(Projects funded under the Call 2014 onwards must use this format)

LIFE Project Number

LIFE17 ENV/GR/000215

Final Report

Covering the project activities from 01/09/2018 to 30/04/2023

Reporting Date

25/07/2023

LIFE PROJECT NAME or Acronym

LIFE GreenYourRoute: A European innovative logistic platform for last mile delivery of goods in urban environment

Data Project

Project location:	Czech Republic, Greece, Italy
Project start date:	01/09/2018
Project end date:	30/04/2023
Total budget:	€ 2,191,237
EU contribution:	€ 1,300,879
(%) of eligible costs:	60%

Data Beneficiary

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This table comprises an essential part of the report and should be filled in before submission

Please note that the evaluation of your report may only commence if the package complies with all the elements in this receivability check. The evaluation will be stopped if any obligatory elements are missing.

Package completeness and correctness check	
Obligatory elements	**✓ or N/A**
Technical report	
The correct latest template for the type of project (e.g. traditional) has been followed and all sections have been filled in, in English *In electronic version only*	✓
Index of deliverables with short description annexed, in English *In electronic version only*	✓
Final report: Deliverables not already submitted with the MTR annexed including the Layman's report and after-LIFE plan Deliverables in language(s) other than English include a summary in English *In electronic version only*	✓
Financial report	
The reporting period in the financial report (consolidated financial statement **and** financial statement of each Individual Beneficiary) is the same as in the technical report with the exception of any terminated beneficiary for which the end period should be the date of the termination.	✓
Consolidated Financial Statement with all 5 forms duly filled in and signed and dated *Electronically Q-signed or if paper submission signed and dated originals* and in electronic version (pdfs of signed sheets + full Excel file)*	✓
Financial Statement(s) of the Coordinating Beneficiary, of each Associated Beneficiary and of each affiliate (if involved), with all forms duly filled in (signed and dated). The Financial Statement(s) of Beneficiaries with affiliate(s) include the total cost of each affiliate in 1 line per cost category. *In electronic version (pdfs of signed sheets + full Excel files) + in the case of the Final report the overall summary forms of each beneficiary electronically Q-signed or if paper submission, signed and dated originals**	✓
Amounts, names and other data (e.g. bank account) are correct and consistent with the Grant Agreement / across the different forms (e.g. figures from the individual statements are the same as those reported in the consolidated statement)	✓
Mid-term report (for all projects except IPs): the threshold for the second pre-financing payment has been reached	N/A
Beneficiary's certificate for Durable Goods included (if required, i.e. beneficiaries claiming 100% cost for durable goods) *Electronically Q-signed or if paper submission signed and dated originals* and in electronic version (pdfs of signed sheets)*	N/A
Certificate on financial statements (if required, i.e. for beneficiaries with EU contribution ≥750,000 € in the budget) *Electronically Q-signed or if paper submission signed original and in electronic version (pdf)*	N/A
Other checks	
Additional information / clarifications and supporting documents requested in previous letters from the Agency (unless already submitted or not yet due) *In electronic version only*	N/A
This table, page 2 of the Mid-term / Final report, is completed - each tick box is filled in *In electronic version only*	✓

**signature by a legal or statutory representative of the beneficiary / affiliate concerned*

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2. List of key-words and abbreviations

API	Application Programming Interface
BMC	Business Model Canvas
CH_4	Methane
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CP	Check Point
CSR	Corporate Social Responsibility
EA	External Assistant
EC	European Commission
EES	Environmental Externality Score
ERP	Enterprise Resource Planning
ETV	Environmental Technology Verification
EU	European Union
FC	Fuel Consumption
GYR	GreenYourRoute
KPI	Key Project-level Indicators
MoU	Memorandum of Understanding
N_2O	Nitrous Oxide
NH_3	Ammonia
NO_x	Nitrogen Oxides
PA	Partnership Agreement
PM	Particulate Matter
PSC	Project Steering Committee
SME	Small and medium-sized enterprise
SO_2	Sulfur Dioxide
TSP	Travelling Salesman Problem
UI	User Interface
VOC	Volatile Organic Compounds
VRP	Vehicle Routing Problem

3. Executive Summary (maximum 2 pages)

LIFE GreenYourRoute (LIFE GYR) was a project implemented from September 2018 to April 2023, under the coordination of the Department of Mechanical Engineering of the University of Thessaly (UTH), Greece, with the participation of CHAPS and CEDA both IT companies located in Czech Republic, MILITOS a consulting company, ATHINAKI, PLUS, and KOUKOUZELIS 3PL companies located in Greece and ITACA IT company located in Italy.
The objectives of LIFE GYR were to contribute to the implementation of EU emission reduction commitments under UNFCCC Kyoto Protocol and the specific objectives of the LIFE climate action sub-programme, as set out in Article 10 of the LIFE regulation, by reducing in the frame of the project GHG and non-GHG emissions by developing and demonstrating a European innovative logistic platform for last mile delivery of goods in urban environment, promoting green logistics and raising awareness regarding the socioeconomic and environmental benefits of the green routing planning.
To this scope, GYR service, an innovative verified with ISO 14034: 2016 logistic platform for last mile green delivery, available through web and mobile apps was developed, to assist logistics companies in creating in a daily base their routing plans minimizing environmental impact and operational cost. In parallel, awareness on green logistics was raised through several dissemination and communication activities with the vivid participation of stakeholders. LIFE GYR not only delivered an innovative logistic platform for last mile green delivery, but also two fully transferable and replicable web services available via APIs, i.e. a novel emission calculation API and a novel optimization algorithm API for green vehicle routing. Moreover, a novel emission calculation model and a routing planning optimization algorithm for calculating the greenest and cheapest routing plans of logistics companies were developed, which are easy to be introduced by other routing planning providers and have already been replicated into the routing planning service provided by one of the associated beneficiaries (i.e. ITACA). The abovementioned web services are organized in such a way to help other engineers and developers reuse the developed material as well as extend it to similar contexts and are accompanied by manuals accommodating their extensibility and reusability.
GYR Company, which became the official provider of GYR service, was established in Greece on August 2021. In total, 10 contracts are signed between GYR Company and 10 SMEs located in Czech Republic, Greece and Italy which use GYR service in a daily base. The starting date of the contracts was the first date after the end of the project and their duration is for at least 3 years. Five between these 10 SMEs were associated beneficieries of the project and the other 5 SMEs found via networking and dissemination activities implemented in the frame of the project. GYR service was fully integrated and demonstrated successfully for a period of 17 months into the operational business environment of the SMEs previously associated beneficiaries of the project and for a period of 7 months to 3 between the 5 SMEs signed contracts with GYR company.
Dr. Saharidis, successfully became an external member of the national (Greece) committee's board of logistics and supply chain. This privileged position enables Dr. Saharidis to actively participate in their meetings and advocate for green supply initiatives associated with the LIFE GYR project. A report including recommendations for updating Greek legislation was well prepared, presented and delivered by Dr. Saharidis to the appropriate committee which consults the Greek parliament for the new law of logistics.
The developed service (i.e. GYR service) and the other outcomes of the project were disseminated and communicated through several channels. The project's website was the official communication tool, where all dissemination material was hosted and communicated through several social media accounts developed for the purposes of the project. For the dissemination of the project, electronic means, such as videos, newsletters, and webinars were favoured, to keep the project's environmental footprint as low as possible. Very few other from

electronic dissemination material was produced, such as notice boards, flyers and promotional giveaway items. Communication activities were directed to SMEs and authorities. SMEs and authorities were reached through networking activities, workshops, webinars and personal visits, in order to guarantee their co-operation in the GYR platform development and the promotional activities needed to disseminate it. In total 3 workshops were well organized in Greece and 3 workshops in Czech Republic increasing the dissemination of the outcomes of GYR project. The 3 workshops in Greece were fully successful with immediate results such as the signature of 5 contracts with 5 new users of the GYR service. One workshop has been organized also in Italy. More than 100 persons on average participated to which electronic questioners were distributed. In total 43 policy makers answered the questioners distributed electronically. Additionally, 23 webinars was organized, presenting GYR service, training potential users, and highlighting marketing and business development activities linked to the GYR platform. The overall quality of the web app was evaluated via the questioners by the managers of the SMEs with the highest score (i.e. 5/5) by the 90.1% of the users and with 4/5 by the rest 9.9% and the overall quality of the mobile app evaluated by the drivers of the SMEs with the highest score (i.e. 5/5) by the 90.8% of the users and with 4/5 by the rest 9.2%.

To assess the environmental and socio-economic impact of the project and consequently the effectiveness of the developed innovative platform two monitoring protocols have been developed, the first one for the assessment of the environmental impact of the project and the second one for the socio-economic assessment impact. In total, more than 880.000 kilometers travelled were saved, more than 1600 routes were avoided and more than 1,570 tns of fuel were saved. In addition, more than 4,900 tns of CO2, 150kg of CH4, 18,200 kg of CO, 98kg of N2O, 31kg of NH3, 39tn of NOx, 480kg of PM, 2000kg VOC and 101 kg of SO2 were saved as well. One of the major deviations of the project was the partial achievement of the environmental impact of the real life demonstration period. Even if the real life demonstration period was prolonged by 5 months, due to a wrong calculation and a wrong assumption the 55.87% of CO2, 1.77% of CH4, 24.98% of CO, 1.70% of NH3, 92.57% of NOx, 10.40% of PM,19.04% of VOC, and 1.25% of SO2 savings were achieved.

Another issue encountered was that COVID-19 pandemic introduced several difficulties in the project implementation due to remote work or unsynchronized work in some cases resulting a prolongation of the project for 14 months. The implementation of several tasks during the COVID-19 pandemic required more effort, thus more working hours, due to cases of unsynchronized working and reduced productivity in cases of working from home. Differences in curfew periods between Greek, Czech and Italian beneficiaries participating in implementation actions of GYR platform affected the technical team members' availability, thus resulting in further delays. These actions required strong collaboration, continuous feedback between all participants, direct contact, and immediate response to occurring issues. Proper coordination of the process was impossible with all these unexpected changes in the beneficiaries' working environments.

Moreover, GYR team faced obstacles in the Environmental Technology Verification (ETV) process. The ETV process proved unfeasible as it was recognized that initial performance claim could not be defined. The main reason was that the potential environmental benefit of a 3PL company is defined based on a multi-criteria optimization mathematical problem. In the case of GYR service, we could not define specific condition due to multi criteria problem. ISO 14034: 2016 which forms the base for ETV was obtained instead.

4. Introduction (maximum 2 pages)

Freight transport is one of the most essential sectors for the economic development in EU. Nearly every economic activity in urban areas depends on the movement of goods through freight carriers. Freight transport activities account for approximately one third of total

transport GHG emissions. European Commission's analysis shows that while deeper cuts can be achieved in other sectors of the economy, a reduction of at least 60% of emissions by 2050 with respect to 1990 is required from the transport sector, which is a significant and still growing source of emissions. By 2030, the goal for transport will be to reduce emissions to around 20% below their 2008 level. Given the substantial increase in transport emissions over the past two decades, this would still put them 8% above the 1990 level.

LIFE GYR project focuses on emissions generated by logistic operation which are mainly, Nitrogen Oxides (NOx), Non Methane Volatile Organic Compounds (NMVOC), Ammonia (NH3), Particular Matters (PM), Carbon Monoxide (CO), Sulphur oxides expressed as Sulphur dioxide (SO2), Carbon Dioxide (CO2) and Methane (CH4). According to EEA, these pollutants can be grouped into acidifying substances, particulates and ozone precursors. Acidification of soils and waters is caused by emissions of NOx, SO2 and NH3 into the atmosphere, and their subsequent chemical reactions and deposition on ecosystems and materials. The deposition of acidifying substances causes damage to ecosystems, buildings and materials. Airborne PM has adverse effects on human health and can be responsible for and/or contribute to a number of respiratory problems. A large fraction of the urban population is exposed to levels of fine particulate matter in excess of air quality limit values set for the protection of human health. Emissions of NMVOC, NOx, CO and CH4 contribute to the formation of ground-level (tropospheric) ozone, which has adverse effects on human health and ecosystems. Finally, CO2 and CH4 contribute to climate change.

In our days, SMEs use navigation systems offered for free or at low prices in the market. Navigation systems make use of the built-in GPS that tend to be standard equipment in the automobile industry or mobiles which do have a GPS functionality to rely on. However, almost all navigation systems provided to SMEs allow for point-to-point navigation employing shortest paths algorithms. In the vehicle routing problem, one needs not only to determine the shortest path from one point to another, but most important to determine the optimal sequence according to which points should be visited and at the same time select the vehicles (between a fleet of available vehicles) that will be used for the delivery. Currently, freight transport operators as well as companies that manage their own fleet of vehicles are using new technologies such as telematics mainly for real-time fleet monitoring. As far as vehicle routing is concerned, it is usually performed via empirical methods giving no concern to environmental friendly methods for planning and execution of freight transport operations. However, empirical vehicle routing methods do not promote sustainability and cannot support decision making. The difference between an optimized route using optimization app and the route defined based on experience could vary between 10% and 50% concerning environmental impact and operational cost.

To this end the aim of GYR project is to deliver and demonstrate, to 5 SMEs in 3 different EU member states, an innovative, smart, and integrated green vehicle routing platform (i.e. an intelligent transportation planning and execution system) for last mile delivery that will include a set of tools and services that will promote eco-efficient sustainable freight transport operations in urban regions, via environmental-friendly vehicle routing decisions addressing at the same time driving eco-requirements as well as operational cost efficiency through an innovative environmental assessment approach (i.e. Environmental Externality Score Function). To the best of our knowledge, a platform that integrates all the aforementioned characteristics did not exist before GYR platform.

LIFE GYR project's initial objective was to contribute to the implementation of EU emission reduction commitments under UNFCCC Kyoto Protocol and the specific objectives of the LIFE climate action sub-programme, as set out in Article 10 of the LIFE regulation, by reducing in the frame of the project GHG and non-GHG emissions. Additionally, LIFE GYR project was foreseen to introduce an innovative policy in the pan-European transport system,

based on the environmentally friendliest routing of vehicles by demonstrating that environmental friendly is also cost saving using an innovative approach to minimize environmental cost of routing plans. It was also important to increase replicability and transferability of GYR service to other contexts, sectors, regions and entities and establish a sustainable GYR Company which will be the provider of a verified green routing service to transport operators and certify them as green routing operators. Furthermore three additional objective were foreseen: a) the development of a significant network of customers for GYR Company in Czech, Greece and Italy as well as in 3 additional EU member states, b) the awareness and mobilization of key local, regional and national actors in order to adopt green procurements rules and environmental measures towards sustainable urban mobility and c) the exchange of good practice between SME's and scientists. Finally, in order to assess the impact of the project the monitoring of the environmental and socio-economic impact during the real life demonstration of 12 months resulted by the sue of GYR service by 5 SMEs was foreseen.
The expected results foreseen were the yearly emission savings of routing operations of 5 demonstrators equal to: 42.255tn NOx, 4.632tn of PM, 73.133tn of CO, 1.869tn of NH3, 8,885.697tn of CO2, 8.939tn of CH4, 10.564tn of VOC and 8.129tn of SO2 and to make hard effort to update the air quality legislation. Additionally, it was expected that 3 new users of GYR service will sign contracts with GYR Company and that GYR platform would be verified by EU-ETV Pilot Programme. Additionally, it was foreseen that more than 900 representatives of SMEs in 3 different EU member states (Czech, Greece and Italy) would be informed through workshops and webinars about their potential environmental and operational cost benefit by using GYR platform in their daily routing operations and more than 3,000 individuals would be informed about the benefits of GYR platform through regulars dissemination activities.
The expected long-term results are mainly, the future contribution to the implementation or updating and/or development of Greek legislation (i.e. of the Greek law 4302/2014) via the participation of the project coordinator to the national committee's board of logistics and supply chain, b) The replication and transfer of GYR platform and its APIs to other sectors such as waste collection companies and school bus companies and c) The economic viability of GYR Company by attracting new users of GYR service.

5. Administrative part (maximum 1 page)

The project coordinator (UTH, Coordinating Beneficiary of LIFE GYR), through the monitoring tools developed, tracked, monitored and checked the quality of the actions' implementation. All deliverables completed by the associated beneficiaries were sent to the project coordinator, who reviewed their quality against certain standards and criteria.
Associated Beneficiaries in collaboration with UTH worked together as a team in order to implement successfully and timely all implementation actions.

The most significant deviations: a) due to the decision of PAPARITSIDIS to withdraw from the project was the amendment request to replace PAPA with KOUKOUZELIS, b) due to COVID-19 pandemic was the amendment request for the prolongation of the project c) due to wrong calculation and invalid assumption was the reduced compared to the foreseen, environmental impact of the project and d) due to multi-criteria optimization mathematical problem used by GYR platform the replacement of the ETV with ISO 14034-2019.

Communication with EASME/CINEA during the project implementation was productive. Comments on the monitoring reports received from EASME/CINEA were fruitful and helped LIFE GYR team to better understand their responsibilities for the project. Communication with the monitoring team (Dr. Marouli, monitoring expert from NEEMO) during the reporting period was extremely valuable. Dr. Marouli was always available via any communication

channel (Email, phone calls, skype calls etc.) to assist and support the successful implementation of the project, as well as to clarify and suggest directions based on LIFE program guidelines for several managerial and financial issues. Six monitoring meetings were performed during the project implementation, which helped LIFE GYR team to keep the project on track and comply with EASME/CINEA's expectations regarding the project.

