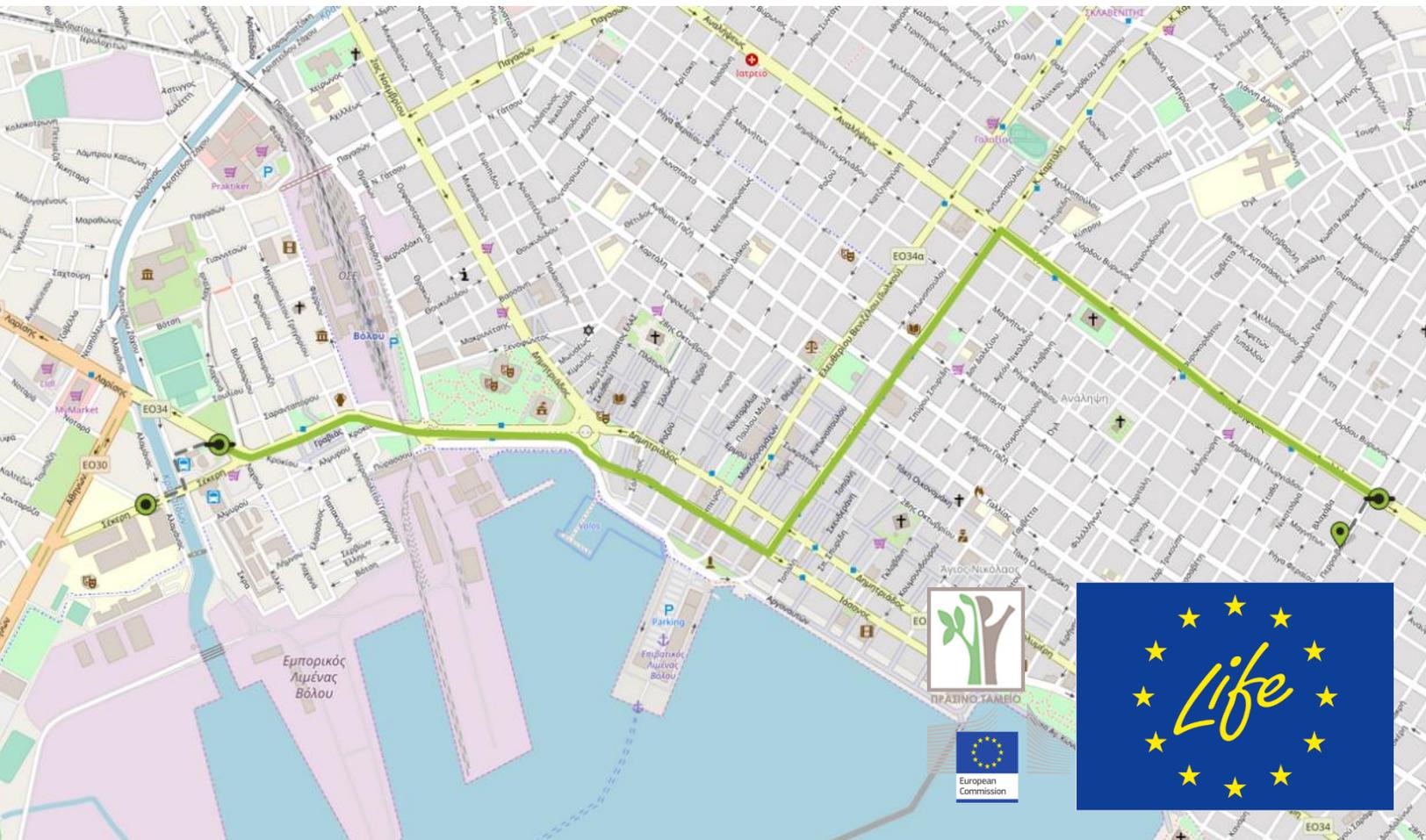




# LIFE GreenYourMove: Development and promotion of a co-modal journey planning platform to minimize GHG emission in Europe

Final Report

2019





LIFE Project Number  
**LIFE14 ENV/GR/000611**

**Final Report**  
**Covering the project activities from 15/09/2015 to 14/09/2019**

Reporting Date  
**14/12/2019**

LIFE PROJECT NAME or Acronym  
**LIFE GYM**

Data Project

<b>Project location:</b>	Greece, Czech Republic, Slovakia
<b>Project start date:</b>	15/09/2015
<b>Project end date:</b>	15/08/2018 <b>Extension date:</b> 14/09/2019
<b>Total budget:</b>	€ 1,245,052
<b>EU contribution:</b>	€ 732,030
<b>(%) of eligible costs:</b>	60%

Data Beneficiary

<b>Name Beneficiary:</b>	University of Thessaly
<b>Contact person:</b>	Dr. Georgios K.D. Saharidis
<b>Postal address:</b>	Department of Mechanical Engineering - University of Thessaly, Leoforos Athinon, Pedion Areos, 38334, Volos, Greece
<b>Telephone:</b>	+306977404429
<b>E-mail:</b>	<a href="mailto:saharidis@gmail.com">saharidis@gmail.com</a>
<b>Project Website:</b>	<a href="http://www.greenyourmove.org">www.greenyourmove.org</a> & <a href="http://www.greenyourmove.eu">www.greenyourmove.eu</a>

# 1. Table of contents

1.	Table of contents .....	3
2.	List of key-words and abbreviations .....	5
3.	Executive Summary .....	7
4.	Introduction .....	10
5.	Technical part .....	12
5.1.	Technical progress, per Action .....	12
	Action A1: Reviewing.....	12
	Action B1: Creation of GreenYourMove database and related data-access services .....	13
	Action B2: Development of case-specific co-modal emission calculation models .....	15
	Action B3: Development of modelling and solution approach for environmental co-modal vehicle routing.....	16
	Action B4: Promotion of co-modality through rescheduling.....	17
	Action B5: Creation of the platform .....	19
	Action B6: Smartphone application .....	22
	Action B7: GreenYourMove (GYM) Demonstration & Replication.....	23
	Action C1: Monitoring of the environmental impact of the project.....	25
	Action C2: Monitoring and assessment of the socio-economic impact of the project actions.....	27
	Action C3: Monitoring & evaluation of GYM methods and techniques .....	28
	Action D1: Web presence.....	29
	Action D2: Production of electronic material .....	30
	Action D3: Organisation of workshops and webinars .....	31
	Action D4: Publications & Participation in conferences .....	33
	Action D5: Direct communication .....	35
	Action D6: Networking with other LIFE and/or non-LIFE projects .....	38
	Action E1: Project Management by the Consortium .....	40
	Action E2: Monitoring of project progress and indicators.....	41
	Action E6: After-life communication plan.....	42
5.2.	Main deviations, problems and corrective actions implemented .....	43
	Data digitization and update.....	43
	Technical issues.....	43
	Co-modal ticketing tool.....	43
	Replication of GYM in other journey planning systems.....	44
	Environmental impact of LIFE GYM .....	44
	Webinars participation .....	45
5.3.	Evaluation of Project Implementation .....	46

Methodology applied.....	46
Results .....	46
Visibility of results .....	59
Replication .....	60
Dissemination activities .....	60
Policy impact.....	61
5.4. Analysis of benefits .....	63
Environmental benefits .....	63
Economic benefits .....	63
Social benefits .....	63
Replicability .....	63
Best Practice lessons .....	64
Innovation and demonstration value .....	64
Policy implications.....	64

## 2. List of key-words and abbreviations

API	Application Programming Interface
AUTH	Aristotle University of Thessaloniki
CEO	Chief Executive Officer
co-VRP	Co-modal vehicle routing problem
CO <sub>2</sub>	Carbon Dioxide
CF	Communication Flash
CP	Check Point
CP	Cestovné poriadky
CSUM	Conference on Sustainable Urban Mobility
CSV	Comma-separated values file
Del	Deliverable
EA	External Assistant
EAP	Environment Action Programme
EASME	Executive Agency for Small and Medium-sized Enterprises
EC	European Commission
EEA	European Environment Agency
ESCC	International Conference on Energy, Sustainability and Climate Change
EU	European Union
FTE	Full Time Equivalent
GA	Grant Agreement
GDPR	General Data Protection Regulation
GHG	GreenHouse Gas
GIS	Geographical Information Systems
GPS	Geographic Position System
GTFS	General Transit Feed Specification
GYM	LIFE GreenYourMove
HF	Hellenic Forum
IKA	Institute for social charges
KML	Keyhole Markup Language
KPI	Key Performance Indicator
JP	Journey planning
MedSOS	MEDITERRANEAN SOS Network
MS	Member States
Mt	Megatons
NPs	Number of Persons
NSFR	National Strategic Reference Framework (in Greek: <i>Εθνικό Στρατηγικό Πλαίσιο Αναφοράς, ΕΣΠΑ</i> )
OASA	Athens Mass Transit System (in Greek: <i>Οργανισμός Αστικών Συγκοινωνιών Αθηνών</i> )
OASTH	Thessaloniki Urban Transport Organisation (in Greek: <i>Οργανισμός Αστικών Συγκοινωνιών Θεσσαλονίκης</i> )
OSM	Open Street Map
OTP	Open Trip Planner
PA	Partnership Agreement
PDF	Portable Document Format
pkm	Passenger-kilometers
POAS	Pan-Hellenic Federation of Urban Transport
POAYS	Pan-Hellenic Federation of Intercity Transport
PSC	Project Steering Committee
REST	Representational State Transfer
SUMPs	European Conference on Sustainable Urban Mobility Plans
TAP	International Transport and Air Pollution Conference

ThITA	Thessaloniki's Integrated Transport Authority
TIF	Thessaloniki International Fair
TSMED	Institute for social charges for engineers
UI	User Interface
UoM	University of Macedonia
UTH	University of Thessaly
VAT	Value Added Tax
WFS	Web Feature Service
WMS	Web Map Service

### 3. Executive Summary

LIFE GreenYourMove (LIFE GYM) is a project implemented from September 2015 to September 2019, under the coordination of University of Thessaly (UTH), Greece, with the participation of additional beneficiaries located in Greece, Czech Republic, and Slovakia. The objectives of LIFE GYM were to enhance sustainable mobility in European cities, reduce pollution and minimize public transport emissions in urban environments, by developing a co-modal journey planner providing environmental friendly solutions, promoting public transport means and raising awareness regarding the environmental footprint of passengers. To this scope, GYM application, an environmental co-modal journey planning platform, available through web and smartphone was developed, to assist travelers in choosing the environmental friendliest way to perform their trip and transport operators to promote the environmental aspect of public transport means. In parallel, awareness on environmental travelling was raised through several dissemination and communication activities with the vivid participation of public transport operators.

LIFE GYM not only delivered an environmental friendly platform, but also a functional database and web access service including data from several transport operators in 11 European countries. Moreover, novel emission calculation models and algorithms for calculating the environmentally friendliest co-modal route were developed, which are easy to be adopted by other journey planning platforms and are already demonstrated by two journey planners, IDOS and Cestovné poriadky (CP), in Czech Republic and Slovakia respectively and COPERT, a software tool used world-wide to calculate air pollutant and greenhouse gas emissions from road transport. Additionally, a novel procedure for timetable's rescheduling, already implemented for 3 European public transport networks, was also developed. The abovementioned tools 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.

The developed tools 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, communication flashes, newsletters and press releases, 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, posters, flyers and some communication gifts.

Communication activities were directed to transport operators and local authorities before the release of GYM platform and mostly to passengers after its release. Transport operators and local authorities were reached through networking activities, workshops and personal visits, in order to guarantee their co-operation in the platform development and the promotional activities needed to disseminate it. A central awareness campaign was organized after the platform release in 11 Greek cities in parallel with the European Mobility Week, with the participation of all transport operators and local press coverage, aiming at disseminating GYM applications and promoting public transportation. Several other awareness activities in Athens and Thessaloniki were also performed, providing LIFE GYM outcomes a wide acceptance by inhabitants of Greek cities.

Moreover, the novel scientific outcomes of LIFE GYM were disseminated through conferences, scientific workshops and events. Scientific articles were also produced, a book handling co-modal routing issues and disseminating LIFE GYM and two special issues addressing environmental issues from transport.

To assess the environmental and socio-economic impact of the project and consequently the effectiveness of the developed tools and the activities performance monitoring protocols were developed, which can be re-used and extended to other LIFE or similar projects.

One of the major issues LIFE GYM consortium had to cope with was the withdrawal of associated beneficiary Plannerstack, located in the Netherlands. This compromised not only the project implementation, since Plannerstack was responsible for the smartphone applications, but also the transnational character of the project, since all other beneficiaries were located in Greece and Czech Republic. The substitution of Plannerstack with INRPOP, located in Slovakia, in LIFE GYM consortium, caused the project and its outcomes to delay and set its end date to September 2019 instead of August 2018, since the development of the smartphone application was inextricably bound with the platform development. This also affected the replication of LIFE GYM outcomes to other Journey Planners; since the platform was delayed, the project team could not promote and demonstrate the novel features included, such as the emission calculation models and the co-modal routing algorithm.

The substitution of Plannerstack also affected the replication of LIFE GYM outcomes in CHAPS and INPROP journey planning systems. The initial scheduling was changed, since resources and effort was put in the smooth integration of INRPOP in LIFE GYM consortium, resulting in the replication of LIFE GYM outcomes to be given low priority and therefore to delay. Moreover, the experience gained from CHAPS and INPROP replication of LIFE GYM outcomes showed that replicating different components in an already existing system is a relevant slow process, which needs to be studied thoroughly, even though the components to be integrated are fully replicable. Existing journey planning systems do not easily proceed in changes in their provided services; altering parts of their developed platforms needs planning and requires time to mature. LIFE GYM team is confident that in the future several journey planners will adopt parts or full components developed under the frame of the project.

Another issue encountered was that of the lack of digitized transport network data, as well as the unwillingness of several transport operators to cooperate with LIFE GYM team in order to include the network they covered in the platform; the first was handled with visits to transport operators for data collection and the development of additional tools to handle the various forms of available data, while the latter was handled with the intervention of the Pan-Hellenic Federation of Urban Transport (POAS) and the Pan-Hellenic Federation of Intercity Transport (POAYS), which strongly supported LIFE GYM initiative and its contribution was critical in convincing other transport operators to participate. The tools for data digitization and updating developed were not foreseen under the frame of the project, but were considered necessary for its implementation and are easy to use and replicate by transport operators or other journey planners.

Moreover, regarding data, another issue raised had to do with the updating of the existing data. Transport operators update their itineraries approximately twice per year and there were no tools available to support the update. LIFE GYM team developed several tools to cope with this issue, among which a GTFS editor application.

Several barrier were encountered in the development of a co-modal ticketing application in the Greek market. Transport operators did not have either the willingness or the technical infrastructure to support such a service, although GYM platform could support such a tool. Moreover several accounting and legal issues (e.g. different Value-Added Tax (VAT) numbers of the transport operators) hindered its development.

Regarding the platform release, an issue LIFE GYM team came up with was the inclusion of address numbering in the search option of the platform. This is an additional service, which required resources not foreseen from the project budget and the consortium could not afford to purchase this additional feature. This was partially faced through a combination or several reverse geocoding services. Furthermore, the settings of the platform were altered compared to its first release, based on user comments, in order to improve the user experience. The settings related to the preference for walking distance and numbers of interchanges were transferred from the frontend of the platform to its backend. Instead of the user choosing these

search features, the platform calculates the minimum walking distance and interchanges required and provides the most suitable solution.

The total saved Carbon Dioxide (CO<sub>2</sub>) since the launch of GYM platform (meaning for a total of 13 months) in Greece is equal to 0.55 Megatons (Mt) for all transport means. The importance of all the project objectives and their effect on air quality has been communicated through several media and activities. The response of the passengers has been remarkable. Transport operators managed to increase the tickets sold, since more citizens were willing to choose public transport means instead of their car when travelling. Questionnaires completed by passengers during several awareness raising and promotional activities showed that, based on their answers, they care for their environmental footprint when travelling and they are willing to choose the environmental friendlier instead of the fastest way of travelling, even if this would mean travelling for longer time.

The future of LIFE GYM and its developed applications looks promising. Both the developed applications, as well as the additional applications developed, are useful tools for journey planners and transport operators. The maintenance, update and preservation of GYM application has been secured for at least 10 years after the project end with the contribution of all project beneficiaries. The extension of the application and its replication to other markets is already discussed, whereas the synergies developed during the project, both between project beneficiaries and stakeholders from the transport sector, are a springboard to future collaborations in projects of similar context.

