

# Review of Emission Factors 2021

## Summary

This publication records the emission factors that Climate Neutral Group is using for footprint calculations for the year 2021 and for any possible subsequent calculations for that year. Footprint calculations for the year 2020 are made using the list of Emission Factors for 2020.

Are you, as a CNG client, looking for explanation as to why there are differences between your CO<sub>2</sub> footprints from 2019 and 2020 that do not seem to be based on changes in usage? These can possibly be caused by changed emission factors. You can find the factors relevant for your footprint 2019, [here](#).

We receive both questions about the emission factors used by Climate Neutral Group and proposals for changes to them throughout the year. In addition, there are regularly reviews in the literature with new proposals for emission factors. To keep a handle on these continuous improvements and to make comparisons between all calculations possible, Climate Neutral Group has chosen to present one update per year.

## Introduction

The use of the correct emission factors is essential for good CO<sub>2</sub> footprint calculations. Because there are regularly new emission factors published due to changes in fields like fuel composition or the efficiency of incinerators, it is necessary to keep track of developments in this area. The emission factors procedure states that Climate Neutral Group publishes an annual review of the emission factors. This document is a result of that review.

In December 2014, as the final result of the Emission Factors Green Deal, the first National List of Emission Factors from The Netherlands, which was made public ([www.co2emissiefactoren.nl](http://www.co2emissiefactoren.nl)). The purpose of this list is, among other things, to make CO<sub>2</sub> footprint calculations more comparable. Because the Climate Neutral Group supports this goal, we are using the National List of Emission Factors as the basis for this review. This means that we are using the factors wherever possible and documenting any differences.

The National List is updated at irregular times, but because CNG makes footprints annually, we determine the emission factors that we use once per calendar year.

This review shows all emission factors that are part of the footprint of the average (service-providing) organisation. It may be that your organisation has emissions for which there are no emission factors on this list. CNG adheres to this National Emission Factors List as much as possible, which also includes emission factors that are not on this list. In the event that there is also no emission source factor on the National Emission Factors List, we then use other recognised sources such as Ecoinvent or Agrifootprint. If this is the case, we will note the actual factor and source in your footprint calculation. If your company isn't based The Netherlands, most Dutch factors are applicable, but if not we shall use relevant factors for your country or international factors.

## Emission Factors 2020 and 2021

In the Appendix is a table with the emission factors that we are using within the Netherlands for 2020 and 2021. **The most important points are explained below.**

We use a Well-to-Wheel (WtW) approach for all emission factors. This means that all emissions are included, from the production phase (e.g., fuel production), through to direct emissions (e.g., fuel combustion). This is the most complete approach.

## Energy Use

### Grey Electricity

The emission factor for grey electricity represents the typical mix of power originating from fossil fuels in the Netherlands, which includes coal, gas and nuclear energy. This factor did not change in 2021 compared to 2020.

### Green Electricity

As in previous years, the emission factors for green electricity are in all cases much lower than those for grey electricity. However, these are not equal to zero in all cases, such as biomass. Electricity from biomass can come from many types of biomass and the emission factor is highly dependent on the type of biomass used and its origin. If the origin of the biomass is unknown, we calculate the CO<sub>2</sub> footprints for 2021 with a conversion factor of 0.075 kg CO<sub>2</sub>/kWh, following the National List of Emission Factors.

The emission factors for green electricity apply to both self-generated electricity (such as from solar panels) and most green electricity certificates, or Guarantees of Origin (GOs). In the event that you have purchased green electricity certificates originating from biomass, then your emissions are not equal to zero, but are calculated with the respective emission factor for biomass.

In addition, Climate Neutral Group does not recognise GOs originating from hydropower from Scandinavia (including Iceland) as green and calculates these with the factor for grey power. This is because these certificates do not add to the European energy transition because they have been around for a long time and are therefore not an additional investment in more green electricity.

The diagram below shows the emission factors used:

Guarantees of Origin	Emission Factor 2021
Hydropower from Iceland and Scandinavia	The 'grey' electricity factor is used: 0.556 kg CO <sub>2</sub> /kWh
All other GOs	Green electricity produced by: Water, wind or sun: 0 kg CO <sub>2</sub> / kWh Biomass (unknown): 0.075 kg CO <sub>2</sub> / kWh

## Green Gas

The term 'green gas' can be interpreted in various ways. As CNG, we only regard gas as 'green' if it actually comes from renewable sources, which is also known as biogas. This gas is released during the fermentation of materials like vegetable, garden and fruit (VGF) waste, maize or manure. In this case, we also use a lower emission factor. However, there is only a limited amount of green gas available for heating in the Netherlands.

