DFGE
Institute for Energy, Ecology and Economy

NavVis

Unlocking Sustainability

How NavVis Technology leads to Avoided Emissions

Whitepaper 2023

DFGE – Institute for Energy, Ecology and Economy GmbH

Online publication series of the DFGE | ISSN 2747-7770

Autors DFGE: Anja Hoffmann, Lukas Becker, Dr.-Ing. Thomas Dreier

Autors NavVis: Korbinian Donhauser, Paul Hänchen

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1 Introduction

This whitepaper examines the possible effects of innovative spatial mapping and software products on the amount of needed business trips in comparison to a business-as-usual scenario, looking at the example of an automotive OEM site project phase. Setting up manufacturing sites abroad can be a resource-intensive, global process with a variety of different stakeholders participating. The planning phase usually contains multiple trips by planning and industrial engineering teams to collect spatial measurements and conduct visual inspections of the site. These business trips, often done by air travel, belong to the category of business travel, which is responsible for an estimated 15 to 20 percent of global travel.[1] From an environmental perspective, travel is going to be contributing to 12 to 27 percent of global Green House Gas (GHG) emissions by 2050 and meanwhile, it is seen that air travel emissions are rising 70 percent quicker than originally expected by the Intergovernmental Panel on Climate Change (IPCC).[2] With its high environmental impact and share of global emissions, business travel should be reduced as much as possible.

To understand the impact of its business on climate change, NavVis, a company producing mobile laser scanning devices (NavVis VLX) and building digital twins of the reality capture data in a corresponding software platform (NavVis IVION), appointed DFGE – Institute for Energy, Ecology and Economy to measure the carbon footprint of its business. A further goal was to examine the possible positive or negative effect of its products towards the avoidance of GHG emissions by NavVis customers.

[1] Borko et al. 2020
[2] McCain et al. 2021 (World Resources Institute)

Covered are all lifecycle emissions of the hardware and software. The Product Carbon Footprint was calculated from a “cradle-to-grave” perspective. This includes emissions from material acquisition and pre-processing, production energy and waste, storage and distribution, to emissions by end-of-life treatment.

Regarding its use cases, NavVis technology allows for much faster scanning than terrestrial spatial data capture methods. The assumption for the comparative scenario is that by using NavVis VLX to scan automotive OEM sites and by making this data available online via NavVis IVION, companies will require fewer on-site visits and thereby fewer travel activities. This would result in decreased emissions caused by the respective business travel.

The comparative scenario covered emissions from traveling including potentially travelled distances, mode of transport, hotel stays, and travel frequency. The analysis and calculation were based on activity data, literature research, and expert interviews with NavVis. The reference year for the emissions balance is the calendar year 2022.

