

Australian Capital Territory

Climate Change and Greenhouse Gas Reduction (Greenhouse Gas Emissions Measurement Method) Determination 2015

Disallowable instrument DI2015–264

made under the

Climate Change and Greenhouse Gas Reduction Act 2010 (the Act), s 11 (Measuring greenhouse gas emissions – determinations)

1 Name of instrument

This instrument is the *Climate Change and Greenhouse Gas Reduction (Greenhouse Gas Emissions Measurement Method) Determination 2015*.

2 Commencement

This instrument commences on the day after it is notified.

3 Determination of method for measuring greenhouse gas emissions

I determine the method for measuring the amount of greenhouse gas emissions in the ACT as set out in the schedule.

Note The Greenhouse Gas Emissions Measurement Method is used, under s12 of the *Climate Change and Greenhouse Gas Reduction Act 2010*, by an independent entity to prepare a report for the Minister about greenhouse gas emissions in the ACT for the year.

4 Revocation

I revoke the *Climate Change and Greenhouse Gas Reduction (Greenhouse Gas Emissions Measurement Method) Determination 2013 (DI2013-76)*.

Simon Corbell MLA
Minister for the Environment
10 September 2015

Schedule to the Climate Change and Greenhouse Gas Reduction (Greenhouse Gas Emissions Measurement Method) Determination 2015

1. Objects of the determination

This determination sets out the method for the measurement of greenhouse gas emissions arising from sources, or attributable to activities, located within the geographic boundary of the Australian Capital Territory (ACT).

2. Application of the determination

The method determined in this instrument must be used to measure the amount of greenhouse gas emissions in the ACT for the year (the annual emissions amount) in the annual report prepared by an independent entity as required under section 12 of the Act.

3. Greenhouse gas emissions covered

The emissions covered by this determination are:

- Scope 1 emissions from:
 - fuel combustion
 - fugitive emissions from fuels
 - industrial processes
 - agriculture
 - land use, land use change and forestry
 - waste.
- Scope 2 emissions from electricity consumption in the ACT, adjusted for scope 3 electricity transmission and distribution losses.

4. Definitions

In this Determination:

Action Plan 2 means AP2 – A new climate change strategy and action plan for the Australian Capital Territory

carbon dioxide equivalence or *CO₂-e*, means the amount of greenhouse gas multiplied by its specific global warming potential.

dry wood means wood that:

- a) has a moisture content of 20% or less if the moisture content is calculated on a wet basis; and
- b) is combusted to produce heat.

emission factors refer to the kilograms of carbon dioxide equivalent emitted per unit of activity.

energy content factor, for a fuel, means gigajoules of energy per unit of the fuel measured as a gross calorific value.

fugitive emissions means the release of emissions that occur during the extraction, processing and delivery of fossil fuels.

global warming potential refers to an index (on a 100 year time horizon) representing the combined effect of the differing times greenhouse gases remain in the atmosphere and their relative effectiveness in absorbing outgoing infrared radiation.

greenhouse gas emissions has the meaning given by the *Climate Change and Greenhouse Gas Reduction Act 2010*.

GreenPower means renewable energy purchased in accordance with the Australian Government's GreenPower program.

scope 1 emissions refer to the emission of greenhouse gases directly resulting from an activity, or series of activities (including ancillary activities).

scope 2 emissions refer to the emission of greenhouse gases that occurs outside the ACT as a consequence of using grid-supplied electricity, heating and/or cooling within the ACT.

scope 3 emissions refer to the emission of greenhouse gases not included as a scope 1 or scope 2 emission that occur outside the ACT as a result of activities within the jurisdiction due to use of goods and services. Scope 3 emissions include electricity transmission and distribution losses.

5. Method for calculating emissions from stationary energy

The method for calculating the emissions from stationary energy will be made using the equations presented below:

5.1 Electricity

The calculation of Scope 2 emissions attributable to consumption of electricity by ACT consumers using the market based method is particularly complex because of the many different sources of zero emission electricity for which ACT consumers are paying and because of the interaction between the physical and the financial transactions in the National Electricity Market (NEM). Relating to this latter point, the calculation relies on the propositions that the ACT is part of the NSW region of the NEM, that the NSW region exchanges electrical energy with Victoria and Queensland through the relevant interconnectors, that interconnector flows are sourced from the marginal source of generation in each region, and that the marginal source in all three regions is coal fired generation.

