Ministry for the Environment
Manatū Mō Te Taiao

Guide to Reporting for *Waste Combustion Activities* under the New Zealand Emissions Trading Scheme

New Zealand Government

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1 Overview

As part of the New Zealand Emissions Trading Scheme (NZ ETS), stationary energy participants are required to monitor and report on their greenhouse gas emissions from 1 January 2010. The details of these reporting obligations are set out in the Climate Change (Stationary Energy and Industrial Processes) Regulations 2009 (SEIP Regulations).[1]

Persons who combust used or waste oil, used tyres, or waste to generate electricity or industrial heat are required to participate in the NZ ETS. A threshold of 1500 tonnes of used or waste oil will be in place by 1 January 2010.

The SEIP Regulations provide four alternative methods to determine emissions from the combustion of a particular class of fuel. Two of these require the use of an emissions factor. The other two use direct measurement of emissions from particular equipment.

Participants can apply for a unique emissions factor (UEF) to be used in the first two SEIP methods. The option to apply for a UEF for waste that consists entirely of biomass is restricted to direct measurement of emissions from fuels combusted in particular equipment. For waste that contains non-biomass, the participant can choose the direct measurement approach or the sampling and testing of the fuel.

[1] The Climate Change Response Act 2002 and related regulations are available at www.legislation.govt.nz.

2 Process for becoming a registered participant

Those who combust classes of waste, along with others in the stationary energy and industrial processes sectors, will become mandatory participants in the NZ ETS when their reporting obligations begin on 1 January 2010. Surrender obligations begin on 1 July 2010.

The Climate Change Response Act 2002 (the Act) requires mandatory participants to register as participants within 20 working days of carrying out the ETS activity. In most cases this will be within 20 working days of 1 January 2010 ie, 1 February 2010.

To register as a participant you must:

- first, apply to open a holding account which will ultimately be used for surrendering and receiving NZUs. A participant who will be involved in more than one activity can use a single holding account for all activities.

  To open a holding account, register as a user on the New Zealand Emission Unit Register (NZEUR) website at www.eur.govt.nz. Once registered, use the online application form to open an account

- second, register as a participant by completing an online participant notification form at www.eur.govt.nz.

3 Combusting used or waste oil, used tyres, or waste for the purpose of generating electricity or industrial heat

Climate Change (Stationary Energy and Industrial Processes) Regulations 2009: 21–26

3.1 Overview

Methods for calculating emissions associated with combusting classes of waste account for greenhouse gas emissions resulting from the combustion of the fuel. There are four options for participants to use to calculate their emissions. A participant can use different methods for different sources of emissions under this activity. For example, a participant might have installed direct emissions monitoring equipment on one boiler, and use a mass balance approach for calculating emissions on a second boiler.

Standard option 1

This method requires information to be collected about total fuel consumed in the period, and its gross calorific value (expressed as a weighted average). These two values are multiplied together and the result is multiplied with either a default or a unique emissions factor to determine total emissions. If combusting used oil, any obligation fuel can be explicitly deducted as that fuel would have already been counted in the NZ ETS.