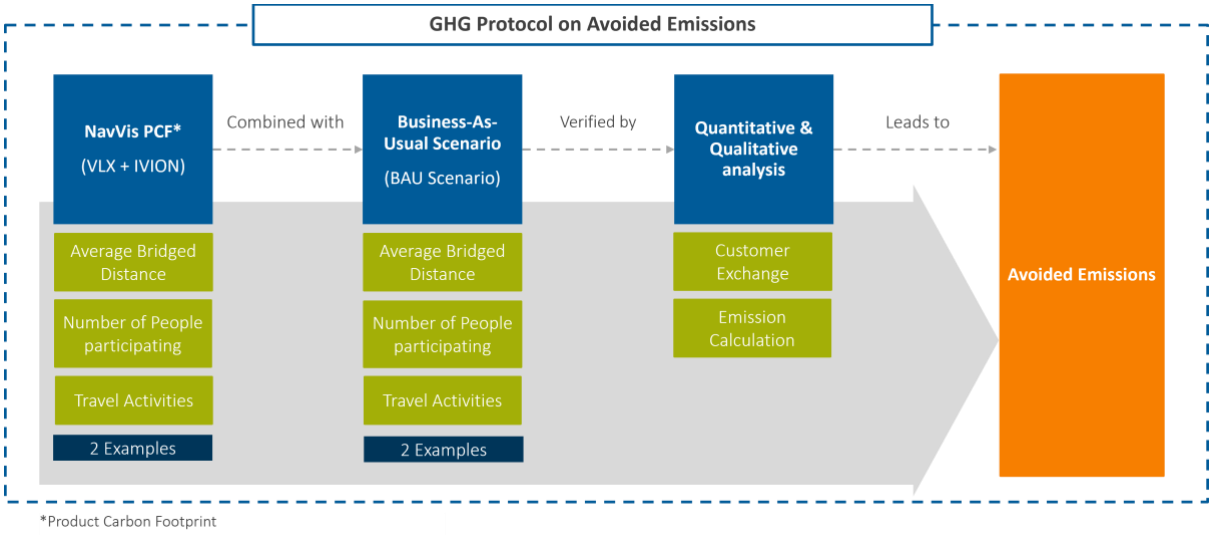
2 Methodological approach

2.1 Avoided Emissions

For estimating the potential avoided emissions using NavVis technology, the attributional approach following the "Estimating and Reporting the Comparative Emissions Impacts of Products" was used[3]. The attributional approach estimates the greenhouse gas (GHG) impacts by determining the differential in emissions between a scenario where NavVis technology was being used with those in a Business-As-Usual scenario (i.e., BAU scenario) where NavVis technology was not utilized.[4].

The figure below shows the overall structure and framework of the comparative emissions study. The different components, the product carbon footprint, the Business-as-usual (BAU) system and the quantitative and qualitative analysis are explained in the following sections.

Figure 1: PCF and comparative emissions structure and framework



In the present study GHG emissions are examined for comparison of the different examples. Appropriate Life Cycle Impact Assessment (LCIA) methods were used in accordance with the applied standards – GHG Protocol Product Life Cycle Accounting and Reporting Standard and ISO 14040/44. The GHG emissions were analysed in a holistic cradle-to-grave approach considering the complete life cycle of the NavVis System and the compared examples.

In chapter 2.3 the examples and scenarios are described in more detail.

2.2 Product Carbon Footprint

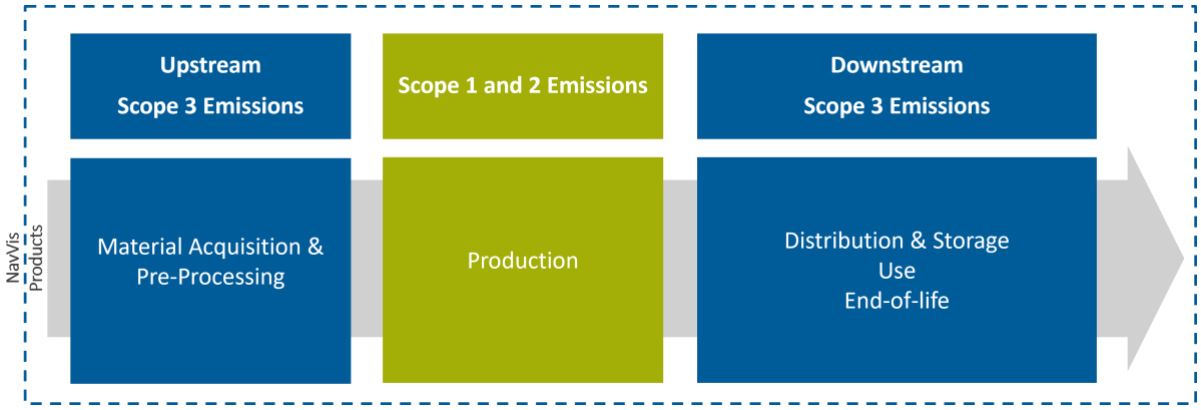
The Product Carbon Footprint (PCF) builds the base of the example comparison, representing the overall emissions of the NavVis technology portfolio. The Business-as-usual scenario (see chapter 2.3)

[3] BCG 2010
[4] WRI 2019

embraces the alternative scenario in which NavVis solutions were not available and the user needed to travel more often to substitute what is gained by NavVis technology.

