

Framework of requirements of pilots

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V0.3	Update after bilateral KPI meetings with pilot partners
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V0.9	Finalized details before review
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List of abbreviations

Abbreviation/Term	Description
API	Application programming interface
B2B	Business to business
B2C	Business to consumer
C2C	Consumer to consumer
CO₂	Carbon dioxide
CO	Carbon monoxide
NO_x	Nitrogen oxides
SO_x	Sulphur oxides
EV	Electric vehicle
ICE	Internal combustion engine
KPI	Key Performance Indicator
LEZ	Low emission zone
MVP	Minimal viable product
PUDO	Pick up and drop off
VKT	Vehicle kilometer's travelled
ZE	Zero emission



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1. Executive Summary

This deliverable explains how the GreenTurn pilots will be run and how results will be tracked in a consistent way across sites. It is meant to be used during implementation, so it brings together the operational set-up for each pilot with the monitoring approach that will be used during the pilot period.

For each pilot city, the document describes what will be tested and within which boundaries, including locations, stakeholders, delivery and return processes, timelines, and the main risks and quality measures to keep operations stable and to secure the necessary data.

The five pilots cover different logistics contexts:

- **Vienna (LogPOINT):** B2C food deliveries in Vienna using electric scooters for the last mile, combined with an on-site sustainable packaging measure (carton shredding) at the fulfilment hub.
- **Athens (ElectroSmart):** B2B deliveries and returns for business customers in Western Attica using light electric vehicles supported by routing and time-slot coordination, with a reference case using ICE vehicles for comparison.
- **Zaragoza (Green Button):** a city-oriented set-up linked to market-based flows, including nudging measures to increase uptake of more sustainable delivery choices.
- **Lyon (SustainSwap):** reusable packaging in a C2C flow at pickup points, zero-emission replenishment of pickup points by e-cargo bike, and zero-emission grocery home delivery for Intermarché by e-cargo bike, combined with consumer nudging to support uptake and reuse.
- **Poznan (Green Route):** a simulation-based pilot focusing on sustainable last-mile delivery configurations, including the use of zero-emission vehicles, microhub-based consolidation, and the role of PUDO networks, as well as the influence of behavioural interventions on the uptake of eco-delivery options.

In addition, the project includes digital pilots that complement the physical pilots by modelling and simulating selected scenarios. These digital pilots focus on (i) freight demand and consumer choices, and (ii) supply-side operations and green fleet configurations, enabling the exploration of alternative conditions such as changes in demand, operational constraints, and customer behaviour.

To support cross-pilot learning, the deliverable sets out a shared comparison approach across environmental, economic, and social dimensions. Because the pilots differ in size and set-up, the comparison is based mainly on shares within each pilot scope and against a baseline, rather than absolute totals. The detailed KPI definitions and data requirements are handled through the pilot-specific Excel tracking files, which also support ongoing monitoring through dashboards.

Finally, each site includes a digital pilot component where the planned operations are modelled and simulated to test a small number of scenarios, such as changes in volumes, geography, operational constraints, and customer uptake of sustainable options. This

supports interpretation of the physical pilot results and helps frame scalability discussions later in the project.

With this framework in place, the next step is to launch the physical and digital piloting activities. During implementation, pilot partners can use this deliverable as the reference for roles, processes, and boundaries, and use the KPI tracking files to monitor progress and performance in a consistent way throughout the pilot period.

2. Introduction

This deliverable sets out how the GreenTurn pilots will be implemented and how results will be captured in a structured and comparable way. Its main purpose is to provide a practical reference for pilot partners: what will be tested, where it will take place, who is involved, and how implementation and monitoring will be organized.

The content and structure of the deliverable were developed collaboratively to ensure alignment with both earlier project outputs and upcoming implementation needs. Together with ECON, as Work Package leader and lead for Task 4.2, an outline was established that reflects the information required for pilot implementation and monitoring. In parallel, a coordination meeting was held with UAEG, responsible for Deliverable D3.3 (Prototypes and MVPs co-created), to ensure consistency in terminology, scope, and pilot descriptions across deliverables. This approach ensured that the document builds on work already underway and is fit for purpose for the tasks that follow.

Following this initial alignment, pilot partners were invited to provide the first set of pilot-specific inputs, including descriptions of the pilot set-up, participating stakeholders, and the planning of pilot implementation. Dedicated follow-up meetings were then held with each pilot partner to address questions or challenges in supplying the requested information and to validate the operational details included in the document. These meetings were also used to jointly review the KPIs to be measured during the pilots, with the specific aim of ensuring that each pilot captures a set of comparable indicators to support cross-pilot analysis.

The document describes each pilot city and the scenarios to be carried out, including the operational scope, locations, participating stakeholders, and delivery and return processes within the pilot boundaries. It also outlines the planned timeline and key implementation risks and quality measures to support smooth execution and to ensure that relevant data are secured throughout the pilot period. In this deliverable, the term scenario is used to refer to a distinct intervention / testing stream within a pilot. These scenarios are complementary elements of the same pilot design, and where relevant they may run in parallel during the same implementation period.

In addition to the operational set-up, the deliverable explains how pilot performance will be monitored and assessed during implementation. It introduces a shared comparison approach across environmental, economic and social dimensions, following the KPI categories established in Deliverable 3.1. Since the pilots take place in different cities and operate under different conditions, the comparison is not primarily based on absolute

totals such as total deliveries or total kilometres. Instead, the metrics are defined as shares within each pilot's own scope, meaning that pilot activities are assessed relative to the wider company activity in the same area and time period, or against a suitable baseline. This makes the results more meaningful and comparable across pilots, as they are less influenced by differences in scale or operational context.

More specifically, the environmental comparison focuses on the shift towards non-fossil delivery and return operations, the economic comparison examines the efficiency of logistics operations, and the social comparison considers both the uptake of sustainable options where applicable and selected indicators related to working conditions. While the general comparison logic and monitoring approach are presented in this deliverable, the detailed KPI definitions, required data inputs, and measurement frequency are documented in the pilot-specific Excel tracking files. These files support ongoing KPI monitoring throughout the pilot period and provide the basis for consistent reporting across sites.

The structure of this deliverable is as follows. After this introduction, Chapter 3 provides an overview of the pilots and explains the overall purpose of the document, as well as the common approach used to compare pilots. Chapters 4 to 8 present the individual physical pilot cases and their scenarios, including the operational scope, participating stakeholders, implementation planning, risks, and measures for securing pilot results. Chapter 9 is dedicated to the digital pilots and describes the simulations through which selected operational configurations will be modelled and assessed. Finally, Chapter 9 summarises the main conclusions of the deliverable.

Overall, the deliverable is designed to be used during implementation. It combines the pilot descriptions with the monitoring and assessment set-up so that pilot activities and evaluation requirements are aligned from the start, and results can be documented consistently and compared meaningfully across sites.

3. Pilot assessment

This chapter explains how the five pilots will be assessed within the GreenTurn project. It defines the evaluation approach, the dimensions of impact that will be considered, and the indicators that will be used to capture pilot performance in a structured and consistent way.

The assessment framework is based on the KPI categories developed in Deliverable 3.1 and covers three main dimensions: environmental, economic, and social. These dimensions reflect the key areas in which the pilots are expected to generate insights, and together they provide a comprehensive basis for evaluating both operational performance and broader impacts.

Given that the pilots differ in context, scale, and operational design, the assessment is primarily focused on understanding performance within each individual pilot. To support this, the indicators are defined in a way that relates pilot activities to their specific operational context. In most cases, this means expressing results as shares within the

pilot scope or relative to a baseline, rather than as absolute totals. This allows each pilot to be assessed on its own terms, while still applying a common evaluation logic across all sites.

At the same time, the use of a shared set of KPIs and a consistent measurement approach ensures that results can be interpreted across pilots where relevant. This enables cross-pilot learning, without implying direct comparison between pilots that operate under different conditions or pursue different objectives.

The environmental dimension focuses on the transition towards non-fossil delivery and return operations. It considers both the share of activity taking place within the pilot scope and the extent to which zero-emission vehicles are used. These indicators are defined relative to the company's total activity in the same pilot area and period, or to a baseline measure. The environmental assessment is based on a set of KPIs that are measured across all pilot sites:

1. Emissions (CO₂, CO, NO_x, SO_x, PM₁₀, PM_{2.5}) per km per vehicle type
2. Share of non-fossil fuel vehicles in the fleet
3. Share of deliveries and returns made by non-fossil fuel vehicles
4. Emissions (CO₂, CO, NO_x, SO_x, PM₁₀, PM_{2.5}) per delivery/return

The economic dimension focuses on the efficiency of logistics operations. It assesses how effectively vehicles and routes are utilised during delivery and return activities, with particular attention to vehicle capacity use and kilometres travelled in relation to the number of deliveries and returns performed. All pilot sites are able to measure the following KPIs, enabling a consistent assessment approach:

1. Average load factor at the start of the tour by vehicle type
2. Total VKT and VKT per delivery/return
3. Average stops per tour

The social dimension addresses both the adoption of sustainable options and selected aspects of working conditions. Where relevant, the assessment considers the uptake of more sustainable delivery or return options, particularly in pilots where nudging mechanisms are implemented. This is feasible for Zaragoza and Lyon, but not for Athens and Vienna given their pilot designs. The relevant KPIs are:

1. Potential accessibility to logistics services
2. Share of costumers ready to adopt sustainable behaviors
3. Costumers' expenditure with shipping and returns

In addition, working conditions are considered through indicators related to workload and job quality. These are measured across two pilots, with the exception of Vienna and Athens where data availability is limited. The relevant KPIs are:

1. Ratio between average wage of logistics workers and minimum income
2. Coefficient of variation in route duration (std/mean of the route duration)

To provide an overview of the different pilot configurations and their respective scenarios, Table 1 summarises the main characteristics of each pilot. Table 2 provides an overview of all KPIs from Deliverable 3.1 (KPIs and metrics framework for co-creation and

impact assessment) and indicates, for each pilot site, whether the KPI will be measured (yes/no).

Table 1. Summary overview of all pilots

Pilot	Location	Pilot focus	Scenario	Short description
LogPOINT	Vienna	B2C food logistics and circular packaging	ZE deliveries of biologically produced food	Zero-emission last-mile delivery using electric scooters from a city logistics hub
			On-site carton shredding	Recycling of used cartons into filler material within the fulfilment hub
ElectroSmart	Athens	B2B deliveries with electric vehicles and orchestration	Environmental efficiency	Use of electric light vehicles with routing platform, compared to ICE baseline
			Productivity and cost efficiency	Assessment of operational efficiency and cost performance of electric vs conventional operations
Green Button	Zaragoza	Urban consolidated deliveries and nudging	Environmental efficiency	Shared low-emission delivery model with consolidation, routing, and incentives
SustainSwap	Lyon	C2C logistics and zero-emission delivery	Reusable packaging (Vinted Go)	Testing reusable packaging in parcel flows via pickup points
			ZE delivery to PUDO network	Zero-emission replenishment of pickup/drop-off points
			ZE home delivery (Intermarché)	Zero-emission grocery delivery combined with behavioural nudging
GreenRoute	Poznań	Simulation-based urban logistics pilot for sustainable last-mile delivery	Sustainable last-mile delivery system (ZE + microhub + PUDO)	Simulation of an integrated delivery system combining zero-emission vehicles, microhub-based consolidation, and partial replacement of home delivery by PUDO collection
			Behavioural adoption of eco-delivery options	Simulation of customer responses to eco-delivery options under different interface, pricing, and incentive conditions, and assessment of system-level impacts
Digital pilots	Cross-pilot	Modelling and simulation	Freight demand and consumer choices	Simulation of demand-side changes and behavioural responses
			Supply-side operations and fleet configurations	Simulation of operational and fleet configurations under different conditions

Table 2. KPI overview from D3.1

		Key Performance Indicator	Zaragoza	Athens	Lyon	Vienna
Environment	Increase the number of non-fossil fuel deliveries and returns	Emissions (CO ₂ , CO, NO _x , SO _x , PM ₁₀ , PM _{2.5}) per km per vehicle type	YES	YES	YES	YES
		Share of non-fossil fuel vehicles in the fleet	YES	YES	YES	YES
		Share of deliveries and returns made by non-fossil fuel vehicles	YES	YES	YES	YES
		Emissions (CO ₂ , CO, NO _x , SO _x , PM ₁₀ , PM _{2.5}) per delivery/return	YES	YES	YES	YES
	Increase use of sustainable packaging	Share of returnable and reusable packaging	NO	NO	NO	NO
		Share of reusable packaging returned	NO	NO	NO	NO
Economic	Increase the efficiency of logistics operations	Average load factor at the start of the tour by vehicle type	YES	YES	YES	YES
		Total VKT and VKT per delivery/return	YES	YES	YES	YES
		Avg. stops per tour	YES	YES	YES	YES
		Cost per delivery/return	NO	YES	YES	YES
Social	Increase the choices and adoption of sustainable options	Number of parcel pick-up/drop-off points per inhabitant	YES	NO	YES	YES
		Potential accessibility to logistics services	YES	NO	YES	NO
		Share of costumers ready to adopt sustainable behaviors	YES	NO	YES	NO
		Costumers' expenditure with shipping and returns	YES	NO	YES	NO
	Improve conditions for logistic workers	Ratio between average wage of logistics workers and minimum income	YES	NO	YES	NO
		Share of delivery/pickup tours longer than work journey	YES	NO	YES	NO
		Coefficient of variation in route duration (std/mean of the route duration)	YES	NO	YES	NO

4. LogPOINT – Vienna

4.1. General information

4.1.1. General description of the pilot

LogPOINT is a fulfilment and intralogistics provider running a City Logistics Hub in Vienna. The pilot tests a carbon-free food logistics model that combines zero-emission distribution with circular packaging practices, including improved returns management and on-site recycling of cartons into filler material for outbound shipments. Deliveries are consolidated locally and distributed using zero-emission micro-mobility solutions with a transport partner. The pilot comprises two scenarios that will run simultaneously: the first focuses on zero-emission deliveries, and the second on recycling packaging materials.

4.1.2. Location / Pilot Site

The pilot will take place at LogPOINT's City Logistics Hub in Vienna, Austria. Vienna has approximately 2.03 million residents. The fulfilment center is located in an industrial area in the north of the city, with direct access to major arterial roads, while the city hub is located closer to the inner city, enabling short transfer distances to the target delivery zones.

Within the pilot scope, LogPOINT together with the participating retailers La Vialla and Bio Balkan handles approximately 55,000 parcels per year, with around 65 to 70% of LogPOINT's total parcel volume delivered in Vienna. Returns are below 0.2%, largely because food logistics typically involves very few returns.

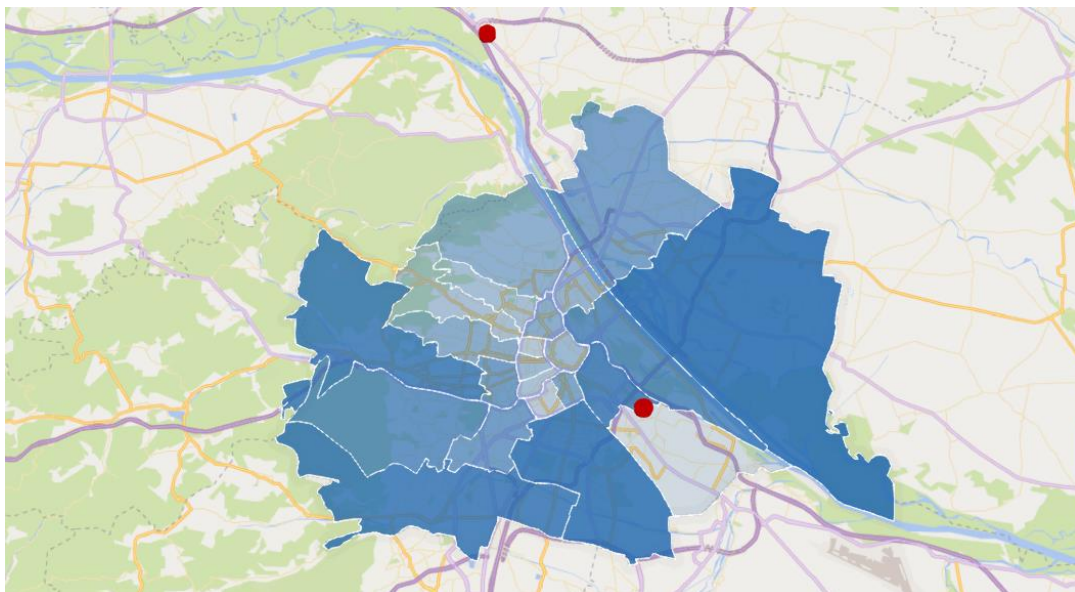


Figure 1. Pilot area of LogPOINT - Vienna

4.2. Scenario 1: ZE deliveries of biologically produced food

4.2.1. Description and objectives

Description

The pilot introduces a zero-emission delivery model for biologically produced food within Vienna. Instead of handing over parcels to the Austrian Post, shipments prepared in the LogPOINT fulfilment hub are consolidated and distributed directly by the local logistics partner Veloce using electric scooters. The concept establishes a short-range, fully electric last-mile system that operates within predefined delivery zones and time windows. It connects regional food producers and customers through a local zero-emission distribution network, reducing transport distances and eliminating direct CO₂ emissions from the final delivery stage.