Standard option 2

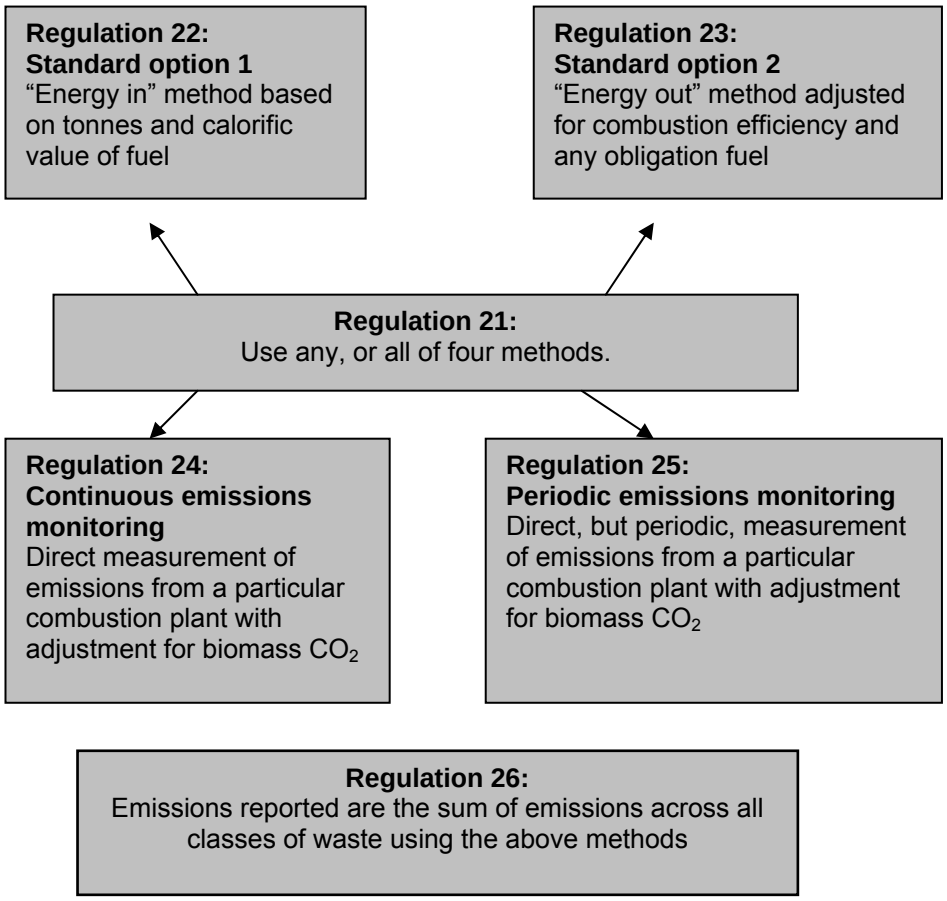
This method requires estimates of total energy produced and the gross energy efficiency of the particular combustion equipment to be made. Any obligation fuel can be explicitly deducted. A default or unique emissions factor is then multiplied against the energy data to determine total emissions from the particular equipment.

Continuous emissions monitoring

This method requires direct monitoring of characteristics of stack emissions at least every 30 minutes. Tests of CO_2, CH_4 and N_2O concentrations are required along with optional testing of the non-biomass fraction of that CO_2 concentration if biomass is combusted. The mass rate per second of the above gases is then determined for each set of data. A representative rate of emissions per hour is calculated, with total emissions for the year being a function of that value and the number of hours that the particular equipment was operating, with an adjustment for any biomass-sourced CO_2 emitted.

Periodic source testing

This method has similar requirements and steps to the continuous emissions monitoring method, but permits a lesser number of direct measurements to be taken. A participant who chooses this method is required to take enough measurements and perform sufficient tests to develop a set of "representative" data. That representative data must be able to be reliably extrapolated to provide estimates of emissions across the full range of operating conditions for that year (regulation 25(a)).



[2]

3.2 Record keeping

Participants must retain sufficient records to enable the Chief Executive of the Ministry for Economic Development to verify the emissions a participant reports in their emissions return. Records must be retained for a period of at least seven years after the end of the year to which they relate. This includes any records relating to a unique emissions factor.

If a participant combusts different classes of waste during the year in a single boiler (for example, by testing one class of fuel or blending classes over a short period) then it may be difficult to obtain robust information on the total energy or emissions produced from each class for standard option 2, or the continuous or periodic emissions monitoring methods. However, a documented best effort must be made to record energy output or direct emissions by class of waste. As no emissions factor is used in those methods, determination of precisely which classes of waste were combusted is less important than the accuracy of the total emissions estimate across all classes.

[2] For further information see: Review of Default Emissions Factors in Draft Stationary Energy and Industrial Process Regulations: Waste Combustion for the Purpose of Generating Electricity or Industrial Heat (Duffill Watts Ltd, May 2009) available at www.climatechange.govt.nz/consultation/draft-regulations-seip/review-default-emissions-factors-draft-stationary.pdf

4 Standard reporting option 1: fuel input sampling

This method requires the determination of total energy consumed from a class of waste. Total emissions are then a function of energy consumed and an emissions factor.

