Industrial Alliance
for Reducing Energy consumption and CO_2 emissions
(IND-ECO)

Leather and footwear industries

WP 7: Communication

Task 5: Companies communication - CO_2 claims

Guideline for a simplified calculation of the CO_2 equivalent emissions in leather and footwear industries due to energy uses

Index

Foreword

This guideline provides a methodology to calculate the emissions of Green House Gases expressed as CO_2 equivalent caused by energy use within a tannery or footwear industrial site and to prepare and issue a "CO_2 equivalent emission due to energy use" report for any tannery or footwear industrial site.

Supporting data, parameters and conversion factors, basic useful definitions and acronyms are also provided.

The guideline herewith presented has been prepared in compliance with Task 4 "Companies communication - CO_2 claims" of the Work Package 7 "Communication" of the project "Industry alliance for reducing energy consumption and CO_2 emissions" (INDECO).

This is a simplified methodology based on emission factors made available by the European Commission and on the overall energy consumption figures monitored by the INDECO companies.

More detailed methodologies may be used to calculate CO_2 equivalent emissions taking into account:

- specific characteristics of the energy carries,
- GHG emission from other sources such as
  - off – site transport,
  - use / combustion of raw materials, chemicals, etc.,
- GHG losses from refrigerators and air conditioning systems, electric devices, etc.

Please consider that several supporting conversion factors and parameters describe the energy carriers characteristics that can vary from one region to another and from a supplier to another. Anybody wishing to carry out a more precise calculation of CO_2 equivalent emissions may retrieve and apply specific conversion factors related to his situation.

Acronyms

CO_2	Dioxide carbon
CO_2 eq	Dioxide carbon equivalent
IPCC	Intergovernmental Panel on Climate Change
GHG	Greenhouse Gas
GWP	Global Warming Potential
NCV	Net Calorific Value
Smc	Standard cubic meter

Definitions

Carbon Dioxide Equivalent
A metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential (GWP). The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP.
Emission Factor
A unique value for scaling emissions to activity data in terms of a standard rate of emissions per unit of activity (e.g., grams of carbon dioxide emitted per barrel of fossil fuel consumed, or per pound of product produced).
Energy

Electricity, fuels, steam, heat, compressed air, and other like media

Energy consumption

Quantity of energy applied

Greenhouse Gas

Any gas that absorbs infrared radiation in the atmosphere. Greenhouse gases include, carbon dioxide, methane, nitrous oxide, ozone, chlorofluorocarbons, hydrochlorofluorocarbons, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride.

Global Warming Potential

A measure of the total energy that a gas absorbs over a particular period of time (usually 100 years), compared to carbon dioxide. Source for GWP is IPCC, GWP100, 2007.

Net calorific value

Amount of heat released by combusting a specified quantity (initially at 25°C) and returning the temperature of the combustion products to 150°C, which assumes the latent heat of vaporization of water in the reaction products is not recovered. The NCV are the useful calorific values in boiler combustion plants and are frequently used in Europe.

Standard cubic meter

A gas cubic meter in standard conditions: temperature of 273.15 K (0 °C) and absolute pressure of 1.00 atm (1.01325 bar)

Proposed report index

It is proposed the following index for the "CO_2 equivalent emission due to energy use" report.

1 Company / site description
2 Scope of the calculation of CO_2 eq emissions
3 Plant and process description
4 Energy consumption generating GHG emissions
5 CO_2 eq emission factors
6 CO_2 eq emissions from diesel oil combustion
7 CO_2 eq emissions from natural gas combustion
8 CO_2 eq emissions from coal combustion
9 CO_2 eq emissions from off – site electricity production
10 Contribution of self production of electricity
11 CO_2 eq emissions from methane / natural gas leaks
12 Total CO_2 equivalent emissions

Guidelines

1 Company / site description

Provide a short Company profile (if available from audit: products, production sites, description of plant processes, personnel, etc.).

2 Scope of the calculation of CO_2 eq emissions

Define the scope of your calculation of CO_2 eq emissions making the following example text suited for you own situation:

"
The emissions of CO_2 eq have been calculated considering the emissions of GHG due to the use of different energy carriers such as gas, diesel oil, electricity within the PLANT NAME.
The considered time scale is one year.
The reference year is 201X
Methane losses from pipelines have been considered.
Emissions arising from off-site transports have not been considered.
"

3 Energy consumption generating GHG emissions (if available from audit)

Explanatory note:
Direct GHG emissions are generated by:
Methane / natural gas combustion
Gasoil combustion
Methane losses from natural gas distribution
Indirect GHG emissions are generated by
Electric energy consumption - CO_2eq emissions due to electric energy production off site

