Zemo Partnership
Accelerating Transport to Zero Emissions

Renewable Fuels Assurance Scheme

Guide for Fleet Operators

WTW GHG Emissions Calculation Tool

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Version 2.0

Contents

1 Introduction to RFAS 3

2 WTW GHG Emissions Calculator 4

2.1 Methodology 4

2.2 Inputs 4

2.3 Inbuilt data and assumptions 5

2.4 Outputs 5

Acronyms and glossary 7

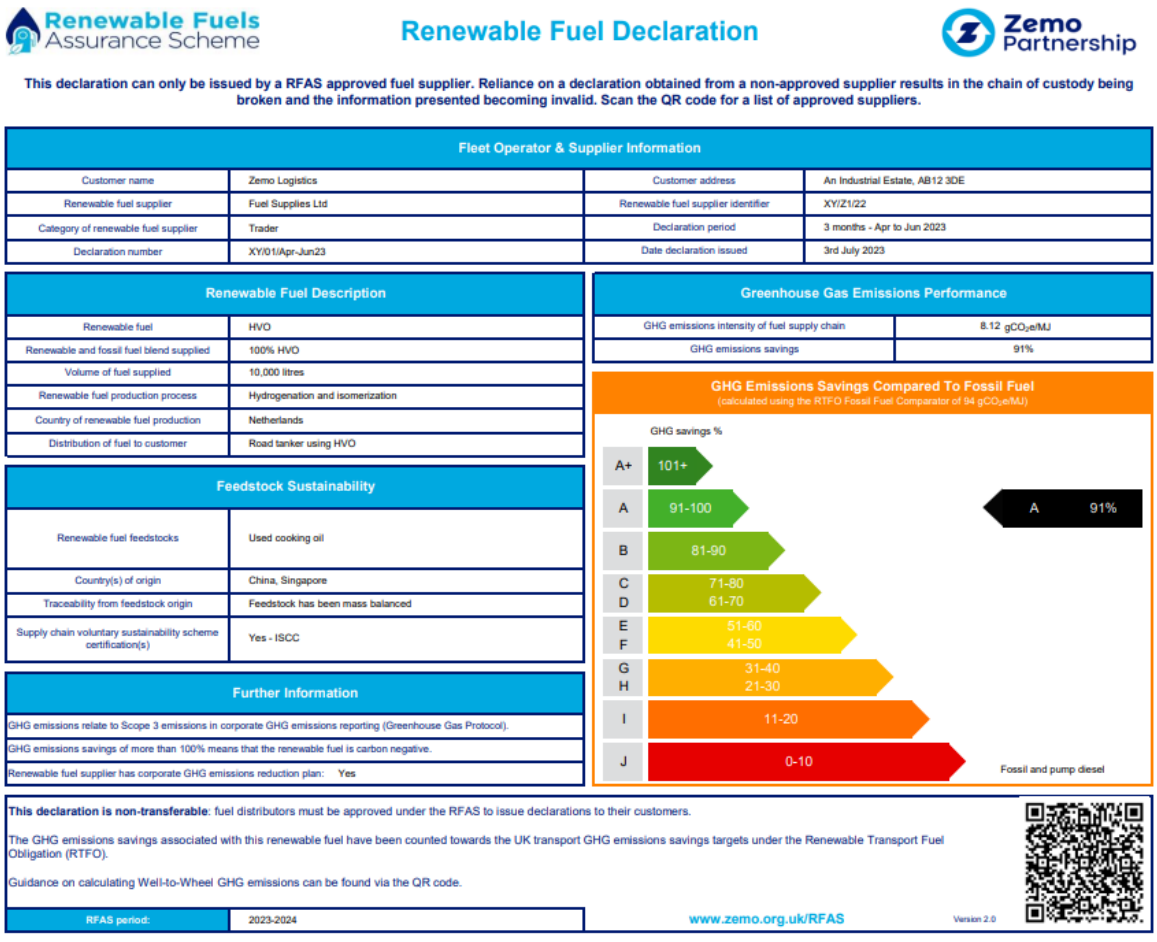
Further Information 8

1 Introduction to RFAS

Zemo's Renewable Fuels Assurance Scheme (RFAS)[1] provides commercial vehicle fleet and non-road mobile machinery operators with independent assurance of the life cycle greenhouse gas emissions and feedstock sustainability performance of renewable fuels. This information is specific to the customer's renewable fuel supply chain.