In order to make the steps in the calculation somewhat easier to follow, the methodology is structured in three parts. The first part calculates the total quantity of zero emission electricity (electricity supplied by renewable generators) is being paid for by ACT electricity consumers. This includes renewable generation forming a component of day to day generation supplying the NEM in NSW, including long

established hydro generators (mainly the Snowy Hydro power stations) and wind generators constructed under the Large Renewable Energy Target (LRET) scheme. The second part calculates the average emissions intensity of non-renewable electricity being supplied through the NEM in the NSW region. The third part calculates how much of this electricity is required to meet the total demand for electricity by ACT consumers (including electricity lost in the ActewAGL distribution network) and the total quantity of emissions associated with that quantity of electricity, based on the average emissions intensity of NSW region non-renewable electricity, as calculated in the preceding part of the overall calculation.

5.1.1 Calculate total renewable electrical energy being paid for by ACT electricity consumers

5.1.1.1 LRET purchases

$$S_1 = \alpha_i \times (\beta_i + \gamma_i)$$

Where,

S_1 = Total LRET purchases;
 α_i = Renewable power percentage;
 β_i = Total electricity supplied to residential customers;
 γ_i = Total electricity supplied to non-residential and other customers.

Data sources:

α_i - Clean Energy Regulator <http://www.cleanenergyregulator.gov.au/RET/About-the-Renewable-Energy-Target/The-certificate-market/The-renewable-power-percentage>.
 β_i - ActewAGL Distribution (a component of the annual Regulatory Information Notices (RIN) submission to the Australian Energy Regulator (AER)).

5.1.1.2 GreenPower

$$S_2 = \sum_i \delta_i$$

Where,

S_2 = Total GreenPower sales in the ACT;
 $\sum_i \delta_i$ = Sum of Quarterly GreenPower Sales in the ACT

Data sources:

$\sum_i \delta_i$ - National GreenPower™ Accreditation Program. Annual Compliance Audit for 1 January 2013 to 31 December 2013 <http://www.greenpower.gov.au/Business-Centre/Annual-Audit/~media/7E75EC20541B4CA39E97DE708D1816B6.pdf> (see Table 8: Summary of GreenPower Sales 2013 (MWh)).

Also National GreenPower Accreditation Program Status Report. Executive Summary.

Quarterly status of National GreenPower Accreditation Program

http://www.greenpower.gov.au/~media/Business%20Centre/Quarterly%20Reports/2014_Q4_Report.pdf

5.1.1.3 Rooftop photovoltaics (PV)

$$S_3 = \sum_i \varepsilon_i$$

Where,

S_3 = Total Rooftop PV output;

$\sum_i \varepsilon_i$ = Sum of metered output in the year of all PV installations with capacity less than 200 kW in the following categories:

- supplied with ACT feed in tariff (f.i.t.)
- supplied under gross metering but without f.i.t.
- supplied under net metering.

Data sources:

$\sum_i \varepsilon_i$ - As advised by ActewAGL Distribution in regular reports to the ACT Environment and Planning Directorate

5.1.1.4 Below Baseline NSW region NEM renewable generation

For each of the following Stations: Hume, Blowering, Guthega, Tumut 1, Tumut 2, Tumut 3 (net of pump energy input)ⁱ:

$$S_4 = \sum_{n=1}^6 \left(\text{Min} \left(ES_n, \left(\frac{\omega_n + \varphi_n}{2} \right) \right) \right) \times \left(\frac{ED}{(ND_{NSW} - NG_{NSW} - TL_{NSW})} \right)$$

Where,

For each of the following Stations:

1 = Hume;

2 = Blowering;

3 = Guthega;

4 = Tumut 1;

5 = Tumut 2;
 6 = Tumut 3 (net of pump energy input);
 $Min\left(ES_n, \left(\frac{\omega_n + \varphi_n}{2}\right)\right)$ = the lesser of:

- ES_n = electrical energy sent out in the inventory year, and
- $\frac{\omega_n + \varphi_n}{2}$ = the simple average of the Renewable Energy Target (RET) Baseline in the calendar year covering the first half of the reporting year and the calendar year covering the second half of the reporting year.

ED = Electrical energy supplied by TransGrid to ActewAGL Distribution;
 ND_{NSW} = Total NSW region Native demand;
 NG_{NSW} = NSW region Small Non-scheduled Generation;
 TL_{NSW} = NSW region transmission losses.