Nine regular project meetings were performed and additional short meetings between the Coordinating and Associated beneficiaries were conducted in order to discuss the progress of specific tasks. UTH also prepared the Partnership Agreements (PAs) of all associated beneficiaries. The PAs include detailed description of tasks and activities, assigned tasks per action to each beneficiary, associated with intermediate deadlines, and budget allocation.

6. Technical part (maximum 25 pages)

6.1. Technical progress, per Action

Action A1: Reviewing, partnership agreements and MoU for green procurement

Foreseen Start Date: 01/09/2018 Actual Start Date: 01/09/2018
Foreseen End Date: 31/12/2018 Actual End Date: 23/04/2019

UTH prepared the PAs and the MoUs for Green Procurement of the project and sent them to each Associated Beneficiary, who submitted their comments. Then UTH revised the PAs and the MoUs and prepared their final versions. UTH also prepared guidelines for the application of Green Procurement rules, based on the MoUs signed by the Associated Beneficiaries.

The Partnership Agreements include the general and special conditions included in the LIFE Grant Agreement, the model technical report, financial statement, terms of reference for the certificate on the financial statement, the financial and administrative guidelines, a maximum budget allocation per action, sub-action and beneficiary, a detailed technical description and outlines of each action and sub-action and financial guidelines and guidelines for implementing actions, customized to the special needs of LIFE GYR actions implementation and the special characteristics of each beneficiary.

The scope of establishing Green Procurement rules through an MoU was to apply to each beneficiary general and specific rules for Green Procurement. The provisions decided to be included in the MoUs take into account the environmental performance of the beneficiaries, cost considerations, market availability and ease of verification. To assist the implementation of Green Procurement rules, UTH proceeded in producing guidelines for implementing the rules included in the MoU. To monitor the proper implementation of the MoUs, each associated beneficiary submitted a self-assessment form on a quarterly basis (in total 16 self-assessment forms per associated beneficiary), including all the relevant purchases made. The self-assessment forms submitted are available in **Annex II/Action A1**.

The scope of reviewing the latest technical developments was to further uptake and improve the database, modelling approach and optimization algorithms of Green-VRP developed in the frame of previously, implemented by UTH, EU projects and comprise a set of recommendations and guidelines for LIFE GYR implementation actions. The outcomes of the review of the database designs, architectures and structures used in web applications were used for the implementation of Action B1; the outcomes of the review of new algorithms for solving the VRP were used in Action B2; the outcomes of the European Union (EU) policies, standards, directives and practices on air quality, noise and urban mobility were used in Action B7.

All deliverables related to Action A1 have been delivered with previous reports and/or after a project visit of the LIFE monitoring team (Del A1.1, A1.2, A1.3 were delivered at 1st monitoring meeting on 17/05/2019 and Del. A1.4 was delivered at 3rd monitoring meeting on 15/05/2021. All

4 deliverables were re-submitted with the mid-term report on 29/02/2020). Milestone "Partnership Agreements signed" was reached in March 2019, with a delay of 4 months, due to minor amendments in the responsibilities of Action B3, which affected CEDA and CHAPS, and the inclusion of KOUKOUZELIS in GYR consortium. GYR company with the support of UTH, will continue monitoring recent developments in Green-VRP and databases architecture as long as the GYR platform has active users. Additionally, GYR Company with the support of MILITOS will monitor EU policies and the new EU directives, etc. in order to keep GYR service fully compatible with the EU legislation.

Action B1: GYR database and related data access service

Foreseen Start Date: 01/10/2018 Actual Start Date: 01/10/2018
Foreseen End Date: 30/06/2022 Actual End Date: 30/06/2022

Based on the work done on the previous EU projects, UTH in close cooperation with CHAPS adjusted and restructured the database schema in order to reflect the latest information that was included in the real life demonstration examples. Furthermore, it was enriched with more details that came from the algorithm implementation needs and the review of the database designs in Action A1. The database schema includes 28 tables, each one of which includes between 3 and 13 data entries. The changes resulted during the development phase or during the real life demonstration were first deployed in a database under development in the GYR server to a specific virtual machine, which was ready to use for testing purposes.

Concerning the Data access service, UTH developed 4 different approaches to cover the plethora of the business operation environments of logistics companies. The 1st approach connects the ERP of a logistic company with the GYR database API, the 2nd approach transforms, using an external software, the data export file of orders by an ERP system to the appropriate format for the GYR database, the 3rd approach introduces an excel file which follows the specification of GYR database and the 4th approach corresponds to the creation of the orders via GYR web application. UTH developed several intermediate versions of these approaches which have been communicated to the demonstrators of GYR service. UTH was in close collaboration with the ERP developers of the demonstrators to define the necessary modifications to the GYR database API and the ERP APIs. After several communications, the developed approached took the highest possible compatibility with the business environment of the demonstrators as well as the business environment of the new customers of GYR company. Finally, UTH translated the user manual to 7 EU languages (in total the manual is available in 11 EU languages).

Regarding the database security, UTH has taken all the appropriate measures until now by restricting both the physical access and the outside network access to the GYR database server. Two database were setup to ensure that data loss due to physical damage to the server is prevented. The first one was setup to the GYR server and plays the role of back-up and the 2nd one is the main database and it was setup to the cloud service purchased by GYR company. GYR Company decided to move the productive version of the GYR service (including the GYR database) to a cloud service in order to have the highest possible security. The selected cloud service includes a proactive threat management, manages the entire data lifecycle – from creation to end of life, protects personal and financial data, is responsive to fluctuations in demand of GYR service and can adjust capacity between users, and high availability (i.e. 24/7/365). Additionally, all user passwords used are strongly encrypted and the access to certain entities in the database is determined based on user permissions that are set.

Action B1 is implemented the way it was foreseen with a short delay of 4 months which did not affect the implementation of the other actions. Action B1 was associated with two deliverables: Deliverable B1.2 was delivered in the frame of the 5th monitoring meeting on 29/09/22 and Deliverable B1.1 was delivered in the frame of the 6th monitoring meeting on 31/03/23. Both deliverables have been prepared by UTH with the support of CHAPS. GYR company will continue

updating and maintaining the GYR database and improve the data access services to make compatible additional ERPs systems that potential users of GYR service may have.

Action B2: Green Vehicle Routing Problem

Foreseen Start Date: 01/01/2019 Actual Start Date: 01/01/2019
Foreseen End Date: 30/04/2023 Actual End Date: 30/04/2023

The existing modelling approaches developed under the frame of GreenRoute, EnvRouting and FindMyWay, as well as the additional constraints introduced, based on demonstrators' consultation, i.e. outcomes of sub-action B4.1 and the outcomes of the review of new algorithms for solving the VRP of Action A1, were taken into account to produce a generic modelling approach for the Green-VRP. For the modelling of the Green-VRP, the Environmental Externality Score (EES) functions developed under the frame of GreenRoute and EnvRouting projects were used to represent the environmental impact of the routes. Additionally, a novel emission calculation model is developed in Action C1 and used in this action for the accurate and case-tailored emission estimation. The requirements included in the modelling approach developed are: pickup and delivery of freight under specified conditions; time windows of customers, roads and vehicles; different packages and material types; accessibility restrictions; different freight temperatures; vehicle attributes; different starting points of vehicles; performance of open routes. Based on the specified requirements, the following Green-VRP variants can be handled by GYR service: the Capacitated VRP, the VRP with Time Windows, the VRP with Pickup and Deliveries, the VRP with Backhauls, the Multi-Depot VRP, the Open VRP, the heterogeneous fleet VRP, the asymmetric VRP, the Load-specific Vehicles VRP and the Customer-specific Vehicles VRP.

For solving the abovementioned problems four hybrid solution approaches were developed and tested during the integration phase and then during the real life demonstration period. The first one included the following steps: 1. Geographical clustering based on k-means (heuristic step); 2. Sub-clustering of large to handle clusters based on mathematical programming (exact step); 3. VRP of the produced clusters solving based on mathematical programming (exact step). The second approach included the following steps: 1. Geographical clustering based on k-means (heuristic step); 2. Balancing of the produced clusters based on mathematical programming (exact step); 3. TSP or VRP of the produced clusters solving based on mathematical programming (exact step). The third approach included the following steps: 1. Geographical clustering based on k-means (heuristic step); 2. Balancing of the produced clusters based on mathematical programming (exact step); 3. TSP of the produced clusters solving based on Nearest Neighbor Search algorithm (heuristic step). The forth approach which was developed based on the previous three approaches, included the following steps: 1. Geographical clustering of customers to be visited including a heuristic step and the k-means++ clustering; 2. Assignment of vehicles to each cluster, taking into account the compatibilities between customers included in each cluster and the vehicles attributes and/or distance of starting point of each vehicle from the clusters which is an exact step including a mathematical programming model; 3. Assignment of orders to clusters taking into account customers restrictions and vehicle attributes which is a hybrid step, including a mathematical programming assignment model and an update step; 4. Merging step where the nodes assigned to the same cluster with the same coordinates or coordinates under specific limits (i.e. +- 0.5 Kilometer) are merged to reduce the size of the resulted mathematical model, and 5. Creation of the vehicles' final routes which is an exact step including a mathematical programming model for the TSP. The resulted TSP has as objective function the minimization of the total distance multiplied by EES. The most satisfying results were produced by the forth approach with an execution time equal to minimum 2 seconds and maximum 90 seconds (i.e. depending on the size of the problem). All algorithms for the solution approaches were developed in C++ programming language using CPLEX with Concert Technology C++ libraries.

Action B2 is implemented the way it was foreseen with a short delay of 4 months which did not affect the implementation of the other actions. The Deliverable B2: Report on adjusted modelling

approach and solution algorithm has been prepared by UTH and it was delivered in the frame of the 6th monitoring meeting on 31/03/23. GYR Company with the research team of UTH will continue updating and maintaining the solution approach of the Green-VRP.

Action B3: Creation of GYR platform and apps

Foreseen start date: 01/01/2019 Actual start date: 01/01/2019
Foreseen end date: 30/04/2021 Actual date: 30/04/2023

During the first phase of the project, UTH designed the mockups of the web and mobile applications. The idea was to create a web and mobile application that include all the necessary information and functionalities that are useful for the demonstrators and also supports all the necessary data exchange between the backend (i.e. platform) and the frontend (i.e. UI of the apps). Based on this idea, 355 different web app mockups and 29 mobile app mockups were created in a way that satisfied the requirements. The web app mockups included for instance the login page, the planning section where the user could upload the daily orders in three different ways and the deliveries and pickups are displayed, the live section where the user could monitor and check the status of the routes of a daily plan with information about each vehicle, the settings page where the user could add, edit, delete and monitor its customers, etc. The mobile app mockups included for instance the login page, the main dashboard where the necessary information about the route assigned to a driver are displayed, the list of orders page where the driver is able to monitor the orders of the route with analytical details about, the map representation page where the driver monitor the implementation of its trip, the rerouting page where the driver could change the sequence of the orders during the execution of a route etc.

UTH and CHAPS adopting an iterative development process followed 11 developing sprints for the web app and 10 developing sprints for the mobile app. UTH team prepared and delivered instructions for the development of the web and mobile apps to CHAPS. The instructions contained technical information about the methodologies that the frontend follows to request the data from the backend and information about the attributes that the frontend uses to display the data in the correct order and place in the application. The iterative development process followed included four phases: 1) Development phase, 2) qualification phase, 3) revisions phase, 4) testing phase. When this iterative process was concluded with the implementation of the revisions decided by UTH and CHAPS, then the technical team moved to the following sprint and started the iterative process from its 1st phase (i.e. development).

In parallel with the apps development, UTH and CEDA adopting the same iterative development process developed the GYR platform (i.e. the back-end). The backend developed by UTH and CEDA team based on different parameters and requirements. The most critical parameter for the development of the backend was the framework and the services that were used to handle the different requirements imposed by applications and microservices. After a series of development sprints of the backend, UTH and CEDA team were able to provide the final version of the backend The web application is available http://app.greenyourroute.com/login . You can use the following credentials to login to the web application with credentials, username: gyr_user and password: gyr_team. One may fine the mobile apps in **Annex II/ Action B3** and use the following credentials to login to the apps: username: gyr_driver1 and password: gyr_team.

A cluster of two host machines was setup for the development, testing and hosting of the individual parts, e.g. APIs, User Interfaces, web services that form the platform. In this cluster, multiple Virtual Machines are deployed and used as development or production servers. Also, to ensure data redundancy the storage of the cluster has been setup to RAID array type 1.

Additionally, user manuals in 11 EU languages for the web and mobile application have been developed by UTH.

Action B3 is implemented the way it is foreseen in the technical description. Milestone “Final version of Web and mobile apps” was reached at the end of the project as it was foreseen after the 2nd amendment. Action B3 was associated with two deliverables: Deliverable B3.1: Manual of

Web and mobile app in 11 EU languages which was delivered in the frame of the 6th monitoring meeting on 31/03/23 and Deliverable B3.2: Report on the development of the web and mobile application which is available in **Annex I/Action B3**. Both deliverables have been prepared by UTH with the support of CHAPS and CEDA. Milestone "Final version of Web and mobile apps" was reached successfully. GYR company will continue updating and maintaining the GYR platform and GYR apps. The technical team of GYR Company will develop new functionalities based on the new customers' requirements.

Action B4: Demonstration - 1st phase

Foreseen Start Date: 1/10/2018 Actual Start Date: 1/10/2018
Foreseen End Date: 31/3/2023 Actual End Date: 31/3/2023

The initial approach to define users requirements was a questionnaire designed by UTH team, where initial information about each demonstrator was requested. Through the questionnaire, UTH team realised that it was difficult to get the actual answers needed. Thus, this approach was replaced with regular Skype calls and on-site visits, when possible. Through this continuous procedure, it was found that the information gathered through the questionnaires was far from the actual needs of the demonstrators, thus, the results of the questionnaire were not taken under consideration for defining the demonstrators' requirements as through the discussions and on-site visits UTH team managed to understand the needs of the demonstrators thoroughly.

ATHINAIKI – KOUKOUZELI – PLUS: The three Greek demonstrators were initially approached by UTH team as separate entities. Several on-site visits by UTH to the demonstrators' premises organized, for discussions regarding the demonstrator's routing needs and understanding their ERP systems. During this phase, UTH identified several benefits in a synergy between the three Greek Demonstrators and proposed a shared distribution synergy. The three Greek Demonstrators, after several discussions agreed on a synergy among them, the implementation of which is also supported by the GYR platform. The routing needs of ATHINAIKI-PLUS-KOUKOUZELI and the available fleet were considered as one unified VRP problem.

ITACA: In January 2019, ITACA proposed GLS, a courier company performing both urban and long distance deliveries. The definitions of the demonstrator's requirements were realised through weekly skype calls between UTH and ITACA team. Since July 2019, for the testing period, UTH team requested several routing instances from ITACA's demonstrator. The demonstrator, in order to be convinced to send instances, requested to firstly receive a solved solution by UTH team for one VRP problem before proceeding. In order to support ITACA's efforts, UTH started working on the demonstrator's request. This task was difficult to be accomplished, since several tools (e.g. the geocoding and reverse geocoding tools for Italy, aspects on the VRP algorithm etc.) were in early stages during the phase of this request and could not be directly used for producing the solution requested. In September 2019, UTH team was able to produce several solution versions to ITACA's Demonstrator, by using several geocoding alternatives. Finally, ITACA convinced its customer to use GYR service by presenting the benefits resulted by the use of GYR platform.

CEDA: CEDA proposed as a demonstrator a company that focuses on transport and forwarding, earthworks, construction work, vehicle servicing, and fuel sales, namely DS Logistic s.r.o. The definition of the requirements was realised through weekly planned Skype calls. Several routing examples were provided to UTH from CEDA's demonstrator on a monthly basis. UTH, continues gathering routing examples from the demonstrators to check if the solutions produced by the algorithms developed in Action B2 satisfy their requirements. UTH also defined the necessary indicators that will be assessed during the test and evaluation process, which was initiated after the release of the beta version of the platform in September 2021 (instead of October 2020). GYR team performed a series of test in order to evaluate the GYR platform and its applications against the foreseen 6 criteria i.e. functionality, usability, interface, compatibility, performance and security. The testing phase was part of the iterative development of GYR platform and its application. Iterative development was preferred to the classical waterfall lifecycle, as the latter is used in cases

where we have no changes when demonstrating a system in an operational environment. The iterative development included mainly 4 steps: a) the pilot demonstration phase of the apps into the operational environment of the demonstrators, b) the evaluation phase by the users/demonstrators of the results obtained by the pilot demonstration, c) the revision phase of the apps based on the obtained results, and finally d) the testing phase of the apps.
Based on the suggestions provided by demonstrators and the evaluation and testing results, a fine-tuning of different services of the GYR platform and its apps was occurred to build-up their final version. This fine-tuning included adjustments of the previous versions of the apps to satisfy the needs of demonstrators as well as potential new users. These adjustments included improvements on the user interfaces, available web toolboxes, uploading and downloading of data, statistics records and comprehensibility of the routing solutions. After tests were passed and related issues were resolved, the final version of the GYR platform and its apps was available for integration to demonstrators' environment. GYR team selected high combinatorial real numerical examples not only to evaluate the robustness of GYR apps but also in order to get maximum environmental advantage during the second demonstration phase (e.g. maximum of PM reduction during testing) in the frame of Action B5. The savings of higher combinatorial examples (ex. 10 vehicles visiting 200 points) was significant higher comparing less combinatorial examples (ex. 1 vehicle visiting 3 points). An optimization tool integrated into the apps, has more to optimize when the problem is more complicated.
The 1st demonstration phase, implemented during Action B4, was significant critical for the development of GYR service. The business requirements of demonstration were taken under consideration to develop a platform highly marketable and useful for logistic companies. A deeply consideration of the business and operational requirements guarantees that the developed service was and it will be in the future easy compatible and replicable and allowed GYR team to understand further the market where GYR company is introduced. Action B4 is implemented the way it was foreseen. Action B4 was associated with two deliverables: Deliverable B4.1: Report of demonstrators requirements which was delivered in the frame of the 2nd monitoring meeting on 21/02/20 and Deliverable B4.2: Testing and evaluation report of GYR platform which was delivered in the frame of the 6th monitoring meeting on 31/03/23. Both deliverables have been prepared by UTH with the support of the other associated beneficiaries.

