BENEŠ a LÁT a.s.
Továrni 463, 289 14 Poříčany

Calculation of the carbon footprint
Plant Z02 - Poříčany

(Scope 1 and 2)

Processed by authorized person according to Act No. 201/2012 Coll., on air protection	Ing. Zbyněk Krayzel Poupetova 13/1383, 170 00 Prague 7 Holesovice ID number - 71519475 Tel.: 602 829 112, 266 711 179 E-mail: zbynek.krayzel@seznam.cz
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Stamp and signature	Ing. Zbyněk Krayzel Poupětova 13/1383 170 00 Praha 7 - Holešovice IČO: 71519475

Content

1. Introduction and company introduction

The production of BENES a LAT a.s. at the assessed facility "Engineering plant in the Poricany industrial zone" includes the production of aluminium castings for the automotive industry, radio communications, the production of locomotives, compressors, etc. The smelting and casting technology includes an aluminium smelter with four crucible furnaces and one shaft melting furnace and a foundry of aluminium, where there is a gravity casting workplace, a low-pressure casting workplace into metal molds and a low-pressure casting workplace with sand cores.

The raw materials for the production of castings are primarily aluminium ingots, to which production waste (offcuts, scrap castings) is added. The ingots are melted in melting furnaces, and after degassing, the molten metal is distributed to individual gravity or low-pressure casting workplaces. The molten metal is further modified by the addition of alloying additives to modify the chemical composition and refining salts to modify the physical properties of the castings.

Related operations are the sand core preparation, where the surface of the cores is prepared, in the smelting plant, the deposits on the inflow systems of the castings are removed and the surface of the castings from gravity and low-pressure casting is refined. The machining shop is an operation for machining aluminium castings equipped with CNC machines and a washing machine for castings. Heat treatment of castings (hardening) is carried out on an electric continuous hardening line.

2. Carbon footprint, introduction, and concepts

The carbon footprint is the sum of released greenhouse gases expressed in CO_2 equivalents. A carbon footprint can relate to an individual, a product or an event. However, it is most often used in connection with products and defines the sum of all greenhouse gases that were emitted during the production of the given product. Similar product characteristics serve to select the one whose production has the least impact on the environment.

This is an indicator of the environmental load, which is derived from the total ecological footprint. It is usually expressed in CO_2 equivalents. That is, not in the weight of carbon itself, but of the carbon dioxide produced from it and also other emitted greenhouse gases (e.g. methane, nitrous oxide, halogenated hydrocarbons), whose weight is recalculated to how much CO_2 would have the same warming effect. However, it is necessary to pay attention to the fact that sometimes the other gases are neglected in the data on the carbon footprint, which can mean a big difference (this is also a problem with the data in the following text). A term that clearly indicates their inclusion is the so-called **greenhouse footprint.**

Direct and indirect footprint

The carbon footprint can be divided into direct and indirect.

Direct (primary) footprint – the amount of greenhouse gases released directly during a given activity (during electricity generation, heating, fuel combustion, etc.).

Indirect (secondary) footprint – the amount of greenhouse gases released during the product's entire life cycle – from production to eventual disposal.

Carbon footprint levels

Carbon footprint can be measured at different levels – city level, business level, individual level, product level, etc.

Enterprise level

This includes all released emissions falling within the operation of the company. Currently, the Greenhouse Gas Protocol (GHG Protocol) is used to calculate a company's carbon footprint, which divides the carbon footprint into three categories: Category 1 emissions (Scope 1), Category 2 emissions (Scope 2) and Category 3 emissions (Scope 3).

Scopes

Scope 1 (direct emissions) – activities that fall under the given enterprise and are controlled by it, during which emissions are released directly into the air. These are direct emissions. They include, for example, emissions from boilers or generators burning fossil fuels in the company, emissions from mobile sources (e.g. cars) owned by the company or emissions from industrial processes, emissions from waste treatment or wastewater treatment in facilities operated by the company.