4.1 Information you are required to collect

The following information must be collected for each class of waste in the year:

Information to collect	How to collect
• tonnes of each class of waste combusted in the year	• through weighbridge data or fuel purchase information or other sources
• tonnes of obligation fuel component of any used or waste oil combusted, if sought	• through documentation with used or waste oil supplier
• gross calorific value of the fuel combusted, expressed as a weighted average	• through sampling and testing

4.2 Example calculation

Future Energy Ltd uses 5000 tonnes of used oil in its generation of electricity. Through sampling and testing, the firm develops a weighted average estimate of calorific value of 0.045 terajoules per tonne (TJ/t) of used oil. Through documentation with the supplier of used oil, the firm considers that approximately 25 per cent of the used oil supplied is obligation fuel.

Class of waste combusted	Tonnes	Weighted average calorific value (TJ/t)	Emissions factor (tCO_2-e/TJ)	Emissions (tCO_2-e)
Used oil less obligation fuel component	5000 * (1 – 0.25) = 3750	0.045	78.35	13,222
Total				**13,222**

The total emissions to be reported for the activity of combusting used oil are:

Emissions = **13,222 tonnes CO_2-e**

5 Standard reporting option 2: energy output

This method requires the calculation of total energy output by the particular equipment over the year, as well as its estimated efficiency on a gross energy basis. The participant can adjust the result to account for any energy produced from combusted obligation fuel. This adjustment has identical information requirements to that in the standard method option 1 above. The result is then multiplied against an emissions factor.

5.1 Information you are required to collect

The following information must be collected for each class of waste in the year:

Information to collect	How to collect
• total energy output by the combustion process over the year in terajoules	• through standard operation monitoring, such as from the amount of steam produced or water vaporised • no standards are stipulated, but for reference, a commonly used standard is ASME PTC 6-2004
• estimated efficiency of the particular equipment	• through operational estimation and monitoring • no standards are stipulated, but for reference, a commonly used standard is ASME PTC 6-2004
• tonnes of obligation fuel component of any used or waste oil combusted	• through documentation with used or waste oil supplier • optional
• gross calorific value of fuel combusted	• through sampling and testing • expressed as a weighted average

5.2 Example calculation

Future Energy Ltd produced 10,000TJ of energy from combusting used tyres in the year in a single boiler. The efficiency of the boiler was estimated at 70 per cent. The firm must calculate emissions from those classes and that boiler.

Class of waste combusted	Energy output	Efficiency	Emissions factor (tCO_2-e/TJ)	Emissions (tCO_2-e)
Used tyres	1000 TJ	0.80	150.99	188,738
Total				**188,738**

The total emissions to be reported for the activity of combusting used tyres are:

Emissions = **188,738 tonnes CO_2-e**

6 Continuous emissions monitoring

For continuous emissions monitoring (CEM), recordings of particular stack gas characteristics are made automatically by installed equipment. The method prescribed by the regulations has several equipment requirements, such as equipment calibration and its minimum operating time (see Regulation 24(2)). Compared with the standard method options 1 and 2, CEM has considerably more data and cost requirements, but significantly greater accuracy on emissions estimates.

6.1 Information you are required to collect

The following information must be collected for each class of waste in the year:

Information to collect	How to collect
• volumetric flow rate from the stack • pressure of the gas stream in kilopascals • temperature, in Kelvin, of the gas stream	• automatically using continuous emissions monitoring equipment with measures taken at most every 30 minutes
• CO_2, CH_4 and N_2O concentrations in the gas stream	• by sampling and testing or automatically through installed equipment • at the same time that the information above is collected
• a representative estimate of the non-biomass CO_2 fraction in the gas stream	• by sampling and testing or automatically through installed equipment

6.2 Example calculation

Future Energy Ltd has installed CEM equipment in its only boiler and will use the data it collects to estimate emissions, as its equipment does not automatically calculate emissions. The equipment records the data required above every 15 minutes. Using that data, representative mass rates of each type of greenhouse gas emitted per hour are determined in accordance with the formula in Regulation 24(1)(c) as well as an estimate of the non-biomass proportion of the CO_2 emitted.

