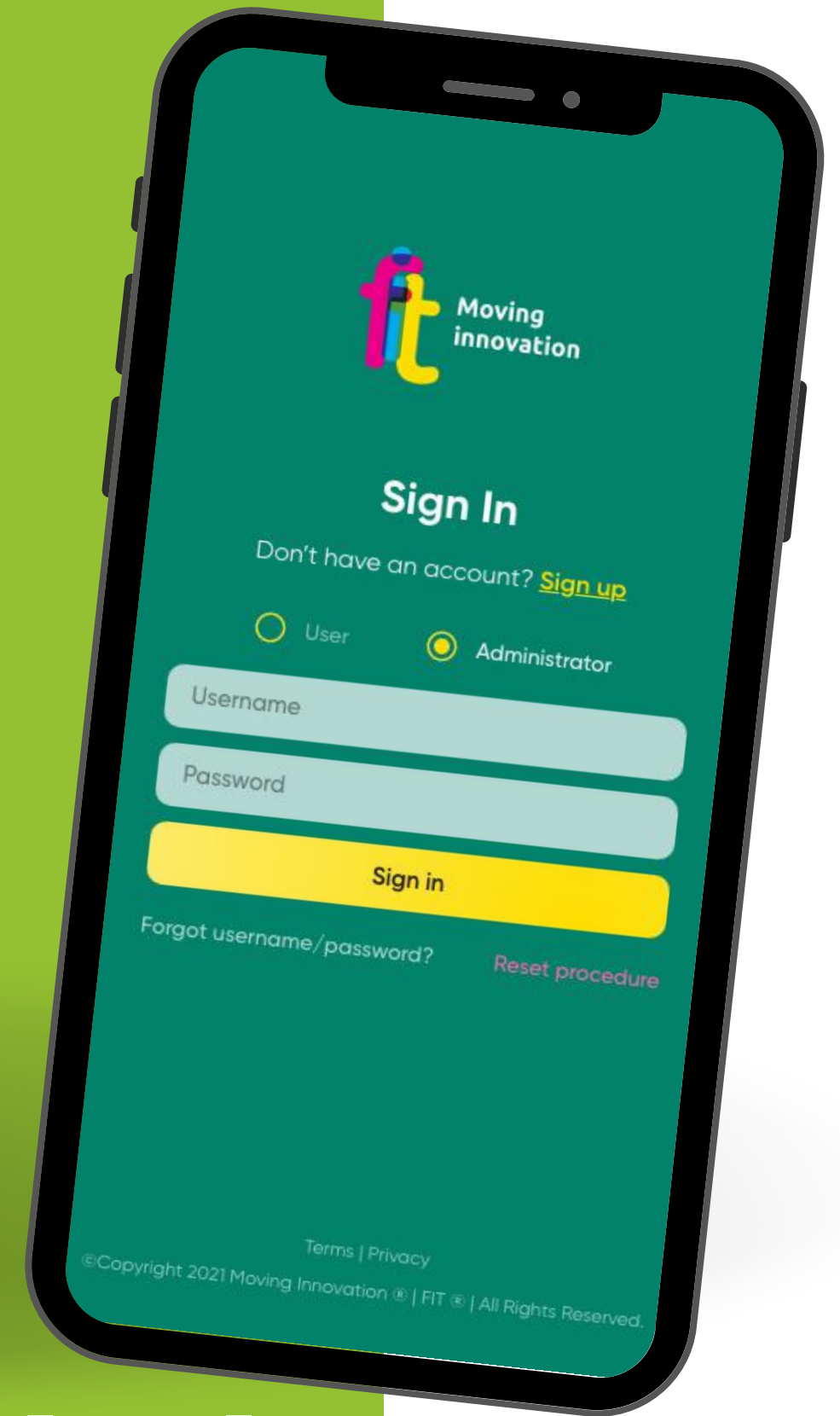


CO2 emissions label for any single package delivered



Massimo Marciani

A need for accurate and transparent emission accountability

- E-commerce is exploding with an estimated **29 million consumers online in Europe**
- Online spending on large consumption goods has nearly doubled since 2019
- Online sales represent **10% of the retail sector**
- **35 % of online consumers choose the purchasing platform based on the delivery/collection conditions**
- **Reverse logistics** costs 59% of the original price. According to Optoro (2021), the impact for returns in terms of transport is estimated in 15 million tonnes of CO₂ emissions
- 88% of shoppers believe retailers use too much **packaging** in their outbound parcels (source The Independent)
- 70% of consumers believe that addressing **climate change** is more important now than ever before. (Source ThredUp, 2020)
- Well-organized and efficient logistics generate less impact but must be able to **account for this efficiency**