Action B.5: Demonstration – 2nd phase

Foreseen Start Date: 01/01/2020 Actual Start Date: 01/01/2020
Foreseen End Date: 30/04/2023 Actual End Date: 30/04/2023

After the test and the evaluation of GYR platform by the demonstrators of LIFE GYR project, GYR Team started the real life demonstration of GYR platform. Action B5 started with the integration of GYR service into the operational environment of demonstrators. The GYR service was integrated into the business environment of the SMEs participated to the real life demonstration. In addition, APIs of GYR service was integrated into the business environment of a routing planning provider (i.e. ITACA). The integration was made with a cyclic way based on the iterative development of GYR platform and its application (see Action B3). The cyclic integration approach included Collaboration, Development, Integration and Dissemination. The collaboration included the collaboration of the technical team and the users to ensure their use case and the satisfaction of their requirements. The development included the iterative development presented in Deliverable B4.2. The integration brought together several software components, different systems, firmware and hardware. Finally, the dissemination focused on the benefits of GYR service, showing to the perspective users its plethora functionalities. After the full integration of GYR service into the environment of the demonstration of the project, the real life demonstration started on December 1st, 2021and lasted for 17 months (on April 30th, 2023). In addition, the GYR platform was demonstrated also in the operational business environment of 3 new companies which agreed to use the GYR service for a period of 7 months without cost and based on their

experience with GYR service to decide to purchase or not the service after the end of the project. Action B5 was implemented the way it was foreseen. Action B5 was associated with three deliverables: Deliverable B5.1: Report on integration activities, Deliverable B5.2: Integration manual in 11 EU languages (prepared by UTH and both delivered in the frame of the 6th monitoring meeting on 31/03/23), Deliverable B5.3 Signed contracts with the demonstrating companies (prepared by MILITOS and available in **Annex I/Action B5**). Milestones "Integration of GYR platform" & "End of real life practice" were reached successfully.

Action B6: Marketability plan

Foreseen start date: 01/04/2020 Actual start date: 01/04/2020
Foreseen end date: 30/04/2022 Actual end date: 30/04/2023

MILITOS was responsible for the preparation of the Business Plan. The business plan included 4 segments: 1) The Segment Business Concept described mainly the market needs, the main idea of the product, the product as it was developed and the innovation of GYR service. Additionally, this segment presented the GYR Company vision, mission and objectives. A market and competition analysis was implemented as well as a SWOT analysis. 2) The Segment Sales and Marketing Plan included mainly GYR company competitors' position, the different customers segments, and the marketing strategy of the company. 3) The Segment Internal Structure and Organisation included the organasation chart including roles and responsibilities, the Company culture, the ownership structure and the location strategy and the timeline for the establishment of GYR Company. 4) The Segment Financial Plan defined mainly the assumptions and forecasts, the cash flow, the initial capital and funding required, the risk assessment and the payback strategy plan.

MILITOS with the support of UTH investigated the benefits and disadvantages of the candidate EU member states that GYR Company may be established. After this analysis, established GYR Company at Volos, Greece on 16/8/2021.

MILITOS in close collaboration with UTH started the process of the Environmental Technology Verification (ETV) in March 2019. After contacting several Verification Bodies, BRE Global was identified and assigned as the appropriate Verification Body to consult GYR Consortium. Several contacts were made with BRE Global to assess the eligibility of GYR platform to apply for an ETV and to identify the technological scope for which it will be accredited. MILITOS and UTH finalized the verification plan including the main steps to be followed to receive the ETV. Even if BRE Global assessed positively the Quick Scan document, the acquisition of the ETV was considered impossible due to the nature of the service. As the case of the ETV process proved to be unfeasible alternative independent verification scheme was selected with an environmental component and with value for the market uptake of the GYR service namely ISO 14034. The ISO 14034 has been obtained by GYR Company for GYR service on 21/04/2023. Finally, GYR certificates has been developed in the frame of this action. As part of the verification process, GYR team developed a certificate that, under specific conditions confirms that clients who purchase the GYR service and implement it into their systems following the provided guidelines and meeting minimum compliance thresholds are actively promoting green logistics.

Action B6 is implemented the way it was foreseen with a main deviation the replacement of the ETV with ISO 14034 which forms the base for ETV. The milestone "Establishment of GYR Company" was reached in August 2021. The milestone "Environmental Technology Verification" was not reached as the acquisition of the ETV was considered impossible. Action B6 was associated with three deliverables: Deliverable B6.1: Business plan which was delivered in the frame of the 5th monitoring meeting on 29/09/22, Deliverable B6.2: Legal registration document of GYR Company which was delivered in the frame of the 4th monitoring meeting on 31/05/22 and Deliverable B6.3: Verification plan and GYR certificate is included **in Annex I/Action B6**. Milestones "Establishment of GYR Company" was reached and "Environmental Technology Verification" was not reached successfully. GYR company will continue operating based on the

business plan developed in the frame of the GYR project. ISO14034 will be renewed by GYR Company on 20/04/26 (i.e. expiration date).

Action B.7: Replicability and transferability Strategy

Foreseen Start Date: 01/10/2018 Actual Start Date: 01/10/2018
Foreseen End Date: 30/04/2023 Actual End Date: 30/04/2023

The developed replicability and transferability plan as foreseen illustrates the necessary steps needed to involve additional users of the GYR service and how to convince them to benefit from its utilization. New users may come from the supply chain domain in a broad perspective but not only logistic and 3PL companies, which were the main target during LIFE GYR project's implementation. In the context of this plan the Replicability and Transferability concerns different sectors (i.e. Waste Collection, School Buses) or different ways to expand GYR services, such as the emission calculation model or other monitoring and reporting tools that work as stand-alone plugins to other systems. GYR team realized in the frame of Action B7 that the potential investments and technical adaptations needed, the prospective growth and the respective risk-management mitigation strategies are different according to the sector or country. Apart from targeting new sectors and replicability options, new EU and global regions have been also pursued and the challenges have been examined. Essentially, the replicability and transferability plan studied new market sectors, possibility of expansion of geographical coverage and identification of new services and positioning. MILITOS team examined the status in the sector vis-à-vis digitalization and need of routing optimization, pros and cons for targeting the sector and alternative marketing strategies. Special attention was given to the digitalization levels of the sectors because GYR service set-up and operation is directed correlated to these levels. It is important to mention that in the frame of the project, one of the partners of the consortium, ITACA was one of the first examples of GYR platform replicability applications. The emissions calculation model was not a part of the system that ITACA was using to create routes. Therefore, the emissions calculation model was integrated to its system and currently all their routings take into consideration the emission calculation models of GYR platform. In addition, the Optimization algorithm APIs was replicated as well to improve further the quality of the routing plans.

Another important outcome of Action B7 was the organization of 23 webinars. MILITOS has taken the initiative to develop a presentation roadmap to introduce the outputs of the project. Throughout these webinars, discussions were held with owners and representatives of logistics companies, who were presented with GYR services tailored to their specific needs. The agenda of the webinars included: 1) A detailed presentation on the GYR platform, 2) A real-time demonstration of the GYR platform, highlighting its user-friendly interface, data visualization tools, and interactive features, 3) An interactive question and answer session where participants could ask queries, and seek clarifications, 4) Discussion of the possibilities of replicating and transferring the GYR platform to different sectors, 5) Highlighting marketing and business development activities linked to the GYR platform, including special offers for entities following green procurement rules and the provision of GYR certificates for CSR purposes, 6) Providing information on the next steps and 7) wrapping up the webinar with closing remarks, and encouraging participants to explore the potential of the GYR platform for their organizations.

Additionally, MILITOS with the support of UTH, after the deep study and analysis of EU and national legislation framework of urban transport prepared specific recommendations for the update of the current Greek legislation. GYR consortium was actively engaged in communicating the aforementioned recommendations to relevant stakeholders, with the objective of promoting the adoption of green features in supply-chain law. As part of these efforts, the project approached the standing logistics and supply chain committee, the Greek national body responsible for giving consultation to the lawmakers of the Greek parliament. Dr. Saharidis, successfully became an external member of the committee's board. This privileged position enables Dr. Saharidis to

actively participate in their meetings and advocate for green supply initiatives associated with the LIFE GYR project.
Following the presentation of recommendations of GYR project in June-July 2021, the committee requested Dr. Saharidis to provide them with the Framework of Recommendations. This request arose due to the establishment of a drafting-law committee tasked with revising Law 4302/2014. More about policy impact one may find at the end of section 6.3. Note that in Annex I/Action B7 Deliverable B7.3 provides the document containing the Framework of Recommendations, presented in Greek and also translated in English.
Finally, the focus of MILITOS and UTH was also on addressing the existing gap in EU policy and legislation related to green vehicle routing planning, which plays a crucial role in reducing emissions and promoting sustainable transportation practices. The objective of updating EU policy and legislation regarding vehicle operations was to promote sustainable transportation practices, reduce emissions, and address the existing gap in policy and legislation concerning vehicle operations. The policy recommendations of GYR project focused on integrating green vehicle routing planning principles, setting emission reduction targets, and fostering the adoption of sustainable practices across the European Union. Through extensive research and analysis, MILITOS identified the gap in EU policy and legislation concerning the optimization of vehicle routes for environmental sustainability. The adopted networking activities included the presentation of the baseline of routing planning and continued with the invitation of policy makers to GYR workshops and finalized with the delivery of the final report to appropriate directions and policy makers. GYR team focused on green vehicle routing planning and emphasized the potential to reduce emissions and promote sustainable transportation practices. Indicatively, Dr. Saharidis from UTH and Mr. Karamanlis from MILITOS presented the GYR project during the "LIFE and SMEs" Online Event on May 26, 2021. This event provided a platform to showcase the GYR project within the context of another initiative. Additionally, Dr. Saharidis attended the international conferences on energy sustainability and climate crisis (7th, 8th, 9th) the last years to present the project and its outcomes. GYR team's objective during meetings and events was to present policy makers with relevant data that showcased the expertise of the GYR project and its positive impact on environmental sustainability. Dr. Saharidis and Mr. Karamanlis attended also the virtual event, the LIFE Platform Meeting, organized by the EUROPEAN CLIMATE, INFRASTRUCTURE AND ENVIRONMENT EXECUTIVE AGENCY (CINEA) on October 12 and 13, 2022. The engagement of stakeholders and the broader ecosystem in the GYR project was emphasized by showcasing collaborations with various organizations, including CSR associations, responsible consumers' and logistics associations, governmental and municipal organizations, NGOs, and road safety organizations and associations. In line with this, our team established contact with the Hellenic Logistic Company's central department and the department of Northern Greece. We engaged with Mr. Zeimpekis and Mr. Vlachos, respectively, to seek the association's support for our project's initiatives.
Action B7 was implemented the way it was foreseen. The milestone "Signature of 3 new contracts with GYR-C" was reached. Action B7 was associated with four deliverables: Deliverable B7.1: Replicability and transferability plan which was delivered in the frame of the 6th monitoring meeting on 31/03/23, Deliverable B7.2: Webinar report, Deliverable B7.3: Report updating air quality legislation and Deliverable B7.4: Report on actions taken to update EU policy which are included in **Annex I/Action B7**. GYR company will continue studding the existing gap in EU policy and legislation related to green vehicle routing planning and in any opportunity will recommend specific policy updates include the use of green routing planning services such as GYR service. Finally, GYR Company will continue being in close collaboration with Dr. Saharidis who continues to be member of the Greek logistics and supply chain committee.

Action C1: Monitoring of the impact of the project actions

Foreseen start date: 01/10/2018 Actual start date: 01/10/2018

Foreseen end date: 30/04/2023 Actual end date: 30/04/2023

A monitoring protocol is established by UTH based on a novel emission inventory methodology, which is applied in the routing problems of the project's demonstrators in order to assess the environmental impact of the problem. The expected emission reductions in terms of fuel consumption and emission emitted were calculated during the real life demonstration period. For this purpose a novel emission inventory methodology was developed for the accurate and case-tailored emission inventory estimation. The novel emission inventory methodology included 5 steps: Step 1: Determination of the needed activity data for each emission source; Step 2: Collection of the activity data; Step 3: Quality assurance / Quality Control procedure; Step 4: Selection of appropriate emission factors based on the available activity data; Step 5: Calculation of emissions for each air pollutant. The 5th step included novel emission calculation models which were developed in the frame of the project. One of the main goals was to update and produce vehicles emission calculation models in the form of a database. The purpose of the emission calculation models were to imprint a database based on updated COPERT model and a thorough state of the art analysis concerning vehicles emission factors. This database operated as a new, improved and detailed database for emission factors. The database was used as a source for the GYR platform operations. More specifically, the platform was used as a tool where the user can automatically calculate the emissions of vehicles by selecting specific parameters. The new models produced, focused on different vehicle types including Light commercial, L-category, HDV (up to 14 tn) and HDV (more than 14 tn) vehicles. Furthermore, in the new database GYR team tried to focus and to find solutions (valid values) for a wide range of emission factors. The emission factors of the models were identified and relevant classes and respective emissions values were analyzed in order to identify gaps. Several gaps were identified including emission factors such as Road Conditions, Wind velocity and directions, A/C use, traffic conditions, fuel types (i.e. LPG, CNG and electricity). GYR team performed a gap analysis for each one of the factors taken under consideration, recorded the main findings and identified a solution to the resulted gap.

The GYR service is used during the real life demonstration period of 17 months. The obtained routing plans are compared using the simulation tool developed in Action C3 which simulated the corresponding routing plans if GYR service was not used and instead the heuristic approach based on the experience of the managers of the companies was used. GYR team collected data during the real life demonstration period which were stored in the GYR database. Then these data were introduced into the simulation tool in order to create a potentially feasible routing plan that may be created using the traditional (i.e. before the release of GYR service) heuristic approach. These routing plans corresponded to the 1st check point referred to as CP1.1. The routing plans created using the simulation tool and the actual routing plans created using GYR service (these plans corresponded to the 2nd check point referred to as CP1.2) were compare. The obtained environmental impact due to the real life demonstration was important. In total, more than 880.000 kilometres travelled were saved, more than 1600 routes were avoided and more than 1,570 tns of fuel were saved. In addition, more than 4,900 tns of CO2, 150kg of CH4, 18,200 kg of CO, 98kg of N2O, 31kg of NH3, 39tn of NOx, 480kg of PM, 2000kg VOC and 101 kg of SO2 were saved as well. The main deviation in the frame of this action was the percentage of the environmental impact achieved which is presented with details in section 6.2 and 6.3.

Action C1 is implemented the way it was foreseen. The main deviation of the Action C1 was the overall environmental impact of the project and a less significant deviation was the need to recalculate the baseline scenario. The milestone "Definition of the environmental benefit of GYR platform use" was reached. Action C1 was associated with the Deliverable C1: Emission inventory methodology and monitoring of the environmental impact of the project which is included in **Annex I/Action C1**. The users of the GYR service 5 associated beneficiaries of the project and 3 new customers of GYR company will continue monitoring their environmental impact as GYR service calculates by default the environmental impact of their daily routing plan implementation.

Action C2: Monitoring and assessment of the socio-economic impact of the project actions

Foreseen start date: 01/10/2019 Actual start date: 01/10/2019

Foreseen end date: 30/04/2023 Actual end date: 30/04/2023

UTH developed the socio-economic impact assessment protocol to assess the socio-economic impact of the project. The protocol follows a multi-criteria analysis approach, aggregating the socioeconomic benefits of the project. For each axis (i.e. social and economic axis), a number of criteria and indicators are set in order to enable tracking the socio-economic impact in measureable units. The social impact was assessed based on 8 criteria: 1) Reduction of transport cost; 2) Economic efficiency; 3) Freight distributors' involvement; 4) Improved know–how & Increased competitiveness; 5) Employment generation; 6) Market Uptake; 7) Replication; 8) Evaluation of routing plans. The economic impact was assessed based on 8 criteria: 1) Social responsibility; 2) Awareness rising; 3) Networking; 4) Training; 5) Promotion of environmental friendly distribution of goods; 6) LIFE GYR tools acceptance; 7) Update of EU policy; 8) Environmental factors. UTH team assign to each one of these criteria one or more indicators and with the support of an external assistant collect, digitize homogenized and format the necessary data. The collected data were used in several cases in order to calculate the value of the indicators. Two Check Points (CPs, i.e. CP2.1 and CP2.2) were considered for the assessment of the socio-economic impact. The first was the baseline scenario defined using the simulation tool as in the case of Action C1 and the second one was the actual routing plans implemented during the real life demonstration.