The Carbon Footprint calculations are oriented on the accounting and reporting framework developed by the Greenhouse Gas Protocol, namely the "Corporate Standard", "Scope 3 Standard", and "Product Life Cycle Accounting and Reporting Standard"[5]. Based on these frameworks, the Product Carbon Footprint analyses the life-cycle emissions of NavVis VLX mobile mapping system and its corresponding software solution NavVis IVION. This is done from a cradle-to-grave perspective. The functional unit for the PCF of NavVis VLX was one selling unit, for NavVis IVION one active license over the respective product lifetimes. Figure 1 shows a schematic process map of the cradle-to-grave PCF.

Figure 2: Life cycle stages of a product range in relation to Corporate Carbon Footprint scopes defined by the Greenhouse Gas Protocol in relation to NavVis[6]



NavVis VLX

NavVis VLX is a high-performance mobile scanning device that utilizes LiDAR technology to capture three-dimensional data of an environment. This is accomplished by simply walking through an environment with the device. Regarding the PCF, all relevant cradle-to-grave PCF categories as seen in Figure 1 were included.

NavVis IVION

NavVis IVION is a platform for spatial data, enabling owners, operators, and contractors to convert buildings, factories and assets into intelligent spaces. By transforming reality capture data into digital twins, it facilitates smart collaboration and decision-making, bridging the gap between the physical and digital world. The PCF focused on the emissions occurring during the use phase of the software.

2.3 Examples investigated

In this study, the Business-As-Usual (BAU) systems are activities related to business travel and the associated hotel stays. NavVis technology allows for much faster scanning than conventional scanning methods. The assumption for the comparative scenario is that by using NavVis VLX to scan automotive OEM sites and by making this data available online via NavVis IVION, companies will require fewer on-

[5] GHG Protocol 2011
[6] DFGE 2023

site visits and thereby fewer travel activities. This would result in decreased emissions caused by the respective business travels and hotel stays.

The determination of avoided emissions through using the entire NavVis Reality Capture Solution (NavVis VLX and NavVis IVION) is subject to many variables and dependencies, which will be discussed in chapter 3 under sources of sensitivities. To determine, however, potential avoided emissions arising from the use of NavVis technology, the following two generic examples were established based on expert interviews:

Table 1: Examples and Scenarios

Examples /Scenarios	Business-As-Usual scenarios	NavVis scenarios
Example 1 “Europe”	154 business trips in total, each with one night in a hotel	79 business trips in total, each with one night in a hotel
Example 2 “International”	21 business trips in total, each with a 10-day hotel stay	12 business trips in total, each with a 10-day hotel stay

In both examples, the assembly planning team is based at the company's headquarters in Germany, with the project location in the first example being in Romania and in the second example in Mexico. The entire assembly planning team is responsible for the conception, planning, implementation, and ramp-up of a new vehicle project into an existing vehicle plant within the OEM's existing production network. Close collaboration with the local production team is necessary, resulting in travel activities.

The project timeline of those projects, set to last two years, is divided into four key stages. The initial six months are dedicated to the conceptualization phase, followed by a year dedicated solely to planning. During the planning phase, the use of NavVis technology can save most business trips. This is attributed to various reasons, such as the ability to visualize processes remotely, facilitate best practice sharing, optimize factory space and layout planning, utilize point clouds for 3D modelling, and enable seamless communication with suppliers. Subsequently, the project transitions into the implementation stage for a month, concluding with a three-month ramp-up.

Table 1 lists the respective frequencies of business trips. In the European example, assuming 17 team members including project managers and factory planners stay overnight per travel activity, while the international example involves 3 planning experts staying for 10 nights per business trip. In both examples, it is assumed that the mode of transportation is by airplane, with a one-way distance of 1.223 km in the first example (short-haul) and 9.456 km in the second example (long-haul). Emissions were calculated using specific emission factors for short- and long-haul flights and country-specific emission factors for hotel stays.

The total emissions in the NavVis scenarios result from the emissions arising from the flights and hotel stays, as well as the PCFs of NavVis VLX and NavVis IVION. The avoided emissions are ultimately derived from the difference between the BAU and the NavVis scenarios.