Class of waste combusted	Representative mass rate tonnes per hour			Non-biomass CO_2	Time (hrs)	Emissions (tCO_2-e)
	CO_2	CH_4	N_2O			
Used tyres	150	0.03	0.002	0.8	7534	974,463
Total						**974,463**

The total emissions to be reported for the activity of combusting used tyres are:

Emissions = **974,463 tonnes CO_2-e**

7 Periodic source testing

Like the CEM method, periodic source testing takes direct measurements of stack gas characteristics, but at longer intervals (daily, weekly, monthly, etc). The regulations require that sufficient samples must be taken to produce representative data that can be reliably extrapolated across the full range of operating conditions for the year.

7.1 Information you are required to collect

The following information must be collected for each class of waste in the year:

Information to collect	How to collect
• volumetric flow rate from the stack • pressure of the gas stream in kilopascals • temperature, in Kelvin, of the gas stream	• periodically from direct measurement of stack gas emissions
• CO_2, CH_4 and N_2O concentrations in the gas stream	• at the same time that the information above is collected
• a representative estimate of the non-biomass CO_2 fraction in the gas stream	• by sampling and testing or automatically through installed equipment

7.2 Example calculation

Future Energy Ltd combusts municipal waste in its single boiler to generate electricity. It takes monthly measures of the required data above from the boiler stack. It considers the sum of measures it has taken is representative of the full range of operating conditions. The firm then determines the mass rate of each greenhouse gas type in tonnes per second for each set of data. Finally, the firm estimates total annual emissions by multiplying the number of seconds the equipment was operating in the year by a representative mass rate for each greenhouse gas type.

Class of waste combusted	Representative mass rate tonnes per second			Non-biomass CO_2	Time (seconds)	Emissions (tCO_2-e)
	CO_2	CH_4	N_2O			
Municipal waste – consisting of or comprising non-biomass	0.0444	1.111e-5	6.389e-7	0.55	29,160,000	724,666
Total						**724,666**

The total emissions to be reported for the activity of combusting waste are:

Emissions = **724,666 tonnes CO_2-e**

8 Unique emissions factors

Climate Change (Unique Emissions Factors) Regulations 2009: 14–17

8.1 Overview

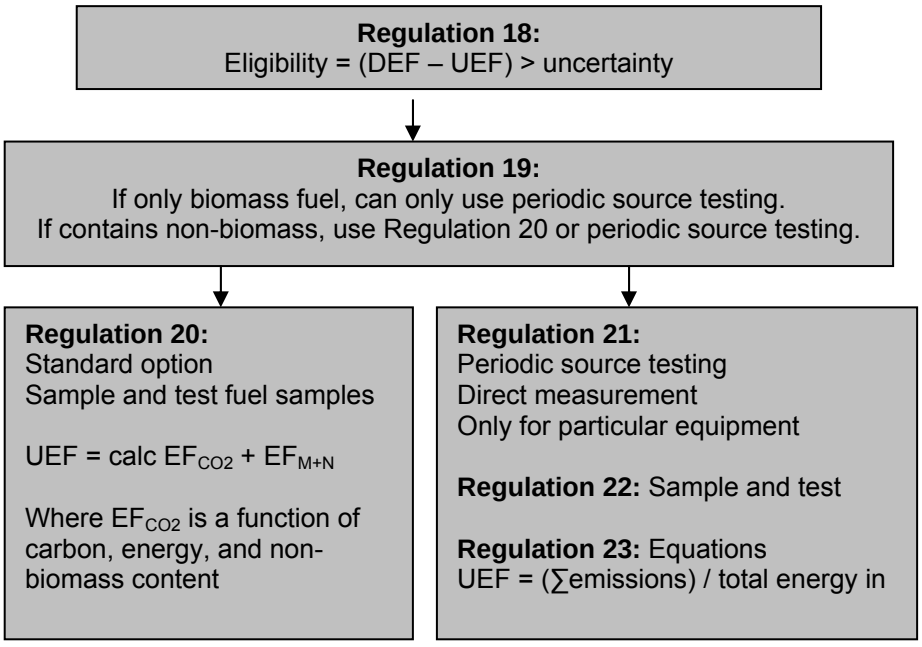
A waste combustion participant may apply for approval to use a unique emissions factor (UEF). This allows a waste combustion participant to use an UEF if it considers that its fuels have particular properties or the firm has better fuel combustion efficiencies than are assumed in the default emissions factors.