Objectives

- 1) CO₂ emission reduction: Replacement of conventional parcel deliveries by delivery vans with fully electric scooters, thereby reducing direct exhaust emissions and total greenhouse gas emissions per shipment.
- 2) Operational efficiency: Testing whether direct handover to a local zero-emission carrier can lead to streamlined processes, shorter delivery times and better route utilization compared to conventional parcel transfer.
- 3) Digital integration: A more automated data exchange between the fulfilment hub and the zero-emission carrier will be established, improving transparency in tracking and enabling efficient coordination of deliveries within a time window.
- 4) Economic feasibility: Assessment of the cost implications of using e-scooters as a means of transport.
- 5) Scalability and Replicability: To analyze operational limits and develop guidelines for transferring the zero-emission delivery model to other urban areas or product categories.

Alignment with project objectives

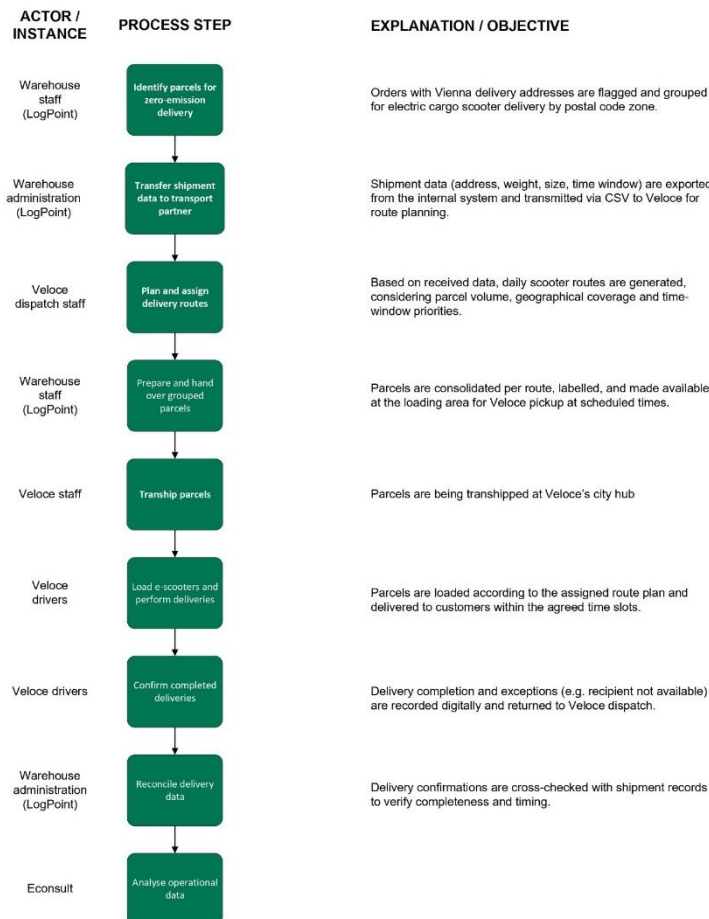
Project objective	Alignment
S01 Consolidate knowledge on attractive zero-emission delivery and return options, and successful behavioral interventions leading to greener choices	The pilot directly tests a zero-emission delivery configuration using electric scooters for food logistics in Vienna. It contributes concrete evidence on operational feasibility, user acceptance and emission performance, expanding the project's knowledge base on sustainable, low-impact delivery models.
S02 Co-develop solutions with diverse stakeholders, combining behavioral interventions and delivery and return options, testing them through pilots	The pilot is the result of cooperation between LogPOINT, Veloce, and local bio-food suppliers. It demonstrates co-creation between logistics providers and regional producers, testing an

that cover relevant e-commerce markets and cultures.	adaptable zero-emission delivery model that reflects real-world e-commerce conditions in Vienna.
S04 Develop replicable and scalable processes for retailers and LSPs, supporting them to provide consumers with accurate information regarding environmental footprints.	The pilot establishes a replicable micro-distribution process that can be scaled to other urban areas or product categories. The results provide process parameters that logistics partners and retailers can integrate into environmental communication and reporting.

Expected results

- 1) Environmental: ≥ 100 % reduction of direct CO₂ emissions compared to conventional van deliveries within the same urban area; zero tailpipe emissions
- 2) Economic: Comparable or slightly lower delivery cost per parcel through shorter distances and reduced handling steps; no increase in total logistics cost despite smaller vehicle capacity.
- 3) Operational: Reliable daily operation of e-scooter deliveries within defined Vienna zones; > 95 % on-time delivery rate after ≤ 2 weeks adaptation further automatized digital data exchange between LogPOINT and Veloce with less manual correction needs.

Process Description



Involved Technologies/Tools

Software with API connection LaViolla/Veloce/LogPOINT and the transport vehicle Cargo Scooter.

Innovative Elements

This approach enables the efficient use of electric scooters for multiple customers within one delivery area. The integration of micro-distribution logistics into a regional fulfilment hub represents an innovative and scalable model for sustainable e-commerce operations.

4.2.2. Organization

Timeline

November 2025 (M16) – January 2026 (M18)

- a. Preparation of pilot

February 2026 (M19) – June 2026 (M23)

- a. Start piloting
- b. Evaluation of pilot in Jun 2026

July 2026 (M23) – January 2027 (M30)

- a. Adjust pilot where necessary and continuation of piloting

Stakeholder Involvement

Name and Function	Task/Role
LogPOINT	Fulfilment hub operator coordinating parcel preparation, data exchange and pilot monitoring.
Veloce	Zero-emission transport partner responsible for e-scooter delivery operations and daily reporting.
La Violla and other bio-food suppliers	Producers and senders of organic food products distributed within the Vienna delivery area.
Econsult	Technical and evaluation partner supporting data collection, KPI analysis and reporting.

Risk and quality management (for pilot operations)

Risk	Description of the risk	Quality assurance mechanism
Geographical and infrastructural constraints	Certain delivery zones may be difficult to reach with scooters due to gradients or other restrictions	Continuous assessment of route feasibility and routing algorithms together with the LSP.
Volumetric weight limitations	Scooter loading capacity restricts the maximum parcel size and weight, which may limit service coverage or require additional trips.	Regular monitoring of parcel dimensions and weights; adaptation of packaging routines and vehicle allocation in coordination with the LSP.
Battery range and charging logistics	Actual range of e-scooters can vary depending on temperature,	Scheduling of intermediate charging breaks; documentation of

	payload and driving profile, potentially causing interruptions in operation.	range data to inform future vehicle selection and operational planning.
Data and reporting accuracy	Manual or semi-automated CSV data transfer between LogPOINT and Veloce may cause deviations in shipment tracking or performance reporting.	Periodic validation of transmitted data; cross-checking of delivery confirmations with actual route logs; ongoing joint monitoring with the transport partner.

4.3. Scenario 2: On-site Carton Shredding

4.3.1. Description and objectives

Description

At the LogPOINT fulfilment hub, several cubic meters of carton boxes from inbound deliveries and customer returns accumulate every day. Instead of discarding these materials and purchasing new filler paper, the pilot introduces an on-site carton shredder that transforms used boxes into recycled filling material for outbound shipments. The measure aims to demonstrate substantial cost and CO₂ savings through waste prevention and material circularity.

Objectives

- 1) Waste Reduction: To decrease the amount of cardboard waste generated at the fulfilment hub by recycling used boxes from inbound deliveries and customer returns into filler material.
- 2) CO₂ Emission Reduction: To quantify avoided emissions through the substitution of virgin packaging material (approx. 249 kg CO₂ cardboard) with recycled material, and to verify that the additional energy use of shredding does not offset the environmental benefits.
- 3) Material Cost Saving: To reduce the purchase of virgin paper fillers by producing recycled filler material on-site, thereby lowering monthly packaging expenditure.
- 4) Avoided Disposal Fees: To minimize waste-management costs by decreasing the volume of material sent to external disposal or recycling contractors.
- 5) Process Feasibility and Scalability: To assess how easily the shredding process can be integrated into daily warehouse routines, including sorting, space management and staff workload, and whether one or two machines are required for full-scale implementation.
- 6) Knowledge Transfer: To provide quantified evidence and practical guidance for replication of similar waste-reduction measures in other fulfilment hubs or logistics centers.

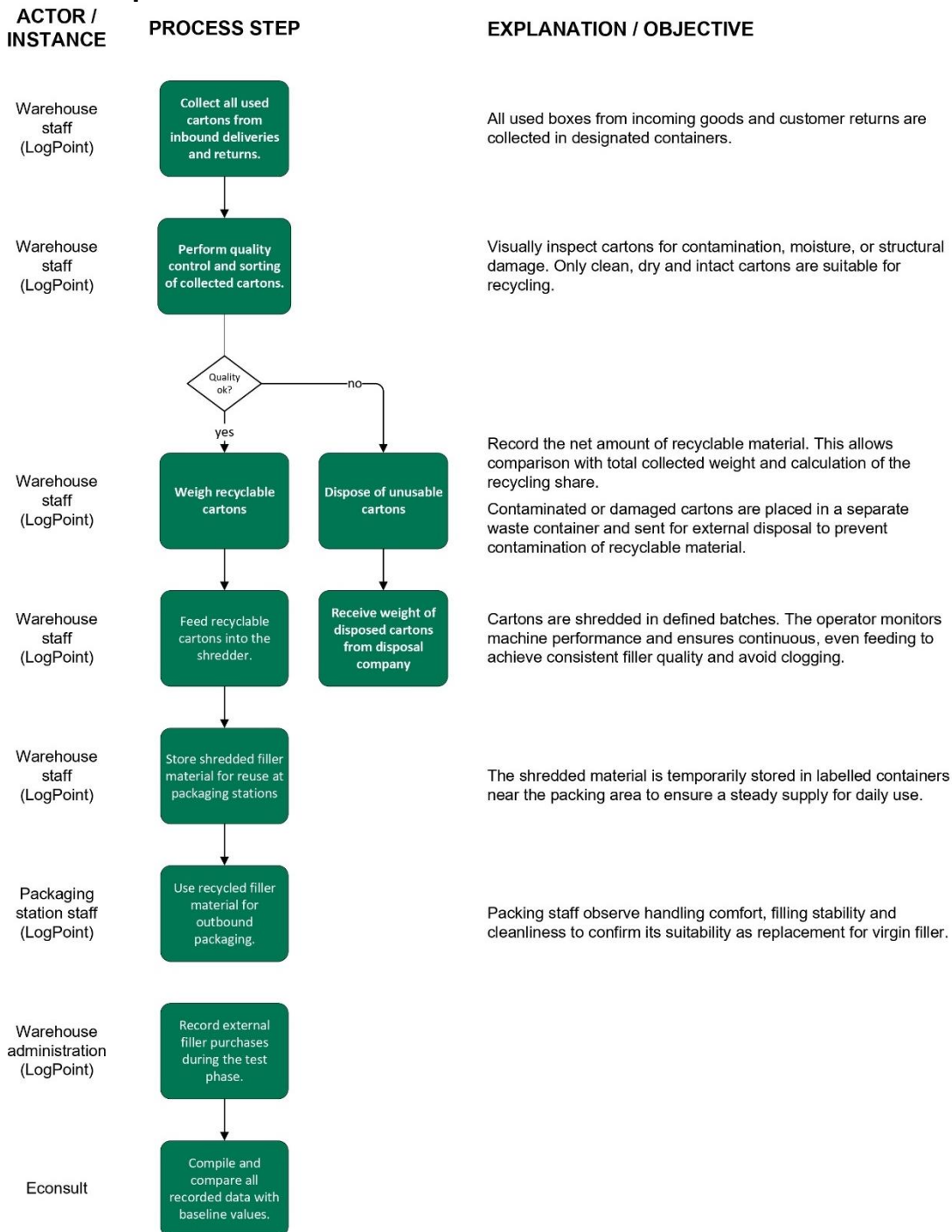
Alignment with project objectives

Project objective	Alignment
S01 Consolidate knowledge on attractive zero-emission delivery and return options, and successful behavioral interventions leading to greener choices	The pilot directly tests a zero-emission delivery configuration using electric scooters for food logistics in Vienna. It contributes concrete evidence on operational feasibility, user acceptance and emission performance, expanding the project’s knowledge base on sustainable, low-impact delivery models.
S02 Co-develop solutions with diverse stakeholders, combining behavioral interventions and delivery and return options, testing them through pilots that cover relevant e-commerce markets and cultures.	The shredder initiative was co-developed between LogPOINT and Econsult, involving fulfilment staff, clients, and packaging suppliers. It is tested as part of the Vienna pilot, representing a concrete operational solution under real market conditions.
S03 Develop a concrete, step-by-step way to account for the footprint of e-commerce deliveries and returns, in line with CountEmissions EU.	The test produces measurable CO ₂ avoidance data (avoided virgin material, reduced disposal) that can feed into the GreenTurn emission accounting framework, thereby extending it to packaging-related emissions—a key but often unrecorded component of e-commerce logistics.
S04 Develop replicable and scalable processes for retailers and LSPs, supporting them to provide consumers with accurate information regarding environmental footprints.	The LogPOINT pilot demonstrates a replicable, low-threshold process for circular packaging management within e-commerce fulfilment. By transforming used shipping boxes into recycled filler, it establishes a scalable operational model that reduces waste and material emissions. The resulting data enhance transparency and comparability of environmental footprints, enabling retailers and LSPs to communicate accurate and verifiable sustainability information to customers.
S05 Develop guidelines for data visualization which can incentivize smaller e-commerce footprints for deliveries and returns.	The outcome of the pilot will form part of GreenTurn best-practice guidelines on internal waste management and sustainable packaging. It demonstrates how logistics providers can integrate waste reduction into their sustainability strategies.

Expected results

- 1) Environmental: reduction of carton waste volume / weight,
- 2) Economic: saving in filler purchase cost
- 3) Operational: Workflow stable after ≤ 1 week adaptation; no production delays.

Process Description



Involved Technologies/Tools

Carton shredder machine operated by one employee

Innovative Elements

The scenario introduces a closed-loop approach to packaging within the fulfilment process by recycling used shipping boxes on-site into filler material for outbound shipments. The experimental aspect lies in testing how such internal recycling can be

operationally integrated into daily logistics routines, quantified in terms of cost, waste and CO₂ reduction, and scaled to other fulfilment centers.

4.3.2. Organization

Timeline

November 2025 (M16) – January 2026 (M18)

- a. Preparation of pilot

February 2026 (M19) – June 2026 (M23)

- a. Pilot phase 1
- b. Evaluation of pilot in Jun 2026

July 2026 (M23) – January 2027 (M30)

- a. Pilot phase 2
- b. Adjust pilot where necessary and continuation of piloting

Stakeholder Involvement

Name and Function	Task/Role
LogPOINT (Fulfilment Hub Operator).	Responsible for implementation of the recycling workflow, staff coordination, and on-site machine operation.
LogPOINT clients and vendors (mainly Thalia, Fattoria La Vialla, and Biobalkan).	Provide inbound and return carton flows used as input material for shredding, and their outbound shipments are packed using the recycled filler material, benefiting from lower packaging and disposal costs.
Econsult (Research and Evaluation Partner).	Supports analysis, monitoring, and evaluation of performance and environmental impact.

Risk and quality management (for pilot operations)

Risk	Description of the risk	Quality assurance mechanism
Insufficient recyclable material volume	The share of reusable cartons from inbound deliveries and returns may be lower than expected, reducing the achievable waste reduction and cost savings.	Continuous monitoring of input quantities; adjustment of collection frequency; coordination with vendors to ensure proper separation and collection.
Bad quality or contamination of returns and shipping boxes	Soiled, wet, or damaged cartons cannot be reused and may clog the shredder or reduce filler quality.	Visual inspection before shredding; exclusion of unsuitable materials; regular cleaning of input area and machine.
Inconsistent sorting quality	Incorrect separation of recyclable and non-recyclable cartons can lower filler quality and increase manual handling effort.	Operator training, illustrated sorting guidelines, and periodic spot checks by supervisors.
Operational downtime or machine malfunction	Technical failure or overload may interrupt warehouse processes and reduce shredding performance.	Regular maintenance schedule; supplier support hotline; backup handling procedures in case of breakdown.

