# BENEŠ and LÁT a.s.
# Tovární 463, 289 14 Poříčany

## Carbon footprint calculation for 2023 (01/04/2023 - 31/03/2024)

**for**

## Z02 plant – Poříčany
## Z03 plant – Sutice
## Z08 plant – Mimoň
## Z10 plant - Slaná

(Scope 1 and 2)

| | |
|---|---|
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Content

# 1. Carbon footprint, introduction and concepts

**A carbon footprint** is the sum of released greenhouse gases expressed in $CO_2$ equivalents. The 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 carbon dioxide produced from it and other greenhouse gases emitted (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.**

# 2. Introduction and presentation of the company

The document "Calculation of the carbon footprint of BENEŠ a LÁT a.s." is a continuation of the carbon footprint calculations for individual plants of the company for the years 2020-2022, processed in 2023.

The mentioned documents also include a description of the technologies of individual plants, given that there have been no significant changes in the technology operated at any plant in the meantime, these parts of the description are omitted, and the document focuses exclusively on the calculation of carbon footprints for individual plants and for the company as a whole.

**The operator has requested a carbon footprint calculation for the "financial year 2023", which is the period from 1 April 2023 to 31 March 2024.**

The calculation is processed for the following plants:
Plant Z02 – Poříčany – gravity and low-pressure casting of aluminum, machine shop
Plant Z03 – Sutice – plastic molding plant
Plant Z08 – Mimoň - high-pressure aluminum casting
Plant Z10 – Slaná - zinc casting

In the tables and calculations, plant numbers will be used to indicate the plants.

**Company data**

| | |
|---|---|
| Business dentification number | 257 24 304 |
| Business name | BENEŠ and LÁT as |
| Residence | Tovární 463, 289 14 Poříčany |
| Phone | +420 267 227 300 |
| E-mail | info@benesalat.cz |
| Statutory representative of the business | Svatopluk Runčík, director of the company |
| A person authorized to act on behalf of the business | Ing. František Šulc, company ecologist |

# 3. Basis for calculating carbon footprints

The following activities generate greenhouse gas emissions at the company:

| | Plant | Z02 | Z03 | Z08 | Z10 |
|---|---|---|---|---|---|
| **Source of $CO_2$** | **unit** | **Basic energy** | | | |
| electrical energy | kWh | 2,763,435 | 790,541 | 1,787,982 | 1,652,063 |
| share of supply from renewable sources | % | 100 | 100 | 100 | 100 |
| of which renewable | TJ/year | 2,763,435 | 790,541 | 1,787,982 | 1,652,063 |
| non-renewable from it | TJ/year | 0 | 0 | 0 | 0 |
| natural gas (measured by main gas meter) | $m^3$ | 362,142 | 49,565 | 317,651 | 58,315 |
| | | **Other energy inputs** | | | |
| motor vehicles (gasoline) | l | 1 195 | 2,795 | - | 396 |
| motor vehicles (diesel) | l | 3,607 | 5,483 | 2,790 | 3,617 |
| motor vehicles (LPG) | l | 1 985 | 1,466 | - | 1,328 |
| propane-butane for forklifts | kg | 2080 | 1,760 | 2,550 | 0 |
| | CHLaS | **CHLaS** | | | |
| burning methane | kg | 35.5 | - | - | 995.4 |
| burning oil | kg | - | - | 1,900 | - |
| acetylene | kg | 101.5 | 67.7 | 0 | 33.8 |
| dry ice | kg | 11,250 | 0 | 0 | 0 |
| $CO_2$ compressed | kg | 150 | 40 | 60 | 70 |
| refining salt Eutektal T 201 (25% $CaCO_3$) | kg | 144 | - | - | - |
| Arsal refining salt (20% $CaCO_3$) | kg | - | - | 1,750 | - |
| | | Leaks of refrigerants (freons) | | | |
| | kg | 0 | 0 | 0 | 0 |
| | | Wastewater treatment | | | |
| wastewater treatment | $m^3$ | 3,180 | 742 | 0 | 1,226 |

**Identification of emission sources**

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 Czech crowns (CZK), not liters. In most cases, however, it is possible to convert monetary units into physical units, which are necessary for calculating the carbon footprint.

