



**HAL**  
open science

## Carbon care action of a European research project on electrified vehicles

Amandine Lepoutre, Alain Bouscayrol, Cristi Irimia, Calin Husar, Theodoros Kalogiannis, Mariam Ahmed, Claudia Martis, Dragan Zuber, Damien Phetsinorath, Fei Gao, et al.

► **To cite this version:**

Amandine Lepoutre, Alain Bouscayrol, Cristi Irimia, Calin Husar, Theodoros Kalogiannis, et al.. Carbon care action of a European research project on electrified vehicles. VPPC-IEEE'21, Oct 2021, Online, Spain. hal-03714985

**HAL Id: hal-03714985**

**<https://hal.univ-lille.fr/hal-03714985>**

Submitted on 6 Jul 2022

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

# Carbon care action of a European research project on electrified vehicles

Amandine LEPOUTRE<sup>1</sup>, Alain BOUSCAYROL<sup>1</sup>, Cristi IRIMIA<sup>2</sup>, Calin HUSAR<sup>2</sup>, Theodoros KALOGIANNIS<sup>3</sup>, Mariam AHMED<sup>4</sup>, Claudia MARTIS<sup>5</sup>, Dragan ZUBER<sup>6</sup>, Damien PHETSINORATH<sup>7</sup>, Fei GAO<sup>8</sup>, Wieteke VAN BALEN<sup>9</sup>, Adrian BIRTAS<sup>10</sup>, Johan LECOUTERE<sup>11</sup>

<sup>1</sup> Univ. Lille, Arts et Metiers Paris Tech, Centrale Lille, JUNIA-Hauts-de-France, EA 2697- L2EP, F-59000 Lille, France

<sup>2</sup> Siemens Industry Software SRL, Brasov 500203, Romania

<sup>3</sup> Vrije University of Brussels, Mobi-group, Brussels 1050, Belgium

<sup>4</sup> Valeo Equipements Electriques Moteurs SAS, Créteil 94000, France

<sup>5</sup> University of Technology of Cluj Napoca, Cluj-Napoca 400114, Romania

<sup>6</sup> Typhoon HIL, Novi Sad 21000, Serbia

<sup>7</sup> TÜV SÜD Battery Testing GmbH, Garching bei München 85748, Germany

<sup>8</sup> Université de Bourgogne Franche-Comté, FEMTO-ST, Besançon 25000, France

<sup>9</sup> Uniresearch BV, Delft 2628XG, Netherlands

<sup>10</sup> Renault Technologie Roumanie SRL, Bucharest, Romania

<sup>11</sup> Blueways International BVBA, Leuven 3001, Belgium

\* PANDA, Grant Agreement 824256, <https://project-panda.eu/>

**Abstract** — A carbon care action has been developed for a European research project focused on the development of greener vehicles. The aim of this action is to reduce and mitigate the greenhouse gases emissions due the project activities. The classical carbon assessment has been extended to consider all the activities of an international research project. For the 3.5 years project, 209 tons of CO<sub>2</sub>eq have been estimated as GHG emissions. The most important part is related to the transport despite a significant reduction of travel during the COVID-19 pandemic.

**Keywords** — Assessment method, greenhouse gases emissions, research.

## I. INTRODUCTION

Greenhouse gases (GHG) due to human activities lead to increase global warming [1]. In Europe, the mobility sector is the most important contributor to GHG [2], and the European Commission has several on-going research projects to develop “Green Vehicles” within the Horizon 2020 programmer. Within this framework, the H2020 PANDA project aims to propose new methods for testing electrified vehicles and their components to speed up their insertion on the market [3]. If the project will propose new vehicles with lower emission, the different project activities have also an ecological footprint that lead to GHG emissions.

Carbon care actions have been developed to reduce the GHG emissions of activities such as industrial activities or conferences. For example VPPC conferences have initiated carbon care action in 2010, as other conferences [4][5], with a dedicated method. However, this method is not adapted for a complete research project. The H2020 PANDA has

extended this method in order to better fit a research project [6]. A more precise decomposition of the different items has been stated. Moreover a carbon referent has been defined by each PANDA partner, based on the past experience of L2EP on Carbon Care action [7]. An important part consists in awareness of the members and also on future project members. In that aim, a dedicated presentation is also proposed for Master and PhD students at University of Lille.