## 4. Introduction

Climate change is one of the biggest challenges that man will be facing in the forthcoming years. The Kyoto protocol is the first step towards cutting Greenhouse Gas (GHG) emissions. The European Union (EU) has set the most ambitious GHG emissions reduction targets in the world, with binding mechanisms already in place that guarantee a unilateral 20% reduction by 2020 compared to the 1990 levels. Therefore, it is necessary for the EU Member States to promote policies that will result in the prevention of climate change. Transport accounts for around a third of energy consumption in the European Environment Agency (EEA) member countries and for more than a fifth of GHG emissions. It is also responsible for a large share of urban air pollution as well as noise nuisance. The last 10 years, a lot has been achieved in road and in the rail transport sector. Nevertheless, according to the [White Paper](#) “Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system” (2011), if we stick to the business as usual approach, energy consumption and CO<sub>2</sub> emissions from transport instead of decreasing, would remain one third higher than their 1990 level. One can distinguish between internal and external barriers when it comes to green initiatives in passenger transport. Internal barriers can be financial, technical, informational, managerial and organisational; while external barriers include policy and market issues. Among internal barriers, financial and informational barriers are the most relevant to implement green initiatives. Furthermore, external barriers could be a lack of economic resources, lack of knowledge and experience and problems related to the passengers and behaviour.

LIFE GYM is a demonstration project which put into practice methodologies and approaches in reference with co-modal transportation, GHG emissions’ reduction and air quality improvement, not only in Greece, but also at a European level. While the concept of co-modal transportation seems to be familiar in many European countries, its absence in Greece results in a big gap in the passenger transportation sector. GYM platform, providing co-modal journey planning solutions, is an additional way for Greece to go one step forward and start dealing, in a structured and organised way, with the reduction of CO<sub>2</sub> emissions, air emissions and fuel consumption from the transport sector. LIFE GYM was an opportunity for putting these results in practice, by providing local inhabitants and stakeholders a valuable tool: GYM platform.

GYM platform introduced novel GHG emission calculation models for the first time in journey planning systems. The user of the platform can obtain the environmental friendliest route, compare it with the alternative of choosing a car and also with the fastest solution using the public transport network. LIFE GYM’s objective was not only developing a platform providing environmental friendly solutions; its demonstrative character also included the promotion of utilizing public transport means for travelling and cultivate the environmental thinking of citizens. By promoting co-modal and environmentally efficient transport patterns, the project’s initiative managed to shift trips undertaken by car towards public transport. Furthermore, it made railways, bus networks (urban and intercity networks), metro networks and tramways more efficient than before by increasing the number of passengers per vehicle (e.g. wagon, busses) and per trip. This in turn was a way to reduce energy demands in fuel and the associated emissions. Co-modal options for commuting and travelling, as well as dissemination activities to promote public transport, increased the number of passengers who use public transport. This increase reduced CO<sub>2</sub> and other emissions generated per kilometre travelled per passenger. Moreover, the total increase in passengers using co-modal routing options has the potential to change the sustainable mobility culture of passengers in Greece. As a positive side effect, an improvement in traffic congestion in large metropolitan areas should also be expected through the decrease in road transport.

To this scope, a number of technical and methodological solutions were put together in order to develop GYM platform. First, the database and the associated data-access and web services necessary to manage, store and update transport data were developed. Several protocols were adopted to provide access to the developed data-access and web services. Improved emissions calculation models catering co-modality were developed with the addition of new factors affecting the emissions production and fuel consumption. Static factors such as gradient of the road as well as dynamic factors such as weather conditions enriched existing emissions calculation models to better correspond to the specific conditions and types of vehicles identified in the Czech, Greek and Slovak transport networks. Furthermore, LIFE GYM team developed modelling and solution approaches for environmental co-modal vehicle routing problem (co-VRP). Decomposition techniques, such as clustering and Benders decomposition, as well as heuristic and hybrid approaches, such as bi-directional Dijkstra and geographical hexagonal clustering were adopted in order to obtain these modelling and solution approaches.

Many results were achieved at implementation level: These included a database covering more than 70% of Greek public transport network of cities with population more than 50,000 citizens; novel co-modal energy consumption and GHG emission calculation models for European public transport means; improved modelling and solution approaches for the environmental co-VRP; demonstration of the first national co-modal environmental public transport planner in Greece in 11 big cities; and a pan-European journey planner service via a web platform and mobile devices, already including 10 European countries and easy to include other areas.

Significant environmental benefits for Greek cities were achieved during LIFE GYM. A reduction of 0.55 Mt CO<sub>2</sub> eq. (instead of 2.699 Mt erroneously expected, the deviation is explained in the following sections) during the lifetime of the project and moreover the change in the environmental thinking of citizens by raising awareness on the environmentally friendliest journey planning decisions and highlighting the importance of co-modal transport in terms of environmental impact via numerous dissemination and communication activities were the most important ones. Seamless door-to-door urban mobility was supported by developing an environmental co-modal journey planner. Moreover, novel scientific solutions developed under the frame of the project were shared at EU level through scientific dissemination channels.

The implementation of the above actions, affected also the replicability and transferability of the core project's actions, encouraging future stakeholders to include the new innovative practices into their own transport network, since all project outcomes are easy to replicate and can be easily partially or fully adopted. Thus, the project not only enhanced the implementation of an integrated policy for sustainable urban planning of public transport and mobility in Greece, but also laid the foundation for the development and sharing of new solutions and best practices at the EU level, which needs time in order to mature. This promotes also the implementation of a Union environmental policy by the public and private sectors, in particular in the environmental and air quality sectors, covering one of the main targets of the Roadmap to a Resource Efficient Europe.

The future of LIFE GYM project outcomes foresees a service providing the environmental friendliest co-modal routing solution covering several areas in Europe and the integration of additional areas. The consortium will focus in the replication of its outcomes in other journey planning systems, expecting potential commercialization and revenue inflows.

## 5. Technical part

### 5.1. Technical progress, per Action<sup>1</sup>

#### **Action A1: Reviewing**

Foreseen start date: 15/09/2015    Actual start date: 15/09/2015

Foreseen end date: 14/11/2015    Actual end date: 30/11/2015

The scope of the action was to review the methodological tools and practices on topics related to LIFE GYM. AVMap reviewed 4 architectures and structures of databases for journey planning applications and 4 EU research projects in the same context; EMISIA reviewed 3 methodologies used to calculate GHG emissions from transport and 2 projects in the context of GHG emissions calculation models; UTH reviewed 7 methodologies on modelling and solution approaches for the environmental co-VRP and 2 projects in the context of GHG emissions calculation models; CHAPS reviewed 6 web applications for journey planning; Plannerstack delivered a review of 6 smartphone applications for journey planning; finally, TRAINOSE reviewed 5 policies for co-modality promotion. AVMap monitored partners for their contribution and homogenized the material gathered. UTH reviewed and proofread Deliverable A1, while AVMap finalized the formatting errors.

Action A1 outcomes were utilized for the implementation of several project actions. More specifically, the outcomes of the review of methodologies used to calculate GHG emissions and the review of European and international projects in the context of GHG emission calculation models were used in Action B2; the review of European or international projects in the context of journey planning and the review of web applications outcomes were used in Activity B5.1; the review on modelling and solution approaches for the environmental co-VRP were used for the implementation of Action B3; the review of different designs, architectures and structures of database were used for the implementation of Action B1; the review of smartphone applications were used for the implementation of Action B6; and the review of current policies for the promotion of co-modality outcomes were used for the detection of successful actions and initiatives for promoting co-modality.

After the end of the project, UTH will continue, as part of its regular research activities, reviewing methodological tools and practices on topics related to LIFE GYM.

---

<sup>1</sup> All online references and available material are marked with blue colour. Clicking on the text will redirect the reader to the referenced link.

## **Action B1: Creation of GreenYourMove database and related data-access services**

Foreseen start date: 15/10/2015 Actual start date: 28/09/2015

Foreseen end date: 14/04/2016 Actual end date: 28/02/2017

The scope of this action was the development of GYM platform's database and the relevant data access services, based on the outcomes of the review of different designs, architectures and structures of database for journey planning applications of Action A1. AVMap team studied the database technologies suitable for GYM platform as well as the minimum requirements from a software, hardware and network point of view for GYM system. AVMap, in cooperation with UTH, gathered, homogenised, digitized and incorporated the transport data (e.g. timetables, routes etc.) of several Greek transport operators into the database.

The final version covers General Transit Feed Specification (GTFS) data of city buses in Alexandroupoli, Volos, Komotini, Larissa, Lamia, Thessaloniki, Patra, Katerini, Serres, Trikala, Florina, and Chalkida and intercity busses in Thiva, Thessaloniki, Evros, East Attica, West Attica, Karditsa, Larissa, Magnesia, Rodopi, Trikala, Achaia, Euboea, Fthiotis, Florina, Pieria and Serres as well as GTFS of the public transport network in Athens, Greece (i.e. TRAINOSE, Athens Mass Transit System (OASA), Urban Rail Transport S.A. (metro lines and tram)), and the complete Greek railway network of TRAINOSE, Greece; Limassol, Nicosia, Larnaca, Paphos and Famagusta urban busses network, Cyprus and also the complete Cypriot intercity busses network; the complete network (urban and intercity busses network, tram network (whenever available), metro network (whenever available) and train network) of Luxembourg, the Netherlands, Sweden, Denmark, Czech Republic, Slovakia, Switzerland and Estonia.

Additionally, a second group of GTFS data was produced and updated for the city busses in Rhodes, Mytilini and Corfu and the intercity busses in Xanthi. This second group of GTFS data is not yet included in the applications as the corresponding transport operators have not yet verified their validity. In total, 20 Greek cities are included in GYM database, 16 of which are updated, validated and included in the application.

AVMap also developed data access services to allow different client systems (such as GYM web and mobile application) to communicate between them over pre-established protocols. The developed web services allow communication over 4 different protocols: Web Map Service (WMS), Web Feature Service (WFS), GTFS and Representational State Transfer (REST). The data that can be accessed through the web services include both the "static" data (e.g. itinerary and emissions data) and the dynamic data (e.g. weather data). In addition to the final GYM database, a data services manual was developed for internal distribution between partners. This document provides technical information on how to access GYM database and GYM web services. An interactive, step-by-step wizard, for transport operators for GTFS data [creation](#) and [updating](#) was also developed. This version of the manual was developed for transport operators to assist them in creating and updating the data of their network.

The development of the database scheme was finalized at the end of 2015 after being reviewed by all partners. The scheme was modified for a final time in May 2016, after reviewing the final emission data produced in Action B2, in order to store dynamic data from GYM web services. The issue LIFE GYM team encountered was that transport data existed in several different formats; such as web pages, Microsoft Excel format files, Portable Document Format (PDF) files, Keyhole Markup Language (KML) files and images. To deal with this issue, the project team separated the data that could be processed with and without human intervention. Three tools were developed (data retriever program, digitization program, homogenization program), in order to digitize, extract, transform, homogenize and

load all the available data. The functionalities of these tools have been enhanced under the frame of Action B5.

After the end of the project, UTH team will use feedback received from potential users of the data updating system to further improve the step by step wizard. UTH will continue updating transport operators data as well as including new data covering new areas in the database. Finally, UTH will continue improving the developed data updating tools and develop new ones if necessary.

## **Action B2: Development of case-specific co-modal emission calculation models**

Foreseen start date: 15/10/2015 Actual start date: 15/10/2015

Foreseen end date: 14/10/2017 Actual end date: 30/09/2018

At the beginning of the action, EMISIA and UTH, taking into account the review of methodologies used to calculate GHG emissions from transport and the review of European and international research projects in the context of GHG emission calculation models of Action A1, defined the emission factors to be included in the emissions models and then identified the necessary information for the development of these models. This information was related to the methodology and to the input data required for the calculations. Thereinafter, EMISIA and UTH developed the new case-specific emissions calculation models and prepared a manual accommodating their extensibility and reusability. EMISIA homogenized the different types of vehicles circulating in the Czech, Dutch, Greek and Slovak transport system. EMISIA, UTH and AVMap analysed several factors influencing the emissions production. The factors taken under consideration were: average speed, road gradient, occupancy rate, wind velocity, wind direction, humidity, temperature, and road age. The selection of those factors respects the trade-off between the need for detailed and accurate emissions calculations of co-modal routes on one hand, and the use of minimum input data on the other. CHAPS provided static data from the Czech network and TRAINOSE provided data related to infrastructure conditions and technological factors for its network. The rest of the static data were collected by UTH and AVMap. AVMap and UTH developed web services in order to collect the dynamic data in real time by specific online Application Programming Interfaces (APIs). The developed models cover all four transport networks (Greek, Czech, Slovak and Dutch) as well as other European networks included in GYM application (see Action B1). EMISIA and UTH developed models not only for specific type of vehicles and engines but also for average type of vehicles. These average models are significantly useful for the replication and re-use of the developed models as they could be applied in any network even if all data are not available. This action provided not only useful results at a practical level, but also at the scientific level, since it improved existing models catering to co-modality and additional factors influencing the emissions production.

EMISIA, UTH and INPROP examined if any changes to the existing average models were necessary due to the addition of INPROP and consequently the inclusion of the Slovak transport network. There was no need to develop new models before the publication of the applications. For the inclusion of other European networks (i.e. Cypriot, Swedish, Danish, etc.) the already developed models were utilized.

After the end of the project and for at least 5 years, EMISIA will continue enhancing the developed emission calculation models under the frame of its research activities.

### **Action B3: Development of modelling and solution approach for environmental co-modal vehicle routing**

Foreseen start date: 15/02/2016 Actual start date: 15/02/2016

Foreseen end date: 14/10/2017 Actual end date: 14/10/2017

In this action, case-tailored modelling and solution approaches for the environmental co-VRP; including exact, heuristics and hybrid methods, were developed, taking under consideration the outcomes of Action A1. UTH was the main contributor of this action. EMISIA assisted UTH to incorporate the co-modal GHG emissions calculation models into the modelling approaches (e.g. definition of measuring unit - CO<sub>2</sub> per passenger per kilometer travelled). CHAPS supported UTH in developing the mathematical inequalities for the mathematical programming models (e.g. decreasing the size of the network) and the integration model of GTFS data. Additionally, CHAPS supported UTH in the development of Python codes necessary for the implementation of modelling and solution approaches (i.e. supporting the debugging process).

As initially proposed, the implementation of the actions was based on the fact that the algorithms and the general approaches developed should be easily integrated into existing journey planning web platforms and especially into the ones using the OpenTripPlanner (OTP) and OpenStreetMap (OSM) as a base. In a general context, each approach was composed of several modules in different programming languages, such as Python and Java, and took as input a starting station/point, an ending station/point of a journey and a departure time. Then, each approach, based on its characteristics, moves on to compute the best itinerary for the user's routing request.

Moreover, the algorithms were created in such a way so that they would be data-agnostic and cross-platform compatible. That means that the algorithms were developed in such a way so that they can be disseminated, examined, used and improved further by other engineers or software developers and can be as easily incorporated into OTP and OSM. The technologies used by GYM team make it easy to operate with any GTFS dataset, from any personal computer, even those with low specifications.

Under the frame of this action three modelling approaches have been developed. The first is an integration model of GTFS data, transforming GTFS data to the necessary format in order to feed a mathematical programming model. The developed model is a reusable and extendable model as it could be replicated under any type of modelling approach and solution algorithm. The other two were for the mathematical representation of the co-VRP. Additionally, 3 decomposition techniques have been developed for the co-VRP. The first two applied Benders decomposition to the two mathematical representation of co-VRP, and the third applied Benders decomposition combined with covering cut bundle generation method to the second mathematical representation which performed better than the first one. Furthermore, 2 heuristic approaches and 3 hybrid approaches were implemented for the solution of co-VRP. An analysis was conducted to assess the solution quality and the computational requirements that resulted between the exact and heuristic solution approaches. This analysis showed that the third hybrid approach was the most suitable to be integrated into GYM platform. The third hybrid approach solved the selected routing examples in less than 10 seconds and at the same time produced the best solution. This means that any query (i.e. routing request) submitted by the users of the web or the smartphone app are solved in less than 10 seconds.