For example :

“the choice of green delivery saved 30 % emissions compared to standard delivery generating 0.25kg of CO₂»

Business development: environmental credits

The **Kyoto protocol** enables the establishment CO2-equivalent markets to reward less polluting organizations.

Freight transport and logistics, driven by governments or consumers, will be able to enter into these dynamics of emissions trading between companies.

It is necessary to have **tools that transparently accounts and certifies the emissions for any single parcel transported.**

The emissions calculator is a tool for single parcel/single trip accounting that cover the entire transport cycle

Emissions accounting

As part of the research project Urbelog (URBan electronic LOGistics funded by the Italian Ministry of Research), **FIT has developed an Emissions Calculator for single parcel which has the peculiarity to:**

- **Attribute the emission of pollutants at each single parcel transported and potentially generate a *green label*.**
- Allow a **punctual accounting of the singles trips**, groups of trips over time and in space.
- Evaluate, based on the characteristics of the vehicle, route and weight transported, emissions **for each segment of the itinerary.**

Which polluting factors

It is based on the kg/km emissions.
Polluting factors are:

CH₄

NH₃

N₂O

CO

NO_x

VOC_s

pm

EC

CO₂

(in Kg/Km
or in
Kg/Lfuel)

Parameters related to pollutants come from
official sources recognized at European level
(COPERT, SINANET, EQUILIBRE, etc.)

Which vehicles

It can process polluting emissions for the following vehicle typologies:

Light Commercial Vehicle

Small trucks

Medium trucks

Heavy Trucks

under 3.5 tons

under 12 tons

under 20 tons

over 20 tons

* For the vehicles over 20 tons it is possible to indicate whether the vehicle is rigid or articulated.

The system can potentially calculate the **emissions** (CO, NOx, HC, PM, CO2) of temperature-controlled transport **refrigeration systems**.

Which fuels

Emissions can be calculated for the following fuel types:

Gas

Diesel

CNG

LNG

Hybrid

PHEV

How they are calculated

The data source from which the algorithm get the necessary information for calculations have been quality-checked by the Italian Council of Research – Institute on Air Quality.

The accounting algorithm

The algorithm considers the emissions by segment adopting a **criterion of proportionality on the distances traveled for the loading/unloading of each parcel.**

* percentage of emissions additional for weight increase compared to mass maximum vehicle load , LBEP Load-based Emission Percentage)



Breakdown by distance :

- Proportionality **by distance** is based on the principle that any **parcel** generates an impact in the overall route due to the destination and paths.
- The weight for each parcel is calculated analyzing the **pick-up/ delivery segments** and then splitting them on undertaken distances.

