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« Let's reduce environmental hypercapnia as we do for our patients »

Assessment of the carbon footprint of the care pathway of patients on non-invasive ventilation monitored at the Bordeaux University Hospital

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Introduction

8% of greenhouse gas emissions in France come from the health sector[1].

No assessment of the carbon footprint of care pathways, particularly in respiratory health, has been found in the literature.

In order to contribute to low-carbon health practices, the Bordeaux University Hospital, in collaboration with the healthcare provider Alizé Médical and the manufacturer Löwenstein Medical, is initiating the approach by assessing the carbon footprint of the care pathway of 23 patients receiving non-invasive ventilation (NIV), monitored in pulmonology at the Haut-Lévêque Hospital.

[1] : Roadmap - Ecological health system planning - December 2023

Methodology

Consulting firm — Evaluation carried out in partnership with **Axionable** : a recognized and B-Corp certified consulting firm that supports financial institutions, industrial players, and media in reducing their carbon footprint.

Methodology — The GHG Protocol® is an international standard. It provides an accounting framework, along with globally recognized standards and tools for measuring and managing GHG emissions by businesses and governments.

Arrangement — *Ministerial standard* : Collection and distribution of data according to 3 emission fields, called «scopes», upstream, during or downstream the 2023 reporting period of Alizé Médical.

Scope 3 — Indirect emissions (upstream)

sources not owned or controlled by the company but related to its activities

- **3.3 : Fuel -and energy- related activities.** *Production of fuel purchased by Alizé Médical.*
- **3.6 : Business travel.** *Emissions related to transportation and logistics.*
- **3.2 : Capital goods.** *Emissions from the production of goods acquired by Alizé Médical in 2023 (NIV*, cars, IT, etc.)*
- **3.1 : Purchased goods and services** *Emissions upstream of the production of products purchased or acquired by Alizé Médical in 2023 (consumables, financial services, supplies, etc.)*
- **3.4 : Upstream transportation and distribution.** *Löwenstein : LCA* (NIV*) Multi-suppliers (consumables)*

Scope 2 — Indirect emissions

Generation of purchased electricity consumed by Alizé Médical

2 : Indirect emissions

Electricity consumption

Scope 1 — Direct emissions

Sources owned or controlled by Alize Médical

1 : Mobile combustion sources

Fuel combustion
Car fleet

Scope 3 — Indirect emissions (downstream)

Sources not owned or controlled by the company but related to its activities

- **3.11 : Use of sold product** *Actual electricity comsumption of the 23 patients*
- **3.1 : Purchased goods and services** *Data storage and transfert*
- **3.5 : Waste generated in operations** *Consumables provided to the 23 patients Operations*
- **3.12 End-of-life treatment of sold products** *NIV* recycling*

Upstream activities | **Alizé Médical** | *Downstream activities*

Results — BASE Empreinte® ecoinvent

Activity data		Emission factors		Carbon footprint
Physical (kg, kWh, L...) Financial (€)	X	*Conversion of activity data into a measurable quantity of emissions.*	=	**xtCO2eq***

**Tons of CO2 equivalent*

Uncertainties — ADEME

The assessment of a carbon footprint involves uncertainties related to the activity data obtained and the emission factors chosen. The thresholds and allocation rules are available in databases such as those of ADEME*.

$$\text{Total uncertainty (\%)} = \sqrt{(\text{Activity data uncertainty in \%})^2 + (\text{Emission factor uncertainty in \%})^2}$$

Activity data uncertainty :
0% - direct measurement (invoices, meters ...)
30% - recalculed data (extrapolation...)
15% - non-measured data (from an ERP, a tool....)
50% - approximate data (statistical data)

Emission factor uncertainty :
5% - fuel combustion factors (for example)
50% - emission factors of CO2e per Km (for example)
80% - monetary emission factors

Results

8,29 tCO2e — **0,36** tCO2e per **patient** — **7,32%** uncertainty

Impact CO_2	8 290 kg CO_2e	= **4,68** *Round trip Paris - New York by plane*	**96,6** *smartphones*	**129 497** *hours of video streaming*
Impact CO_2	360 kg CO_2e	= **0,88** *Round trip Lille - Nîmes York by car*	**3,87** *% of a french citizen carbon footprint*	**146 234** *emails*