After the end of the project and for at least 5 years, UTH will continue enhancing the developed mathematical models and solution algorithms under the frame of its research activities at the Department of Mechanical Engineering and incorporate potentially faster and producing results of better quality approaches in GYM applications.

#### **Action B4: Promotion of co-modality through rescheduling**

Foreseen start date: 15/05/2016    Actual start date: 15/02/2016  
Foreseen end date: 14/08/2017    Actual end date: 14/10/2018

The main objective of Action B4 was to increase the utility of co-modality vis-à-vis the passengers through the rescheduling of TRAINOSE's timetables. Two improved mathematical representations of the timetable synchronization problem were developed by UTH with the support of CHAPS. The first concerned TRAINOSE timetable synchronization (foreseen), and the second several intercity bus transport operators' timetable synchronization (not foreseen, but requested by intercity bus transport operators during workshops in Action D3). In both cases a decomposition of the network under study was implemented and applied for the solution of the underlying problem. The modelling and solution approaches were created in such a way so that they would be data-agnostic in order to increase their reusability and replicability.

The networks considered were initially the Greek and Czech transport network. Plannerstack (replaced by INPROP) did not provide any support in this action and the analysis of the Dutch network never proceeded. On November 2017, INPROP started working along with UTH to analyse the Slovak transport network, to identify the transitional nodes to be included in the synchronization of the timetables and proceeded with the optimization procedure.

The criterion for timetable synchronization was the minimization of waiting time in transitional railway nodes, while transiting between train and intercity bus routes. Under the frame of this action the synchronization recommendations for TRAINOSE timetables with intercity buses was calculated in July 2017 for 21 popular TRAINOSE lines (e.g. Athens to/from Piraeus, Athens to/from Chalkida, Metamorfoosi to/from Aerodromio, Aspropirgos to/from Kiato, etc.) which serve more than 59% of the total number of its passengers (i.e. 750.221 in a total of 1.269.329 passengers per month). Additionally, the synchronization recommendations for 22 intercity buses timetables were calculated to minimize the waiting time in transitional nodes between their main and secondary trips.

The obtained results concerning TRAINOSE timetable synchronization showed a potential of a 22.87 minutes per line (9%) waiting time reduction on average. Concerning intercity buses timetable synchronization, the obtained results showed a potential reaching up to 40% (Intercity busses of Pieria) reduction in waiting time (not taking into account the case in which full deviation from the current schedule is allowed in order to keep deviations from the original schedule within certain limits, i.e. 15, 30, 45, 90 minutes), the synchronization of the Czech timetables up to 45% (Sunday Brno-Prague line) and the synchronization of the Slovak timetables up to 43% (Sunday Zilina-Kosice line).

TRAINOSE adopted several of the produced synchronization suggestions in 10 of its lines and communicated these changes through the [5<sup>th</sup> press release](#) (distributed through [web media](#) and [TRAINOSE's official website](#)) under the frame of Action D2. For revising its timetables, TRAINOSE encountered several constraints related to its network infrastructure, railway traffic control to avoid inter-train conflicts and security issues, hindering them to proceed to changes. Therefore the overall reduction of its waiting time was 2,316 minutes in total.

The revised timetables reports for each intercity bus operator were included in the dissemination package delivered to 13 transport operators during the 2<sup>nd</sup> workshop series in Action D3 and to 8 transport operators through courier service (see Dissemination Package included in the Annex of the Progress Report). 18 Greek intercity transport operators adopted some of the proposed optimization of timetable changes in their itineraries; this resulted in the Greek bus public transport network achieving a reduction of 117.39 minutes on average per transport operator (4.91%) in their waiting time. The analysis of the results of the Czech and Slovak transport network were also provided to České dráhy (Czech Railways) by CHAPS and Železničná spoločnosť Slovensko, a.s. (Railways of the Slovak Republic) by INPROP

(see Annex Supporting Documents/ Action B4/ Czech and Slovak Synchronization Reports), and GYM team reached Milestone 4: “Set of recommendation for re-scheduling timetables”. So far, no feedback was received regarding any revisions in the Czech and Slovak timetables. A code was also developed in C++ (not foreseen) for the pre-processing and filtering of GTFS files to accommodate the developed manual necessary for the extensibility and reusability of the modelling and solution approach. After the end of the project, UTH will be at the disposal of any interested transport operator wishing to perform a synchronization analysis of its timetables.

## **Action B5: Creation of the platform**

Foreseen start date: 15/05/2016 Actual start date: 15/01/2016

Foreseen end date: 14/09/2019 Actual end date: 14/09/2019

CHAPS, UTH and AVMap developed two designs for GYM platform taking into account the outcomes of Action A1, the feedback received from transport operators during the 1<sup>st</sup> workshop series of Action D3 and the visits performed to transport operators under the frame of Action D6. The team started implementing the designs in order to examine which one was the most appropriate for GYM applications. The first scheme defined the optimization algorithm as an addition to the OTP component, which communicates with the database directly as well as with the data engine, and the second defined the data engine and the optimization algorithm as one unified component of OTP. Both schemes were based on OTP and OSM as it was foreseen in the technical description of the project.

GYM team developed the testing platform in the first year of the project to test the outcomes of Actions B1, B2 and B3, as well as the User Interface (UI). During the project, GYM team ran a number of tests in order to evaluate the functionality, usability, compatibility and security of the developed platform and web application. Several bugs were identified by these tests and they were handled by CHAPS, UTH and AVMap.

The [testing version](#) (temporarily available) and [final version](#) of GYM web application are installed on GYM server, which is hosted in University of Thessaly premises.

In a year of operation, i.e. from September 2018 to September 2019, more than 29,000 requests (2,238 unique requests per month on average) have been submitted in GYM platform, providing users the environmental friendliest route with public transport. The number of new users visiting GYM platform was 9,686 at the end of the project; most of the users connect to GYM platform through an Android operating system (63.16%) and Windows (31.69%), whereas the majority of the users come from Greece (95.59%). The rest of the users were located in several European countries, such as United Kingdom (0.51%), Germany (0.38%), Cyprus (0.29%) and Czech Republic (0.24%), but also in countries outside the EU, such as United States (0.79%), Russia (0.10%) and Japan (0.06%).

One of the main barriers GYM team came up with during the implementation phase was the availability, collection validation and update of transport operators' data. Substantial effort was put in the updating of transport operators' GTFS data, which change approximately twice per year. Apart from personal visits to transport operators to collect data and teleconferences performed during the project duration, GYM team developed the following tools for the GTFS data updating:

- 1) UTH developed guidelines for transport operators on how to use QuantumGIS software in order to produce shape files. The shape files include the stops and the routes of a public transportation mean.
- 2) UTH developed a software (named shp2GTFS) which can generate GTFS data by combining the shapes files produced by QuantumGIS and the timetables of transport operators in Comma-Separated Values (CSV) files format. The software was developed based on PostgreSQL and OTP for the calculation of travelling times between stops. The programming language used is Python 3.4.
- 3) UTH developed a database in excel file format that can be used by transport operators not familiar with webservices. This database is used for the timetable updating. Transport operators using this database can check the timetables pre-prepared by UTH team and make changes based on their new timetable. Then they have to send GYM team the revised timetable in order to include it in the platform.
- 4) UTH developed a software to download in an automatic and systematic way updated GTFS data from transitfeeds.com. The software, developed in Python 3.4, can connect to the

API of transitfeeds.com, download the most updated GTFS data registered on the site and generate separate GTFS data sets representing each transport operator.

5) UTH and AVMap developed a [GTFS editor](#) web service to be used by transport operators to digitize, homogenize, revise and update transport data. The web service can easily generate GTFS data. UTH digitized, validated, uploaded and updated on the GTFS editor the GTFS data included in GYM application. Login info to the web service was provided to all transport operators during the 2<sup>nd</sup> workshop series under the frame of Action D3.

6) UTH co-developed with E-Analysis S.A. (E-Analysis currently manages the tracking system of 18 transport operators, including city and intercity busses) a web service which can be used for the GTFS data updating. This web service communicates with E-Analysis tracking service and produces the most updated KML files of transport operators. KML files include stop positions and routes shapes.

7) UTH developed a software for the transformation of KML files obtained by the tracking system to GTFS files. This software is necessary, since several transport operators have updated KML files.

UTH, during workshops, on-site visits, webinars and the awareness campaign, trained transport operators on how to use the abovementioned tools. GYM team used feedback continually received from potential users of the data updating systems to further improve them. UTH during the 2<sup>nd</sup> and 3<sup>rd</sup> workshop series (Action D3) presented the data updating tools to all transport operators visited and provided them with a manual. Further visits to transport operators to assist them on using the developed updating tools were performed when requested and Skype calls on their training took place. Urban transport operators of Trikala, Larissa, Serres and Lamia and intercity transport operators in Thiva, Trikala, Alexandroupoli and Lamia are already operating the developed applications, while other transport operators either use it with the assistance of UTH or assist UTH in updating the data. Feedback received from transport operators was very productive since they are communicating their needs in order to keep the platform updated in a convenient way.

The development of a co-modal ticketing tool was not implemented due to many technical and managerial barriers encountered from different transport operators. Instead, links to the online ticket purchase applications of transport operators providing online ticketing have been added (e.g. TRAINOSE, KTEL Thessalonikis S.A.).

Several technical issues were encountered since the release of the platform, mostly derived through users' feedback. One was the production of non-realistic routing solutions, where long walking distances were included. This was addressed by removing from the frontend the user option to choose maximum walking distance and optimizing in the backend the walking distance required to reach the desired destination. Another issue was the reverse geocoding functionalities not providing the option to include street number. To resolve this issue LIFE GYM team included additional reverse geocoding services, such as HERE geocoding service. Moreover, in several cases the service response time to produce a query was longer than expected, i.e. 10 seconds. This occurred due to the request of real-time traffic data by external APIs, such as the weather API. Such additional APIs are introduced in the platform and are combined with the existing APIs in order to calculate emissions. The requests are submitted in parallel, i.e. for different places simultaneous requests by several APIs. To cope with this issue LIFE GYM team assumed that data requested in a timeframe of 30 minutes (e.g. temperature) from the same area remain the same and therefore are not requested again. This way, less requests to external APIs are needed and the requested queries are produced within a reasonable time less than 10 seconds.

Under the frame of Action B5, UTH developed several additional services that could be integrated in the future in GYM platform. These are:

- 1) A Trip Tracking and Monitoring System, available under request at [saharidis@gmail.com](mailto:saharidis@gmail.com);
- 2) A Trip Scheduling system, available under request at [saharidis@gmail.com](mailto:saharidis@gmail.com);
- 3) GreenYourMove Live, available at [link](#) and already running as a pilot program for the urban busses of Volos, which provides information on bus itineraries in real time.
- 4) Real-time communication system for smart bus stops, available at [link](#), a web service providing information to smart bus stops about the arrival of the next bus

After the end of the project, UTH, assisted by CHAPS and INPROP, will keep the platform online, update the existing itineraries data and introduce new public transport network data from Greece, EU and also countries outside the EU for at least 10 years. Also, LIFE GYM team will perform all necessary and critical technical updates in order the platform to be compatible with popular operating systems. Moreover, LIFE GYM team continuously improves and will further improve after the end of the project the platform functionalities and quality of the produced results. Quality issues coming up during the platform operation, either communicated from users or noted by LIFE GYM team, which quite often, i.e. on a weekly basis, performs quality control of the platform by performing test queries until the platform operation is stabilized, will be addressed in order to provide users with a reliable and useful environmental journey planning service.

Great effort and attention will be put in the promotion of the tracking system and GreenYourMove Live platform including transport means track and trace information and LIFE GYM team will make high effort for it to be replicated, extended and re-used by other transport operators. We are really confident that our initiative of developing such a system can provide GYM platform with great opportunities. We proceeded in merging the static and the live version. The merged version is available at the following [link](#). We decided to keep the live version separately from the static version already communicated to the public, i.e. [greenyourmove.eu](http://greenyourmove.eu), for the time being, in order not to confuse the users. Our goal is to convince other transport operators as well to create the infrastructure needed to support live information. As soon as adequate number of transport operators enters the live version, then we will integrate it in [greenyourmove.eu](http://greenyourmove.eu). For this purpose, UTH participated in a meeting in Katerini, Greece in September 2019, along with Urban KTEL of Larissa, KTEL of Corfu, Urban KTEL of Katerini and KTEL of Mytilini, to present the additional applications developed under the frame of LIFE GYM project on the occasion of the recent National Strategic Reference Framework (NSRF, in Greek ΕΣΠΑ) call for telematics applications.

## **Action B6: Smartphone application**

Foreseen start date: 15/09/2016    Actual start date: 15/10/2017  
Foreseen end date: 14/09/2019    Actual end date: 14/09/2019

INPROP developed the smartphone applications with the support of CHAPS, UTH and AVMap. INPROP with the support of CHAPS and UTH analyzed the API of GYM platform. Additionally, INPROP with the support of UTH connected the smartphone application with GYM platform and with the support of AVMap connected the smartphone application with the database. EMISIA evaluated the co-modal emission calculation models and UTH and AVMap evaluated the optimization algorithm and the database in the smartphone environment.

LIFE GYM team released the initial version of the Android application on August 24, 2019 and the iOS application on September 17<sup>th</sup>, 2019. The Android application is available on Google Play (3,936 installations at the end of the project and counting) and the iOS application on AppStore (523 installations).

Action B6 was implemented the way it was described in the technical description of the project. The application developed includes several functionalities, such as account creation, routing history recording, shopping cart button, Facebook and calendar sharing option. The only exception is the implemented methodology for real time traffic information. It should be noted that track and trace data necessary for traffic estimation, are not collected by users (although the platform has the possibility to collect these data) due to the General Data Protection Regulation (GDPR) which does not allow GYM application to collect personal data of travelers. LIFE GYM team implemented real time traffic information integrating external API (Bing maps API) which anonymously collects traffic data and feeds GYM database. Finally, social media accounts of GYM applications inform directly travelers for any change on timetables and routes of transport operators included in the applications.

Several errors and bugs were fixed and updates and improvements were performed by LIFE GYM team in the developed applications. Moreover, the technical issues LIFE GYM team came up with in the web application (see Technical progress of Action B5), also affected the smartphone application. Resolving these issues in the web application required also updating the smartphone application, by releasing a new version including these updates and corrections, in order to improve the user experience. So far, 7 additional versions, following the initial, have been released for the Android application and 2 additional versions have been released for the iOS application.

After the end of the project, GYM team will perform all necessary and critical technical updates in order the applications to remain compatible with Android and iOS operating systems. The developed smartphone applications will remain active for at least 10 years.

## **Action B7: GreenYourMove (GYM) Demonstration & Replication**

Foreseen start date: 15/07/2017 Actual start date: 14/01/2017

Foreseen end date: 14/09/2019 Actual end date: 14/09/2019

The objective of Action B7 was to demonstrate GYM web platform and smartphone application into real life practices of passengers in urban zones. The Action was coordinated by AVMap, while TRAINOSE demonstrated GYM project outcomes in Greece, CHAPS in Czech Republic, INPROP in Slovakia and EMISIA at international level.

GYM application is currently available through TRAINOSE official website ([link](#)) and also TRAINOSE's online booking system is automatically accessed through by users of GYM applications. Additionally, TRAINOSE's employees working at the telephone center and the ticketing offices received the manuals of GYM application developed under the frame of Actions B5 and B6 and were also trained on site by TRAINOSE's people involved in GYM project on how to use the platform in order to provide passengers with information on the environmental friendliest route to perform their trip. The telephone center and the ticketing offices, along with TRAINOSE's official website, are the main information channels of TRAINOSE's passengers. In total, 56 employees were trained in how to use GYM platform and received GYM application manuals: 48 employees at the ticketing offices, i.e. 2 employees per station in 24 stations and 8 employees at the telephone center.

TRAINOSE does not have an official training procedure to integrate training in using GYM platform to its personnel. In case new personnel are hired, it is informed about GYM application by the current personnel and is provided with GYM application manual. For the time being, there are several hard copies of the manual available. In case there are no hard-copies left after the end of the project, TRAINOSE will consider reprinting some manuals or provide the electronic version of the manual.