UTH team analyse one by one the impact of the project to each one of the criteria defined. The overall analyse shown that the highest impact was related to the promotion of the environmental friendly distribution of good (social criterion, B.5) with the market uptake (economic criterion, A7) and update of EU policy (social criterion, B7) being at the second and the third place.

Action C2 is implemented the way it is foreseen. The milestone "Finalization of LIFE performance indicators tables" was reached. Action C2 was associated with the Deliverable C2: Quantification of socio-economic impact report including methodological approach and data collected which is included in **Annex I/Action C2**.

Action C3: Update and Monitoring of Key Project-level Indicators

Foreseen start date: 01/09/2018 Actual start date: 01/09/2018

Foreseen end date: 30/04/2023 Actual end date: 30/04/2023

UTH in direct communication with the external monitoring team and following the instructions and guidelines provided by EASME/CINEA included the first months of the project into the KPIs web tool, the indicators included in the beginning of the project into the "LIFE Performance indicators Call 2017.xls" which was submitted on the eproposal. These indicators are presented in section 7. After the finalization of the setup of the web tool, UTH team developed a simulation tool in order to monitor the environmental (in Action C1) and socio-economic (in Action C3) impact of the project. As the demonstrators stopped following empirical approaches to create, their daily routing planning, due to the use of GYR service, a simulation tool to define these potential routing plans (i.e. empirical plans) was necessary to be developed. The simulation tool used the input data (i.e. daily orders, available fleet of vehicles etc.) of the demonstrators into the GYR platform in order to generate the potential routing plans in case an empirical approach was followed. This simulation tool is a heuristic routing tool which simulates the former approach providing sub optimal and feasible routing plans based on daily routing requests. The simulation tool includes emission calculation models used in GYR platform and heuristic rules such as heuristic clustering approach grouping customers based on geo-data, heuristically decomposing the problem into vehicle selection and then assignment of customers to the selected vehicles, defining visiting order of customers based on the criteria of the nearest neighbour. This simulation tool provided with the opportunity to obtain the empirical solution fast with an automatic, systematic and easy way, without the demonstrators having to invest effort and spend time to provide a non-applicable solution according to the former approach. UTH team in the beginning

of the project inserted the baseline, end of the project and 3 years period after the end of the project values of the KPIs with the guidance of the external monitoring team. As long as the project implementation continued, UTH team updated periodically the values for the KPIs creating updated data snapshots of the KPIs, which were delivered to the external monitoring team during a monitoring project meetings. After the complication of the real life demonstration of GYR platform (i.e. 30/04/2023), UTH team using the developed simulation tool updated the baseline values of the KPIs which were depended on the created routing plans.
Action C3 was implemented the way it was foreseen. A latest data snapshot of the project's KPIs including the actual or the expected values of each indicator are included in **Annex II/ Action C3**. More details regarding the KPIs assessment is presented in Section 7. Action C3 was associated with the three deliverables: Deliverable C3.1: Report focusing on the results achieved and/or deviations experienced/expected as compared to the original estimates/inputs in the KPI Webtool and LIFE performance Indicators, Deliverable C3.2: Report focusing on the results achieved and/or deviations experienced/expected as compared to the original estimates/inputs in the KPI Webtool and LIFE performance Indicators, Deliverable C3.3: Report focusing on the results achieved and/or deviations experienced/expected as compared to the original estimates/inputs in the KPI Webtool, and LIFE performance Indicators. These deliverables actual are identical including different values for the KPIs. UTH team instead of sending 3 deliverable including out-of-date values, decided to create 3 different deliverable including different content: Deliverable C3.1 presents the the simulation tool (it was not foreseen), Deliverable C3.2 includes the final values of the KPIs (it was foreseen) and Deliverable C3.3 includes the devilation of the values of the KPIs comparing the actual and the foreseen values (it was not foreseen). All three deliverable are included in **Annex I/Action C3**. The monitoring of the KPIs continues by GYR Company team, for a period at least of 3 years after the end of the project in order to record the impact of the GYR service.

Action D.1: Dissemination planning and execution

Foreseen Start Date: 01/10/2018 Actual Start Date: 01/10/2018
Foreseen End Date: 31/03/2023 Actual End Date: 30/04/2023

UTH is responsible for all the dissemination material produced, either electronic or printed, while MILITOS is responsible for the networking activities with the assistance of UTH. An external assistant (i.e. EA) produced eight notice boards, placed in portable stands with side cases for information material and flyers. The notice boards are placed in all beneficiaries' offices in spots where many individuals pass or visit. The EA also produced 15,000 flyers and 40 posters, which were distributed to all beneficiaries to be used in communication, promotional and networking activities. All printed material was produced in the English and Greek language for beneficiaries UTH, MILITOS, ATHINAIKI, PLUS and KOUKOUZELIS, in the English and Czech language for beneficiaries CEDA and CHAPS and in the English and Italian language for beneficiary ITACA. UTH catered for the English and Greek version of the information included, CEDA and CHAPS produced the Czech translations of the information ITACA catered for the Italian translations. Moreover, promotional giveaway items were produced to be distributed during participation in conferences/events, meetings, workshops, etc. These included mouse pads, wire-bound notebooks including a ball pen, folders and printed linen bags. In total 2,400 sets of promotional giveaway items were produced, to cover the needs of 7 workshops organized under the frame of Action D2 and other promotional needs such as participation to conferences, meetings with stakeholders, customers, and policy makers during dissemination and networking activities of Actions D1, D2 and B7. The official website of LIFE GYR was created under the domain name www.greenyourroute.com under the guidance of UTH. The website is available in English, Greek, Czech and Italian. LIFE GYR's website is updated regularly with events, news, articles, project material, etc. The material necessary for the website is produced by LIFE GYR team and the EA. UTH makes a quality check to the produced material and then sends it to the EA. According to the

website counter, 5,259 were the total hits of the website since its launch. 5,109 out of 5,259 hits were unique visitors of the website.
Additionally, UTH assigned to an EA the promotion of LIFE GYR through social media. EA created accounts under LIFE GYR name in the following social media: Facebook for the dissemination of website content, LinkedIn for the dissemination of the project's outcomes and YouTube for hosting of produced for the purposes of the project videos. EA under the supervision of UTH maintains the social media accounts and uploads the available material. Additionally, an online helpdesk (i.e. real time chat) was created by the EA on the website's homepage. The helpdesk plays an important role concerning the replication and transfer of LIFE GYR outcomes to other logistics operators, engineers and researchers. The scope of the helpdesk is to receive questions from potential users of LIFE GYR outcomes and give real-time scientific and technical answers and guidelines.
UTH assigned to an EA the design and production of the project's newsletters. In total, 11 newsletters were foreseen and produced during the project. The first newsletter was about the environmental efficiency and logistics optimization and the initiation of LIFE GYR project and its goals and was sent to 115 recipients. The second newsletter was about green procurements in logistics and was sent to 112 recipients. The third newsletter was about how to make Europe climate neutral through sustainable mobility and was sent to 374 recipients. The forth newsletter was about COVID-19 pandemic challenges in logistics sector and was sent to 354 recipients. The fifth newsletter was about the vehicle routing planning challenges and was sent to 352 recipients. The sixth newsletter announced the publication of GYR apps and the beginning of the real life demonstration period and was sent to 315 recipients. The seventh newsletter was presenting the GYR apps and was sent to 312 recipients. The eighth newsletter was about urban air pollution and was sent to 302 recipients. The ninth newsletter announced the workshops organized in the frame of the project and was sent to 309 recipients. The tenth newsletter was about the ISO 14034:2016 obtained for GYR service and was sent to 306 recipients. The eleventh newsletter was about the impact of the real life demonstration period and was sent to 320 recipients.
GYR team with the support of an EA created 5 videos and translated in Greek, English, Czech, and Italian. The 1st video convinces drivers and managers to follow Green Procurement rules and behave with a green way in a daily base. The 2nd video present the opinion of GYR service users. The 3rd and the 4th video is a user's manual of the web and mobile app respectively. Finally, the 5th video demonstrates that environmental friendly routing solutions are also cost saving. In addition, a Layman's report was produced targeting at a non-specialist audience and serving to inform decision-makers and non-technical parties of the project objectives and results. All dissemination material produced is also hosted in LIFE GYR website in the Communication section.
GYR LIFE project has made efforts to establish connections and collaborate with other EU projects in the field of green environmental approaches. The following actions are demonstrating how GYR project has reached out and connected with other EU projects, platforms, and networks, in the domain of green environmental approaches. These actions were linked with the overall dissemination strategy of the project in order to disseminate its results and actions. It should be noted, that COVID-19 has had a large impact on the ability of the project to conduct effective networking. Here are some ways in which the GYR LIFE project has engaged in networking with other projects:
•Collaboration with other EU projects: The project has focused on collaborating with five other EU projects in the same domain. This collaboration has allowed for the exchange of knowledge, sharing of best practices, and mutual support in achieving common objectives.
•Online networking and clustering activities: Due to travel restrictions and limitations imposed by the pandemic, in-person networking and clustering activities were significantly restricted.

GYR LIFE project has engaged in networking with a) ALICE, b) GRAGE, c) GREENOMED, d) RE-SOURCE, e) LIFE for Silver Coast project.
Networking activities were also performed during the participation of UTH in "Life and Cities" in April 2019, 6th International Conference on Energy, Sustainability and Climate Change (ESCC 2019) in June 2019 and MILITOS in 5th Conference on Intelligent Transport Systems and latest developments in Greece in December 2019. During its presence in these events, LIFE GYR team had the opportunity to contact other projects' team members, stakeholders and logistics practitioners and create awareness of LIFE GYR project and its expected outcomes.
Action D1 is implemented the way it was foreseen. Action D1 was associated with one deliverable: Deliverable D1: Deliverable D1: Report including material associated with dissemination pack and networking activities. The deliverable (including Layman's report) is included in **Annex I/Action D1**. Additionally, the layman's report in included as a separate document in **Annex II/Action D1**. The website of project will be maintained by the GYR Company team, for a period at least of 3 years after the end of the project and it will be updated for the same period with news related to the GYR apps.

Action D.2: Direct communication and workshops

Foreseen Start Date: 01/10/2018 Actual Start Date: 01/10/2018
Foreseen End Date: 30/04/2023 Actual End Date: 30/04/2023

For dissemination purposes, the presence and presentation of LIFE GYR project to events, like workshops and conferences, was a very effective way to reach and engage all target groups as well as promote and serve its objectives and spread the benefits of its results through knowledge transfer. Most importantly, LIFE GYR team established alliances and joined forces with similar initiatives and policy makers. MILITOS disseminated LIFE GYR project to Scent project events, on November 16th and November 17th, 2018, at Region of Attica (Periferia Attikis) and to 5th ITS Hellas Conference "Transportation & Logistics 2022: Research.Reshape.Innovate" on November 17th and November 18th, 2019. UTH participated in the workshop "Life and Cities" on April 10th and 11th, 2019, in Athens, organized by the Greek Task Force and to the 6th and 7th International Conference on Energy, Sustainability and Climate Change on June 3rd – June 7th, 2019 and August 24th – 27th, 2020 respectively. In 2021, MILITSO and UTH participated to an online event and 2 conference i.e. Online Event "LIFE and SMEs", May 26th, 2021, 8th International Conference on Energy, Sustainability and Climate Change, August 30th – September 3rd, 2021 and 7th ITS Hellas Conference "Transportation & Logistics 2022: Research.Reshape.Innovate", 8th-9th September 2021. Finally, after COVID-19 pandemic and during 2022, the participation of GYR project to physical events was easier. MILITOS participated to 3 events: 24rd Leading Supply Chains in a disruptive world on September 22nd - 23rd, 2022, LIFE GREEN MOBILITY Platform Meeting, October 12th – 13th, 2022, KEDE conference Volos (Municipalities Gathering), November 21st - 22nd, 2022. Finally, UTH participated in 2022 to a Training Seminar entitled VEHICLE ROUTING SYSTEMS 1. CALCULATION AND MANDATORY RECORDING OF CARBON FOOTPRINT (DIRECT & INDIRECT GREENHOUSE GAS EMISSIONS) UNDER THE NEW CLIMATE LAW 4936, 2. ROUTING TOOLS TO ACHIEVE DESIRED OBJECTIVES OF REDUCTION at Oikonomotexniki on November 30th, 2022.
Another important outcome of Action D2 was the organization of workshops. Each workshop was meticulously designed to establish connections with stakeholders in the logistics industry and provide them with an opportunity to familiarize themselves with the GYR platform and the newly introduced legal framework regarding carbon footprint. The primary objective of these workshops was to showcase the functionalities of the platform, including its web and smartphone applications, and emphasize the advantages and added value it offers to SMEs and stakeholders. The workshops also aimed to collect valuable feedback from participants, address the significance of the GYR certificate, and explore potential strategies for integrating it into companies' marketing plans. Finally, to bring policymakers in the loop and provide them insight that they could use at a later

stage when working towards climate-neutral transportation policies. In total 7 Workshops events should were organized. The workshops brought together GYR partners, representatives of different specialties related to the sector of logistics and all the abovementioned stakeholders (logistics business owners, drivers, freelancer, EU policy makers, executive managers etc.) in order to share knowledge, discuss options and provide recommendations. The 1st workshop in Greece was organized in Military Museum, Athens on February 15th, 2023, the 2nd workshop was organized in YMCA, Thessaloniki on March 27th 2023 and the 3rd workshop in Centre for Culture and Arts "Theatini", Volos on April 26th, 2023. The 1st workshop in Czech Republic was organized in the frame of a bigger event URBIS SMART CITY FAIR in Brno on September 20th-22nd, 2022, the 2nd workshop in the frame of Telematics CE Europe conference & expo and the 3rd workshop in the frame of the 10th Conference of the Czech Parking Association on March 18th-20th, 2022 in Kouty. Finally, the workshop organized in Italy was organized Itaca S.r.l. head office on April 6th, 2023. The quality of the workshops and the perceived satisfaction with its contents at all levels have been openly discussed during the open discussions at the closure of each workshop. Participants have stated that they have been highly satisfied with the project intervention and acknowledged the need for further support and interventions in the future with EU best practices.
Action D1 was implemented the way it was foreseen. All material foreseen have been produced. The only deviations were a) the delay of the organization of the workshops as GYR team focussed more to the implementation of the real life demonstration during the foreseen period of the workshops organization and b) the organization of 1 instead of 3 workshops in Italy (no official explanation was given by ITACA – no report about the workshops was delivered – ITACA informed UTH that a 2nd workshop was organized on April 20th, 2023 at the same place without providing any details). Action D2 was associated with one deliverable: Deliverable D2: Report with the most important points resulted during the workshops, conferences and events participation. The deliverable is included in **Annex I/Action D2**. GYR Company will continue participating in events related to GYR service in order to promote its innovative product.

Action E1: Project management and monitoring of the project progress

Foreseen Start Date: 01/09/2018 Actual Start Date: 01/09/2018
Foreseen End Date: 30/04/2023 Actual End Date: 30/04/2023

The scope of this Action was the successful implementation of the project and the timely and efficient management of all actions. UTH, as the Coordinating Beneficiary, was responsible for the overall coordination of the project and supervised and provided guidance in all actions implementation. For the scope of the project, a Project Steering Committee (PSC) was formed, acting as the decision-making body within the project Consortium. The PSC comprised of a representative from each beneficiary and the Project Coordinator. UTH determined the variables that need to be tracked in line with the particular requirements of the project and developed the following monitoring tools (in addition to the official files requested by EASME/CINEA) for the tracking, monitoring and quality check of the project implementation:

• In Trello.com, boards per beneficiary and per action were created. Each Action Leader was responsible to supervise and update them.

• A Dropbox.com shared folder was created where project related material (e.g. deliverables, timesheets, proof of payments etc.) was stored.

These tools provided the relevant data for each action and associated deliverables and indicate their status online and in real-time. They assisted UTH in assessing "planned versus actual" and deciding whether any task require procedural adjustments.

The Risk Management Plan allowed the verification of the life-cycle of the project in terms of risk. Specifically, team members recorded and analysed the relevant risks that threaten the project's implementation and defined the appropriate corrective measures. Updated versions of the plan was provided periodically to present active risks and include future ones. LIFE GYR team also prepared risk assessment forms in order the consortium to monitor the project's risks. The principal objective

of the risk management plan was to identify and prevent all kinds of risks. These risks were identified together with their implications and the consequential impact on the program in terms of timescale, quality, cost and the delivery of milestones and deliverables. Each risk was assessed against the probability of its occurrence and the potential impact it might had on the identified risk. Factors were then be marked on a scale of "null", through "low" and "medium", to "high". Each risk that was identified was further characterized by a set of risk reduction measures that could be implemented in order to reduce either the likelihood of the risk event occurring, or to mitigate the impact if it did happen. Based on this risk assessment, contingency/recovery plans were developed placing particular emphasis on any high-probability or high-impact risks. A "risk owner" was identified and was assigned with responsibilities for monitoring the risk, taking proactive and preventive measures and implementing the contingency plan if required.

Throughout the project implementation 9 regular project meetings were organized, four by UTH in Volos, Greece, one by MILITOS in Athens, Greece, one by CHAPS in Prague, Czech Republic and two virtual (due to COVCID-19) by UTH. During the meetings, LIFE GYR team discussed the project's progress, planned necessary corrective actions when needed and set out future steps. No communication issues occurred within the consortium. Electronic communication (file sharing through Dropbox, e-mail exchange, teleconferences through Skype, project monitoring through Trello.com) and onsite visits related to the real life demonstration were the main mean of communication.