Every 3 months, Renewable Fuel Suppliers approved under RFAS issue their customers a Renewable Fuel Declaration for the batches of renewable fuel sold. The declaration is specific to each customer and provides GHG emissions data for the fuel supplied. To ensure that the chain of custody is unbroken and the information presented is valid, the declarations are non-transferable; fuel distributors or traders must be approved in their own right to issue declarations to their customers.

Example Renewable Fuel Declaration



Renewable Fuels Assurance Scheme

Renewable Fuel Declaration

Zemo Partnership

This declaration can only be issued by a RFAS approved fuel supplier. Reliance on a declaration obtained from a non-approved supplier results in the chain of custody being broken and the information presented becoming invalid. Scan the QR code for a list of approved suppliers.

Fleet Operator & Supplier Information

Customer name	Zemo Logistics	Customer address	An Industrial Estate, AB12 3DE
Renewable fuel supplier	Fuel Supplies Ltd	Renewable fuel supplier identifier	XY/Z1/22
Category of renewable fuel supplier	Trader	Declaration period	3 months - Apr to Jun 2023
Declaration number	XY/01/Apr-Jun23	Date declaration issued	3rd July 2023

Renewable Fuel Description

Renewable fuel	HVO
Renewable and fossil fuel blend supplied	100% HVO
Volume of fuel supplied	10,000 litres
Renewable fuel production process	Hydrogenation and isomerization
Country of renewable fuel production	Netherlands
Distribution of fuel to customer	Road tanker using HVO

Greenhouse Gas Emissions Performance

GHG emissions intensity of fuel supply chain	8.12 gCO_2e/MJ
GHG emissions savings	91%

Feedstock Sustainability

Renewable fuel feedstocks	Used cooking oil
Country(s) of origin	China, Singapore
Traceability from feedstock origin	Feedstock has been mass balanced
Supply chain voluntary sustainability scheme certification(s)	Yes - ISCC

GHG Emissions Savings Compared To Fossil Fuel

(calculated using the RTFO Fossil Fuel Comparator of 94 gCO_2e/MJ)

Further Information

GHG emissions relate to Scope 3 emissions in corporate GHG emissions reporting (Greenhouse Gas Protocol).

GHG emissions savings of more than 100% means that the renewable fuel is carbon negative.

Renewable fuel supplier has corporate GHG emissions reduction plan: Yes

This declaration is non-transferable: fuel distributors must be approved under the RFAS to issue declarations to their customers.

The GHG emissions savings associated with this renewable fuel have been counted towards the UK transport GHG emissions savings targets under the Renewable Transport Fuel Obligation (RTFO).

Guidance on calculating Well-to-Wheel GHG emissions can be found via the QR code.

RFAS period:	2023-2024

www.zemo.org.uk/RFAS

Version 2.0

In alignment with the UK Government's Renewable Transport Fuel Obligation (RTFO), the GHG emissions savings (%) reported on the RFAS Renewable Fuel Declaration are relative to the fossil fuel comparator, currently 94 gCO_2e/MJ. This should not be confused with a percentage GHG emissions savings relative to a conventional fuel, e.g. switching from standard retail diesel to a higher blend of biodiesel or HVO.

[1] www.zemo.org.uk/RFAS

2 WTW GHG Emissions Calculator

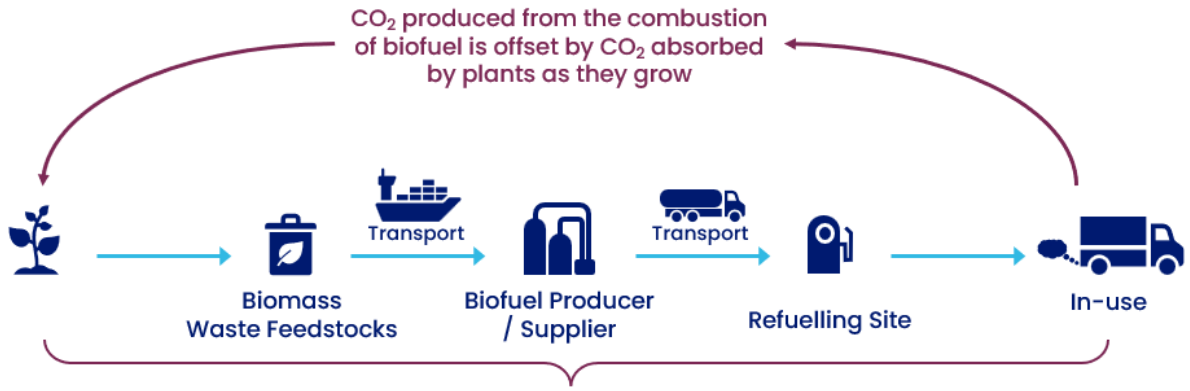
The GHG emissions intensity of the fuel shown on the Renewable Fuel Declaration is provided in gCO_2e/MJ. Zemo has produced a simple calculator[2] to enable fleet operators to estimate the WTW (Well-to-Wheel) GHG emissions of the renewable fuel purchased in $kgCO_2e$. **Disclaimer: whilst every effort has been made to ensure the accuracy of this tool, Zemo Partnership take no responsibility or liability whatsoever for the results provided.**