In order to disseminate GYM project and motivate the passengers to consider their environmental footprint while travelling, TRAINOSE proceeded in offering discount coupons at its passengers. In total, 200 discount coupons of 20€ for a trip of preference (20€ is 50% off of the Athina-Thessaloniki ticket price and can reach 100% for other trips) were distributed by TRAINOSE through UTH exhibition booth at the 84<sup>th</sup> Thessaloniki International Fair (TIF). The current promotional policy of TRAINOSE is not to provide a discount percentage, but to provide a discount amount, e.g. discount of 20€. This discount corresponds to minimum 50 until 100% of discount. The environmental friendliest route provided by the platform did not always include a TRAINOSE itinerary. That is the reason why users of the platform could not receive discount coupons during the dissemination activities (awareness campaign, Athens awareness raising activity, TIF participation, workshops, etc.).

EMISIA demonstrated the developed emissions calculation models into COPERT 5, a software tool used world-wide to calculate air pollutant and greenhouse gas emissions from road transport. The development of COPERT is coordinated by the European Environment Agency (EEA). By integrating the novel emission calculation models of Action B2 and the emission inventory methodology of Action C1, COPERT provides higher accuracy since it takes into account additional vehicles' types and co-modality parameters.

CHAPS demonstrated the emission calculation models of Action B2 and the environmental co-modal routing algorithms of Action B3 in IDOS, the Czech national journey planner. The IDOS version integrating GYM project outputs is available at the following [link](#). The domain used for this purpose was GreenYourMove.cz, which was preferred from the original IDOS link to discriminate the project outcomes from CHAPS' commercial version and disseminate LIFE GYM project.

INPROP demonstrated the developed emissions calculation models Action B2 and the environmental co-modal routing algorithms of Action B3 into Cestovné poriadky (CP), a

Slovakian Android journey planning application. CP release version 1.5, including LIFE GYM outcomes, is available through Google Play in Android smartphones and tablets.

Action B7 was implemented with a delay, due to the change in LIFE GYM consortium and the submitted amendment request. Only EMISIA demonstrated GYM components for a period of 12 months, since integration of the emission calculation models in COPERT was not affected by the change in LIFE GYM's consortium; CHAPS and INPROP, which integrated several other components, such as the developed algorithms, which had to be tested for their efficiency before integrated in a different system, started the integration after the release of GYM platform. Existing journey planning systems do not easily proceed in changes in their provided services; altering parts of their developed platforms needs planning and requires time to mature. Since the release of GYM platform was delayed (see Action B5), the integration process finished at the final month of the project, i.e. in September 2019 for both CHAPS and INPROP, not having the chance to demonstrate GYM components for a 12 month period. This also had an impact in the replication of LIFE GYM outcomes in other journey planning systems, since during the webinars, which were considered the most important tool to convince other journey planning systems to replicate LIFE GYM outcomes, there was no existing journey planning system apart from GYM platform itself to demonstrate or Journey Planners to share their experience and know-how in integrating GYM components. Apart from that, the late integration of LIFE GYM outcomes in IDOS and CP didn't affect other project outcomes, since, for instance, the environmental impact assessment was conducted in Greece.

The transport networks of 7 additional EU countries were included, i.e. Slovakia, Cyprus, Switzerland, Denmark, Luxembourg, Estonia and Sweden, ensuring increased demonstration and replication of GYM application, since in most of these countries no co-modal journey planning application is available (for instance Cyprus) and in none of these countries an environmental journey planning application exists.

GYM team has put high effort and will continue after the end of the project, in order to disseminate GYM project outcomes to OTP initiative through event participations or webinars or the development of the next OTP version. Mr. Andrew Byrd, Mr. Landon Reed and Mr. David Emory which are members of the community and were initially the main developers of OTP, showed interest about the outcomes of LIFE GYM (e.g. emission calculation models). Based on our continuous efforts, we are confident that in the future OTP will proceed in integrating several of GYM components. This is considered by the project team the best strategy to disseminate the outcomes of the project in European and international level.

The COPERT modules developed by EMISIA will remain in COPERT after the end of the project and IDOS and CP versions developed under the frame of GYM project will continue running with GYM algorithms and providing the user with the environmental friendliest alternatives of their scheduled trip. The [webinar platform](#) developed by AVMap under the frame of Action D3 will be online after the end of the project, providing GYM components a replication potential in the case that future stakeholders emerge.

### **Action C1: Monitoring of the environmental impact of the project**

Foreseen start date: 15/05/2016    Actual start date: 15/05/2016  
Foreseen end date: 14/09/2019    Actual end date: 14/09/2019

The purpose of this action was to monitor and measure LIFE GYM's impact on the environmental problem of road transport emissions in Greece. EMISIA, UTH and AVMap worked together to prepare the emission inventory methodology.

In order to assess the environmental impact of GYM application, the project team monitored the tickets sold by 28 bus transport operators and TRAINOSE in Greece. Four Check-Points (CPs) were defined by the project team for the collection of data. The first was the baseline scenario (September 2015), the second was after the launch of GYM applications (October 2018), the third was after the completion of the awareness campaign performed under the frame of Action D5 (December 2018) and the fourth was at the end of the project (September 2019).

The collection of the required data was a difficult procedure, since not all transport operators were willing to provide such data. Various methods were employed by GYM team (e-mails, phone calls, official letters, on-site visits) and a gap filling procedure was also developed to cope with missing data. Official data request letters were sent in October 2017 to 70 transport operators (see Mid-term Report Annex for copies of the sent letters) and were delivered with the dissemination package during the 2<sup>nd</sup> workshop series of Action D3 to 36 transport operators (see Dissemination Package included in the Annex of the Progress Report).

During the 2<sup>nd</sup> workshop series, GYM team made contact with E-analysis S.A., a private company collecting data from Greek public transport operators and received the necessary data for 14 Greek urban and 14 Greek intercity transport operators for all check points. GYM team proceeded in revising all CPs after receiving these data and the environmental impact was assessed without use of missing data tools.

Moreover, the environmental impact of the project outcomes was also assessed through questionnaires ran on passengers during the awareness campaign and other awareness raising activities in Athens and Thessaloniki under the frame of Action D5. The results of these questionnaires provided important conclusions regarding the environmental thinking of passengers and their attitude towards GYM applications, which are assessed in detail in Action C2.

To evaluate the environmental impact of LIFE GYM, an assumption was made for the increase in the use of public transport that was attributed to the introduction of GYM platform and web application. Based on the outcomes of the responses in the questionnaires filled-in during the awareness campaign, 51% of the responders answered that they would surely make use of GYM application in their following trips. Taking into account all the awareness raising, communication and promotional activities following the introduction of GYM platform and aiming to promote public transport usage (see public awareness and dissemination of results activities, i.e. Actions D1-D6), it was safe to attribute half of the increase in the use of public transport, meaning an increase equal to 15% in CP1.4, as foreseen in the project's technical description, to the launch of GYM platform and LIFE GYM awareness raising and promotional activities.

This is also confirmed through the analysis of the queries performed in GYM platform for the 13 month period. The number of queries performed was 29,098 queries. Assuming that 30% of these queries, i.e. 8,729 queries, were performed by frequent passengers, for instance travelers seeking how to reach their working place with public transport means or students, this is translated in 3,247,266 tickets, taking into account the following assumptions: each result contains at least 2 different itineraries (2 to 5 itineraries are included in the produced results, translated in 2 different tickets); these passengers didn't know how to reach their destination with public transport means, otherwise they wouldn't search it in GYM platform,

supported also by awareness campaign survey answers regarding the intention to use GYM platform after getting familiar with it, which was over 65%; these passengers will not perform a query again, once they find the way to reach their destination; these passengers, since they are frequent, they will make use of the proposed route for 22 days monthly, since their request in the platform and for the following months until the end of the project. Summing up also the remaining tickets produced for non-frequent travelers, which were assessed to 40,737 tickets, i.e. 20,369 queries producing at least 2 tickets, the total ticket increase was calculated to 3,288,003 tickets. The actual ticket increase according to statistics acquired for city and intercity busses operators and TRAINOSE for the 13 month period since the platform release was 7,640,886 tickets. Therefore it is safe to attribute half of this increase in LIFE GYM activities and the platform release.

The increase in public transport tickets was translated in CO<sub>2</sub> savings. The total saved CO<sub>2</sub> since the launch of GYM platform (meaning for a total of 13 months) was equal to 0.55 Mt for all transport means (see Deliverable C1 for the assessment analysis). The environmental impact of LIFE GYM was communicated through the 9<sup>th</sup> press release, the 9<sup>th</sup> CF and the Layman's Report.

After the end of the project, UTH will validate the monitoring of the environmental impact of LIFE GYM for at least 2 years, through air quality monitoring devices and use of a professional drone to map bus trip lines. GYM team will also run one more data collection phase in September 2022 in order to assess the environmental impact of LIFE GYM three years after its conclusion.

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

Foreseen start date: 15/03/2016 Actual start date: 15/03/2016

Foreseen end date: 14/09/2019 Actual end date: 14/09/2019

AVMap generated the socio-economic impact assessment protocol to assess the socio-economic impact of GYM. 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 (more than 10 subcategories and 100 weighted criteria) were set in order to enable tracking the socio-economic impact in measurable units. The monitoring protocol was updated by AVMap after the comments suggested by the NEEMO monitoring expert during the 2<sup>nd</sup> monitoring meeting.

Three CPs were considered for the assessment of the socio-economic impact. The first was the baseline scenario at the beginning of the project (September 2015), the second corresponds to the period after the launch of GYM applications (December 2018) and the last corresponds to the period after the dissemination activities (end of the project – September 2019). The quantification of socio-economic impact was assessed for the three CPs using the developed protocol and data collected by UTH and EMISIA. CHAPS, INPROP and TRAINOSE contributed with providing data regarding their networks and in the analysis of the results. More specifically, UTH contributed with data associated with travel time reduction, social changes and use of public transport, TRAINOSE with data associated with social changes and use of public transport, CHAPS and INPROP with data associated with GYM tools acceptance. AVMap assessed all these criteria and indicators, as well as collected the rest of the data necessary for the socio-economic impact assessment, with the contribution of all beneficiaries, including EMISIA.

The overall analysis of LIFE GYM impact indicates that it has satisfied or even gone beyond the initially set goals for the socio-economic parameters. LIFE GYM deliverables and the environmental co-modal routing have certainly quantitative economic and social benefits. LIFE GYM increased the awareness of European journey planning initiative both at Greek and European level. GYM European platform engaged 936 transport operators located in 145 cities in 10 countries. It increased the total number of passengers using public transport in Greece and motivated them to environmental awareness during their travelling planning. Regarding the social changes, LIFE GYM managed to increase environmental awareness of passengers and transport operators in Greece via strategic communication mechanisms. LIFE GYM project team organized and attended in several communication and networking activities of all types (conferences, special events, international fairs, workshops) which created the conditions for more than 1.400 organisations (bodies, agencies, transport operators, local authorities, etc.) and more than 200.000 persons to get familiar with GYM scopes, methods and outcomes. .

After the end of the project, LIFE GYM team will run one more data collection phase in September 2022 in order to assess the Key Performance Indicators (KPIs) related to the socio-economic impact of LIFE GYM three years after its conclusion.

### **Action C3: Monitoring & evaluation of GYM methods and techniques**

Foreseen start date: 15/09/2015 Actual start date: 15/09/2015

Foreseen end date: 14/09/2019 Actual end date: 14/09/2019

AVMap and UTH developed the monitoring protocol to monitor and evaluate the techniques and methods developed in the frame of preparatory and implementation actions for the platform development, i.e. Actions A1 and B1 to B4, and actions to demonstrate GYM techniques, i.e. Action B7.

AVMap developed the monitoring reports of the protocol which are template reports that beneficiaries used to monitor actions' methods and techniques. AVMap delivered the monitoring report for Action A1, the monitoring report for the evaluation of GYM database for Action B1 and the monitoring report of demonstration and replication activities for Action B7, with the assistance of TRAINOSE, CHAPS and INPROP. EMISIA delivered the monitoring report for the evaluation of new-case specific emission calculation models for Action B2. UTH delivered the monitoring report for the modelling approach and solution algorithms for co-VRP for Action B3 and the monitoring report for timetables rescheduling for Action B4. Additionally, UTH created under the frame of Action E2 quality check indicators which were included in the monitoring reports. The real time schedule of the Action followed the planned timeframe of the involved actions.

The evaluation of the preparatory and implementation actions monitored under the frame of Action C3 showed that the preparatory actions produced useful results for the implementation actions; the implementation actions were implemented the way they were foreseen, the quality of their outcomes was satisfactory. Only the replication action B7 failed to be totally aligned with its expected outcomes.

After the end of the project, no activities will be further performed under the frame of Action C3.

## Action D1: Web presence

Foreseen start date: 15/11/2015    Actual start date: 26/11/2015  
Foreseen end date: 14/09/2019    Actual end date: 14/09/2019

The purpose of this action was to establish a vivid web presence for LIFE GYM and its outcomes. For this purpose, a website for hosting the project outcomes and content intended to promote and support co-modal journey planning and highlight its environmental benefits for the passengers was created. Social media accounts were also created to disseminate uploaded material.

An External Assistance (EA) created two websites for LIFE GYM. The 1<sup>st</sup> website is the official project's website ([www.greenyourmove.org](http://www.greenyourmove.org)) the 2<sup>nd</sup> website is the official website ([www.greenyourmove.eu](http://www.greenyourmove.eu)) of GYM web application (details have been presented in Action B5). UTH checked and confirmed the design of both websites and AVMap created and maintained a [Journey Planners blog](#). GYM's website was updated regularly with events, news, articles, videos, project material, etc. The material necessary for the website was produced by LIFE GYM team and the EA. UTH made a quality check to the produced material and then sent it to the EA. Additionally, AVMap translated the static part of the website in Greek, CHAPS in Czech, Plannerstack in Dutch and INPROP in Slovak. UTH, AVMap, EMISIA and TRAINOSE contributed with articles and posts in Greek and English, CHAPS in Czech and English, Plannerstack in Dutch and English and INPROP in Slovak and English.

According to the website counter, 19,434 were the total hits of the LIFE GreenYourMove website since its launch. 7,526 out of 19,434 hit were unique visitors of the website.

Additionally, UTH assigned to the EA the promotion of GYM project through social media. EA created accounts under GYM name in the following social media: [Twitter](#), [Facebook](#), [LinkedIn](#) and [Google+](#) (not available since April 2019) for the dissemination of website content and other relevant to public transport content, [YouTube](#) and [Vimeo](#) for hosting of produced for the purposes of the project videos and communication flashes (CFs) and [SlideShare](#) for hosting presentations of GYM project in PowerPoint format. EA under the supervision of UTH maintained the social media accounts and uploaded the material available on the website. Additionally, an online helpdesk (i.e. real time chat) was created by the EA. The helpdesk plays an important role concerning the replication and transfer of GYM outcomes to other transport operators, journey planners, engineers and researchers. The helpdesk receives questions from potential users of GYM outcomes and gives real-time scientific and technical answers and guidelines. So far, more than 50 persons contacted LIFE GYM team through the online helpdesk. Most contacts were related to inquiries regarding the availability of GYM platform in several areas and technical issues of GYM platform reporting.

After the end of the project UTH with the assistance of AVMap will maintain the project's website and the social media accounts for at least 10 years and AVMap with the assistance of UTH will maintain the Journey Planners blog for at least 3 years.

## **Action D2: Production of electronic material**

Foreseen start date: 15/11/2015 Actual start date: 18/11/2015

Foreseen end date: 14/09/2019 Actual end date: 14/09/2019

The purpose of this action was to produce electronic material for the dissemination of LIFE GYM and its outcomes and the concept of co-modal routing and its environmental benefits. The material was targeted to passengers and transport operators and stakeholders in the EU.

The electronic material was designed and produced as it was described in the technical description of the project. UTH assigned to an EA the design and production of the project's newsletters, communication flashes, promotional videos and the GYM logo. UTH was responsible to check and confirm the material sent by the associated beneficiaries necessary for the production of electronic material. TRAINOSE was responsible for the production and dispatch of all the produced press releases. UTH and AVMap contributed with content for the press releases related to the platform development progress and the assessment of the project's socio-economic impact respectively. EMISIA contributed by authoring 2 editorial entries for the produced newsletters and provided content related to emissions for the produced videos, communication flashes and press releases. CHAPS and INPROP contributed with their experience in promoting journey planning applications by indicating the necessary content related to the developed applications to be included in the produced material (e.g. CHAPS suggested the story presenting the problems a traveller encounters due to the absence of a journey planner in Greece in the [Meteora video](#)).