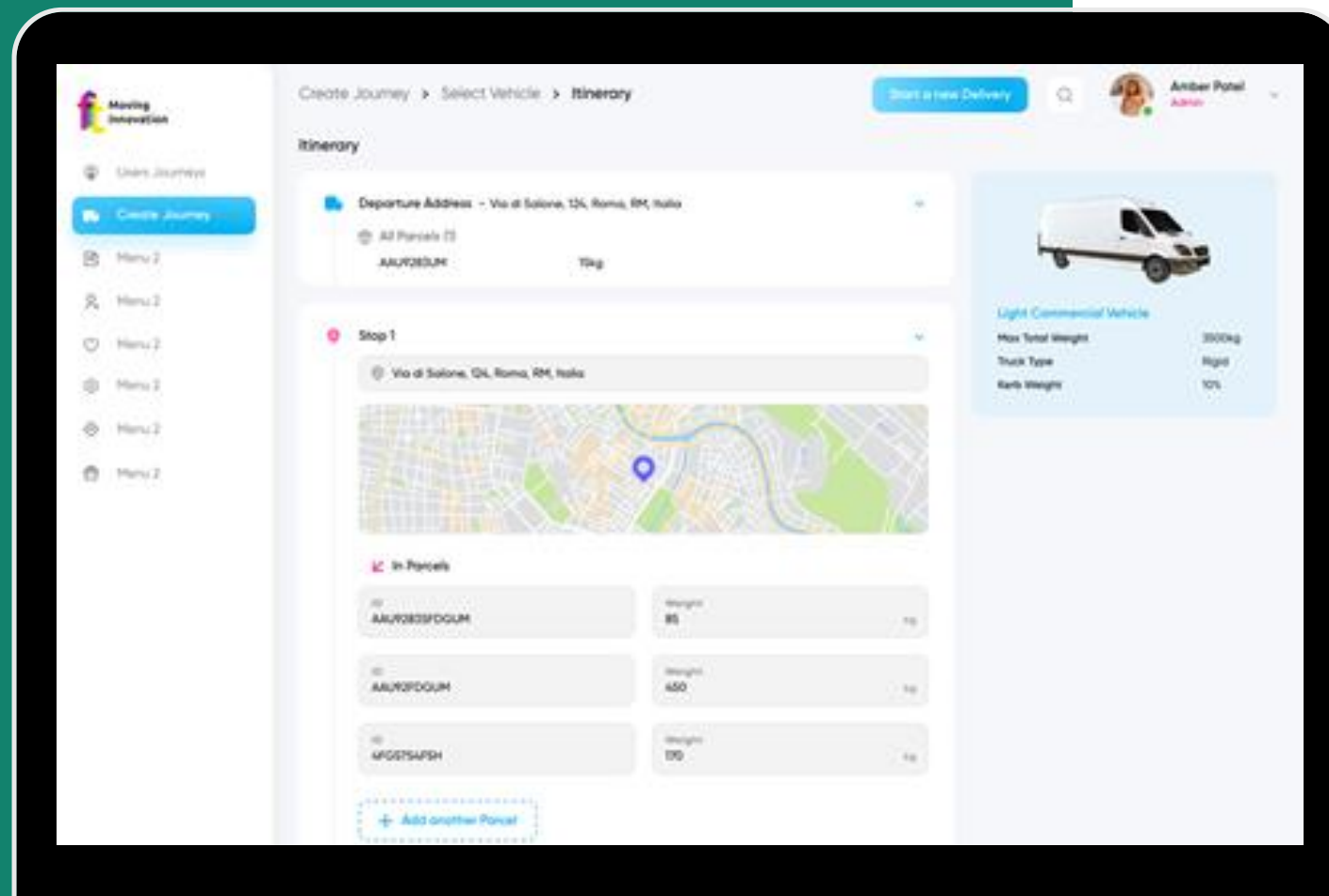
Breakdown by weight

- If for some segments there are several parcels, the emission per route is **calculated proportionally to the** total weight to each transported.
- The total weight transported in a specific segment determines corrective factors considering **the increase in emissions due to the load transported ***.

How it works delivery by delivery

By entering the information via the user interface indicating:

- **Vehicle type**
- **Rigid/articulated**
- **Fuel type**
- **Pollutant class**
- **Fuel consumption (optional)**
- **Whether the transport is refrigerated or not**
- **The itinerary traveled and the loaded/unloaded parcels including:**
 - Addresses or coordinates (lat/long) of collection and delivery
 - parcel weight



How it works: all day duties

Through the xls template below
(function which is easy-to-use when you have large lists of itineraries)