Space limitations for shredded material	Lack of suitable storage space may hinder workflow efficiency and material flow.	Planning of dedicated storage zones; use of labelled containers; continuous review of layout by warehouse management.
Data gaps and inaccuracies	Missing or inconsistent measurement data may compromise evaluation of environmental and financial results.	Weekly data validation by Econsult; use of standardized log sheets and double-entry control.
Low staff acceptance	Employees may resist new sorting and shredding tasks, affecting consistency and data quality.	Clear communication of goals and benefits; practical training sessions; regular feedback and adjustments based on operator input.

4.4. KPI Securing the pilot results

Nudging and behavioral design

This scenario does not include any nudging measures.

Baseline measurement

The baseline measurement will be conducted using actual operational figures from the past year, focusing on the same months covered by the pilot period to ensure seasonal effects are properly reflected.

KPI tracking tool and measurement approach

The KPI framework, including monitoring and pilot measurement, is documented in the LogPOINT pilot Excel file. The file defines the KPI set, specifies the required data inputs for each KPI, and indicates the measurement frequency (which is also shown in Table 2). A dedicated input sheet is provided for entering new measurement values as they become available. The dashboard visualizes KPI performance over time, enabling continuous monitoring throughout the pilot.

Table 3 KPI overview LogPOINT pilot

Scenario	Category	KPI	Description	Input data	Formula	Unit	Frequency	Measurement
2	Environment	Share of recycled material	Share of recycled packaging material in total packaging material	- kg of new packaging material used - kg of shredded packaging material used per period	$(\text{kg recycled material} / \text{kg total material used}) * 100$	%	Monthly	Manual + Calculated
2	Environment	CO2 avoidance - packaging	CO2 saved by using recycled filling material	- kg of shredded packaging material used per period - Emission factor for carton	$\text{Weight} * \text{EF}$	kg CO2	Monthly	Calculated (with reference data)
1	Environment	Emissions (CO2, CO, NOx, SOx, PM10, PM2.5) per km per vehicle type	Emissions (CO2) per km per vehicle type caused	- Fuel consumption per vehicle type - Emission (CO2) per l of fuel - VKT per vehicle type	Total grams of type of pollutant per vehicle type / total number of kilometers driven per vehicle type	gram	Once	Information by LSP, calculated (with reference data)
1	Environment	Share of non-fossil fuel vehicles in the fleet	Share of operational vehicles powered entirely by non-fossil energy sources	- Number of vehicles in the fleet by type	$\text{Number of non-fossil fuel vehicles} / \text{total number of vehicles} * 100$	%	Once	Information by LSP
1	Environment	Share of deliveries made by non-fossil fuel vehicles	Share of stops made by non-fossil fuel vehicles	- Number of deliveries (=stops) executed by vehicle type	$\text{Number of stops by non-fossil fuel vehicles} / \text{total number of stops} * 100$	%	Once	Information by LSP/Calculated
1	Environment	Emissions (CO2, CO, NOx, SOx, PM10, PM2.5) per delivery	Emissions (CO2) per stop	- Number of stops, VKT per vehicle type - Total fuel consumption per vehicle type and period	Total grams of type of pollutant / total number of deliveries (or returns)	gram	Once	Information by LSP/ Calculated with reference data
2	Economic	Packaging cost per delivery	Cost for packaging material per parcel	- Monthly expenses for packaging material USED - Number of parcels/deliveries	$\text{€} / \text{Deliveries}$	EUR	Once	Accounting
2	Economic	Financial share of new packaging material	Share of cost of new packaging material in total quantity	- Monthly expenses for packaging material used - Monthly expensed for recycled filling material	$\text{Cost new packaging material} / \text{Total Cost packaging material}$	%	Monthly	Accounting
2	Economic	Shredder output	kg filler produced per period	- kg of shredded packaging material produced per period	kg_out	kg	Monthly	Manual
1	Economic	Average load factor at the start of the tour by vehicle type	Average load factor at the start of the tour by vehicle type	- Weight (or volume?) of packages loaded - Permitted weight (available volume?)	$\text{Used capacity in volume or weight in tour} / \text{total available capacity in volume or weight in tour}$	No.	once	Information by LSP

1	Economic	VKT per delivery/return	Avg. delivery distance	- Total VKT travelled - Total number of deliveries	Total km traveled / total number of deliveries (or returns)	No.	Monthly	Information by LSP
1	Economic	Avg. stops per tour	Avg. stops per tour	- Number of stops (per period) - Number of tours (per period)	Total number of stops / total number of tours	No.	Monthly	Information by LSP
1	Economic	Cost per delivery/return	Cost per delivery	- Operational costs per vehicle type - Number of deliveries	Total operational costs / total number of deliveries	EUR	once	Accounting
1&2	Social	Customer satisfaction (%)	Measuring customer interest by analyzing survey participation and result	- Number of returned questionnaires - Total number of questionnaires - 1-5 score (average)	(Number of returned questionnaires/ total number of questionnaires) *100 1-5 score (average)	%	once or twice	Survey
1&2	Social	Customer satisfaction (Score)	Measuring customer interest by analyzing survey participation and result	- Number of returned questionnaires - Total number of questionnaires - 1-5 score (average)	(Number of returned questionnaires/ total number of questionnaires) *100 1-5 score (average)	Score	once or twice	Survey
-	Social	Number of parcel pick-up/drop-off points per inhabitant (Vienna)	Own pick-up points only (Tambouri)	- Number of pick-up/drop-off points in the study area	Number of Tambouri points / inhabitant	No.	Once	Information by LSP/ Calculated

5. ElectroSmart – Athens

5.1. General information

5.1.1. General description of the pilot

ElectroSmart is a B2B pilot in the Athens metropolitan area, developed through a partnership between Logika, a fourth-party logistics provider, and KYOCERA, the business client. Within the Athens metropolitan region, Logika manages deliveries to corporate customers using a fleet of approximately 10 to 22 trucks, coordinating with third-party carriers while routing all shipments through its internal planning systems.

The pilot will assess how light electric vehicles can support business deliveries and returns when integrated with a last-mile orchestration platform for route planning, scheduling, and real-time monitoring, while aiming to preserve operational efficiency under real-world conditions. The evaluation will be conducted through two scenarios: one focused on environmental performance, and the other on productivity and cost efficiency.

5.1.2. Location / Pilot Site

The pilot will take place in Elefsina, a western suburb within the Athens metropolitan area and one of the region’s main logistics and industrial zones, located approximately 21 km northwest of central Athens. As of 2025, Elefsina had a population of about 23,546 residents. In addition, air-quality rankings indicate that Elefsina is a pollution hotspot, reported as the most polluted city in Attica and among the most polluted cities in Greece (5th nationally in one 2024 PM2.5 ranking), which further reinforces the relevance of testing lower-emission logistics solutions in this area. The pilot operations cover LOGIKA’s B2B delivery area Elefsina (Western Attica). Within this pilot area, LOGIKA performs approximately (2,745) deliveries per [week: 53/month: 229/year: 2,745] and (138) return pickups per [week: 5/month: 60/year: 138] for the participating client network.

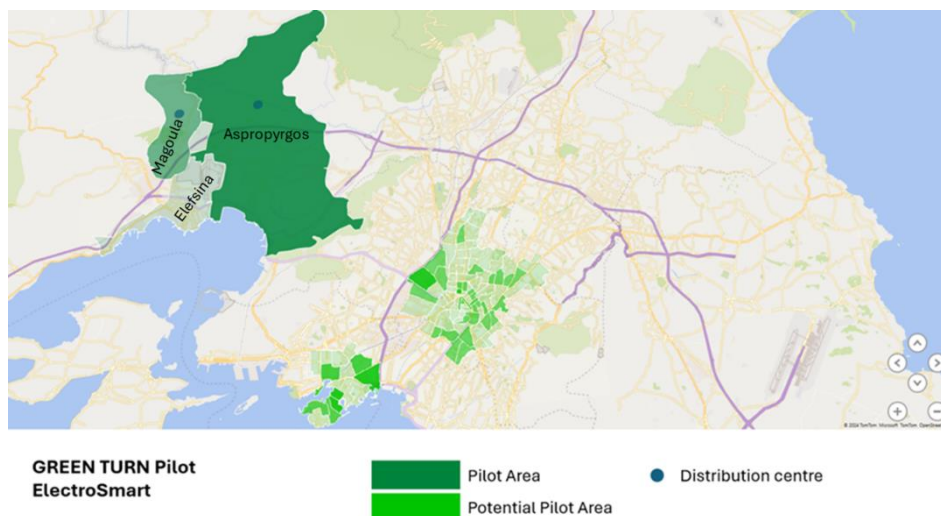


Figure 2. Pilot area of ElectroSmart - Athens

5.2. Scenario 1: Environmental efficiency

5.2.1. Description and objectives

Description

This scenario focuses on environmental performance. The pilot configuration uses two Citroën Ami Cargo electric vans to perform B2B last mile deliveries and pick up returns in Western Attica. The operations are coordinated through a last mile orchestration platform. The platform assigns delivery time windows, plans route order, and records proof of delivery. The scenario also defines a comparison case using conventional internal combustion engine (ICE) vans. The ICE vans follow the same type of service (same geography, same type of customer, same delivery and return logic), but they are fossil fuel vehicles. In both cases the work is carried out in Elefsis and nearby areas. Parcels are prepared at LOGIKA’s warehouse in Melissa, Aspropyrgos, loaded according to the route plan, and then delivered according to agreed time slots.

Objectives

The objective is to measure the environmental impact of the Athens pilot configuration. This includes:

- 1) Tailpipe greenhouse gas emissions and local pollutants
- 2) Potential alignment with low emission access rules in the wider Athens area
- 3) Total kilometer’s driven per successful stop
- 4) Ability to consolidate deliveries and reverse flows (returns) in the same trip

The Citroën Ami Cargo plus orchestration platform is expected to reduce emissions per tour and per delivered unit. The ICE van case is kept to provide a quantitative reference.

Alignment with project objectives

Project objective	Alignment
S01 Consolidate knowledge on attractive zero-emission delivery and return options, and successful behavioral interventions leading to greener choices	Tests zero tailpipe emission delivery in Athens (Citroën Ami Cargo) and operational measures that reduce detours and mileage, including combined delivery and return routes. Uses an ICE van baseline to evidence improvement.
S03 Develop a concrete, step-by-step way to account for the footprint of e-commerce deliveries and returns, in line with Count Emissions EU.	Produces environmental KPIs and compares against an ICE baseline, enabling quantification of gains from electrification and route orchestration.
S06 Develop a sound methodology to evaluate the successful communication, implementation, and adoption of zero-emission delivery and return options	The before-and-after setup (ICE vs electric plus orchestration) supports evaluation of implementation and operational adoption using measurable KPIs.
S07 Work with consumers, retailers, logistics service providers and public authorities to develop behavioral	Structured routing and time windows function as operational interventions to reduce inefficient driving and missed deliveries.

interventions that lead to more sustainable e-commerce practices	
S08 Support public authorities in determining the policy and regulatory action they can take in fostering more sustainable e-commerce deliveries and returns	Generating environmental KPIs that can be reported to the municipality and to policy stakeholders

Expected results

We expect that the Citroën Ami Cargo configuration, with time window slots and orchestration, will:

- 1) Have lower CO₂ equivalent emissions per kilometer and per delivered unit
- 2) Reduce exposure to future access restrictions for polluting vans
- 3) Match or outperform ICE vans in service coverage within the Elefsis area, as long as the daily range of the electric vans is respected.

We expect that the ICE van reference will show higher direct emissions and higher policy risk, even if service quality is acceptable.

Process Description

- 1) Parcels and possible return items are prepared and scanned in the LOGIKA warehouse in Melissia, Aspropyrgos.
- 2) The orchestration platform generates an optimized route for the Citroën Ami Cargo vans, with defined delivery time windows.
- 3) The electric vans execute the route in Elefsis and neighboring areas. Deliveries and returns are handled in the same visit when possible.
- 4) The platform tracks vehicle movement, timestamps, and stop completion.
- 5) Environmental data (distance driven, energy use, estimated avoided emissions compared to ICE) is recorded.
- 6) For comparison, an equivalent ICE van route is documented using the same structure (stops, geography, service type), and its environmental indicators are calculated.

Involved Technologies/Tools

- 1) Citroën Ami Cargo electric vans (zero tailpipe emissions, limited daily range, compact footprint suitable for access-restricted areas).
- 2) Orchestration platform for last mile: route optimization, assignment of time windows, live tracking, proof of delivery and pickup, consolidation of returns.
- 3) Time window delivery logic: coordinated appointment-style slots with business customers, to reduce idle circulation and failed delivery attempts.
- 4) ICE vans: same service logic and same geography, used only as a benchmark for environmental comparison.

Innovative Elements

The innovative element is the combination of three components:

- 1) Use of a fully electric light vehicle (Citroën Ami Cargo) for B2B last mile work.
- 2) Use of delivery time windows agreed with the client. This limits unplanned circulation and supports predictable access.
- 3) Use of an orchestration platform that plans the route, monitors execution, and links deliveries with returns to reduce empty distance.

The novelty is not only the vehicle, but the way it is scheduled, controlled, and monitored under defined time slots.

5.2.2. Organization

Timeline

February 2026 (M19) – March 2026 (M20)

- a. Confirm the final pilot scope and operating area (Elefsis) and validate delivery time windows with KYOCERA business clients.
- b. Configure the orchestration platform for the pilot geography, routing constraints, and time slot logic.
- c. Prepare the operational setup at the LOGIKA warehouse (charging readiness, dispatch routines, user accounts, and access roles).
- d. Driver and dispatcher onboarding on the platform workflows (route execution, proof of delivery/collection, exception handling).
- e. Dry runs using test data and short trial routes to verify range assumptions, loading logic, and time slot feasibility.

April 2026 (M21)

- a. Controlled pilot start with limited volume and a restricted set of clients in Elefsis.
- b. Verify end-to-end workflow: order input, route generation, loading sequence, delivery confirmation, and return pickups integrated into routes.
- c. Adjust routing rules and time slot parameters based on observed constraints (access, parking, unloading times, client availability).
- d. Stabilize incident handling and escalation routines with the platform provider.

May 2026 (M20) – October 2026 (M27)

- a. Full pilot operations in Elefsis with regular scheduled B2B deliveries and returns using the two Citroën Ami Cargo vans.
- b. Apply operating parameters consistently (product consolidation, customer consolidation, time slot management, delivery and return integration, payload monitoring).
- c. Continuous collection of operational records from the platform (route and stop timestamps, distance travelled, time slot compliance, exceptions, battery and charging events where available).
- d. Periodic operational reviews to refine consolidation rules, routing constraints, and customer communication routines.

November 2026 – December 2026

- a. Consolidate operational datasets and documentation from the full pilot period.
- b. Perform an initial synthesis of lessons learned, including what worked well, where constraints appeared, and which adjustments improved stability.

- c. Prepare inputs for cross-pilot learning and the downstream evaluation workstreams (including early WP5 coordination where relevant).

Stakeholder Involvement

Name and Function	Task/Role
LOGIKA (Logistics Service Provider)	Responsible for fleet operation, loading, routing, and customer service.
KYOCERA (Business Client)	Provides the B2B demand for deliveries and returns of consumables and related products.
University of the Aegean	Supports analysis, monitoring, and evaluation of performance and environmental impact.

These actors are already collaborating in the Athens pilot “ElectroSmart,” which targets B2B last-mile flows in Western Attica.

Risk and quality management (for pilot operations)

Risk	Description of the risk	Quality assurance mechanism
Vehicle range limits not respected	The Electric vans operate with restricted mileage during shifts while needing scheduled battery replenishment. The failure to maintain range limits will force additional trips and temporary vehicle charging which will impact emission tracking accuracy.	The orchestration platform needs to generate routes which stay within the vehicle's operational range.
Data completeness and traceability for reporting	The pilot must maintain open documentation of emissions and operating distance data for local authority reporting and for future replication. Gaps or unclear records reduce usefulness and credibility.	Maintain open and consistent documentation of emissions and operating distance data.
ICE reference constraints in restricted areas	The ICE van operates under original conditions with higher environmental impact and can face limited access in low-emission or restricted traffic zones, which can constrain comparable operations.	Keep the ICE reference operation documented “as-is”, including any access limitations due to low-emission or traffic restrictions.