Calculation of emissions

The following 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 scale. If the input data is given in units other than the emission factor, it is necessary to convert it to the corresponding unit and scale. 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 x EFix = CFix

CFx x 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

To obtain aggregate results for all Scopes – emissions for individual activities and items – it is necessary **to add up** the sub-items. In the case of larger

companies that have several plants, or for multinational companies, it is necessary to perform a calculation for individual plants/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 carbon dioxide equivalents - $CO_2$ equiv. 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 plants.

# 4. Calculation

## 4.1 Combustion of natural gas

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

**Table No. 1 - Calculation of the carbon footprint - combustion sources for burning natural gas**

| parameter | unit | Z02 | Z03 | Z08 | Z10 |
|---|---|---|---|---|---|
| Natural gas (measured by main gas meter) | $m^3$ | 362,142 | 49,565 | 328,341 | 55,590 |
| Calorific value | $kJ/m^3$ | 34,330 | 34,330 | 34,330 | 34,330 |
| Heat in the fuel | TJ/year | 12.432 | 1.702 | 11.272 | 1.908 |
| Emission factor | t $CO_2$/TJ | 55.45 | 55.45 | 55.45 | 55.45 |
| **Emissions of $CO_2$ equiv** | **tons/year** | **689.373** | **94.352** | **625.029** | **105.821** |

## 4.2 Electricity consumption

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

**Table No. 2 – Electricity consumption**

| parameter | unit | Z02 | Z03 | Z08 | Z10 |
|---|---|---|---|---|---|
| Total consumption | kWh | 2,763,435 | 790,541 | 1,787,982 | 1,652,063 |
| Share of supply from renewable sources | % | 100 | 100 | 100 | 100 |
| of which renewable | kWh | 2,763,435 | 790,541 | 1,787,982 | 1,652,063 |
| of which non-renewable | kWh | 0 | 0 | 0 | 0 |

**Table No. 3 – Carbon footprint calculation – according to electricity consumption**

| parameter | unit | Z02 | Z03 | Z08 | Z10 |
|---|---|---|---|---|---|
| El. energy from non-renewable sources | kWh | 0 | 0 | 0 | 0 |
| **Emissions of $CO_2$ eq** | **tons/year** | **0** | **0** | **0** | **0** |

### 4.3 Emissions from transport

Each of the plants operates several passenger cars on different fuels (gasoline, diesel, LPG).

**Table No. 4 – emissions from transport – diesel fuel**

| Parameter | unit | Z02 | Z03 | Z08 | Z10 |
|---|---|---|---|---|---|
| Diesel consumption for own passenger cars | liters/year | 1,195 | 5,483 | 2,790 | 3,617 |
| Emission factor of passenger cars | t $CO_2$/liter NM | 0.00266 | 0.00266 | 0.00266 | 0.00266 |
| **Emissions of $CO_2$ equiv.** | **tons/year** | **3.179** | **14.585** | **7.421** | **9.621** |

**Table No. 5 – emissions from transport – petrol**

| Parameter | unit | Z02 | Z03 | Z08 | Z10 |
|---|---|---|---|---|---|
| Gasoline consumption for own passenger cars | liters/year | 3,607 | 2,795 | 0 | 396 |
| Emission factor | t $CO_2$/liter BA | 0.00201 | 0.00201 | 0.00201 | 0.00201 |
| **Emissions of $CO_2$ equiv.** | **tons/year** | **7.250** | **5.618** | **0** | **0.796** |

**Table No. 6 – emissions from transport – LPG**

| Parameter | unit | Z02 | Z03 | Z08 | Z10 |
|---|---|---|---|---|---|
| Consumption of LPG for own passenger cars | liters/year | 1 985 | 1,466 | 0 | 1,328 |
| Emission factor | t $CO_2$/liter LPG | 0.00166 | 0.00166 | 0.00166 | 0.00166 |
| **Emissions of $CO_2$ equiv.** | **tons/year** | **3.295** | **2.434** | **0** | **2.204** |