As a company, you can also choose to offset your gas consumption, which is often referred to as 'greening', but this is in fact CO<sub>2</sub> compensation. This does not mean that gas has actually been generated from renewable sources. In this case, CNG does not use a lower emission factor, but rather the emission factor for natural gas. This is also what has actually been used. Of course, the CO<sub>2</sub> offsets count for the compensation of the emissions.

## Transportation

### Fuels - Cars and Public Transport

Here we use the factors as prescribed by the National List of Emission Factors. For a complete description of the CO<sub>2</sub> footprint, we use the WtW (Well-to-Wheel) factors, which means that the energy use for the production of fuel is included.

These emission factors were updated at the beginning of 2021 based on the STREAM Cargo Transport 2020 report from CE Delft. As a result, many emission factors have changed, especially those for the composition of litres of petrol. This is based on a blend of fossil and renewable petrol and has been updated to reflect the blend (E10, 90% fossil and 10% renewable) now customary in the EU. The same also applies to diesel and the current blend (B7, based on 93% fossil and 7% renewable) used in the EU.

### Air Travel

The National List includes factors for short, medium length and long flights. The proposed factors are based on operational data from KLM and include the RF Index (RFI)\* in order to include the contribution of gases other than CO<sub>2</sub> to the greenhouse effect. There is no distinction made between different flight classes, which are included as a separate factor in the calculation.

CNG has therefore decided, as in previous years, not to use CO<sub>2</sub>emissiefactoren.nl, unless expressly desired, but to use its own calculation. We believe these emission factors to be more accurate. See Appendix 1 for all applicable emission factors. Starting in 2021, CNG uses three different methods, depending on the available data:

#### 1) Flight Carbon Calculator (FCC):

This is Climate Neutral Group's new flight calculator, which has been available since February 2021. The calculator uses special database that can make accurate, flight-specific calculations. This fuel-based method is based on calculating the fuel consumption for a specific flight segment and converting this into CO<sub>2</sub> emissions using a standard conversion factor (3.16 tonnes CO<sub>2</sub>/tonne aviation fuel<sup>1</sup>). This produces increasingly accurate results for the CO<sub>2</sub> emissions from a flight, depending on the available input data,

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<sup>1</sup>Source: ICAO <https://www.icao.int/environmental-protection/Carbonoffset/Pages/default.aspx> (last access: 3-2-2021)

the aircraft type and the flight class. The following input data is essential for this calculation method: IATA codes, flight class, airline code and aircraft type (equipment code).

Our calculation is based on input fields that include flight duration, aircraft type and age, airline, seat configuration and passenger load factor. By default, an RFI of 1.9 is included in the calculation, which can be adjusted if necessary.

## **2) CNG Flight Calculator:**

If all the data necessary for the FCC is not known, CNG uses the CNG flight calculator (as in previous years). This is based on BEIS (formerly Defra) emission factors and distinguishes between flight class (if known), RFI and distance flown (including a default detour distance). This detour is maximised in the same way that ICAO does in its calculations. An RFI of 1.9 is used as standard and can be adjusted where necessary. The Tank-to-Wheel (TtW) factor and Wheel-to-Tank (WtT) factors are included in the relevant parameters of the calculation.

## **3) Zone Model:**

The zone model is based on flight zones from the Netherlands and is only used if air travel does not make up a significant part of the total footprint.

Zone 1: Europe and North Africa

Zone 2: North America, Central Africa, Middle East, India and Russia

Zone 3: West Coast America, South America, Southern Africa, Southeast Asia and Japan

Zone 4: Chile, Argentina, Australia, New Zealand and Polynesia

*\* Climate Neutral Group (CNG) uses a standard RFI of 1.9. CNG calculations of emissions from air travel also include the standard RFI factors and use tonnes of CO<sub>2e</sub> (all greenhouse gases) as the unit, in the same way as all other calculations, and can therefore be included in the total footprint. After offsetting the emissions, flying becomes **climate neutral**.*

## Paper and Water

There are no factors for these areas in the National List of Emission Factors. We therefore use emission factors from the Ecoinvent 3.6 database, calculated with the ReCiPe Midpoint (H) Method. See Table 1 for the specific emission factors.

### References

- National List of Emission Factors: [www.co2emissiefactorenfactoren.nl](http://www.co2emissiefactorenfactoren.nl)
- BEIS factors: <https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2020>