5.3. Scenario 2: Productivity and cost efficiency

5.3.1. Description and objectives

Description

This scenario focuses on economic and operational performance. The pilot setup uses two Citroën Ami Cargo electric vans coordinated through a last mile orchestration platform. The platform creates optimized tours with assigned delivery time windows and integrates the pickup of returns in the same route. This is expected to reduce empty kilometer’s and improve utilization of each round. For comparison, the scenario also

considers performing the same service with conventional ICE vans. This reference case reflects traditional operations without strict range constraints, but with higher fuel exposure and higher emissions. The intention is to evaluate cost per stop, kilometers per stop, resource utilization, and service reliability.

Objectives

The main objective is to quantify productivity and cost efficiency under the Athens pilot configuration. Key performance questions include:

- 1) How many successful deliveries (and pickups of returns) can be completed per round using Citroën Ami Cargo vans under orchestrated routing and time slots.
- 2) How many kilometers are driven per completed stop.
- 3) How predictable is the service when customers are given a defined time window.
- 4) What are the resource requirements (driver time, charging time, dispatch management effort).
- 5) How this compares with ICE van operations performing a similar workload.

This directly links to economic KPIs such as cost per delivery attempt, cost per successful delivery, and staff utilization.

Alignment with project objectives

Project objective	Alignment
S02 Co-develop solutions with diverse stakeholders, combining behavioral interventions and delivery and return options, testing them through pilots that cover relevant e-commerce markets and cultures	Tests a concrete B2B operational setup in Athens: electric light vehicles plus an orchestration platform, structured delivery time windows, and integrated return pickups in the same route.
S04 Develop replicable and scalable processes for retailers and LSPs, supporting them to provide consumers with accurate information regarding environmental footprints	Supports development of viable and replicable LSP operating models by quantifying cost efficiency, utilization, and service reliability for orchestrated routes with time windows and integrated returns.
S06 Develop a sound methodology to evaluate the successful communication, implementation, and adoption of zero-emission delivery and return options	Provides a structured evaluation of implementation performance by measuring service reliability, productivity, and operating effort for orchestrated electric operations, benchmarked against ICE service.

Expected results

We expect that route optimization plus time window delivery will:

- 1) Reduce wasted distance (fewer unplanned detours and fewer failed delivery attempts)
- 2) Increase stop density per round (more useful deliveries and returns per kilometer)
- 3) Allow better planning of driver working hours
- 4) Reduce idle waiting at customer sites because the visit is booked in a defined time slot.

We also expect that the electric vans may have some operational constraints (range, charging coordination, payload volume), which can translate into scheduling complexity. The ICE van reference is expected to have fewer range constraints but higher fuel cost exposure and less structured utilization.

Process Description

- 1) Orders and potential returns are known in advance from the business customer.
- 2) Dispatch uses the orchestration platform to assign stops, define time windows, and build the round for the Citroën Ami Cargo vans.
- 3) Vans are loaded at the LOGIKA warehouse in Melissia, Aspropyrgos following the manifest produced by the platform.
- 4) The vans execute the route in Elefsis. At each stop they deliver, collect returns if needed, and record proof of service in the platform.
- 5) The platform logs timestamps, stop sequence, and completion status.
- 6) After the round, data is used to compute cost and productivity KPIs.
- 7) For the ICE van reference, the same calculation is done: kilometers per stop, time per stop, and total stops per round are documented for comparison.

Involved Technologies/Tools

- 1) Citroën Ami Cargo vans: small electric vehicles with limited daily range. They are dispatched through the orchestration platform and operate under defined time windows.
- 2) Orchestration platform: creates optimized routes, allocates stops to vehicles, provides navigation and proof of delivery, and logs timestamps for KPI calculation.
- 3) Time window scheduling: agreed delivery slots that reduce failed visits and unnecessary repeat attempts.
- 4) ICE van reference case: conventional vans performing similar tasks, used to benchmark cost, distance per stop, and flexibility.

Innovative Elements

From the productivity and cost perspective, the innovation is organizational:

- 1) The orchestration platform gives dispatch the ability to plan the full round in advance, lock in time windows, and integrate return flows in the same round.
- 2) The same digital layer records completion in real time. This gives evidence of service reliability and punctuality for each stop.
- 3) The process treats returns as part of the planned workload, not as a separate trip. This improves load factor and reduces empty kilometers. In other words, the pilot is testing a service model, not only a vehicle.

5.3.2. Organization

Timeline

February 2026 (M19) – March 2026 (M18)

- a. Confirm the final pilot scope and operating area (Elefsis) and validate delivery time windows with KYOCERA business clients.
- b. Configure the orchestration platform for the pilot geography, routing constraints, and time slot logic.
- c. Prepare the operational setup at the LOGIKA warehouse (charging readiness, dispatch routines, user accounts, and access roles).
- d. Driver and dispatcher onboarding on the platform workflows (route execution, proof of delivery/collection, exception handling).
- e. Dry runs using test data and short trial routes to verify range assumptions, loading logic, and time slot feasibility.

April 2026 (M21)

- a. Controlled pilot start with limited volume and a restricted set of clients in Elefsis.
- b. Verify end-to-end workflow: order input, route generation, loading sequence, delivery confirmation, and return pickups integrated into routes.
- c. Adjust routing rules and time slot parameters based on observed constraints (access, parking, unloading times, client availability).
- d. Stabilize incident handling and escalation routines with the platform provider.

May 2026 (M22) – October 2026 (M27)

- a. Full pilot operations in Elefsis with regular scheduled B2B deliveries and returns using the two Citroën Ami Cargo vans.
- b. Apply operating parameters consistently (product consolidation, customer consolidation, time slot management, delivery and return integration, payload monitoring).
- c. Continuous collection of operational records from the platform (route and stop timestamps, distance travelled, time slot compliance, exceptions, battery and charging events where available).
- d. Periodic operational reviews to refine consolidation rules, routing constraints, and customer communication routines.

November 2026 (M28) – December 2026 (M29)

- a. Consolidate operational datasets and documentation from the full pilot period.
- b. Perform an initial synthesis of lessons learned, including what worked well, where constraints appeared, and which adjustments improved stability.
- c. Prepare inputs for cross-pilot learning and the downstream evaluation workstreams (including early WP5 coordination where relevant).

Stakeholder Involvement

Name and Function	Task/Role
LOGIKA (Logistics Service Provider)	Responsible for fleet operation, loading, routing, and customer service.
KYOCERA (Business Client)	Provides the B2B demand for deliveries and returns of consumables and related products.
University of the Aegean	Supports analysis, monitoring, and evaluation of performance and environmental impact.

These actors are already collaborating in the Athens pilot “ElectroSmart,” which targets B2B last-mile flows in Western Attica.

Risk and quality management (for pilot operations)

Risk	Description of the risk	Quality assurance mechanism
Operational saturation (EV range and payload limits)	Electric vans have range and payload limits. If demand spikes, additional rounds or charging breaks may be needed, increasing cost per stop and reducing productivity.	Monitor demand versus vehicle range and payload constraints, and record when extra rounds or charging breaks are required for KPI interpretation.
Time slot reliability versus real traffic conditions	The orchestration platform and time slot commitments may not match real traffic conditions. Missed slots can create rework and reduce service reliability.	Monitor whether planned routes and time windows can be met in practice, and document deviations where they occur.
ICE reference case cost and access uncertainty	ICE operations face fuel cost variability, congestion exposure, and possible future access limitations in regulated zones that could disrupt promised delivery times.	Document ICE operating conditions consistently, including congestion impacts, fuel cost context, and any access constraints affecting delivery performance.
Data capture reliability for KPI benchmarking	Without reliable timestamp and route data, KPI calculation and cost benchmarking (EV vs ICE) will not be trusted.	Ensure accurate capture of timestamps and route data and check completeness before KPI calculation and benchmarking.

5.4. Securing the pilot results

Nudging and behavioral design

This scenario does not include any nudging measures.

Baseline measurement

LOGIKA will establish a baseline by observing and recording current delivery and return operations (i.e. by using diesel vans) for the same client group and operating area that will be used in the pilot (Elefsis). The baseline period will take place before the pilot goes live and will rely on routine operational records (dispatch lists, driver logs, routing information, and delivery confirmations). The aim is to capture the “business as usual”

operating pattern under comparable demand and scheduling conditions, so that pilot performance can later be interpreted against a consistent reference.

For the baseline period and sampling, LOGIKA will define a short baseline window, for example 2 to 4 weeks, immediately before pilot launch. The same delivery geography will be used, along with similar delivery days and the same time window rules expected in the pilot. Both deliveries and returns will be included, if returns already occur in regular operations.

For data sources and method, baseline data will be extracted from LOGIKA's existing dispatch planning tools, delivery confirmations, and driver route records. If available, GPS traces or navigation logs will be used to confirm distances and route duration. The baseline dataset will then be cleaned and consolidated into a consistent format so that the same variables can be extracted during the pilot from the orchestration platform.

The baseline will result in a reference dataset that describes typical routing patterns and operational effort in Elefsis under standard operations, using diesel vans. This dataset will allow a structured comparison with the pilot period, where the orchestration platform and electric vans apply consolidation rules and time slot coordination.

KPI tracking tool and measurement approach

The KPI framework, including monitoring and pilot measurement, is documented in the Athens pilot Excel file. The file defines the KPI set, specifies the required data inputs for each KPI, and indicates the measurement frequency (which is also shown in Table 3). A dedicated input sheet is provided for entering new measurement values as they become available. The dashboard visualizes KPI performance over time, enabling continuous monitoring throughout the pilot.

Table 4 KPI overview ElectroSmart pilot

Scenario	Category	KPI	Description	Input data	Formula	Unit	Frequency	Measurement
1	Environment	Emissions (CO ₂) per km per vehicle type	Emissions (CO ₂) per km per vehicle type caused	Total grams of type of pollutant per vehicle type Total number of kilometers driven per vehicle type	Total grams of type of pollutant per vehicle type / total number of kilometers driven per vehicle type	gram	monthly	manual entry
1	Environment	Share of non-fossil fuel vehicles in the fleet	Share of operational vehicles powered entirely by non-fossil energy sources	Number of vehicles in the fleet by type	Number of non-fossil fuel vehicles / total number of vehicles * 100	%	monthly	manual entry
1	Environment	Share of deliveries made by non-fossil fuel vehicles	Share of stops made by non-fossil fuel vehicles	Number of deliveries (=stops) executed by vehicle type	Number of stops by non-fossil fuel vehicles / total number of stops * 100	%	monthly	manual entry
1	Environment	Emissions (CO ₂) per delivery	Emissions (CO ₂) per stop	Total number of deliveries Total grams of type of pollutant per vehicle type	Total grams of type of pollutant / total number of deliveries (or returns)	gram	monthly	manual entry
2	Economic	Average load factor at the start of the tour by vehicle type	Average load factor at the start of the tour by vehicle type	Weight (or volume?) of packages loaded Permitted weight (available volume?)	Used capacity in volume or weight in tour / total available capacity in volume or weight in tour	No.	monthly	manual entry
2	Economic	VKT per delivery	Avg. delivery distance	Total vehicle kilometers travelled Total number of deliveries	Total km traveled / total number of deliveries (or returns)	No.	monthly	manual entry
2	Economic	Avg. stops per tour	Avg. stops per tour	Number of stops (per period) Number of tours (per period)	Total number of stops / total number of tours	No.	monthly	manual entry
2	Economic	Cost per delivery	Cost per delivery	Operational costs per vehicle type Number of deliveries	Total costs / total number of deliveries	EUR	monthly	manual entry

6. Green Button – Zaragoza

6.1. General information

6.1.1. General description of the pilot

Green Button is a pilot in the historic city center low emission zone, built around municipal marketplaces, specifically the Central Market and Agroecological Market. The pilot also includes Valdespartera Market which is outside the historic city center. The markets function as logistics center’s where orders (mainly fresh produce and local services) are prepared, then collected for delivery. A dedicated website and mobile app (Mercadeando) support ordering, delivery planning, and monitoring, and the pilot combines low-emission delivery options (on foot and electric vehicles) with incentives and social inclusion partners to support uptake and accessibility. These elements are brought together and tested through a single pilot scenario.

6.1.2. Location / Pilot Site

The pilot will take place in Zaragoza, Spain, a city of around 700,000 residents (2025). Activities are concentrated in the historic city-center low-emission zone and are anchored at three municipal market sites: Central Market, Agroecological Market, and Valdespartera Market. The Central Market is the largest site and recorded 1,800,000 visitors in 2020, equivalent to an average of approximately 34,000 visitors per week.

Implementation is carried out through Mercadeando, Zaragoza’s market logistics and ordering service, which currently involves 32 vendors at the Central Market, 10 at the Agroecological Market, and 2 at the Valdespartera Market. The delivery area covers the entire city of Zaragoza, including rural districts and several municipalities within the metropolitan area.

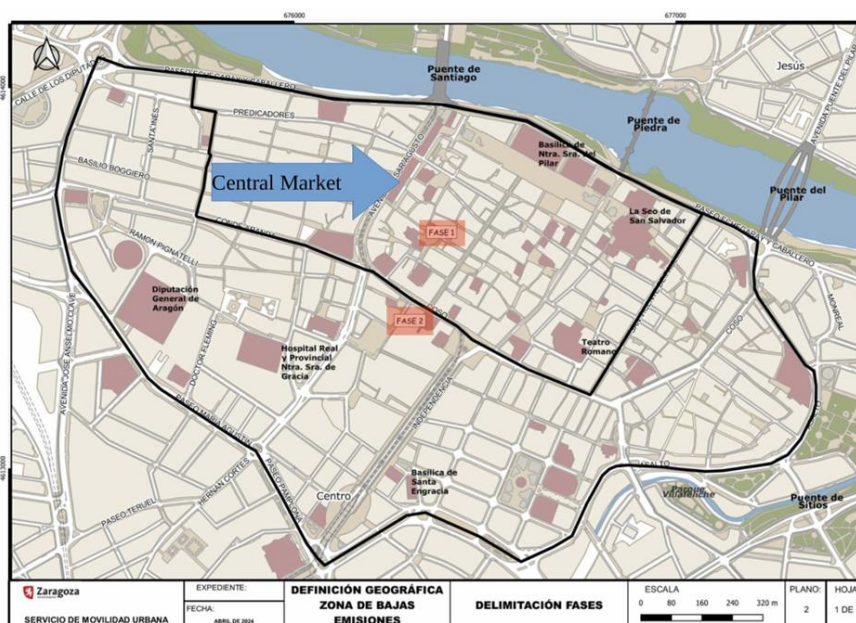


Figure 3. Pilot area of Green Button - Zaragoza

6.2. Scenario 1: Environmental efficiency

6.2.1. Description and objectives

Description

Green Button is testing an advanced model within the city of Zaragoza, based on deliveries from Central Market, Agroecological Market and Valdespartera Market. This scenario introduces temporal coordination, delayed dispatching, and integrated pick-ups to increase efficiency and sustainability. Parcels from several logistics service providers are grouped, sorted, and redistributed by electric vans, cargo bikes, or pedestrian couriers, using optimized time windows and a shared digital platform.

Objectives

Main objectives:

- 1) Demonstrate the operational feasibility and efficiency of a shared, low-emission delivery model in an urban area.
- 2) Prove that coordinated, data-driven distribution can reduce vehicle-km and emissions while improving cost efficiency.

Specific objectives:

- 1) Achieve CO₂ reduction compared to baseline.
- 2) Improve delivery productivity and reduce total vehicle kilometers.
- 3) Test user acceptance of shared logistics services and green delivery incentives.
- 4) Evaluate the impact on vendor competitiveness and citizen satisfaction.

Alignment with project objectives

Project objective	Alignment
S01 Consolidate knowledge on attractive zero-emission delivery and return options, and successful behavioral interventions leading to greener choices	Tests a shared low-emission delivery model (electric vans, cargo bikes, pedestrian couriers) and green delivery incentives, with user acceptance as a stated objective.
S02 Co-develop solutions with diverse stakeholders, combining behavioral interventions and delivery and return options, testing them through pilots that cover relevant e-commerce markets and cultures	Coordinates multiple logistics service providers via grouping, sorting, and redistribution using shared time windows and a shared digital platform.
S03 Develop a concrete, step-by-step way to account for the footprint of e-commerce deliveries and returns, in line with CountEmissions EU	Targets measurement of CO ₂ reduction and vehicle-km reduction compared to a baseline.
S06 Develop a sound methodology to evaluate the successful communication, implementation, and adoption of zero-emission delivery and return options	Evaluates feasibility, efficiency, user acceptance, vendor competitiveness, and citizen satisfaction.
S07 Work with consumers, retailers, logistics service providers and public authorities to	Tests user acceptance of shared logistics services and green delivery incentives, in

develop behavioral interventions that lead to more sustainable e-commerce practices	a model involving LSPs and market vendors.
S08 Support public authorities in determining the policy and regulatory action they can take in fostering more sustainable e-commerce deliveries and returns	Explicitly aligned with Zaragoza SUMP/SULP and operation within the Low Emission Zone (ZBE), with public-private collaboration and open data sharing.