Type of Vehicle	Rigid or Articulated Vehicle	Type of fuel	EURO class	Refrigerated vehicle	Net power (cooling system) [kW]	Temperature (cooling system) [°C]	Load capacity (kg)	Maximum allowed mass (kg)	Addresses/postal codes of the origin and destination for each journey/stage of journey, of each point of delivery, including departure and ending points	Loading ID	Loading weight (kg)	Delivering ID	Delivering weight (kg)
Light Commercial Vehicle	Rigid	Diesel	2	NO	0	0	1275	3325	Via Tiburtina Antica, 14, Roma, Roma	1	100		
									Via dei Missaglia, 89a, 20142 Milano MI	2	200		
									Piazza della Libertà, 11, 34132 Trieste TS	3	40		
									Via Succi, 5, 47042 Cesenatico FC	4	400		
									LARGO DELLA FONTANELLA DI BORGHESE 186 ROMA	5	30		
												1	100
												2	200
												3	40
												4	400
									Via del Boschetto, 1, 00184 Roma RM				
									VIA DELLA FREZZA 43 186 ROMA	6	1000		
									LARGO DELLA FONTANELLA DI BORGHESE 186 ROMA			5	30
									Via Sardegna, 38, 00187 Roma RM, Italia				
									Via Tiburtina Antica, 14, Roma, Roma			6	1000
Light Commercial Vehicle	Rigid	Diesel	2	NO	0	0	1275	3325					
									38.094095, 15.635096	123	40		
									38.166853, 15.835171	456	30		
									38.151801, 16.170198	789	50	456	30
									38.148584, 16.172893				123
									38.147790, 16.174251	567	15	789	50
									38.166853, 15.835171	890	25	567	15
									38.094095, 15.635096			890	25
Light Commercial Vehicle	Rigid	Petrol	3	YES	19	-5	2375	3500					
										123456	60		
										345672	50		
										456738	40		
									50.8346, 4.3039	342567	46		
										214536	74		
										985632	32		
										234781	45		
									50.8339, 4.3032			234781	45
									50.8345, 4.3038			123456	60
									50.8344, 4.3037			345672	50
									50.8343, 4.3036	356734	24	456738	40
									50.8342, 4.3035			356734	24
												342567	46
									50.8341, 4.3034			214536	74
									50.8340, 4.3033			985632	32
Light Commercial Vehicle	Rigid	Petrol	3	NO	19	-5	1375	3500					
									Dunaharaszti;2330	123	40		
									Budafoki út;1111	456	30		
									Szeremi út;1117	789	50	456	30
									Erika út;2036				123
									Budai út;2030	567	15	789	50
									Diosdi út;2030	890	25	567	15
									Fogyó utca;2030				890
Light Commercial Vehicle	Rigid	Diesel	6 d	NO	0	0	1275	3325					

Or **via API** (automatic acquisition from information system)



Outputs of the calculator

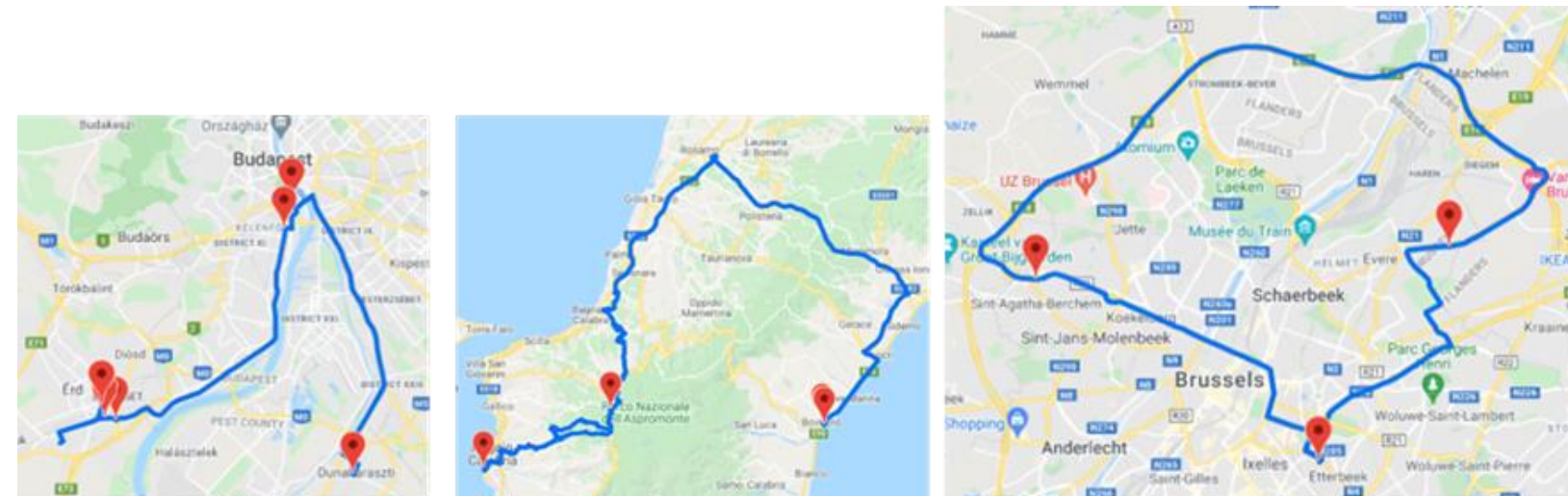
Pollutant emissions for each segment of the itinerary