Data sources:

Info for each station - Clean Energy Regulator <https://www.rec-registry.gov.au/rec-registry/app/public/power-station-register>
 ED - Australian Energy Regulator <http://www.aer.gov.au/node/24311>
 ND_{NSW} - Australian Energy Market Operator <http://forecasting.aemo.com.au/AnnualConsumption>
 NG_{NSW} - Australian Energy Market Operator <http://forecasting.aemo.com.au/AnnualConsumption>
 TL_{NSW} - Australian Energy Market Operator <http://forecasting.aemo.com.au/AnnualConsumption>

5.1.1.5 Total metered electrical energy sent out from all renewable generators contracted by the ACT Government under Action Plan 2.

$$S_5 = \sum_i \mu_i$$

Where,

$\sum_i \mu_i$ = Sum of metered electrical energy sent out by all renewable generators contracted by the ACT Government under Action Plan 2.

5.1.1.6 Total renewable electrical energy being paid for by ACT electricity consumers

$$S_{renew} = \sum_{n=1}^5 S_n$$

Where,

- S_1 = Total LRET purchases;
- S_2 = Total GreenPower sales in the ACT;
- S_3 = Total Rooftop PV output;
- S_4 = Below Baseline NSW region NEM renewable generation;
- S_5 = Total metered electrical energy sent out from all renewable generators contracted by the ACT Government under Action Plan 2.

5.1.2 Calculate the emissions intensity of other electricity supplied through the NEM

5.1.2.1 Calculate the average sent out emissions intensity of NSW coal fired generation

$$El_{NSW} = \frac{\sum_i \left(\frac{S_i \times E_i}{(1 - aux_i)} \right)}{\sum_i \left(\frac{S_i}{(1 - aux_i)} \right)}$$

Where

- El_{NSW} = The average sent out emissions intensity of NSW coal fired generation
- S_i = Electricity generated at coal fired generator i in the inventory year
- E_i = As generated emissions intensity of coal fired generator i in the inventory year
- aux_i = Auxiliary factor for generator i

Data sources:

- S_i - Data on S , Exp and Imp from Australian Energy Market Operator:
<http://www.aemo.com.au/Electricity/Data/Market-Management-System-MMS/Generation-and-Load> and <http://www.aemo.com.au/Electricity/Data/Market-Management-System-MMS/Dispatch>
- aux_i - Data on e and aux from Australian Energy Market Operator :
<http://www.aemo.com.au/Electricity/Planning/Related-Information/Planning-Assumptions>

5.1.2.2 Calculate the average sent out emissions intensity of Queensland coal fired generation

$$El_{Qld} = \frac{\sum_j \left(\frac{S_j \times E_j}{(1 - aux_j)} \right)}{\sum_j \left(\frac{S_j}{(1 - aux_j)} \right)}$$

Where

El_{Qld} = Average sent out emissions intensity of Queensland coal fired generation
 S_j = Electricity generated at coal fired generator j in the inventory year
 E_j = As generated emissions intensity of coal fired generator j in the inventory year
 aux_j = Auxiliary factor for generator j

5.1.2.3 Calculate the average sent out emissions intensity of Victorian coal fired generation

$$El_{Vic} = \frac{\sum_k \left(\frac{S_k \times E_k}{(1 - aux_j)} \right)}{\sum_k \left(\frac{S_k}{(1 - aux_k)} \right)}$$

Where,

S_k = Electricity generated at coal fired generator k in the inventory year
 E_k = As generated emissions intensity of coal fired generator k in the inventory year
 aux_k = Auxiliary factor for generator k

5.1.2.4 Calculate the total emissions from coal fired generation consumed in NSW

$$E_{coal} = \left(\sum_i \frac{S_i}{(1 - aux_i)} - Exp_{vic} - Exp_{Qld} \right) \times El_{NSW} + Imp_{vic} \times El_{Vic} + Imp_{Qld} \times El_{Qld}$$

Where,

E_{coal} = Total emissions from coal fired generation consumed in NSW
 Exp_{vic} = Exports of electricity from NSW to Victoria
 Exp_{Qld} = Exports of electricity from NSW to Queensland
 Imp_{vic} = Imports of electricity to NSW from Victoria
 Imp_{Qld} = Imports of electricity to NSW from Queensland

5.1.2.5 Calculate the average sent out emissions intensity of fossil fuel electricity consumed in NSW

$$El_{fossil} = \left(E_{coal} + \frac{\sum_g \left(\frac{S_g \times E_g}{(1 - aux_g)} \right)}{\sum_g \left(\frac{S_g}{(1 - aux_g)} \right)} - Exp_{vic} - Exp_{Qld} + Imp_{vic} + Imp_{Qld} + \sum_g \frac{S_g}{(1 - aux_g)} \right)$$