Expected results

- 1) Reduction of total distance and emissions ($\geq 30\%$ CO₂ savings).
- 2) Cost reduction of around 10% through shared routes and temporal optimization.
- 3) Increased delivery efficiency (shipments per km and per hour).
- 4) Positive user response to green delivery options via “Green Button” platform (Mercadeando).
- 5) Establishment of replicable framework for public-private logistics coordination.

Process Description

- 1) Parcels are sorted and consolidated for optimized routing from de Central Market.
- 2) Deliveries are made by electric vans, cargo bikes, or pedestrian couriers.
- 3) In case of pick-ups from consumers will be integrated into return trips.
- 4) Real-time monitoring and emission tracking are handled through the digital platform.
- 5) Consumers selecting “Green Button” on the platform receive discounted, sustainable delivery options.

Involved Technologies/Tools

- 1) Digital routing and optimization platform.
- 2) Gamification and incentive modules (Green Button).
- 3) Emission tracking and data-sharing dashboards.
- 4) Electric vans, cargo bikes, and pedestrian couriers.
- 5) Smart scheduling and performance monitoring tools.

Innovative Elements

- 1) Consolidation model operated in Municipal Markets within urban area of Zaragoza.
- 2) Integration of temporal coordination and delayed dispatching.
- 3) Inclusion of social enterprises employing workers at risk of exclusion for local deliveries.
- 4) Use of digital incentives and data-driven routing/gamification system.
- 5) Municipal managed platform.

6.2.2. Organization

Timeline

November 2025 (M16) – February 2026 (M19)

- a. Preparation and setup of pilot
- b. Coordination, agreements, training

March 2026 (M20) – July 2026 (M24)

- a. Pilot implementation
- b. Operational phase and monitoring

August 2026 (M25) – October 2026 (M27)

- a. Evaluation and results
- b. Analysis of indicators and workshops with stakeholders

Stakeholder Involvement

Name and Function	Task/Role
Zaragoza City Council	Coordination, policy alignment, incentives
Market Authority	Facility management and vendor engagement
Logistics Service Providers	Operations and routing
Social Enterprises	Pedestrian deliveries in nearby areas
Technology Partners	Digital platform, data analytics, gamification tools
Consumers and Retailers	Adoption of sustainable delivery options

Risk and quality management (for pilot operations)

Risk	Description of the risk	Quality assurance mechanism
Limited hub space for peak volumes	Hub space may be insufficient to handle peak parcel volumes.	Exploring the possibility of using supplementary depots, as well as flexible route and vehicle planning to adapt to demand variations, could help reduce congestion and optimize delivery routes.
Coordination complexity among multiple operators	Multiple stakeholders (City Council, the Market Services Department, logistics companies, retailers, and the software developer) increase coordination needs for grouping, sorting, and redistribution.	Organize regular meeting and share information between each other.
Low initial citizen acceptance	Citizens may be hesitant to use or support shared logistics services and green delivery incentives at first.	incentive campaigns (points, discounts); integrate with popular local apps. Awareness and education campaigns on the benefits of sustainable delivery, information campaigns to involve the community, and facilitate the transition to the new system. Offering incentives such as discounts or additional benefits could also increase participation.
Data privacy and cybersecurity risks	Shared digital operations and data sharing can create privacy and cybersecurity risks.	Implementing robust cybersecurity protocols, such as data encryption, and authentication measures to

		<p>prevent unauthorized access. Compliance with European and Spanish regulations such as GDPR (General Data Protection Regulation) is also essential. Establishing clear agreements on data exchange protocols, ensuring system interoperability and transparency in data usage.</p>
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6.3. Securing the pilot results

Nudging and behavioral design

The planned nudging approach is designed to steer both consumers and businesses toward greener delivery choices by combining clear information at decision points with targeted incentives.

- Purpose and expected behavioral outcomes
The nudges aim to increase the uptake of sustainable delivery options (for example consolidated deliveries), reduce delivery failures (such as unsuccessful first-attempt deliveries), and strengthen acceptance of low-emission last-mile solutions. The expected overall effect is a measurable reduction in CO₂ emissions from last-mile delivery. In addition, the nudges are intended to increase awareness of the pilot’s environmental and social benefits.
- Target groups
The nudging measures address four main groups: consumers, retailers, logistics companies, and drivers.
- Planned nudges and measures
A combination of informational and economic nudges will be applied:
 - Informational nudges: Clear sustainability information will be provided to consumers and retailers, including estimated carbon savings compared to conventional delivery and the positive social impact of employing workers at risk of social exclusion. This information will be presented at key decision points, such as during checkout and delivery-option selection.
 - Economic nudges: Monetary incentives will be used to encourage sustainable choices, for example free shipping above a defined purchase threshold and improved pricing for selected sustainable delivery options.
- Monitoring and evaluation of effectiveness
Effectiveness will be tracked through KPIs such as participation and uptake rates for sustainable delivery options, number of completed deliveries, user satisfaction, and qualitative feedback from consumers, retailers, and logistics operators. Where possible, results will be compared against baseline data collected before the pilot to assess behavioral change and overall impact.

Baseline measurement

Data will be collected using a combination of quantitative and qualitative methods. Quantitative data will include current delivery volumes, number and type of vehicles used, fuel or energy consumption, delivery distances, emissions estimates, delivery times, and operational costs. Qualitative data will be gathered through surveys and interviews with

market operators, logistics providers, and participating retailers to assess current practices, challenges, and user satisfaction.

KPI tracking tool and measurement approach

The KPI framework, including monitoring and pilot measurement, is documented in the Zaragoza pilot Excel file. The file defines the KPI set, specifies the required data inputs for each KPI, and indicates the measurement frequency (which is also shown in Table 4). A dedicated input sheet is provided for entering new measurement values as they become available. The dashboard visualizes KPI performance over time, enabling continuous monitoring throughout the pilot.

Table 5 KPI overview GreenButton pilot

Scenario	Category	KPI	Description	Input data	Formula	Unit	Frequency	Measurement
1	Environment	Emissions (CO ₂ , CO, NO _x , SO _x , PM ₁₀ , PM _{2.5}) per km per vehicle type	Emissions (CO ₂) per km per vehicle type caused	Total grams of type of pollutant per vehicle type Total number of kilometers driven per vehicle type	Total grams of type of pollutant per vehicle type / total number of kilometers driven per vehicle type	gram	quarterly	calculated from LSP
1	Environment	Share of non-fossil fuel vehicles in the fleet	Share of operational vehicles powered entirely by non-fossil energy sources	Number of vehicles in the fleet by type	Number of non-fossil fuel vehicles / total number of vehicles * 100	%	quarterly	calculated from LSP
1	Environment	Share of deliveries made by non-fossil fuel vehicles	Share of stops made by non-fossil fuel vehicles	Number of deliveries (=stops) executed by vehicle type	Number of stops by non-fossil fuel vehicles / total number of stops * 100	%	quarterly	calculated from LSP
1	Environment	Emissions (CO ₂ , CO, NO _x , SO _x , PM ₁₀ , PM _{2.5}) per delivery	Emissions (CO ₂) per stop	Total number of deliveries Total grams of type of pollutant per vehicle type	Total grams of type of pollutant / total number of deliveries (or returns)	gram	quarterly	calculated from LSP
1	Economic	Average load factor at the start of the tour by vehicle type	Average load factor at the start of the tour by vehicle type	Weight (or volume?) of packages loaded Permitted weight (available volume?)	Used capacity in volume or weight in tour / total available capacity in volume or weight in tour	No.	quarterly	calculated from LSP
1	Economic	VKT per delivery/return	Avg. distance per delivery	Total vehicle kilometers travelled Total number of deliveries	Total km traveled / total number of deliveries (or returns)	No.	quarterly	calculated from LSP
1	Economic	Avg. stops per tour	Avg. stops per tour	Number of stops (per period) Number of tours (per period)	Total number of stops / total number of tours	No.	quarterly	calculated from LSP
1	Social	Number of parcel pick-up/drop-off points per inhabitant	All pick up points in the area	Number of pick-up/drop-off points in the area	Number of pick-up points / populations in the area	No.	once	manual entry
1	Social	Potential accessibility to logistics services	Proximity of roads, subway, shops, train station...	Location of pick-up/drop-off points, population data	Total population within threshold of service point / total population	No.	once	manual entry
1	Social	Share of costumers ready to adopt sustainable behaviors	Percentage of citizens	Number of citizens that responded positively to adopt sustainable behaviors	Number of customers that chose sustainable delivery / total number of customers * 100	%	once	survey-based
1	Social	Costumers' expenditure with shipping and returns	Customers' expenditure with shipping	Price of shipping	(total shipping cost + total return cost) / total number of customers	€	quarterly	accounting data
1	Social	Ratio between average wage of logistics workers and minimum income	We have national statistics to make the comparison	Wage of logistic workers Total number of logistic workers Minimum income	(total wage logistics workers / number logistics workers) / minimum income	%	once	calculated from LSP

1	Social	Share of delivery/pickup tours longer than work journey		Duration of tours Duration of work day	Number of tours longer than work day / total number of tours * 100	%	quarterly	calculated from LSP
1	Social	Coefficient of variation in route duration (std/mean of the route duration)	Possible with our GPS	Duration of tours	100 * std of route duration / mean route duration	%	quarterly	calculated from LSP

7. SustainSwap – Lyon

7.1. General information

7.1.1. General description of the pilot

SustainSwap is led by Pick & Smile in Lyon and evaluates how circular packaging and zero-emission delivery models can work across different urban logistics flows. The pilot combines three operational setups run with different clients: reusable packaging for Vinted Go C2C parcels, zero-emission replenishment of selected PUDO points using e-cargo bikes, and zero-emission grocery home delivery for Intermarché using e-cargo bikes.

7.1.2. Location / Pilot Site

The pilot will take place in Lyon, France (about 2.3 million residents), within the operational area of the Pick & Smile network. Pilot activities are centered on selected Pick & Smile PUDO points and parcel lockers across the city and surrounding urban neighborhoods, combined with nearby consolidation points and participating partner sites (for example Intermarché store locations) that feed into the last-mile operations.

The pilot activities are centered around the Pick & Smile XL PUDO point at Westfield Lyon Part-Dieu and one Intermarché store used as the dispatch hub for home delivery, with operations covering selected central districts of Lyon. The feeder flow is organized from an Intermarché consolidation/preparation hub to the Part-Dieu XL point.

7.2. Scenario 1: Reusable Packaging (Vinted Go)

7.2.1. Description and objectives

Description

The scenario tests the multi-cycle use of reusable parcel packaging within Vinted Go's operations. It leverages WP2 behavioral insights on packaging acceptance and sustainability attitudes to target user groups more likely to reuse. In parallel, it includes nudges (informational prompts, carbon savings messages etc. depending on the choice) to encourage users to select the reusable option and return the packaging correctly.

Objectives

Main objectives

- 1) Demonstrate feasibility and sustainability of multi-cycle reusable packaging.
- 2) Increase adoption and proper return behavior using nudge-based engagement.

Specific objectives

- 1) Use WP2 insights to identify behavioral segments likely to adopt reuse.
- 2) Test nudges (e.g., carbon savings info, progress counters) at key touchpoints.
- 3) Evaluate lifecycle efficiency and user compliance.

Alignment with project objectives

Project objective	Alignment
S01 Consolidate knowledge on attractive zero-emission delivery and return options, and successful behavioral interventions leading to greener choices	Generates evidence on reusable packaging acceptance and which nudges increase selection and correct return behavior.
S02 Co-develop solutions with diverse stakeholders, combining behavioral interventions and delivery and return options, testing them through pilots that cover relevant e-commerce markets and cultures	Tests a concrete solution inside Vinted Go operations, combining a reusable packaging option with behavioral targeting and nudges at key touchpoints.
S03 Develop a concrete, step-by-step way to account for the footprint of e-commerce deliveries and returns, in line with CountEmissions EU	Evaluates lifecycle efficiency of multi-cycle packaging, supporting footprint-related assessment of packaging reuse.
S06 Develop a sound methodology to evaluate the successful communication, implementation, and adoption of zero-emission delivery and return options	Measures adoption, compliance, and correct return behavior, and tests which communications and prompts work.
S07 Work with consumers, retailers, logistics service providers and public authorities to develop behavioral interventions that lead to more sustainable e-commerce practices	Uses WP2 behavioral segmentation and tests nudges (informational prompts, carbon savings messages, progress counters) to drive reuse and correct returns.

Expected results

Hypotheses

- 1) Users exposed to sustainability nudges will return reusable packaging more reliably.
- 2) Behavioral segments identified in WP2 will show significantly higher reuse rates.

Expected results

- 1) Increased adoption of reusable packaging.
- 2) Evidence on effectiveness of nudges in promoting circular behavior.
- 3) Reliable packaging lifecycle dataset.

Process Description

- 1) Introduction and activation of reusable packaging at P&S points:
 - a. Reusable packaging is made available directly at Pick & Smile PUDO locations and integrated into the ongoing Vinted Go flow.
 - b. Customers visiting the PUDO are encouraged to use the provided packaging and scan the QR code to activate the tracking ID.
 - c. Simple on-site messages support awareness of environmental benefits and ease of use.
- 2) Parcel preparation and delivery using reusable packaging:
 - a. Once activated, the packaging is used for the customer's outgoing parcel and enters its first lifecycle.
 - b. The packaging ID allows to track each new customer who use it.

- c. Delivery takes place through existing Vinted/Pick & Smile logistics operations.
- 3) Customer-driven reuse of the packaging:
 - a. After receiving the parcel, the customer decides whether to reuse the packaging for their next Vinted shipment.
 - b. If reused, they simply repack the next item and scan the QR code again, initiating the next lifecycle.
 - c. If not reused, the lifecycle ends naturally, and the package is not forced back into the system.
- 4) Lifecycle tracking and monitoring:
 - a. Each subsequent reuse cycle is recorded automatically whenever a user scans the QR code and ships again.
 - b. Wear, damage, and number of cycles per package are monitored.
 - c. Turnaround time and geographic spread of reuse flows are analyzed.
- 5) Behavioral observation and WP2-driven customer segmentation
 - a. Reuse behavior is monitored alongside the communication methods applied (e.g., green leaves, alternative visual cues, short environmental messages).
 - b. Variants of messaging (e.g., CO₂ emissions saved, equivalent number of trees, waste avoided) are tested to understand which formats are clearer or more motivating.
 - c. Reuse rates are compared against these communication styles to identify which information approach supports the reuse flow most effectively.
- 6) KPI calculation and sustainability assessment:
 - a. Core KPIs: number of reuse cycles, return compliance, avoided single-use packaging, estimated CO₂ reduction.
 - b. Operational and behavioral data are combined to evaluate real-world performance.
 - c. Results feed into recommendations for scaling the reusable packaging model.

Involved Technologies/Tools

Parcel tracking will be carried out by the Pick&Smile information system linked to the Reutec system. This will enable parcel information to be linked to each customer (initial customers and subsequent customers who scan the QR code). All data will be easily accessible via API or file export. The data will be anonymized.

Innovative Elements

- 1) Introduction of reusable packaging in the process.
- 2) Integration of WP2 behavioral personas with reusable packaging.
- 3) Application of nudges to increase packaging returns.
- 4) Material and behavioral sustainability combined.

7.7.2 Organization

Timeline

March 2026 (M20)

- a. Technical setup (QR activation, data logging, packaging ID system).
- b. Preparation of communication variants (icons, messages, environmental cues).
- c. Coordination with Pick & Smile staff and alignment with WP2 insights.

April 2026 (M21) – October 2026 (M27)

- a. Full operational deployment of reusable packaging at participating PUDO points.
- b. Ongoing lifecycle tracking of packaging use and customer-driven reuse.
- c. Testing different communication methods (green leaves, CO₂ info, tree-equivalents).
- d. Adjustments if needed (e.g., strengthening instructions, adding reminders).

November 2026 (M28) – December 2026 (M29)

- a. Finalization and securing of all lifecycle datasets.
- b. Consolidation of reuse metrics and communication-performance data.
- c. Evaluation, KPI analysis, and preparation of lessons learned for WP4.