3 Results

3.1 NavVis Product Carbon Footprint

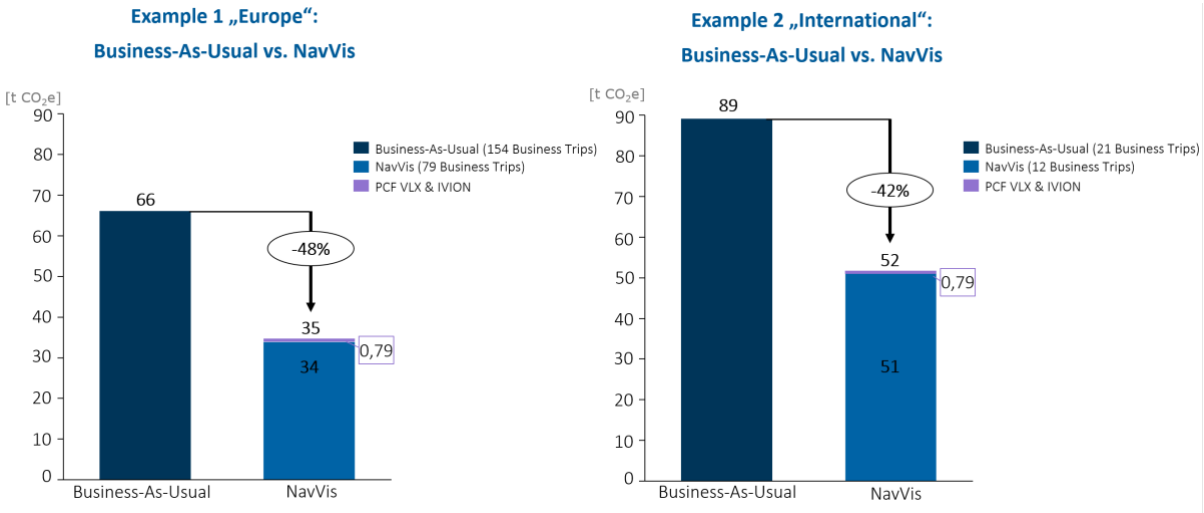
NavVis VLX – Product Carbon Footprint: The Carbon Footprint for NavVis VLX was assessed via a complete analysis considering the selected inventory boundaries. The calculation is based on the methodology of the Greenhouse Gas Protocol (GHG Protocol) Product Life Cycle Accounting and Reporting Standard[7] and covers all relevant processes of the considered life cycle stages. The total PCF emissions for NavVis VLX amount to 787 kg CO2e/selling unit NavVis VLX.

NavVis IVION – Product Carbon Footprint: The Carbon Footprint for NavVis IVION was calculated via the same methodology used for NavVis VLX. Hereby, only one life cycle stage (Use Phase) was contributing to the PCF. The values refer to one active license, comprised of on-premise use and cloud use. The total PCF emissions for NavVis IVION amount to 2.680 kg CO2e/active license.

3.2 Avoided Emissions through NavVis Systems

The estimated total avoided emissions resulting from the use of NavVis VLX and NavVis IVION amount to approximately 31,4 t CO2e (Example 1) and 37,4 t CO2e (Example 2). The avoided emissions represent the difference between potential travel emissions of the respective Business-As-Usual scenario and, in the NavVis scenario, the sum of the potential travel emissions and the emissions caused by NavVis VLX and NavVis IVION. These results are based on the selected input information of each case used for quantification.

Figure 3: Avoided emissions of the investigated examples 1 and 2



The results show that, in the investigated scenarios, the additional use of NavVis technology can reduce emissions by between 42% and 48%, as travel activities can be reduced. However, it should be

[7] Standards available at http://www.ghgprotocol.org/standards/ (Jun 22)

noted that the input parameters play a significant role in the results. The following table shows the most sensitive sources of uncertainty.