Scope 2 (indirect emissions from energy) – emissions associated with the consumption of purchased energy (electricity, heat, steam, or cooling), which do not occur directly in the company, but are a consequence of the company's activities. These are indirect emissions from sources that the company does not directly control, yet it has a fundamental influence on their size. If the company itself produces electricity/heat and sells it to other customers, or if it sells the purchased electricity/heat to other customers (for example, tenants) and the amount of this electricity is measured, it is deducted from the total Scope 2 emissions. The procedure for determining Scope 2 emissions (in terms of own energy production from renewable energy sources and other factors) was updated in January 2015, and detailed methodologies are available on the GHG Protocol website.

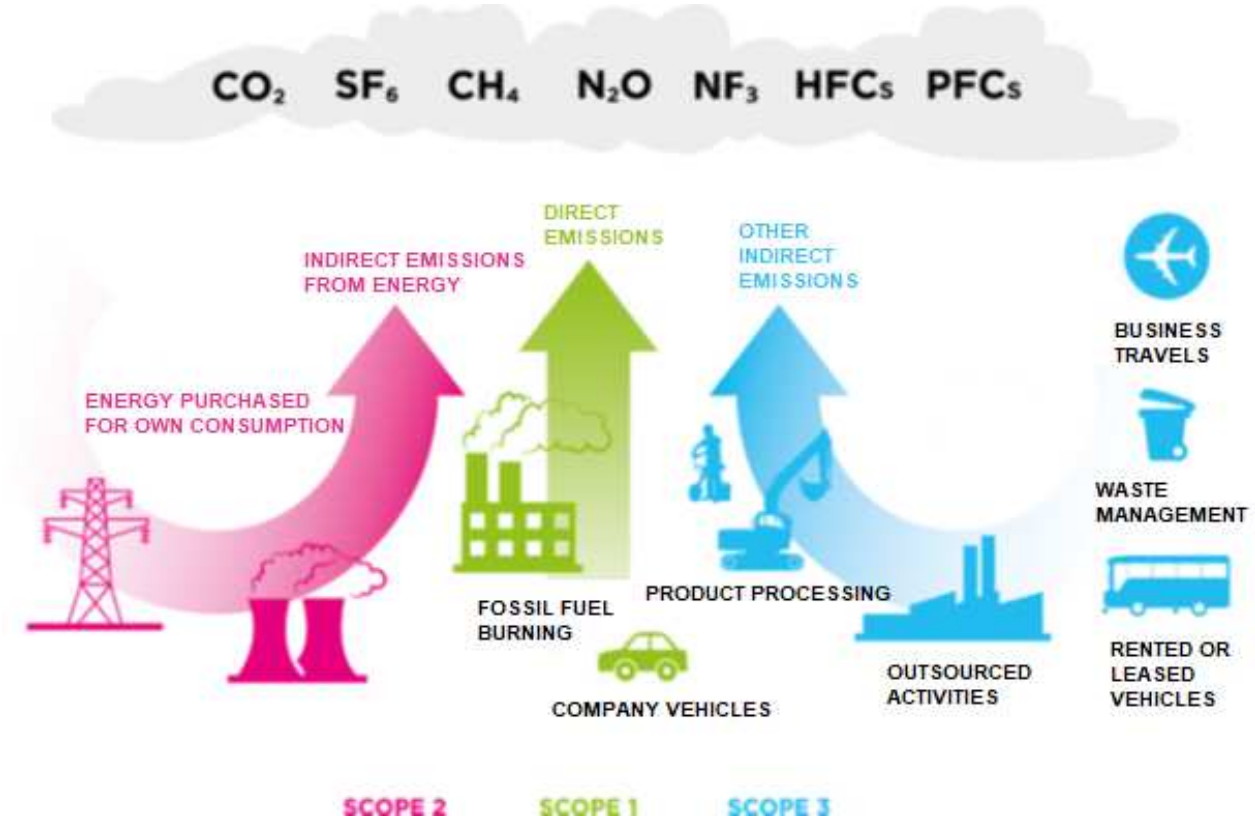
Scope 3 (other indirect emissions) – emissions that are a consequence of the company's activities and that arise from sources outside the control or ownership of the company but are not classified as Scope 2 (e.g. business travel by plane, landfilling, purchase, and transport of material by a third party etc.). It follows from the definition that it is the broadest and logically least precisely defined category. While Scope 1 and Scope 2 emissions are well comparable between companies, Scope 3 emissions are only comparable to a limited extent. Therefore, reporting of Scope 1 and Scope 2 emissions is mandatory in the GHG Protocol and in the CDP database, while Scope 3 is only recommended. In recent years, however, Scope 3 has become increasingly important, and companies report at least the most important items within Scope 3 as a standard. Here they can demonstrate innovative emissions reduction management. A detailed technical description of the calculation of the main types of Scope 3 emissions is provided by the GHG Protocol.