UTH was responsible and acts as the contact point with the European Commission (EC). During the project implementation, one monitoring meeting was organized by MILITOS in Athens, Greece on Mai 17th, 2019 and four monitoring meetings was organized by UTH in Volos, Greece, on February 2nd, 2020, on Mai 14th, 2021, on Mai 31st, 2022 and on March 31st, 2023. All beneficiaries provided input to UTH in a timely manner in order to report the project's progress to the EC (monthly reports covering the period September to December 2018 and trimester reports covering the period January 2019 to April 2023). Additionally, UTH team with the support of the associated beneficiaries of the project prepared 1 mid-term report, 1 progress report and the current final report.

UTH also handled the partnership modification, communicated to EASME through an amendment request, of substituting beneficiary KOUKOUZELIS with beneficiary PAPA. A second amendment was prepared and submitted by UTH to EASME/CINEA on December 9th, 2021 requesting mainly the prolongation of the project and the revision of the submission date of several deliverables.

Action E1 is implemented the way it was foreseen in the technical description. Action E1 was associated with three deliverables: Deliverable E1.1: Final version of the project's steering committee which was delivered in the frame of the 5th monitoring meeting on 29/09/22 (updated version), Deliverable E1.2: Minutes of project meetings which was delivered in the frame of the 6th monitoring meeting on 31/03/23 and Deliverable E1.3: Risk Management Plan associated with Risks Assessment Forms and Quality Control Report which is available in **Annex I/Action E1**. For the period after the end of the project, UTH will keep records of the material associated with deliverables and expenses conducted in the frame of the project for any further request by CINEA.

Action E.2: After-life communication plan

Foreseen Start Date: 01/01/2021 Actual Start Date: 31/03/2023
Foreseen End Date: 01/01/2021 Actual End Date: 30/04/2023

The Action E.2 objectives was at maintaining and ensuring the viability of the project results beyond the project lifetime across project's countries and beyond. The after-life communication plan and the exploitation plan were developed by UTH and MILITOS. Both plans set out the methodology and steps to ensure maximum commitment to the objectives of sustainability, replicability, continuity, and extensibility of the GYR services and GYR apps. The After-life communication plan has a broad scope by designing key actions for the promotion of the general

scope and results of the GYR project while the Exploitation plan focuses on the sustainability and economic development of the main GYR product, namely the GYR Company. The afterlife communication plan defined the role of each beneficiary after the end of the project. The after-LIFE communication activities were grouped in three main categories:
1. The ones that ensure long-term digital visibility: Ensuring long-term digital visibility for the project means that the project identity and results will be present and noticeable in the online space for a specific, predetermined period (i.e. at least 3 years) following its closure. 2. Participation in third-party events: Participating in third-party events is a great opportunity for both the project to gain exposure to a broader audience and the partners to network with potential stakeholders from the industry, academia, and/or political sphere, depending on the scope and nature of the event. 3. Complementary activities: Including E-mail Marketing: Building upon the existing project e-mail list, implementing an automated e-mail campaigns for the dissemination of news and events related to GYR service and Online Community Building such as a closed Facebook group of the users of GYR apps.
The developed Exploitation plan elaborates on the GYR Company operation issues (incl. organisational, financial, marketing), based on the Business Plan and the Replicability and Transferability plan, both developed by MILITOS within the project lifecycle. More specifically, it aims at: 1) Updating and adjusting to the current situation the setting up process of the GYR Company and 2) Prioritising and specifying the key actions that will mark the initiation phase and set the foundation for company's growth.
Action E2 was implemented the way it was foreseen. Action E2 was associated with two deliverables: Deliverable E2.1: After-life communication plan and Deliverable E2.2: Exploitation plan. Both deliverables are included in **Annex I/Action E2**. For the period after the end of the project, GYR Company and the beneficiaries' of GYR project will implemented the activities included in both after life and exploitation plans.

6.2. Main deviations, problems and corrective actions implemented

Environmental Impact of the project
The goal (the value foreseen) concerning the NOx saved was achieved by a high percentage which is equal to 92.57% (the actual value saved compare the value foreseen) and more than 55% of the goal for CO2 was achieved. The goal for CO and VOC emitted were achieved by 25% and 19% respectively and the goal for PM by 10%. Finally, only a small percentage (less than 2%) of the goal for CH4, NH3 and SO2 was achieved. We have to notice that the impact associated with the fuel consumed and the N2O emitted was not foreseen in the frame of the project and for this reason there is not comparison between the fuel consumed and N2O emitted using GYR service and using the simulation tool.
Justification of deviations based on a wrong calculation: The minimum requirements to approximate a baseline of emissions emitted by the demonstrators of the project used was the pollution emission factors per tonne-kilometre (tkm) for LDVs and the freight traffic demand in tkm of each demonstrator. Ecoinvent database, for an average fleet of light duty vehicles up to 3,5 tones, gives the following emission factors: NOX=0.52, PM=0.057, CO=0.9, NH3=0.023, CO2=109.35, CH4=0.11, NMVOC=0,13 and SO2=0,1.
The 12 months before the starting month of the project, the total distance travelled by KOUKOUZELIS's trucks was around 5,500 km during 140 trips (~39km/trip), and the total amount of freight transported was around 120 tn (~ 0,85 tn/trip). Hence, in each trip the traffic demand was 0.85 x 39 ≈ 33.7 tkm per trip. The total yearly tkm for KOUKOUZELIS is equal to 4,718tkm and results by multiplying the 33.7 tkm per trip by 140 trips. When the environmental impact was calculated, the total tkm was calculated wrongly by multiplying the tkm per trip by the total kilometres (33.7x5,500=185,204) which give a value to the total tkm 39 larger than the correct one. The 12 months before the starting month of the project, the total distance travelled by PLUS's

trucks was around 172.602km during 1.040 trips (~166 km/trip), and the total amount of cold cargo transported was around 2.846 tn (~ 2,73tn/trip). Hence, in each trip the traffic demand was 166 x 2.73 ≈ 453.18 tkm per trip. The total yearly tkm for PLUS is equal to 471,307.2tkm and results by multiplying the 453.18 tkm per trip by 1,040 trips. When the environmental impact was calculated, the total tkm was calculated wrongly by multiplying the tkm per trip by the total kilometers (453.18x172.602=78,219,774.36) which give a value to the total tkm 166 larger than the correct one. The 12 months before the starting month of the project, the total distance travelled by ATHINAKI's trucks was around 978.078km during 4.520 trips (~216 km/trip), and the total amount of dry cargo transported was around 11.023tn (~ 2,45tn/trip). Hence, in each trip the traffic demand was 216 x 2.45 ≈ 639.45 tkm per trip. The total yearly tkm for ATHINAKI is equal to 2,890,314.2tkm and results by multiplying the 639.45 tkm per trip by 4,520 trips. When the environmental impact was calculated, the total tkm was calculated wrongly by multiplying the tkm per trip by the total kilometers (639.45x978.078=625,431,977.1) which give a value to the total tkm 216 larger than the correct one. We assumed that the customer of CEDA and ITACA have a yearly traffic demand of at least 1.5% of the total demand of the Greek demonstrators which corresponds to a traffic demand of at least 10,000,000tkm both. Based on the wrong calculation that the Greek demonstrators would have a total demand of 703,836,955tkm (=185,204+78,219,774+625,431,977) the 1,5% of this demand is equal to 10,557,554.3tkm.

Justification of deviations based on a wrong assumption: The above assessment of the environmental impact of the project was done based on the assumption that the tons of freight delivered or pick-up were transported for the entire km travelled by the trucks. This assumption was wrong for all demonstrators as for instance the trucks of ATHINAKI, PLUS, KOUKOUZELIS and ITACA start from the depot and progressively decrease their load factor by visiting one by one the delivery points and when the last point is served they return to depot empty. Additionally, the trucks of CEDA's demonstrator start form the depot with their freight and go to their final destination to deliver it and then go empty to the next visiting point to pick-up the next freight to deliver etc. As a consequence of this wrong assumption the total tkm of each demonstrator were 2-3 times overestimated.

The main corrective action which had positive effects to the replicability of GYR service, the further development of the apps and the further introduction of GYR Company into the logistic market resulting extra revenue, was that three new customers of GYR service were convinced to use the service in their full business operational environment for the last 7 months of the real life demonstration. The use of the GYR service in the frame of the project, by these additional entities increased the total impact (environmental and socio-economic) of the project.

Timeline affected due to COVID-19

COVID-19 pandemic introduced several difficulties in the project implementation due to remote work or unsynchronized work in some cases. The implementation of several tasks during the COVID-19 pandemic required more effort, thus more working hours, due to cases of unsynchronized working and reduced productivity in cases of working from home. Differences in curfew periods between Greek, Czech and Italian beneficiaries participating in implementation actions of GYR platform affected the technical team members' availability, thus resulting in further delays. These actions required strong collaboration, continuous feedback between all participants, direct contact, and immediate response to occurring issues. Proper coordination of the process was impossible with all these unexpected changes in the beneficiaries' working environments.

Additionally, the COVID-19 pandemic affected the overall working sector of the logistics companies. The logistics companies were closed for a period of 3-4 months during the first wave of the pandemic, but still, even when they were open again, the volume and the way their work was implemented, were not stabilized to the status before the crisis. Since the outbreak of the COVID-19 crisis, the business of the logistics companies participating in the project as Demonstrators has been seriously affected (retail and food service businesses were closed), thus,

the Consortium needed (corrective action) to wait for the reinstatement of their business back to normal circumstances. During the period October-November 2021, the stabilization of the logistics environment almost to the initial conditions (i.e., with the least possible impact of the COVID-19 pandemic) occurred. The stabilization of the logistics sector was necessary for the proper implementation of the Real-Life Practice. Taking under consideration that the logistics business was back to normal status in October-November 2021, it was expected that the Real-Life Practice would start on December 2021-January 2022 and last for 12 months (i.e., until November-December 2022), so that the environmental impact of the project remains to the initially foreseen status (on a 12-month basis). It should be noted that, the step before the Real-Life practice, the Integration Activity, was also affected with delays due to COVID-19. Key persons from the demonstrator's personnel have been working remotely or have been in suspension during the originally planned integration period, thus, hindering coordination of the integration activities. Additionally, while some customers of the demonstrators were not working during the COVID-19 crisis, there was risk that issues regarding the integration may not be encountered to be resolved and may be excluded in the fine-tuning of the platform. Therefore, the integration procedure needed additional time (corrective action) for its implementation for both of the reasons mentioned above; low productivity due to difficulties in co-ordination and the effect in the sector of the logistics. Moreover, the COVID-19 crisis and the uncertainty that it caused in the business of the logistics, added difficulties for the integration of three additional companies, since most logistic companies encountered several organizational and economic issues during this era. The stabilization of the logistics market was also crucial for this activity, which was expected to give more results in the period after November-December 2021 as well. The main corrective action for these delays was to submit an amendment request (which was accepted) for the prolongation of the project for a period of 14 months.

Networking and EU policy updating

COVID-19 pandemic has significantly impacted the networking activities of the GYR project. As the project aimed to establish close links with relevant stakeholders and engage in networking activities, the physical restrictions and limitations imposed by the pandemic had a profound effect. Many physical events, conferences, and face-to-face meetings had to be canceled or postponed, hindering the project's ability to conduct effective networking. However, the GYR project quickly adapted to the new circumstances and shifted its networking activities to online platforms. Virtual meetings, webinars, and digital conferences became the norm, allowing the project team to continue engaging with stakeholders and disseminating information about the project's objectives and outcomes.

Verification ETV explain the problem submit for ISO which is based the ETV

GYR team faced obstacles in the Environmental Technology Verification (ETV) process. The ETV process proved unfeasible as it was recognized that initial performance claim could not be defined. The main reason was that the potential environmental benefit of a 3PL company is defined based on a multi-criteria optimization mathematical problem. In the case of GYR service, we could not define specific condition due to multi criteria problem. As a corrective action GYR team proceeded the verification process with ISO 14034-2019 which is the international standard that ETV was based on. ISO 14034-2019 has been obtained on April 2023.

6.3. Evaluation of Project Implementation

Methodology applied

The methodology applied for all actions is efficient since the revised (i.e. after the amendment request for prolongation) timeframe was followed and expected results were gradually achieved. The Actions were managed in a cost-efficient way as the impact of the project was significant and the expected outcomes were achieved. The success of the methodology includes mainly the development of a fully marketable innovative logistic platform for last mile delivery of goods in

urban environment and the 10 signed contracts of GYR Company with 10 SMEs. Additionally, the decision to obtain ISO 14034 in replace of ETV was a successful decision in order to get a verified service for green logistics increasing with that way its marketability. The failure of the methodology includes the initial estimation of the environmental impact, which was based on a wrong assumption and a wrong calculation (more in section 6.2).

Action A1: *Objectives*: The review of the developments after the proposal submission, preparation and signing of partnership agreements and MoU for Green Procurement, production of guidelines on how to implement Green Procurement. *Expected results*: 7 Partnership Agreements and 7 MoUs of Green Procurement between UTH and the Associated Beneficiaries. Guidelines for implementing Green Procurement. Assessment of Green Procurement, 77 assessment forms. Review of new database designs, architectures and structures used in web applications for the general VRP. Review of new algorithms for solving the Green-VRP and its variants. Review of new EU policies, standards, directives, practices and initiatives on air quality, noise and urban logistics (Achieved). *Evaluation*: (Successful) LIFE GYR team gathered and analysed the most recent trends in the basic sectors related to the project, available to all interested target groups coming from research, private or public sector, providing important feedback to the implementation actions. The role and tasks of each project beneficiary were well defined and the framework for reducing the project's environmental footprint had been set.

Action B1: *Objectives*: Creation of an improved and safe database storing all the demonstrator and algorithm requirements and a data access service for feeding it with data. *Expected results*: Tables with information about system users' component. Statistical information for monitoring component. Mapping information of the transport network component. Static and dynamic data for the definition and monitoring of the environmental impact of routes component. Development of relations between components. Data access service. Database and data access service security controls (Achieved). *Evaluation*: (Successful) The database was created in order to be fully replicable and extendable and the data access service supports different case of data entry.

Action B2: *Objectives*: Development of modelling and solution approach for environmental co-modal vehicle routing. *Expected results*: Adjustment of modelling approaches developed in previous projects. A generic model representing the main variants of Green-VRP. An approach to produce clusters and assign them to vehicles. A TSP solution algorithm (Achieved). *Evaluation*: (Successful) The models and algorithms for the Green-VRP were created in such a way so that they are data-agnostic and easily integrated to newly introduced logistics companies.

Action B3: *Objectives*: Development of GYR platform. *Expected results*: Cost Matrix API. Traffic API. Weather API. Routing API. GYR API. Implementation of user interface. Communication between web and mobile applications. Beta version of web and mobile applications. Pre-final version of web and mobile applications. Final version of web and mobile applications (Achieved). *Evaluation*: (Successful) The GYR platform was developed using APIs increasing the replicability and extensibility of the resulted services (i.e. Optimization algorithm API, emission calculation models API). GYR web app was developed as it was foreseen with the innovation of 3 steps of optimization. The first step pre-assign orders to trucks and the second assign the rest of the orders to the available truck using the optimization algorithm. The third step gives the flexibility to the user to revise the resulted by the second step routing plan. The revisions satisfied specific needs (i.e. a specific truck should visit a specific point) without affecting the feasibility of the trips and the optimality of the trips (i.e. from environmental and socio-economic point of view). The GYR mobile apps were developed as it was foreseen.

Action B4: *Objectives*: Definition of project demonstrators' routing requirements and testing of GYR platform through real routing examples. *Expected results*: Selection of a demonstrator in Czech Republic. Selection of a demonstrator in Italy. Definition of ATHINAIKI, PLUS, KOUKOUZELIS CEDA and ITACA routing requirements. Testing of the beta version of GYR platform. Evaluation of the beta version of GYR platform (Achieved). *Evaluation*: (Successful)

The demonstrator's requirements have been well defined. The beta version of the web app was tested and evaluated (see questioners in Action C2) with the highest score (i.e. 5/5) by the 90% of the users and with 4/5 by the rest 10%. The beta version of the web app was tested and evaluated (see questioners in Action C2) with the highest score (i.e. 5/5) by the 82% of the users and with 4/5 by the rest 18%.

Action B5: *Objectives*: Integrate the pre-final version of GYR platform into the operational environment of demonstrators. Demonstrate GYR service into real life practices of logistics operations in urban zones for a period of 12 months. Integration GYR service into the operational environment of 3 new users in additional to the 5 demonstrators. *Expected results*: Analysis of the existing hardware and software within the demonstrator's environment. Analysis of potential needs for additional hardware and/or software required to support the integration of GYR platform within the demonstrator's environment. Customize and setup the data access service. Train managers of demonstrator on how to use GYR web app. Train drivers of the demonstrators on how to use the mobile app. Integration of green procurement rules. Develop integration manual. Daily use of GYR service. Extract and record routing solution and statistics. Implement the created daily routing plans. Monitor routing plan implementation. Evaluate Routing plans by trained users. Fine-tuning of the apps during the real life demonstration period (Achieved). Sign 3 contracts with 3 new users of GYR service located in Hungary, Slovak Republic and Belgium (not achieved). *Evaluation*: ***(Partially Successful)***. ***The GYR service was well integrated*** into the operational environment of 5 demonstrators as well as ***(no-foreseen) into the operational environment of 3 new users.*** In the case of the Greek demonstrators the ERPs of the 3 SMEs were connected with the GYR database in order to create a unique daily plan for all 3 SMEs. ***Real life practice*** was well implemented for a longer period (i.e. ***12 months were foreseen – 17 months lasted***) into the operational environment of the 5 demonstrators. On the top (no-foreseen), ***the 3 new customer demonstrated (no-foreseen) GYR service for the last 7 months*** of the real life demonstration period. 5 additional contracts have been signed between GYR company and the 3 between these 5 additional SMEs participated the last 7 months of the real life practice. ***The new users are not located in Hungary, Slovak Republic and Belgium. All 3 are located in Greece***.

