project that is an eligible offsets project.

41 Record-keeping requirements

(1) The project proponent must keep the following records in relation to each installed HE fan and each installed SM fan:

(a) for a ventilation fan:

(i) the building type of the building serviced by the fan; and

(ii) the location of the fan within or with respect to the building;

(b) for a refrigeration fan:

(i) the type of refrigeration system in which the fan is installed; and

(ii) the location of the fan within or with respect to the refrigeration system;

(c) whether the project involved an installation of a new fan, or a modification or replacement of an existing fan;

(d) for each fan or motor that was installed as part of the project—records that evidence:

(i) the motor input power, as evidenced by the supplier's product specifications or standard test reports; and

(ii) the nominal motor power;

(e) for each fan that was modified or replaced—records that evidence:

(i) the motor input power; and

(ii) the nominal motor power;

of the original fan.

(2) The proponent must keep the following additional records in relation to each installed HE fan:

(a) where an existing fan was replaced—records evidencing the fan type of the replaced fan;

(b) records of the ducting arrangement of the fan sufficient to establish the installation category;

(c) records that demonstrate that the model of each fan has been tested in accordance with section 16 (including records of testing produced by the relevant testing laboratory—see subsection 16(3));

(d) records of any relevant publication relied on for the purposes of subparagraph (a)(i) of the definition of $\eta_{C,i}$ in section 28 of this determination and section 4 of Schedule 1.

Note: Paragraph (d) applies in relation to $\eta_{C,i}$ as it appears in both sections 28 and 30.

(3) The project proponent must keep the following additional records in relation to each installed SM fan:

(a) evidence that the fan is driven by an electronically commutated motor;

(b) the supplier's product specifications for any control system fitted to the electronically commutated motor;

(c) for the fan that was replaced or modified—evidence that it was driven by a shaded pole motor or permanent split capacitor motor before the project;

(d) evidence that any fan or component removed as part of the project was disposed of in accordance with section 18 and any other applicable legislative requirements.

Part 6—Dividing a refrigeration and ventilation fan project

42 Division of project for reporting purposes

For subsection 77A(2) of the Act, the project may be divided into parts only if:

(a) each part would qualify as a refrigeration and ventilation fan project; and

(b) each part has achieved an abatement of at least 2,000 tonnes CO_2-e in the reporting period before the division; and

(c) all fans that:

(i) are installed, modified or replaced as part of the project; and

(ii) are in the same building, or buildings with the same physical address;

are in the same part.

Schedule 1—High efficiency fan installations—operating efficiency and high efficiency threshold

Note: The definitions of several parameters used in this Schedule mirror the corresponding definitions in Division 3 of Part 4, and the values of those parameters calculated for the purposes of this Schedule can be re-used when undertaking calculations for the purposes of that Division.

Division 1—Purpose of Schedule

1 Purpose of Schedule

This Schedule sets out how to determine:

(a) the operating efficiency (see Division 2 of this Schedule); and

(b) the high efficiency threshold (see Division 3 of this Schedule);

for a fan, for the purposes of subparagraph 9(3)(a)(iii) of this determination.

Division 2—Calculating operating efficiency of fan

2 Equation 12—determining operating efficiency of fan ($\eta_{Operating,i}$)

The operating efficiency of a particular fan i, $\eta_{Operating,i}$, is worked out using the equation (***equation 12***):

$$\eta_{Operating,i} = \eta_i \times C_{C,i}$$

where:

η_i is the overall driven fan efficiency of the fan, and is:

(a) if the model of the fan was tested with the same drive, motor and transmission as the fan (see paragraph 16(4)(b) of this determination)—the overall driven fan efficiency given by equation 13; and

(b) otherwise—the overall driven fan efficiency given by equation 14.

$C_{C,i}$ is the part load compensation factor for the controller of the fan, and is:

(a) if the motor is controlled by a variable speed drive that is to be installed as part of the project—the value given by equation 16 (subsection 5(1) of this Schedule); and

(b) if the motor is controlled by a multi-speed control or a switching control that is to be installed as part of the project—the value given by equation 17 (subsection 5(2) of this Schedule); and

(c) otherwise—1.