When determining a company's carbon footprint, it is necessary to correctly quantify all Scope 1 and Scope 2 emissions, which are mandatory from the point of view of the GHG Protocol and other standards. Scope 3 emissions are optional - we recommend selecting those items that are the most important from the point of view of management or the operation of the company, or which can be effectively reduced.

Carbon footprint of the company (Company Carbon footprint)

The carbon footprint of the company is therefore a measure of the impact of the company's functioning on the environment and especially on climate change. The carbon footprint is an indirect indicator of the consumption of energy, products, and services. It measures the amount of greenhouse gases that correspond to the company's activities or products. In addition to the enterprise level, the carbon footprint can be determined at other levels – national, municipal, individual.

COMPOSITION OF THE COMPANY'S CARBON FOOTPRINT



Greenhouse gases (GHG – Green House Gases)

These are gases that occur in the Earth's atmosphere and contribute to the greenhouse effect. On the one hand, they are of natural origin (such as water vapor, methane), and on the other hand, they are released by human activity (mainly by burning fossil fuels, but also by a number of other activities). In the context of human-induced climate change and the carbon footprint, we are interested in the second group of these gases.

The GHG Protocol1 registers a total of seven anthropogenic greenhouse gases that are relevant in terms of the company's carbon footprint. The table shows the main sources of these gases, their names, sources, and global warming coefficient. The most common of them is carbon dioxide - CO_2, which is formed every time a substance containing carbon (C) reacts with oxygen (O_2) in the atmosphere. Carbon dioxide covers all greenhouse gases, we can convert them to it, similar to how we convert Czech crowns to euros, for example. The exchange rate in this comparison is the so-called global warming potential (GWP).

GWP - Global Warming Potential

A measure of the potential contribution of a given gas to the greenhouse effect. The unit is the contribution to the greenhouse effect of one molecule of CO_2. Using these coefficients, it is possible to determine the so-called CO_2 equivalent (written as CO_2 equiv., CO_2 eq., CO_2e), i.e. the amount of CO_2 that

would have an equivalent contribution to the greenhouse effect of the atmosphere equal to the given amount of the relevant gas. It usually refers to a time horizon of 100 years.

Table No. 1 - Greenhouse gases and GWP

Greenhouse gas	Chem. formula	Resources (from human activity)	GWP
Carbon dioxide	CO_2	Combustion of fossil fuels and biomass (80%); deforestation; aerobic decomposition of organic matter; erosion.	1
Methane	CH_4	Anaerobic decomposition of organic matter, biomass burning and landfill (5%); natural gas and oil processing, coal resources, gas leaks, cattle breeding, rice cultivation (25%).	25
Nitrous oxide	N_2O	Agricultural activity, production of nitric and adipic acid, combustion processes, rocket, and aviation technology.	298
Fluorinated hydrocarbons	HFC	Industrial processes, replacement of freons in refrigeration and air conditioning equipment, propellant gases - fire extinguishers, cleaning agents, foaming agents.	650 - 14,800
Perfluorocarbons	PFC	Refrigeration equipment, industrial processes, aluminium and semiconductor production, pharmaceuticals, cosmetics.	6,500 – 23,000
Sulphur fluoride	SF_6	Electrotechnical industry, magnesium, and aluminium smelting.	22,800 – 23,900
Nitrous fluoride	NF_3	Production of plasma screens, solar panels and liquid crystal displays, selective agent.	17,200

Note: The GWP values of specific HFCs, PFCs and other substances can be found on the GHG Protocol website: http://www.ghgprotocol.org/files/ghgp/tools/Global-Warming-Potential-Values.pdf.

