Green LaMiS

Baseline Analysis

Version 1

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Index

List of tables

List of figures

Glossary

Approach "distance-based method": refers to a methodological approach detailed by the GHG protocol which consists of determining the distance, and mode of the movements, then applying the appropriate distance emission factor for the used vehicle so to estimate the carbon footprint.

Approach "fuel-based method": refers to a methodological approach detailed by the GHG protocol which consists of determining the amount of fuel consumed and applying the appropriate emission factor for that kind of fuel so to estimate the carbon footprint.

Carbon Footprint: refers to the total amount of greenhouse gases, primarily carbon dioxide (CO_2), emitted directly or indirectly by an individual, organization, event, or product. It includes emissions from activities such as energy consumption, transportation, production, and waste management. The carbon footprint is a key metric in assessing environmental impact and developing strategies to reduce emissions and promote sustainability.

Emission factors: are coefficients that quantify the amount of a specific pollutant released into the atmosphere per fuel consumption, or industrial output. It is typically expressed in units such as kilograms or tons of emissions per unit of fuel burned, energy produced, or material processed (e.g., kg CO_2 per liter of diesel, g NO_x per kWh). Emission factors are widely used in carbon footprint calculations to estimate greenhouse gas (GHG) from various sources, including transportation, industry, and energy production.

FPM: Fondazione Politecnico di Milano

GHG protocol: is an international accounting tool and standard that establishes comprehensive global standardized frameworks to measure and manage greenhouse gas (GHG) emissions from private and public sector operations, value chains and mitigation actions.

Home-delivered social services (HDSS): refer to a set of social support services provided directly to individuals in their homes. These services are typically designed to assist elderly individuals, people with disabilities, or those with limited mobility in maintaining their independence and well-being. HDSS can include personal care, meal delivery, medical assistance, psychological support, and other essential services aimed at improving quality of life and reducing the need for institutional care.

Isochrone: is a line on a map connecting points that can be reached within the same amount of time from a specific starting location, considering the available modes of transportation and routes.

Isodistance: is a line on a map connecting points that are at an equal distance from a specific starting location, measured along a transportation network rather than as a simple radial buffer. Isodistance lines represent the exact distance travelled along roads, railways, or other infrastructure. This method provides a more accurate representation of accessibility in real-world conditions, accounting for network constraints such as road connectivity and geographic barriers.

KPIs of Carbon Intensity: refer to key performance indicators that measure the amount of greenhouse gas (GHG) emissions produced per unit of output. These KPIs are crucial for monitoring and reducing carbon emissions, improving sustainability, and aligning with climate targets such as the Paris Agreement.

KPIs of Territorial Analysis: refer to key performance indicator that correlate the carbon footprint with territorial data and spatial distribution of users to be reached. These KPIs allow to fairly monitor the trends of carbon emissions over time considering the features of accessibility of the users for each service.

KPIs: are measurable values that indicate how effectively a specific objective is achieved. KPIs help to track progress towards strategic goals. Effective KPIs are specific, measurable, achievable, relevant, and time-bound.

Location-based: approach intended to estimate emissions by electricity consumption. It relies on the average emission factor of the electricity grid in the geographical area where electricity consumption occurs. Therefore, it uses a national or regional average emission factor, regardless of the organization's energy procurement choices.

Market-based: approach intended to estimate emissions by electricity consumption. It considers the organization's specific electricity purchasing choices, considering: direct contracts with renewable energy providers, purchase of renewable energy certificates (GO, REC, etc.), Power Purchase Agreements (PPA) and energy mix declared by the chosen supplier.

Executive summury

This document represents Deliverable 1.2.2 of the Interreg CENTRAL EUROPE 2021-2027 CE0200590 - Green LaMiS Project, which is dedicated to developing and adopting a common strategy and action plan for assessing and monitoring the environmental impact of home-delivered social services (HDSS) in the cities of Bergamo (IT), Klis (HR), and Szombathely (HU). The primary objective of this deliverable is to provide a comprehensive baseline analysis of the carbon footprint associated with the mobility activities of HDSS for the inventory year 2023 (latest available year featured by a complete disposal of data), thereby establishing a reference point for future assessments and interventions aimed at reducing carbon emissions. This deliverable corresponds to the 2nd project Milestone ("Impact assessment of project activities").

The document details the estimated carbon emissions for the set of HDSS identified, organized by service type. It includes critical metrics such as the overall carbon footprint, key performance indicators (KPIs) of carbon intensity, and KPIs of territorial analysis. These metrics allows to understand the environmental impact of social services and to monitor changes over time, particularly in relation to the actions and measures implemented within the project. By establishing a baseline, this deliverable offers a picture of the current emissions, allowing the evaluation of the effectiveness of future interventions.

A significant component of this project is the development of a common assessment tool tailored specifically for Green LaMiS. This tool, based on Excel platform, provides a user-friendly interface that guides users through data entry and analysis. It has been co-designed with input from all project partners, ensuring that it is adaptable to the diverse characteristics of the three involved cities, applicable to various types of HDSS and open to different levels of details for input data. The methodology adopted in the tool incorporates both fuel-based and distance-based approaches for estimating emissions, considering also the possibility to assess the contribution of electric vehicles and public transportation. This flexibility allows for a more accurate assessment of emissions based on the specific operational contexts of each service provider.

The application of the assessment tool is structured in two distinct phases. The first phase involves a baseline analysis managed by the LP FPM, which utilizes data collected from local partners to generate initial results. This phase not only presents the overall carbon footprint but also includes the set of KPIs defined by the adopted methodology. The second phase focuses on yearly monitoring, where local authorities and partners will take over the tool's application. A designated reference person will be responsible for collecting input data from service providers, ensuring continuity and accuracy in the monitoring process. To facilitate this transition, a comprehensive user manual is provided, and training sessions will be deployed, equipping local partners with the necessary skills to effectively use the tool and understand its outputs.

The results generated by the assessment tool offer a crucial starting point for understanding the current emissions framework. However, it is important to note that a single reading of these results is not particularly meaningful. The relevant value lies in the ongoing monitoring of emissions over time, allowing stakeholders to assess trends and variations. The KPIs introduced in this analysis enable a more meaningful understanding of how changes in service demand and user distribution impact carbon emissions. For instance, an increase in the number of users served may lead to a rise in total carbon emissions, but when contextualized with the number of users, a clearer picture of service efficiency emerges. This approach encourages a more responsible evaluation of service delivery.

In conclusion, this deliverable establishes a foundational framework for assessing the environmental impact of HDSS, promoting a pathway toward greener mobility solutions. By facilitating continuous improvement through data-driven analysis, the Green LaMiS Project aims to enhance the sustainability of social services in the involved cities. The insights gained from this project will not only inform local authorities and service providers but also contribute to broader discussions on carbon management and environmental responsibility in the social services sector.

Hereby, a synthesis of the baseline is reported, presenting the main numerical outputs, organized by city and service.

Bergamo - Social Transport for People with Disabilities by Partnership of Bodies

Table 1 - Overall Carbon Footprint - Contributions by sources and by approaches

LOCATION BASED	
Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	15.106,00
Public Transport	0,00
Electric Fleet	0,00
TOTAL	15.106,00
MARKET BASED	
Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	15.106,00
Public Transport	0,00
Electric Fleet	0,00
TOTAL	15.106,00

Table 2 - KPIs of Carbon Intensity

LOCATION BASED		
CI.1	kg CO_2/Service Users	368,44
CI.2	kg CO_2/SE Operator	408,27
CI.3	kg CO_2/Vehicles used by the SE	3.021,20
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,18
MARKET BASED		
CI.1	kg CO_2/Service Users	368,44
CI.2	kg CO_2/SE Operator	408,27
CI.3	kg CO_2/Vehicles used by the SE	3.021,20
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,18

Table 3 - KPIs of Territorial Analysis - TA.1

Isodistance threshold (km)	**Service Users within the threshold**	**Threshold x Users (Users x km)**
1,5	9	13,5
3	22	66
5	10	50
10	0	0
25	0	0
	Total	129,5
TA.1 LOCATION BASED		116,65 (kg CO_2 / Users x km)
TA.1 MARKET BASED		116,65 (kg CO_2 / Users x km)

Table 4 - KPIs of Territorial Analysis – TA.2

Isochrones threshold (min)	Service Users within the threshold	Threshold x Users (Users x minutes)
5	20	100
10	21	210
15	0	0
20	0	0
25	0	0
	Total	310
TA.2 LOCATION BASED		48,73 (kg CO_2 / Users x minutes)
TA.2 MARKET BASED		48,73 (kg CO_2 / Users x minutes)

Bergamo - Day Centre for people with disabilities (C.D.D.)

Table 5 - Overall Carbon Footprint – Contributions by sources and by approaches

LOCATION BASED	
Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	9.566,00
Public Transport	0,00
Electric Fleet	0,00
TOTAL	**9.566,00**
MARKET BASED	
Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	9.566,00
Public Transport	0,00
Electric Fleet	0,00
TOTAL	**9.566,00**

Table 6 - Overall Carbon Footprint – Contributions by sources and by approaches

LOCATION BASED		
CI.1	kg CO_2/Service Users	289,88
CI.2	kg CO_2/SE Operator	1.195,75
CI.3	kg CO_2/Vehicles used by the SE	2.391,50
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,22
MARKET BASED		
CI.1	kg CO_2/Service Users	289,88
CI.2	kg CO_2/SE Operator	1.195,75
CI.3	kg CO_2/Vehicles used by the SE	2.391,50
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,22

Table 7 - KPIs of Territorial Analysis – TA.1

Isodistance threshold (km)	Service Users within the threshold	Threshold x Users (Users x km)
1,5	2	3
3	13	39
5	11	55
10	7	70
25	0	0
	Total	167
TA.1 LOCATION BASED		57,28 (kg CO_2 / Users x km)
TA.1 MARKET BASED		57,28 (kg CO_2 / Users x km)

Table 8 - KPIs of Territorial Analysis – TA.2

Isochrones threshold (min)	Service Users within the threshold	Threshold x Users (Users x minutes)
5	12	60
10	12	120
15	9	135
20	0	0
25	0	0
	Total	315
TA.2 LOCATION BASED		30,37 (kg CO_2 / Users x minutes)
TA.2 MARKET BASED		30,37 (kg CO_2 / Users x minutes)

Klis - Household assistance and meal delivery services

Table 9 - Overall Carbon Footprint – Contributions by sources and by approaches

LOCATION BASED	
Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	4.620
Public Transport	0
Electric Fleet	0
TOTAL	**4.620**
MARKET BASED	
Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	4.620
Public Transport	0
Electric Fleet	0
TOTAL	**4.620**

Table 10 - Overall Carbon Footprint – Contributions by sources and by approaches

LOCATION BASED		
CI.1	kg CO_2/Service Users	105,00
CI.2	kg CO_2/SE Operator	462,00
CI.3	kg CO_2/Vehicles used by the SE	513,33
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,14
MARKET BASED		
CI.1	kg CO_2/Service Users	105,00
CI.2	kg CO_2/SE Operator	462,00
CI.3	kg CO_2/Vehicles used by the SE	513,33
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,14

Table 11 - KPIs of Territorial Analysis – TA.1

Isodistance threshold (km)	**Service Users within the threshold**	**Threshold x Users (Users x km)**
1,5	29	43,5
3	4	12
5	4	20
10	7	70
25		0
	Total	145,5
TA.1 LOCATION BASED		31,75 (kg CO_2 / Users x km)
TA.1 MARKET BASED		31,75 (kg CO_2 / Users x km)

Table 12 - KPIs of Territorial Analysis – TA.2

Isochrones threshold (min)	Service Users within the threshold	Threshold x Users (Users x minutes)
5	33	165
10	6	60
15	5	75
20		0
25		0
	Total	300
TA.2 LOCATION BASED		15,40 (kg CO_2 / Users x minutes)
TA.2 MARKET BASED		15,40 (kg CO_2 / Users x minutes)

Szombathely - Support Services for People with Disabilities by FEHE

Table 13 - Overall Carbon Footprint - Contributions by sources and by approaches

LOCATION BASED	
Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	11.756,00
Public Transport	170,00
Electric Fleet	0,00
TOTAL	11.926,00
MARKET BASED	
Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	11.756,00
Public Transport	170,00
Electric Fleet	0,00
TOTAL	11.926,00

Table 14 - Overall Carbon Footprint - Contributions by sources and by approaches

LOCATION BASED		
CI.1	kg CO_2/Service Users	165,64
CI.2	kg CO_2/SE Operator	2.385,20
CI.3	kg CO_2/Vehicles used by the SE	5.963,00
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,23
MARKET BASED		
CI.1	kg CO_2/Service Users	165,64
CI.2	kg CO_2/SE Operator	2.385,20
CI.3	kg CO_2/Vehicles used by the SE	5.963,00
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,23

Table 15 - KPIs of Territorial Analysis - TA.1

Isodistance threshold (km)	Service Users within the threshold	Threshold x Users (Users x km)
1,5	13	19,5
3	33	99
5	12	60
10	9	90
25	5	125
	Total	393,5
TA.1 LOCATION BASED		30,31 (kg CO_2 / Users x km)
TA.1 MARKET BASED		30,31 (kg CO_2 / Users x km)

Table 16 - KPIs of Territorial Analysis - TA.2

Isochrones threshold (min)	Service Users within the threshold	Threshold x Users (Users x minutes)
5	37	185
10	26	260
15	5	75
20	3	60
25	1	25
	Total	605
TA.2 LOCATION BASED		19,71 (kg CO_2 / Users x minutes)
TA.2 MARKET BASED		19,71 (kg CO_2 / Users x minutes)

Szombathely - Home care service for the elderly by Pálos

Table 17 - Overall Carbon Footprint - Contributions by sources and by approaches

LOCATION BASED	
Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	13.360,00
Public Transport	0,00
Electric Fleet	0,00
TOTAL	13.360,00
MARKET BASED	
Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	13.360,00
Public Transport	0,00
Electric Fleet	0,00
TOTAL	13.360,00

Table 18 - Overall Carbon Footprint - Contributions by sources and by approaches

LOCATION BASED		
CI.1	kg CO_2/Service Users	66,80
CI.2	kg CO_2/SE Operator	954,29
CI.3	kg CO_2/Vehicles used by the SE	890,67
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,20
MARKET BASED		
CI.1	kg CO_2/Service Users	66,80
CI.2	kg CO_2/SE Operator	954,29
CI.3	kg CO_2/Vehicles used by the SE	890,67
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,20

Szombathely - Day care service for the elderly by Pálos

Table 19 - Overall Carbon Footprint – Contributions by sources and by approaches

LOCATION BASED	
Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	1.710,00
Public Transport	0,00
Electric Fleet	0,00
TOTAL	1.710,00
MARKET BASED	
Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	1.710,00
Public Transport	0,00
Electric Fleet	0,00
TOTAL	1.710,00

Table 20 - Overall Carbon Footprint – Contributions by sources and by approaches

LOCATION BASED		
CI.1	kg CO_2/Service Users	155,45
CI.2	kg CO_2/SE Operator	855,00
CI.3	kg CO_2/Vehicles used by the SE	855,00
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,22
MARKET BASED		
CI.1	kg CO_2/Service Users	155,45
CI.2	kg CO_2/SE Operator	855,00
CI.3	kg CO_2/Vehicles used by the SE	855,00
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,22

Table 21 - KPIs of Territorial Analysis – TA.1

Isodistance threshold (km)	Service Users within the threshold	Threshold x Users (Users x km)
1,5	4	6
3	7	21
5	0	0
10	0	0
25	0	0
	Total	27
TA.1 LOCATION BASED		63,33 (kg CO_2 / Users x km)
TA.1 MARKET BASED		63,33 (kg CO_2 / Users x km)

Table 22 - KPIs of Territorial Analysis – TA.2

Isochrones threshold (min)	Service Users within the threshold	Threshold x Users (Users x minutes)
5	9	45
10	2	20
15	0	0
20	0	0
25	0	0
	Total	65
TA.2 LOCATION BASED		26,31 (kg CO_2 / Users x minutes)
TA.2 MARKET BASED		26,31 (kg CO_2 / Users x minutes)

1. Introduction

This document represents the Deliverable 1.2.2 of the Interreg CENTRAL EUROPE 2021-2027 CE0200590 - Green LaMiS Project. The document is developed within the Activity 1.2 - *Development and adoption of the common strategy and action plan* of the *WP1 -Assessment and monitoring of services' environmental impact for a Joint Action Plan.*

It is intended to present the baseline analysis in the involved territories. This deliverable is directly connected to the deliverables 1.1.1 - *Transnational methodology co-design* and 1.2.1 – *Common assessment tool,* representing their application. The goal is the estimation of the carbon footprint, referred to the inventory year 2023, of home-delivered social services (HDSS) for the social enterprises operating in the three cities involved in the Project: Bergamo (IT), Klis (HR), and Szombathely (HU).

The document reports the estimated carbon emissions for the HDSS, organized by services and detailing for each of them:

- The overall Carbon Footprint
- The KPIs of Carbon Intensity
- The KPIs of Territorial Analysis

The theoretical presentation of these three elements is detailed in the deliverable 1.1.1 - *Transnational methodology co-design*. Nevertheless, it is appropriate to highlight relevant aspects relating to the interpretation of the numerical results. These prove to be significant in the perspective of monitoring these results over time, with particular attention to the impacts that actions and measures developed within the project will have on them.

Thus, they precisely constitute a baseline, an 'as of today' snapshot of the emissions, whose meaning is less relevant in absolute terms.

2. The Common Assessment Tool: synthesis and application

The common assessment tool for the estimation of the carbon footprint of HDSS has been internally developed within the Green LaMiS Project and customized to its specific needs. It is based on excel programming, allowing the use of a familiar interface where the user is guided step by step in data entry and its actual usage.

2.1. Theoretical background

The Green LaMiS Project customizes the GHG Protocol to assess the carbon footprint related to the mobility needs of HDSS. The methodology developed meets the following requirements:

- Co-designed: Developed with input from all project partners.
- Transferable: Applicable across three cities with diverse features and adaptable to different HDSS types.
- Modular: Can be applied using basic data with options for refinement as more detailed information becomes available.
- Replicable: Can be used yearly for benchmarking and monitoring purposes.
- Scenario functional: Allows assessment of single or combined interventions and actions.

To estimate the emissions of HDSS different methods are allowed:

- Fuel-based method: Determines emissions by fuel consumption.
- Distance-based method: Estimates emissions by distance traveled and vehicle type. Both methods require activity data, such as fuel quantities or travel distances, multiplied by appropriate emission factors.

Similarly, different sets of activity data can be considered, based on the actual availability of information at SE:

- Fuel-based: Fuel quantities (e.g., diesel, gasoline) or purchase records.
- Distance-based: Travel distances from internal systems or online tools.

According to this set of activity data, also the emission factors are refereed to different approaches:

- Fuel-based method: Uses emission factors for fuel consumption.
- Distance-based method: Uses emission factors based on transport mode and vehicle type.

A final mention concerns the management of electric vehicles. The emissions are considered based on electricity production, with two approaches for managing emission factors:

- Location-based: Uses average grid emission factors for the region.
- Market-based: Considers specific energy procurement choices, including renewable energy sources.