Moreover, for the purposes of the awareness campaign in September 2018, 10 radio spots were produced by an EA under the supervision of UTH (not foreseen).

All produced material was disseminated through the official website of LIFE GYM ([Newsletters](#), [Communication Flashes](#), [Videos](#), [Press Releases](#)) and the social media accounts. Videos and CFs produced are hosted in [YouTube](#). The produced press releases were disseminated through [Greek web press](#) and TRAINOSE's [website](#). All beneficiaries made high effort to disseminate electronic material.

After the end of the project, the produced electronic material will remain online for at least 3 years. UTH is considering producing at least one newsletter, to keep followers of LIFE GYM (newsletter subscribers) updated regarding GYM platform.

### **Action D3: Organisation of workshops and webinars**

Foreseen start date: 15/04/2016    Actual start date: 15/02/2016  
Foreseen end date: 14/09/2019    Actual end date: 14/09/2019

The scope of this Action was twofold: to introduce GYM project concept and its forthcoming applications to public transport operators and ensure their cooperation in the implementation of the project through workshops; to disseminate and replicate GYM project outcomes and modules through webinars.

UTH was responsible for the implementation of the workshops. In total, 3 series of workshops were conducted and one additional workshop under the frame of the 83<sup>rd</sup> TIF.

The 1<sup>st</sup> workshop series was conducted in April 2016 and included 3 full-day workshops in Athens, organized by AVMap, in Thessaloniki, organized by EMISIA and in Volos, organized by UTH. In total 65 participants attended the 1<sup>st</sup> workshop series. The workshops were aimed at transport operators and the local press. Their scope was to receive feedback for the transport network, define the applications' requirements and raise awareness regarding LIFE GYM. Transport operators participating in these workshops provided significant details to LIFE GYM team regarding their networks and also specified several requirements that GYM platform should include, e.g. the characterization of stops on boarding and landing stops in several cases.

The 2<sup>nd</sup> workshop series included 14 workshops in 14 Greek cities in the form of personal visits to the transport operators, were performed between May and July 2018 and were organized by UTH. Their scope was to involve transport operators in the organization of the awareness campaign (see Action D5), deliver the timetable synchronization reports developed in Action B4 to intercity busses transport operators, receive data for the environmental impact assessment of Action C1 and introduce the GTFS editor application developed in Action B5 (see Dissemination Package included in the Annex of the Progress Report). In total, 44 participants attended the 2<sup>nd</sup> workshop series. Through this workshop series, LIFE GYM team managed to convince several transport operators to actively participate in the awareness campaign and resulted in the initiative of several operators to contribute in the promotion of GYM platform on their own, e.g. by providing bus panel advertisements. Moreover, access to the GTFS editor application was provided and training on how to update their data took place, resulting in the more active participation of the transport operators in the data updating procedure.

The 3<sup>rd</sup> workshop series included 10 workshops performed during the awareness campaign in September 2018 in 10 Greek cities and were organized by UTH. In total 267 participants attended the 3<sup>rd</sup> workshop series. The workshops were aimed at drivers, transport operators, local authorities and the local press. Their scope was to present GYM applications and demonstrate how to use them to people involved in transport services. This was very important, since, as it turned out from the answers received during the awareness campaign survey, the percentage of people who request information on itineraries by calling the transport operator's information office or people requesting information from ticketing booths or the drivers, while arriving at the station or bus stop, is quite significant (31.23%) and people involved in public transport services can both encourage passengers to use GYM platform or even use it on their own to find and provide the necessary information.

UTH also organized a workshop entitled "City and Intercity public transport: today and tomorrow" during the 83<sup>rd</sup> TIF. The workshop was held at the TIF's premises in September 2018 and was addressed to stakeholders and transport operators. The scope of the workshop was to discuss current and future trends in public transport, while presenting the developed GYM applications. In total, 60 participants attended the workshop. This workshop, which coincided with the release of GYM platform, provided LIFE GYM team the chance to receive

feedback from transport operators for the platform and discuss further functionalities that could possibly be included in the future.

AVMap, supported by UTH and EMISIA organized 12 webinars in the form of a half-day session. The response of transport operators was not the foreseen one (see Section 6.2). For this reason AVMap proceeded with implementing a platform, which is hosted at the following [link](#). In total, 14 institutes watched parts of the offline version of the webinars. Among these, four JPs, Mitfahr De Zentrale, Entur, Af83 and CeiiA from Germany, France, Norway and Portugal respectively have registered to LIFE GYM webinar platform so far. After the publication and the dissemination of the webinar platform, the database of GYM project was requested by the consortium of OPTITRANS project. UTH started investigating with the consortium of OPTITRANS possible areas of cooperation after the end of the project. The rest of the participants were individuals from research and academic institutes.

After the end of the project, AVMap will keep the webinar platform online for at least 3 years and along with UTH will communicate with interested journey planners, aiming at GYM applications replication.

#### **Action D4: Publications & Participation in conferences**

Foreseen start date: 15/02/2016 Actual start date: 07/01/2016

Foreseen end date: 14/09/2019 Actual end date: 14/09/2019

The scope of this Action was to disseminate LIFE GYM novel scientific outcomes through scientific publications and participation in conferences, as well as the exchange of scientific knowledge, favoring enhancements in environment and transport policy development, through the creation of Special Issues. Under the frame of Action D4, the Layman's Report of the project was also developed.

UTH prepared two scientific journal papers, one to disseminate the scientific outcomes of Action B3: Saharidis, G. K., Rizopoulos, D., Fragkogios, A., & Chatzigeorgiou, C. (2017). **A hybrid approach to the problem of journey planning with the use of mathematical programming and modern techniques**. *Transportation research procedia*, 24, 401-409: [link](#); and one to disseminate the scientific outcomes of Action B4: Rizopoulos, D., Saharidis, G. K., **Generic approaches for the rescheduling of public transport services**, *Energy Systems*. This scientific paper is currently under review (minor revisions are necessary) and is expected to be published in 2020 (see Annex Supporting Documents/ Action D4). EMISIA, with the support of UTH, prepared a scientific journal paper to disseminate the scientific outcomes of Action B2: Kastori E. G., Papadimitriou G., Katsis P., Kouridis C., & Saharidis G.K. (2019). **Development of a novel model for co-modal emission calculation and inventory methodology**. *Energy Systems*: [link](#).

UTH organized two Special Issues: Energy Systems, Special Issue on Energy, Sustainability and Climate Change in Transportation. Guest Editors: Dr. Georgios K.D. Saharidis, University of Thessaly, Greece, Chariton Kouridis, EMISIA S.A, Greece & Dr. Mihalis Golias, The University of Memphis, USA ([call for papers link](#)) and Energy, Ecology and Environment, Special Issue on Energy, Sustainability and Climate Change. Guest Editor: Dr. Georgios K.D. Saharidis, University of Thessaly, Greece ([call for papers link](#)). Currently, 7 manuscripts have been accepted for publication in both issues, out of 32 submitted (see Annex Supporting Documents/ Action D4/ Special Issues). Both Special Issues will be published as soon as adequate manuscripts for publishing are accepted (at least 12 manuscripts per issue).

Regarding the book with special topic on co-modal environmental routing and journey planning publication, UTH has put high effort on contacting and requesting from other researchers to participate in its publication. Unfortunately, most researchers prefer scientific journals to publish their work, and were not willing to participate in the proposed book. Instead, UTH contacted two practitioners/stakeholders, Mr. Kolyndrinis, Chairman of the Board of Directors and Management Director of KTEL Intercity Buses of Magnesia S.A. and Mr. Panagiotis Giolas, Management Director (October 2014 – October 2018) of KTEL Urban Buses of Volos S.A., who kindly contributed to the book publication with Chapter 2 “Public transport operators and stakeholders opinions”. These two people also act as policy makers for the Greek public transport market, since they have large activity in Greek associations related to public transport, e.g. Panhellenic Association of Urban Transport and Panhellenic Association of Intercity Transport. The book in Co-modal Environmental Routing and Journey Planning was published by the University of Thessaly Press. The added value of the book is that it addresses the issue of green journey planning, currently not available in the literature. The novel developed algorithms and emission calculation models are presented in Layman terms. Also, the outcomes of LIFE GYM are promoted through the published book.

GYM team participated in conferences to disseminate the project's outcomes and its scientific results. UTH participated in 7 EU conferences (e.g. [3rd CSUM](#), [ESCC 2016](#), [ESCC 2017](#), [HF 2017](#), [SUMP 2018](#), [ESCC 2018](#), [ESCC 2019](#)) and 1 international event (Incheon workshop, 2016, South Korea). ESCC 2016, 2017, 2018 and 2019 were organized by UTH, providing GYM team the chance to organize special sections dedicated to co-modal transportation and

journey planning in EU and disseminate LIFE GYM outcomes. The organization of conferences was not foreseen by LIFE GYM and the expenses were covered by other sources. EMISIA participated in 4 EU conferences ([TAP 2016](#), [ESCC 2016](#), [ESCC 2018](#) and [TAP 2019](#)) and CHAPS and PlannerStack participated in [ESCC 2016](#). All presentations of GYM team members are hosted in [Slideshare](#). During these conferences, GYM team distributed promotional material of LIFE GYM and, where possible, erected notice boards and posters, developed under the frame of Action D5, and also performed networking activities under the frame of Action D6.

The project's Layman's Report was prepared by UTH in English and was also translated in Greek. CHAPS prepared the Czech version and INPROP the Slovak one. The Layman's Report was produced in paper and electronic version. The paper version of the report was sent to 104 transport operators and stakeholders by regular mail, while the electronic version of the report was sent to 631 recipients related to LIFE GYM (stakeholders, policy makers, transport operators, subscribers to the project's newsletters and similar to LIFE GYM other EU project team members). The electronic version of the report is available on the project's website at the following [link](#). Its publication was disseminated through social media accounts and was also announced through the 9<sup>th</sup> press release produced under the frame of Action D2.

After the end of the project, UTH and EMISIA will continue disseminating scientific outcomes of LIFE GYM during their regular participation in conferences, workshops and other scientific events. Other project beneficiaries will continue participating in relevant to LIFE GYM events and workshops.

### **Action D5: Direct communication**

Foreseen start date: 15/02/2016    Actual start date: 15/02/2016  
Foreseen end date: 14/09/2019    Actual end date: 14/09/2019

The scope of this Action was to communicate GYM applications and the project's outcomes directly to passengers. Apart from the printed material developed, all awareness raising activities of LIFE GYM were performed under the frame of this action.

UTH, with the assistance of an EA, organised the production of all printed material utilized for the dissemination of the project. This included the production of flyers, posters and four types of notice boards: notice boards providing information about LIFE GYM, placed at each project beneficiaries facilities, a scientific notice board erected in conferences participations under the frame of Action D4, notice boards erected during workshops performed under the frame of Action D3 and notice boards erected during the awareness campaign. Moreover, UTH proceeded in the production of promotional material (folders, notepads, mouse pads, pens), not foreseen at the proposal phase, which was mainly distributed during the workshops performed, the conferences participation and other networking activities performed under the frame of Action D6. The produced posters were erected in conferences and events participation, when possible, and were also erected in UTH facilities. TRAINOSE also erected posters at the ticket booths and passenger waiting areas of 24 of its stations in several cities around Greece. EMISIA and AVMap erected posters in several spots in Athens and Thessaloniki, during the conduction of awareness raising activities. Posters were also produced for the purposes of the awareness campaign. Produced flyers were distributed whenever possible: during workshops, visits to transport operators, conferences and events participation, the awareness campaign and all awareness raising activities. Moreover, flyers were also left at strategic places in order passers-by to collect them, e.g. transport operators ticketing booths.

UTH, assisted by all project beneficiaries, performed the awareness campaign in September 2018 in parallel with the European Mobility Week. Several transport operators were also actively involved in the organization of the awareness campaign, after the 2<sup>nd</sup> workshop series performed 3 months earlier. The awareness campaign aimed at encouraging passengers to prefer public transport means and introduce GYM applications. The cities visited were: Patra (14/09/2018), Alexandroupoli and Komotini (17/09/2018), Larissa and Trikala (18/09/2018), Katerini and Volos (19/09/2018), Chalkida and Lamia (20/09/2018, Serres and Florina (21/09/2018). LIFE GYM team visited all transport operators facilities, i.e. urban and intercity main stations and TRAINOSE central stations, as well as the city centre and several other places where potential passengers could be reached, e.g. universities.

The activities that took place were: 1) In a form of a half day workshop, Dr. Saharidis presented the developed application to the drivers of the buses, the shareholders and the employees of transport operators in several regions where the awareness campaign was performed, as well as to local government authorities and the local press; 2) Two groups of 4 persons presented the apps to the travelers waiting to take the bus at specific busses stops and/or central stations and distributed GYM flyers and posters to central stations, hotels and universities; 3) The results of GYM project and the apps were disseminated through local media (e.g. local TV channels, radio, newspaper, websites etc.); 4) Several transport operators put advertisements on one to four buses of their fleet (interior advertisements and partial or full exterior advertisements) and their facilities; 5) Most city buses offered free tickets for the downloaders of the app (in addition to those provided by TRAINOSE) and most intercity buses offered a discount of 15-25% for the next ticket for the downloaders; 6) Users of the apps were registered in order to get for free one of the 10 smart-phones offered by UTH for the promotion of the apps; 7) Transport operators played promotional videos where infrastructure was available (e.g. inside the buses or at the bus stations); and 8) More than

1,000 travellers (1,255 in total) answered the electronic questionnaires. In total, it is estimated that more than 2,000 persons were informed in each city through the awareness campaign (in total 23,255 persons).

Apart from the awareness campaign, several other promotional and awareness raising activities, not foreseen at the proposal phase, took place to disseminate LIFE GYM:

TRAINOSE and UTH participated for three consequent years in the TIF, i.e. 2017, 2018 and 2019. The TIF is the most important exhibition event in Greece and the Balkans, attracting more than 200,000 visitors and thousands of exhibitors. TRAINOSE and UTH erected GYM noticeboards at their exhibition booths, distributed flyers, presented the application to visitors and performed several networking activities with public transport stakeholders, public authorities and other educational institutions participating in the TIF. Moreover, UTH ran a questionnaire to 511 visitors of the 84<sup>th</sup> TIF.

UTH visited the 15<sup>th</sup> Primary School of Volos, Greece in May 2018 to present GYM application to higher grade students. The scope of the visit was to encourage children to consider their environmental footprint when travelling and prompt them to prefer public transport means. The activity was very successful, since children showed great interest for the application. UTH wanted to perform several activities to other schools as well and even contacted MEDITERRANEAN SOS Network (MedSOS), a non-profitable, non-governmental organization aiming at encouraging changes in citizens' - especially youth - everyday behavior that impact on the environment, to assist them in this activity, but unfortunately without success. No similar activities were performed, since a special permit requested by the school staff from the Ministry of Education was required.

AVMap conducted an awareness raising activity in Rafina, East Attica, Greece in May 2019, during EU Green Week 2019. The scope of the activity was to introduce GYM application to the inhabitants of Rafina; Rafina's transport network had at that time been included in GYM application. AVMap's team installed 3 information desks, where they presented GYM application, distributed flyers, ran a questionnaire to 240 passers-by and conducted a smartphone lottery.

EMISIA conducted two awareness raising activities in the city of Thessaloniki. The first one was conducted in June 2019, after the inclusion of Thessaloniki Urban Transport Organization (OASTH) network in GYM application. The activity was performed in key spots in the Thessaloniki centre (i.e. around Aristotelous square) and in Thessaloniki's educational institutions (i.e. Aristotle University of Thessaloniki (AUTh) and University of Macedonia (UoM)). The second awareness raising activity organized by EMISIA was performed in September 2019, in parallel with the 84<sup>th</sup> TIF. The activity was performed outside of the TIF's facilities and in AUTh and UoM. In both activities, EMISIA's team members were equipped with tablets and were able to offer a hands-on experience to passers-by who wished to have a better overview of the application. Additionally, posters were posted to the bus stations and other relevant spots outside both universities and the TIF's facilities.

TRAINOSE conducted two awareness raising activities. The first one was performed in July 2019 in Karditsa's main railway station. TRAINOSE's representatives distributed promotional material of GYM project to TRAINOSE's passengers and met with the Deputy Mayor of Digital Policies, Innovation and Youth Activities of the city of Karditsa and informed him about the project. The second awareness raising activity was conducted in September 2019 in Athens central train station. Staff from TRAINOSE installed an information kiosk, distributed flyers, informed the morning route passengers about the application and the platform and encouraged them to download the application.