Emission factors

Emission factors express the amount of greenhouse gases in tons of carbon dioxide or other greenhouse gases related to a unit of energy or use another unit expression (per mass or volume of the product). In the next step, these factors must be converted to the corresponding amount of greenhouse gases expressed in carbon dioxide equivalents (CO_2 eq.) using the GWP of the given gas. Some emission factors are country-specific – for example, electricity depends on the national energy mix, which is different for each country and changes over time. Similarly, for specific products (for example a computer) it is advisable to obtain the emission factor directly from the manufacturer of the given product.

Units

A company's carbon footprint is usually expressed in tons of carbon dioxide equivalent (t CO_2 eq.). In the case of partial activities or the carbon footprint of the product, kilograms (kg) or grams (g) of CO_2 eq. can be used. The input data units for calculating the carbon footprint are much more varied. In the case of energy, it is most often kWh or MWh. Other used energy units (e.g. joules or calories) must be converted to this unit. Other inputs are most often weight (tons, kilograms) or volume (cubic meters, litres).

Carbon neutrality

Carbon neutrality means achieving a zero-carbon footprint. This is a somewhat misleading term. In the case of the vast majority of businesses, this is an unrealistic goal. Businesses must primarily focus on their activities, and in doing so, greenhouse gas emissions inevitably arise. Carbon neutrality therefore means achieving zero **net emissions**. This means offsetting the production of emissions and removing them from the atmosphere, for example through offsets. The key point is that the primary concern of each emitter should be **the reduction of** their gross (absolute) amount of emissions and only the second step of offsetting them.

Offsets

Offsets are defined as quantified reductions in greenhouse gas emissions used to offset (i.e. offset) greenhouse gas emissions emitted somewhere else (by another source), for example to meet a voluntary or mandatory greenhouse gas emission reduction target. Offsets are calculated relative to a default value that represents a hypothetical scenario for the original state (i.e. the level of emissions in the absence of an offset project).

Additionality

Additionality means the implementation of compensatory measures that would otherwise not be implemented. If, for example, replacement planting or reforestation of forest land is carried out by law, this is not additionality, as there will be no additional assimilation of CO_2 compared to *business-as-usual*. The following criteria can be applied to test whether an offset project meets the conditions of additionality:

- The measure is not required by current regulation.
- It is not common practice in the given sector or region.
- There is a guarantee that the project will be implemented within the necessary time horizon (e.g., the newly planted greenery will not be neglected in maintenance so that it binds the required amount of carbon dioxide from the atmosphere during its lifetime).

Basic standards

GHG Protocol (http://www.ghgprotocol.org)

A globally used corporate standard for carbon footprint measurement and reporting. It standardizes the procedure for measuring, managing, and reporting greenhouse gas emissions from the company. It was created by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). It is used as the basis for a large number of programs that inventory greenhouse gas emissions. Since its inception in 2001, more than 1,000 businesses and other types of organizations have used it. This methodology is based on the GHG Protocol standard.

CSN ISO 14064 standard – Greenhouse gases

The ISO 14064 standard consists of three complementary components. The ISO 14064-1 standard includes requirements for the planning, implementation, management, and administration, reporting and verification of greenhouse gas emission inventories for organizations. The second part of the standard (14064-2) regulates the requirements for monitoring and reporting achieved reductions in emissions or increases in greenhouse gas sinks through projects and/or project-oriented activities. The third part (14064-3) sets out the principles and requirements for the verification of greenhouse gas inventories and for the validation and verification of greenhouse gas projects. The GHG Protocol and ISO 14064 are mutually compatible.

CDP - Carbon Disclosure Project (https://www.cdp.net)

CDP is a voluntary scheme for disclosing information about the carbon footprint of businesses and the impact of businesses on the environment. It is a global initiative to which, on the one hand, companies report detailed data on their

carbon footprint and energy and carbon management, and on the other hand, investors and other interested parties draw information from it. Thousands of companies, including the most important globally, are currently reporting to the scheme, and 822 institutional investors with a total asset volume of $95 trillion draw on it. In addition to the carbon footprint, CDP has a program focused on forests and the supply chain. The provision of data to the CDP is based on online questionnaires for companies.