Action B6: *Objectives*: Establishment of GYR Company and preparatory actions for the Environmental Technology Verification of GYR service. *Expected results*: Business plan of GYR Company. Investigation and definition of the region of GYR Company. Statute creation of GYR Company. Definition of the ownership structure of GYR Company. Establishment of GYR Company. Development of Verification Plan for ETV. Eligibility check with a Verification Body for ETV(Achieved). Contractual agreement for ETV. Elaboration of test plan and implementation of tests for ETV. Statement of Verification for ETV (Not achieved) *Evaluation*: ***(Partially Successful)*** The GYR Company was established in Greece few months earlier than it was foreseen because it was mandatory for ETV process. ETV did not obtained. ***ISO 14034 which was obtained on April 2023, replaced ETV***. ISO 14034 was the best available option after ETV as ISO 14034 forms the base for ETV.

Action B7: *Objectives*: Replication of GYR service, creation of synergies with stakeholders and updating of existing legislation with a directive for green logistics. *Expected results*: Replicability and transferability plan development. Webinar sessions, 20 in total. Report including recommendations for updating EU policy and legislation (Achived). 8 meetings with policy makers in EU All expected results were achieved (***Partially Achieved-limited***). *Evaluation*: ***(Partially Successful)*** Dr. Saharidis, successfully became an external member of the national (Greece) committee's board of logistics and supply chain. This privileged position enables Dr. Saharidis to actively participate in their meetings and advocate for green supply initiatives associated with the LIFE GYR project. ***Replicability and transferability plan*** were developed and ***applied (no-foreseen) to 3 new users***. 23 ***webinars (3 more than foreseen)*** were organized. ***Report*** including recommendations for updating Greek legislation was well prepared, ***presented and delivered to***

the appropriate committee which consults the Greek parliament for the new law of logistics.
GYR team ***did not organized 8 meetings*** with policy makers in EU due to COVID-19. The only chance to meet policy maker in EU level was during the virtual event i.e. the LIFE Platform Meeting, organized by CINEA on October 12 and 13, 2022.

Action C1: *Objectives*: Monitoring and measurement of LIFE GYR's impact on the environmental problem targeted. *Expected results*: Monitoring the environmental impact of the project at a regular basis: calculation of 2 emission inventories. Novel emission inventory methodology for monitoring of the environmental impact of the project. Total environmental savings of 13.22% during real life practice period (Achieved). Saving of CO2 equal to 8885.697tns. Saving of CH4 equal to 8.939tns. Saving of CO equal to 73.133tns. Saving of NH3 equal to 1.869. Saving of NOx equal to 42.255. Saving of PM equal to 4.632. Saving of VOC equal to 10.564. Saving of SO2 equal to 8.126 (***Partially Achieved***). *Evaluation*: ***(Partially Successful)*** More than 50% (foreseen 13.22%) of environmental savings occurred. Due to a wrong calculation and a wrong assumption: ***55.87%*** of ***CO2*** savings were ***achieved***, ***1.77%*** of ***CH4*** savings were ***achieved***, ***24.98%*** of ***CO*** savings were ***achieved***, ***1.70%*** of ***NH3*** savings were ***achieved***, ***92.57%*** of ***NOx*** savings were ***achieved***, ***10.40%*** of ***PM*** savings were ***achieved***,***19.04%*** of ***VOC*** savings were ***achieved***, ***1.25%*** of ***SO2*** savings were ***achieved***. The baseline scenario was re-defined and re-calculated as the initially foreseen baseline scenario was not comparable with the routing plans created using GYR service.

Action C2: *Objectives*: Monitoring and assessment of the socio-economic impact of the project actions. *Expected results*: Establishment of a set of criteria for describing implementation and dissemination actions. Socio-economic impact assessment report (Achieved). *Evaluation*: (Successful) The action was well implemented. The socio-economic impact was well recorded.

Action C3: *Objectives*: Implementation of the KPIs evaluation process. *Expected results*: Inclusion of data into the KPI database webtool. Evaluation of the KPIs for the reporting period of the Mid-term report. Evaluation of the KPIs for the reporting period of the Progress report. Evaluation of the KPIs for the reporting period of the Final report. Development of a simulation tool in order to simulate the routing planning approach used before the use of GYR service (Achieved). *Evaluation*: ***(Successful)*** The foreseen KPIs, the mandatory KPIs as well as KPIs suggested by the external monitoring team was setup into the KPI web tool. KPIs were updated regularly and with the submission of a report. The simulation tool simulated the heuristic approach for routing planning without the use of GYR service.

Action D1: *Objectives*: Dissemination activities of the project aiming to promote the project's outcomes. *Expected results*: Production of 8 noticeboards. Production of 2,400 promotional packages. Project's official website creation. Project's website visited by 4,200 individuals. Setup of social media accounts (Facebook, LinkedIn, YouTube). Production of 5 videos. Production of 11 newsletters. Networking with other projects, at least 5. Production of the Layman's report (Achieved). *Evaluation*: (Successful) The website had 5,280 hits which 5,109 were unique visitors (16% more than foreseen). High quality promotional material was created and disseminated during events. Layman's report was created and disseminated. High quality promotional video was created and disseminated (average more than 1000 view per video).

Action D2: *Objectives*: Presence and presentation of LIFE GYR in conferences and demonstration of the platform through workshops. *Expected results*: Participation in 3 EU conferences. Organization of 3 workshops in Greece. Organization of 3 workshops in Czech Republic. Number of policy makers participating at each workshop: at least 9. Number of persons participating at each workshop: at least 100 (Achieved). Participation in 1 conference outside EU (***Not achieved***). Organization of 3 workshops in Italy (***Partially achieved***). *Evaluation*: ***(Partially Successful)*** UTH participated to 3 international workshops organizing special sessions and round tables dedicated to LIFE GreenYourRoute project. GYR team did not participate to EU conference due to COVID-19 travelling limitations. In total 3 workshops in Greece and 3 workshops in Czech Republic were well organized increasing the dissemination of the outcomes of GYR project. The 3 workshops in

Greece were fully successful with immediate results such as the signature of 5 contracts with 5 new users of the GYR service. ***Only one workshop*** has been organized ***in Italy*** resulting ***limited dissemination of projects outcomes***. More than 100 persons on average participated (physically 20 persons on average and virtually 84 persons) to workshops. In total 43 policy makers answered the questioners distributed electronically.

Action E1: *Objectives*: Successful implementation of the project and the timely and efficient management of all the Actions. *Expected results*: Establishment of a Project Steering Committee (PSC). An Indicator Table for each Action describing the progress of the Action. Efficient coordination and smooth implementation of the project. Organization of 9 regular project meetings. High quality results and reporting delivered by beneficiaries under the supervision of the Project Coordinator. Total compliance with the project timetable regarding reporting to EC (Achieved). *Evaluation*: Successful.

Action E2: *Objectives*: Define supportive tasks to ensure maximum commitment to the objective of sustainability, replicability, continuity and extensibility. *Expected results*: Prepare an after-life communication plan. Prepare an exploitation plan (Achieved). *Evaluation*: (Successful) A high quality after-life communication and an exploitation plan were created.

Visibility of results

-Several dissemination activities results are visible to the public since their production, either through physical placement in facilities or through the project's website and social media accounts.

-Suggestion for the new law for logistics have been sent and it is visible to the board responsible to suggest the new law to the parliament of Greece.

-Emission API and Optimization API were developed increasing the replicability of GYR service. ITACA is the first replicator of those APIs.

-The developed optimization algorithm could solve several versions of the vehicle routing problem resulting the collaboration of 3 new customers with GYR Company.

-The 3 workshops in Greece were fully successful with immediate results such as the signature of 5 contracts with 5 new users of the GYR service.

-In total 10 contracts were signed with GYR Company, offering sustainability to its business development, its replications and especially its continuation after the end of the project.

-GYR Company is established offering 2 FTE jobs until now.

-Significant environmental impact was occurred which was immediate visible to the urban regions where the demonstrators run their business.

Amendment Request: PAPA's withdrawal and its substitution by KOUKOUZELIS were communicated to EASME through an amendment request. PAPA withdrew of the project in the first month of its implementation and its substitution did not create significant delays in the project. The overall project objectives remained unchanged and the EU contribution was not increased or affected; moreover, the geographic coverage and transnational aspect of the project were not affected, since both companies are situated in Greece. In case this amendment was not accepted by CINEA then the GYR service would have been developed based on the business environment of 4 3PL companies instead of 5, limiting in some level its generally applicable character. In additional the socio-economic and environmental impact would be less than the actual.

A second significant amendment was requested by UTH requesting a prolongation of the project the timeline of which, has been significantly affected by the COVID-19 pandemic. A 14-month prolongation of the project was requested. The overall project objectives remained unchanged and the EU contribution was not increased or affected; moreover, the real life practice lasted 17 months (5 months longer than initially foreseen) improving further the environmental and socio-economic impact of the project. In case this amendment was not accepted by CINEA then the GYR project would not have the opportunity to demonstrate GYR service into the business environment of 5 3PL companies resulting zero environmental and socio-economic impact.

Finally, several minor amendments were also communicated to EASME, which did not affect the project implementation. These included changes in the legal representatives of UTH and CHAPS, as well as administrative changes in CEDA.

Dissemination activities: Dissemination activities focused mainly to

-the production of the necessary material for the direct communication activities, i.e. workshops, participation in conferences, which included the notice boards, promotional material and moreover, flyers and posters. The distribution of the dissemination material was highly effective as it was distributed to stakeholders and potential users of GYR service or replicators of GYR outcome (i.e. emission calculation models API, optimization algorithm API).

-the creation of traffic in the project's website and social media accounts through relevant to LIFE GYR objectives and framework posts. The impact of the website was effective as several potential users contact GYR Company via the live chat created for the website.

-the production of 11 newsletters which effectively informed several logistics companies (more than 300 individuals read the each newsletter). The newsletters announced events organized in the frame of the project, the publication of the apps, the environmental and socio-economic impact of the project, as well as the importance of taking into account environmental factors in logistics operations.

-the organization of webinars which successfully trained new users to the use of GYR service.

-the organization of 7 workshops. The effectiveness of the workshops was significant resulting the real-life demonstration of GYR service by 5 additional companies participating to the workshops and the signature of 5 contracts between these companies and GYR Company.

The major drawback of dissemination activities was the travel restrictions and limitations imposed by the pandemic, in-person networking and clustering activities were significantly restricted.

Replication: The main results of the replication efforts were: 1) The replication of Emissions API and Optimization Algorithm API into ITACA operational environment and then the replication of these APIs during real life demonstration. 2) The replication of GYR service into the business operational environment of 3 companies (between the 5 companies signed contract with GYR Company) which demonstrate GYR service during the last 5 months of the real life demonstration period.

Policy impact: To provide evidence and support for the updating of EU policy and legislation the following steps were followed by GYR consortium focused on a Gap Analysis of the existing EU policy and Benefits analysis of Green Routing. The main outcomes of GYR team updating EU policy were: **1)** It is therefore suggested to amend article 5 of the Greek law 4302/2014 in 3 parts, as follows: a)"For the achievement of the goal of Green Logistics, motives are provided for the adoption of methods of routing optimization by the Logistics Companies". b)"The terms upon which a certification for adopting and using methods of routing optimization are defined by a Joint Ministerial Decision (Ministers of Economy, and Environment and Transport), as well as the terms of operation for the bodies that provide Green Logistics certification". c)"In the environmental performance factors that are measured and made public as by the terms of paragraph 1 of JMD 1023/2018, polluting emissions beside greenhouse gases are included." **2)** In the context of the specific strategic goal-setting that has been analyzed, the following initiatives are proposed: a) Creation of a new all-encompassing Parliamentary Law or Code with the goal of encoding all current provisions and regulations concerning the regulation of Urban Mobility and are now present as fragmented traffic regulations with a non-unified rationale, thereby creating a modern and coherent legislative infrastructure in one text. b) Refinement and unification of categories, criteria, and rules for trucks and areas limiting exceptions and a la carte regulations and connecting them with evidence of environmental footprint and possibly with routing optimization (e.g., linking exceptions not by truck type but with the total cost based on load carried per Km, or total Km per company fleet). c) Institutionalization of appropriate motives for using certified routing software

that ensure routing optimization with criteria such as minimization of environmental cost and fuel consumption, and maximization of energy saving.
GYR consortium was actively engaged in communicating the aforementioned recommendations to relevant stakeholders, with the objective of promoting the adoption of green features in supply-chain law. As part of these efforts, the project approached the standing logistics committee, the Greek national body responsible for giving consultation to the lawmakers. Through a series of meetings, the project coordinator, Dr. Saharidis, successfully became an external member of the committee's board. This privileged position enables Dr. Saharidis to actively participate in their meetings and advocate for green supply initiatives associated with the LIFE GYR project. Following the presentation of recommendations of GYR-Project in June-July 2021, the committee requested Dr. Saharidis to provide them with the Framework of Recommendations. This request arose due to the establishment of a drafting-law committee tasked with revising Law 4302/2014. The recommendations put forward by the GYR project were partially taken into consideration and partially affected the new national climate law 4946 Gazzette_105_27.05.2022. From May 2022, monitoring of the carbon footprint of supply-chain companies (logistics companies, 3PL, courier etc.) must be reported obligatory to the Ministry of Environment. Note that the methodology that is followed by GYR Platform to measure/monitor emissions is the one that is required by EU and the Greek State according to the abovementioned law. Unfortunately, the use of green-routing optimization software is not yet mandatory by law, as it is still difficult to apply.

6.4. Analysis of benefits

Environmental benefits: The total impact of the real life demonstration of GYF service resulted by the 5 demonstrators and the 3 new customers of GYR company. The environmental impact is: 1,571.247 of FC (tns), 4,964.767 tns of CO2, 157.895 kg of CH4, 18,270.855 kg of CO, 98.282 kg of N2O, 31.742 kg of NH3, 39.114 tns NOx, 481.661 kg PM, 2,011.292 kg of VOC, 101.559 kg of SO2. The deviation concerning the environmental impact of the project are discussed in section 6.2 above. The developed GYR service could be considered as a long-term sustainable technology as a) always 3PL companies and other SMEs (e.g. waste collection companies) need to create in a daily base a routing plan, resulting potential new customers for GYR Company and b) the GYR service could create routing plans of any future type of vehicles as it could be easily improved with future emission calculation models, future type of engines, future type of vehicles etc.
Economic benefits: The main economic benefits are: 1) In total, 883,118 kilometres (16,01% less compared to the baseline scenario) are saved for the 8 demonstrators of GYR service during the real life demonstration period. 2) In total, 1,648 less routes (5,52% less compared to the baseline scenario) are performed for the 8 demonstrators of GYR service during the real life demonstration period. 3) The average percentage of kilometres that carried no inventory/freight for CP2.1 (baseline scenario) was 33.52%, and for CP2.2 (actual implemented scenario) was 28.24%. 4) Optimize Load Fulfilment (i.e. the utilization of the truckload capacity) was 41.06% for CP2.1 and for CP2.2 was 47.38%. 5) The average amount of consumed fuels for CP2.1 was 66.30 lt/100km and for CP2.2 was 41.29 lt/100 km. 6) The average fuel usage for each truck was for CP2.1 0.396 lt/tkm, and for CP2.2 was 0.133 lt/tkm. 7) The average maintenance cost for each order processed for CP2.1 was 3.42€/order and for CP2.2 was 2.95€/order. During the project implementation, the full-time equivalent (FTE) of jobs created, i.e. new part or full time positions created for the purposes of the project, was 21.84FTE of qualified staff for all project's beneficiaries. (Note see calculation is Del C1 point 1-2 and C2 the rest of the points).
Social benefits: The main social benefits are: 1) Environmental footprint consideration: The normalized rating score calculated for C2.1 was 0.7573 and for CP2.2 was 0.8078. 2) The entities reached through LIFE GYR dissemination activities and made aware of LIFE GYR initiatives and objectives are equal to 0 for CP2.1 and 2808 for CP2.2. 3) The individuals reached through LIFE GYR dissemination activities and made aware of LIFE GYR initiatives and objectives are equal