Where,

El_{fossil} = Sent out emissions intensity of NSW fossil fuel generation

S_g = Electricity generated at NSW gas and petroleum fired generator g in the inventory year

E_g = As generated emissions intensity of gas and petroleum fired generator g in the inventory year

aux_g = Auxiliary factor for generator g

5.1.3 Calculate total Scope 2 emissions attributable to electricity consumed in the ACT

$$E_{elec} = (D - S_{renew}) \times El_{fossil}$$

Where,

E_{elec} = Scope 2 emissions of electricity consumed in the ACT

D = Total consumption of electricity, including distribution losses, in the ACT in the inventory year

Data sources:

D - ActewAGL Distribution (a component of the annual RIN submission to the AER)

5.2 Natural gas

Annual emissions are calculated using the following equation:

$$E_{NG} = (Q_{NG} - Q_{Action} \times EC_{NG}) \times EF_{NG} / 10^6 \quad (2)$$

Where:

E_{NG} is emissions from natural gas consumption in kilotonnes of CO₂-e
 Q_{NG} is the consumption of purchased natural gas in the ACT, in gigajoules
 Q_{Action} is natural gas used by the ACTION bus fleet, in cubic metres
 EC_{NG} is the energy content of natural gas, in gigajoules per cubic metre
 EF_{NG} is the Scope 1 emission factor for natural gas combustion in kilograms of CO₂-e per gigajoule.

Data sources:

Q_{NG} ActewAGL Distribution
 Q_{Action} ACTION
 EC_{NG}, EF_{NG} The most recent published edition of Department of the Environment, National Greenhouse Accounts Factors <http://www.environment.gov.au/climate-change/greenhouse-gas-measurement/publications/national-greenhouse-accounts-factors-dec-2014>

5.3 Liquefied Petroleum Gas (LPG) stationary combustion

Annual emissions are calculated using the following equation:

$$E_{LPG} = Q_{LPG} \times EC_{LPG} \times EF_{LPG} / 10^6 \quad (3)$$

Where:

E_{LPG} is emissions from LPG stationary combustion expressed in kilotonnes of CO₂-e
 Q_{LPG} is the consumption of LPG for stationary combustion expressed in tonnes
 EC_{LPG} is the energy content factor for LPG expressed in gigajoules per tonne
 EF_{LPG} is the Scope 1 emissions factor for LPG in kilograms of CO₂-e per gigajoule.

Data sources:

Q_{LPG} Total bulk and bottled sales of LPG to ACT consumers; data to be collected from Elgas, Boral and Supagas
 EC_{LPG} and EF_{LPG} The most recent published edition of Department of the Environment, National Greenhouse Accounts Factors <http://www.environment.gov.au/climate-change/greenhouse-gas-measurement/publications/national-greenhouse-accounts-factors-dec-2014>

5.4 Fuel oil

Annual emissions are calculated using the following equation:

$$E_{FO} = E_{IW} + Q_{FO} \times EC_{FO} \times EF_{FO}$$

Where:

E_{FO} is emissions from fuel oil consumption expressed in kilotonnes of CO₂-e.

E_{IW} is annual Scope 1 emissions from combustion of fuel oil by Icon Water, as included in the annual report by the business under the National Greenhouse and Energy Reporting Scheme (NGERS).

Q_{FO} is the consumption of fuel oil in the ACT by users other than Icon Water (if any)

EC_{WF} is the energy content factor for fuel oil expressed in gigajoules per tonne

EF_{WF} is the Scope 1 emissions factor for fuel oil in kilograms of CO₂-e per gigajoule.

Data sources:

E_{IW} Icon Water

Q_{FO} Total sales of fuel oil to ACT consumers); data to be collected by a survey of users/and/or suppliers.

EC_{FO} and EF_{FO} The most recent published edition of Department of the Environment, National Greenhouse Accounts Factors <http://www.environment.gov.au/climate-change/greenhouse-gas-measurement/publications/national-greenhouse-accounts-factors-dec-2014>

5.5 Wood fuel

Annual emissions are calculated using the following equation:

$$E_{WF} = Q_{WF} \times EC_{WF} \times EF_{WF} / 10^6$$

Where:

E_{WF} is emissions from wood fuel consumption expressed in kilotonnes of CO₂-e

Q_{WF} is the consumption of dry wood expressed in tonnes

EC_{WF} is the energy content factor for dry wood expressed in gigajoules per tonne

EF_{WF} is the Scope 1 emissions factor for dry wood in kilograms of CO₂-e per gigajoule.