For details concerning the methodology please refer to *Green Lamis - Deliverable 1.1.1 - Transnational methodology co-design*.

2.2. Conceptualization of the tool

The details concerning the steps that led to the conceptualization of the tool and its features are fully described in the deliverable 1.2.1 – *Common assessment tool*. Nevertheless, a key element (i.e. its functional structure) is reported hereby in Figure 1, to ease the consultation of this document. The structure highlights the definition of the main requirements in terms of input data as well as a series of actions and decisions to define relevant data, conversion factors, and emission factors to assess the carbon footprint.

- General Service and Inventory Information: Collects data on services, such as the number of operators and users served, useful for calculating carbon footprint intensity.
- Fleet of Internal Combustion Engine Vehicles: If fuel consumption is known, it must be specified for each vehicle, and CO_2 emissions are calculated using conversion and emission factors. If fuel consumption is unknown, users can provide the emission factor for each vehicle or just specify the kilometers traveled. In the latter case, an average emission factor is used to calculate CO_2 emissions.
- Electric Vehicles: If energy consumption in kWh is known, the value must be provided for each vehicle. If not, only the kilometers traveled need to be specified. Two approaches are available:
    - Market-based: Requires the percentage of certified renewable electricity used. The remaining electricity is multiplied by a residual mix emission factor to calculate CO_2 emissions.
    - Location-based: The emission factor is applied directly to the energy consumption to assess CO_2 emissions.
- Public Transportation: Data on kilometers traveled by vehicle type (bus, metro, etc.) is used, with emissions calculated based on specific emission factors.

These data are processed within the module Carbon Footprint Calculation, leading to the output requested.

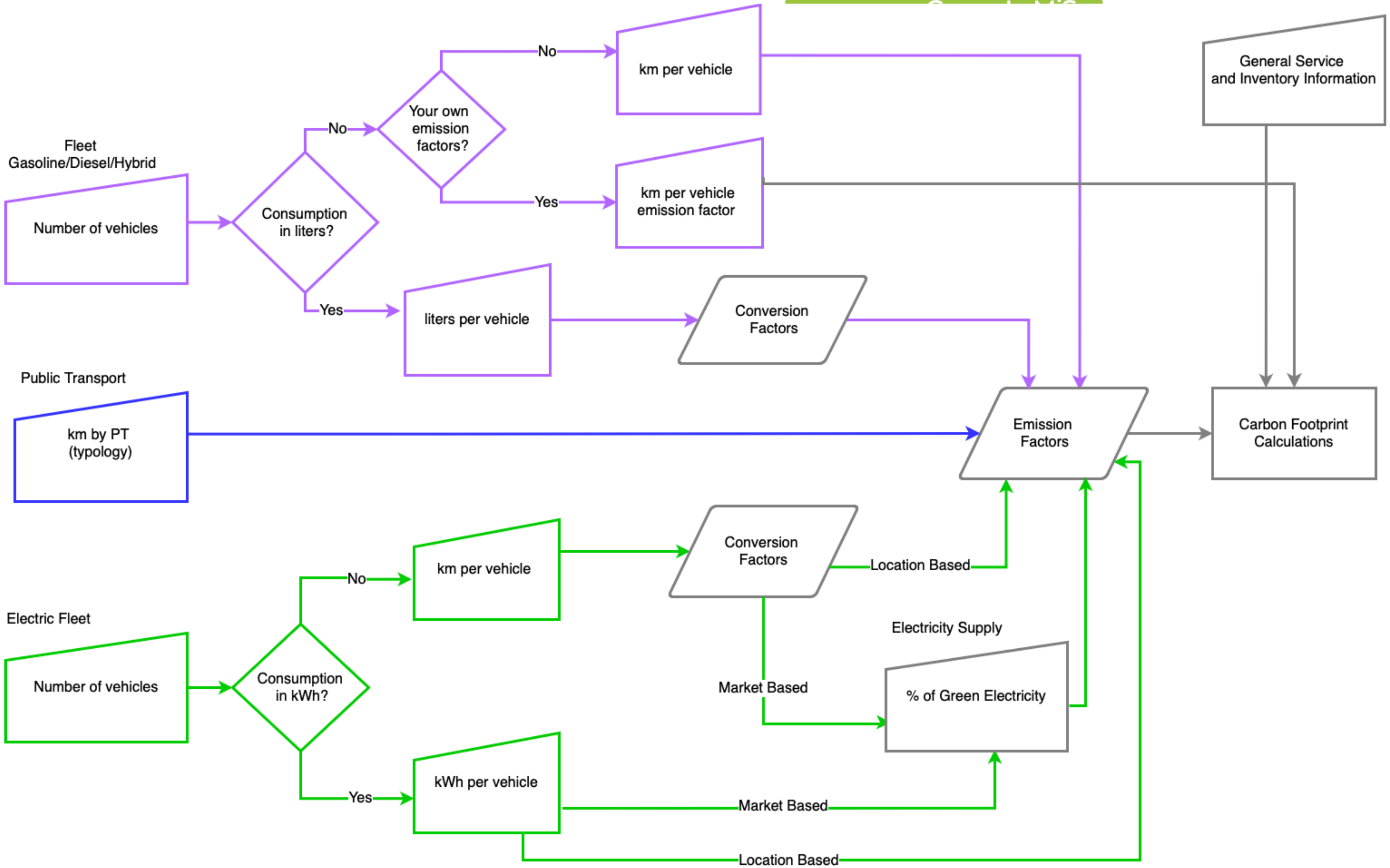


Figure 1 - The functional structure of the tool

2.3. Use of the tool

The actual use of the tool within the Green LaMiS Project is organized in two steps as follow:

- **Phase 1 – Baseline analysis managed by partner FPM**
  It represents the first application of the tool considering the inventory year 2023. It is managed by partner FPM based on the data collected and shared by local partners. The results are presented in this deliverable. Beside the overall carbon footprint, also the set of KPIs defined by the adopted methodology is reported.
- **Phase 2 – Yearly monitoring managed by local authorities/local partners**
  In the incoming years, the tool will be used directly by local authorities/local partners. A reference person will collect the input data from the services' provider, as did for the baseline. Differently from the first application, she/he will also manage the input phase and the actual run of the tool.
  To ease as much as possible this task training moments are planned during the time period covered by the Green LaMiS Project. Moreover, a dedicated user manual, detailing how to use the tool is available at the end of this document. Moreover, for the elaboration of KPIs of territorial analysis, isodistance and isotime maps are made available in different formats to Local Authorities, so to allow the replication in the incoming years.

2.4. Reading the results

The **overall carbon footprint** provided for each service represents a starting point, a picture of the current situation in terms of emissions, referred to a specific inventory year as requested by the scientific sectorial references [4]. A single and independent reading of this outcome is not much meaningful as a standalone information. The key for an effective reading of this result is represented by its monitoring over time on yearly basis.

Since HDSS are "living" elements (i.e. their quantitative feature may change over time in terms of users served and their location, operators involved, …), the set of **KPIs of Carbon Intensity** introduced allows to support a fair comparison over time.

Indeed, variations in the overall carbon footprint (both increases and decreases) could be determined by changes in the "quantity of services" requested. A clarifying example can be represented by differences over the years of the number of users served. It is conceivable that an increase in the number of users served could lead to a rise in the total carbon footprint. Relating these CO_2 emissions to the new number of users served allows for a fairer critical assessment of the reasons behind the increase.

The **KPIs of Territorial Analysis** relate the overall carbon footprint to denominators that reflect how the distributions of users are geographically dispersed. Higher values of these denominators describe a greater dispersion of users and consequently the need for a greater "quantity of service" to be provided. As in previous cases, the consideration of these elements allows for appropriate consideration of variations over time in the results obtained.

In conclusion, it is necessary to emphasize that all the results provided by the tool should be understood as:

- Functional from a comparative perspective over time, developing monitoring over several years and adopting the year 2023 as the starting point of a pathway.
- As a set of information available for a critical and broad analysis to be developed by a competent subject (i.e. a mobility manager) who can benefit from it to monitor the impacts of carbon management measures and actions and make any corrections/recalibrations of these as needed. In this framework the possible analysis and considerations can be multiple. Hereby, a possible example

referred to the KPI of Territorial Analysis TA.1 is reported in Table 23.
Reduced emissions over years are a positive result, but it should be the consequence of an increase efficiency of the service in the direction of a greener mobility, and not just of a reduction of the "quantity of service" deployed or of a rewarding distribution of the users (i.e. denominator *users x kms*).
Similarly for possible increases in the emissions. Typically, they are perceived as a negative outcome, but if this is the result of a large increment of the "quantity of service" deployed or of a penalizing distribution of the users (i.e. denominator *users x kms*), the final evaluation could be less severe.

Table 23 - TA.1 - Possible configurations of comparison over time

	Users x Kms	
Overall CO_2 Emissions		
	To be investigated How much does the CO_2 increase compare to the increase of Users x Kms?	
		To be investigated How much does the CO_2 decrease compare to the decrease of Users x Kms?

3. Bergamo - Social Transport for People with Disabilities by Partnership of Bodies

3.1. Brief description of the service

Social Transport for People with Disabilities - Aiding families to ensure the social integration of their relatives.

The service includes accompanying people with disabilities from their residences to various services within the Municipality of Bergamo. Service is carried out by volunteers who work every day from 7:00 AM to 6:00 PM, as well as by paid operators.

3.2. Input data

Input data are referred to the categories **General Service and Inventory Information** and **Fleet Gasoline /Diesel/Hybrid**, as reported hereby in Table 24 and Table 25.

Based on the available data, the approach adopted is the distance-based method, relying on the emission factors specifically referred to each single vehicle. These are available at https://www.ilportaledellautomobilista.it/web/portale-automobilista/ext/verifica-classe-ambientale-veicolo (last access January 25).

Table 24 - General Service and Inventory Information - Input

General Service and Inventory Information	
City	Bergamo
State	IT - Italy
Service Name	TRASPORTO DISABILI
Service Operator	Associazione I Pellicani ODV
Inventory year	2023
Inventory compiled by	-
Position of compiler	-
email compiler	-
Number of users served	41
Number of operators/volunteers involved	37

Table 25 - Fleet Gasoline /Diesel/Hybrid - Input

Fleet Gasoline /Diesel/Hybrid	
Number of vehicles	5
Consumption in litres?	NO
Do you use a specific emission factor?	YES
vehicle_1	
Model	FIAT SCUDO
Plate	BK088GG
Vehicle Typology	VAN
Fuel Type	Diesel
Km travelled	11.085
Your own emission factor (gCO_2/km)	171
vehicle_2	
Model	RENAULT TRAFIC
Plate	ET744RK
Vehicle Typology	VAN
Fuel Type	Diesel
Km travelled	21.100
Your own emission factor (gCO_2/km)	190
vehicle_3	
Model	IVECO DAILY
Plate	EN806RH
Vehicle Typology	VAN
Fuel Type	Diesel
Km travelled	15.250
Your own emission factor (gCO_2/km)	212
vehicle_4	
Model	OPEL ASTRA 1.81
Plate	DA310PK
Vehicle Typology	Passenger car
Fuel Type	Gasoline
Km travelled	11.050
Your own emission factor (gCO_2/km)	182
vehicle_5	
Model	DOBLO' CV 19
Plate	DY696NM
Vehicle Typology	VAN
Fuel Type	Diesel
Km travelled	24.280
Your own emission factor (gCO_2/km)	163

3.3. Output

Table 26 reports the overall Carbon Footprint detailing the contribution of each vehicle part of the fleet.

Table 26 - Overall Carbon Footprint - Contributions within sources

	CO_2 Emissions (kg CO_2)
vehicle_1	1.895,54
vehicle_2	4.009,00
vehicle_3	3.233,00
vehicle_4	2.011,10
vehicle_5	3.957,64
Total Fleet	**15.106,28**

Table 27 reports the overall Carbon Footprint, with the contribution of the different vehicles aggregated, while detailing the amount of CO_2 emissions determined by other sources (Public Transport and Electric Fleet). In this case, these contributions are equal to 0. The table provides the Carbon Footprint with both Location and Market Based approaches. However, since no electric vehicle is part of the fleet, the two Carbon Footprint are quantitively the same.

Table 27 - Overall Carbon Footprint - Contributions by sources and by approaches

LOCATION BASED	
Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	15.106,00
Public Transport	0,00
Electric Fleet	0,00
TOTAL	15.106,00
MARKET BASED	
Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	15.106,00
Public Transport	0,00
Electric Fleet	0,00
TOTAL	15.106,00

3.3.1. KPIs Carbon Intensity

The KPIs of Carbon Intensity are detailed in Table 28, considering both the Location and Market Based approaches. However, since no electric vehicle is part of the fleet, the two set of KPIs are quantitively the same.

Table 28 - KPIs of Carbon Intensity

LOCATION BASED		
CI.1	kg CO_2/Service Users	368,44
CI.2	kg CO_2/SE Operator	408,27
CI.3	kg CO_2/Vehicles used by the SE	3.021,20
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,18
MARKET BASED		
CI.1	kg CO_2/Service Users	368,44
CI.2	kg CO_2/SE Operator	408,27
CI.3	kg CO_2/Vehicles used by the SE	3.021,20
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,18

3.3.2. KPIs Territorial Analysis

The KPIs of Territorial Analysis involves the distribution of the total carbon footprint over a territorial elaboration concerning the spatial distribution of the service users and of the possible starting point(s) of the movements. These last are the points of origin for the definition of isodistance areas and isochrone areas, with thresholds.

Figure 2 reports these geographical elaborations, referred to isodistances, with the following thresholds: 1,5 km; 3 km; 5 km; 10 km; 25 km.

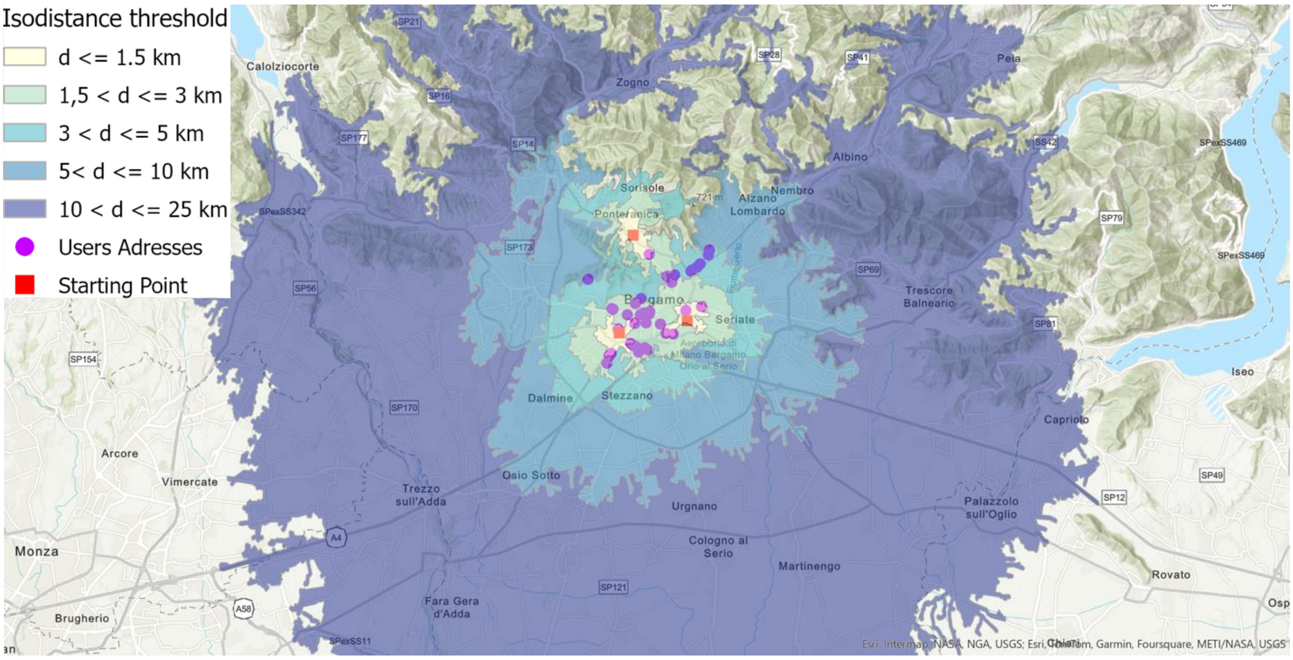


Figure 2 – Isodistance areas from the starting points and distribution of service users

The numerical results are reported in Table 29.

Table 29 - KPIs of Territorial Analysis – TA.1

Isodistance threshold (km)	Service Users within the threshold	Threshold x Users (Users x km)
1,5	9	13,5
3	22	66
5	10	50
10	0	0
25	0	0
	Total	129,5
TA.1 LOCATION BASED		116,65 (kg CO_2 / Users x km)
TA.1 MARKET BASED		116,65 (kg CO_2 / Users x km)

Figure 3 reports these geographical elaborations, referred to isochrones, with the following thresholds: 5 mins.; 10 mins.; 15 mins.; 20 mins.; 25 mins.

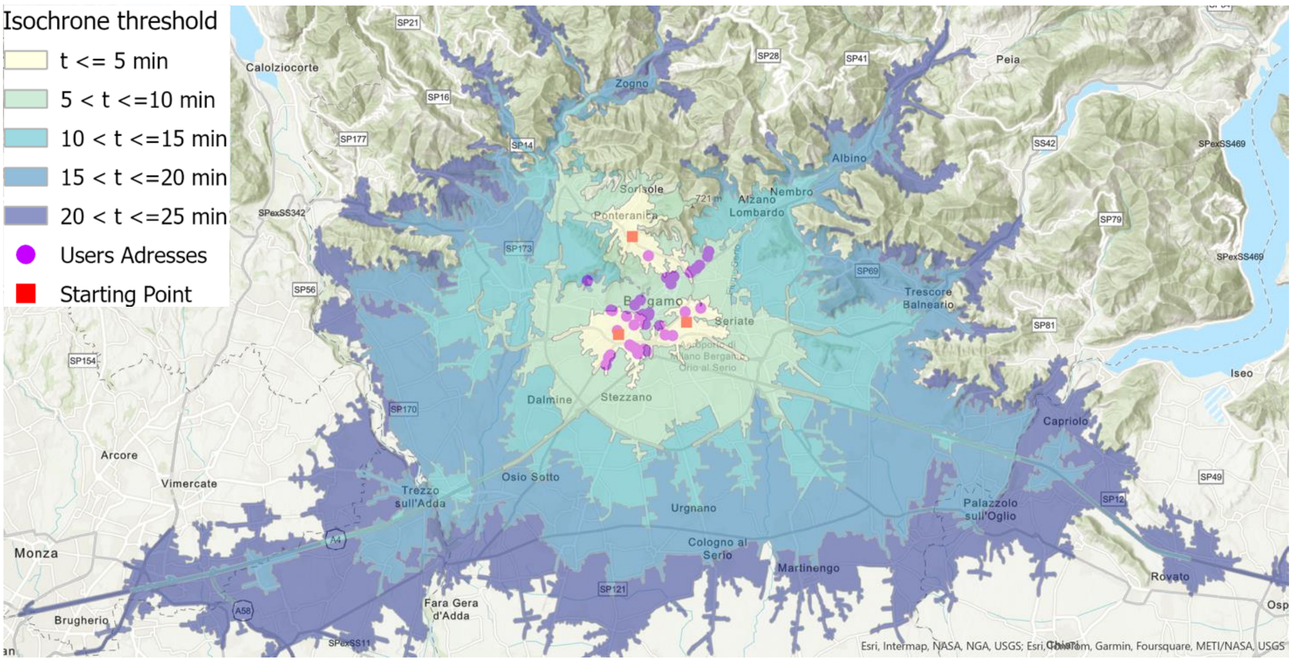


Figure 3 - Isochrone areas from the starting points and distribution of service users

The numerical results are reported in Table 30.