18,068. 4) The number of persons participated to the workshops, webinars, conferences, and general networking activities is equal 571. 5) The number of trained users of GYR web and mobile applications are 179.6) The number of individuals to which an application manual was delivered is 231.7) The total people reached through social media are 13,756. 8) The total number of routing requests of LIFE GYR platform is equal to 25,114.9) The average duration of a user utilizing LIFE GYR platform is equal to 252 minutes.10) The number of users of the mobile applications is 149.
Replicability, transferability: GYR platform has high potential for replication in same and other sectors at the local and EU level. As it is described in other section of the FR, GYR platform is developed in a different design that it was foreseen. The main part of this design is the devleopement of API for each one of the services provided by GYR platform (i.e. Optimization algorithm and Emission calculation models). The platform is already replicated (another sector) into ITACA routing planning optimization where the two APIs are used improving the existing service provided by ITACA. Additionally, GYR platform was replicated (same sector) into the operational environment of 3 SMEs which has also signed a contract with GYR Company.
The C2M checklist was updated during the implementation of the project and completed at the end (see **Annex II/Action B7**). The main info included in the C2M checklist are: 1) The innovation of the GYR service/product: GreenYourRoute platform strengthen innovation capacity and contribute to the development of new technology-based products in the environmental sector, reduce yearly GHG emissions, ensure environmental but also operational cost benefits in the daily routing operations of companies and minimise environmental impact of SMEs, promote the adoption of green procurement rules in business environments and influence policy-making, including through updating the air quality legislation. 2) GYR service reached TRL9. 3) GREEN YOUR ROUTE MON. IKE is the owner of GYR service. 4) Market: There is a growing demand and few offerings are available. The market is growing. There is an established competition but none with a proposition GYR service. The GYR service will be fully commercialized between 1 and 3 years. 5) What are the steps and their status in order to bring GYR service to the market: a) Done so far: Technology transfer, A partner's research team and business units are both engaged in activities relating to this innovation, Market study, Prototyping in laboratory environment, Prototyping in real world environment, Pilot, demonstration or testing activities, Feasibility study, Launch a start-up or spin-off, Complying with existing standards, Contribution to standards, Business plan, Product/service sale price determination. b) Not planned but needed/desirable: Raise capital, Raise funding from public sources, Securing intellectual property rights (patents, copyright). c) Not planned and not needed: Licensing the innovation to a 3rd party.
Best Practice lessons: For the implementation actions, the outcomes of Action A1 were used. This review summarizes best practices in database designs, architectures and structures used in web applications, new algorithms for solving the VRP and practices on air quality and urban mobility.
Innovation and demonstration value: GYR platform is innovative in the logistics industry as the developed mobile application is not a static routing planner including routing plan and information, but at the same time supports a rerouting option in case something unpredictable occurs during the execution of the initial planned route. The innovation value of LIFE GYR is also the monitoring and calculation of produced emissions from transport, since especially in Greece, no such monitoring schemes are available. Additionally, the GYR platform is innovative as it includes 3 levels of optimization that does not exist in any routing planning service so far. The first level could be used to create a routing plan entirely or partially manually in the frame of a digitized environment. This level of optimization actually simulates the heuristic based on the managers' experience routing planning approach implemented by several 3PL. The second level of optimization is the one, which based on the decision (if any) taken manually in the first level of optimization, creates automatically the optimal from environmental point of view routing plan. Finally, the third level of optimization could be used in order to revise manually the resulted routing plan by the second optimization level. In certain cases, the routing plan created by a system (i.e. a

platform) could not take under consideration specific constraints (i.e. specific condition in a route e.g. street market). These constraints could be applied manually, using the third level of optimization. Furthermore, for the development of GYR platform, 5 SMEs participated and suggested their routing needs, making it more attractive, since several special features are included compared to the existing routing platforms, which produce basic routing solutions without considering the environmental impact.
Policy implications: Due to page limitation please for more see last part of 6.3 section.

7. Key Project-level Indicators

In this section, the KPIs selected with the support of external monitoring team and introduced in the KPIs web tool are presented. For each one of the KPIs which was foreseen in the beginning of the GYR project, we provide an analytical comparison with the targets foreseen. Note that more details about the values of the KPIs the potential deviation between the value foreseen and the values reached, and related justification one may find in Deliverable C3.2 and C3.3 as well as in section 6.3 of the current report.

KPI: 1.5. Project area/length

The project area includes Czech Republic, Greece and Italy. The indicator selected was Area of environmental/climate implementation actions and the activities included was the freight transportation of the participating company. In Italy, ITACA's demonstrator performs logistics operations in the area of Cosenza. According to Wikipedia, the province of Cosenza covers **6,710 km^2**. In Czech Republic, CEDA's demonstrator performs logistics operations in the greater area of Czech Republic. According to Wikipedia, the area of Czech Republic covers 78,866 km^2. Due to the wide range of logistics activities of CEDA's demonstrator it is assumed that at least half of Czech Republic's extent is influenced by the project actions, i.e. **39,433 km^2**. In Greece, all Greek operators perform logistics operations in the area of Region of Attica. ATHINAIKI, also performs logistics operations in Thessaloniki, Larissa, Lamia, Patra, Ioannina and Rhodes and DIGICOM also in the region of central Macedonia, the region of eastern Macedonia and Thrace, Volos and Crete. The total extent of the Greek areas influenced by the project activities covers **68,791 km^2**.The total spatial extent of the project expected to be directly influenced by the project actions covers **114,934 km^2**. Note that this value is valid both for the end of the project and 3 years after the end of the project assuming that, the new customer of GYR service will run their business at the same regions where the existing customer run their own business. No value for this indicator was foreseen in the beginning of the project.

KPI: 1.6. Humans (to be) influenced by the project

a) Persons whose lives were directly, positively impacted by MAIN envir. actions of project. This descriptor is assessed through the inhabitants of the areas where the project is implemented.
The residents living in the project area in which the pressures (in this case the air pollution) are to be partially reduced are 11,172,143 inhabitants located in 11 regions of Greece, in Czech Republic and in 3 region in Italy. This value is not expected to differentiate significantly 3 years after the end of the project as the population will be similar.

b) Persons with improved capacity or knowledge due to project actions. This descriptor is assessed through the persons participating to workshops and webinars and they were explained that adopting a green logistics technologies such as LIFE GreenYourRoute platform does not only improves the environmental impact of their operations but at the same time results in important cost saving (i.e. fewer kilometers travelled and faster deliveries).

This descriptor included **232** persons.
We estimate that 3 years after the end of the project additional 60 persons (i.e. 20 per year) will get involved into the after the end of the project activities (i.e. webinars organized by GYR Company for 3LP companies in order to train new users on how to use GYR service).
The value of the indicator Beyond 3 year is equal to **292** individuals.

c) Persons who may have been influenced via dissemination or awareness raising project-actions (reaching). This descriptor is assessed through the persons participating to bilateral meetings between an SME and GYR team resulting in some cases the purchase of GYR service by the SME and persons participating to events. This indicator included **508** persons.
We estimate that 3 years after the end of the project additional 150 persons (i.e. 50 per year) will get involved into the after the end of the project activities (i.e. promotional events of GYR service, conference and workshops participation etc.). The value of the indicator Beyond 3 year is equal to **658** individuals.

d) Persons who changed their behaviour or practices due to the project actions. This descriptor is assessed through the persons adopting Green Procurement rules within GYR Consortium and trained on how to use GYR apps. The total number of persons is equal to **238**. Based on the business plan, 63 SMEs will become customer of GYR service 3 year after the end of the project. In the frame of the project, 8 SMEs are customers of GYR service influencing the behaviour of 179 persons (22 persons per entity). In case 63 SMEs become customers of GYR service, we estimate the persons which will change their behavior (i.e. their daily routing planning approach) by adopting GYR service are expected to be 1386.
In total, the value of this descriptor 3 years after the end of the project is equal to **1624**.

No value for the above indicators was foreseen in the beginning of the project.

KPI: 6.1. Air emissions (non-GHG emissions) and KPI 8.1. Greenhouse gas emissions

According to the calculations performed during the assessment of CP1.1 (i.e. 1st Check Point of the C1 Action) and CP1.2 (i.e. 2nd Check Point of the C1 Action) under the frame of Action C1, the produced non-GHG emissions from the project demonstration of the 17 months are presented in the following table.

All users of GYR service	CP1.2	CP1.1
FC (Tones/year)	1,779.446	3,526.847
CO (Kilograms/day)	73.596	145.025
N2O (Kilograms/year)	118.262	235.226
NH3 (Kilograms/day)	0.178	0.350
NOx (Tones/year)	49.479	96.393
PM (Kilograms/day)	2.994	5.694
VOC (Kilograms/day)	10.473	19.947
SO2 (Kilograms/day)	0.477	0.947

The values for the period 3 years after the end of the project will remain the same as the current users of the GYR service they have signed a 3 year contract with GYR service.

According to the calculations performed during the assessment of CP1.1 and CP1.2 under the frame of Action C1, the produced GHG emissions from the project demonstration of 17 months are presented in the following table.

All users of GYR service	**CP1.2**	**CP1.1**
CO2 (Tones/year)	5,499.493	11,012.121
CH4 (Kilograms/year)	226.725	428.817
N2O (Kilograms/year)	118.262	235.226

In the frame of this indicator, additional sub-indicators for GHG emission are estimated. These indicators referred to CO2 kg/km per kg transported by a vehicle and to CH4 and N2O kg/km per kg transported. The tables below present the values of these indicators.

All users of GYR service	**CP1.2**	**CP1.1**
CO2 (Kg/km per mg)	123	195.9670
CH4 (Kg/km per mcg)	21.3	32.6
N2O (Kg/km per mcg)	5.7	8.9

Similar to KPI 6.1. the values for the period 3 years after the end of the project will remain the same as the current users of the GYR service they have signed a 3 year contract with GYR service.

The percentage achievement comparing the impact foreseen and the impact achieved per year is presented in the following table:

Fuel consumed and pollutant emitted	Savings Foreseen	Savings Achieved	% achieved
FC (Tones/year)	No foreseen	1,747.401	N/A
CO2 (Tones/year)	8885.697	5,512.628	62.04%
CH4 (Kilograms/year)	8939	202.092	2.26%
CO (Kilograms/day)	304.7208333	71.429	23.44%
N2O (Kilograms/year)	No foreseen	116.964	N/A
NH3 (Kilograms/day)	7.7875	0.172	2.21%
NOx (Tones/year)	42.255	46.915	111.03%
PM (Kilograms/day)	19.3	2.700	13.99%
VOC (Kilograms/day)	44.01666667	9.474	21.52%
SO2 (Kilograms/day)	33.85833333	0.469	1.39%

The goal concerning the NOx saved (tns/year) was achieved with a percentage equals to 111.03%. Additionally, 62% of the goal for CO2 was achieved. The goal for CO and VOC emitted were achieved by 23.44% and 21.52% respectively and the goal for PM by 13.99%. Finally, only a small percentage of the goal for CH4, NH3 and SO2 was achieved (i.e. 2.26%, 2.21% and 1.39% respectively). We have to notice that the impact associated with the fuel consumed and the N2O emitted was not foreseen in the frame of the project and for this reason there is not comparison between the fuel consumed and N2O emitted using GYR service and using the simulation tool.
Note the justification of the above deviation is presented in section 6.3 below.

KPI: 10.2. Involvement of non-governmental organisations (NGOs) and other stakeholders in project activities

Public body/bodies

The coordinator of the project Dr. Georgios K.D. Saharidis during the implementation of GYR project became an external advisor member of the national (i.e. Greece) board of logistics and supply chain. His involvement to the board was important as it was assigned to him the responsibility to prepare and present to the relevant stakeholders a report about the legislation of green logistics in Greece. The report was communicated to the board of the parliament responsible to prepare the new law for the logistics.
The value at the end of the project of this indicator is equal to 1 and 3 years after the end of the project it continues to be equal to 1 as Dr. Saharidis will continue to be member of the board.

Private for profit

The last 7 months of the real life practice, the 3 new customers of GYR service which purchased the service after the end of the project for a period of 3 years, were gotten involved into the development of the final (current) version of the GYR web and mobile apps. The technical team of GYR project, in collaboration with the technical team of the new customers as well as the new users of GYR service worked together for 7 months in order to introduce additional functionalities into the final version of the apps. The value of this indicator at the end of the project is equal to 3. After the end of the project, it will continue to be equal to 3 as the project activities were ended.

No value for the above indicators was foreseen in the beginning of the project.

KPI: 11.1. Website (mandatory)

The number of total unique visits of the website is equal to 5,109. Our estimation 3 years after the end of the project of the unique visits is estimated to 4,000.
The unique visits foreseen based on "LIFE Performance indicators Call 2017.xls" was 4,200 and for the period 3 years after the end of the project was additional 1,800 unique visits. The first value of the indicator (unique visits until the end of the project) is satisfies as GYR website has 5,109 unique visits. The unique visits for the period of 3 years after the end of the project we estimate that it will be equal to 4,000 and it will be easily achieved as new customers will purchase GYR service and several dissemination activities will be implemented to increase the market chare of GYR company.

KPI: 11.2. Other tools for reaching/raising awareness of the general public

a) Number of discrete Project Reports drafted
The total number of reports drafted is equal to 31 including, monthly reports, trimester reports, progress report, mid-term report, final report and Laymans report.
There is not deviation for this indicator.
b) Number of different publications made (Journal/conference)
Three publications have been made in the frame of 3 national conferences (i.e. ESCC 2020, ESCC 2021 and ESCC 2022). Three years after the end of the project, we estimate that 3 additional publication will be made in the frame of 3 international conferences (e.g. ESCC 2024, 2025, 2026).
No value for this indicator was foreseen in the beginning of the project.
c) Other distinct media products created
In total 5 promotional videos have been produced. Additionally, in total 11 newsletters, have been produced and disseminated. The total people reached are 3,041.
Finally, 4 unique leaflets (Greek, English, Italian, Czech version) and one promotional package including mousepads, note pads etc. have been created during the project.
3 years after the end of the project 3 additional promotional video and 3 additional newsletter will be created.
There is not deviation for this indicator.

d) Number of Hotline/information centres created
An online helpdesk has been created in the frame of the official website of the project.
There is not deviation for this indicator.
e) Number of events/exhibitions organised
In the frame of the project 7 workshops have been organized, 3 workshops in Greece, 3 workshops in Czech Republic and 1 workshop in Italy. Additionally, UTH co-organizes with other international universities in a yearly base the International Conference of Energy, Sustainability and Climate Crisis. For the year 2020, 2021 and 2022, the conference was dedicated to LIFE GYR project. In total, 10 events have been organized in the frame of the project.
After the end of the project, at least every year special sessions and round tables dedicated to the objectives of LIFE GYR project discussing the after-life activities and results will be organized in the frame of the next yearly ESCC conferences.
The initial foreseen number of events (i.e. workshops) was equal to 9 in total, which corresponds to 3 events per country of demonstration (i.e. Czech Republic, Greece, Italy). The workshops in Czech Republic and in Greece were organized as they were initial foreseen. The main deviation concerning the organization of events is the organization of workshops in Italy, where only one workshop has been organized.
f) Number of different displayed information created (posters, information boards)
Displayed information (poster, information boards): 8 notice boards have been produced which were installed at each beneficiary's facilities and 40 posters were distributed among project beneficiaries to be used in conferences participation, workshops, etc.
In total, 48 different displayed information were created.
There is not deviation for this indicator

KPI: 12.1. Networking (mandatory)

LIFE GYR project has engaged in networking with 5 projects a) ALICE, b) GRAGE, c) GREENOMED, d) RE-SOURCE, e) LIFE for Silver Coast project. 3 years after the end of the project, it is expected that networking activities will be implemented with at least one project per year.
No value for this indicator was foreseen in the beginning of the project.

KPI: 12.2. Professional training or education

Professionals - experts in the field
In the frame of the project, GYR team (i.e. UTH, MILITOS, CEDA and ITACA) trained one by one or in small groups of 4-5 persons the drivers using the mobile app. In total, 149 downloads (18 downloads per organization) of GYR mobile app were reached, resulting in the training of 149 users. Additionally, GYR team trained one by one or in small groups of 2-3 persons the users of the web application. On average 5.5 individuals per organization were trained on how to use the web application in order to create a daily green routing plan. In total, 44 individuals were trained on the use of the web application. Summarizing, at the end of the project, 193 logistics experts were trained on how to use GYR service.
Three years after the end of the project and based on the business plan, 63 new customer will purchase the GYR service resulting 1134 (i.e. 18*63) new trained users of the mobile application and 346 (i.e. 5.5*63) new trained users of the web application. Summarizing, three years after the end of the project the users trained will be equal to 1673.
No value for this indicator was foreseen in the beginning of the project.

KPI: 13. Jobs

The total hours of additional staff generated in the frame of project is equal to 37,577.51 which corresponds to 21.84FTE. After the end of the project 4 FTE are estimated that will be necessary for the GYR company.
The foreseen total FTE was equal to 17.2 FTE. The final total number of FTE is 27% higher than the one foreseen i.e. 21.84 FTE.

KPI: 14.1. Running cost/operating costs during the project and expected in case of continuation/replication/transfer after the project period

The running costs of the project are equal to €2.231.219,14. The Running cost/operating costs expected in case of continuation/replication/transfer after the project period is equal to 1,631,000 EUR.
No value for this indicator was foreseen in the beginning of the project.

KPI: 14.2.1. Capital expenditure expected in case of continuation/replication/transfer after the project period

The Capital expenditure expected in case of continuation/replication/transfer after the project period is equal to 53,000 EUR.
No value for this indicator was foreseen in the beginning of the project.

KPI: 14.2.2. Operating expenses expected in case of continuation/replication/transfer after the project period

The operating expenses expected in case of continuation/replication/transfer after the project period is equal to 1,631,000 EUR.
No value for this indicator was foreseen in the beginning of the project.

KPI: 14.2.3. Revenue expected in case of continuation/ replication/transfer after the project end

The revenue expected in case of continuation/ replication/transfer after the project end is equal to 1,920,000 EUR which is based on assumed 131 customers at the end of year 3 with average vehicle fleets and charges per vehicle and month.
The revenue expected after the end of the project have been estimated equal to 459,540 EUR.