**Table No. 7 – emissions from transport – propane-butane**

| Parameter | unit | Z02 | Z03 | Z08 | Z10 |
|---|---|---|---|---|---|
| Forklifts - PB consumption | Liters/year | 2,080 | 1,760 | 2,550 | 0 |
| Emission factor | t $CO_2$/liter PB | 0.00166 | 0.00166 | 0.00166 | 0.00166 |
| **Emissions of $CO_2$ equiv.** | **tons/year** | **3.453** | **2.922** | **4.233** | **0** |

### 4.4 Emissions from other technological sources

**Table No. 8 – sources burning methane**

| Parameter | unit | Z02 | Z03 | Z08 | Z10 |
|---|---|---|---|---|---|
| Consumption of $CH_4$ | kg/year | 35.5 | -- | -- | 995.4 |

| | | | | | |
|---|---|---|---|---|---|
| emission factor | kg $CO_2$/kg $CH_4$ | 2.75 | 2.75 | 2.75 | 2.75 |
| emission of $CO_2$ equiv | kg/year | 97.625 | | | 2,737.35 |
| **Emissions of $CO_2$ equiv** | tons/year | **0.098** | **0** | **0** | **2.737** |

The combustion equation for burning methane is:

$$\mathbf{CH_4 + 2O_2 = CO_2 + 2H_2O}$$

Which is: 16 + 2 x 32 = 44 + 2 x 18 (vg/mol)

Burning 16 g of methane and 64 g of oxygen produces 44 g of $CO_2$. The rest is water.

1 kg of methane produces 2.750 kg of $CO_2$

**Table No. 9 – sources burning oil**

| Parameter | unit | Z02 | Z03 | Z08 | Z10 |
|---|---|---|---|---|---|
| Amount of fuel based on useful oils | liters/year | 0 | 0 | 2,000 | 0 |
| Amount of fuel based on useful oils | kg/year | | | 1,900 | |
| Calorific value | kJ/kg | | | 40,000 | |
| Amount of energy | **TJ/year** | | | 0.076 | |
| Emission factor | **t $CO_2$/TJ** | | | 72.53 | |
| **Emissions of $CO_2$ equiv.** | **tons/year** | **0** | **0** | **5.512** | **0** |

**Table No. 10 - acetylene combustion (maintenance, welding)**

| Parameter | unit | Z02 | Z03 | Z08 | Z10 |
|---|---|---|---|---|---|
| acetylene consumption per year | kg/year | 101.5 | 67.7 | 0 | 33.8 |
| emission factor | kg $CO_2$/kg $C_2H_2$ | 3.385 | 3.385 | 3.385 | 3.385 |
| emission of $CO_2$ equiv | kg/year | 343.578 | 229.165 | 0 | 114.413 |
| **Emissions of $CO_2$ equiv.** | **tons/year** | **0.344** | **0.229** | **0** | **0.114** |

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 (vg/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 $CO_2$

### 4.5 $CO_2$ emissions from chemicals containing CaCO3

**Table No. 11 – Calculation of the carbon footprint from CHLaS**

| Parameter | unit | Z02 | Z03 | Z08 | Z10 |
|---|---|---|---|---|---|
| Arsal 2125 | kg/year | 0 | | 1,750 | |
| Eutectal T 201 (25% $CaCO_3$) | kg/year | 144 | | 0 | |
| Sodium carbonate content | % | 25 | | 20 | |
| Amount of sodium carbonate | kg/year | 36 | | 350 | |
| Amount of $CO_2$ from 1 kg of $CaCO_3$ | kg/kg | 0.4151 | | 0.4151 | |
| **Emissions of $CO_2$ equiv.** | **t/year** | **0.015** | **0** | **0.145** | **0** |

### 4.6 $CO_2$ emissions from the consumption of dry ice and compressed $CO_2$

Dry ice and compressed $CO_2$ are used at the plants.