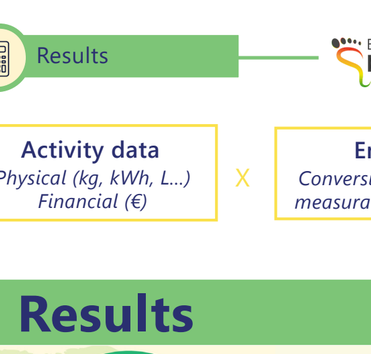
Source : impactco2.fr comparator - ADEME* - French Republic

45% Scope 1 — *Emissions directly resulting from the **combustion of fuel** by Alizé Médical's car fleet, **with 95% coming from utility vehicles**. Graph 1*

0% Scope 2 — *Indirect emissions related to the production of electricity purchased by Alizé Médical. **The electricity is decarbonized in France.** Graph 1*

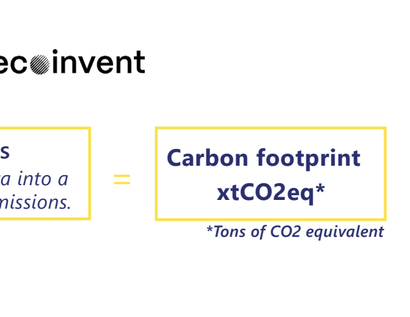
55% Scope 3 — *Indirect emissions, arising from sources not owned or controlled by Alizé Médical. 22% are attributable to the purchase of goods, products, and services. Graph 1-2*

Distribution by emission fields



Graph 1 - CO2 emissions by GHG Scope (%)

Emissions and uncertainties of emissions fields by category



Graph 2 - CO2e emissions by GHG category (%)

GHG Protocol Emission Fields		Emission (tCO2e)	Uncertainty
Scope 1.2 :	Mobile combustion sources	3,752 (45%)	11%
Scope 3.3 :	Fuel -and energy- related activities	1,528 (19%)	11%
Scope 3.1 :	Purchased goods and services	0,981 (12%)	34%
Scope 3.2 :	Capital goods	0,860 (10%)	16%
Scope 3.6 :	Business travel	0,652 (8%)	33%
Scope 3.11 :	Use of sold product	0,449 (5%)	2%
Scope 3.4 :	Upstream transportation and distribution	0,055 (<1%)	32%
Scope 2.1 :	Electricity consumption	0,007 (<1%)	16%
Scope 3.12 :	End-of-life treatment of sold products	0,005 (<1%)	26%
Scope 3.5 :	Waste generated in operations	0,005 (<1%)	11%
TOTAL		8,294	7,32%

Table 1 - Emissions and uncertainties of emission fields

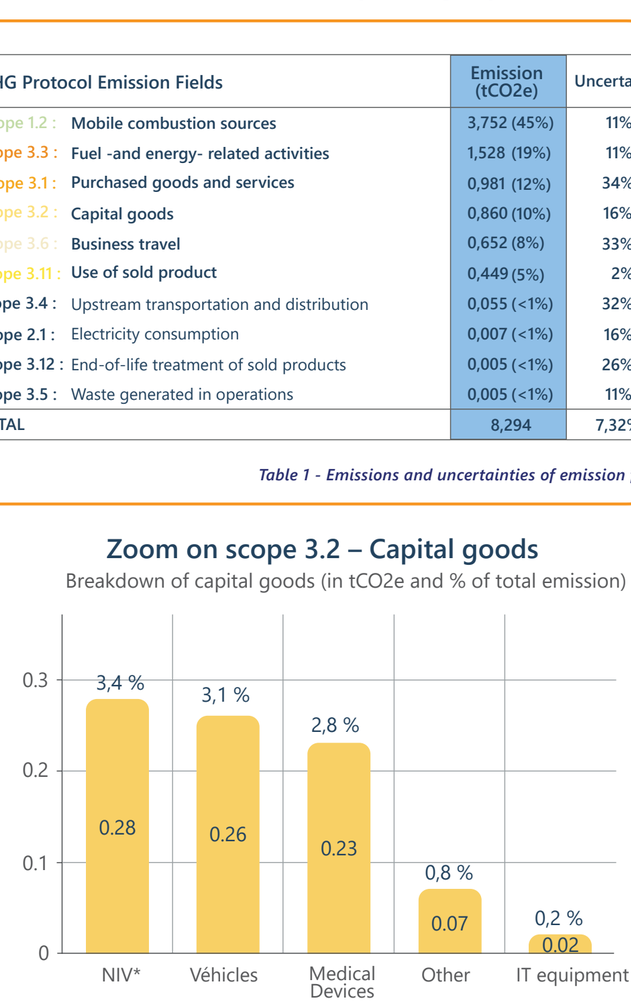
Zoom on scope 3.1 – Purchased goods and services