3. Company data and technical description of greenhouse gas sources

Company data

Table No. 2 – Operator specifications

Operator identification number	257 24 304
Business name	BENES a LAT a.s.
Residence	Tovarni 463, 289 14 Poricany
Phone	+420 267 227 300
E-mail	info@benesalat.cz
Statutory representative of the operator	Svatopluk Runcik, director of the company
A person authorized to act on behalf of the operator	Ing. Frantisek Sulc, company ecologist

Table No. 3 – Establishment specifications

Establishment identification number (ICP)	725980921
Name of establishment	**BENES a LAT a.s. – Z02 Poricany**
Resource name	**Classification**
101 – Melting furnaces LAC 1, 2, 3, Elsklo, STRIKO, gravity and low-pressure casting	Listed stationary source of air pollution according to Annex No. 2 of Act 201/2012 Coll., **4.10.** – Melting and casting of non-ferrous metals and their alloys with a total projected capacity of more than 50 kg per day
102 – Shot Blasting Machine (Sand Core Production)	Listed stationary source of air pollution according to Annex No. 2 of Act 201/2012 Coll., **4.8.1.** – Transport and handling of the batch or product
103 – Amine Washer (Sand Core Production)	
104 – Tool shop	Listed stationary source of air pollution according to Annex No. 2 of Act 201/2012 Coll., **4.13** – Grinding of metals and plastics with a total electrical input higher than 100 kW
105 – Blasting molds	Listed stationary source of air pollution according to Annex No. 2 of Act 201/2012 Coll., **4.12** – Surface treatment of metals and plastics and other non-metallic objects with a total projected capacity of the spa volume up to 30 m^3 inclusive (excluding rinsing), processes without the use of spas

106 – Machining plant	Listed stationary source of air pollution according to Annex No. 2 of Act 201/2012 Coll., **4.13** – Grinding of metals and plastics with a total electrical input higher than 100 kW
Melting furnace burners ELSKLO and LAC (non-contact heating) unlisted source	
Region	Central Bohemia
Address of the establishment	Poricany 463
Cadastral territory	Poricany, 725986
Municipality	Poricany 537705
Parcel numbers	709/50 (foundry hall), 709/85 (workshop hall), 709/80 (area road), 709/81 (wastewater treatment plant), 709/78 (central maintenance building) and 709/1 (handling area) After the workshop was built, there were changes to the land, see change 3 of the IP decision
Responsible person	Ing. Frantisek Sulc
Mobile phone	+ 420 606 611 519
E-mail	frantisek.sulc@benesalat.cz
Total capacity	7920 tons of metal per year

The following activities generate greenhouse gas emissions at the company:

Table No. 4

Z02-Poricany		2020	2021	2022
	basic energy			
electrical energy	MWh	3,695	4,152	3,221
share of energy from renewable sources	%	24	28	72.6
of which renewable	MWh	887	1,163	2,338
non-renewable from it	MWh	2,808	2,989	883
gas (consumption via main gas meter)	m^3	440,003	490,179	352,317
gas (consumption via main gas meter)	MWh	4,664	5,196	3,735
	other energy inputs			
motor vehicles (gasoline (GO))	l	1,172	820	1,137
motor vehicles (diesel (DF))	l	1,765	3,633	6,116
motor vehicles (gas, LPG)	l	1,896	2,202	2,249
propane-butane for forklifts	kg	2,230	2,640	1,710
	wastewater treatment			
sewage wastewater from the WWTP		8,790	5,735	8,118
	CHS&C			
name				
dry ice	kg	13,800	14,200	14,600
CO_2 compressed	kg	160	160	200
acetylene	kg	30	30	20
Ferroline C18 (18% $CO_{2)}$	l	0	0	0
Eutectal T 201 (25% $CaCO_{3)}$	kg	0	0	0

4. Carbon footprint calculation

Emission sources identification

The basic step in determining the total emissions of greenhouse gases from the company (i.e. its carbon footprint) is the identification of the main sources of these emissions within the company, or beyond its borders, if they are related to its activity (see Scope 1, Scope 2, and Scope 3). In practice, this means obtaining data from various departments of the company (e.g. *facility management, procurement, environmental management,* etc.) about **the consumption** of given items in a given period (most often it is a calendar year). The problem may be that the relevant departments have information in monetary (invoice) units, not physical units. For example, fuel consumption in company vehicles is expressed in crowns, not litres. In the vast majority of cases, however, it is possible to convert monetary units into physical units, which are necessary for calculating the carbon footprint.