Stakeholder Involvement

Name and Function	Task/Role
Pick & Smile	Procures packaging; manages stock at Part-Dieu XL; staff guidance; QR activation and logging; exports scan events via SMIL/Data Lake.
Vinted Go	Ecosystem partner enabling circulation in C2C flow; provides identifiers/labels needed to match packaging events to transactions
The manufacturer of reusable packaging	Supplies reusable pouches; may provide technical specs and durability guidance
Vinted Go customers	Adopt/reuse/return packaging; interact with nudges at PUDO

Risk and quality management (for pilot operations)

Risk	Description of the risk	Quality assurance mechanism
Low adoption	Users may not choose the reusable packaging option.	A/B test nudges to improve uptake and track adoption rates.
Low return rates	Users may not return reusable packaging, limiting multi-cycle use.	Track return and compliance rates to identify issues early.
Ineffective nudges	Nudges may not influence selection or correct return behavior.	A/B test nudges and review results; apply quality checks on the implementation and tracking.

7.3. Scenario 2: Zero-Emission Delivery to PUDO Network

7.3.1. Description and objectives

Description

This scenario evaluates whether electric cargo bikes can replace vans in delivering consolidated parcels from a central logistics hub to selected Pick & Smile PUDO points across Lyon. The focus is on reducing emissions, improving operational efficiency in dense urban zones, and assessing the conditions under which bike-based feeder distribution is feasible at scale.

Objectives

Main objectives

- 1) Demonstrate operational feasibility and performance of hub → PUDO e-cargo distribution.
- 2) Quantify emission reductions and distance savings compared to van-based feeder routes.

Specific objectives

- 1) Evaluate routing efficiency, delivery time windows, load capacity, and daily throughput.
- 2) Assess integration with existing PUDO staffing, processes, storage, and opening hours.
- 3) Use WP2 insights to priorities PUDOs where green feeder delivery yields the highest net impact.
- 4) Identify operational constraints and scalability factors (distance, elevation, bike lanes, capacity).

Alignment with project objectives

Project objective	Alignment
S01 Consolidate knowledge on attractive zero-emission delivery and return options, and successful behavioral interventions leading to greener choices	Tests a zero-emission feeder delivery option (electric cargo bikes) from hub to PUDO points and documents feasibility and performance conditions.
S02 Co-develop solutions with diverse stakeholders, combining behavioral interventions and delivery and return options, testing them through pilots that cover relevant e-commerce markets and cultures	Tests integration with PUDO operations (staffing, storage, opening hours) and uses WP2 insights to select PUDOs where the green feeder model has highest impact.
S03 Develop a concrete, step-by-step way to account for the footprint of e-commerce deliveries and returns, in line with CountEmissions EU	Quantifies emission reductions and distance savings versus van-based feeder routes, generating data for emissions modelling.
S06 Develop a sound methodology to evaluate the successful communication, implementation, and adoption of zero-emission delivery and return options	Evaluates operational performance and scalability factors (routing efficiency, time windows, capacity, throughput; constraints like distance, elevation, bike lanes).
S08 Support public authorities in determining the policy and regulatory action they can take in fostering more sustainable e-commerce deliveries and returns	Provides evidence on the infrastructure and operating conditions that enable bike-based feeder distribution at scale (for example bike lanes and urban constraints).

Expected results

Hypotheses

- 1) E-cargo bikes can reliably fulfil hub to PUDO deliveries within operational constraints (distance, load, timing).
- 2) Replacing vans on short urban feeder routes allows achieving emission reductions, depending on distance and payload.
- 3) Operational performance (on-time rate, parcel availability by morning cut-off) can be maintained or improved.

Expected results

- 1) A complete set of KPIs comparing bike vs van feeder routes: emissions, time, reliability, cost aspects.
- 2) Spatial criteria identifying where e-cargo feeder distribution is feasible (distance, topography, cycling infrastructure).
- 3) Recommendations for scaling green feeder routes beyond the pilot.

Process Description

- 1) Parcels arrive at the central consolidation hub from partner carriers and are checked, scanned and transferred into the Pick & Smile flow.
- 2) Shipments are sorted by destination PUDO, taking into account time windows, parcel volumes and PUDO staffing capacity.
- 3) E-cargo bikes are loaded at the hub; bikes depart on optimized multi-stop routes designed for short-range, urban delivery.
- 4) Deliveries are made to selected PUDO locations, where staff receive, scan, register and store parcels for customer pickup.
- 5) Operational, routing and handover data are collected, including distance, timing, load factors and delivery performance, feeding into KPI calculation and the digital modelling.

Involved Technologies/Tools

- 1) Electric cargo bikes used for zero-emission feeder delivery from the central hub to PUDO points.
- 2) GreenTurn's digital modelling and assessment tools, including demand forecasting, operational simulation, scenario testing and multi-dimensional impact evaluation, enabling the replication, scaling and performance assessment of the zero-emission feeder delivery model beyond the physical pilot.

Innovative Elements

- 1) Introduction of e-cargo bikes as zero-emission feeder vehicles, replacing van-based hub/PUDO replenishment for the first time in the Pick & Smile network.
- 2) Integrated multi-actor logistics workflow combining carrier consolidation, central-hub operations, cargo-bike micro-distribution, and staffed PUDO reception.

- 3) Testing a hybrid last-mile model where parcel consolidation and zero-emission feeder delivery operate together, enabling insights into scalability, feasibility, and operational performance.

7.3.2. Organization

Timeline

March 2026 (M20)

- a. Routing design and definition of feasible e-cargo delivery zones.
- b. Coordination with carriers, hub operator and cargo-bike partners.

April 2026 (M21)

- a. Controlled test deliveries with limited volume.
- b. Verification of routing, loading, and PUDO reception workflows.

May 2026 (M22) - October 2026 (M27)

- a. Full feeder operations (central hub to PUDO) with regular e-cargo bike deliveries.
- b. Continuous collection of operational and routing data.

November 2026 (M28) - December 2026 (M29)

- a. Consolidation of all physical data and securing pilot results.
- b. Initial evaluation and lessons learned (feeding into early WP5 workstreams).

Stakeholder Involvement

Name and Function	Task/Role
Pick & Smile	Carrier/operator of e-cargo bike feeder rounds; routing and scheduling; logging distances/times/load proxies; PUDO handover and staffing.
Intermarché	Provides the parcel flow for this feeder leg and defines handover points/time windows at consolidation/preparation hub.
Customers	Indirect recipients picking up parcels at PUDO (acceptance/experience may be captured via feedback).

Risk and quality management (for pilot operations)

Risk	Description of the risk	Quality assurance mechanism
Weather-related disruptions	Bad weather may disrupt electric cargo bike deliveries and affect reliability.	Use a hybrid fallback to vans during severe weather.
Insufficient e-cargo bike capacity on peak days	Peak-day volumes may exceed e-cargo bike capacity, reducing performance.	Use a hybrid fallback to vans during peak days.
Integration issues between hub workflows and PUDO staffing	Misalignment between hub dispatch/arrival times and PUDO staffing or readiness may cause delays or failed handovers.	Use predefined delivery windows aligned with PUDO opening hours.

7.4. Scenario 3: Urban Zero-Emission Home Delivery Service (Intermarché)

7.4.1. Description and objectives

Description

The scenario introduces zero-emission home delivery using e-cargo bikes within the Pick & Smile network, in partnership with Intermarché as the provider of grocery orders. The pilot tests how selected Intermarché stores in Lyon can hand over part of their e-commerce home-delivery flows to Pick & Smile, who will organize and execute the final delivery by e-cargo bike.

The setup evaluates the operational feasibility, service performance and emissions reduction of shifting grocery home deliveries from vans to cargo bikes. Deliveries originate from Intermarché locations or a nearby consolidation point and follow optimized bike routes to customers' homes. Physical testing in Lyon will be complemented by digital simulations exploring scalability across different store types, catchment areas and urban conditions.

Objectives

Main objectives

- 1) Demonstrate the feasibility and performance of zero-emission home delivery using e-cargo bikes for Intermarché orders within the Pick & Smile network.
- 2) Assess the operational, behavioral, environmental and service-quality impacts of replacing van-based home deliveries with e-cargo bikes.

Specific objectives

- 1) Integrate Intermarché order flows into Pick & Smile's processes and test how users respond to a new zero-emission delivery choice, building on GreenTurn's behavioral insights.
- 2) Measure delivery times, reliability, routing efficiency, and emissions compared to conventional delivery.
- 3) Identify operational and behavioral conditions (zones, distance, user expectations) under which e-cargo home delivery is viable and scalable.

Alignment with project objectives

Project objective	Alignment
S01 Consolidate knowledge on attractive zero-emission delivery and return options, and successful behavioral interventions leading to greener choices	Demonstrates zero-emission grocery home delivery using e-cargo bikes and assesses customer response to a green delivery choice.
S02 Co-develop solutions with diverse stakeholders, combining behavioral interventions and delivery and return options,	Tests a partner setup between Intermarché (order provider) and Pick & Smile (delivery execution), integrating

testing them through pilots that cover relevant e-commerce markets and cultures	store order flows into the Pick & Smile network and processes.
S03 Develop a concrete, step-by-step way to account for the footprint of e-commerce deliveries and returns, in line with CountEmissions EU	Measures emissions and compares e-cargo deliveries against conventional van delivery.
S04 Develop replicable and scalable processes for retailers and LSPs, supporting them to provide consumers with accurate information regarding environmental footprints	Produces operational evidence and scaling insights (physical pilot plus simulations) to support replication across store types, catchment areas, and urban conditions.
S06 Develop a sound methodology to evaluate the successful communication, implementation, and adoption of zero-emission delivery and return options	Evaluates feasibility, service performance and adoption through delivery time, reliability, routing efficiency, and user acceptance measures.
S07 Work with consumers, retailers, logistics service providers and public authorities to develop behavioral interventions that lead to more sustainable e-commerce practices	Uses behavioral insights to test customer acceptance, convenience expectations, and perceived value of a green home-delivery option.

Expected results

Hypotheses

- 1) Home deliveries completed by e-cargo bikes can achieve comparable reliability and delivery times to traditional van-based services within suitable urban zones.
- 2) A share of customers will positively respond to the introduction of a zero-emission home-delivery option, especially when it matches their expectations on convenience and service quality.
- 3) Replacing vans with e-cargo bikes for selected deliveries will lead to measurable reductions in emissions, distance travelled and delivery-related congestion.

Expected results

- 1) Verified operational performance of e-cargo home delivery, including routing efficiency, delivery speed and service reliability.
- 2) Empirical insights into customer acceptance and perceived value of a green home-delivery option.
- 3) Quantified environmental benefits (e.g., reduced CO₂ emissions, fewer vehicle-kilometer's, lower noise impact).
- 4) Practical criteria identifying where and how e-cargo home delivery can be scaled or replicated, considering both operational feasibility and customer preferences.

Process Description

- 1) Order preparation at Intermarché
 - a. Grocery orders are picked, packed and staged for bike delivery at participating Intermarché locations, following standard store workflows.
- 2) Transfer to Pick & Smile delivery workflow

- a. Prepared orders are handed over to Pick & Smile at a designated handover point (store or nearby consolidation spot), scanned and assigned to bike routes.
- 3) E-cargo bike delivery to customers
 - a. Orders are loaded onto electric cargo bikes and delivered along optimized multi-stop routes within a defined urban delivery zone.
- 4) Customer reception and confirmation
 - a. Deliveries are completed at customers' homes, with digital confirmation and basic feedback collected where possible.
- 5) Data capture for operational and behavioral analysis
 - a. Key data on order characteristics, routing, delivery times and customer acceptance are recorded to support performance evaluation and digital scenario modelling.

Involved Technologies/Tools

- 1) Electric cargo bikes adapted for grocery delivery, suitable for transporting mixed baskets with varying weight and volume.
- 2) Routing and delivery management software enabling efficient allocation of orders, multi-stop route optimization and real-time monitoring of bike operations.
- 3) Order preparation and handover systems at Intermarché, supporting product picking, staging and seamless transfer to Pick & Smile's delivery workflow
- 4) Digital data collection and simulation tools used to analyze delivery performance, model scalability and assess environmental and operational impacts based on both physical pilot data and digital scenario testing.

Innovative Elements

- 1) First introduction of home delivery by e-cargo bikes within the Pick & Smile network, expanding their service model beyond staffed PUDO points into direct-to-home operations.
- 2) Integration of grocery e-commerce flows from Intermarché, testing how retail orders with higher weight, volume and time sensitivity can be handled through zero-emission transport.
- 3) Combination of operational and behavioral innovation, assessing not only the logistics feasibility of bike-based home delivery but also how customers perceive and respond to a new, greener delivery option.

7.4.2. Organization

Timeline

March 2026 (M20)

- a. Joint planning between Pick & Smile and Intermarché (delivery zones, handover points, operational boundaries).
- b. Routing design for e-cargo home delivery and definition of feasible delivery zones.

- c. Technical and organizational setup: order-handover workflow, scanning, staging procedures.

April 2026 (M21)

- a. Controlled test deliveries with limited order volumes.
- b. Validation of picking/handover/bike-load/home-delivery chain.

May 2026 (M22) - October 2026 (M27)

- a. Full operational pilot: regular e-cargo home deliveries within the selected urban zone.
- b. Continuous collection of delivery performance data (timings, reliability, failed attempts).

November 2026 (M28) - December 2026 (M29)

- a. Consolidation of all physical pilot data.
- b. Joint evaluation and lessons learned on reliability, customer acceptance and operational feasibility.

Stakeholder Involvement

Name and Function	Task/Role
Pick&Smile	Operates riders and vehicles; route planning via SMIL/SMIL@IA; delivery execution; logging operational KPIs; rider observations.
Intermarché	Order preparation and handover; defines product constraints/time windows; operational feedback loop.
Customers who have ordered in PUDDO	Receive groceries; feedback/satisfaction and behavioral response.

Risk and quality management (for pilot operations)

Risk	Description of the risk	Quality assurance mechanism
Operational challenges	Cargo-bike operations may be constrained by capacity, weather, or zones that exceed feasible cycling distances.	Use controlled delivery zones, fallback procedures, and clear operational boundaries for cargo-bike routes.
Service-quality issues	Failed deliveries or mismatches between grocery delivery expectations and bike-based capabilities can reduce service quality.	Close coordination between Intermarché and Pick & Smile to synchronize picking, staging and handover times.
Coordination gaps	Coordination gaps between Intermarché order preparation and Pick & Smile's bike routing and dispatching.	Continuous monitoring of delivery performance and rapid adjustments to routing and time windows.
Data limitations	Data limitations, affecting the ability to analyze performance or model scalability.	Standardized data collection protocols to ensure complete and comparable datasets.

7.5. Securing the pilot results

Nudging and behavioral design

Nudging activities in Lyon target end users at the Part-Dieu XL PUDO interface. The approach focuses on encouraging the uptake and repeat use of reusable packaging, as well as increasing acceptance of greener delivery options through simple, highly visible cues and short, benefit-framed messages.

Several communication variants will be tested, including different visual cues, short message formats, and benefit framing. Outcomes will be monitored through QR-based packaging events and operational logs, supported via SMIL/SMIL@IA.

Baseline measurement

For the first scenario, reusable packaging is not currently in use, meaning the baseline for reusable packaging uptake is zero and will serve as the reference point for measuring changes introduced during the pilot.

For the second scenario, baseline measurement data includes CO2 emissions and tours operated for current van deliveries in Lyon. The pilot compares these metrics against electric cargo bike deliveries.

For the third scenario, baseline measurement data will be sourced from Intermarché operational records for the relevant period.

KPI tracking tool and measurement approach

The KPI framework, including monitoring and pilot measurement, is documented in the Lyon pilot Excel file. The file defines the KPI set, specifies the required data inputs for each KPI, and indicates the measurement frequency (which is also shown in Table 5). A dedicated input sheet is provided for entering new measurement values as they become available. The dashboard visualizes KPI performance over time, enabling continuous monitoring throughout the pilot.