Table 30 - KPIs of Territorial Analysis – TA.2

Isochrones threshold (min)	Service Users within the threshold	Threshold x Users (Users x minutes)
5	20	100
10	21	210
15	0	0
20	0	0
25	0	0
	Total	310
TA.2 LOCATION BASED		48,73 (kg CO_2 / Users x minutes)
TA.2 MARKET BASED		48,73 (kg CO_2 / Users x minutes)

4. Bergamo - Day Centre for people with disabilities (C.D.D.)

4.1. Brief description of the service

The Day Centre for people with disabilities (C.D.D.) of the City of Bergamo is a service for severely disabled people who need continuous and specific assistance. The Centre is organized in such a way to ensure high-level educational, social and health interventions and rehabilitation, able to build integrated paths between the different professional figures to realize effective and efficient individualized projects.

The C.D.D. guarantees, from 9 am to 4 pm, from Monday to Friday, for 235 days a year, the provision of services to guests on the basis of the Individualized Educational Project (P.E.I.), which involves families and is characterized by the opening to the outside, in an integration with the resources present on the territory.

4.2. Input data

Input data are referred to the categories **General Service and Inventory Information** and **Fleet Gasoline /Diesel/Hybrid**, as reported hereby in Table 31 and Table 32.

Based on the available data, the approach adopted is the distance-based method, relying on the emission factors specifically referred to each single vehicle. These are available at https://www.ilportaledellautomobilista.it/web/portale-automobilista/ext/verifica-classe-ambientale-veicolo (last access January 25).

Table 31 - General Service and Inventory Information - Input

General Service and Inventory Information	
City	Bergamo
State	IT - Italy
Service Name	CDD
Service Operator	-
Inventory year	2023
Inventory compiled by	Pierluigi Rota
Position of compiler	Coordinator
email compiler	-
Number of users served	33
Number of operators/volunteers involved	8

Table 32 - Fleet Gasoline /Diesel/Hybrid - Input

Fleet Gasoline /Diesel/Hybrid	
Number of vehicles	4
Consumption in litres?	NO
Do you use a specific emission factor?	YES
vehicle_1	
Model	CITROEN Jumper
Plate	DR749JT
Vehicle Typology	VAN
Fuel Type	Diesel
Km travelled	8494
Your own emission factor (gCO_2/km)	224
vehicle_2	
Model	PEUGEOT BOXER
Plate	GM158BT
Vehicle Typology	VAN
Fuel Type	Diesel
Km travelled	7500
Your own emission factor (gCO_2/km)	235
vehicle_3	
Model	MERCEDES-BENZ Sprinter
Plate	FY165YC
Vehicle Typology	VAN
Fuel Type	Diesel
Km travelled	14300
Your own emission factor (gCO_2/km)	189
vehicle_4	
Model	DUCATO TWIN ARM
Plate	GH500NP
Vehicle Typology	VAN
Fuel Type	Diesel
Km travelled	13000
Your own emission factor (gCO_2/km)	246

4.3. Output

4.3.1. Overall Carbon Footprint

Table 33 reports the overall Carbon Footprint detailing the contribution of each vehicle part of the fleet.

Table 33 - Overall Carbon Footprint - Contributions within sources

	CO_2 Emissions (kg CO_2)
vehicle_1	1.902,66
vehicle_2	1.762,50
vehicle_3	2.702,70
vehicle_4	3.198,00
Total Fleet	**9.565,86**

Table 34 reports the overall Carbon Footprint, with the contribution of the different vehicles aggregated, while detailing the amount of CO_2 emissions determined by other sources (Public Transport and Electric Fleet). In this case, these contributions are equal to 0. The table provides the Carbon Footprint with both Location and Market Based approaches. However, since no electric vehicle is part of the fleet, the two Carbon Footprint are quantitively the same.

Table 34 - Overall Carbon Footprint - Contributions by sources and by approaches

LOCATION BASED	
Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	9.566,00
Public Transport	0,00
Electric Fleet	0,00
TOTAL	**9.566,00**
MARKET BASED	
Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	9.566,00
Public Transport	0,00
Electric Fleet	0,00
TOTAL	**9.566,00**

4.3.2. KPIs Carbon Intensity

The KPIs of Carbon Intensity are detailed in Table 35 considering both the Location and Market Based approaches. However, since no electric vehicle is part of the fleet, the two set of KPIs are quantitively the same.

Table 35 - Overall Carbon Footprint - Contributions by sources and by approaches

LOCATION BASED		
CI.1	kg CO_2/Service Users	289,88
CI.2	kg CO_2/SE Operator	1.195,75
CI.3	kg CO_2/Vehicles used by the SE	2.391,50
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,22
MARKET BASED		
CI.1	kg CO_2/Service Users	289,88
CI.2	kg CO_2/SE Operator	1.195,75
CI.3	kg CO_2/Vehicles used by the SE	2.391,50
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,22

4.3.3. KPIs Territorial Analysis

The KPIs of Territorial Analysis involves the distribution of the total carbon footprint over a territorial elaboration concerning the spatial distribution of the service users and of the possible starting point(s) of the movements. These last are the points of origin for the definition of isodistance areas and isochrone areas, with thresholds.

Figure 4 reports these geographical elaborations, referred to isodistances, with the following thresholds: 1,5 km; 3 km; 5 km; 10 km; 25 km.

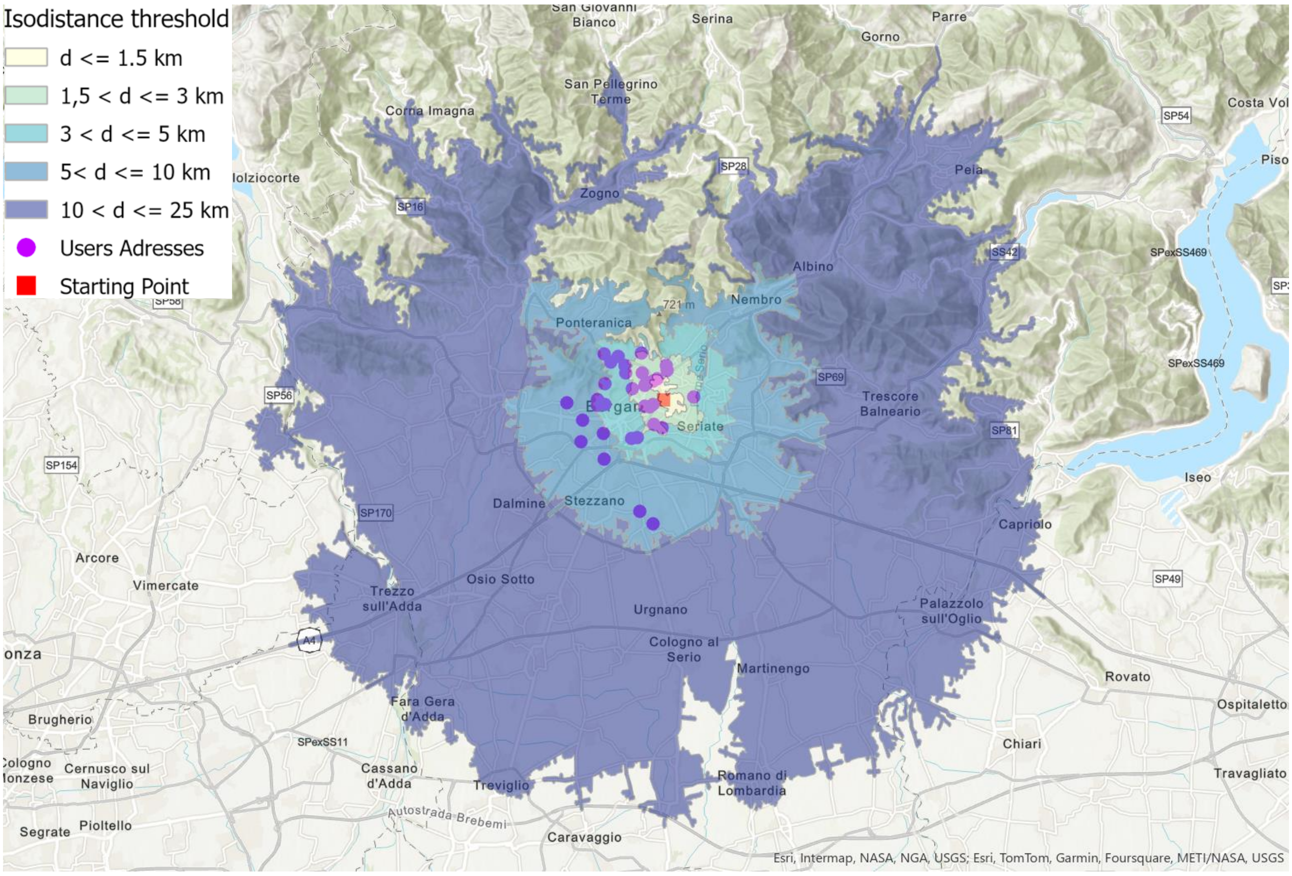


Figure 4 - Isodistance areas from the starting point and distribution of service users

The numerical results are reported in Table 36.

Table 36 - KPIs of Territorial Analysis - TA.1

Isodistance threshold (km)	Service Users within the threshold	Threshold x Users (Users x km)
1,5	2	3
3	13	39
5	11	55
10	7	70
25	0	0
	Total	167
TA.1 LOCATION BASED		57,28 (kg CO_2 / Users x km)
TA.1 MARKET BASED		57,28 (kg CO_2 / Users x km)

Figure 5 reports these geographical elaborations, referred to isochrones, with the following thresholds: 5 mins.; 10 mins.; 15 mins.; 20 mins.; 25 mins.

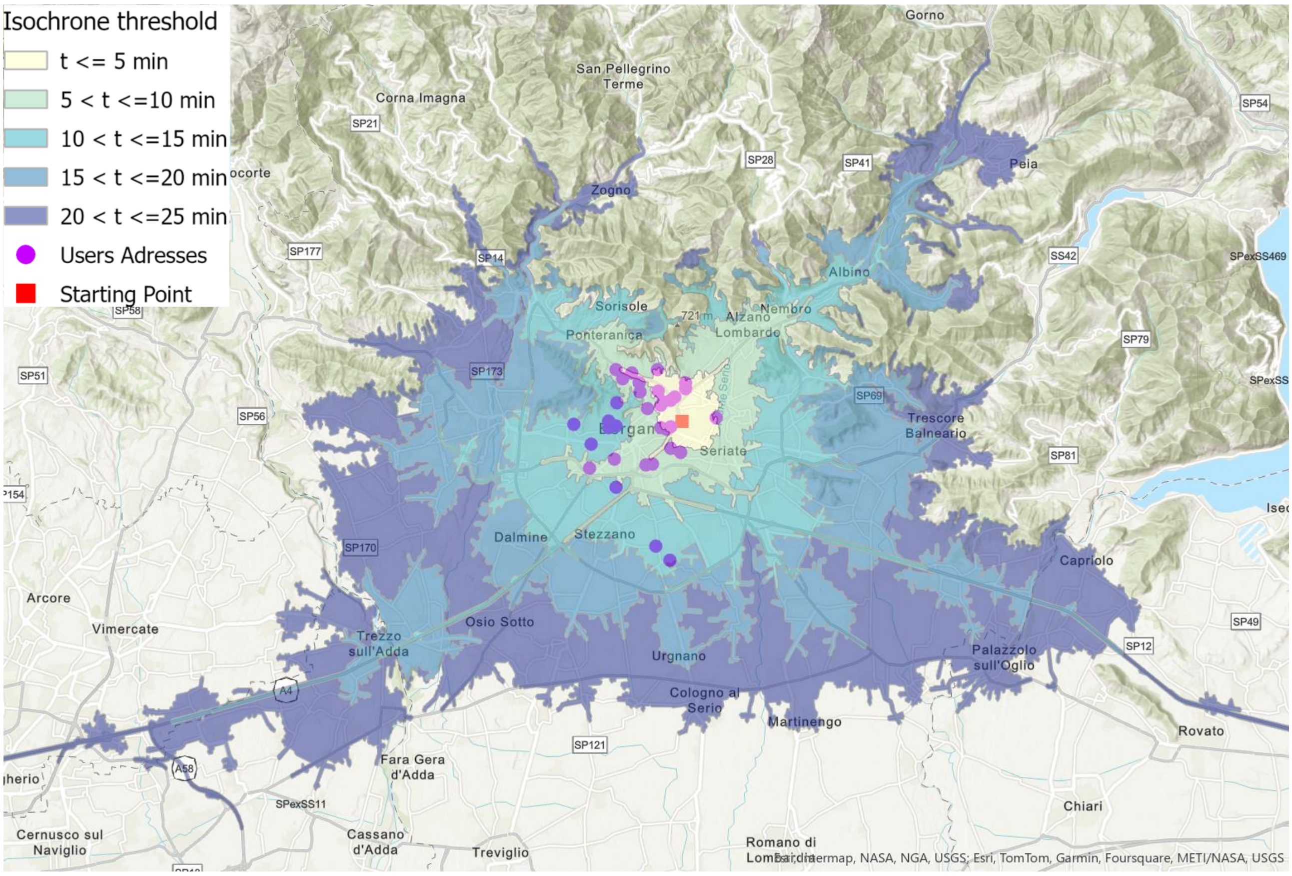


Figure 5 - Isochrone areas from the starting point and distribution of service users

The numerical results are reported in Table 37.

Table 37 - KPIs of Territorial Analysis - TA.2

Isochrones threshold (min)	Service Users within the threshold	Threshold x Users (Users x minutes)
5	12	60
10	12	120
15	9	135
20	0	0
25	0	0
	Total	315
TA.2 LOCATION BASED		30,37 (kg CO_2 / Users x minutes)
TA.2 MARKET BASED		30,37 (kg CO_2 / Users x minutes)

5. Klis - Household assistance and meal delivery services

5.1. Brief description of the service

The municipality provides household assistance services and meal delivery services for socially disadvantaged residents. The service provider is a local self-government unit.

The service users are more than 50 elderly and infirm citizens, living on the territory of the municipality. 10 women between the ages of 40 and 60 are employed to provide domestic help services, covering their movements by foot or using personal vehicles.

5.2. Input data

Input data are referred to the categories **General Service and Inventory Information** and **Fleet Gasoline /Diesel/Hybrid**, as reported hereby in Table 38 and Table 39.

Preliminary operations were deployed to estimate the kms travelled by the individual vehicles of the caregivers. These are listed below:

- Caregivers were asked to track the distances covered to deploy the services during 2 weeks in 2024.
- These distances were upscaled considering 52 weeks per year and assuming the resulting kms travelled as reference for year 2023.
- Distances for vehicles 5 and 9 were estimated based on Google Maps thanks to the availability of addresses for both the caregivers and users involved.

The number of users served is considered equal to 44. This data is obtained based on the addresses of the users.

Based on the available data, the approach adopted is the distance-based method, relying on the emission factors specifically referred to each single vehicle. These were extracted by technical sheets of the vehicle publicly accessible on the web. These are collected and reported in the section References [1].

Table 38 - General Service and Inventory Information - Input

General Service and Inventory Information	
City	KLIS
State	HR - Croatia
Service Name	Helping with everyday household chores
Service Operator	-
Inventory year	2023
Inventory compiled by	Ana Bralic
Position of compiler	-
email compiler	ana.bralic@pi-klis.hr
Number of users served	44
Number of operators/volunteers involved	10

Table 39 - Fleet Gasoline /Diesel/Hybrid - Input

Fleet Gasoline /Diesel/Hybrid	
Number of vehicles	9
Consumption in litres?	NO
Do you use a specific emission factor?	YES
vehicle_1	
Model	OPEL ASTRA, ENJOY 1.4 16V
Plate	ST 745 RN
Vehicle Typology	Passenger car
Fuel Type	Gasoline
Km travelled	2.756
Your own emission factor (gCO_2/km)	146
vehicle_2	
Model	SKODA OCTAVIA, 1.6 TDI,2008year
Plate	ST7883AI
Vehicle Typology	Passenger car
Fuel Type	Diesel
Km travelled	2.756
Your own emission factor (gCO_2/km)	119
vehicle_3	
Model	MAZDA DEMIO 1.3, 1999year
Plate	ST 7682 Z
Vehicle Typology	Passenger car
Fuel Type	Gasoline
Km travelled	10.283
Your own emission factor (gCO_2/km)	167
vehicle_4	
Model	BMW, seria 1, 118D, 2007 year
Plate	ST 6163 AD
Vehicle Typology	Passenger car
Fuel Type	Diesel
Km travelled	5.564
Your own emission factor (gCO_2/km)	119
vehicle_5	
Model	NISSAN QASHQAI, 1.6 2007 year
Plate	ST 280 RD
Vehicle Typology	Passenger car
Fuel Type	Gasoline
Km travelled	2.002
Your own emission factor (gCO_2/km)	144
vehicle_6	
Model	SKODA FABIA, 2003 year
Plate	ST 789 GN
Vehicle Typology	Passenger car
Fuel Type	Diesel
Km travelled	5.538
Your own emission factor (gCO_2/km)	122
vehicle_7	

Model	VW POLO 1.6 TDI 2010 year
Plate	ST 6350 T
Vehicle Typology	Passenger car
Fuel Type	Diesel
Km travelled	1.560
Your own emission factor (gCO_2/km)	109
vehicle_8	
Model	PEUGEOUT 307, 1.4, 2005year
Plate	ST 3453 AC
Vehicle Typology	Passenger car
Fuel Type	Gasoline
Km travelled	1.726
Your own emission factor (gCO_2/km)	155
vehicle_9	
Model	BMW seria 1 2014 year
Plate	ST 3811 AK
Vehicle Typology	Passenger car
Fuel Type	Diesel
Km travelled	915
Your own emission factor (gCO_2/km)	119

5.3. Output

5.3.1. Overall Carbon Footprint

Table 40 reports the overall Carbon Footprint detailing the contribution of each vehicle part of the fleet.

Table 40 - Overall Carbon Footprint - Contributions within sources

	CO_2 Emissions (kg CO_2)
vehicle_1	402,38
vehicle_2	327,96
vehicle_3	1.717,26
vehicle_4	662,12
vehicle_5	288,29
vehicle_6	675,64
vehicle_7	170,04
vehicle_8	267,53
vehicle_9	108,89
Total Fleet	**4.620,10**

Table 41 reports the overall Carbon Footprint, with the contribution of the different vehicles aggregated, while detailing the amount of CO_2 emissions determined by other sources (Public Transport and Electric Fleet). In this case, these contributions are equal to 0. The table provides the Carbon Footprint with both Location and Market Based approaches. However, since no electric vehicle is part of the fleet, the two Carbon Footprint are quantitively the same.