There are two methods provided to calculate a UEF for waste combustion. The resulting UEF would then be used in either standard reporting option 1 or option 2 above. A participant seeking a UEF for any class of waste that is entirely biomass must use the periodic source testing approach. A participant applying for a UEF for a class of waste that consists of, or contains, non-biomass can use either approach.

The standard testing option develops an emissions factor for CO_2 from specified testing of fuel samples for carbon content and gross calorific value. The samples must be representative of the fuel being combusted over the course of a year.

The periodic source testing option requires the estimation of total emissions over a measurement period (not necessarily a year) in accordance with the same method prescribed in section 7 above. A UEF can then be developed by dividing total emissions by the amount of energy consumed during that measurement period.

Samples must be taken at a sufficient frequency and duration to ensure that extrapolations provide representative estimates of emissions across the full range of operating conditions.



8.2 Applications

The UEF must be based on the sampling, testing and calculation methods set out in regulation, the results of which must be independently verified.

An application for approval of a UEF must:

- describe the class of waste covered by the UEF, with well-defined parameters so that the fuel may be easily identified and accounted for separately from fuel that is not within the class
- be accompanied by a verifier's statement and a plan for ongoing testing
- be submitted to the Chief Executive of the Ministry for Economic Development by 31 January in the year following the first year to which the UEF relates.

8.3 Eligibility

An application may only be submitted if the UEF differs from the default emissions factor that would otherwise apply by more than the estimated uncertainty. As defined in regulation, this is the uncertainty associated with sampling and testing used to establish the unique emissions factor, estimated at a 90 per cent confidence level.

The participant is required to estimate the uncertainty around the unique emissions factor and submit this information to the verifier.

8.4 Verification

The sampling, testing and calculations undertaken to develop a UEF must be independently verified. A recognised verifier must review the records provided by the applicant and assess these against the process outlined in the regulations to establish and calculate the UEF. A list of recognised verifiers will be posted at www.eur.govt.nz.

8.5 Use of a unique emissions factor

Details of approved unique emissions factors, including the name of the participant and any conditions of approval, will be published in the *New Zealand Gazette*.

If approved by the Chief Executive of the Ministry of Economic Development, a unique emissions factor may be used until:

- there is a material change in any of the information or factors on which the Chief Executive's approval was based, or the relevant legislation, or
- any conditions to which the approval is subject cease to be met or complied with.

To help determine when a material change might occur, participants are required to submit a plan for ongoing sampling and testing with their application. The Chief Executive may also grant approval subject to any conditions considered appropriate. This could, for example, include a requirement to submit the results of ongoing testing.

Example 1: standard option

Information to collect	How to collect
• representative samples of the class of waste that the UEF is sought for	• standard sampling techniques
• tonnes of obligation fuel component of any used or waste oil combusted, if sought	• through documentation with used or waste oil supplier
• carbon content, gross calorific value, biomass content	• through testing of the samples

Step one: sample and test

Future Energy wishes to apply for a unique emissions factor for the used tyres it combusts. The firm takes several samples of tyre materials. It considers the samples it has taken are representative of the range of used tyres that it combusts.

These samples are tested for carbon content, calorific value and biomass content.