Emissions calculation

The next step is the actual calculation of greenhouse gas emissions. In practice, it means **multiplying** the consumption/production data by the corresponding emission factors. Great care must be taken to use the correct unit and order. If the input data is given in units other than the emission factor, it is necessary to convert it to the corresponding unit and order. In the first phase, the calculation is performed separately for each relevant greenhouse gas (CO_2, CH_4, N_2O, HFC, PFC, SF_6 and NF_3). Subsequently, these emissions are converted according to their contribution to global climate change (GWP) into so-called equivalent emissions of carbon dioxide (CO_2 eq.). This parameter represents the resulting unit of the company's carbon footprint. Calculation formula and calculation procedure based on specific data:

EMISSION CALCULATION FORMULA

$$ADix \times EFix = CFix$$

$$CFx \times GWPx = CF\ CO_2\ eq.$$

- ADix – activity data for item "i" and greenhouse gas "x"
- EFix – emission factor for item "i" and greenhouse gas "x"
- CF – carbon footprint (greenhouse gas emissions) for item "i" and greenhouse gas "x"
- GWPx – contribution to climate change of greenhouse gas "x"
- CF CO_2 equiv. – carbon footprint (greenhouse gas emissions) expressed in carbon dioxide equivalents.

Presentation of results

In a subsequent step, the sub-items - emissions for individual activities and items - need to be summed to obtain aggregate results for all Scopes. In the case of larger companies that have several establishments, or multinational companies, it is necessary to perform a calculation for individual establishments/countries.

These data can be presented individually and only in a subsequent step then collectively for the entire company. The unit used in summary reporting is equivalents of carbon dioxide – CO_2 eq. When it comes to repeated calculation, it is advisable to include graphs and tables affecting the development of the company's emissions in individual years. Again, it is possible to present separately the results for Scopes and establishments.

Another possibility is the presentation of the development of the carbon footprint and economic results of the company in one graph. If it is a repeated calculation, it is advisable to include graphs and tables affecting the development of emissions of the given company in individual years. Again, it is possible to present separately the results for Scopes and establishments. Another possibility is the presentation of the development of the company's carbon footprint and economic results in one graph, which enables a simple view of the company's emission efficiency. Various examples of presentation of results are given in the box.

Table No. 5

National values for EF, calorific value, and oxidation factors

Excerpt from the Czech National Inventory Report 2020 regarding the calorific values and emission factors used.

Fuel (definition accordingly to IPCC 2006 Guidelines)	NCV [TJ/kt]	CO_2 EF [a] [t CO_2/TJ]	Oxidation factor	CO_2 EF [b] [t CO_2/TJ]
Crude Oil	42.5	73.3	1	73.3
Gas/Diesel Oil	42.6	74.1	1	74.1
Residual Fuel Oil	39.5	77.4	1	77.4
LPG [d]	45.945	65.86	1	65.86
Naphtha	43.6	73.3	1	73.3
Bitumen	40.193	80.7	1	80.7
Lubricants	40.193	73.3	1	73.3
Petroleum Coke	39.4	97.5	1	97.5
Other Oil	39.29	73.3	1	73.3
Coking Coal [d]	29.498	93.53	1	93.53
Other Bituminous Coal [d]	26.511	94.41	0.9707	91.64
Lignite (Brown Coal) [d]	13.228	99.35	0.9846	97.82
Brown Coal Briquettes	23.055	97.5	0.9846	96
Coke (Brown Coal Coke)	28.299	107	1	107
Coke Oven Gas	16.064	44.4	1	44.4
Natural Gas (TJ/Gg) [d]	47.114	55.45	1	55.45
Natural Gas (TJ/mill.m^3) [d]	34.51	55.45	1	55.45

a) Emission factor without oxidation factor
b) Resulting emission factor with oxidation factor
c) TJ/mill. m^3, t= 15 °C, p = 101.3 kPa
d) Country specific values of CO2 EFs and oxidation factors

Item	Emission factor (t CO_2 /TJ)
Brown coal	96.07
Black coal	89.80
Distant heat	110.00
Light fuel oil	72.53
Diesel	72.53