Table 2: Sources of uncertainty

Uncertainty factor	Description
Transport mode, distance, frequency	The estimated mode of transport has a strong effect on the amount of avoided emissions of the different examples. Changes hereby would significantly impact the resulting emission reduction. Same goes for assumed distances and needed frequency of travel during the project phase.
Team size	Estimating the size of the team involved into the project phase has a direct link to the number of necessary flights and is therefore a major lever on calculating the sum of avoided emissions.
Data quality	Another lever on the grand total of avoided emissions is the overall data quality of the product carbon footprints from BAU, NavVis VLX and IVION. Improvements in data quality can have an impact on the PCF sum and therefore on the resulting avoided emissions.

In conclusion, it is shown that the mode of transport, travel distances and frequency, as well as the size of the team involved, are critical factors in estimating avoided emissions. Therefore, the data quality of NavVis VLX and NavVis IVION Product Carbon Footprints plays only a minor role.

Each of these factors might have a significant impact on the calculated emissions reductions and can influence the results depending on the respective project. Therefore, a rough sensitivity analysis was conducted and demonstrated that the achievable savings or avoided emissions can increase up to 60 tCO2e per example or reduced to 25 t CO2e. Overall the demonstrated results of 31,4-37,4 t CO2e per example are considered as conservative estimate and rather robust.

4 Conclusion & Outlook

This analysis aimed to quantify the potential environmental impact of the innovative spatial mapping and visualization technology offered by NavVis, in reducing the frequency of business trips typically required during the project phase of setting up automotive OEM sites. NavVis VLX, a mobile laser scanning device, and NavVis IVION, its corresponding software platform, offer a more efficient way to capture spatial data and an easy-to-use platform for visualization & planning, reducing the needed size of teams and number of on-site visits.

This reduction of on-site visits leads to less air travel during the project phase and a clear avoidance of greenhouse gas emissions through this. The use of NavVis VLX does not eliminate travel activities, but it can potentially reduce them, as shown in the respective NavVis examples.

Considering urgently needed emission reduction, this comparison has shown that using NavVis technology can avoid emissions usually occurring during a Business-As-Usual project phase setting up an automotive OEM site by about 40 to 50%.

The analysis of results and data, also shows that the data is quite sensitive. Changes in the assumed variables, especially regarding the use of air travel as default mode of transport and the potential travel distances and the respective frequency of business trips can impact the sum of avoided emissions.

This preliminary quantification should serve as a foundation and first analysis for more extensive, detailed analysis in the future.

Comparative assertions i.e., claims regarding the overall environmental superiority or equivalence of a product versus a competing product are not supported by this work. The results of this comparison need to be reported separately from NavVis' own emissions and cannot be seen as a balance sheet of compensating or reducing own emissions[8].

Putting the result into perspective, it must be noted that, although efficient in the category of business travel, the avoided emissions only make up a low share of companies' total corporate carbon footprints. It can be seen as one of many steps to achieve greatly needed emission reductions, but the perspective on all relevant emission scopes should be considered and prioritised.

[8] WRI 2019

About NavVis

BUILD BETTER REALITY — Bridge the gap between the physical and digital worlds through reality capture technology that provides the digital foundation for the world you want to live in. We supply fast, reliable spatial data to service providers and enterprises seeking to capture photorealistic digital twins of the built environment. And our digital factory solutions enable greater organizational operability, productivity, agility, and profitability. Headquartered in Munich, Germany, and with offices in the United States, the United Kingdom, and China, NavVis serves global customers across the surveying, AEC, and manufacturing industries. Learn more at www.navvis.com.

About DFGE

DFGE – Institute for Energy, Ecology and Economy was founded in 1999 as a spin-off of the Technical University Munich (TUM) and provides support regarding ecological sustainability, energy efficiency, international norms and climate protection. DFGE offers consulting, software, and auditing services to companies to enable them to realize a green vision and integrate it into their daily business. Our core competency concerns the question whether and how a fruitful combination of ecological and economical concerns is achievable. Learn more at https://dfge.de/en/.

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Munich/Germany, September 2023

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This document was submitted by:
DFGE – Institute for Energy, Ecology and Economy GmbH
Kreitstr. 5, 86926 Greifenberg, Germany
T. +49.8192.99733-20 / F. +49.8192.99733-29
info@dfge.de
www.dfge.de