Class of waste	Mean carbon content tC/t	Mean non-biomass fraction	Mean gross calorific value TJ/t	Emissions factor for carbon tCO_2/tC	Emissions factor (tCO_2e/TJ)
Used tyres	0.85	0.95	0.027	3.6641	109.58
Emissions factor CH_4					0.663
Emissions factor N_2O					1.305
Emissions factor CO_2e					**111.6**

Step two: calculation

Using the data above, the firm calculates the UEF for which it seeks approval:

$$UEF = EF_{CO2} + EF_{M+N} \text{ where } EF_{CO2} = (m_C \times EF_C \times m_{NB}) / CV$$

$$= \frac{(0.85 \times 3.6641 \times 0.95)}{0.27} + 1.969$$

$$= 111.6 \text{ } tCO_2\text{-e / TJ}$$

Step three: estimate uncertainty

The firm estimates the uncertainty associated with the sampling and testing undertaken, at a 90 per cent confidence level, to be plus or minus 9 per cent. The expected maximum emissions factor is

$$1.09 \times 111.6 \text{ } tCO_2\text{-e / TJ} = \mathbf{121.6} \text{ } tCO_2\text{-e / TJ}$$

As the DEF that would otherwise apply is 150.99 tCO_2-e / TJ for used tyres, this UEF passes the eligibility threshold.

Example 2: periodic source testing

Information to collect	How to collect
• volumetric flow rate from the stack • pressure of the gas stream in kilopascals • temperature, in Kelvin, of the gas stream	• periodically from direct measurement of stack gas emissions
• CO_2, CH_4 and N_2O concentrations in the gas stream	• at the same time that the information above is collected
• a representative estimate of the non-biomass CO_2 fraction in the gas stream	• by sampling and testing or automatically through installed equipment
• tonnes of obligation fuel component of any used or waste oil combusted, if sought	• through documentation with used or waste oil supplier
• gross calorific value of any obligation fuel combusted, if sought	• through representative sampling and testing • expressed as a weighted average
• total energy output by the combustion process over the year in terajoules	• through standard operation monitoring, such as from the amount of steam produced or water vaporised • no standards are stipulated, but for reference, a commonly used standard is ASME PTC 6-2004
• estimated efficiency of the particular equipment	• through operational estimation and monitoring • no standards are stipulated, but for reference, a commonly used standard is ASME PTC 6-2004

Step one: taking measurements to estimate greenhouse gas mass rates

Future Energy wishes to apply for a unique emissions factor for a particular boiler that combusts used tyres using the periodic source testing method. The firm takes several measures of stack emissions' characteristics over a period of 12 weeks. It considers the measures it has taken are representative of the full range of operating conditions of the plant over the full year.

These measurements are used to calculate the mass rate of each greenhouse gas per second. The firm also wishes to use the data it records on energy produced and the estimated efficiency of the boiler to determine the amount of energy that is consumed, as it does not have a weighbridge.

Class of waste combusted	Representative mass rate tonnes per second			Non-biomass CO_2	Time (seconds)	Emissions (tCO_2-e)
	CO_2	CH_4	N_2O			
Waste – consisting of or comprising non-biomass	0.0444	1.111e-5	6.389e-7	0.55	6,652,800	165,331
Total						**165,331**

Class of waste combusted	Energy output	Efficiency	Total emissions tCO_2-e	Emissions factor (tCO_2-e/TJ
Waste – consisting of or comprising non-biomass	1250 TJ	0.73	165,331	94.92
Total				

Step two: calculation

Using the data above, the firm calculates the UEF for which it seeks approval:

UEF = total emissions / energy consumed

total emissions = (0.0444 x 0.55 x 6,652,800) + (1.111e-5 x 21 x 6,652,800) + (6.389e-7 x 310 x 6,652,800) = 165,331 tCO_2-e

total energy consumed = 1250 / 0.73 = 1712 TJ

UEF = 165,331 / 1712 = 96.57 tCO_2-e/TJ waste

Step three: estimate uncertainty

The firm estimates the uncertainty associated with the measurements and estimates of energy produced and boiler efficiency, at a 90 per cent confidence level, to be plus or minus 25 per cent. The expected maximum emissions factor is

$$1.25 \times 96.57\ tCO_2e / TJ\ waste = \mathbf{120.7}\ tCO_2e / t\ waste$$

As the DEF that would otherwise apply is 97.53 tCO_2-e / t waste, this UEF does not pass the eligibility threshold.