Item	Emission factor (t CO_2 /TJ)
Petrol	67.91
LPG	63.06
Natural gas (including CNG)	55.50
Propane butane	62.39

CO_2 emission factor from electricity production for the years 2020–2022

The current value of the CO_2 emission factor from electricity production is calculated based on the following methodology:

The primary energy of fossil fuels used in a given year (according to individual fuels) for the production of electricity is multiplied by specific emission factors for the given fuels (or for related fuels). The resulting total value is divided by the total gross production of electricity in the Czech Republic. The CO_2 emission factors from the burning of fossil fuels in the calculation are based on the IPCC 2006 methodology and national emission factors. In the calculation, RES are considered as CO_2 neutral, i.e. with zero emissions. This is a calculation based on the underlying data of the Comprehensive Energy Balance of the Czech Republic for 2019.

The values of the CO_2 emission factor of electricity calculated on the basis of this methodology are not identical to the values specified in Decree No. 480/2000, on energy audit and energy assessment, where the values of the CO_2 emission factor are determined for a specific purpose (enforcement of state policy) and relate to produce electricity from fossil sources. This decree will be replaced in 2021 by two decrees, the decree on energy audit and the decree on energy assessment.

The data below can be used exclusively for informational purposes, e.g. to monitor the real carbon footprint of companies that purchase electricity from the public grid, or e.g. for electricity sellers who purchase it on the open market.

Table No. 6

Year	t CO_2 / MWh
2020	0.384
2021	0.390
2022	0.413

5. Calculation

5.1. Combustion of natural gas

Natural gas is used to produce heat both for domestic hot water and for technology needs.

Table No. 7 - Calculation of the carbon footprint - combustion sources for burning natural gas

Parameter	Unit	2020	2021	2022
gas (consumption via main gas meter)	m^3	440,003	490,179	352,317
gas (consumption via main gas meter)	kWh	4664000	5196000	3735000
Heat in the fuel	TJ/year	16.790	18.706	13,446
Emission factor	t CO_2/TJ	55.45	55.45	55.45
Emissions of CO_2 equiv.	**tons / year**	**931.028**	**1037.225**	**745.581**

5.2. Consumption of electrical energy

Electrical energy is consumed both in production and in administration. It is supplied from external sources.

Table No. 8 – Electricity consumption

Parameter	Unit	2020	2021	2022
electrical energy	MWh	3,695	4,152	3,221
share of supply from renewable sources	%	24.0	28.0	72.6
of which renewable	MWh	886.800	1162.560	2338.446
non-renewable from it	MWh	2,808.200	2,989.440	882.554

Table No. 9 – Carbon footprint calculation – according to electricity consumption

Parameter	Unit	2020	2021	2022
Amount of electricity purchased	MWh / year	2,808.200	2,989.440	882.554
Emission factor	t CO_2 / MWh	0.384	0.39	0.413
Emissions of CO_2 equiv.	**tons / year**	**2808.200**	**2989.440**	**882.554**

5.3. Emissions from transport - diesel combustion

Diesel fuel is used in passenger cars.

Table No. 10 - Calculation of the carbon footprint - emissions from transport – diesel

Parameter	Unit	2020	2021	2022
Passenger cars - consumption diesel of own vehicles	litres / year	1765	3633	6116
Emission factor	t CO_2 /litre DF	0.00266	0.00266	0.00266
Emissions of CO_2 equiv.	**tons/year**	**4.695**	**9.664**	**16.269**

5.4. Emissions from transport - burning gasoline

Gasoline is used in passenger cars.

Table No. 11 - Carbon footprint calculation - emissions from transport – gasoline

Parameter	Unit	2020	2021	2022
Passenger cars - consumption gasoline of own vehicles	litres / year	1172	820	1137
Emission factor	t CO_2 /litre GO	0.00201	0.00201	0.00201
Emissions of CO_2 equiv.	**tons/year**	**2.356**	**1.648**	**2.285**

5.5. Emissions from transport - burning LPG

LPG is used in passenger cars.

Table No. 12 – Carbon footprint calculation – emissions from transport - LPG

Parameter	Unit	2020	2021	2022
Passenger cars - LPG consumption	litres / year	1896	2202	2249
Emission factor	t CO_2 /litre LPG	0.00166	0.00166	0.00166
Emissions of CO_2 equiv.	**tons/year**	**3.147**	**3.655**	**3.733**

5.6. Emissions from transport - combustion of PB

PB is used in forklifts.