Transport operators supporting LIFE GYM, also proceeded on their own in communication activities for the dissemination of the project's outcomes. Urban KTEL of Komotini created a [video](#) to promote GYM application and several Urban KTELs provided free panel bus

advertisement, which were left in place for several months after the organization of the awareness campaign in September 2018. Urban KTEL of Volos placed a GYM bus stop and integrated GYM application in the [tickets information section](#) of its website. Promotional material of GYM application (flyers and posters) was and is still available in several public transport operators' facilities and central stations.

After the end of the project, all project beneficiaries will maintain the notice boards in their premises for at least 3 years. UTH and TRAINOSE are considering producing in the future additional flyers, presenting the updates of the applications; these flyers will be distributed to passengers by TRAINOSE and busses transport operators with whom LIFE GYM team has developed cooperation during the implementation of the project.

## **Action D6: Networking with other LIFE and/or non-LIFE projects**

Foreseen start date: 15/09/2015    Actual start date: 15/09/2015  
Foreseen end date: 14/09/2019    Actual end date: 14/09/2019

The activities performed under the frame of Action D6 aimed at networking LIFE GYM with other field-related projects and ensure an efficient transfer of know-how and experience in order to foster its replication in similar contexts. The actions performed included visits and meetings to several stakeholders for networking purposes, networking activities performed during the participation in conferences, workshops and other events, networking activities with other EU funded projects and networking activities performed during the workshops organized by LIFE GYM team.

UTH conducted several personal visits to city and intercity busses transport operators to establish a personal relationship, receive feedback regarding the applications implementation and ensure their active involvement in the project, by providing updated data and participating in events organized by the project team. Through these visits, UTH developed a close collaboration with the General Secretary of POAS, Mr. Michail Sakellariou, who fully supported the project implementation and his involvement was significant. Mr. Sakellariou motivated other transport operators to participate in the workshops, to support GYM applications and participate in the organization of the awareness campaign, therefore turning out to be a key person in the implementation of the project. Moreover, UTH travelled to Cyprus in order to visit Cypriot transport operators during the integration of the Cypriot network in GYM applications. The scope of the visit was not only the collection of data, but also to create awareness to Cypriot transport operators regarding LIFE GYM and involve them in the project implementation. Among these contacts, UTH also came in touch with Geomatic Technologies (T.C. Geomatic Ltd). T.C. Geomatic Ltd is one of the biggest cartographic companies in Cyprus and the only company that exclusively deals with Geographical Information Systems (GIS).

Through the participation in conferences, workshops and several scientific and non-scientific related to the project events, all project beneficiaries performed networking activities with several stakeholders, policy makers, specialists in public transport, scientists in the field of co-modal routing and public transport and other EU projects beneficiaries and raised awareness regarding the project implementation and its outcomes.

AVMap and EMISIA investigated and detected several similar to LIFE GYM EU projects to network with. LIFE GYM team performed networking activities with [GR LTF](#), [HoPE](#) and [OPTITRANS](#). GR LTF nominated LIFE GYM as [the project of the month](#) in September 2018, while UTH presented LIFE GYM in several events organized by GR LTF. UTH presented LIFE GYM in HoPE's final conference in Brussels to a European-wide network of stakeholders such as fellow cities, transport operators, public sector, private companies, universities, and local as well as European projects. Also, UTH participated in several events organized by OPTITRANS (a contact derived from the organization of the project's webinars of Action D3), resulting in planning future steps on urban and local mobility (see Action E6 for more details).

Moreover, GYM team made contact with [MOVESMART](#), [LIFE U-MOB](#), [LIFE ASPIRE](#) and [LIFE for Silver Coast](#) projects. These contacts resulted in mutual dissemination of projects' activities and outcomes through their communication tools (websites, newsletters, social media accounts).

LIFE GYM team also performed networking activities with the community of OTP, where more than 30 projects are members. Mr. Andrew Byrd, Mr. Landon Reed and Mr. David Emory which are members of the community and were initially the main developers of OTP, showed interest about the outcomes of LIFE GYM (e.g. emission calculation models). Based

on our continuous efforts, we are confident that in the future OTP will proceed in integrating several of GYM components.

Finally, during the visits performed by UTH and the events organized throughout the project (workshops and direct communication events), LIFE GYM team also made contact with several local government authorities (Governors of Administrative Regions and Regional Units in Greece, Mayors, Deputy Mayors, etc.).

All beneficiaries of LIFE GYM will continue after the end of the project and for at least 5 years, to perform networking activities with transport operators in order to get assistance in the data update of GYM application and integrate more transport networks in the developed applications. Moreover, contacts and networking activities will also be continued with OTP community and POAS. Contacts will also be made with the consortia of other related to GYM EU projects in order to seek common areas for future collaborations, either in the research or the dissemination area.

## **Action E1: Project Management by the Consortium**

Foreseen start date: 15/09/2015 Actual start date: 15/09/2015

Foreseen end date: 14/09/2019 Actual end date: 14/09/2019

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 also formed, acting as the decision-making body within the project Consortium. The PSC comprised of a representative from each partner and the Project Coordinator (see Annex Supporting Documents/ Action E1 /PSC for the final version of the PSC).

UTH was also responsible for the preparation and handling of all Partnership Agreements (PAs) with the associated beneficiaries of the project. The signed versions of all PAs between UTH and the project's associated beneficiaries are available in Annex Supporting Documents/ Action E1/ Partnership Agreements.

Throughout the project implementation 9 regular project meetings were organized, 2 by UTH in Volos, Greece, 3 by AVMap in Athens, Greece, 2 by EMISIA in Thessaloniki, Greece and Athens, Greece, 1 by CHAPS in Prague, Czech Republic and 1 by INRPOP in Slovakia. During the meetings, LIFE GYM team discussed the project's progress, planned necessary corrective actions when needed and set out future steps. The meetings' agendas, presentations, attendance lists and minutes are available in Annex Supporting Documents/ Project Meetings. Apart from these meeting additional ones were performed between UTH, AVMap and EMISIA to discuss the development of a data updating system, the development of emission calculation models and the design of the database.

No communication issues occurred within the consortium. Electronic communication was the main mean of communication (file sharing through Dropbox, e-mail exchange, teleconferences through Skype, project monitoring through Trello.com).

UTH was responsible and acted as the contact point with the European Commission (EC). During the project implementation, 5 monitoring meetings were organized, 2 by UTH in Volos, Greece, 2 by EMISIA in Thessaloniki, Greece and Athens, Greece, and 1 by AVMap in Athens, Greece. The meetings' agendas, presentations, attendance lists and minutes are available in Annex Supporting Documents/ Monitoring Meetings. All beneficiaries provided input to UTH timely in order to report the project's progress to the EC (monthly reports, trimester reports, Mid-term, Progress and Final Reports). LIFE GYM team submitted the compulsory project reporting timely, under the guidance and assistance of the monitoring expert from NEEMO. Comments on the monitoring reports received from the monitoring expert from NEEMO and the Executive Agency for Small and Medium-sized Enterprises (EASME) were fruitful and helped LIFE GYM team to better understand their responsibilities in the project.

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 threatened the project's implementation and defined the appropriate corrective measures. Updated versions of the plan were provided periodically to present active risks and include future ones. LIFE GYM team also prepared risk assessment forms in order the consortium to monitor the project's risks.

After the end of the project, UTH will coordinate the proper implementation of all activities included in the After-LIFE Communication plan. A meeting between the project beneficiaries will also be arranged 3 years after the end of the project to assess the project's impact and plan future steps for the developed applications exploitation.

## **Action E2: Monitoring of project progress and indicators**

Foreseen start date: 15/09/2015 Actual start date: 15/09/2015

Foreseen end date: 14/09/2019 Actual end date: 14/09/2019

UTH determined the variables that needed 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) for the tracking, monitoring and quality check of the project implementation:

- In Trello.com, boards per partner and per action were created. Each Action Leader was responsible to supervise and update them.
- Excel sheets named “Indicator Progress and Quality Check”, where progress indicators and the quality check were monitored for each action (see Annex Supporting Documents/Action E2).
- A Dropbox.com shared folder was created where all project related material (e.g. deliverables, videos, timesheets, proof of payments etc.) was stored.

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

After the end of the project, no activities will be further performed under the frame of Action E2.

## **Action E6: After-life communication plan**

Foreseen start date: 15/02/2018    Actual start date: 15/09/2018

Foreseen end date: 14/09/2019    Actual end date: 14/09/2019

All activities described in the previous Actions for the after the end of the project period, were included in the After-LIFE Communication, which was prepared by UTH and AVMap and is available in Annex Deliverables. The first version of the After-LIFE Communication plan was submitted during the 5<sup>th</sup> monitoring meeting in October 2019 and was revised after EASME's recommendations in November 2019.

So far, UTH participated in a meeting in Katerini, Greece in September 2019, along with Urban KTEL of Larissa, KTEL of Corfu, Urban KTEL of Katerini and KTEL of Mytilini, to present applications developed under the frame of LIFE GYM on the occasion of the recent NSRF call for telematics applications. UTH also participated in a meeting organized by OPTITRANS project consortium at the Region of Thessaly premises, Larissa, Greece in September 2019 to plan future steps on urban and local mobility. UTH proposed the implementation of a touristic guide integrating GYM application to assist visitors of Thessaly in both finding places of interest and the ways to reach them through public transport means. A brief summary of the proposal has been already submitted at the Region of Thessaly.

UTH discussed with transport operators during the visits performed under the frame of Action D6 about their potential involvement in the period after the end of the project in order to guarantee the continuous and smooth operation of GYM applications. To this scope, UTH is currently preparing a promotional folded leaflet to be distributed to all Greek Urban and Intercity transport operators. This leaflet will include details regarding the additional applications developed under the frame of LIFE GYM, as presented in Action B5, i.e. the live version of GYM, the trip tracking and monitoring system for busses, the trip scheduling system, the real-time communication system for smart bus stops and the GTFS editor application. Together, they will also seek funding opportunities on public transport activities. GYM team will also examine expansion opportunities to non-European markets, starting with Mediterranean countries (e.g. through funding under the Interreg-Med program).

Moreover, LIFE GYM team will continue contacts with the OTP community through events and workshops participation in order to disseminate the project's outcomes and convince OTP members to integrate GYM components.

In the period following the project's end, UTH will evaluate the possibilities offered by the outcomes of LIFE GYM, will perform a feasibility study and discern the pros and cons of undertaking the commercialization of LIFE GYM outcomes and especially GYM platform. One possible step towards that could be the cooperation with companies providing web services to transport operators, such as eAnalysis and AMCO.

## 5.2. Main deviations, problems and corrective actions implemented

### **Data digitization and update**

One of the main problems encountered by LIFE GYM team was the collection and update of the data required to operate the platform. Especially for the Greek public transport network, very few transport operators had their data in a digitized and suitable to be entered in GYM application format. Also the information required to create the GTFS data was not available. In order to digitize the transport network's data, LIFE GYM team had to visit several times Greek transport operators to understand their lines and itineraries. Members of LIFE GYM team even boarded on several busses to chart the lines' routes and determine the stops' location. Substantial effort was also put in the updating of transport operators' GTFS data, which change approximately twice per year.

LIFE GYM team developed several tool for the digitization and update of transport operators data which were presented in Action B5 technical progress.

### **Technical issues**

Several technical issues were encountered since the release of the platform, mostly derived through users' feedback. One was the production of non-realistic routing solutions, where long walking distances were included. This was addressed by removing from the frontend the user option to choose maximum walking distance and optimizing in the backend the walking distance required to reach the desired destination. Another issue was the reverse geocoding functionalities not providing the option to include street number. To resolve this issue LIFE GYM team included additional reverse geocoding services, such as HERE geocoding service. Moreover, in several cases the service response time to produce a query was longer than expected, i.e. 10 seconds. This occurred due to the request of real-time traffic data by external APIs, such as the weather API. Such additional APIs are introduced in the platform and are combined with the existing APIs in order to calculate emissions. The requests are submitted in parallel, i.e. for different places simultaneous requests by several APIs. To cope with this issue LIFE GYM team assumed that data requested in a timeframe of 30 minutes (e.g. temperature) from the same area remain the same and therefore are not requested again. This way, less requests to external APIs are needed and the requested queries are produced within a reasonable time less than 10 seconds.

### **Co-modal ticketing tool**

LIFE GYM team discussed with the transport operators participating in workshops the potential for creating a co-modal ticket through GYM apps. The development of a co-modal ticketing tool faced many barriers, even though from technical point of view GYM applications could offer it (i.e. the database, the platform and the user interface could support this option). The barriers encountered are mostly due to transport operators:

- the transport operators have different VAT numbers and the coordination of several accounting departments in the frame of the project is extremely difficult;
- they have contradictory visions and interests and different levels of development;
- they were not willing to ensure compliance with any single co-modal ticket as they don't have any fund to ensure it;
- they do not trust each other and there are many contradictory interests (e.g. same trip is offered by different transport operators);
- they believed that there is a limited commercial benefit;

But also technical barriers were encountered, such as:

- the development of a web-service (not foreseen in the project) was necessary to interconnect the ticketing systems, databases and accounting software of transport operators;

- the data format/data exchange standards were extremely difficult to be defined as transport operators use case tailored databases.

It should be noted that even if the above difficulties were overcome the option for purchasing a single co-modal ticket is not possible in Greece as only few transport operators offer online ticketing applications. Moreover, even those transport operators offering online ticketing tools, they only offer them for specific routes.

Although the co-modal ticketing tool application didn't proceed, links to the online ticket purchase applications of transport operators providing online ticketing have been added (e.g. TRAINOSE, KTEL Thessalonikis S.A.).

### **Replication of GYM in other journey planning systems**

Replication of GYM in other journey planning systems was not implemented through webinars (see Action D3). For this reason, UTH proceeded with replicating GYM applications in additional EU regions by including their networks in GYM application. The aim of replicating GYM components in other journey planning platforms was to change traveler behavior by encouraging them to prefer green routing solutions, to shift to public transport means and also to enter other European markets not foreseen by the project and introduce GYM platform to the inhabitants of these areas. This was not achieved through webinars and GYM outcomes could not enter other markets through an existing journey planning platform. In order to achieve GYM entering other markets the only solution left was to include other European transport networks in GYM application itself. This way, similar results were achieved, since an environmental journey planning platform is available for these countries, some of which didn't have a similar application, such as Cyprus. Currently, GYM application includes, apart from the foreseen Greek, Czech, Dutch and Slovak public transport networks, the public transport networks of 6 additional EU countries: Cyprus, Luxembourg, Denmark, Sweden, Switzerland and Estonia, thus trying to achieve the highest possible replication of the project's outcomes.

### **Environmental impact of LIFE GYM**

The total saved CO<sub>2</sub> since the launch of GYM platform (meaning for a total of 13 months) is equal to 0.55 Mt for all transport means. Comparing the calculated saved CO<sub>2</sub> emissions, with the ones that were originally expected, i.e. between 2.699 and 2.9 Mt, great difference is observed.

An erroneous calculation of the expected CO<sub>2</sub> emission savings in the technical description, in the project's technical description (2.699 Mt), was conducted. In the technical description, an increase of 15% in the use of public transport at the end of the project is assumed. This increase was erroneously attributed to the total pkm conducted by private passenger cars (96,900 mio pkm, see Deliverable C1 for more details on calculated values) instead of attributed to the pkm conducted by the public transport means, i.e. 23,600 mio pkm. The increase in the use of public transport expected by the end of the project should be first translated to decrease in the use of private passenger cars, by recalculating the corresponding pkm that would not be conducted by private passenger cars. Then, the CO<sub>2</sub> savings, meaning the CO<sub>2</sub> that private passenger cars would have emitted if the increase in the use of public transport did not occur, should have been calculated, resulting in the final environmental impact of the project.

More specifically, the total average increase of 15% in the use of public transport should have been calculated as follows:

The 15% increase should have been attributed to the pkm of public transport means, thus to the 23,600 million pkm, resulting in 3,540 million pkm yearly increase. This translates in

approximately 2,950 million pkm that would have been conducted by private passenger cars and would have emitted 0.6 Mt.