This paper presents the final results of the GHG emissions of the PANDA project based on the French national Data bases on GHG emissions [8].

## II. CARBON CARE ACTION FOR RESEARCH PROJECT

A global method has been proposed in [5]. It is composed on 4 main tasks that are: 1) estimation or assessment of the GHG emitted by the project; 2) reduction of the GHG of the activities; 3) awareness of the participants and other stakeholders; 4) and mitigation of the GHG emitted. Because of its complexity, the most sensitive task is the assessment of the GHG which deserves a strict organization for a successful Carbon Care action.

In order to assess the different actions of the project, the different tasks are proposed in [6]. First the project is decomposed in the following (Fig. 1):

- Development activities: all works to achieved the scientific and technical targets
- Management activities: all consortium and management meetings of the project

- Dissemination activities: all actions to contribute to the promotion of the project and the dissemination of the outputs

Moreover for all these tasks, the following subtasks are considered:

- Functioning: all actives to achieve the task (e.g. simulation, experimental test...)
- Travel: all trips to achieve the task (e.g. commuting, travel for meeting)
- Equipment: all devices bought to achieve the task (e.g. battery for test)



Fig. 1: Organization of a study for GHG emissions' assessment

A responsible for every task can be defined. But for international project, it is better to define a carbon referent per partner. He/she will be in charge of the gathering of all data related to all tasks and subtasks.

### III. APPLICATION TON THE H2020 PANDA PROJECT

#### A. The PANDA project

The PANDA project aims to propose new testing method for electrified vehicles in order to reduce their development time [3]. The PANDA project will thus contribute to replace thermal vehicles by electrified vehicles with lower environmental impact.

As a European H2020 project, the PANDA consortium is composed of 11 partners from 6 countries (Belgium, France, Germany, Netherlands, Romania and Serbia). This geographical distribution normally leads to many travels for the project, and thus to equivalent GHG emissions. The carbon assessment should thus cover the on-site development in the 6 countries and also travels between these locations.

The project duration is 3 years. Starting in December 2018, as the COVID-19 pandemic lead to some delay in the development, an extension of 6 months has been validated by the European Commission. The carbon care assessment is thus defined for a period of 3.5 years.

A carbon referent has been defined by each partners (Bluways, Renault Technologie Roumanie, Siemens Industry Software, Tech. Univ. Cluj Napoca, TUV-Sud Battery testing, Typhoon HIL, Univ. Lille, Univ. Bourgogne France Comté, Uniresearch, Valeo, Vrije Univ. Brussel). Each referent is in charge of the collection of the data per task and

subtask per year. Univ. Lille is in charge of the management of the carbon care action.

#### B. Global results

When all data have been gathered, a total amount of 207 tons of C02eq (equivalent CO2) have been estimated with an uncertainty of +/- 35%. These GHG are distributed in the different tasks (Fig. 2): 63% for the development, 25% for the management and 12% for dissemination. It can be noted that the PANDA final event is not yet considered in the figures. An update will be proposed for the final paper.

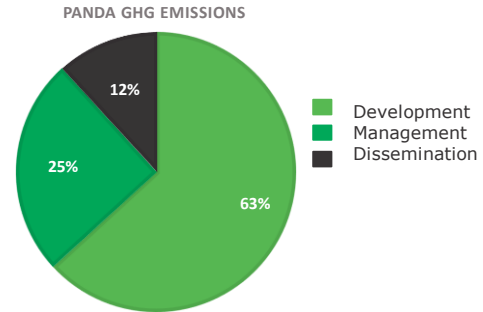


Fig. 2: Estimation of the GHG emission of the PANDA project

Differents GHG have been emitted along the project, and specifically because of the COVID-19 pandemic when teleworking was required and travelling impossible:

- 80 tons on 2019: regular operations
- 87 tons on 2020: purchase of equipment but stroing reduction of the travels
- 41 tons on 2021 and 6 months of 2022: no more purchase but still limitation of the travels

#### C. Distribution of the GHG emissions

All the data can also be computed by subtasks (Fig. 3). It can be observed that the travel is the most important contributor to GHG emissions (42%) despite the strong limitation of travelling during half of the project. This point highlights the interest of developing new low-carbon vehicle such as for PANDA. More analysis on the GHG distribution will be provided in the final paper.