**Table No. 12 - Calculation of the carbon footprint - emissions from the use of dry ice and compressed $CO_2$**

| Parameter | unit | Z02 | Z03 | Z08 | Z10 |
|---|---|---|---|---|---|
| dry ice | kg | 11,250 | 0 | 0 | 0 |
| $CO_2$ compressed | kg | 150 | 40 | 60 | 70 |
| emission of $CO_2$ equiv. | kg/year | 11,400 | 40 | 60 | 70 |
| **Emissions of $CO_2$ equiv.** | **tons/year** | **11.400** | **0.040** | **0.060** | **0.070** |

### 4.7 Emissions from wastewater treatment

In the Z03, Z03 and Z10 plants, local sewage treatment facilities are operated. At the Z08 plant, sewage effluent is discharged directly into the public sewer system and is not included in the carbon footprint calculation.

**Table No. 13 - Calculation of the carbon footprint - emissions from wastewater treatment**

| Parameter | unit | Z02 | Z03 | Z08 | Z10 |
|---|---|---|---|---|---|
| Amount of treated wastewater | $m^3$/year | 3,180 | 742 | 0 | 1,226 |
| Degraded $BOD_5$ | mg/liter | 598.857 | 2,354.447 | 0 | 1773.246 |
| Degraded amount of $BOD_5$ | t/year | 1.904 | 1.747 | 0 | 2.174 |
| $CO_2$ eq emission intensity | $tCO_2$/t $BOD_5$ | 2.5-5 | 2.5-5 | 0 | 2.5-5 |
| **Tons of $CO_2$** | **t/year** | **9.522** | **8.735** | **0** | **10.870** |

## 4.8 Refrigerant leakage emissions

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

**Table No. 13 – Calculation of the carbon footprint from the leakage of cooling media**

The plant has several facilities containing greenhouse gases. These devices are hermetically sealed but may leak in the event of malfunctions or accidents.
In 2023, there were no leaks at any plant.

| **Parameter** | | **unit** | **Z02** | **Z03** | **Z08** | **Z10** |
|---|---|---|---|---|---|---|
| HFC type | GWP | kg/year | 0 | 0 | 0 | 0 |
| HFC type | GWP | kg/year | 0 | 0 | 0 | 0 |
| **Emissions of $CO_2$ equiv.** | | **kg/year** | **0** | **0** | **0** | **0** |

# 5. Conclusion

In 2023, the following tons of $CO_2$ equiv. were produced at the company's individual plants.

**Table No. 14 – Grand total**

| Parameter | unit | Z02 | Z03 | Z08 | Z10 |
|---|---|---|---|---|---|
| Natural gas | t/year | 689.373 | 94.352 | 625.029 | 105.821 |
| Electricity | t/year | 0 | 0 | 0 | 0 |
| Transport NM | t/year | 3.179 | 14.585 | 7.421 | 9.621 |
| Transport BA | t/year | 7.25 | 5.618 | 0 | 0.796 |
| LPG | t/year | 3,295 | 2.434 | 0 | 2.204 |
| PB | t/year | 3,453 | 2.922 | 4.233 | 0 |
| Methane combustion | t/year | 0.098 | 0 | 0 | 2,737 |
| Acetylene combustion | t/year | 0.344 | 0.229 | 0 | 0.114 |
| Oil combustion | t/year | 0 | 0 | 5.512 | 0 |
| Using compressed $CO_2$ and dry ice | t/year | 11.4 | 0.04 | 0.06 | 0.07 |
| CHLaS with $CaCO_3$ | t/year | 0.015 | 0 | 0.145 | 0 |
| Refrigerant leaks | t/year | 0 | 0 | 0 | 0 |
| Wastewater treatment | t/year | 9.522 | 8.735 | 0 | 10.87 |
| **In total** | **t/year** | **727.929** | **128.915** | **642.4** | **132.233** |
| Of which | | | | | |
| **Scope 1** | **t/year** | **727.929** | **128.915** | **642.4** | **132.233** |
| **Scope 2** | **t/year** | **0** | **0** | **0** | **0** |