3 Equations 13 and 14—calculation of overall driven fan efficiency (η_i)

(1) For equation 12, if paragraph (a) of the definition of η_i is applicable, η_i is worked out using the equation (***equation 13***):

$$\eta_i = \frac{P_{U,i}}{P_{E,i}}$$

where:

$P_{U,i}$ is the fan air power or fan static air power (as appropriate) in kilowatts, as measured in testing using the same drive, motor and transmission as the fan to be installed.

$P_{E,i}$ is the motor input power of the fan in kilowatts, as measured in testing using the same drive, motor and transmission as the fan to be installed.

Note: For the testing for $P_{U,i}$ and $P_{E,i}$, see paragraphs 16(4)(b) and (5)(d) and (e) of this determination.

(2) For equation 12, if paragraph (b) of the definition of η_i is applicable, η_i is worked out using the equation (***equation 14***):

$$\eta_i = \frac{P_{U,i}}{P_{E,i}} \times 0.9$$

where:

$P_{U,i}$ is the fan air power or fan static air power (as appropriate) in kilowatts as determined from test results in accordance with section 16 of this determination.

$P_{E,i}$ is the motor input power of the fan in kilowatts, as calculated in accordance with equation 15.

Note: The factor 0.9 is a mismatch factor that reflects that the testing was not done with the same drive, motor and transmission of the fan to be installed.

4 Equation 15—calculation of motor input power, $P_{E,i}$

For subsection 3(2) of this Schedule, $P_{E,i}$ is calculated using the following equation (***equation 15***):

$$P_{E,i} = \frac{P_{M,i}}{\eta_{T,i} \times \eta_{M,i} \times \eta_{C,i}}$$

where:

$P_{M,i}$ is the mechanical power supplied to the fan impeller of the fan, being:

(a) for a fan that has a shaft—the fan shaft power, in kilowatts; and

(b) for a fan that does not have a shaft—the fan impeller power, in kilowatts;

as determined from test results in accordance with section 16 of this determination.

$\eta_{T,i}$ is the transmission efficiency of the transmission of the fan, and is determined in accordance with Schedule 3.

$\eta_{M,i}$ is the motor efficiency of the motor of the fan, as determined from test results in accordance with section 16 of this determination.

$\eta_{C,i}$ is the electrical drive efficiency of the controller of the fan, and is:

(a) if a variable speed drive is installed (whether or not as part of the project) and:

(i) the manufacturer or supplier has publicly released data in Australia relating to the electrical drive efficiency of the controller—the electrical drive efficiency ascertained in accordance with that data that corresponds to the point at which the impeller is operating at optimum efficiency; and

(ii) if subparagraph (i) does not apply—0.95; and

(b) if a variable speed drive is not installed—1.

5 Equations 16 and 17—calculating part load compensation factor for controller of fan, $C_{C,i}$

(1) For equation 12, if paragraph (a) of the definition of $C_{C,i}$ is applicable, $C_{C,i}$ is worked out using the equation (***equation 16***):

$$C_{C,i} = -a_i \times \ln(P_{E,i}) + b_i$$

(2) For equation 12, if paragraph (b) of the definition of $C_{C,i}$ is applicable, $C_{C,i}$ is worked out using the equation (***equation 17***):

$$C_{C,i} = \frac{1}{2} \times (1 - a_i \times \ln(P_{E,i}) + b_i)$$

(3) For this section, for fan *i*:

***a*$_i$** is a regression coefficient, and is:

(a) if the motor input power ($P_{E,i}$) of the fan is less than 5 kilowatts—0.030; and

(b) otherwise—0.

ln(P$_{E,i}$) is the natural log of the motor input power ($P_{E,i}$), in kilowatts, of the fan.

P$_{E,i}$ is the motor input power, in kilowatts, of the fan, and is:

(a) if the model of the fan was tested with the same drive, motor and transmission as the fan—the motor input power of the fan in kilowatts, as referred to in subsection 3(1) of this Schedule; and

(b) otherwise—the motor input power of the fan in kilowatts, as referred to in subsection 3(2) of this Schedule.

***b*$_i$** is a regression constant, and is:

(a) if the motor input power ($P_{E,i}$) of the fan is less than 5 kilowatts—1.088; and

(b) otherwise—1.04.