### **Webinars participation**

AVMap searched the contact information for various European journey planners and relevant private and public bodies in order to send the invitation. Despite the tremendous effort AVMap put in contacting those journey planners and operators by mails, phones, even Facebook messages, with a three-wave approach, the results were disappointing for gathering Journey Planners interested in participating in live webinars. There was only one request for participation. As all partners agree that the project's purpose and results should have been interesting to other journey planners and operators as well, this disappointing participation should be attributed to the chosen means of training: a half-day online webinar, where one journey planner would have to sit-through and be trained by the whole GYM team. As a result, GYM team decided to set up an online open-source training platform, where the webinar material was uploaded, as well as the material for GYM components to be adopted by other interested parties (emission calculation models etc.). AVMap proceeded with implementing a platform, which is hosted at the following [link](#). Under this revised plan, the webinars were organized as "courses" in this online-platform, and there are 12 courses available instead of 12 repeated webinars. The courses are targeted to transport operators, journey planners and developers, as did the original webinars. Each course is taught by a GYM team member, according to their expertise with their project. Following this strategy, each interested party could decide which part of the webinar to participate in and arrange their participation according to their schedule. In total, 14 institutes watched parts of the offline version of the webinars, among which journey planners and research and academic institutes. All webinar courses are also available through LIFE GYM YouTube channel.

### 5.3. Evaluation of Project Implementation

#### Methodology applied

The methodology applied for all actions was efficient since the timeframe was followed and expected results were gradually achieved

The Actions were managed in a cost-efficient way and foreseen budget analysis covered the main needs of the project team.

#### Results

Action	Foreseen in the revised proposal	Achieved	Evaluation
<b>Action A1</b>	Objectives:		Action A1 was successful regarding implementation and output. In addition to assisting LIFE GYM team to gather and analyse the most recent trends in the basic sectors related to the project, also delivered a useful brief e-booklet on issues related to co-modality and journey planning available to all interested target groups coming from research, private or public sector.
	Review of: - existing GHG emission calculation models; - vehicle routing modelling and solution approaches; - database architectures for web and smart phone applications for journey planning; - online platforms for calculation of GHG emissions in vehicle routing; - online platforms for journey planning with ticketing services; - current policies and initiatives in co-modal promotion.	The objectives of the action are fully achieved. The real outcomes exceed the expected results having reviewed 39 cases instead of 34.	
	Expected results:		
	At least 3 methodologies used to calculate GHG emissions from transport.	3 were reviewed	
	At least 3 European or international research projects in the context of GHG emission calculation models.	4 were reviewed	
	At least 3 European or international research projects in the context of journey planning.	4 were reviewed	
	At least 5 methodologies on modelling and/or solution approaches for the environmental co-modal VRP.	7 were reviewed	
	At least 3 different designs, architectures and structures of database for journey planning applications.	4 were reviewed	
	At least 6 web applications for journey planning.	6 were reviewed	
At least 6 smart phone applications for journey planning.	6 were reviewed		

Action	Foreseen in the revised proposal	Achieved	Evaluation
	Current policies for promotion of co-modality in cases in at least 5 MS (Member States).	5 were reviewed	
<b>Action B1</b>	Objectives:		Action B1 was successful regarding implementation and output.
Creation of GreenYourMove database and related data-access services.	The objectives of the Action were fully achieved. The real outcomes exceed the expected results, since additional software was developed to digitize, extract, transform and homogenize transport data and additional transport networks than the foreseen were included.		
Expected results:			
Homogenize and convert 100% of the itinerary data of TRAINOSE's railway network into the GYM database structure.	Achieved.		
Homogenize and convert 100% of the itinerary data of networks (bus, tram, train, metro, suburban, trolley) connected to Greece's two major cities (Athens and Thessaloniki) into the GYM database structure.	Achieved.		
Homogenize and convert >90% (16 cities) of the itinerary data of Greek cities with populations more than 50,000 citizens into the GYM database structure.	Achieved.		
20 Greek cities and 9 additional EU countries; develop GYM unified data scheme transport data about routes, vehicles and emissions.	Achieved.		
GYM unified data scheme for multilingual web-application.	Achieved, additional software was also developed.		

Action	Foreseen in the revised proposal	Achieved	Evaluation
	GYM data access software and manual for the inclusion of data by other companies/authorities willing to include their data in the GYM database during or after the duration of the project.	Achieved, additionally an interactive wizard was developed.	
<b>Action B2</b>	Objectives:		Action B2 was successful regarding implementation and output.
Development of case-specific co-modal emission calculation models.	The objectives of the Action were fully achieved.		
Expected results:			
Emission calculation models for as many vehicles as possible of Czech, Dutch, Greek and Slovak (CDGS) transportation network, targeted at >80%.	Achieved 90%.		
An objective function for the environmental co-modal VRP using these models.	Achieved.		
Data sets from various database, timetable and other resources required for the emission calculation of each vehicle type of CDGS transportation network, targeted at >70%.	Achieved 90%.		
<b>Action B3</b>	Objectives:		The models and algorithms were created in such a way so that they would be data-agnostic and cross-platform compatible.
Development of modelling and solution approach for environmental co-modal vehicle routing.	The objectives of the Action are fully achieved. The real outcomes exceed the expected results, since we had 3 hybrid solution approaches instead of 2 and 3 decomposition approaches instead of 2.		
Expected results:			
A functional and tested algorithm able to solve environmental co-VRP instances within less than 10 seconds.	Achieved 32ms best time, 2.4sec worse time.		
At least 2 modelling approaches for the environmental co-VRP problem based on decomposition techniques.	Achieved, 3 developed.		
At least 2 decomposition techniques.	Achieved, 3 developed.		

Action	Foreseen in the revised proposal	Achieved	Evaluation
	At least 2 heuristic solution approaches.	Achieved	
	An analysis of the solution quality and the computational requirements results between exact and heuristics solution approaches.	Achieved	
	At least 2 hybrid solution approaches.	Achieved, 3 developed.	
<b>Action B4</b>	Objectives:		The models, the algorithms and the user manual were created in such a way so that they would be data-agnostic and replicable for any other transport network. The results concerning, the synchronized timetables of TRAINOSE, have been visible to the passengers since July 2017.
Promote co-modal options of routing through re-scheduling of timetables of Czech Republic, Greece and Slovakia networks, thus making co-modal options more attractive to passengers.	The objectives of the Action are fully achieved. For the case of Greece and Czech Republic the real outcomes exceed the expected results, since we had calculated synchronized timetables not only for the TRAINOSE network but for intercity busses network.		
Expected results:			
Synchronized timetables with minimum transitional waiting times for Czech, Greek, and Slovak networks and the actual revision of TRAINOSE timetables.	Achieved.		
<b>Action B5</b>	Objectives:		The platform is online and operable since August 2018. Additional applications were developed to expand the platform following transport operators needs and suggestions.
Production and publication of GYM platform on the web.	The objectives regarding the platform were fully achieved. The development of a co-modal ticketing tool is possible through GYM environment, but did not proceed due to several barriers encountered (see Section 6.2).		
Expected results:			

Action	Foreseen in the revised proposal	Achieved	Evaluation
	GYM platform and the demonstration of the environmental benefits using a journey planner through co-modal routing.	Achieved	
	Development of a co-modal ticketing tool.	Not achieved	
<b>Action B6</b>	Objectives:		The Android and iOS applications are online and operable since August and September 2018 respectively.
Development of GYM smartphone application.	The objectives of the Action were achieved for Android and iOS mobile applications, apart from the track and trace functionality due to GDPR regulations prohibiting the collection of such data.		
Expected results:			
Development of a smartphone application for co-modal journey planning.	Achieved.		
Synchronization with a calendar and linking with other smartphone apps.	Achieved.		
Track and trace functionality.	Not achieved.		
<b>Action B7</b>	Objectives:		Successful integration of GYM components into COPERT 5 completed timely and into IDOS and CP completed with a delay.
Demonstration of GYM web platform and smart phone application into real life practices of passengers in urban zones for a period of 14 months.	The objectives of the Action were mostly achieved.		
Expected results:			
Full demonstration of the GYM apps (web platform and smartphone application) at a national level in Greece.	achieved		
Replication of GYM's components at a national and international level in at least 3 more countries (Czech Republic, Slovakia and one more).	Partially achieved, one additional country was not found.		
Integration of developed emissions calculation models into the COPERT software.	Achieved		

<b>Action</b>	<b>Foreseen in the revised proposal</b>	<b>Achieved</b>	<b>Evaluation</b>
	Replication of GYM in other journey planners.	Not achieved due to low webinar participation (See Section 6.2).	
<b>Action C1</b>	Objectives:		The objectives of the Action were fully achieved, with a deviation explained in Section 6.2.
	Monitoring and measurement of LIFE GYM's impact on the environmental problem targeted.	Successful assessment of the project's environmental impact for all CPs. The environmental savings were significant.	
	Expected results:		
	Monitoring the environmental impact of the project at a regular basis: calculate 4 emission inventories.	Achieved.	
	Novel emission inventory methodology for monitoring of the environmental impact of the project.	Achieved.	
	Inclusion of as many part of the Greek transport network in the emission inventory methodology >70%.	Achieved.	
	Inclusion of as many vehicles running into the Greek transport network in the emission inventory methodology: >70%.	Achieved.	
	Simulation emission inventories corresponding to sub-networks where the required data are missing: 100%.	Achieved.	
Reduction from the introduction of the platform until the end of the project of 2.699 Mt CO <sub>2</sub> eq.	Not achieved, but it was miscalculated in the proposal phase (see Section 6.2).		
<b>Action C2</b>	Objectives:		The protocol for the

Action	Foreseen in the revised proposal	Achieved	Evaluation
	Monitoring and assessment of the socio-economic impact of the project actions.	A monitoring protocol was developed, which could be replicated to similar projects; the objectives of the action were not achieved for indicators of journey planner's involvement due to low webinar participation (see Section 6.2), but, apart from that, the overall analysis of GYM impact indicates that LIFE GYM outcomes have satisfied or even gone beyond the initially set goals for the socio-economic parameters.	monitoring of socio-economic impact of the project is well-planned, since it covers all the socioeconomic parameters foreseen and the indicators/descriptors issued by the LIFE program. The protocol could be adapted for any additional need by adding or removing criteria and indicators. The socio-economic impact of LIFE GYM is significant, especially for public transport operators, since public transport usage was increased by more than 25% since the beginning of the project.
	Expected results:		
	Increase the awareness of European journey planning initiatives.	Not achieved.	
	Socio-economic impact assessment report.	Achieved.	
	Increase the total number of EUJP (European journey planners) by a minimum of 1.	Achieved.	
	Increase awareness of EUJP initiatives where EUJP are included by a minimum of 6.	Not achieved.	
	Increase the total number of EUJP demonstrating the outcomes of Actions B1, B2 and B3 by a minimum of 6 EUJP.	Not achieved.	

<b>Action</b>	<b>Foreseen in the revised proposal</b>	<b>Achieved</b>	<b>Evaluation</b>
	Offsetting social and economic isolation of certain regions of Greece by a minimum of 13 regions.	Achieved, since 14 Greek cities are connected with the two major cities in Greece, i.e. Athens and Thessaloniki through a journey planning platform, not available before GYM platform.	
	Increase the total number of passengers using public transport per mode of transport and per km travelled in Greece by a minimum of 10%.	Achieved.	
<b>Action C3</b>	Objectives:		A protocol was created to monitor GYM techniques and help LIFE GYM team to easily track progress or issues encountered during the implementation of the project.
	Monitoring and evaluation of the techniques and methods used to: a) build the GYM web-platform and smart phone application and b) demonstrate these techniques.	The objectives of the Action were fully achieved.	
	Expected results:		
	Development of a monitoring protocol of the techniques and methods developed and used in the frame of the GYM project.	Achieved.	
	Monitoring and evaluation in specific CPs the techniques and methods used to build the GYM web and smartphone application.	Achieved.	
	Monitoring and evaluation in specific CPs the techniques and methods used to demonstrate these techniques and methods.	Achieved.	
<b>Action D1</b>	Objectives:		LIFE GYM project was well communicated throughout the web and social media.
	Website and associated social media creation, content production and maintenance.	The objectives of the Action were mostly achieved.	
	Expected results:		
	GYM website min total hits 8,000.	Two websites were created (total hits more than 19,000).	
	Set up of at least 6 social media accounts	Seven social media accounts were created	
	Establish one source of content per EU MS	Material from 25 MS was published.	

Action	Foreseen in the revised proposal	Achieved	Evaluation
	Production of news, targeted at 5 items monthly and at least 1,600 persons informed	508 news and events were created, 58,829 persons informed.	
	Production of good practices, targeted at 1 item quarterly and at least 800 persons informed	16 good practices were identified, 320 persons informed.	
	Production of articles, targeted at 1 item monthly, and at least 1,600 persons informed	72 articles were published, 5,560 persons informed.	
<b>Action D2</b>	Objectives:		The electronic material achieved the target setup in the project description, apart from the CFs.
	Production of electronic material mainly targeted towards operators and stakeholders across the EU, but also appealing for passengers.	The objectives of the Action were mostly achieved.	
	Expected results:		
	Production of project logo.	One project logo was created.	
	Newsletters, targeted at 6 with targeted recipients of at least 1,800.	In total 7 newsletters (3,208 recipients) were created.	
	CFs, targeted at 9 and at least 2,100 persons informed.	9 CFs (477 persons informed) were created.	
	Press releases, targeted at 9 and at least 3,800 persons informed.	9 press releases (9,950 persons informed) were created.	
	Production of video, targeted at 5 with target views of at least 650.	20 promotional videos (7,000 persons informed) were created.	
<b>Action D3</b>	Objectives:		The workshops were organized successfully, since transport operators committed to the implementation of LIFE GYM and fully supported its objectives. The response to the webinars was not the foreseen one and corrective measures were taken, resulting in the participation of 14 institutes.
	Organization of workshops to increase the coverage of the Greek public transport network through GYM platform and organization of webinars to replicate GYM outcomes to other Journey Planners.	The workshops organized exceeded the foreseen at the proposal phase and reached their targets. The webinars were organized as foreseen, but the participation was low (see Section 6.2).	
	Expected results:		
	Organization of 3 workshops.	28 workshops were performed (436 participants)	
	Organization of 12 webinars.	12 webinars were organized.	