Reference Journey	Route ID	Departure Address	Ending Address	Kilometers Travelled (Km)	Transport Weight (Kg)	CH4 Emission (Kg)	NH3 Emission (Kg)	N2O Emission (Kg)	CO Emission (Kg)	Nox Emission (Kg)	VOC Emission (Kg)	PM Emission (Kg)	EC Emission (Kg)	CO2 Emission (Kg)	Comment
1	1	Via Tiburtina Antica, 14, Roma	Via dei Missaglia, 89a, 20	576,639	100	0,001031	0,000177	0,000884	0,108476	0,236023	0,02616	0,019163	0,498618	151,2009	[]
1	2	Via dei Missaglia, 89a, 20142	Piazza della Libertà, 11, 3	426,139	300	0,002287	0,000392	0,00196	0,240493	0,523267	0,057998	0,042485	1,105444	118,4227	[]
1	3	Piazza della Libertà, 11, 34132	Via Succi, 5, 47042 Cesen.	390,987	340	0,002378	0,000408	0,002038	0,250076	0,544117	0,060309	0,044177	1,149491	109,8807	[]
1	4	Via Succi, 5, 47042 Cesenatico	LARGO DELLA FONTANEL	343,886	740	0,003155	0,000541	0,002704	0,331782	0,721895	0,080013	0,058611	1,52506	107,4323	[]