Provide a description of energy using plants and installations for each energy carrier:
- plants and installations using natural gas
- plants and installations using diesel oil
- plants and installations using electricity
- plants and installations using other energy carriers

Provide energy consumption figures of the reference year
- Overall energy consumption (MWh)
- Natural gas consumption (Smc)
- Diesel oil (l)
- Coal consumption (Kg)
- Other energy carriers consumptions
- Total self produced electricity using traditional energy carriers (MWh)
- Total self produced electricity using renewable resources (MWh)
- Total electricity sold to the distribution network (MWh)
- Total production of the reference year (m^2 of produced leather or Kg of produced leather)

4 CO_2 equivalent emission factors

Emission factors for combustion of energy carriers and electricity production

Emission factors provide the quantity of emitted GHG expressed in tons of CO_2 equivalent per unit of energy consumed.
Emission factors for each considered energy carrier have been provided by the European Commission – Covenant of Majors "Reporting Guidelines on Sustainable Energy Action Plan and Monitoring", version 1, May 2014.
LCA emission factors are proposed.
LCA emission factors (JRC, 2009) take into consideration the overall life cycle of each energy carrier, i.e. include not only the greenhouse gas emissions due to fuel combustion but also emissions of the entire energy supply chain – exploitation, transport, processing.

Emission factor for leaks of methane

Methane is the major component of natural gas and is a quite powerful GHG having a Global Warming Potential of 25,00 kg CO_2 eq / kg CH_4 (GWP 100 IPCC 4AR - 2007, tab 2.14).
It has been chosen an emission factor for the quantity of CH_4 lost from natural gas distribution networks (pipelines, valves, flanges, etc.) inside a plant provided by SNAM (www.snam.it) "Bilancio di sostenibilità 2011" (Sustainability report 2011).

5 CO_2 eq emissions from diesel oil combustion

Required data

Total diesel oil consumption of the year in litres (l)

Supporting data

Diesel oil net calorific value:	35,9 MJ/l
Emission factor for diesel oil:	0,305 t CO_2 eq/MWh
1 MJ:	0,00028 MWh

CO_2 eq emission (t) = Total diesel oil consumption of the year (l) * 0,003 (t/l)

6 CO_2 eq emissions from natural gas combustion

Required data

Total natural gas consumption of the year in Standard Cubic Meters (Smc)

Supporting data

Natural gas density:	0,71 Kg/Smc
Natural gas net calorific value:	0,0106 MWh/Kg
Emission factor for natural gas:	0,237 t CO_2 eq/MWh

CO_2 eq emission (t) = Total natural gas consumption of the year (Smc) * 0,0018 (t/Smc)

7 CO_2 eq emissions from coal combustion

Required data

Total coal consumption of the year in tons (t)

Supporting data

Coal net calorific value:	25,8 MJ/Kg
Emission factor for coal:	0,386 t CO_2 eq/MWh
1 MJ:	0,00028 MWh

CO_2 eq emission (t) = Total diesel oil consumption of the year (l) * 0,0028 (t/Kg)

8 CO_2 eq emissions from off – site electricity production

Required data

Total electricity consumption of the year in MWh

Supporting data

Emission factors (t CO_2 eq/MWh) are provided for each EU Country in the following table.

Country	**Emission factor (LCA) - IPCC [t CO_2 eq /MWh]**
Austria	0.301
Belgium	0.417
Bulgaria	0.910
Croatia	0.502
Cyprus	1.014
Czech Republic	0.786
Denmark	0.748
Estonia	1.434
Finland	0.412
France	0.147
Germany	0.692
Greece	1.144
Hungary	0.634
Ireland	0.854
Italy	0.683
Latvia	0.584
Lithuania	0.177
Luxembourg	0.641
Malta	1.705
Netherlands	0.743
Poland	1.153
Portugal	0.734
Romania	1.043
Slovak Republic	0.334

Slovenia	0.631
Spain	0.593
Sweden	0.083
United Kingdom	0.644

Source: European Commissione – Covenent of Majors "Reporting Guidelines on Sustainable Energy Action Plan and Monitoring", version 1, May 2014
Source for LCA emission factors: the European Reference Life Cycle Database (ELCD) has been used as primary source of life cycle emissions related to the different technologies of electricity production http://lca.jrc.ec.europa.eu/lcainfohub/datasetArea.vm (year 2002). Data on national electricity production from different energetic vector is acquired from International Energy Agency, 2010 (Energy statistics of OECD Countries).

CO_2 eq emission (t) = Total electricity consumption of the year (MWh) * EF of the Country (t/MWh)

9 Contribution of self production of electricity

The electricity produced within the company's installation may be consumed by the installation itself, sold to the distribution network or both.