14.2.4. Cost reduction expected in case of continuation/ replication/transfer after the project end

Based on the submitted business plan, there is no cost reduction of operating expenses. In fact they will increase with the increased business and net sales. they will decline as a % of top line, but increase absolutely.
No value for this indicator was foreseen in the beginning of the project.

KPI: 14.3. Future funding

The future funding could not be estimate at this time.
No value for this indicator was foreseen in the beginning of the project.

KPI: 14.4.1. Entry into new entities/projects

Replication
GYR service was replicated in the frame of the project to 3 new customers (i.e. DIGICOM, YOUTRADESMART, DASCO S.A.) which used the service for a period of 7 months resulting

in additional environmental benefits. At the end of the project, these (i.e. DIGICOM, YOUTRADESMART, DASCO S.A.) and two more (i.e. MEMEDIMOS and IBEC) customers (five in total) decided to purchase the GYR service and signed contracts.

Continuation
GYR service continues to be used use by the demonstrators (i.e. ATHINAKI, PLUS, KOUKOUZELIS, GLS Company via CEDA, DS Logistic s.r.o. via ITACA) of the project for a period of at least 3 years. Contracts were signed between the GYR Company and these companies for the continued use of the GYR service. Additionally, GYR service continues to be used by the three new customers of GYR Company found in the frame of the project. The new customers (i.e. DIGICOM, YOUTRADESMART, DASCO S.A.) will continue using the GYR service. Contracts were signed between the GYR Company and with these 3 companies for the continued use of the GYR service.
For this indicator the value of 8 entities was foreseen.

8. Comments on the financial report

8.1. Summary of Costs Incurred

PROJECT COSTS INCURRED				
	Cost category	Budget according to the grant agreement in €*	Costs incurred within the reporting period in €	%**
1.	Personnel	1.667.800,00	1.853.519,01	111.14%
2.	Travel and subsistence	91.600,00	42.460,35	46.35%
3.	External assistance	184.500,00	149.720,48	81.15%
4.	Durables goods: total non-depreciated cost			
	- *Infrastructure sub-tot.*			
	- *Equipment sub-tot.*	46.200,00	18,130.75	39.24%
	- *Prototype sub-tot.*			
5.	Consumables			
6.	Other costs	59.300,00	29.540,56	49.82%
7.	Overheads	141.837,00	137.847,99	97.19%
	TOTAL	**2.191.237,00**	**2.231.219,14**	101.82%

*) If the Agency has officially approved a budget modification through an amendment, indicate the breakdown of the revised budget. Otherwise this should be the budget in the original grant agreement.
**) Calculate the percentages by budget lines: e.g. the % of the budgeted personnel costs that were actually incurred

The above-mentioned numbers regard the total cost of the project. Total eligible cost of the project has been 2.222.153,76 Euros. The total number surpasses the initially foreseen budget, and is covered by own contribution of the beneficiaries and the co-financing of the Green Fund. This overspending mainly occurred by the affect of the COVID-19 crisis, when the remote and,

in some cases, unsynchronized work from home affected the productivity of the people involved and led to the prolongation of the project for 14 months.
Thus, the overspending is met in the "personnel" cost category whereas the remaining cost categories have been underspent giving the chance to cover the needs for more work effort.

Budget shifts, in total, do not surpass the threshold of 20% among cost categories that would necessitate an Amendment request.
"Travel and subsistence": Additional travels have been realised, mainly to the Demonstrators in Athens so that members of UTH could understand the requirements of the three Demonstrators. However, due to the COVID -19 period, many meetings took place electronically, resulting in underspending in this cost category.
Underspending in categories "External Assistance" and "Other Cost" is mainly, because market search has resulted in lower than budgeted expenses and due to the fact that some expenses initially foreseen under these cost categories did not take place (ie. ETV certificate was replaced by a most economical alternative; Expenses for External Audit were not needed; expenses for organisation of Meetings were less due to remote Meetings)
Also, not all Equipment components had been purchased, since several components already purchased under GreenYourMove project could be used also for the GYR project, without hindering the efficient performance of the servers of the two projects (eg. Rack for servers, air-conditioning etc). Total value of purchase of the Equipment has been 18.130,75 Euros and has been 100% depreciated since the time of its purchase.

Supporting documents for financial reporting are found in folder ANNEX_F, which is the Annex for all financial issues. The Supporting documents included are:
Annex SPR: Signed payment request, Annex SCFS: Signed Consolidated financial statement, Annex SCS: Signed Costs Summary, Annex SIS: Signed Income Summary, Annex SFD: Signed Funds distribution, Annex CCS: Consolidated cost statement in .xls form. Annex FSIB: Financial statement of the individual beneficiary, produced by all beneficiaries, in both .pdf (signed) and .xls formats. Annex GF: Decisions of Green Fund for co-financing of the project. Annex LR_CHAPS: Registration of new legal representation for CHAPS, Annex LR_UTH: Official Gazettes for new legal representation of UTH.

The public entity "Green Fund" organisation has co-financed the project with the amount of 118.000,00 Euros to UTH. Supporting documents are found in ANNEX_F/GF. The amount was given in four instalments: 1st 40.000 €, 2nd 28.000 €, 3rd 25.000 €, 4th 25.000 €.

Legal representation for CHAPS has changed and the statutory body consists by the following 2 company executives:
Ing. Tomáš VACEK – (unchanged) company executive
Ing. Tomáš DVOŘÁK – (New) company executive
This new status is valid since 24.04.2023, when Mr. Martin SIEGEL (old company executive) was replaced by Mr. Tomáš DVOŘÁK. In Annex_F/LR_CHAPS one may find the official registration of the above-mentioned change.

Legal representation has also changed for UTH. Currently, UTH is legally represented by Rector Mr. Charalampos Mpilinis and Vice Rector Mr. Ioannis Stefanidis. The official Gazzetes mentioning this change are in ANNEX_F/LR_UTH.

Allocation of costs per action follows (eligible direct cost in Euros):

A.1	25,676.71 €

B.1	85,587.63 €
B.2	75,626.72 €
B.3	250,192.59 €
B.4	218,908.44 €
B.5	314,856.32 €
B.6	127,746.07 €
B.7	124,532.94 €
C.1	122,566.15 €
C.2	46,094.75 €
C.3	28,648.50 €
D.1	109,776.00 €
D.2	58,237.37 €
E.1	479,393.67 €
E.2	16,461.91 €
	2,084,305.77 €

Budget deviations occurred due to unforeseen issues that needed to be resolved.
Following, justification for unforeseen implementation technical issues that had to be resolved during the project is presented. These technical issues affected further the implementation of the platform, the cost per Action and the timeline of the project and the total cost related to the technical development actions (i.e. B1, B2, B3, B4, B5). The technical issues were:
- (Action B3) The foreseen design of the platform did not included the development of APIs for its components. GYR team decided to implement for the whole functionality of the GYR platform APIs. The complexity of the web and mobile applications required, that a lot of internal functions where exposed as API endpoints to support the functionalities of the applications. Also, the backend was implemented in a way that the demonstrators and third parties can utilize and extend services of the GYR platform in their system making the replicability and transferability of GYR outcomes possible and easier. In that way, GYR Platform has the flexibility to be fully modular and support different functionalities in a more simple way. The development of APIs was required also to optimize the response time of the Platform's endpoints.
- (Action B1) The format and the quality of the data of some demonstrators was poor so it was necessary to create a lot of external tools to make corrections and validations to the data with an automatic way, with the purpose to use the data in GYR platform. The external tool support the replication of GYR platform to other users where the format of data is not appropriate or the quality of the data is not high.
- (Action B1) There was no automated way to exchange data with the demonstrators' systems/database, so such a process had to be established for the communication between GYR Platform and demonstrators' systems.
- (Action B1 B2 and B4) Each demonstrator had its own very unique format of requirements and data. To solve this issue and make a unique input format of data to the VRP API some external tools were developed. These tools were necessary for the developing of the VRP algorithm in a more efficient way that unites all these differences.
- (Action B3) During the developing of the VRP algorithm the cost matrix (inducing distance time, environmental impact) was necessary. Some internal tools were developed in order to create and calculate the cost matrix in a more efficient and faster way while waiting for the implementation of CEDA's cost matrix endpoint.

- (Action B1 and B3) To support the internal method for the creation of the cost matrix some external additional APIs bridges were necessary to be developed during the process, which give to UTH technical team to work in parallel with CEDA and CHAPS technical team.
- (Action B3) For the development and functioning of the Emission Calculator models API, it was necessary to use some external APIs and develop some internal tools like Traffic, Speed, Elevation and Road Age tools to optimize the response time and reduce the cost (every service has a free number of requests but at the platform the number of data that is necessary in daily base to calculate the cost matrices exceeds this limit and the cost to use those external services can be tens of thousands of euros) without sacrificing the quality of the results that the internal tools and the external APIs produce.
- (Action B3, B4, B5 and C1) During the implementation of the VRP Algorithm an internal software was developed to support the developing face of the platform. This software utilizes all the aforementioned internal tools and also provides a process to run the algorithm in a more efficient and faster way. This software was necessary for the implementation and Testing of the VRP algorithm. In this software, also a visualization tool developed in order to examine the quality of the obtained routing plan on a map. In addition, this process with some minor changes was used to produce the baseline scenario for the environmental monitoring model.
- (Action B2, B3, B4) For the creation of the applications, the requirements were collected and evaluated by UTH, instead of CHAPS, for increased efficiency due to the direct communication with the demonstrators and the know-how of the requirements during the implementation of the VRP Algorithm. Because of this UTH also created the mockups of the applications to communicate the inferred functionalities to CHAPS. This resulted in a time consuming cycle of communications with CHAPS in order to create the User Interface of the applications with all the required features.
- (Action B3) Despite the process described in the Proposal the development of GYR Platform and applications could not take place in parallel up to a point. The main core of the backend of the GYR Platform should have been finalized before the starting of the implementation of the applications. This resulted in a dead time for the implementation of the applications. Some functionalities and API endpoints was necessary to be developed first in order to be utilized by the applications.
- (Action B4 and B5) Because of the process that was explained above, the testing of the applications was done by UTH. This was more efficient to be done by UTH because of the know-how of the functionalities of the backend of the GYR Platform and also of the direct communication and feedback from the demonstrators. An extra process was introduced to UTH simultaneously with the development of GYR Platform. This process involved a lot of cycles between UTH, CHAPS and the Demonstrators for the development of the web and mobile applications which resulted in a relative time overhead.
- (Action B2 and B3) For the communication of the GYR Platform and the VRP algorithm, a middleware bridge had to be implemented. This API was diagrammatically presented in the Proposal but no time was allocated for this implementation. This API is responsible to transform the data that the demonstrators use in their daily plans though the GYR Platform to a format that the VRP Algorithm can process and return the optimal daily plans back to the GYR Platform.
- (Action B3) During the development of the GYR Platform a lot of optimizations in the Cost Matrix creation process and the Emissions Calculator Models had to take place, so that the Platform would be functional and responsive for production use. The process of the creation of the Cost Matrix and the Emissions Calculator Models is resource demanding (i.e. for a daily plan with 200 orders the size of the Cost Matrix is about 700.000 unique values), so a lot of internal optimizations and testing had to take place in order to reduce the response time, the

cost and the allocated computing resources. A lot of revisions of the system took place to ensure the best possible quality of data in real life situations with multiple users in GYR Platform.
- (Action B5) To be ready for the Real Life Practice a data collection took place to setup the GYR Platform with the most updated data of each demonstrator. To do this UTH developed some additional external tools and parsers to upload all the needed data to the Platform with an automatic way.
- (Action B2 and B4) Finally, some of the demonstrators had much more requirements than expected. Some of the requirements where too complex to be handled by the VRP model. So, we end up re-building the core logic of the model for solving the VRP model, in order to maintain the extensibility for future additions and also fulfil all the requirements of the demonstrators.

For the Monitoring Actions, more workload was needed because the baseline scenario had to be calculated more than once after the mistake in the calculations that has been spotted. This led to re-gathering of the data and re-calculations for correction of the initial mistakes. Also, extra workload was needed in Action C3 since the monitoring tool has changed, additional KPIs should be calculated and the new webtool had to be set-up.

Finally, the project's prolongation affected total effort for some actions, since management (E1) was implemented for 14 additional months and TomTom Licence should be purchased for one additional year.

8.2. Accounting system

- Brief presentation of the accounting system(s) employed and the code(s) identifying the project costs in the analytical accounting system
  UTH uses a separate cost account for the management of the project with the distinctive code number 5728.

ATHINAIKI uses separate cost accounts for travel cost and meeting cost organization. The separate account code numbers are 64.01.00.0002 and 64.02.06.0099 respectively.
CEDA's separate cost accounts are: 512001 for Travel cost, 521001: Gross Salary, 524001: Social Charges, 524002: Health insurance. 518004: External Assistance.
CHAPS' separate cost account are:
Costs:
5120100, 5120400 travel
5181000 overheads
5210100, 5210102 gross salaries
5240100, 5240101 social charges
5240200, 5240201 health charges
Income:
6480500 EU contribution
ITACA: A separate accounting system has been setup in the accountant ERP software. Its code is 1 and its name is GYR PROJECT. The cost center recording is called "Centro di imputazione". This cost center contains annual tables that contain several rows, one for employees or cost item (i.e. single travel cost items).
KOUKOUZELI: Partner KOUKOUZELI has second category accounting system and includes all costs of the project in the book for income and expenses that is used in such category of accounting system.
MILITOS includes all project's costs in its regular accounting records.
PLUS uses separate cost accounts for travel cost and meeting cost organization. The separate account code numbers are 64.01.00.0001 and 64.02.06.0098 respectively.

- Brief presentation of the procedure of approving costs

Subcontractors are selected after publicly released requests or directly awarded. For beneficiaries that are private bodies, a direct award is given, after evaluation. For public bodies, the direct award procedure has been followed as predicted by the existing public rules and has been realized according to Law 4485/2017 (and its revisions) has been applied where, orders up to 20.000 Euros (excl. VAT) are directly awarded after market search (Multiple Bids). Orders between 20.000 € (excl. VAT) and 60.000 € (excl. VAT) per item follow an official tender procedure, the notice of which is posted on the UTH's Research Committee web site. Limits for direct award after market search (Multiple Bids) have changed with the effect of laws 4782/2021 and 4957/2022 according to which, direct award is allowed until the amount of 30.000 € (excl. VAT) and a tender procedure is needed for cases more than 30.000 €.

- Type of time recording system used, i.e. electronic or manually completed timesheets

The timesheets to be provided, are filled in electronically, on the excel file template provided. Timesheets can be either printed and signed by the staff members and the supervisors manually, or electronically in the end of each month or early next month. Each partner may keep records manually, but all information is inserted and kept at the excel timesheet template provided by the LIFE toolkit and signed timesheets are provided to the coordinator.

- Brief presentation of the registration, submission and approval procedure/routines of the time registration system

Timesheets are filled in daily and signed by the staff member and the in the end of each month or early next month.

- Brief explanation on how it is ensured that invoices contain a clear reference to the LIFE project showing how invoices are marked in order to show the link to the LIFE project

Clear reference to the project is ensured by either including reference to project during issuing of invoice or by stamping invoices with the project's stamp, whenever it is necessary.

8.3. Partnership arrangements (if relevant)

All Beneficiaries have received the 1st and 2nd pre-financing by the Co-ordinator. The amount of the pre-financing has been given according to the foreseen total cost per Beneficiary by the time of the transaction. Final payment shall balance the total EU grant for each Beneficiary.

Beneficiaries report their expenses on a monthly basis, updated with the costs incurred by providing the FINANCIAL STATEMENT in an .xls form to the co-ordinating beneficiary. For the mid-term report, the individual cost statement has been signed (signed copies of the individual cost statement of each beneficiary is included in Annex FSIB). The stamped and signed financial report, has been taken into consideration in order to produce the consolidated financial statement.

8.4. Certificate on the financial statement

For current project, Certificate on the financial statement is not needed.

8.5. Estimation of person-days used per action

Action type	Budgeted person-days	Estimated % of person-days spent
All projects when applicable Action A: Preparatory actions	213	79.75%
ENV projects Action B: Implementation actions	6303	121.57%

ENV and GIE projects Action C: Monitoring of the impact of the project action	1235	109.15%
ENV and GIE projects Action D: Public awareness/47ommunication and dissemination of results	567	125.43%
ENV and GIE projects Action E: Project management	2734	121.95%
TOTAL	11052	119.67%

9. Annexes

9.1. Annex I

Annex I includes the remaining deliverables. One may download the deliverables using the following link:
https://www.dropbox.com/scl/fo/sz6be4cgiiefs5ess3686/h?rlkey=wrl169emxf4vjk0z7n7tfaoqb&dl=0

9.2. Annex II

Annex II includes the supporting material referred into the final report. One may download the supporting material using the following link:
https://www.dropbox.com/scl/fo/njwr6lheyiz38hv7j94th/h?rlkey=6gp4kz3y2q1y26l6gmzqfun28&dl=0

9.3. Annex F

Annex F includes the supporting documents for financial reporting. One may download the supporting documents using the following link:
https://www.dropbox.com/scl/fo/ffy4yfxcph58qw6fnrtk5/h?rlkey=d7g9gvnpewgz1z3c71dk5ja5f&dl=0