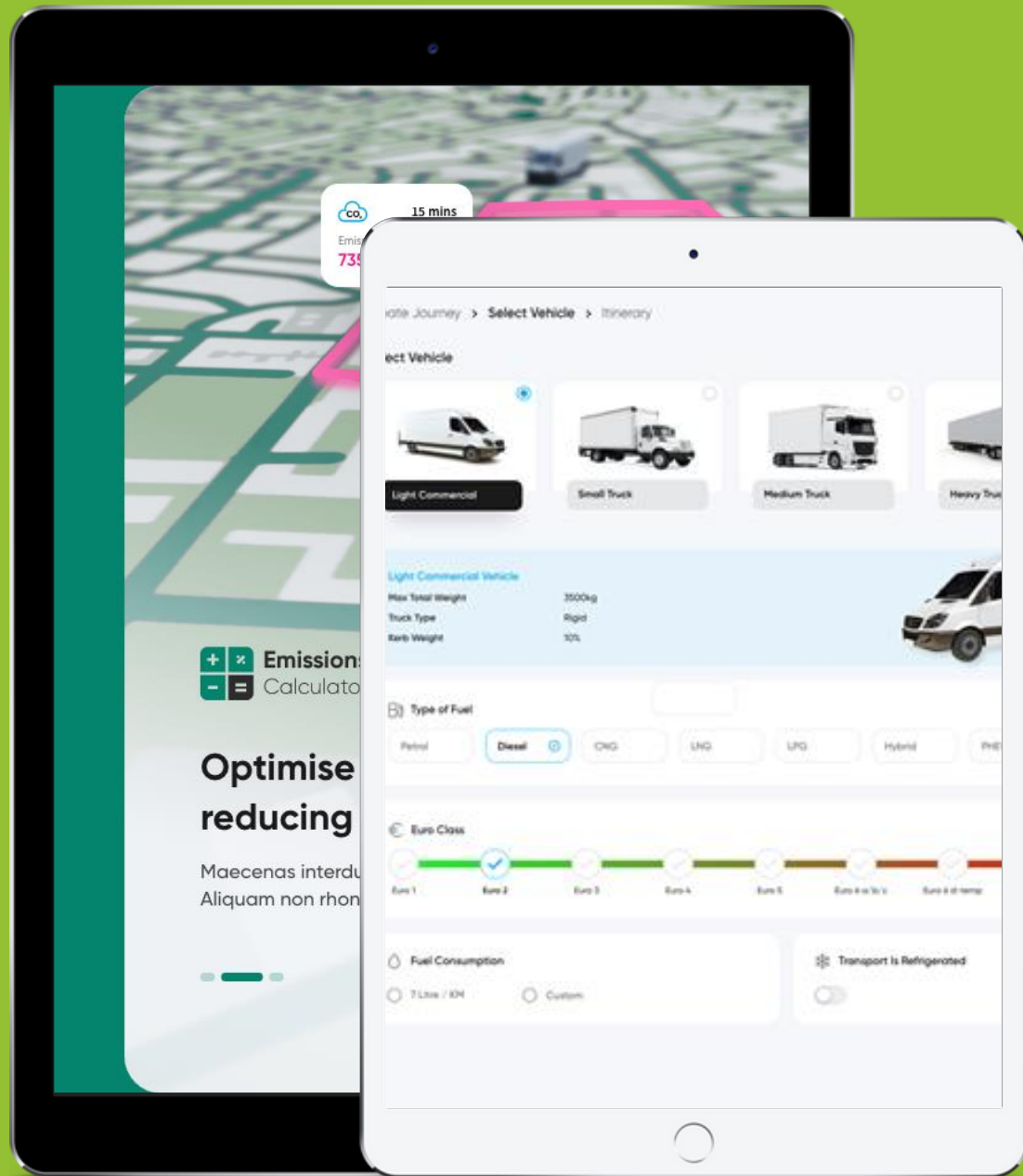
Pollutant emissions for each parcel delivered / picked up

Reference Journey	Package ID Loaded	Package Weight (Kg)	Departure Address	Ending Address	Kilometers Travelled (Km)	CH4 Emission (Kg)	NH3 Emission (Kg)	N2O Emission (Kg)	CO Emission (Kg)	Nox Emission (Kg)	VOC Emission (Kg)	PM Emission (Kg)	EC Emission (Kg)	CO2 Emission (Kg)
1	1	100	Via Tiburtina Antica, 14,	Via del Boschetto, 1,	1740,3	0,0039007	0,00066869	0,003343	0,410228	0,8925779	0,098932	0,072469	1,885642	213,0253
1	2	200	Via dei Missaglia, 89a, 20142	Via Tiburtina Antica, 14,	1175,858	0,0026356	0,00045181	0,002259	0,277177	0,6030827	0,066844	0,048965	1,274061	143,9335
1	3	40	Piazza della Libertà, 11,	Via del Boschetto, 1,	737,522	0,0016531	0,00028338	0,001417	0,173851	0,3782657	0,041926	0,030712	0,799117	90,27803
1	4	400	Via Succi, 5, 47042	Via del Boschetto, 1,	346,535	0,0007767	0,00013315	0,000666	0,081686	0,1777334	0,0197	0,01443	0,375476	42,41839

Data georeferencing



The features for an accountability tool



As described, the user of the tool can perform the following actions thanks to the output processing:

- **Analysis** - Record your emission footprint by parcel, by vehicle, by the entire fleet, by day, by area, by route, by week, by month, by year, etc.
- **Assessment** - Verify the effectiveness of your decarbonization program with a certified metric.
- **Accountability** - Report to your any business customer (the owner/consignee of the goods) and consumer (the e-purchaser/receiver of the goods) the emissions generated for each parcel.
- **Savings** – having visibility and reporting on the savings in terms of emissions compared to a standard delivery mode with traditional retail models (business as usual).

**If you are willing to start this journey with
us on the
of decarbonisation/accountability, we are
open to collaborate!**



Massimo Marciani

 +39 348 643 9486

 marciani@fitconsulting.it