Action	Foreseen in the revised proposal	Achieved	Evaluation
<b>Action D4</b>	Objectives:		The conference participants showed high interest in terms of data base scheme, emission calculation models and co-VRP modelling and solution approach. This interest increased the networking activities of the project as well as the dissemination of its outcomes.
	Demonstration of the scientific novelties of the project in conferences and scientific journals.	The objectives of the Action were fully achieved.	
	Expected results:		
	Worldwide publication in 3 scientific journals.	3 scientific manuscripts were produced, 2 were accepted and published, 1 is under review (minor revisions were requested by the reviewers in order its publication to proceed).	
	Creation of a special issue with minimum 12 publications.	2 Special Issues were created and are expected to be published as soon as adequate manuscripts are accepted for publishing.	
	Creation of a book focusing on co-modal environmental routing and journey planning.	Achieved.	
	Participation in 6 conferences.	Participated in 10.	
2 formats of the Layman's Report, 100 hardcopies and 600 electronic copies sent via the web.	Achieved, 104 hardcopies were sent through regular mail, electronic version was sent to 631 recipients.		
<b>Action D5</b>	Objectives:		The direct communication activities performed raised awareness regarding LIFE
	Communication activities targeting the passengers.	The objectives of the Action were achieved.	
	Expected results:		

Action	Foreseen in the revised proposal	Achieved	Evaluation
	<p>A high-impact awareness campaign with a maximum possible number of passengers informed and encouraged. Production of promotional material targeted to passengers.</p>	<p>1 awareness campaign was organized in 11 Greek cities (estimated 23,255 persons informed) and moreover 5 additional awareness raising activities were performed (estimated 4,150 persons informed), 3 participations in the TIF (estimated 76,759 persons informed). 922 additional from the abovementioned persons are estimated to have been informed through the posters, flyers and noticeboards used in conferences participation. Through the erection of posters by TRAINOSE at its stations, 108,000 persons are estimated to have been informed.</p>	<p>GYM and were embraced by local people. It is estimated that more than 200,000 people were informed by LIFE GYM direct communication activities.</p>
	<p>Flyers distributed to at least 5,000 persons.</p>	<p>Achieved, more than 10,000 flyers were produced and distributed.</p>	
	<p>5 types of posters informing at least 500 persons.</p>	<p>Achieved, 186,419 persons informed.</p>	
	<p>15 notice boards (5 x 3) informing at least 750 persons.</p>	<p>8 were produced, since TRAINOSE decided to erect posters instead, 57,739 persons were informed.</p>	
	<p>Questionnaires filled out by passengers, targeted at &gt;500.</p>	<p>2,006 persons answered the questionnaires.</p>	
<b>Action D6</b>	Objectives:		Networking

<b>Action</b>	<b>Foreseen in the revised proposal</b>	<b>Achieved</b>	<b>Evaluation</b>
	Networking LIFE GYM with other field-related projects. Ensuring an efficient transfer of know-how and experience in order to foster its replication in similar contexts.	The objectives of the Action were achieved.	activities were valuable for the project implementation and laid the foundation for future collaborations and the continuation of LIFE GYM objectives.
	Expected results: Networking with at least 4 other EU funded projects	Networking activities with 7 EU projects and OTP community where more than 30 projects are members.	
	Including a contact list in the stakeholder mailing list	Achieved.	
<b>Action E1</b>	Objectives: Successful implementation of the project and the timely and efficient management of all the Actions.	The objectives of the Action were mostly achieved.	LIFE GYM consortium managed, despite all the difficulties, to effectively solve and overcome problems and reach all project's milestones.
	Expected results: Establishment of a Project Steering Committee (PSC).	Achieved.	
	Efficient coordination and smooth implementation of the project.	Achieved.	
	Operation of the management and communication platform.	Achieved.	
	Organization of up to 9 project meetings.	Achieved.	
	High quality results and reporting delivered by beneficiaries under the supervision of the Project Coordinator.	Achieved.	
	All project actions timely implemented.	Partially achieved due to several barriers encountered, most important being the withdrawal of Plannerstack.	
	Total compliance with the project timetable regarding reporting to EC.	Achieved.	
	Total compliance with the project timetable regarding project meetings.	Achieved.	
<b>Action E2</b>	Objectives:		

<b>Action</b>	<b>Foreseen in the revised proposal</b>	<b>Achieved</b>	<b>Evaluation</b>
	Setup of an effective tracking procedure providing a structured method for monitoring the progress at all times, under the responsibility of the Project Coordinator.	The objectives of the Action were achieved.	supported the monitoring of the project as well as the quality check of its outputs.
	Expected results:		
	An Indicator Table for each Action describing the progress of the Action.	Progress indicator tables with specific quality checks were created for each action.	
<b>Action E3</b>	Objectives:		UTH took all the measures as well as spent extra workload (unforeseen) in order to keep the project on track.
	Overall management of the project by the Coordinator.	UTH successfully managed the project implementation and dealt with all problematic situations encountered.	
	Expected results:		
	Daily management of the successful implementation of project activities and submission of an amendment request to guarantee continuation of the successful implementation of the project.	Daily management of the successful implementation of project activities and submission of an amendment request to guarantee continuation of the successful implementation of the project.	
<b>Action E4</b>	Objectives:		Project management implemented properly even if TRAINOSE changed its ownership (i.e. TRAINOSE was privatized).
	Project Management by EMISIA and TRAINOSE.	The objectives of the Action were fully achieved.	
	Expected results:		
	Smooth implementation of the project and on-time delivery of the reports and each action results for EMISIA and TRAINOSE.	Achieved.	
<b>Action E5</b>	Objectives:		Project management was implemented with many problems as described in the amendment request due to the problematic situation
	Project Management by AVMap, CHAPS and Plannerstack/INPROP.	The objectives of the Action were fully achieved, apart from beneficiary Plannerstack.	
	Expected results:		

Action	Foreseen in the revised proposal	Achieved	Evaluation
	Smooth implementation of the project and on-time delivery of the reports and each action results for AVMap, CHAPS and Plannerstack/INPROP.	Achieved, apart from beneficiary Plannerstack.	generated by Plannerstack.
<b>Action E6</b>	Objectives:		All project beneficiaries are committed in fulfilling their after-life obligations.
	Organising and planning the continuation of the GYM platform beyond the project's duration.	All targets have been included in the project's After-LIFE Communication Plan	
	Expected results:		
	Project's web-site, web and smart phone application active for at least 10 years after the project's completion	Included in After-LIFE Communication Plan.	
	Notice boards at their places for at least 3 years after the project's completion.	Included in After-LIFE Communication Plan.	
	Examine potential call for proposal (e.g. LIFE Information, awareness and dissemination project) to further disseminate GYM.	Included in After-LIFE Communication Plan.	
<b>Action E7</b>	Objectives:		
	Verification of the final statement of expenditure and income provided to the EC conducted by an independent auditor.	Currently an external audited final statement of expenditure is not necessary.	N/A.

### Visibility of results

The most important visible result of Actions B1 to B6 available is the publication of GYM [web](#) and smartphone applications (available through Google Play and AppStore), as well as the additional applications developed, i.e. [GreenYourMove Live](#) and [Real-time communication system for smart bus stops](#) (available for the passengers in Volos), Trip Scheduling system and Trip Tracking and Monitoring System (available to the fleet manager of city busses of Volos). Another important visible result is the [GTFS editor](#) web service developed for the data updating and its step by step wizard for [GTFS data creation](#) and [GTFS data updating](#).

Additionally, Action A1 results as the review of 39 cases, practices and tools related to GYM objectives are available after request on the project's [website](#).

Action B4 results are already visible to travellers of TRAINOSE and intercity busses in Greece, while reports were also sent to the Czech and Slovak rail operators.

The dissemination actions results, i.e. Actions D1, D2, D3 and D5 are visible to the public since their production, either through physical placement in facilities and other strategic places (e.g. transport operators ticket booths) or through the project's [website](#) and [social media accounts](#). The scientific outcomes of the project became visible with the

implementation of Action D4, i.e. through conferences participations and scientific publications.

Actions C1 and C2 results became visible to the public at the end of the project, through the communication of the project's final outcomes, i.e. the 9<sup>th</sup> press release, the 9<sup>th</sup> CF and the Layman's report.

Action E6 results will become visible 3 years after the end of the project.

## **Replication**

LIFE GYM implemented all project activities focusing on the replication of the project's outcomes. The codes, software and models developed are available to any potential interested party or user after the end of the project. The development of the emission calculation models (Action B2), the environmental co-modal algorithm (Action B3), the rescheduling procedure (Action B4) and the methodology and emission inventory model (Action C1) are organized in such a way to help other engineers and developers reuse the developed material as well as extend them to similar contexts (e.g. other transport networks) or by adding additional factors. Several manuals were developed to assist the replication of LIFE GYM outcomes: an "Installation and operation" [manual](#) (Action B1), intended for public use, that allows the complete GYM database and web services environment to be adopted and replicated by others; a manual accommodating the extensibility and reusability of the models for solving the environmental co-VRP (Action B3); a manual accommodating the reusability of the modelling and solution approaches for timetables rescheduling (Action B4); a manual accommodating the extensibility and reusability of modelling and solution approaches for trip re-scheduling (Action B5); a manual of the web platform (Action B5) and smartphone application (Action B6). Furthermore, the GTFS data of the Greek and Cypriot network that were created under the frame of the project could be replicated in other journey planners easily, since GTFS is a schema defining a common format for public transport schedules and associated geographic information. The tools developed for the updating of the GTFS data are proving very valuable for the extensibility of GYM platform; LIFE GYM team will use these tools to expand the application to other networks in and outside the EU.

Replication of GYM components has been successful so far, since the integration of the emissions calculation models (Action B2) have been integrated into COPERT 5 (international level) software, while apart from these models, the developed algorithm (Action B3) was integrated into IDOS (Czech Republic) and CP (Slovakia).

Although the webinars produced didn't achieve their target of integrating GYM components in an existing journey planning platform, GYM team is confident that there is a potential for it in the future, since the platform developed to host the webinars will be available for at least 3 years after the end of the project and so far 4 Journey Planners showed interest in watching the webinars. Despite that, the availability of GYM application in more European countries than foreseen was an adequate way to achieve similar results with the ones expected from the replication in other journey planning platforms, as addressed in Section 6.2.

Moreover, the extended version of GYM application including real-time information on itineraries, [GYM live](#), currently available for the Volos City buses (Urban KTEL of Volos) is expected to be replicated to other Greek transport operators of city busses, or even intercity busses, since no similar application is available in the Greek market.

## **Dissemination activities**

LIFE GYM team, following the project's needs and the applications' acceptance, performed several activities not foreseen at the proposal phase. This included additional workshops, serving several project's needs, such as the organization of the awareness campaign, data collection and training in the developed tools, and direct communication activities. The

project's team recognized opportunities for promoting the applications and decided to be present. For three consecutive years, UTH and TRAINOSE presented GYM application at their exhibition booths at the TIF, one of the greatest events in Greece, attracting more than 200,000 visitors each year. Moreover, several awareness raising activities were performed in Athens and Thessaloniki by AVMap, EMISIA and TRAINOSE, aiming at promoting GYM platform. Presence of GYM team in conferences, workshops and scientific or non-scientific events was vivid, disseminating GYM application in the scientific community and to several stakeholders. GYM team cultivated personal relationships with Greek transport operators, which proved to be very valuable: several Greek transport operators embraced and fully supported GYM initiative, guided the project team in the development of the platform and the accompanying tools, supported and participated actively in all dissemination activities and even performed several promotional activities on their own. Through their active participation in LIFE GYM, they promoted the concepts of choosing public transport means instead of a car and of co-modality through the environmental friendliest routes produced by GYM platform and managed to increase the number of tickets sold and better understand their passengers' habits.

The only deviation in the dissemination activities was the organization of the webinars, which did not provide the expected results and corrective measures were taken (see Section 6.2).

### **Policy impact**

Very few transport operators have developed online ticketing applications. Currently, a call for proposals for bus operators is running under the frame of the NSRF for the development of smart ticketing and online ticketing applications. Overall budget of the call is €16,200,000, while 60% of the expenses are funded (the rest 40% is transport operators contribution). UTH, under the frame of LIFE GYM, identified the lack of digitized data of the transport network, and contributed by convincing key persons managing transport operators to include data digitization in the call. UTH is in close collaboration with transport operators in order to assist them in digitizing their data in GTFS format and any other development related to this call.

LIFE GYM, through its joined approach aiming at environmental benefits and urban transport efficiency, contributed in the integration of environment into transport policy area, which is totally aligned with the 7<sup>th</sup> Environment Action Programme (EAP) to turn the Union into a resource-efficient, green and competitive low-carbon economy. LIFE GYM set the basis for the reduction of the demand for travel by car and shift travel to more efficient public transport modes, since it provided a valuable tool for producing environmental co-modal routes favoring public transport usage and resulted in an increase in tickets sold through public transport operators. According to the Transport White Paper, new technologies are less mature and modal choices are fewer than in the city. The delivery of GYM application is totally aligned with the White Paper's requirement for multimodal solution, since it helps towards establishing the framework for a European co-modal transport information and management, achieved through the development of the one-stop platform for co-modal journey planning. More resource-efficient vehicles and cleaner fuels are unlikely to achieve on their own the necessary cuts in emissions. GYM application promotes not only public transport means, but among these the environmental friendliest ones. LIFE GYM set the basis for the reduction of the demand for travel by car and shifted travel to more efficient public transport modes, since it introduced for the first time an environmental journey planning platform in EU Member States where similar applications were not available, such as Greece and Cyprus. Moreover, it helped towards establishing the framework for a European co-modal transport information and management, since the transport networks of 10 EU Member States are included. Furthermore, it supported urban mobility plans by promoting all public transport services. It also strengthened the scientific knowledge and evidence base for environment and

transport policy through its project team vivid participation in conferences and scientific events, the production of 3 scientific journal papers, 2 of which have already been published and 1 that is expected to be published in the following months and a book addressing issues in co-modal routing. It produced public transport data for Greece, where no such data were available so far. It removed the technological barriers by combining different public transport operators, while its outcomes were replicated in two EU journey planning systems in Czech Republic (IDOS) and Slovakia (CP) and an international emission calculator (COPERT).

## 5.4. Analysis of benefits

### **Environmental benefits**

GYM platform is expected to encourage car drivers to use public transportation and reduce the use of passenger cars. This was achieved by promoting co-modal and environmental efficient transport patterns. Every person shifting towards the public transport does not contribute in CO<sub>2</sub> production, since the public transport mean would anyway be operating on the same route with or without the additional passenger.

For the estimation of the amount of CO<sub>2</sub> saved after the launch of GYM platform, data for 14 intercity bus transport operators, 14 urban bus transport operators and TRAINOSE, were included. Monthly tickets sold for intercity and urban bus transport operators were increased by 21% and 46% respectively, whereas TRAINOSE tickets were increased by 33% since the beginning of the project and until the end of the project. Half of this increase was attributed to LIFE GYM activities and the introduction of GYM platform, as explained in the technical progress of Action C1. This increase in public transport tickets is translated in CO<sub>2</sub> savings of 0.03 Mt per month for urban and intercity buses and 0.01 Mt per month for the rail network (0.37 Mt and 0.18 Mt saved since the launch of GYM platform respectively).

### **Economic benefits**

With the rescheduling procedure developed and the changes adopted by several transport operators the Greek public transport intercity busses and train network managed to reduce their waiting time in transitional nodes by 4.91%.

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 118.12 for all project's beneficiaries (apart from Plannerstack, which never submitted its indicators).

### **Social benefits**

The importance of all the project objectives and their effect on air quality has been communicated through several media and activities. The response of the passengers has been remarkable.

Since the launch of GYM platform in August 2018, more than 25,000 unique routing requests have been produced. More than 8,000 users from all over the world have visited the platform; moreover the mobile applications developed have been installed in more than 3,500 devices.

During the awareness campaign performed after the platform launch, a questionnaire was distributed in more than 1,200 persons in public transport stations. Over 96% of the passengers care for their environmental footprint and moreover more than 85% would prefer an environmental friendlier route instead of the fastest one.

### **Replicability**

Replication of GYM components has been successful so far, since the integration of the GYM emissions calculation models (Action B2) have been integrated into COPERT 5 (international level) software, while apart from these models, the developed algorithm (Action B3) was integrated into IDOS (Czech Republic) and CP (Slovakia).

The likelihood of LIFE GYM's replication is considered high, since the extended version of GYM application including real-time information on itineraries, [GYM live](#), is very close in being incorporated by the urban KTEL of Volos in its daily operations. This application's version is expected to be replicated to several other Greek transport operators of city busses, or even intercity busses, since no similar application is available in the Greek market. Currently UTH is discussing with several Greek public transport operators, i.e. Urban KTELs of Larissa, Katerini, Patra, Lamia and Trikala, to replicate GYM live in the areas where they

operate and the momentum for integrating a telematics system in their daily activities is also favorable, due to the NSFR call on transport operators services upgrade.

### **Best Practice lessons**

For the implementation of Actions B1, B2, B3 and B5, the outputs of Action A1 were used, From the experience gained through the project implementation, a heavier technical focus should be given when planning data-heavy projects, such as LIFE GYM, to the quality of existing data, in order to better estimate the amount of workload needed to incorporate such data into a journey planner.

Through the integration of GYM emission calculation models into IDOS and CP, a valuable know-how was exchanged: CHAPS and INRPOP contributed in the project with their expertise in journey planning applications and stakeholder engagement in the initiative of creating such an application, while in parallel they are currently able to assess the environmental footprint of the produced alternatives offered to the passengers. The experience of CHAPS and INRPOP was significant for the consortium, since they indicated the importance of creating a data updating tool, the importance to visit the facilities of the transport operators instead of inviting them to workshops (which resulted in organizing a 2<sup>nd</sup> workshop series) and the importance of keeping the application as simple as possible by not providing the user with many preferences, but instead the application to decide based on the optimum available choice (for instance walking distance optimization). Finally, CHAPS and INRPOP contributed with their technical experience in bug fixing, backend improvement, the intercommunication of different platform components and the shared memory system.

### **Innovation and demonstration value**

The innovation value added by LIFE GYM as of now is at a national level: a) the GTFS data homogenization for Greece, b) the GYM platform, and at EU/international level: a) the development of emissions calculation models catering co-modality, b) the modelling and solution approach for co-VRP and c) the transportation data updating web-service.

### **Policy implications**

There are no policy implications.