Table 41 - Overall Carbon Footprint - Contributions by sources and by approaches

LOCATION BASED	
Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	4.620
Public Transport	0
Electric Fleet	0
TOTAL	**4.620**
MARKET BASED	
Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	4.620
Public Transport	0
Electric Fleet	0
TOTAL	**4.620**

5.3.2. KPIs Carbon Intensity

The KPIs of Carbon Intensity are detailed in Table 42 considering both the Location and Market Based approaches. However, since no electric vehicle is part of the fleet, the two set of KPIs are quantitively the same.

Table 42 - Overall Carbon Footprint - Contributions by sources and by approaches

LOCATION BASED		
CI.1	kg CO_2/Service Users	105,00
CI.2	kg CO_2/SE Operator	462,00
CI.3	kg CO_2/Vehicles used by the SE	513,33
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,14
MARKET BASED		
CI.1	kg CO_2/Service Users	105,00
CI.2	kg CO_2/SE Operator	462,00
CI.3	kg CO_2/Vehicles used by the SE	513,33
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,14

5.3.3. KPIs Territorial Analysis

The KPIs of Territorial Analysis involves the distribution of the total carbon footprint over a territorial elaboration concerning the spatial distribution of the service users and of the possible starting point(s) of the movements. These last are the points of origin for the definition of isodistance areas and isochrone areas, with thresholds.

Figure 6 reports these geographical elaborations, referred to isodistances, with the following thresholds: 1,5 km; 3 km; 5 km; 10 km; 25 km.

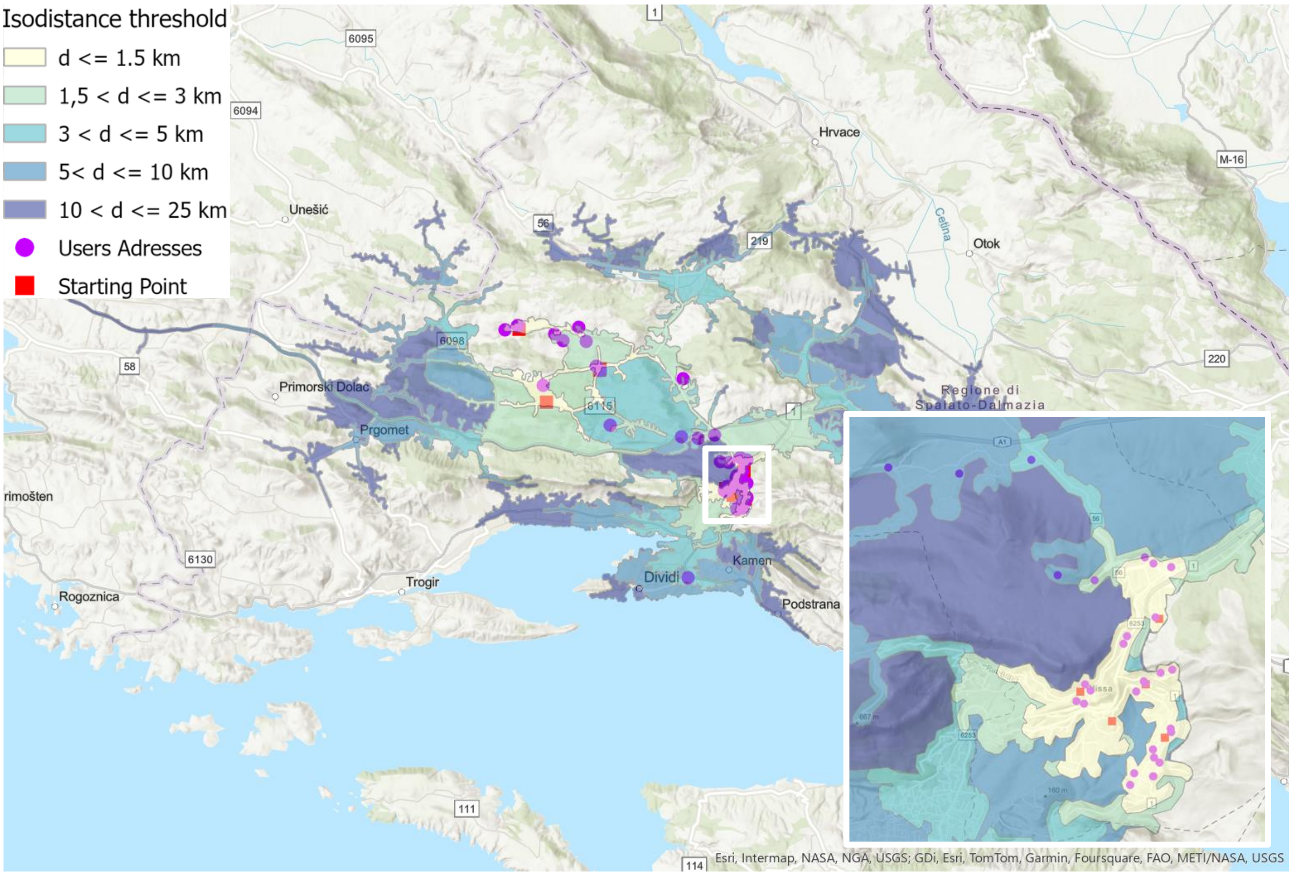


Figure 6 - Isodistance areas from the starting points and distribution of service users

The numerical results are reported in Table 43.

Table 43 - KPIs of Territorial Analysis - TA.1

Isodistance threshold (km)	Service Users within the threshold	Threshold x Users (Users x km)
1,5	29	43,5
3	4	12
5	4	20
10	7	70
25		0
	Total	145,5
TA.1 LOCATION BASED		31,75 (kg CO_2 / Users x km)
TA.1 MARKET BASED		31,75 (kg CO_2 / Users x km)

Figure 7 reports these geographical elaborations, referred to isochrones, with the following thresholds: 5 mins.; 10 mins.; 15 mins.; 20 mins.; 25 mins.

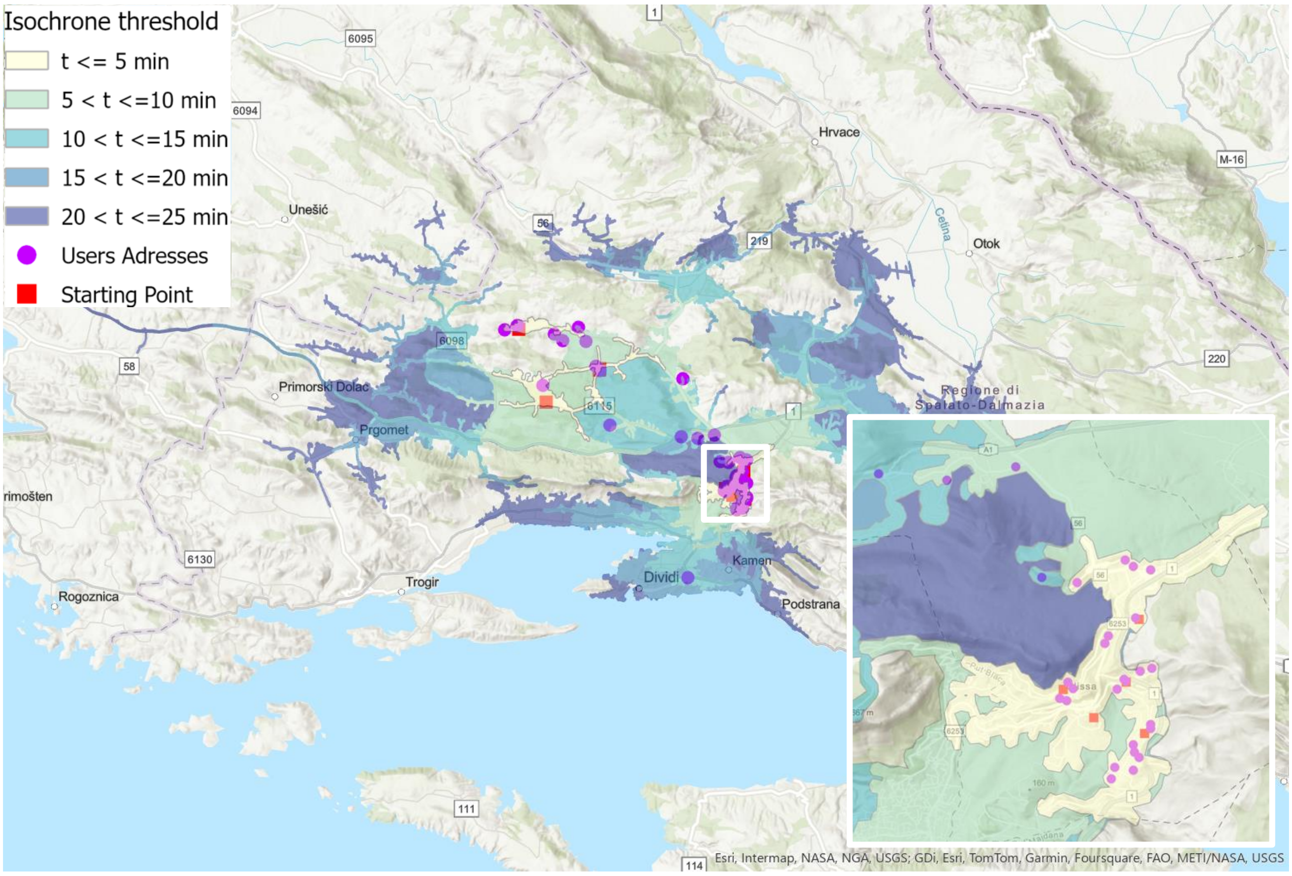


Figure 7 - Isochrone areas from the starting points and distribution of service users

The numerical results are reported in Table 44.

Table 44 - KPIs of Territorial Analysis - TA.2

Isochrones threshold (min)	Service Users within the threshold	Threshold x Users (Users x minutes)
5	33	165
10	6	60
15	5	75
20		0
25		0
	Total	300
TA.2 LOCATION BASED		15,40 (kg CO_2 / Users x minutes)
TA.2 MARKET BASED		15,40 (kg CO_2 / Users x minutes)

6. Szombathely - Support Services for People with Disabilities by FEHE

6.1. Brief description of the service

Support Services for People with Disabilities – partly home service (helping with everyday tasks at home, doing shopping etc.), partly transportation (driving the disabled to school, work or to health service).

The service is provided on workdays between 08.00 till 16.00, the times are not sharp (the morning may start from 7.00 when there are requests for it).

Shifts and operator movements are organised on a weekly basis by the group leader, based upon the users' requests submitted previously. Shift orders are prepared a week ahead. Operators are assigned to their usual users/clients as much as possible to keep service provision as smooth and helpful as possible.

6.2. Input data

Input data are referred to the categories **General Service and Inventory Information**, **Fleet Gasoline /Diesel/Hybrid** and Public Transport, as reported hereby in Table 45, Table 46 and Table 47.

The number of users served is considered equal to 72. This data is obtained based on the addresses of the users.

Based on the available data, the approach adopted is the fuel-based method.

Table 45 - General Service and Inventory Information - Input

General Service and Inventory Information	
City	Szombathely
State	HU - Hungary
Service Name	FEHE
Service Operator	-
Inventory year	2023
Inventory compiled by	Szűcs Gabriella
Position of compiler	Head of the Support Services
email compiler	szucs.gabriella@fehe.hu
Number of users served	72
Number of operators/volunteers involved	5

Table 46 - Fleet Gasoline /Diesel/Hybrid - Input

Fleet Gasoline /Diesel/Hybrid	
Number of vehicles	2
Consumption in litres?	YES
vehicle_1	
Model	Ford Transit
Plate	RAH-650
Vehicle Typology	VAN
Fuel Type	Diesel
Litres Upfilled	3.129
vehicle_2	
Model	Renault Kangoo
Plate	NYJ-816
Vehicle Typology	Passenger car
Fuel Type	Diesel
Litres Upfilled	1.332

Table 47 - Public Transport - Input

Public Transport	
Type of Public transport	**Km travelled in the Inventory Year**
Bus	2.500
Passenger Train	-

6.3. Output

6.3.1. Overall Carbon Footprint

Table 48 reports the overall Carbon Footprint detailing the contribution of each vehicle part of the fleet.

Table 48 - Overall Carbon Footprint - Contributions within sources

	CO_2 Emissions (kg CO_2)
vehicle_1	8.245,75
vehicle_2	3.510,17
Total Fleet	**11.755,92**

Table 49 reports the overall Carbon Footprint, with the contribution of the different vehicles aggregated, and detailing the amount of CO_2 emissions determined by other sources (Public Transport and Electric Fleet). In this case, the contribution by Electric Fleet is equal to 0. The table provides the Carbon Footprint with both Location and Market Based approaches. However, since no electric vehicle is part of the fleet, the two Carbon Footprint are quantitively the same.

Table 49 - Overall Carbon Footprint - Contributions by sources and by approaches

LOCATION BASED	
Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	11.756,00
Public Transport	170,00
Electric Fleet	0,00
TOTAL	11.926,00
MARKET BASED	
Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	11.756,00
Public Transport	170,00
Electric Fleet	0,00
TOTAL	11.926,00

6.3.2. KPIs Carbon Intensity

The KPIs of Carbon Intensity are detailed in Table 50, considering both the Location and Market Based approaches. However, since no electric vehicle is part of the fleet, the two set of KPIs are quantitively the same.

Table 50 - Overall Carbon Footprint - Contributions by sources and by approaches

LOCATION BASED		
CI.1	kg CO_2/Service Users	165,64
CI.2	kg CO_2/SE Operator	2.385,20
CI.3	kg CO_2/Vehicles used by the SE	5.963,00
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,23
MARKET BASED		
CI.1	kg CO_2/Service Users	165,64
CI.2	kg CO_2/SE Operator	2.385,20
CI.3	kg CO_2/Vehicles used by the SE	5.963,00
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,23

6.3.3. KPIs Territorial Analysis

The KPIs of Territorial Analysis involves the distribution of the total carbon footprint over a territorial elaboration concerning the spatial distribution of the service users and of the possible starting point(s) of the movements. These last are the points of origin for the definition of isodistance areas and isochrone areas, with thresholds.

Figure 8 reports these geographical elaborations, referred to isodistances, with the following thresholds: 1,5 km; 3 km; 5 km; 10 km; 25 km.

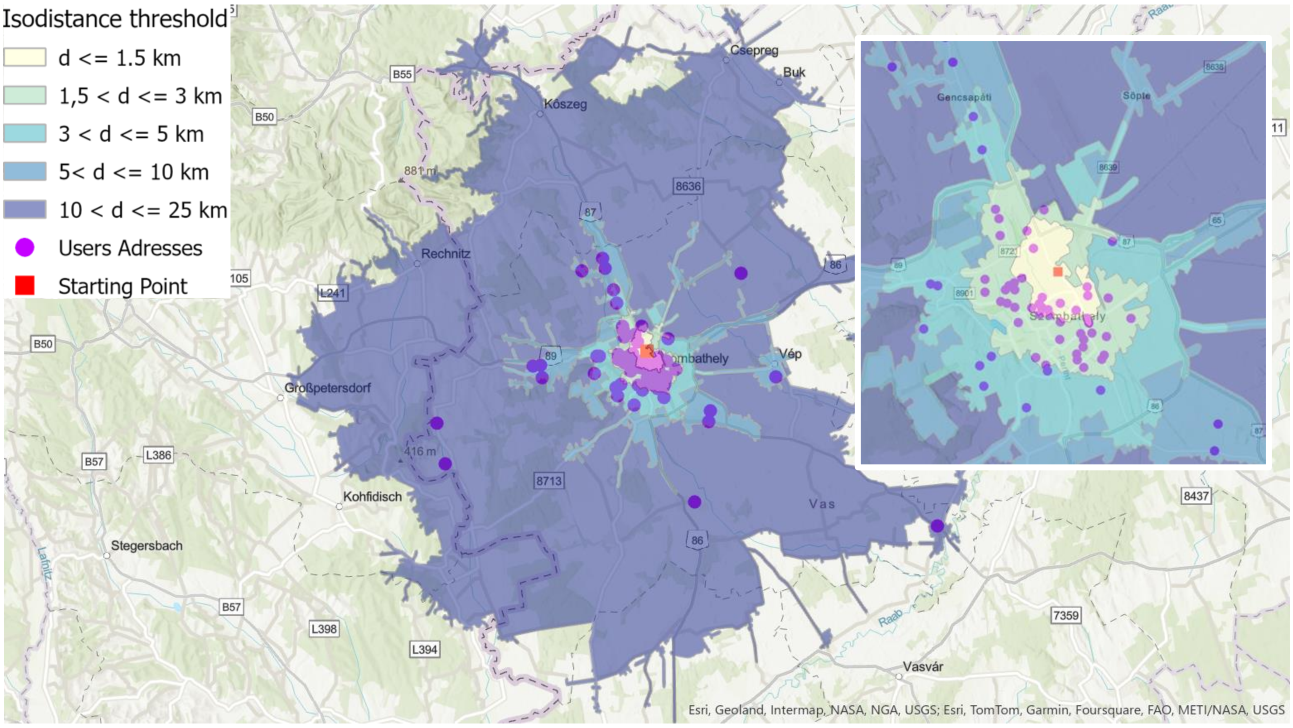


Figure 8 - Isodistance areas from the starting point and distribution of service users

The numerical results are reported in Table 51.

Table 51 - KPIs of Territorial Analysis – TA.1

Isodistance threshold (km)	Service Users within the threshold	Threshold x Users (Users x km)
1,5	13	19,5
3	33	99
5	12	60
10	9	90
25	5	125
	Total	393,5
TA.1 LOCATION BASED		30,31 (kg CO_2 / Users x km)
TA.1 MARKET BASED		30,31 (kg CO_2 / Users x km)

Figure 9 reports these geographical elaborations, referred to isochrones, with the following thresholds: 5 mins.; 10 mins.; 15 mins.; 20 mins.; 25 mins.