2.1 Methodology

Under RFAS, the GHG emissions intensity of the renewable fuel, or blend, is based on a fuel lifecycle methodology. This encompasses feedstock cultivation or waste raw material collection, fuel production, distribution and combustion. The methodology is aligned with the RTFO methodology for the calculation of renewable fuel GHG emissions.

With this methodology, the vehicle combustion GHG emissions from renewable fuels (or the renewable fuel component of a blend) are accepted as zero. CO_2 from combustion is offset by the CO_2 absorbed by the biomass feedstock during growth. This differs from the methodology (GHG Protocol) used in company carbon reporting, whereby the Scope 1 GHG emissions for biofuels are based on N_2O and CH_4 emissions, while CO_2 emissions are set to zero.

Example Biofuel Supply Chain



2.2 Inputs

To use the WTW GHG emissions calculator, the user should input data for the following parameters, sourced from the RFAS Renewable Fuel Declarations received.

1. **Renewable fuel**
   Select the fuel type from the dropdown list. This should match the 'Renewable fuel' entry in the declaration.

[2] www.zemo.org.uk/RFAS

2. **Percentage of renewable component in fuel supplied (%)**
   This should match the 'Renewable and fossil fuel blend supplied' entry in declaration. Enter '100' if unblended. Do not include the % symbol.
3. **Volume of fuel (L or kg)**
   This should match the figure in the 'Volume of fuel supplied' entry in the declaration. The calculator automatically populates the units as L (litres) or kg depending on the fuel type selected. Check that the units match the declaration. If not, a conversion will need to be applied before entering the data.
4. **GHG emissions intensity of fuel supply chain (gCO_2e/MJ)**
   This should match the figure in the 'GHG emissions intensity of fuel supply chain' entry in declaration.

To calculate the total WTW GHG emissions from a single type (and % blend) of renewable fuel purchased over a year, the user can enter data from 4 subsequent declarations (periods 1 to 4 in the calculator). If multiple fuel types or blends are required, the user should repeat the process, starting with a blank calculator each time.

2.3 Inbuilt data and assumptions

The calculator uses some input data that is built into the tool. This data can be found on the 'Emissions Factors' sheet and includes values for LHV (Lower Heating Value), WTT (Well-to-Tank) and TTW (Tank-to-Wheel) emissions factors. The source of the data is also listed for each fuel type. Where available, the values are sourced from the company GHG reporting conversion factors published annually by the UK Government Department for Energy Security and Net Zero (DESNZ). Zemo plans to update the calculator each year, following the publication of the DESNZ company GHG reporting conversions factors (around July). The LHV of renewable diesel is assumed to be the same as HVO.

2.4 Outputs

The calculator estimates the WTW GHG emissions ($kgCO_2e$) as follows.

1. **WTW GHG emissions ($kgCO_2e$): RFAS supply chain specific**
   This is the estimated WTW GHG emissions for the renewable fuel purchased, based on the RTFO methodology. It is calculated from the GHG emissions intensity (gCO_2e/MJ) of fuel supply chain data (as supplied on the RFAS Renewable Fuel Declaration) and the LHV of the renewable fuel or blend.

2. **WTW GHG emissions ($kgCO_2e$): RFAS + TTW (Scope 1) company reporting**
   The calculator also shows the estimated WTW GHG emissions from summing:
   - WTT emissions for the renewable fuel purchased, calculated from the GHG emissions intensity data in the RFAS Renewable Fuel Declaration and the LHV.
   - TTW N_2O and CH_4 emissions, sourced from DESNZ company reporting TTW emissions factors where available.

3. **WTW GHG emissions ($kgCO_2e$): WTT (Scope 3) + TTW (Scope 1) company reporting**
   For comparison purposes, the calculator also shows the estimated WTW GHG emissions of the renewable fuel purchased, calculated from the WTT and TTW emissions factors, sourced from DESNZ company reporting where available.