Table 6 KPI overview SustainSwap pilot

Scenario	Category	KPI	Description	Input data	Formula	Unit	Frequency	Measurement
2&3	Environment	Emissions (CO2) per km per vehicle type	Emissions (CO2) per km per vehicle type caused	Total grams of type of pollutant per vehicle type Total number of kilometers driven per vehicle type	Total grams of type of pollutant per vehicle type / total number of kilometers driven per vehicle type	gram	Monthly	0 g of CO2 with eCargo bike, GPS for the kilometers
2&3	Environment	Share of non-fossil fuel vehicles in the fleet	Share of operational vehicles powered entirely by non-fossil energy sources	Number of vehicles in the fleet by type	Number of non-fossil fuel vehicles / total number of vehicles * 100	%	Monthly	0%
2&3	Environment	Share of deliveries made by non-fossil fuel vehicles	Share of stops made by non-fossil fuel vehicles	Number of deliveries (=stops) executed by vehicle type	Number of stops by non-fossil fuel vehicles / total number of stops * 100	%	Monthly	0%
2&3	Environment	Emissions (CO2) per delivery	Emissions (CO2) per stop	Total number of deliveries Total grams of type of pollutant per vehicle type	Total grams of type of pollutant / total number of deliveries (or returns)	gram	Monthly	0% for eCargo bike
1	Environment	Share of returnable and reusable packaging	Percentage of reusable packaging used	Number of returnable and/or reusable packages Total number of packages	Number of returnable or reusable packages / total number of packages * 100	%	Monthly	The delivery of the reusable's packages will be followed
2&3	Economic	Average load factor at the start of the tour by vehicle type	Average load factor at the start of the tour by vehicle type	Weight (or volume?) of packages loaded Permitted weight (available volume?)	Used capacity in volume or weight in tour / total available capacity in volume or weight in tour	No.	Monthly	We have that in our database
2&3	Economic	VKT per delivery	Avg. delivery distance	Total vehicle kilometers travelled Total number of deliveries	Total km traveled / total number of deliveries (or returns)	No.	Monthly	GPS
2&3	Economic	VKT per return	Avg. Distance traveled per return	Total vehicle kilometers travelled Total number of returns	Total km traveled / total number of returns	No.	Monthly	GPS
2&3	Economic	Avg. stops per tour	Avg. stops per tour	Number of stops (per period) Number of tours (per period)	Total number of stops / total number of tours	No.	Monthly	GPS and database
2&3	Economic	Cost per delivery	Cost per delivery	Operational costs per vehicle type Number of deliveries	Total costs / total number of deliveries	EUR	Monthly	Database
2&3	Economic	Cost per return	Cost per return	Operational costs per vehicle type Number of returns	Total costs / total number of returns	EUR	Monthly	Database

1&2&3	Social	Number of parcel pick-up/drop-off points per inhabitant	All pick up points in the area	Number of pick-up/drop-off points in the area	Number of pick-up points / populations in the area	No.	Monthly	Database
1&2&3	Social	Potential accessibility to logistics services	Proximity of roads, subway, shops, train station...	Location of pick-up/drop-off points, population data	Total population within threshold of service point / total population	No.	Monthly	AI Application
1&2&3	Social	Share of costumers ready to adopt sustainable behaviors	Percentage of citizens	Number of citizens that responded positively to adopt sustainable behaviors	Number of customers that chose sustainable delivery / total number of customers * 100	%	Monthly	Intermarché
1	Social	Costumers' expenditure with shipping and returns	Customers' expenditure with shipping	Price of shipping and returns	(total shipping cost + total return cost) / total number of customers	EUR	Monthly	Intermarché
2&3	Social	Ratio between average wage of logistics workers and minimum income	We have national statistics to make the comparison	Wage of logistic workers Total number of logistic workers Minimum income	(total wage logistics workers / number logistics workers) / minimum income	%	Monthly	INSEE
2&3	Social	Share of delivery/pickup tours longer than work journey	Not planed	Duration of tours Duration of work day	Number of tours longer than work day / total number of tours * 100	%	Monthly	Database
2&3	Social	Coefficient of variation in route duration (std/mean of the route duration)	Possible with our GPS	Duration of tours	std of route duration / mean route duration * 100	%	Monthly	GPS

8. GreenRoute – Poznan

8.1. General information

8.1.1. General description of the pilot

GreenRoute is a simulation-based urban logistics pilot developed in Poznań, Poland, aiming to evaluate the environmental, operational and economic performance of alternative last-mile delivery configurations. The pilot builds on the Pick&Smile concept simultaneously tested in Lyon and explores its transferability to the Polish market through a data-driven Urban Logistics Simulation Model.

Unlike physical pilots, GreenRoute operates as a digital decision-support framework that replicates parcel flows, vehicle allocation and customer behavior within a dense urban environment. The model integrates zero-emission delivery solutions, microhub-based consolidation, PUDO (Pick-Up and Drop-Off) systems and reusable packaging circulation into a single analytical environment.

The pilot comprises two complementary scenarios that are analyzed within the simulation framework: the first focuses on sustainable last-mile delivery configurations combining zero-emission vehicles and microhub/PUDO integration, while the second examines behavioral responses to eco-delivery options and their impact on system performance.

8.1.2. Location / Pilot Site

The pilot focuses on the central urban area of Poznań, Poland. Poznań is a major metropolitan city characterized by high delivery density, mixed residential and commercial land use, and increasing pressure on urban space and transport infrastructure.



Figure 4. Pilot area of GreenRoute - Poznań

The study area includes zones with:

- high concentration of B2C deliveries,
- limited street capacity,
- restricted access for conventional vehicles,
- potential Clean Transport Zone regulations.

The simulation model is calibrated using anonymized operational data from a logistics service provider, reflecting real parcel volumes, delivery density and cost structures. Additional operational insights derived from Pick&Smile activities are used to inform selected modelling assumptions and scenario parameters. The pilot represents a typical dense European urban environment with growing demand for sustainable logistics solutions.

8.2. Scenario 1: Sustainable last-mile delivery system (ZE + microhub + PUDO)

8.2.1. Description and objectives

Description

This scenario introduces an integrated sustainable delivery system combining zero-emission vehicles, microhub-based consolidation and partial replacement of door-to-door deliveries with PUDO-based collection.

Within the simulation, parcels are routed through a microhub acting both as a consolidation node and a customer collection point. Deliveries are performed using a mix of electric cargo bikes and electric vans, prioritized according to parcel characteristics, delivery density and access restrictions.

The system dynamically reallocates deliveries between home delivery and PUDO based on assumed customer adoption rates. This approach enables testing of how consolidation, electrification and behavioral shifts jointly influence logistics performance.

Objectives

1. **CO₂ emission reduction** - to assess the potential reduction of greenhouse gas emissions using cargo bikes, electric vans and reduced vehicle kilometers in dense urban areas.
2. **Operational efficiency** - to evaluate how microhub consolidation and PUDO integration affect route density, number of stops, fleet utilization and delivery performance.
3. **System optimization** - to test a multi-criteria vehicle allocation algorithm balancing cost, emissions and operational constraints.

4. **Economic feasibility** - to analyze cost implications of combined zero-emission delivery and consolidation strategies compared to conventional van-based delivery.
5. **Scalability and replicability** - to identify conditions under which the integrated model can be scaled to other Polish or European cities.

Alignment with project objectives

Project objective	Alignment
S01 Consolidate knowledge on attractive zero-emission delivery and return options, and successful behavioral interventions leading to greener choices	The pilot evaluates zero-emission delivery configurations (cargo bikes, electric vans) and provides quantitative evidence on their environmental and operational performance in an urban context.
S02 Co-develop solutions with diverse stakeholders, combining behavioral interventions and delivery and return options, testing them through pilots that cover relevant e-commerce markets and cultures	The pilot integrates logistics operators, municipal stakeholders and consumer behavior analysis, reflecting real-world e-commerce conditions in Poland.
S04 Develop replicable and scalable processes for retailers and LSPs, supporting them to provide consumers with accurate information regarding environmental footprints.	The simulation model generates scalable operational insights and supports development of replicable sustainable logistics solutions for LSPs and cities.

Expected results

1. **Environmental:** Significant reduction of CO₂ emissions per parcel compared to baseline scenario, especially in high-density central areas.
2. **Economic:** Moderate increase or neutral impact on cost per parcel due to improved route efficiency and consolidation.
3. **Operational:** Improved route density, reduced number of deliveries stops and increased utilization of zero-emission vehicles.

Process Description

The process is structured as a sequence of interconnected modelling steps that replicate the full operational logic of an urban last-mile logistics system. Rather than simulating isolated delivery routes, the model reproduces the complete parcel lifecycle, from initial allocation to final delivery or customer pick-up.

Step 1: Input data preparation and system initialization

The simulation begins with the integration of multiple datasets, including anonymized parcel flow data, spatial information on delivery zones, vehicle fleet characteristics, cost

parameters and emission factors. The urban area is divided into delivery zones reflecting real spatial structure, including high-density central areas and zones with restricted access. Parcel demand is generated based on observed distribution patterns, including both deliveries and returns.

Step 2: Parcel flow generation and classification

Parcels are introduced into the system as individual units characterized by attributes such as weight, size, destination, delivery time constraints and eligibility for PUDO delivery. The model simultaneously generates forward (delivery) and reverse (return and pick-up) flows, ensuring that vehicles operate under realistic mixed-load conditions. Parcels are dynamically grouped based on spatial proximity and delivery windows.

Step 3: Allocation of parcels to delivery channels (door-to-door vs PUDO)

A share of parcels is probabilistically assigned to the PUDO channel based on predefined adoption rates derived from behavioral analysis. The remaining parcels are assigned to traditional home delivery. For PUDO parcels, the model routes shipments to the microhub, where they are consolidated and made available for customer collection. This step directly influences downstream routing complexity and stop density.

Step 4: Multi-criteria vehicle allocation

Each parcel (or parcel cluster) is assigned to a vehicle type using a multi-criteria optimization algorithm.

The allocation considers:

- parcel characteristics (size, weight),
- delivery density and location,
- distance from the microhub,
- access restrictions,
- vehicle capacity and availability,
- operational cost and emission intensity.

The algorithm prioritizes cargo bikes in dense central areas and restricted zones, assigns electric vans to medium-load routes, and uses diesel vans only as a fallback benchmark. The allocation is recalculated iteratively to ensure efficient capacity utilization.

Step 5: Route construction and optimization

Based on the assigned vehicle types, the model generates delivery routes using optimization logic that balances route length, number of stops and vehicle capacity. Routes are constructed separately for each vehicle type but remain interdependent through shared demand and spatial constraints. The presence of PUDO reduces the number of door-to-door stops and allows for more compact route structures, especially in high-density areas.

Step 6: Microhub operations and consolidation logic

The microhub acts as a central node where inbound parcels are sorted and consolidated before last-mile distribution. For PUDO deliveries, parcels are stored at the hub until

collected by customers. For delivery routes, the hub serves as the starting and ending point for vehicles, enabling cross-docking and consolidation of flows. The model tracks hub utilization, throughput and its impact on route efficiency.

Step 7: Simulation of delivery execution and reverse logistics

The model simulates daily operations, including delivery execution, customer pick-ups at PUDO, and collection of returns and reusable packaging. Vehicles operate under realistic constraints such as working time, capacity limits and route sequencing. Reverse logistics flows are integrated into delivery rounds, influencing vehicle load factors and route design.

Step 8: Dynamic system adjustment

The simulation iteratively adjusts routing and vehicle allocation in response to changing conditions, such as different PUDO adoption levels, demand fluctuations or fleet configurations. This dynamic feedback loop allows the model to capture systemic effects, such as how increased PUDO usage reduces stop density and enables higher utilization of cargo bikes.

Step 9: Performance calculation and output generation

For each simulation run, the model calculates a comprehensive set of performance indicators, including:

- total and per-parcel CO₂ emissions,
- vehicle kilometer's travelled,
- number of delivery stops,
- fleet utilization rates etc.... (For a detailed KPI matrix look Table 6 KPI overview GreenRoute pilot)

These outputs are compared across scenarios to identify trade-offs.

Involved Technologies/Tools

- Urban Logistics Simulation Model
- Multi-criteria optimization algorithm
- Spatial datasets and GIS modelling
- Emission and cost calculation modules

Innovative Elements

The scenario introduces a fully integrated system approach combining electrification, consolidation and behavioral elements within one simulation environment. The use of a digital model allows testing complex logistics configurations without real-world implementation risk.

8.2.2. Organization

Timeline

January 2026 (M18) – April 2026 (M21)

a. Data collection and model preparation

April 2026 (M21) - July 2026 (M24)

- a. Model development and initial simulations
- b. Intermediate evaluation

July 2026 (M24) - December 2026 (M29)

- a. Advanced scenario testing
- b. Final evaluation and recommendations

Stakeholder Involvement

Name and Function	Task/Role
Łukasiewicz - Poznański Instytut Technologiczny (LPIT)	Pilot coordination, model development and simulation analysis
Pick&Smile	Logistics expertise, operational data provision and validation
City of Poznań	Policy alignment and urban mobility input
Econsult	Evaluation support and KPI analysis

Risk and quality management (for pilot operations)

Risk	Description of the risk	Quality assurance mechanism
Limited data availability	Restricted access to operational data	Data anonymization and aggregation
Unrealistic modelling assumptions	Model may not reflect real constraints	Validation with stakeholders and real data
Over-optimization	Environmentally optimal but costly solutions	Multi-objective optimization (cost + emissions)
Spatial inaccuracies	Incorrect representation of delivery zones	Use of validated GIS datasets

8.3. Scenario 2: Behavioral adoption of eco-delivery options

8.3.1. Description and objectives

Description

This scenario analyses customer behavior in relation to eco-delivery options using simulated e-commerce checkout environments. Different interface designs present delivery options with varying levels of environmental information, pricing and incentives.

The results are used to estimate customer adoption rates of sustainable delivery options and integrate them into the Simulation Model to assess system-level impacts.

Objectives

- 1) **Behavioral understanding** – to analyze how customers perceive eco-delivery options and what factors influence their choices.
- 2) **Adoption rate estimation** – to determine the share of customers willing to choose sustainable delivery under different conditions.
- 3) **Incentive effectiveness** – to test the impact of pricing, labels and information on customer decisions.
- 4) **System impact integration** – to link behavioral outcomes with operational and environmental performance.
- 5) **Policy relevance** – to provide insights into how behavioral interventions can support sustainable logistics.

Alignment with project objectives

Project objective	Alignment
S01 Consolidate knowledge on attractive zero-emission delivery and return options, and successful behavioral interventions leading to greener choices	The pilot analyses behavioral responses to eco-delivery and contributes knowledge on user acceptance.
S02 Co-develop solutions with diverse stakeholders, combining behavioral interventions and delivery and return options, testing them through pilots that cover relevant e-commerce markets and cultures	It integrates behavioral experiments with logistics modelling, reflecting real e-commerce decision contexts.
S05 Develop guidelines for data visualization which can incentivize smaller e-commerce footprints for deliveries and returns.	Provides insights for designing effective communication and nudging strategies for sustainable choices.

Expected results

- 1) **Environmental:** Increased adoption of eco-delivery leading to indirect emission reductions.
- 2) **Economic:** Identification of acceptable price differences for sustainable delivery.
- 3) **Social:** Improved understanding of customer preferences and barriers.

Process Description

The behavioral testing process is designed to replicate realistic e-commerce decision-making conditions and to generate empirically grounded parameters for the simulation model.

Step 1: Design of checkout interfaces

A set of digital mock-ups is developed to simulate standard e-commerce checkout environments. These interfaces present multiple delivery options, including conventional delivery and eco-delivery alternatives.

Variants differ in terms of:

- labelling (e.g. “Eco delivery”),
- visibility of environmental information (e.g. CO₂ emissions),
- pricing structure,
- presence of incentives (discounts, loyalty points),
- visual elements (e.g. green labels or icons).

Step 2: Experimental setup (A/B testing)

Different interface versions are tested using controlled A/B experiments. Participants are randomly assigned to different interface variants to isolate the impact of specific elements such as pricing, framing or information display on their choices.

Step 3: User interaction and choice recording

Participants interact with the simulated checkout environment in a realistic purchase scenario.

Their delivery choices are recorded, including:

- selected delivery option,
- response time,
- switching behavior between options.

This step ensures that decisions reflect actual behavioral patterns rather than purely declarative preferences.

Step 4: Complementary survey and attitudinal data collection

In parallel, structured surveys are conducted to capture:

- attitudes towards sustainability in delivery,
- perceived importance of environmental impact,
- tolerance for price differences and delivery delays,
- trust in eco-labelling and logistics providers.

This allows linking observed behavior with underlying motivations.

Where relevant, insights from the Lyon pilot, including customer feedback on PUDO usage and reusable packaging routines operated by Pick&Smile, will be used to complement and contextualize the behavioral findings.

Step 5: Behavioral analysis and modelling

Collected data are analyzed to identify:

- adoption rates of eco-delivery under different conditions,
- sensitivity to price and incentives,
- impact of information and framing effects.

Statistical and behavioral models are used to estimate decision probabilities and segment customer groups.

Step 6: Integration into the simulation model

The derived behavioral parameters (e.g. percentage of customers choosing eco-delivery under given conditions) are integrated into the Urban Logistics Simulation Model. These parameters directly influence:

- the share of parcels assigned to PUDO vs home delivery,
- demand patterns affecting routing and vehicle allocation,
- overall system performance.

These parameters may also be interpreted in light of behavioral patterns observed in the Lyon pilot, particularly regarding customer interaction with PUDO services and reusable packaging solutions.