In case of self production of electricity by conventional energy carriers, such as natural gas, diesel oil or coal, the emission due to the production of electricity have been already considered within the combustion of energy carriers.
Il has been also considered that self production generates a reduction of the electricity bought from the distribution network.
If a part of the self produced electricity is sold to the distribution network, a corresponding reduction of CO_2 eq emission due to the off – site electricity production has to be considered.

Required data

Total self produced electricity sold to the distribution network in the year in MWh

Supporting data

Emission factor (t CO_2 eq/MWh): see chapter 8

Avoided CO_2 eq emission (t) = Total self produced electricity sold to the distribution network in the year (MWh) * EF of the Country (t/MWh)

In case of self production of electricity using renewable sources, such as wind power, hydroelectric, photovoltaics, the emission due to the production of electricity has to be considered using the LCA emission factors provided in the following table.

Technology	Emission factor (LCA) - t CO_2 eq. /MWh
Wind power	0.020-0.050a)
Hydroelectric power	0.007
Photovoltaics	0.024b)

Source: European Commissione – Covenent of Majors "Reporting Guidelines on Sustainable Energy Action Plan and Monitoring", version 1, May 2014

CO_2 eq emission (t) = Total self produced renewable electricity (MWh) * EF of the specific renewable resource (t/MWh)

If a part of the self produced renewable electricity is sold to the distribution network, a corresponding reduction of CO_2 eq emission due to the off – site electricity production has to be considered.

Required data

Total self produced renewable electricity sold to the network in the year in MWh

Supporting data

Emission factor (t CO_2 eq/MWh): see chapter 9

Avoided CO_2 eq emission (t) = Total self produced electricity sold to the distribution network in the year (MWh) * EF of the Country (t/MWh)

10 CO_2 eq emissions from methane / natural gas leaks

Required data

Total natural gas consumption of the year in Smc

Supporting data

Natural gas density:	0,71 Kg/Smc
Average methane content in Natural gas	90 %
Methane GWP:	25 kg CO_2 eq / kg CH_4
Emission factor for natural gas:	0,51% (0,0051 lost Kg/bought Kg)

CO_2 eq emission (t) = Total natural gas consumption of the year (Smc) * 0,000081 (t/Smc)

11 Total CO_2 eq emissions

The total amount of CO_2 eq emissions is calculated as the sum of all the emissions calculated for each contribution of direct and indirect GHG emissions.

12 CO_2 eq specific emissions

To allow to compare performances of different plants, the total CO_2 eq emission shall be divided by the value of the total production of the site in the reference year.

Total specific CO_2 eq emissions (t CO_2 eq/m^2*y)= Total CO_2 eq emissions (t CO_2 eq)/ yearly production (m^2/y or other relevant)

13 Evaluation of CO_2 eq emissions reduction due to energy efficiency improvements

Following energy audits carried out within the INDECO Project, improvements to the factory energy efficiency might have been implemented.
In this case, the organization should evaluate the positive impact of the energy efficiency improvements implemented of the CO_2 eq emissions.
Since the yearly energy consumption and the CO_2 eq emissions are directly linked to the yearly production, the effects on the CO_2 eq emissions should be expressed with reference to the specific CO_2 eq emissions and not to the total CO_2 eq emissions.
Different methods for the estimation are proposed in the following.

Method 1

This method can be applied if the total energy consumption for each energy carrier - together with the yearly factory production - have been measured for one year both before and after the improvement implementation.
Total CO_2 eq emissions per unit product can be calculated for one year before and after the implementation of the improvement project and compared.

Method 2

This method can be applied if the total energy consumption for each energy carrier - together with the factory production - have been measured for a significant reference time period (e.g. at least one month) both before and after the improvement implementation.
Total CO_2 eq emissions per unit product can be calculated for the reference time period after the implementation of the improvement project and compared.

Method 3

This method can be applied if energy meters are installed to monitor energy consumption of the specific plant or plant section where the improvement project has been implemented.
In this case, the specific energy consumption of the plant or plant section can be measured before and after the implementation of the energy efficiency project; the two results can be compared

Method 4

This method is to be applied if no measurements nor energy consumption data are available after the energy efficiency project implementation.
The reduction of energy consumption shall be assumed on the basis of technical information communicated by providers or by the designer.

Bibliography

- ISO 14064-I:2006 Greenhouse gases -- Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals
- European Commission – Covenant of Majors "Reporting Guidelines on Sustainable Energy Action Plan and Monitoring", version 1, May 2014.
- IPCC Fifth Assessment Report (http://www.ipcc.ch/report/ar5/)