Division 3—Calculating high efficiency threshold for the fan

6 Equation 18—determining the high efficiency threshold for the fan ($\eta_{HE,i}$)

The high efficiency threshold of a particular fan *i*, $\eta_{HE,i}$, is worked out using the equation (***equation 18***):

$$\eta_{HE,i} = \frac{a_i \times \ln(P_{E,i}) - b_i + N_{HE,i}}{100}$$

where, for fan *i*:

***a*$_i$** is a regression coefficient, and is determined in accordance with Schedule 4.

ln(P$_{E,i}$) is the natural log of the motor input power ($P_{E,i}$), in kilowatts, of the fan, where $P_{E,i}$ has the same meaning as in section 5 of this Schedule.

***b*$_i$** is a regression constant, and is determined in accordance with in Schedule 4.

N$_{HE,i}$ is the high efficiency grade of the fan, and is determined in accordance with Schedule 5.

Schedule 2—Building types and capacity factors

1 Meaning of *building type*

For this determination, the ***building type*** of a particular building is:

(a) if the building is of a single building type listed in the table below—that building type; and

(b) if the building is of more than 1 building type listed in the table—whichever of those building types that has the lowest capacity factor CF_i specified in the table for a ducted or partition ventilation fan.

2 Capacity factors

For equations 3 and 11 (sections 27 and 35 of this determination), the capacity factor CF_i is:

(a) for a ducted or partition ventilation fan—the value indicated in the table below for the building type of the building the i^{th} fan services; and

(b) for a heating/cooling ventilation fan—the value indicated in the table below for:

(i) the building type of the building the i^{th} fan services; and

(ii) the NCC climate zone in which the building is located; and

(iii) the functions (heating, cooling, or both heating and cooling) the fan services.

3 Interpretation

A term that is used in this Schedule and the BCA has the same meaning as in the BCA.

Building type	CF_i for a ducted or partition ventilation fan	CF_i for a heating/cooling ventilation fan							
		Heating, cooling or both	NCC climate zone						
			1	2	3	4	5	6	7 and 8
BCA class 2 (multi-unit dwellings) (see the Note)	0.72	Heating	0.008	0.194	0.184	0.380	0.355	0.527	0.619
		Cooling	0.690	0.511	0.352	0.247	0.303	0.138	0.059
		Both	0.694	0.675	0.528	0.608	0.639	0.642	0.668
BCA class 3 (hotels)	0.72	Heating	0.008	0.194	0.184	0.380	0.355	0.527	0.619
		Cooling	0.690	0.511	0.352	0.247	0.303	0.138	0.059
		Both	0.694	0.675	0.528	0.608	0.639	0.642	0.668
BCA class 5 (offices)	0.32	Heating	0.001	0.034	0.043	0.127	0.112	0.199	0.247
		Cooling	0.314	0.260	0.186	0.143	0.167	0.080	0.038
		Both	0.315	0.289	0.228	0.264	0.273	0.271	0.282
BCA class 6 (shops or shopping centres)	0.46	Heating	0.000	0.044	0.054	0.171	0.151	0.273	0.343
		Cooling	0.442	0.366	0.264	0.204	0.238	0.116	0.055
		Both	0.442	0.403	0.317	0.369	0.382	0.378	0.394

Note: As a result of paragraph 12(i) of this determination, in a building of BCA class 2 (multi-unit dwellings), a project proponent is able to carry out the project only in relation to a fan that provides services to the common areas of the building, or that is otherwise operated or maintained by the body corporate or building owner.