### Appendices

- Table 1 - Emission Factors 2020 and 2021

## Table of Emission Factors 2020 and 2021

Emission Factors for the CO <sub>2</sub> Calculator in the Netherlands					
Energy Use		2020		2021	
	Unit	Kg CO <sub>2</sub> /unit			
		NL	Source	NL	Source
Natural Gas	Nm <sup>3</sup>	1.884	1)	1.884	1)
Biogas (average)	Nm <sup>3</sup>	0.723	1)	0.723	1)
Landfill Gas	Nm <sup>3</sup>	0.398	1)	0.398	1)
Co-fermentation Maize/Manure	Nm <sup>3</sup>	1.039	1)	1.039	1)
Organic Waste Fermentation	Nm <sup>3</sup>	0.461	1)	0.461	1)
WWTP Sludge	Nm <sup>3</sup>	0.859	1)	0.859	1)
Offset Gas ('Green Gas')	Nm <sup>3</sup>	0		0	
Heating Oil	L	3.185	1)	3.185	1)
Electricity - Grey	kWh	0.556	1)	0.556	1)
Electricity - Green					
Wind	kWh	0	1)	0	1)
Water <sup>2</sup>	kWh	0	1)	0	1)
Solar	kWh	0	1)	0	1)
Biomass	kWh	0.075	1)	0.075	1)
District Heating					
Waste Incineration Plant	GJ	26.49	1)	26.49	1)
Combined Cycle Gas Turbine Power Station	GJ	35.97	1)	35.97	1)
Land Transportation		2020		2021	
Fuels	Unit	NL	Source	NL	Source
Petrol	L	2.74		2.784	1)
Diesel	L	3.23		3.262	1)
LPG	L	1.806	1)	1.798	1)
CNG (Natural Gas)	Kg	2.728		2.633	1)
Kilometres (Average Consumption)	Unit	NL	Source	NL	Source
Gasoline (average car)	Km	0.202	1)	0.202	1)
Hybrid - Petrol	Km			0.145	1)
Diesel (average car)	Km	0.176	1)	0.176	1)
Hybrid - Diesel	Km			0.168	1)
LPG (average car)	Km	0.153	1)	0.153	1)
Natural Gas/CNG, Compressed Natural Gas (average car)	Km	0.166	1)	0.166	1)
Electric (grey)	Km	0.092	1)	0.092	1)
Electric (green)	Km	0.003	1)	0.003	1)
Car (unknown)	km	0.195	1)	0.195	1)

<sup>2</sup>Green power certificates from hydropower from Scandinavia (incl. Iceland) are calculated using the emission factor for grey electricity

Passenger Transport by Air				2020		2021	
	Unit	WtW	Source	WtT	TtW	Source	
<b>Short flights (0 to 699km)</b>	person km	0.331	2)				
Undefined	person km	1		0.01703	0.08223	2)	
Economy	person km	0.95		0.01675	0.08088	2)	
Business	person km	1.4		0.02513	0.12132	2)	
<b>Medium Length Flight (700 to 3700 km)</b>	person km	0.180	2)				
Undefined	person km	1		0.0209	0.1009	2)	
Economy	person km	0.95		0.016	0.07727	2)	
Premium Economy	person km	0.95		0.02561	0.12363	2)	
Business	person km	1.4		0.04641	0.22408	2)	
First Class	person km	1.4		0.06402	0.30908	2)	
<b>Long flights (&gt;3700 km)</b>	person km	0.203	2)				
Undefined	person km	1		0.01991	0.09612	2)	
Economy	person km	0.7		0.01525	0.073615	2)	
Premium Economy	person km	0.7		0.02439	0.11778	2)	
Business	person km	2.1		0.04421	0.21348	2)	
First Class	person km	2.9		0.06099	0.29445	2)	
RFI	person km	1.9		1.9			
Zone 1 (return in economy)	kg CO <sub>2</sub>	500	CNG (ex. RFI)	500		CNG (ex. RFI)	
Zone 2 (return in economy)	kg CO <sub>2</sub>	1000	CNG (ex. RFI)	1000		CNG (ex. RFI)	
Zone 3 (return in economy)	kg CO <sub>2</sub>	1250	CNG (ex. RFI)	1250		CNG (ex. RFI)	
Zone 4 (return in economy)	kg CO <sub>2</sub>	2000	CNG (ex. RFI)	2000		CNG (ex. RFI)	

Transport & Overland transport				2020		2021	
	Unit	NL	Source	NL	Source		
Train	person km	0.006	1)	0.002	1)		
Bus	person km	0.140	1)	0.103	1)		
General Public Transport	person km	0.036	1)	0.015	1)		

Miscellaneous				2020		2021	
	Unit	NL	Source	NL	Source		
<b>Loose Paper</b>							
Office Paper	Kg	1.1	CNG	1.22	3)		
Printed Matter	Kg	1.6	CNG	1.22	3)		
<b>Water</b>							
Drinking Water	m <sup>3</sup>	0.003	CNG	0.003	4)		

1) List of National Emission Factors; <http://co2emissiefactoren.nl/>

2) BEIS factors: <https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2020>

3) Ecoinvent 3.6, Paper, newsprint {RER} | market for | Cut-off, S.

4) Ecoinvent 3.6: Tap water {Europe without Switzerland} | market for | Cut-off, S

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