Data sources:

Q_{WF} The most recent available ACT Government *Firewood Sales* report

EC_{WF} and EF_{WF} The most recent published edition of Department of the Environment, National Greenhouse Accounts Factors <http://www.environment.gov.au/climate-change/greenhouse-gas-measurement/publications/national-greenhouse-accounts-factors-dec-2014>

5.6 Fugitive energy emissions: Natural gas distribution

Annual emissions are calculated using the following equation:

$$E_{fug} = Q_{NG} \times UAG / (1 - UAG) \times 0.55 \times (C_{CO2} + C_{CH4}) / 10^3$$

Where:

E_{fug} is the fugitive emissions from the ACT gas distribution network in tonnes CO₂-e.

Q_{NG} is the consumption of purchased natural gas in the ACT, in gigajoules

UAG is Unaccounted for gas in the ACT gas distribution network in the inventory year, in percent; it has the value 1.7% for the period 2010 to 2015.

C_{CO_2} is the composition factor for CO₂ in gas supplied to the ACT, in tonnes CO₂-e per terajoule, and is equal to 0.8 in the 2014-15 inventory year.

C_{CH_4} is the composition factor for methane in gas supplied to the ACT, in tonnes CO₂-e per terajoule, and is equal to 328 in the 2014-15 inventory year.

Data sources:

Q_{NG}	ActewAGL Distribution
UAG	Australian Energy Regulator, 2010. <i>Access arrangement for the ACT, Queanbeyan and Palerang gas distribution network, 1 July 2010 – 30 June 2015</i> . http://www.aer.gov.au/node/4785
$C_{CO_2} + C_{CH_4}$	Department of the Environment, 2014. <i>Technical guidelines for the estimation of greenhouse gas emissions by facilities in Australia</i> . http://www.environment.gov.au/climate-change/greenhouse-gas-measurement/publications/nger-technical-guidelines-2014

6. Method for calculating emissions from transport fuels

The method for calculating the emissions from transport fuels will be made using the equation presented below:

$$E_{Trans} = (\sum (QP_i \times ECP_i \times EFP_i) + Q_{Action} \times EC_{NG} \times EF_{NG}) / 10^6$$

Where:

E_{Trans} is emissions from consumption of road transport fuels in kilotonnes of CO₂-e

QP_i is the consumption of road transport fuel type i , where i is LPG, petrol, diesel, in kilolitres

ECP_i is the energy content factor for road transport fuel type i , in gigajoules per kilolitre

EFP_i is the Scope 1 emissions factor for road transport fuel type i , in kilograms of CO₂-e per gigajoule.

Q_{Action} is natural gas used by the ACTION bus fleet, in cubic metres

EC_{NG} is the energy content of natural gas, in gigajoules per cubic metre

EF_{NG} is the Scope 1 emission factor for natural gas combustion in kilograms of CO₂-e per gigajoule.

Data sources:

QP_i	The Fuel Survey undertaken by the Environment and Planning Directorate
$ECP_i, EFP_i, EC_{NG}, EF_{NG}$	The most recent published edition of Department of the Environment, National Greenhouse Accounts Factors http://www.environment.gov.au/climate-change/greenhouse-gas-measurement/publications/national-greenhouse-accounts-factors-dec-2014
Q_{Action}	ACTION

7. Method for calculating emissions from waste

The method for calculating the emissions from waste will be made using the method presented below:

Annual emissions from nitrous oxide emissions arising from wastewater treatment by Icon Water, as included in the annual report by the business under the National Greenhouse and Energy Reporting Scheme (NGERS).

Data source: Icon Water

8. Method for calculating emissions from other activities

ACT specific methodologies have yet to be developed for several other emission source categories. As an interim measure, emissions will be reported as the relevant value for the ACT contained in the most recent national greenhouse accounts compiled by the Department of the Environment. The source categories to be reported in this way are as follows:

Industrial processes and product use

Emissions from fluorinated substitutes for ozone depleting substances

Waste

Solid waste disposal

Agriculture, Forestry and other land use

Several separate source categories to be assessed to determine materiality

Data source: All data are found in the Australian Greenhouse Emissions Information System, <http://www.environment.gov.au/climate-change/greenhouse-gas-measurement/ageis>