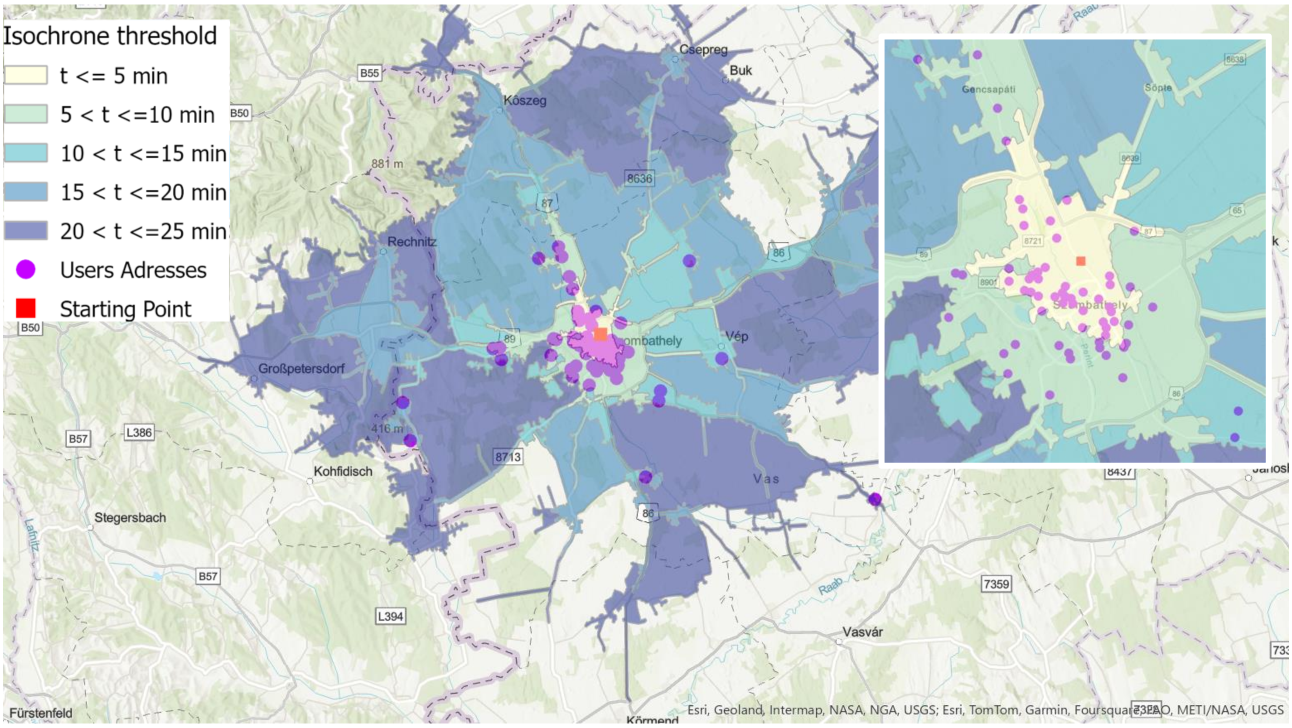


Figure 9 - Isochrone areas from the starting point and distribution of service users

The numerical results are reported in Table 52.

Table 52 - KPIs of Territorial Analysis – TA.2

Isochrones threshold (min)	Service Users within the threshold	Threshold x Users (Users x minutes)
5	37	185
10	26	260
15	5	75
20	3	60
25	1	25
	Total	605
TA.2 LOCATION BASED		19,71 (kg CO_2 / Users x minutes)
TA.2 MARKET BASED		19,71 (kg CO_2 / Users x minutes)

7. Szombathely - Home care service for the elderly by Pálos

7.1. Brief description of the service

Support services for elderly individuals who are unable to care for themselves at home, either living alone or whose family members are unable to care for them.

The caregivers involved have qualifications in social care and nursing, but there are also those with general nursing, assistant and specialized nursing qualifications. The service is provided daily, including weekends and holidays for some. The care is provided as needed, sometimes two to three times daily for certain individuals. Trips are covered using personal owned car by the caregivers. Few movements are covered by bicycle.

7.2. Input data

Input data are referred to the categories **General Service and Inventory Information**, **Fleet Gasoline /Diesel/Hybrid** as reported hereby in Table 53 and Table 54.

Based on the available data, the approach adopted is the fuel-based method.

Table 53 - General Service and Inventory Information - Input

General Service and Inventory Information	
City	Szombathely
State	HU - Hungary
Service Name	Home care service for the elderly
Service Operator	Pálos Károly Szociális Szolgáltató Központ és Gyermekjóléti Szolgálat
Inventory year	2023
Inventory compiled by	Lászlóné Kulcsár
Position of compiler	Head of institution
email compiler	szocialis94@paloskaroly.hu
Number of users served	200
Number of operators/volunteers involved	14

Table 54 - Fleet Gasoline /Diesel/Hybrid - Input

Fleet Gasoline /Diesel/Hybrid	
Number of vehicles	15
Consumption in litres?	YES
vehicle_1	
Model	Hyundai IX 20
Plate	AA JD 372
Vehicle Typology	Passenger car
Fuel Type	Gasoline
Litres Upfilled	217,451
vehicle_2	
Model	Nissan Micra
Plate	KLY-467
Vehicle Typology	Passenger car
Fuel Type	Gasoline
Litres Upfilled	962,082
vehicle_3	
Model	Peugeot206
Plate	SMF-291
Vehicle Typology	Passenger car
Fuel Type	Gasoline
Litres Upfilled	735,859
vehicle_4	
Model	Fiat Punto 55s
Plate	FED-138
Vehicle Typology	Passenger car
Fuel Type	Gasoline
Litres Upfilled	1036,789
vehicle_5	
Model	Citroen C3
Plate	PSG-045
Vehicle Typology	Passenger car
Fuel Type	Gasoline
Litres Upfilled	1069,947
vehicle_6	
Model	Peugeot306
Plate	HLU-700
Vehicle Typology	Passenger car
Fuel Type	Gasoline
Litres Upfilled	877,432
vehicle_7	
Model	Renault Twingo
Plate	SSN-545
Vehicle Typology	Passenger car
Fuel Type	Gasoline
Litres Upfilled	11,619
vehicle_8	
Model	Suzuki Swift
Plate	LAD-779
Vehicle Typology	Passenger car
Fuel Type	Gasoline
Litres Upfilled	588,929

vehicle_9	
Model	Opel Agila
Plate	MTU-473
Vehicle Typology	Passenger car
Fuel Type	Gasoline
Litres Upfilled	7,998
vehicle_10	
Model	Ford Fiesta 1.4
Plate	JRG-815
Vehicle Typology	Passenger car
Fuel Type	Gasoline
Litres Upfilled	5,762
vehicle_11	
Model	Opel Mokka
Plate	RXL-674
Vehicle Typology	Passenger car
Fuel Type	Gasoline
Litres Upfilled	5,461
vehicle_12	
Model	Toyota Avensis
Plate	IWJ-223
Vehicle Typology	Passenger car
Fuel Type	Gasoline
Litres Upfilled	10,553
vehicle_13	
Model	Nissan Micra
Plate	EWX-633
Vehicle Typology	Passenger car
Fuel Type	Gasoline
Litres Upfilled	9,761
vehicle_14	
Model	Volkswagen Bora
Plate	HJZ-463
Vehicle Typology	Passenger car
Fuel Type	Gasoline
Litres Upfilled	36,524
vehicle_15	
Model	Toyota Avensis
Plate	RYN-657
Vehicle Typology	Passenger car
Fuel Type	Gasoline
Litres Upfilled	69,674

7.3. Output

7.3.1. Overall Carbon Footprint

Table 55 reports the overall Carbon Footprint detailing the contribution of each vehicle part of the fleet.

Table 55 - Overall Carbon Footprint - Contributions within sources

	CO_2 Emissions (kg CO_2)
vehicle_1	513,39
vehicle_2	2.275,96
vehicle_3	1.741,27
vehicle_4	2.453,40
vehicle_5	2.531,47
vehicle_6	2.074,86
vehicle_7	28,39
vehicle_8	1.393,49
vehicle_9	18,93
vehicle_10	14,20
vehicle_11	11,83
vehicle_12	26,02
vehicle_13	23,66
vehicle_14	87,54
vehicle_15	165,61
Total Fleet	**13.360,02**

Table 56 reports the overall Carbon Footprint, with the contribution of the different vehicles aggregated, while detailing the amount of CO_2 emissions determined by other sources (Public Transport and Electric Fleet). In this case, these contributions are equal to 0. The table provides the Carbon Footprint with both Location and Market Based approaches. However, since no electric vehicle is part of the fleet, the two Carbon Footprint are quantitively the same.

Table 56 - Overall Carbon Footprint - Contributions by sources and by approaches

LOCATION BASED	
Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	13.360,00
Public Transport	0,00
Electric Fleet	0,00
TOTAL	13.360,00
MARKET BASED	
Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	13.360,00
Public Transport	0,00
Electric Fleet	0,00
TOTAL	13.360,00

7.3.2. KPIs Carbon Intensity

The KPIs of Carbon Intensity are detailed in Table 57, considering both the Location and Market Based approaches. However, since no electric vehicle is part of the fleet, the two set of KPIs are quantitively the same.

Table 57 - Overall Carbon Footprint - Contributions by sources and by approaches

LOCATION BASED		
CI.1	kg CO_2/Service Users	66,80
CI.2	kg CO_2/SE Operator	954,29
CI.3	kg CO_2/Vehicles used by the SE	890,67
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,20
MARKET BASED		
CI.1	kg CO_2/Service Users	66,80
CI.2	kg CO_2/SE Operator	954,29
CI.3	kg CO_2/Vehicles used by the SE	890,67
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,20

7.3.3. KPIs Territorial Analysis

The KPIs of Territorial Analysis are not estimated since data concerning the starting points of the caregivers is a data not available.

8. Szombathely - Day care service for the elderly by Pálos

8.1. Brief description of the service

Services targeted for elderly individuals who are able to care for themselves at their home but are happy to meet fellow elderly people in daytime and play, talk, learn, dine, spend time together. Some of them access the day care centres in the city alone, while others need help in transport. The elderly are picked up by the driver at their homes at a pre-arranged time. The drivers are aware of who has requested transportation on a given day and based on their place of residence, they pick up the elderly one after another and transport them to the clubs. Two vehicles (one van and one passenger car) are used to carry out the service.

8.2. Input data

Input data are referred to the categories **General Service and Inventory Information**, **Fleet Gasoline /Diesel/Hybrid** as reported hereby in Table 58 and Table 59.

Based on the available data, the approach adopted is the fuel-based method.

Table 58 - General Service and Inventory Information - Input

General Service and Inventory Information	
City	Szombathely
State	HU - Hungary
Service Name	Day care service for the elderly
Service Operator	Pálos Károly Szociális Szolgáltató Központ és Gyermekjóléti Szolgálat
Inventory year	2023
Inventory compiled by	Lászlóné Kulcsár
Position of compiler	Head of institution
email compiler	szocialis94@paloskaroly.hu
Number of users served	11
Number of operators/volunteers involved	2

Table 59 - Fleet Gasoline /Diesel/Hybrid - Input

Fleet Gasoline /Diesel/Hybrid	
Number of vehicles	2
Consumption in litres?	YES
vehicle_1	
Model	Renault Trafic
Plate	LRX-105
Vehicle Typology	VAN
Fuel Type	Diesel
Litres Upfilled	462,16
vehicle_2	
Model	Ford C-Max
Plate	RCC-960
Vehicle Typology	Passenger car
Fuel Type	Gasoline
Litres Upfilled	208

8.3. Output

8.3.1. Overall Carbon Footprint

Table 60 reports the overall Carbon Footprint detailing the contribution of each vehicle part of the fleet.

Table 60 - Overall Carbon Footprint – Contributions within sources

	CO_2 Emissions (kg CO_2)
vehicle_1	1.217,49
vehicle_2	492,10
Total Fleet	**1.709,59**

Table 61 reports the overall Carbon Footprint, with the contribution of the different vehicles aggregated, while detailing the amount of CO_2 emissions determined by other sources (Public Transport and Electric Fleet). In this case, these contributions are equal to 0. The table provides the Carbon Footprint with both Location and Market Based approaches. However, since no electric vehicle is part of the fleet, the two Carbon Footprint are quantitively the same.

Table 61 - Overall Carbon Footprint - Contributions by sources and by approaches

LOCATION BASED	
Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	1.710,00
Public Transport	0,00
Electric Fleet	0,00
TOTAL	1.710,00
MARKET BASED	
Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	1.710,00
Public Transport	0,00
Electric Fleet	0,00
TOTAL	1.710,00

8.3.2. KPIs Carbon Intensity

The KPIs of Carbon Intensity are detailed in Table 62, considering both the Location and Market Based approaches. However, since no electric vehicle is part of the fleet, the two set of KPIs are quantitively the same.

Table 62 - Overall Carbon Footprint - Contributions by sources and by approaches

LOCATION BASED		
CI.1	kg CO_2/Service Users	155,45
CI.2	kg CO_2/SE Operator	855,00
CI.3	kg CO_2/Vehicles used by the SE	855,00
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,22
MARKET BASED		
CI.1	kg CO_2/Service Users	155,45
CI.2	kg CO_2/SE Operator	855,00
CI.3	kg CO_2/Vehicles used by the SE	855,00
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,22

8.3.3. KPIs Territorial Analysis

The KPIs of Territorial Analysis involves the distribution of the total carbon footprint over a territorial elaboration concerning the spatial distribution of the service users and of the possible starting point(s) of the movements. These last are the points of origin for the definition of isodistance areas and isochrone areas, with thresholds.

Figure 10 reports these geographical elaborations, referred to isodistances, with the following thresholds: 1,5 km; 3 km; 5 km; 10 km; 25 km.

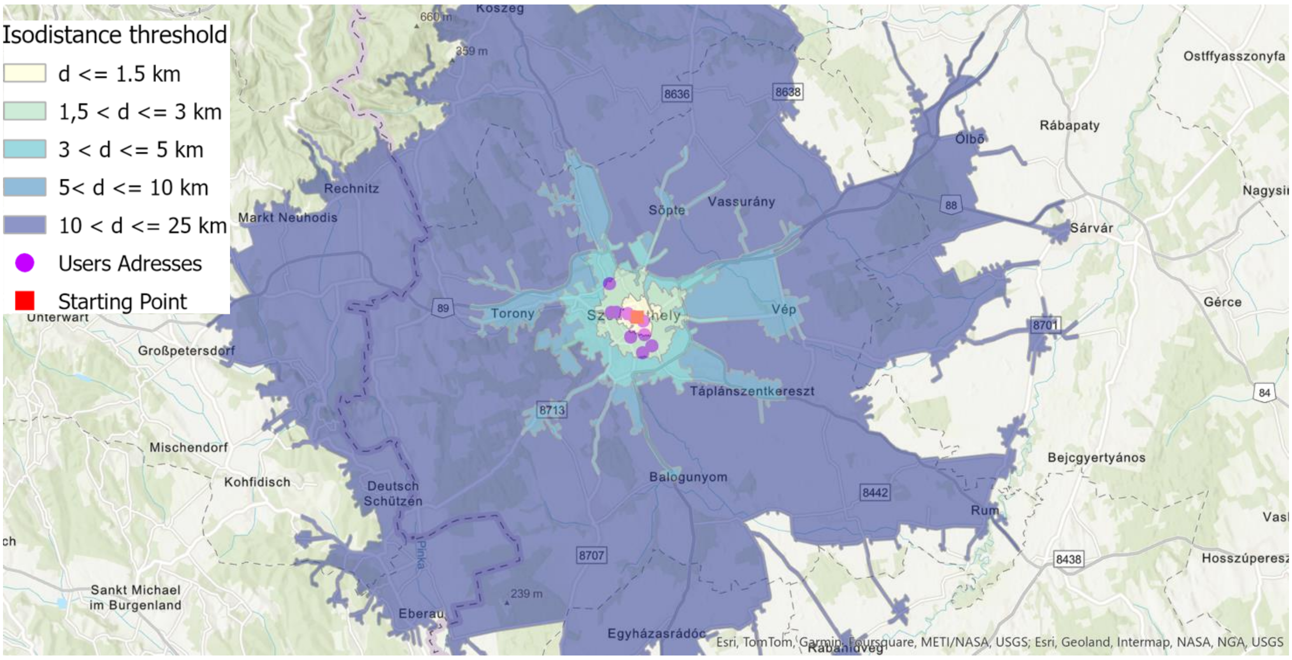


Figure 10 - Isodistance areas from the starting point and distribution of service users

The numerical results are reported in Table 63.

Table 63 - KPIs of Territorial Analysis – TA.1

Isodistance threshold (km)	Service Users within the threshold	Threshold x Users (Users x km)
1,5	4	6
3	7	21
5	0	0
10	0	0
25	0	0
	Total	27
TA.1 LOCATION BASED		63,33 (kg CO_2 / Users x km)
TA.1 MARKET BASED		63,33 (kg CO_2 / Users x km)

Figure 11 reports these geographical elaborations, referred to isochrones, with the following thresholds: 5 mins.; 10 mins.; 15 mins.; 20 mins.; 25 mins.

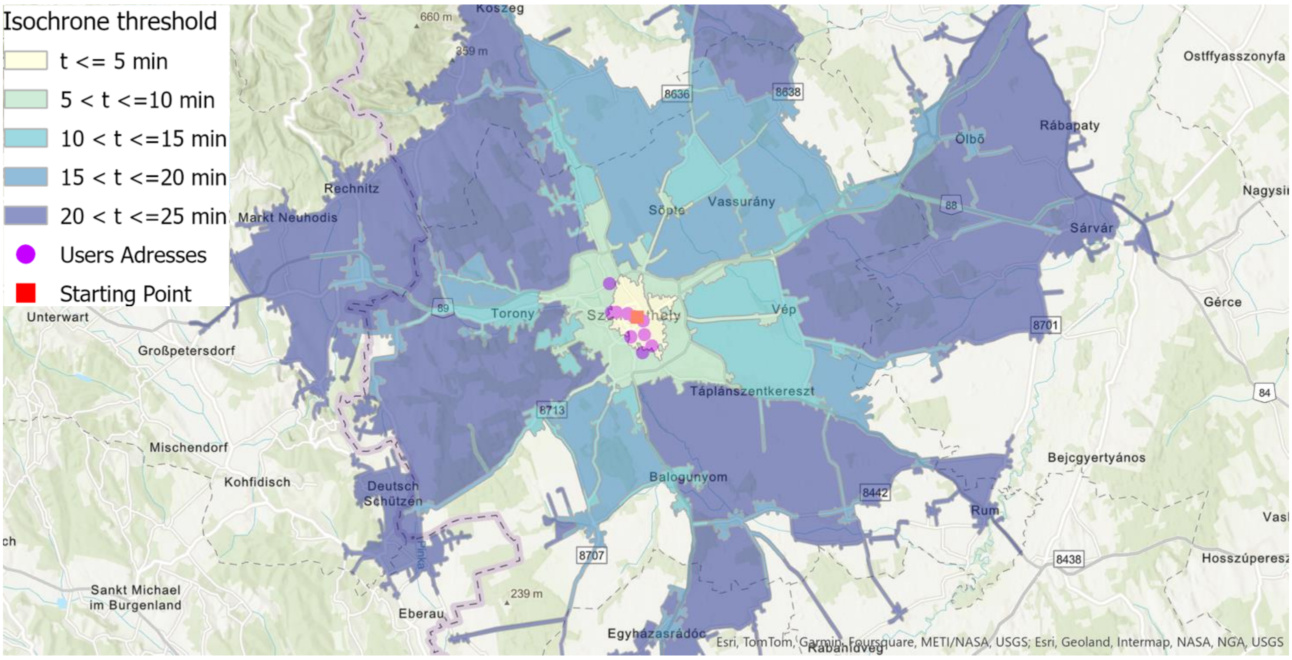


Figure 11 - Isochrone areas from the starting point and distribution of service users

The numerical results are reported in Table 64.