Building type	CF_i for a ducted or partition ventilation fan	CF_i for a heating/cooling ventilation fan							
		Heating, cooling or both	NCC climate zone						
			1	2	3	4	5	6	7 and 8
BCA class 6 (restaurants or cafes)	0.59	Heating	0.000	0.082	0.082	0.233	0.213	0.366	0.455
		Cooling	0.565	0.456	0.325	0.248	0.293	0.141	0.066
		Both	0.565	0.525	0.405	0.473	0.495	0.492	0.515
BCA class 7a (car parks)	0.40	Heating	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		Cooling	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		Both	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BCA class 7b (warehouses), ANZSIC Division A	1	Heating	0.011	0.270	0.256	0.528	0.494	0.733	0.860
		Cooling	0.958	0.710	0.489	0.342	0.421	0.191	0.082
		Both	0.964	0.938	0.733	0.844	0.887	0.892	0.927
BCA class 7b (warehouses), other than ANZSIC Division A	0.57	Heating	0.000	0.082	0.082	0.233	0.213	0.366	0.455
		Cooling	0.565	0.456	0.325	0.248	0.293	0.141	0.066
		Both	0.565	0.525	0.405	0.473	0.495	0.492	0.515
BCA class 8 (factories), ANZSIC Division A or C	0.57	Heating	0.000	0.082	0.082	0.233	0.213	0.366	0.455
		Cooling	0.565	0.456	0.325	0.248	0.293	0.141	0.066
		Both	0.565	0.525	0.405	0.473	0.495	0.492	0.515
BCA class 8 (factories), other than ANZSIC Division A or C	0.32	Heating	0.001	0.034	0.043	0.127	0.112	0.199	0.247
		Cooling	0.314	0.260	0.186	0.143	0.167	0.080	0.038
		Both	0.315	0.289	0.228	0.264	0.273	0.271	0.282
BCA class 9a (clinics)	0.32	Heating	0.001	0.034	0.043	0.127	0.112	0.199	0.247
		Cooling	0.314	0.260	0.186	0.143	0.167	0.080	0.038
		Both	0.315	0.289	0.228	0.264	0.273	0.271	0.282
BCA class 9a (hospitals)	0.68	Heating	0.008	0.184	0.174	0.359	0.336	0.498	0.585
		Cooling	0.652	0.483	0.333	0.233	0.286	0.130	0.056
		Both	0.656	0.638	0.498	0.574	0.603	0.607	0.630
BCA class 9b (theatres)	0.23	Heating	0.000	0.084	0.081	0.230	0.213	0.364	0.455
		Cooling	0.567	0.455	0.324	0.249	0.294	0.142	0.066
		Both	0.567	0.526	0.404	0.471	0.496	0.493	0.515
BCA class 9b (schools)	0.23	Heating	0.000	0.017	0.028	0.085	0.073	0.140	0.175
		Cooling	0.228	0.194	0.137	0.108	0.126	0.059	0.029
		Both	0.228	0.207	0.164	0.190	0.196	0.194	0.201
BCA class 9c (aged care)	0.72	Heating	0.008	0.194	0.184	0.380	0.355	0.527	0.619
		Cooling	0.690	0.511	0.352	0.247	0.303	0.138	0.059
		Both	0.694	0.675	0.528	0.608	0.639	0.642	0.668

Schedule 3—High efficiency fan installations—transmission efficiency

(1) For equation 4 and equation 15 (section 28 of this determination and section 4 of Schedule 1), for the definition of $\eta_{T,i}$, if the i^{th} fan has:

(a) a transmission type indicated in the table below; and

(b) a mechanical power supplied to the fan impeller ($P_{M,i}$) within a range indicated in the table;

the transmission efficiency of the transmission of the fan ($\eta_{T,i}$) is given by the corresponding entry in the table.

High efficiency fan installations: Transmission efficiency

	Transmission efficiency ($\eta_{T,i}$)		
Transmission type	**$P_{M,i}$ < 1 kW**	**1 kW ≤ $P_{M,i}$ < 5 kW**	**5 kW ≤ $P_{M,i}$**
Direct drive transmission	1	1	1
High efficiency transmission	0.94	$0.93 + 0.01 \times P_{M,i}$	0.98
Low efficiency transmission	0.89	$0.8725 + 0.0175 \times P_{M,i}$	0.96

(2) In this Schedule:

direct drive transmission means a transmission system that transmits power directly from the motor to the impeller or to a rigid impeller shaft without gearboxes, belts or flexible couplings, such that the motor and the impeller rotate at the same speed.

high efficiency transmission means a transmission for a fan using:

(a) a belt with a width at least three times the height of the belt; or

(b) a toothed belt; or

(c) toothed gears.

low efficiency transmission means a transmission for a fan other than a direct drive transmission or a high efficiency transmission.

$P_{M,i}$ is the mechanical power supplied to the fan impeller, and is defined in section 28 of this determination or section 4 of Schedule 1, as appropriate.