Step 7: Iterative feedback and scenario testing

The simulation model uses behavioral outputs to test different adoption scenarios (e.g. low, medium, high uptake). Results are iteratively analyzed to assess how behavioral change translates into environmental and operational impacts.

Involved Technologies/Tools

- Interface mock-ups (checkout simulations)
- Survey tools
- Behavioral experiment frameworks
- Data analysis tools

Innovative Elements

The scenario integrates behavioral science with logistics modelling, allowing direct linkage between customer choices and system-level logistics performance.

8.3.2. Organization

Timeline

Parallel to Scenario 1:

- Development of mock-ups (early phase)
- Testing and data collection (mid phase)
- Integration into simulation (final phase)

Stakeholder Involvement

Name and Function	Task/Role
LPIT	Design of behavioral experiments and data analysis
Pick&Smile	Input on delivery options and operational realism
Consumers	Participation in behavioral testing
Econsult	Evaluation and interpretation of results

Risk and quality management (for pilot operations)

Risk	Description of the risk	Quality assurance mechanism
Low participation	Insufficient behavioral data	Incentivized participation and multiple test rounds
Bias in responses	Unrealistic decision-making	Realistic interface design
Uncertain adoption rates	High variability in behavior	Scenario-based modelling

8.4. Securing the pilot results

Nudging and behavioral design

Nudging activities in the Poznań pilot are implemented within the behavioral scenario through simulated e-commerce checkout interfaces. The approach focuses on encouraging the selection of eco-delivery options, particularly those associated with lower emissions (e.g. PUDO-based delivery or zero-emission transport), by influencing how delivery options are presented to customers.

Several interface variants will be tested, including:

- different labelling strategies (e.g. “Eco delivery”, “Green choice”),
- presentation of CO₂ emission information,
- comparison between standard and eco-delivery options,
- visual cues (icons, color coding),
- small financial incentives (discounts, loyalty points).

The objective is to assess how framing, visibility and incentives influence customer decision-making at the point of purchase. Outcomes will be monitored through controlled A/B testing environments, user interaction data and survey-based feedback. The results will be translated into behavioral parameters (e.g. adoption rates), which are subsequently integrated into the simulation model.

Baseline measurement

For the first scenario (sustainable last-mile delivery system), the baseline reflects the current conventional delivery structure in Poznań, characterized by:

- predominance of diesel vans,
- door-to-door delivery model,
- no microhub-based consolidation,
- no PUDO-based delivery substitution,
- no behavioral influence on delivery choice.

Baseline indicators include CO₂ emissions, vehicle kilometer’s travelled, cost per parcel, fleet utilization and number of delivery stops. These values serve as a reference point for evaluating the impact of alternative configurations involving zero-emission vehicles, microhub integration and PUDO adoption.

For the second scenario (behavioral adoption of eco-delivery), the baseline assumes that:

- customers are not exposed to eco-delivery options or environmental information,
- delivery choices are made without behavioral interventions,
- adoption of sustainable delivery options is negligible or limited to default system conditions.

This baseline allows for measuring the effect of different interface designs, information transparency and incentives on customer behavior and delivery choice.

KPI tracking tool and measurement approach

The KPI framework for the Poznań pilot is based on outputs generated by the Urban Logistics Simulation Model combined with empirical data from behavioral experiments. The framework defines a set of environmental, economic and social indicators, along with required input data and measurement frequency and to which scenario the KPI corresponds. The detailed KPI overview is shown in Table 6.

A structured monitoring tool (Excel-based dashboard) is used to:

- input simulation results and behavioral data,
- calculate KPI values,
- compare baseline and scenario outcomes,
- visualize performance over time and across configurations.

This integrated approach enables continuous assessment of both operational and behavioral dimensions of the pilot and supports identification of balanced, scalable solutions for sustainable urban logistics.

Table 7 KPI overview GreenRoute pilot

Category	KPI	Description	Input data	Formula	Unit	Measurement
Environment	Emissions (CO ₂ , CO, NO _x , SO _x , PM ₁₀ , PM _{2.5}) per km per vehicle type	Emissions (CO ₂) per km per vehicle type caused	Fuel consumption per vehicle type Emission (CO ₂) per l of fuel VKT per vehicle type	Total grams of type of pollutant per vehicle type / total number of kilometers driven per vehicle type	gram	Information by LSP, calculated (with reference data)
Environment	Share of non-fossil fuel vehicles in the fleet	Share of operational vehicles powered entirely by non-fossil energy sources	Number of vehicles in the fleet by type	Number of non-fossil fuel vehicles / total number of vehicles * 100	%	Information by LSP
Environment	Share of deliveries made by non-fossil fuel vehicles	Share of stops made by non-fossil fuel vehicles	Number of deliveries (=stops) executed by vehicle type	Number of stops by non-fossil fuel vehicles / total number of stops * 100	%	Information by LSP/Calculated
Environment	Emissions (CO ₂ , CO, NO _x , SO _x , PM ₁₀ , PM _{2.5}) per delivery	Emissions (CO ₂) per stop	No of stops, VKT per vehicle type Total fuel consumption per vehicle type and period	Total grams of type of pollutant / total number of deliveries (or returns)	gram	Information by LSP/ Calculated with reference data
Economic	VKT per delivery/return	Avg. delivery distance	Total VKT travelled Total number of deliveries	Total km traveled / total number of deliveries (or returns)	No.	Information by LSP
Economic	Avg. stops per tour	Avg. stops per tour	Number of stops (per period) Number of tours (per period)	Total number of stops / total number of tours	No.	Information by LSP
Economic	Average load factor at the start of the tour by vehicle type	Average load factor at the start of the tour by vehicle type	Weight (or volume?) of packages loaded Permitted weight (available volume?)	Used capacity in volume or weight in tour / total available capacity in volume or weight in tour	No.	Information by LSP
Economic	Average vehicle speed	Average speed per vehicle	- Total VKT travelled per vehicle - Total delivery time per vehicle (time from departure to return)	Total VKT travelled / Total delivery time	km/h	Information by LSP
Economic	Average delivery time	Average delivery time per tour	- Delivery time per tour (time from departure to return for delivery tours) - Number of tours	Total delivery time / Number of tours	h	Information by LSP
Social	Number of parcel pick-up/drop-off points per inhabitant	All pickup points in the pilot area	Number of pick-up/drop-off points in the study area	Number of points / inhabitant	No.	Information by LSP/ Calculated
Social	Customer satisfaction (%)	Measuring customer interest by analysing survey participation and result	- number of returned questionnaires - total number of questionnaires - 1-5 score (average)	- (Number of returned questionnaires/ total number of questionnaires)*100 - 1-5 score (average)	%	Survey
Social	Customer satisfaction (Score)	Measuring customer interest by analysing survey participation and result	- number of returned questionnaires - total number of questionnaires - 1-5 score (average)	- (Number of returned questionnaires/ total number of questionnaires)*100 - 1-5 score (average)	Score	Survey

9. Digital Pilots

Digital piloting is used in GreenTurn to complement the physical pilots by enabling transversal analysis and controlled testing that cannot be achieved through city-based implementation alone. While physical pilots test concrete delivery configurations under local operational and regulatory conditions, the digital pilot operates across pilots and abstracts from individual locations to analyze mechanisms that recur across different settings.

Data generated in the physical pilots is used primarily to provide operational context, boundary conditions and realistic input ranges. Within this context, the digital pilots provide a controlled environment in which scenarios can be tested that would be impractical or disruptive to implement in real-life operations. In particular, the digital pilot enables the exploration of both demand-side and supply-side variations. On the demand side, this includes testing different levels and spatial distributions of demand, as well as alternative customer behaviors (e.g., choice of delivery options or time slots). On the supply side, different operational configurations can be assessed, such as variations in fleet composition or routing strategies. This approach supports the interpretation of physical pilot experiences, enables the discussion of scalability beyond individual pilot boundaries, and allows demand-side and supply-side mechanisms to be analyzed in a consistent and controlled manner.

Demand-side variations focus on freight demand management mechanisms that influence consumers' choice of when and how deliveries take place. In the physical pilots, consumers are exposed to different delivery options, levels of flexibility and, in some cases, incentives and nudges. However, the operational implications of these choices depend not only on individual decisions but on how they aggregate across time and space. The demand-side digital scenario addresses this by analyzing consumer-led flexibility as an input to freight system organization, allowing assessment of how voluntary delivery coordination and consolidation may affect delivery patterns under different contexts.

Supply-side variations focus on operational constraints and configuration choices associated with vehicle fleets, including vehicle type, battery capacity, routing structure and charging requirements. Although the physical pilots provide insight into the real-world operation of zero-emission vehicles, they are necessarily limited to specific fleet choices and local conditions. The digital pilots address this limitation by providing a controlled environment in which alternative fleet and routing configurations can be explored using realistic demand contexts. This makes it possible to analyze how operational performance is affected by vehicle constraints and to examine how changes on the demand side, such as increased consolidation or delivery flexibility, interact with supply-side feasibility.

8.1 Freight demand management and consumer choices

9.1.1. Description and objectives

The focus is on how choices made by customers, such as selection between delivery options, acceptance of delivery flexibility or response to incentives, affect the temporal and spatial organization of last-mile deliveries and, in turn, overall system performance.

The digital pilot simulation is transversal to the physical pilots and uses delivery data and customer interactions observed in selected physical pilots as contextual input to analyze how similar choice mechanisms influence freight systems across different settings. In this way, customer decisions are treated as system inputs that shape demand patterns, rather than outcomes evaluated in isolation.

In addition to pilot data, the simulation can also draw on the consumer survey (Deliverable D2.4) conducted across all project countries, in which choice modelling was used to analyze preferences between alternative delivery options. The survey results are used to inform and bound assumptions on customer response to delivery service design and nudging, providing a consistent behavioral context across pilots.

Within the demand-side concept, two closely linked components are combined. The first analyses observed customer responses to different delivery service options, pricing structures and choice architectures offered during the physical pilots, supported by insights from the survey-based choice modelling. The second builds on these inputs to explore freight demand management strategies that rely on customer participation, including consumer-led consolidation, delivery day selection and other forms of coordinated demand. The purpose of these two convergent angles is to assess how individual choices aggregate into demand patterns that influence consolidation potential, routing structure and delivery efficiency.

Objectives

General Objectives

- 1) Analyze how customer choices in response to consumer-facing delivery service design influence the temporal and spatial distribution of freight demand in last-mile operations.
- 2) Assess the role of freight demand management mechanisms based on customer participation in shaping delivery patterns and system performance.

Specific Objectives

- 1) Use observed delivery choices from the physical pilots, together with survey-based choice modelling results (Deliverable D2.4), to inform and bound assumptions on customer response to delivery options, incentives and nudging mechanisms.
- 2) Examine how individual customer choices aggregate across time and space and how this aggregation influences consolidation potential, routing structure and delivery efficiency.

- 3) Assess the impact of different levels of customer participation in freight demand management strategies, including delivery day selection and consumer-led consolidation, on delivery patterns and vehicle kilometers travelled.
- 4) Generate demand-side insights that can be considered alongside supply-side digital analyses in the overall interpretation of digital piloting results.

Expected results

Hypotheses

- 1) Customer delivery choices, when aggregated across many orders, shape freight demand patterns at the system level, leading to demand structures that differ from those implied by fixed or operator-driven delivery schedules.
- 2) Given empirically bounded customer willingness to trade off price, timing, or flexibility, specific demand-side nudges can be designed such that resulting choice shifts lead to improved freight system outcomes through enhanced consolidation and routing efficiency.

Expected results

- 1) Identification of demand-side nudges that are linked to measurable improvements in freight system performance across different urban contexts.
- 2) Clarification of the conditions under which customer choice and voluntary flexibility move from being marginal effects to becoming system-relevant inputs for freight demand management.
- 3) Translation of demand-side mechanisms into system-level outcomes that can inform policy discussions on non-mandatory measures (such as incentives, default options or information-based nudges).

9.2. Supply-side operations and green fleet configurations

9.2.1. Description and objectives

The supply-side concept focuses on how last-mile delivery operations are affected by the introduction of green vehicle fleets. The analysis considers how factors such as vehicle range, charging requirements, payload limitations and service time characteristics shape delivery system performance under different operating conditions.

The digital pilot simulations are transversal to the physical pilots and uses operational data and delivery structures observed in selected physical pilots as contextual input to explore how green fleet configurations perform across a range of urban delivery contexts. In this way, the simulations abstract from specific local implementations and focuses on operational mechanisms that are common across settings.

The supply-side simulations treat fleet configuration and operational management as key decision layers. Green vehicles are analyzed as part of an operational system that includes fleet composition, deployment strategy and operational practices. This allows examination of how different configurations and management choices influence feasibility and performance under comparable demand conditions.

The digital pilots also consider variation in demand structure as an external condition affecting operations. Without assuming coordination with demand-side measures, alternative demand patterns are used to test how sensitive green fleet operations are to changes in spatial and temporal demand distribution. This supports the assessment of when operational constraints become binding and when green fleet deployment remains robust across contexts.

Objectives

Main objectives

- 1) Analyze how the introduction of green vehicle fleets affects last-mile delivery operations under different operational and demand contexts.
- 2) Assess the role of fleet configuration and operational management choices in shaping the feasibility and performance of green fleet deployments.

Specific objectives

- 1) Examine how operational constraints associated with green vehicles (e.g. range, charging, payload, service time) influence delivery system performance under realistic operating conditions.
- 2) Analyze how different fleet configurations and operational management choices affect the performance of green fleets across varying urban delivery contexts.
- 3) Assess the sensitivity of green fleet feasibility and performance to changes in demand structure, without assuming modifications to vehicle technology.
- 4) Generate supply-side insights that can be considered alongside demand-side digital analyses in the overall interpretation of digital piloting results.

Expected results

Hypotheses

- 1) Green vehicle fleets introduce operational constraints (e.g. range, charging, payload, service time) that alter delivery system performance compared to conventional fleet configurations, even when demand patterns remain unchanged.
- 2) The operational performance of green vehicle fleets depends primarily on fleet configuration and operational management choices, rather than on vehicle technology characteristics alone.
- 3) The feasibility and performance of green fleet operations vary with the structure of demand (e.g. spatial concentration, temporal distribution), such that identical fleet configurations can lead to different outcomes under different demand contexts.

Expected results

- 1) Identification of demand and operational conditions under which green vehicle fleets can be deployed without significant loss of performance, and conditions under which operational constraints become binding.
- 2) Demonstration that differences in green fleet performance across contexts are driven largely by configuration and management decisions, rather than by vehicle technology in isolation.
- 3) Clarification of when green fleet operations can be scaled using existing operational practices and when broader system adjustments are required.

- 4) Framing of operational findings in a way that informs policy discussions on fleet transition, highlighting when vehicle substitution alone is insufficient and when complementary measures may be necessary

10. Conclusions

This deliverable defines the implementation set-up for the GreenTurn pilots and the approach for monitoring them in a structured and comparable way. It is intended as a practical reference for pilot partners, covering what will be tested, where it will take place, who is involved, and how implementation and data capture will be organized.

Across the pilot sites, the operational contexts differ, but the pilots are aligned through a shared monitoring logic. The cross-pilot comparison is structured around a common set of environmental, economic, and social metrics, defined in a way that supports comparison despite differences in scale and operating context. In particular, results are captured as shares within each pilot's own scope or relative to an appropriate baseline, rather than as absolute totals.

The strength of the results will largely come down to doing the pilots in a consistent way and collecting data reliably throughout. For each site, roles and processes are set out, together with risk and quality measures, to help keep operations stable during the pilot period and to make sure the necessary monitoring data is recorded. Detailed KPI definitions and input formats are handled through the pilot-specific KPI tracking files, which also support continuous monitoring through dashboards.

The pilots themselves cover a range of e-commerce logistics segments and intervention types. Vienna focuses on B2C parcel distribution with circular packaging practices at the hub and low-emission last-mile delivery by electric scooter. Athens focuses on B2B distribution and returns, using electric vans and coordinated routing and time slots. Zaragoza centers on municipal markets and low-emission deliveries supported by a platform and sustainability incentives to influence uptake. Lyon links reusable packaging and zero-emission cargo-bike logistics across pickup point operations and grocery home delivery, and also includes consumer-facing nudging to increase reuse and acceptance of greener delivery choices.

The deliverable also positions the digital pilots as a complement to field testing. By simulating a small set of relevant scenarios per site, the project can test sensitivities that are hard to observe in daily operations alone, such as scaling volumes, expanding service areas, and changes in customer choice and uptake. This supports interpretation of the physical pilot results.

With this framework in place, the next step is to launch the physical and digital piloting activities. During implementation, pilot partners can use this deliverable as the main reference for roles, processes, and boundary conditions, and use the KPI tracking files to monitor progress and performance in a consistent way across the pilot period.



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