4. **WTW GHG emissions savings (%): RFAS + TTW (Scope 1) company reporting**
   The calculator shows the estimated WTW GHG emissions savings (in $kgCO_2e$ and expressed as a percentage) from using the renewable fuel, compared to the conventional fuel, assuming the same volume of fuel consumption. This estimate uses the 'RFAS + TTW (Scope 1)' GHG emissions as described in point 2 and the WTW GHG emissions of the conventional fuel, which is calculated using the WTT and TTW emissions factors sourced from DESNZ company reporting. For biodiesel and renewable diesel, including HVO, the conventional fuel is retail B7 diesel. For gas trucks using compressed or liquified biomethane (bio-CNG or bio-LNG), the conventional fuel is CNG or LNG respectively (compressed or liquified natural gas).

   For renewable hydrogen, the calculator shows the estimated **WTW GHG emissions savings (%): RFAS**, compared to using fossil hydrogen. The emissions factor for fossil hydrogen is sourced from Zemo's hydrogen WTT model as the DESNZ company reporting dataset does not currently include emissions factors for hydrogen. The supply chain for fossil hydrogen is modelled as hydrogen produced by SMR (Steam Methane Reformation) of natural gas in the UK, transported as a compressed gas using tube trailers, and dispensed from a hydrogen refuelling station at 350bar. TTW emissions are not included for hydrogen: for fuel cell electric vehicles these can be considered to be zero.

5. **WTW GHG emissions savings (%): WTT (Scope 3) + TTW (Scope 1) company reporting**
   For comparison purposes, the calculator also shows the estimated WTW GHG emissions savings (in $kgCO_2e$ and expressed as a percentage) using the 'WTT (Scope 3) + TTW (Scope 1)' GHG emissions as described in point 3 and the WTW GHG emissions from the conventional fuel (as described in point 4).

Acronyms and glossary

gCO_2e	Grams of CO_2 equivalent. Unit of measurement for GHG emissions.
GHG	Greenhouse Gas.
LHV	Lower Heating Value. A measure of the energy provided from combustion of a fuel.
Renewable diesel	Paraffinic diesel made from renewable sources.
Retail diesel	Standard diesel available at public refuelling stations. This consists of up to 7% biodiesel (FAME, Fatty Acid Methyl Esters) blended with fossil diesel and may be referred to as B7.
RFAS	Renewable Fuels Assurance Scheme, managed by Zemo Partnership.
RTFO	Renewable Transport Fuel Obligation. UK Government's low carbon fuel policy for reducing GHG emissions from road transport.
Scope 1	Scope 1 of company GHG reporting covers emissions from sources that an organisation owns or controls directly. DESNZ Scope 1 fuel and bioenergy conversion factors are used for primary fuel sources combusted at a site or in an asset owned or controlled by the reporting organisation (e.g. TTW emissions from combusting fuel in a fleet vehicle).
Scope 3	Scope 3 of company GHG reporting covers emissions that are not produced by the company itself, and not the result of activities from assets owned or controlled by them, but by those that it's indirectly responsible for, up and down its value chain. DESNZ WTT fuels and bioenergy conversion factors are used to account for the upstream Scope 3 emissions associated with extraction, refining and transportation of the raw fuel and bioenergy sources to an organisation's site (or asset), prior to combustion.
TTW	Tank-to-Wheel. TTW emissions are generated when driving the vehicle. For renewable fuels, TTW emissions are not the same as the emissions measured from the vehicle tailpipe because the CO_2 emissions from combustion are offset by the CO_2 captured by the biomass feedstock during growth. Where biomethane is produced from biogenic waste feedstock comprising of manure, fugitive emissions of methane are prevented and a methane credit can be applied (as per REDII), resulting in a negative carbon intensity value.
WTT	Well-to-Tank. WTT emissions are generated from fuel production, from the primary energy source to the point of dispensing.
WTW	Well-to-Wheel. WTW emissions are all the emissions generated by a vehicle in-use. This is the sum of the WTT and TTW emissions. (This differs from the vehicle lifecycle emissions which also includes vehicle production and disposal/recycling at end-of-life.)

Further Information

The following publications may be of interest to the reader.

RFAS Technical Guidance https://www.zemo.org.uk/RFAS

GHG Protocol https://ghgprotocol.org/corporate-standard

DEFRA guidance on reporting GHG emissions
https://www.gov.uk/government/publications/guidance-on-how-to-measure-and-report-your-greenhouse-gas-emissions

DESNZ company GHG reporting conversion factors
https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting

JEC Well-to-Tank report v5, Joint Research Centre, 2020
https://publications.jrc.ec.europa.eu/repository/handle/JRC119036

For further information about the RFAS please email rfas@zemo.org.uk.