Table 64 - KPIs of Territorial Analysis - TA.2

Isochrones threshold (min)	Service Users within the threshold	Threshold x Users (Users x minutes)
5	9	45
10	2	20
15	0	0
20	0	0
25	0	0
	Total	65
TA.2 LOCATION BASED		26,31 (kg CO_2 / Users x minutes)
TA.2 MARKET BASED		26,31 (kg CO_2 / Users x minutes)

9. Conclusion

This document represents the Deliverable 1.2.2 of the Interreg CENTRAL EUROPE 2021-2027 CE0200590 - Green LaMiS Project. The document is developed within the Activity 1.2 - *Development and adoption of the common strategy and action plan* of the *WP1 -Assessment and monitoring of services' environmental impact for a Joint Action Plan.*

The document, deeply connected to the deliverables 1.1.1 - *Transnational methodology co-design* and 1.2.1 – *Common assessment tool*, presents the estimated carbon footprint of home-delivered social services (HDSS) for the social enterprises operating in the three cities involved in the Project: Bergamo (IT), Klis (HR), and Szombathely (HU).

The assessment of the CO_2 emissions is developed relying on the tool designed and implemented within the Project and related to the inventory year 2023. Beside the overall carbon footprint, also the set of KPIs defined by the adopted methodology is reported.

Quantitative considerations about the outcomes presented per each service are meaningless in absolute terms as described within chapter 2. All these information represent a starting milestone, a useful reference to monitor the progress achievable thanks to initiatives and measures of carbon management deployable over time. Indeed, the same analysis can be performed on yearly basis, relying on the common assessment tool.

A meaningful conclusion that results by the whole process of estimation of the carbon footprint concerns the tool and its application. This instrument proved to meet all the desired requirements. Most of all it showed features of transferability, being applied to the three cities involved, and of modularity. Indeed, it was able to provide consistent outcomes with a variety of input data sets.

References

[1] KLIS_EmissionFactors.zip

[2] Green Lamis - Deliverable 1.1.1 - Transnational methodology co-design

[3] Green Lamis – Deliverable 1.2.1 – Common assessment tool

[4] https://ghgprotocol.org/

10. Annex A – Common assessment tool – User manual

The tool is designed within the Interreg CENTRAL EUROPE 2021-2027 CE0200590 - Green LaMiS Project to calculate the Carbon Footprint of HSSE and it follows the structure presented in the deliverable 1.2.1 – *Common assessment tool* [3].

It is an Excel workbook structured into seven main sheets, each with a specific function, allowing the management of the required input data and the automatic calculation of the carbon footprint.

The sheets included in the workbook are:

- Input
- Fleet
- Public_Transport
- Electric_Fleet
- Conversion Factor
- Emission factor
- Output

The Input Sheet

The Input sheet allows user to enter basic information about the service.

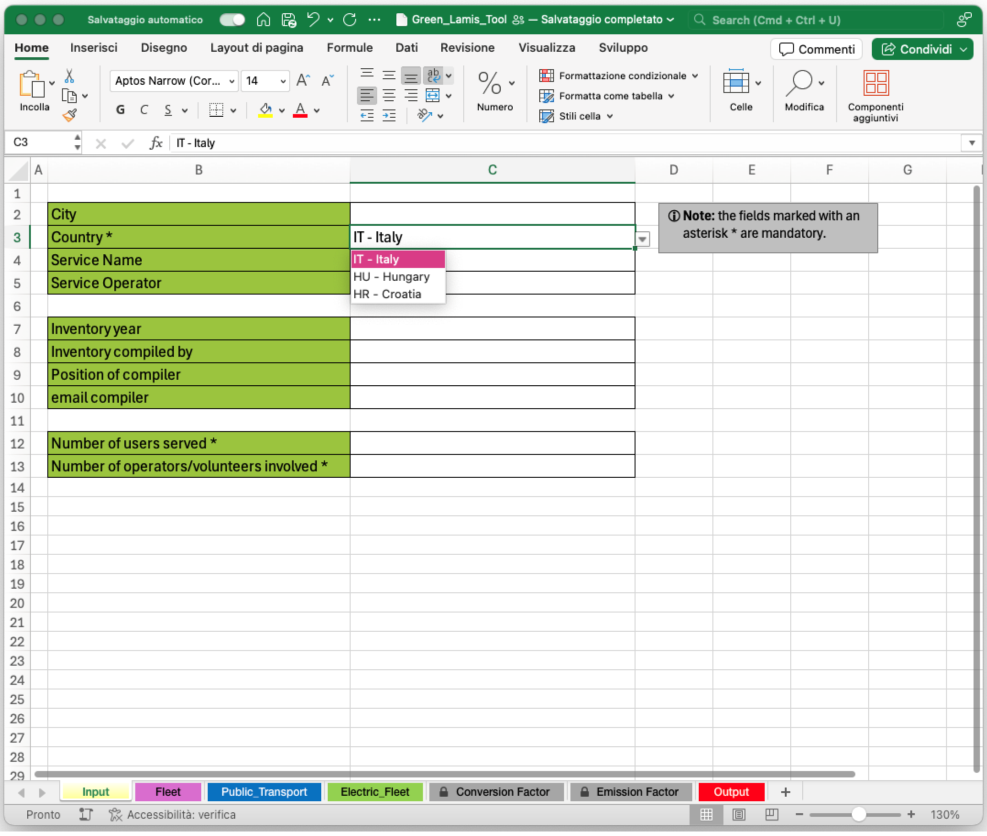


Figure 12 - Input sheet

In column B, see Figure 12, the essential fields for the description are listed. The mandatory ones are marked with an asterisk. If these fields are not filled in, the tool will not be able to calculate the carbon footprint.

The fields to be completed are as follows:

- City
- Country *
- Service Name
- Service Operator

- Inventory year
- Inventory compiled by
- Position of compiler
- email compiler

- Number of users served *
- Number of operators/volunteers involved *

The *Country* field is mandatory to enable the tool to calculate the carbon footprint in both location-based and market-based approaches, in case electric vehicles are part of the fleet.

A dropdown menu allows users to select the Country of the service, see Figure 12.

The fields *Number of users served* and *Number of operators/volunteers involved* are used to calculate the carbon intensity of the service.

The Fleet Sheet

The Fleet sheet enables the input of data related to the combustion engine vehicles used in the service under analysis.

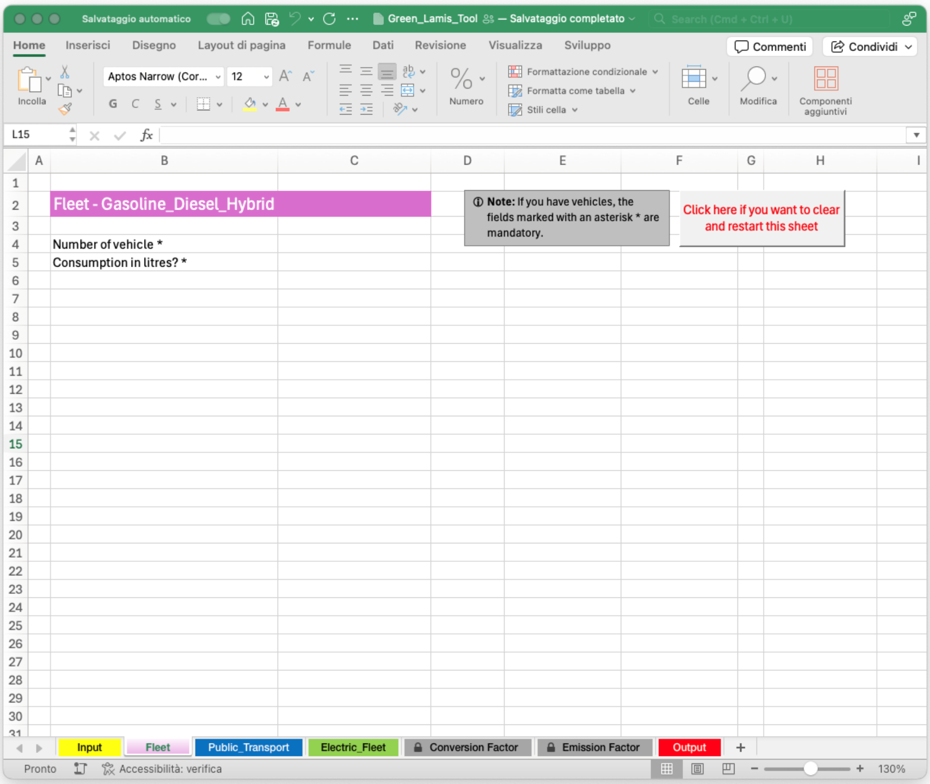


Figure 13 - Fleet sheet

The sheet includes two mandatory fields, marked with an asterisk, that must be filled in to proceed.

The first field requires entering the *Number of vehicles* (petrol, diesel, hybrid, and full-hybrid vehicles) in the service fleet.

The second field asks whether fuel consumption in liters is known. A dropdown menu allows user to select the appropriate response.

If *YES* is selected, the tool will populate the sheet with the necessary fields for each vehicle in the fleet, to proceed with the carbon footprint calculation based on known fuel consumption in liters.

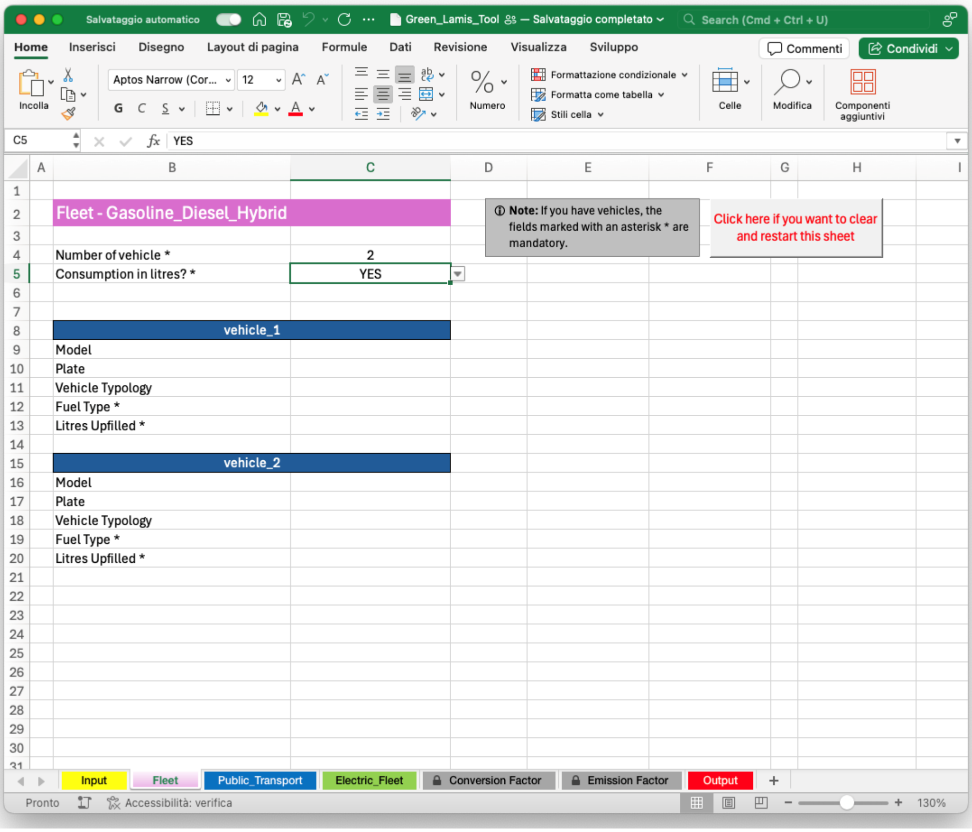


Figure 14 - Fleet sheet in the case of Consumption in litres is known

In the example provided, see Figure 14, the number of vehicles in the fleet is 2; therefore, the tool prepares the necessary information for both vehicles to proceed with the carbon footprint calculation.

The fields *Model*, *Plate*, and *Vehicle Typology* are descriptive fields related to the vehicle model and do not affect the footprint calculation. Differently, the fields *Fuel Type* and *Litres Upfilled* (marked with an asterisk) are mandatory.

A dropdown menu allows user to select the fuel type, choosing from Gasoline, Diesel, Full Hybrid, and Plug-in Hybrid.

If fuel consumption in liters is unknown, the tool will prompt the user to specify whether a specific emission factor is available.

Depending on the answer, the tool adjusts the required information accordingly.

If the response is *YES* (a specific emission factor is available), the mandatory fields are:

- Kilometers traveled
- Emission factor, expressed in gCO_2/km.

See Figure 15 for reference.

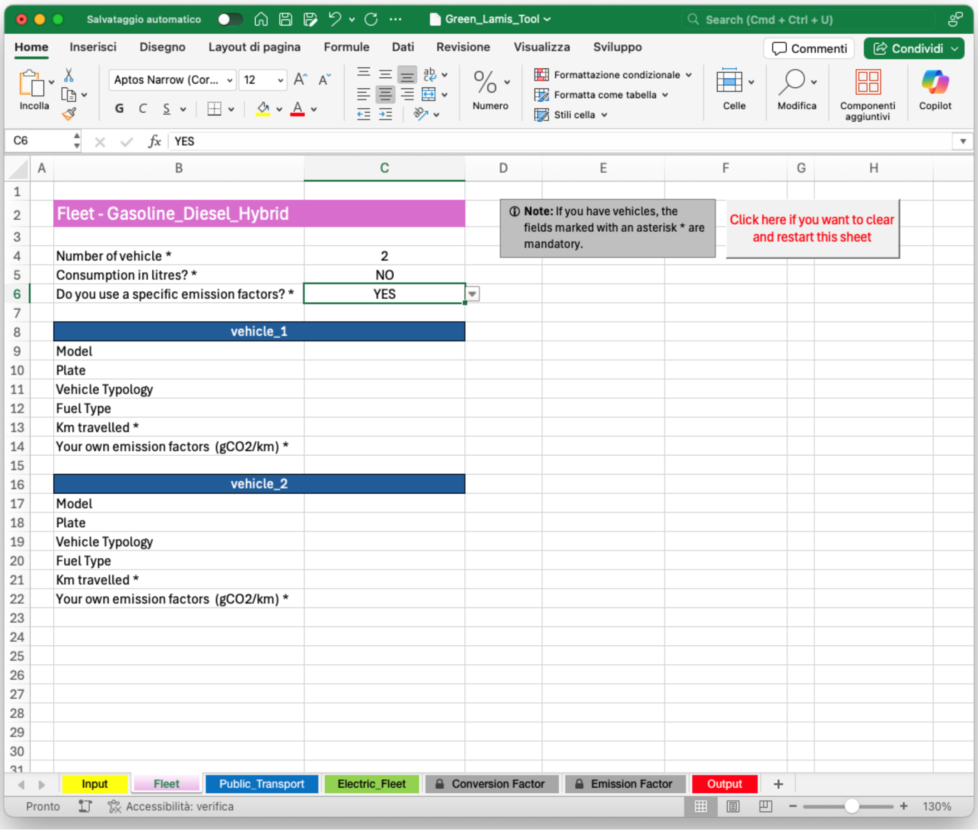


Figure 15 - Fleet sheet in the case of Consumption in litres is not known and a specific emission factor is available

If a specific emission factor is not available, the required fields are shown in Figure 16. In particular, the mandatory fields are:

- Vehicle typology (Passenger Car or VAN)
- Fuel Type
- Kilometers travelled

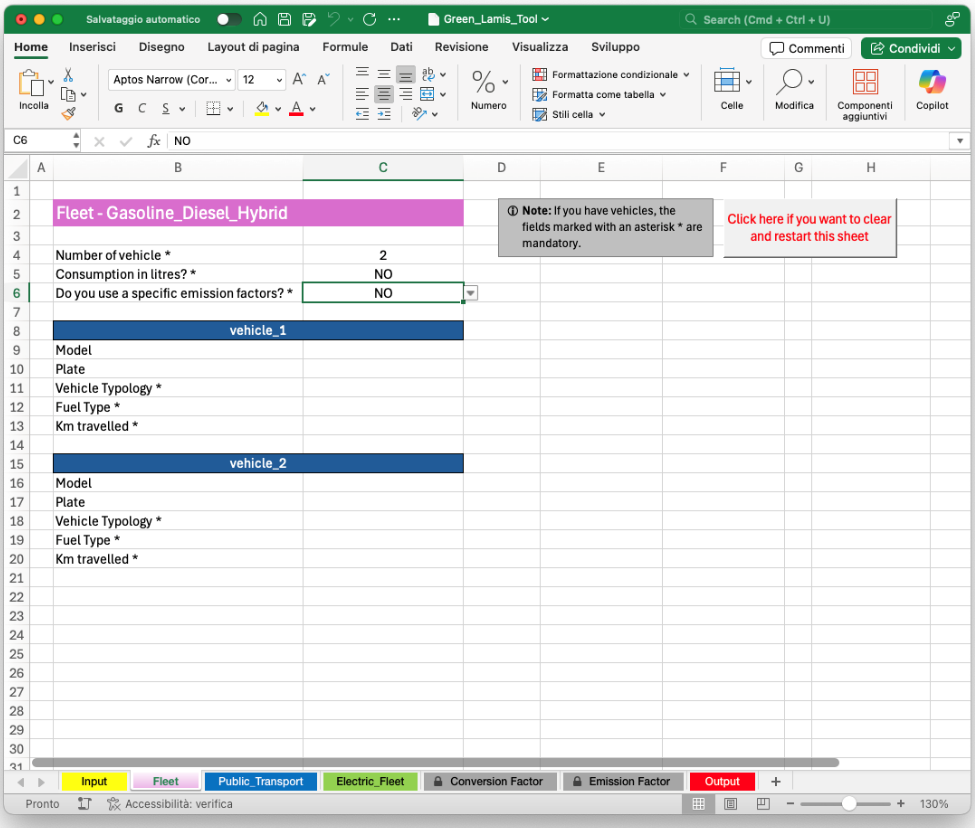


Figure 16 - Fleet sheet in the case of Consumption in litres is not known and a specific emission factor is not available

Once the fields have been entered for all the vehicles, the user can proceed to the next sheet.

In case of mistakes, it is possible to reset the sheet by clicking the button located in the top right corner of the sheet.

The Public Transport Sheet

The *Public Transport Sheet* allows the user to enter the kilometers traveled, if any, using public transport by operators/volunteers. The types of public transport considered are *Bus* and *Passenger Train*.

For both types of transport, it is possible to enter the number of kilometers traveled by public transport in the reference year by the service's operators/volunteers. The data, therefore, represents the total sum of all kilometers travelled in the reference year using public transport, divided between the two considered transport types, by all operators/volunteers (see Figure 17).