Schedule 4—High efficiency fan installations—regression coefficients and regression constants

For equations 7 and 18 (section 31 of this determination and section 6 of Schedule 1), if the model of the i^{th} fan:

(a) is of an eligible fan type indicated in the table below; and

(b) has a motor input power within a range indicated in the table;

the regression coefficient (a_i) and the regression constant (b_i) are the corresponding values indicated in the table:

High efficiency fan installations:
Regression coefficients and regression constants

	0.125 kW ≤ $P_{E,i}$ < 10 kW		**10 kW ≤ $P_{E,i}$ ≤ 185 kW**	
Eligible fan type	**Regression coefficient (a_i)**	**Regression constant (b_i)**	**Regression coefficient (a_i)**	**Regression constant (b_i)**
Axial-flow fan	2.74	6.33	0.78	1.88
Cross-flow fan	1.14	2.6	0	0
Mixed-flow fan	4.56	10.5	1.1	2.6
Centrifugal backward-curved fan	4.56	10.5	1.1	2.6
Centrifugal radial bladed fan	2.74	6.33	0.78	1.88
Centrifugal forward-curved fan	2.74	6.33	0.78	1.88

Schedule 5—High efficiency fan installations—static and total efficiency benchmarks

For section 15 of this determination, and for equations 7 and 18 (section 31 of this determination and section 6 of Schedule 1), if the model of the i^{th} fan:

(a) is of an eligible fan type indicated in the table below; and

(b) was tested using an installation category indicated in the table;

the market average efficiency grade ($N_{ave,i}$) and the high efficiency grade ($N_{HE,i}$) of the fan are the corresponding values indicated in the table.

High efficiency fan installations:
Market average efficiency grade and high efficiency grade

	Installation category A or installation category C (static efficiency grades)		**Installation category B or installation category D (total efficiency grades)**	
Eligible fan type	**Market average efficiency grade ($N_{ave,i}$)**	**High efficiency grade ($N_{HE,i}$)**	**Market average efficiency grade ($N_{ave,i}$)**	**High efficiency grade ($N_{HE,i}$)**
Axial-flow fan	38.0	42.0	54.0	61.0
Centrifugal forward-curved fan	40.5	46.0	45.5	51.5
Centrifugal radial bladed fan	40.5	46.0	45.5	51.5
Centrifugal backward-curved fan without housing	60.0	64.0	–	–
Centrifugal backward-curved fan with housing	59.5	64.0	62.5	64.0
Mixed-flow fan	48.5	52.5	60.0	65.0
Cross-flow fan	–	–	17.0	21.0

Schedule 6—Small motor fan upgrades—regression coefficients and regression constants

For equation 11 (section 35), for the i^{th} fan, if the motor input power $P_{E,i}$ falls within a range indicated in the table below, the regression coefficient a_i and the regression constant b_i are given by the corresponding entry of the table:

Small motor fan upgrades:
Regression coefficients and regression constants

Item	Motor input power ($P_{E,i}$)	Regression coefficient (a_i)	Regression constant (b_i) (watts)
1	$P_{E,i} \leq 110$ W	1.7692	19.385
2	110 W $< P_{E,i} \leq 175$ W	1.2698	6.453

Schedule 7—Small motor fan upgrades—control parameters

For equation 11 (section 35), if the circumstances set out in an item of the table below apply in relation to the control system of the i^{th} fan that is modified or replaced as part of a small motor fan upgrade, the control parameter for the fan is the corresponding value given by the table:

Small motor fan upgrades: Control parameters

Item	Circumstances relating to control system of i^{th} fan	Control parameter (CP_i)
1	For the i^{th} fan: (a) the fan after modification or replacement has a control system consisting of a variable speed drive; and (b) the fan before modification or replacement did not have a control system.	0.8
2	For the i^{th} fan: (a) the fan after modification or replacement has a control system consisting of a multi-speed control or a switching control; and (b) the fan before modification or replacement did not have a control system.	0.9
3	For the i^{th} fan: (a) the fan after modification or replacement has a control system consisting of a variable speed drive; and (b) the fan before modification or replacement had a control system consisting of a multi-speed control or a switching control.	0.9
4	Any other case	1