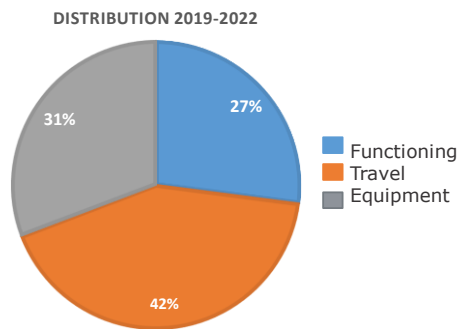


Fig. 3: Distribution of the GHG emission of the PANDA project

#### IV. MITIGATION AND AWARENESS

##### A. Mitigation project

A mitigation project will be now selected to compensate the 209 tons of CO<sub>2</sub>eq of PANDA. In order to give an idea of this amount of GHG emissions, 1 ton of CO<sub>2</sub>eq is required for 1 round trip between Paris and New-York.

An average carbon price of 50€/tons has been considered from CO<sub>2</sub>eq market [Ref]. It leads to a global budget of 10,000 €. The consortium has decided to select a common project for the PANDA project instead of one project per partner. A project for planting trees in an European area seem the most relevant.

##### B. Awareness

Of course, awareness actions have been stated all along the project to the PANDA members. But a dedicated presentation has also been developed for Master and PhD students in order to aware them for future projects. This presentation has been presented in 2021 to 2 Master degrees and in PhD training courses at University of Lille. This presentation aims to be presented in other universities. More details will be given in the final paper.

#### V. CONCLUSION

A carbon care action has been developed for a European research project focused on the development on green

vehicles. The classical carbon assessment has been extended to consider all activities of an international research projects.

For the 3.5 years of the project, 209 tons of CO<sub>2</sub>eq have been estimated as GHG emissions. The most important part is related to transports despite a significant reduction of travel during the COVID-19 pandemic.

A mitigation project will now be selected.

#### \_ACKNOWLEDGMENT

The research leading to these results has received funding from the European Community's Horizon 2020 Program under grant agreement No. 824256 (PANDA).

#### REFERENCES

- [1] IPCC Special Report: Global Warming of 1.5 °C, IPCC 2018 [Available on-line, <https://www.ipcc.ch/>, consulte in April 2021]
- [2] "Global EV outlook 2016, beyond one million electric cars", International Energy Agency report, 2016.
- [3] A. Bouscayrol *et al.*, "Power Advanced N-level Digital Architecture for models of electrified vehicles and their components", *Proceedings of 8<sup>th</sup> Transport Research Arena (TRA2020)*, Helsinki, Finland, April 27-30 2020.
- [4] A. L. Allegre *et al.*, "Experiences on Carbon Care Conferences," *2014 IEEE Vehicle Power and Propulsion Conference (VPPC)*, 2014, pp. 1-6, doi: 10.1109/VPPC.2014.7007068;
- [5] A. Bouscayrol *et al.*, "EPE'13 ECCE Europe, a Carbon-neutral conference," *European Power Electronics and Drives*, Vol. 28, no. 1, 2018, pp. 43-48, doi:10.1080/09398368.2018.1425183.
- [6] A. Lepoutre *et al.*, "Calculation of the GHG emissions of a European research project on electrified vehicles", *IEEE-VPPC'21*, October 21, Gijon, Spain.
- [7] <http://l2ep.univ-lille.fr/en/carbon-care/> [Available online, consulted in April 2021]
- [8] <https://www.bilans-ges.ademe.fr/fr/accueil/> (Version 4.8 consulted in 2021) [Available online, consulted in April 2021].
- [9] R. Obringer, B. Rachumok, D. Maia-Silva, M. Arbazadeh, R. Nateghi, K. Madani, "The overlooked environmental footprint of increasing Internet use", *Resources, Conservation & Recycling*, Vol. 167; 105389, 2021.
- [10] <https://www.websitecarbon.com>