Table No. 13 - Calculation of the carbon footprint - emissions from PB

Parameter	Unit	2020	2021	2022
Forklifts - PB consumption	litres / year	2230	2640	1710
Emission factor	t CO_2 /litre PB	0.00166	0.00166	0.00166
Emissions of CO_2 equiv.	**tons/year**	**3.702**	**4.382**	**2.839**

5.7. Emissions from the combustion of acetylene in the maintenance operation

Welding equipment using acetylene is used during maintenance.

Table No. 14 – Carbon footprint calculation – emissions from acetylene combustion

Parameter	Unit	2020	2021	2022
Combustion sources under maintenance (acetylene aggregates) - amount of acetylene per year	kg/year	30	30	30
Emission factor	kg CO_2 /kg acetylene	3,385	3,385	3,385
Emissions of CO_2 equiv.	kg/year	101.55	101.55	101.55
Emissions of CO_2 equiv.	**tons/year**	**0.102**	**0.102**	**0.102**

The combustion equation for burning acetylene is:

$$\mathbf{2\ C_2H_2 + 5\ O_2 = 4\ CO_2 + 2\ H_2O}$$

Which represents:

2 x 26 + 5 x 32 = 4 x 44 + 2 x 18 (v g/mol)

Burning 52 g of acetylene and 160 g of oxygen produces 176 g of CO_2. The rest is water. 1 kg of acetylene produces 3.385 kg of CO_2.

5.8. Greenhouse gas leak emissions

The plant has a number of equipment containing greenhouse gases. These devices are hermetically sealed but may leak in the event of malfunctions or accidents.

Table No. 15 - Calculation of the carbon footprint - greenhouse gas emissions

Parameter	Unit	2020	2021	2022
HFC and other fillings	kg/year	there were no leaks.		

5.9. CO2 emissions from dry ice and compressed CO_2 consumption

Dry ice and further compressed CO_2 are used at the plant.

Table No. 16 - Calculation of the carbon footprint - emissions from the use of dry ice and compressed CO_2

Parameter	Unit	2020	2021	2022
dry ice	kg/year	13800	14200	14600
CO_2 compressed	kg/year	160	160	200
tons of CO_2	**t/year**	**13.96**	**14.36**	**14.8**

5.10. Emissions from WWTPs

A small sewage treatment plant is operated at the plant.

Table No. 17 - Calculation of the carbon footprint - emissions from the WWTP

Parameter	Unit	2020	2021	2022
Amount of WW	m^3 /year	8790	5735	8118
	litres per year	8790000	5735000	8118000
Degraded BOD_5	mg/litre	657.74	2042.13	739.17
Degraded amount of BOD_5	t/year	5.782	11.712	6.001
CO_2 equiv. emissions intensity	t CO_2/t BOD_5	2.5 – 5	2.5 – 5	2.5 – 5
CO_2	**t/year**	**28.908**	**58.558**	**30.003**

6. Conclusion

Between 2020 and 2022, the following amount of CO_2 eq. in tons was released into the atmosphere at the facility:

Table No. 18 – Grand total

Year	2020	2021	2022
Natural gas	931.028	1,037.225	745.581
Electrical energy	1,078.349	1,165.882	364.495
Transport DF	4.695	9.664	16.269
Transport GO	2.356	1.648	2.285
LPG	3.147	3.655	3.733
PB	3.702	4.382	2.839
Acetylene welding	0.102	0.102	0.102
Greenhouse gases	0	0	0
Using dry ice and compressed CO_2	13.960	14.360	14.800
Wastewater treatment plant	28.908	58.558	30.003
In total	**2,066.246**	**2,295.477**	**1,180.106**
Of which			
Scope 1	**987.897**	**1,129.595**	**815.611**
Scope 2	**1,078.349**	**1,165.882**	**364.495**

Table No. 19 – Total amount of CO_2 eq. from the Poricany plant

Year		
2020	**2021**	**2022**
tons of CO_2 per year		
2,066.246	**2,295.477**	**1,180.106**

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