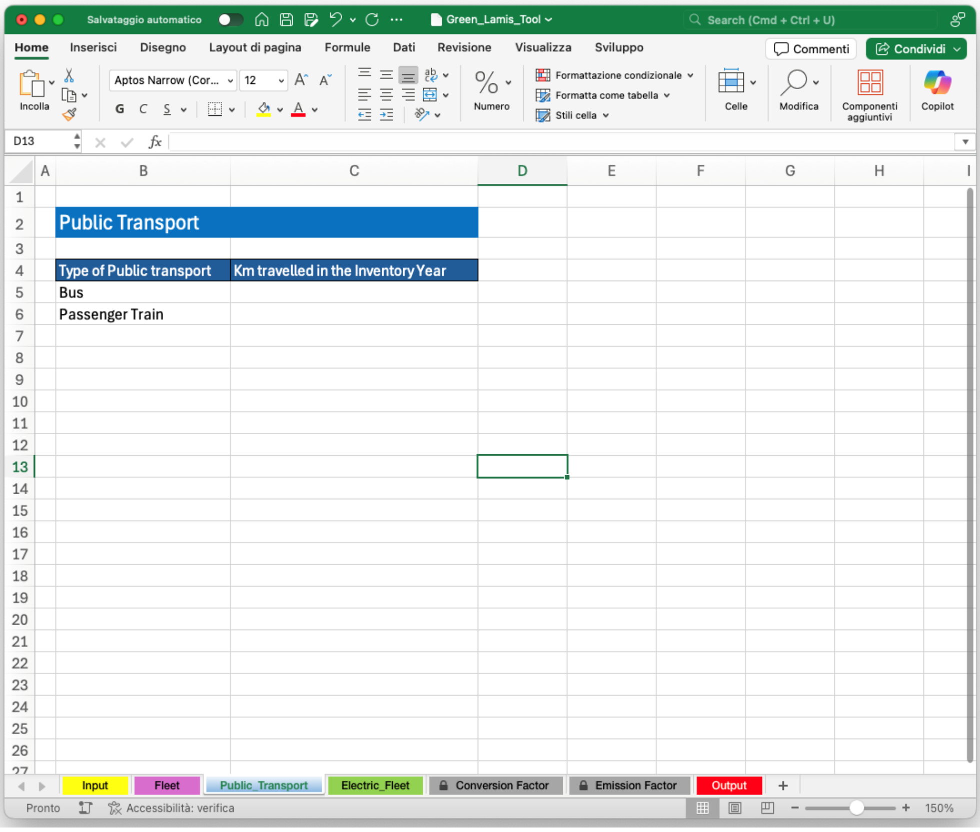


Figure 17 - Public Transport sheet

If no trips have been made using public transport, the fields (both or just one) can be left blank, and the user can proceed to the next sheet.

The Electric Fleet Sheet

This sheet allows the user to enter data related to the electric vehicles, if part of the fleet.

Before processing information about the electric vehicles, it is required to specify the percentage of electricity from renewable sources. This information can come from requirements in the agreement with the energy provider, by means of certification by energy authorities or, in case of self-production of the energy, by certified metering systems. If no information is available, the value to be entered should be zero (see Figure 18).

Afterward, two other mandatory fields must be filled in:

- *Number of vehicles*
- *Consumption in kWh* (*Yes* or *No*); this field requires indicating whether consumption data in kWh is available or not.

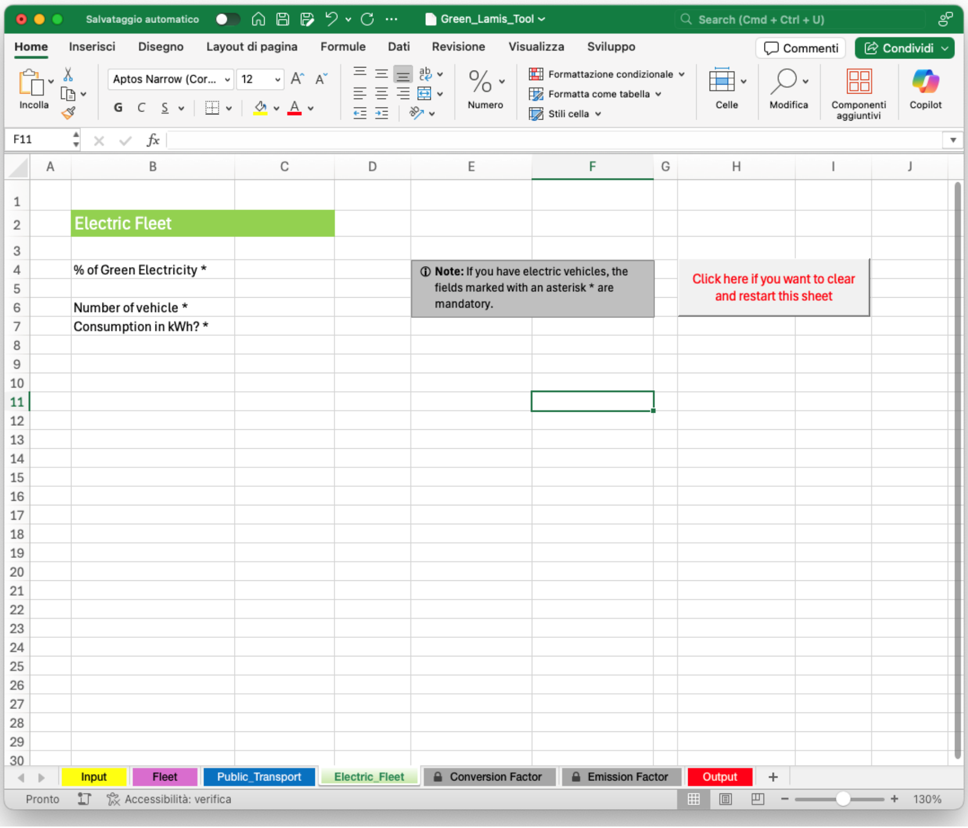


Figure 18 - Electric fleet sheet

The tool will then proceed to compile the necessary data for the electric vehicle fleet based on the available information.

Fields related to the vehicle *Model* and license *Plate* are descriptive but not mandatory, while the *Vehicle Typology* (passenger car or van) is required, as it is necessary for the carbon footprint calculation.

If kWh consumption data is available and the initial question is answered affirmatively, the required field is *Consumption in kWh* (see Figure 19). Differently, if consumption data is not available, entering *km travelled* is mandatory (see Figure 20).

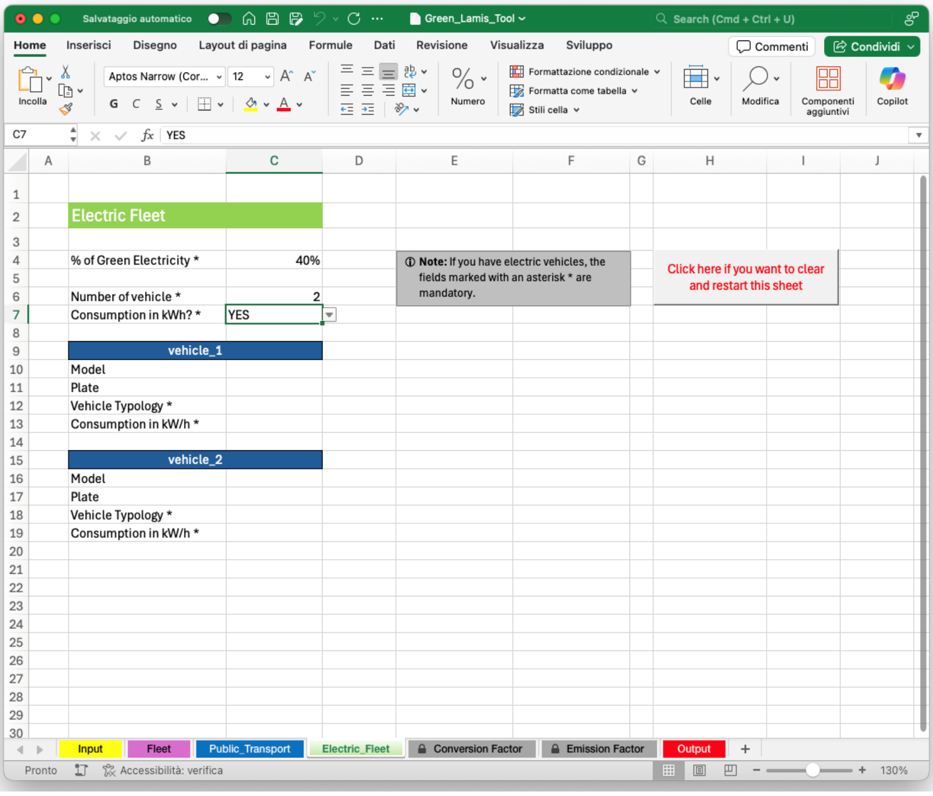


Figure 19 - Electric fleet sheet the case of consumption in kWh is known

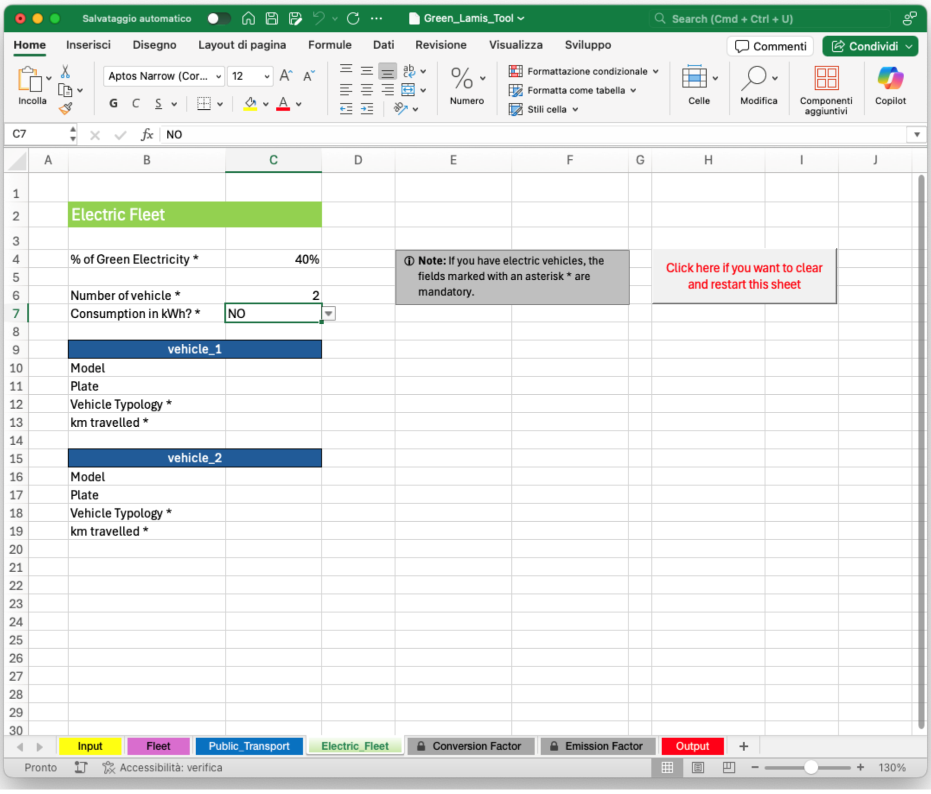


Figure 20 - Electric fleet sheet the case of consumption in kWh is not known

The Conversion Factor and Emission Factor Sheets

These two sheets are essential for calculating the carbon footprint.

The *Conversion Factor Sheet* (see Figure 21) allows for the conversion of fuel liters into kilograms of fuel for combustion vehicles. For electric vehicles, it enables the conversion of kilometers travelled into kWh.

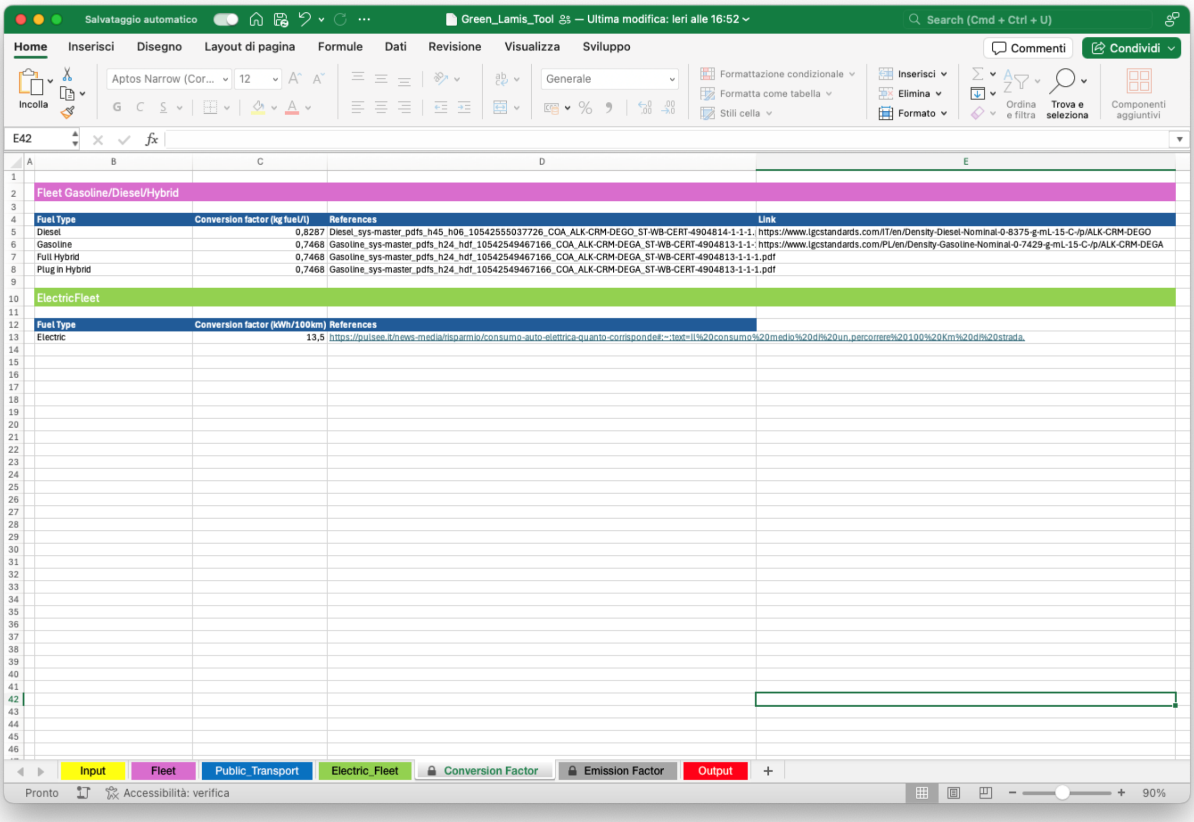
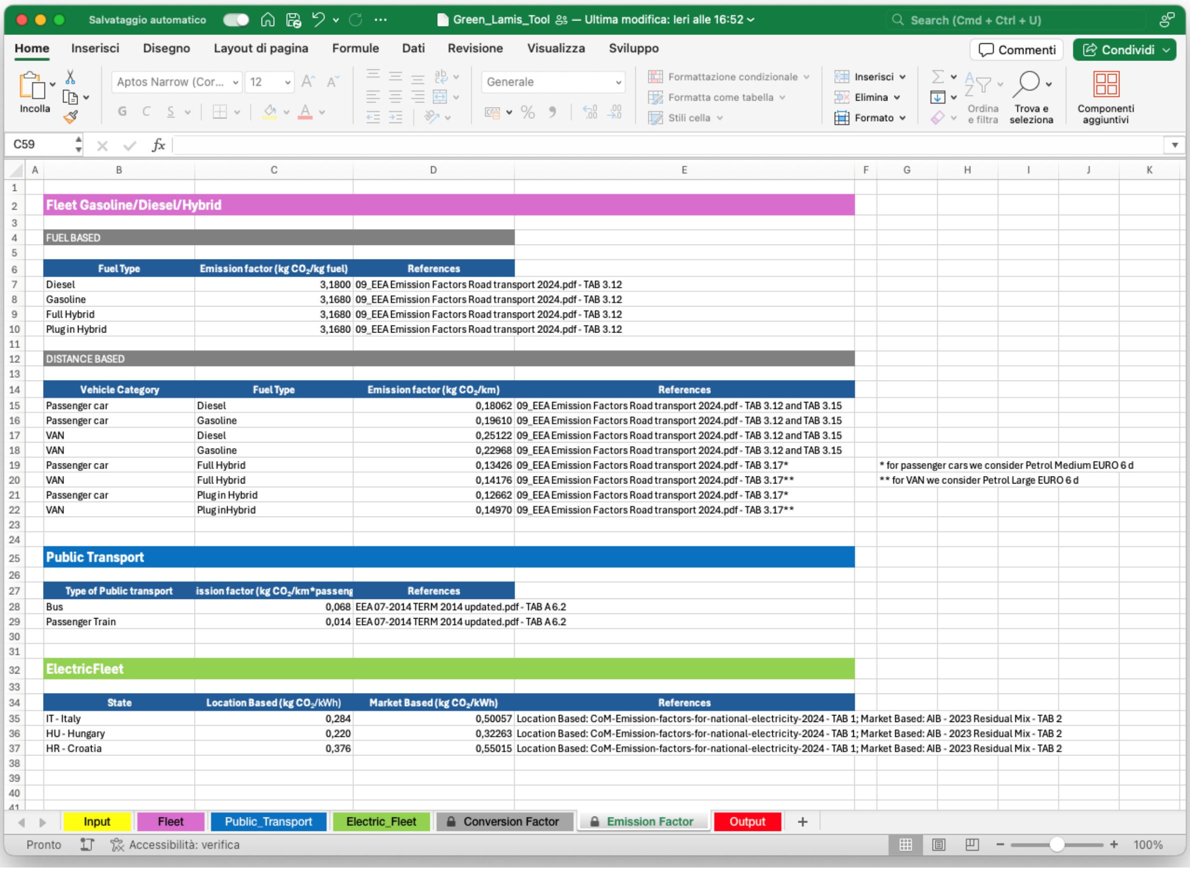


Figure 21 – Conversion Factor sheet

The *Emission Factor Sheet* (see Figure 22), on the other hand, lists the emission factors for all types of vehicles (combustion, public transport, and electric vehicles). For combustion vehicles, it provides emission factors based on both the fuel-based and distance-based approaches. For electric vehicles, it includes location-based and market-based emission factors for the Countries considered in the project.