Breakdown of purchases (in tCO2e and % of total emissions)

Graph 4 - Breakdown of scope 3.1

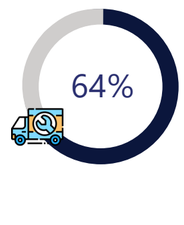
Zoom on scope 3.2 – Capital goods

Breakdown of capital goods (in tCO2e and % of total emission)



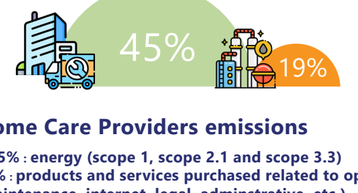
Graph 5 - Breakdown of scope 3.2

Fuel related emissions



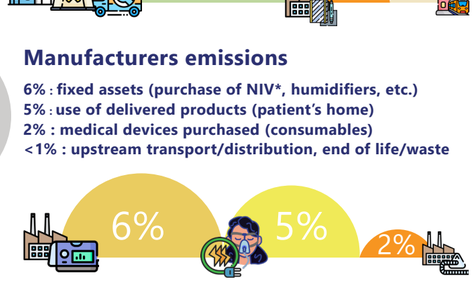
45% : direct combustion of fuel (scope 1)
19% : purchase and transport of fuel upstream (scope 3)

Movement of Alizé Médical's car fleet

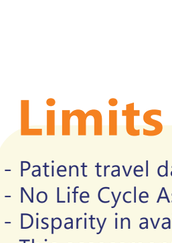


Home Care Providers emissions

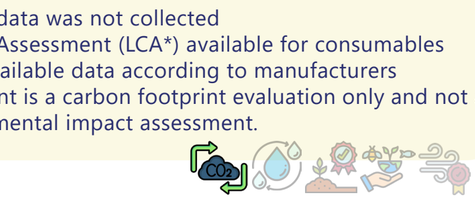
64,5% : energy (scope 1, scope 2.1 and scope 3.3)
10% : products and services purchased related to operations (maintenance, internet, legal, adminstrative, etc.)
8% : business travel (transport/logistics)
3,5% : fixed assets (vehicles/office automation)



Manufacturers emissions



6% : fixed assets (purchase of NIV*, humidifiers, etc.)
5% : use of delivered products (patient's home)
2% : medical devices purchased (consumables)
<1% : upstream transport/distribution, end of life/waste



Limits

- Patient travel data was not collected
- No Life Cycle Assessment (LCA*) available for consumables
- Disparity in available data according to manufacturers
- This assessment is a carbon footprint evaluation only and not an overall environmental impact assessment.

Conclusion

The carbon footprint of the care pathway for the 23 home-ventilated patients monitored at the Haut-Lévêque University Hospital amounts to 8.29 tons of CO2 equivalent, or 0.36 ton per patient.

This result is accompanied by a very low uncertainty rate of 7.32%, which is remarkable for the carbon field.

This small sample allowed for the **collection of specific data for each patient in real life**, minimizing the use of secondary data, extrapolations, and/or prorated values. The accuracy of the data collected for the NIV* part is due to the availability of Life Cycle Assessments (LCA*) for NIV* devices from level 1 to 3 provided by Löwenstein.

64% of the emissions are related to Alizé Médical's car fleet travels (purchase and combustion of fuel), making it the primary area for improvement.

Decarbonization levers

Reduce the number of trips :
- Deploy remote monitoring and telemonitoring
- Better target trips for oximetry/capnography

Reduce the carbon intensity of travel → transition to electric vehicles :
- Given the current technical limits of 200 to 300 km range for utility vehicles, start with large urban areas by optimizing delivery routes.
- In the medium term, while waiting for technological advancements, replace the entire fleet

Hold manufacturers accountable and choose low-carbon medical devices :
- Initiate Life Cycle Assessment (LCA*) processes
- Establish purchasing and prescribing policies (prescriber/provider) between equivalent medical devices.

ADEME : Environment and Energy Management Agency- MD : Medical Device - NIV : Non Invasive Ventilation - LCA : Life Cycle Assessment

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