Fleet Gasoline/Diesel/Hybrid

FUEL BASED

Fuel Type	Emission factor (kg CO_2/kg fuel)	References
Diesel	3,1800	09_EEA Emission Factors Road transport 2024.pdf - TAB 3.12
Gasoline	3,1680	09_EEA Emission Factors Road transport 2024.pdf - TAB 3.12
Full Hybrid	3,1680	09_EEA Emission Factors Road transport 2024.pdf - TAB 3.12
Plug in Hybrid	3,1680	09_EEA Emission Factors Road transport 2024.pdf - TAB 3.12

DISTANCE BASED

Vehicle Category	Fuel Type	Emission factor (kg CO_2/km)	References	
Passenger car	Diesel	0,18062	09_EEA Emission Factors Road transport 2024.pdf - TAB 3.12 and TAB 3.15	
Passenger car	Gasoline	0,19610	09_EEA Emission Factors Road transport 2024.pdf - TAB 3.12 and TAB 3.15	
VAN	Diesel	0,25122	09_EEA Emission Factors Road transport 2024.pdf - TAB 3.12 and TAB 3.15	
VAN	Gasoline	0,22968	09_EEA Emission Factors Road transport 2024.pdf - TAB 3.12 and TAB 3.15	
Passenger car	Full Hybrid	0,13426	09_EEA Emission Factors Road transport 2024.pdf - TAB 3.17*	* for passenger cars we consider Petrol Medium EURO 6 d
VAN	Full Hybrid	0,14176	09_EEA Emission Factors Road transport 2024.pdf - TAB 3.17**	** for VAN we consider Petrol Large EURO 6 d
Passenger car	Plug in Hybrid	0,12662	09_EEA Emission Factors Road transport 2024.pdf - TAB 3.17*	
VAN	Plug inHybrid	0,14970	09_EEA Emission Factors Road transport 2024.pdf - TAB 3.17**	

Public Transport

Type of Public transport	ission factor (kg CO_2/km*passeng	References
Bus	0,068	EEA 07-2014 TERM 2014 updated.pdf - TAB A 6.2
Passenger Train	0,014	EEA 07-2014 TERM 2014 updated.pdf - TAB A 6.2

ElectricFleet

State	Location Based (kg CO_2/kWh)	Market Based (kg CO_2/kWh)	References
IT - Italy	0,284	0,50057	Location Based: CoM-Emission-factors-for-national-electricity-2024 - TAB 1; Market Based: AIB - 2023 Residual Mix - TAB 2
HU - Hungary	0,220	0,32263	Location Based: CoM-Emission-factors-for-national-electricity-2024 - TAB 1; Market Based: AIB - 2023 Residual Mix - TAB 2
HR - Croatia	0,376	0,55015	Location Based: CoM-Emission-factors-for-national-electricity-2024 - TAB 1; Market Based: AIB - 2023 Residual Mix - TAB 2

Figure 22 - Emission Factor sheet

A detailed explanation of the methodology used and of the references adopted is available in the deliverable Deliverable 1.1.1 - *Transnational Methodology Co-Design* [2].

The sheets are accessible but not editable by the user, ensuring transparency regarding the conversion and emission factors used, along with references for each.

The Output Sheet

The last sheet allows for calculating the carbon footprint of the analysed service based on the data entered in the previous ones.

The sheet (see Figure 23) includes three buttons:

- *Run*: it allows the calculation of the carbon footprint.
- *Save the Carbon Footprint in a new sheet*: it saves the results in a new, non-editable sheet.
- *Clear and restart*: it resets the sheet to start a new footprint calculation.

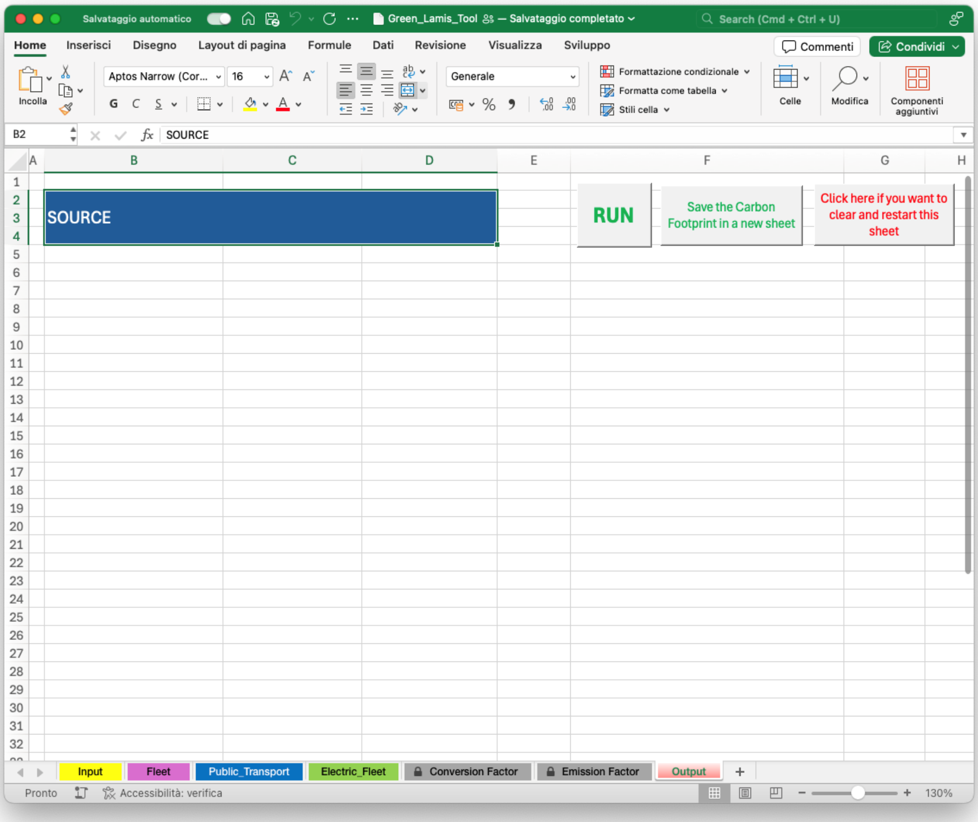


Figure 23 - Output sheet

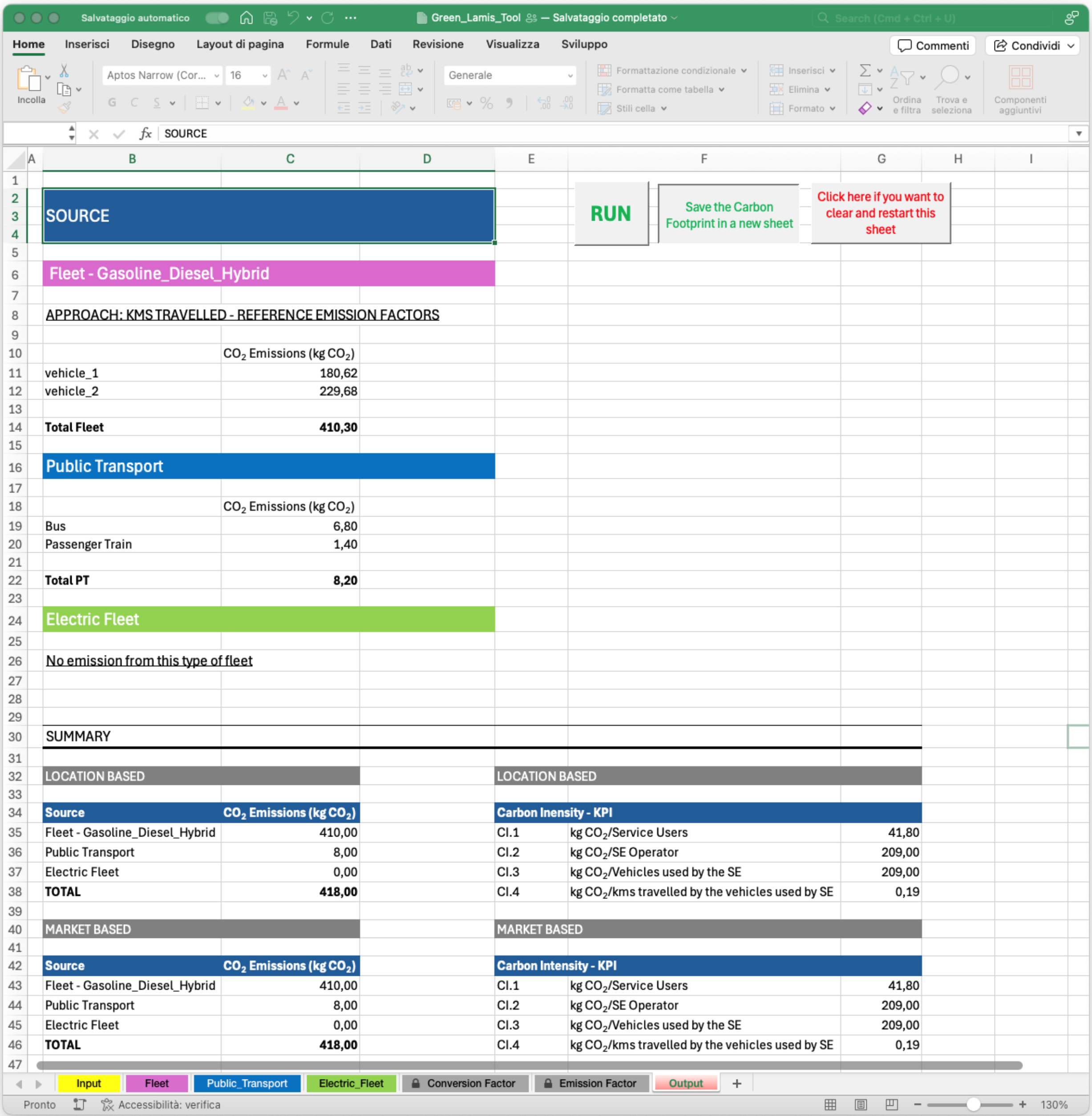
Once the service data has been entered, the carbon footprint calculation can be performed.

The calculation is automatically processed by the tool once the *Run* button is clicked. Figure 24 provides an example of the footprint for a sample service.

In the first section, the tool provides a summary of the carbon emissions ralated to each emission source: *Fleet*, *Public Transport* and *Electric Fleet*. For the source *Fleet*, the indication of the approach adopted for the estimation is also reported.

Finally, a summary table is presented. On the left side, the carbon footprint associated with the service is calculated using both the location-based and market-based approaches. On the right side, the carbon intensity is calculated, detailing the four KPIs identified in deliverable Deliverable 1.1.1 - *Transnational Methodology Co-Design* [2].

If fuel consumption (liters for combustion fleet) or energy consumption (kWh for electric vehicles) has been entered instead of kilometers traveled, the KPI *C1.4 - kg CO_2/km traveled by the vehicles used by SE* will not be available.



SOURCE

Fleet - Gasoline_Diesel_Hybrid

APPROACH: KMS TRAVELLED - REFERENCE EMISSION FACTORS

	CO_2 Emissions (kg CO_2)
vehicle_1	180,62
vehicle_2	229,68
Total Fleet	**410,30**

Public Transport

	CO_2 Emissions (kg CO_2)
Bus	6,80
Passenger Train	1,40
Total PT	**8,20**

Electric Fleet

No emission from this type of fleet

SUMMARY

LOCATION BASED

Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	410,00
Public Transport	8,00
Electric Fleet	0,00
TOTAL	**418,00**

LOCATION BASED

Carbon Inensity - KPI		
CI.1	kg CO_2/Service Users	41,80
CI.2	kg CO_2/SE Operator	209,00
CI.3	kg CO_2/Vehicles used by the SE	209,00
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,19

MARKET BASED

Source	CO_2 Emissions (kg CO_2)
Fleet - Gasoline_Diesel_Hybrid	410,00
Public Transport	8,00
Electric Fleet	0,00
TOTAL	**418,00**

MARKET BASED

Carbon Intensity - KPI		
CI.1	kg CO_2/Service Users	41,80
CI.2	kg CO_2/SE Operator	209,00
CI.3	kg CO_2/Vehicles used by the SE	209,00
CI.4	kg CO_2/kms travelled by the vehicles used by SE	0,19

Figure 24 - Carbon Footprint result in the Output sheet

Once the carbon footprint of the analysed service has been calculated, the results can be saved in a new sheet.

By clicking the *Save the Carbon Footprint in a new sheet* button, a window will appear asking for the name of the new sheet. Figure 25 shows an example where the new sheet is named Baseline 2023.

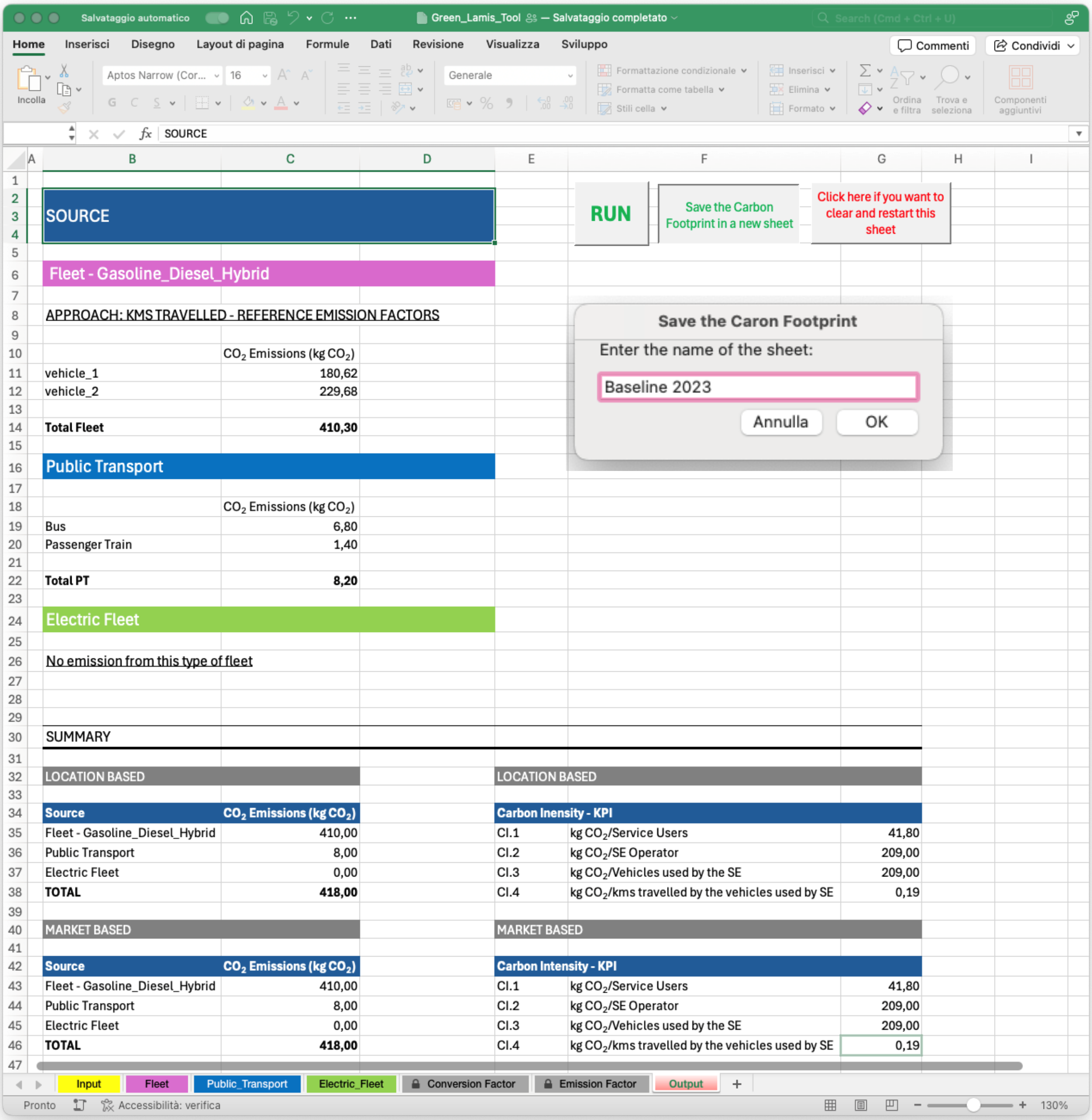


Figure 25 - Save the Carbon footprint button in the Output Sheet

The newly created sheet summarises the carbon footprint and the underlying data used for its calculation, as reported in Figure 26.

This feature serves two main purposes:

- Saving the carbon footprint of a reference year, allowing the same Excel file to be used for calculating the carbon footprint of another year (e.g., the following year) and thus consolidating multiple years of analysis in a single file.
- Saving the carbon footprint and exploring alternative scenarios, such as replacing a combustion vehicle with an electric one or assessing the impact of different percentages of renewable electricity used.

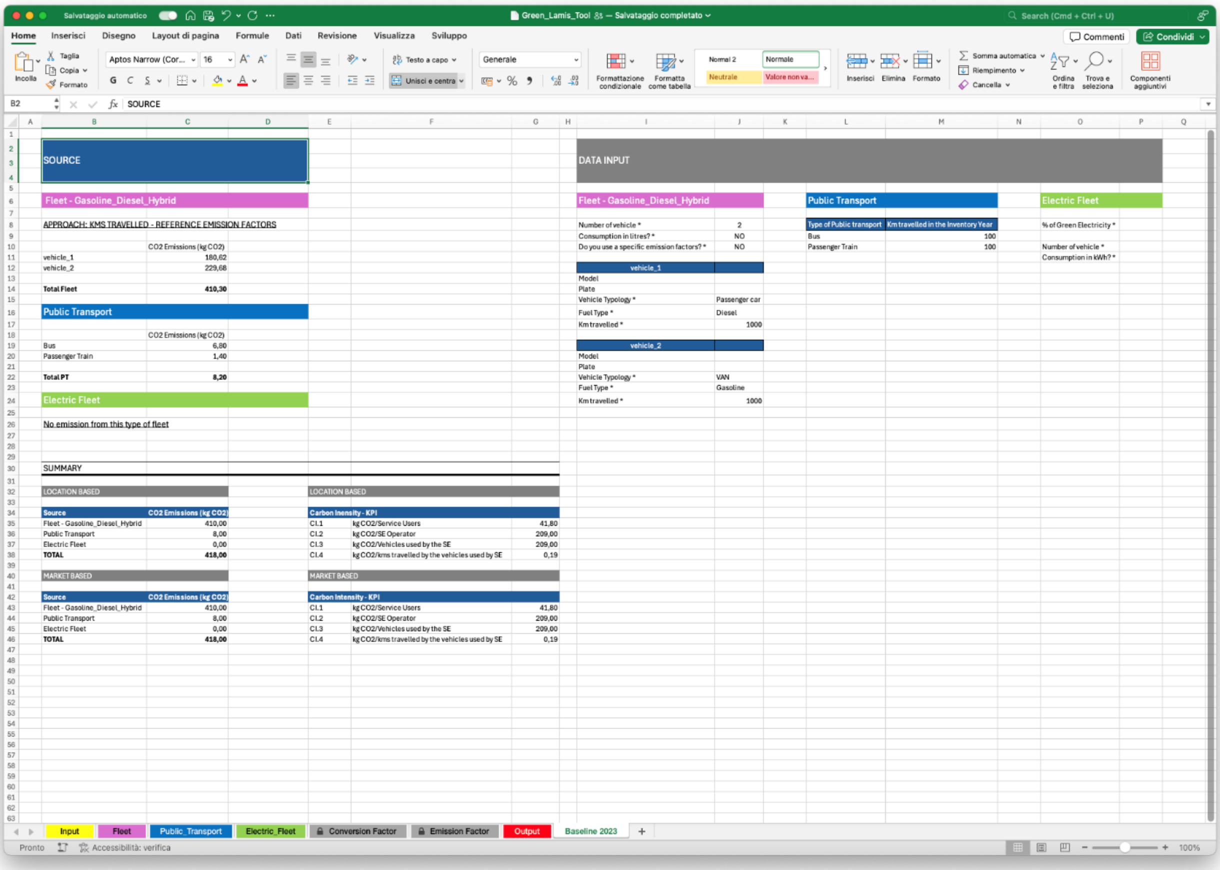


Figure 26 - Output of the saved new sheet

Once the carbon footprint has been saved in a new sheet, the user can return to the output sheet and click the *Clear and restart button* (see Figure 23) to delete the results and proceed with a new carbon footprint calculation.

This new analysis can refer to a different inventory year or include an alternative scenario related to the vehicle fleet or renewable energy contracts, considering a different percentage of renewable resources.