



Corporate value chain analysis Alfen Charging Equipment

CO2 Performance Ladder and GHG Protocol



Table of content

Page

1	About this report	3
1.1	Scope of the report	3
1.2	Main objective	3
1.3	Structure of the report	3
1.4	Calculation methods	3
1.5	Reporting Principles	4
2	Information about Alfen Charging Equipment	5
2.1	History	5
2.2	Product types	5
2.2.1	Eve Mini	6
2.2.2	Eve	6
2.2.3	Twin	6
3	Corporate value chain	7
4	Project analysis baseline description "Energy transition at Stedin"	8
4.1	Research & Development	8
4.2	Materials and suppliers	8
4.2.1	RoHS/REACH declaration of conformity	8
4.2.2	Alfen Supplier code of conduct	9
4.2.3	Emissions from the purchased goods and services	9
4.3	Logistics	11
4.4	Manufacturing	11
4.4.1	Employee commuting	11
4.4.2	Waste generated in operations	12
4.5	Distribution	12
4.6	Use of sold products	13
4.7	End-of-life treatment	14
5	Key findings and opportunities for improvement	16
6	Targets and action plan	19

1 About this report

1.1 Scope of the report

This is Alfen's corporate value chain report. It focuses on the Green House Gas impact of Alfen Charging Equipment across its value chain on an example of an Eve charging station.

Eve charging station is the most popular EV charging station among Alfen's clients. Its design, technical characteristics and performance is optimally suited for the broad market range. The report provides the scope 3 GHG inventory of the charging stations Eve, shows the corporate value chain and indirect emissions produced during the product's life cycle. Indirect emissions are emissions that are a consequence of Alfen's activities, but occur at sources owned or controlled by another company¹.

To optimize the accuracy of the impact calculations it was decided to select a project with Stedin as a baseline. The project covers a reasonable amount of EV charging stations, has different locations and external media recognition which allowed us to obtain the most complete picture of the corporate value chain.

1.2 Main objective

The objective of the document is to understand the full value chain emissions impact of Alfen Charging Equipment in order to focus company efforts on the carbon footprint reduction opportunities, leading to more sustainable decisions with regards to companies' activities and the products. The information about the most significant emissions will help in communication the potential risks of the emissions to the company's stakeholders and engage them with actions planned to reduce the associated risks.

By providing our partners with the results of the corporate value chain inventory and its "hot spots" we hope that Alfen can expand its transparency and environmental management in the supply chain. Also we reduce costs through improved supply chain efficiency and reduction of material, resource, and energy use.

1.3 Structure of the report

The report structured as follows:

Chapter 2 outlines the history and the main product types of Alfen Charging Equipment. Chapter 3 describes the corporate value chain of Eve charging station and provides the reader with an insight on the quantitative information around the value chain. Chapter 4 focuses on each of the components of the corporate value chain and presents a short overview of the carbon dioxide emissions. Chapter 5 builds a synthesis of the key findings and identifies improvement opportunities. Chapter 6 sets main objectives and action plan for further development. And, finally Chapter 7 pictures the results of the calculations and other sources in the Appendixes.

1.4 Calculation methods

The Stedin project served for us as a framework for the analysis of the most significant emissions in Alfen's corporate value chain. As the installation of the charging stations took place between May and

¹ Corporate Value Chain (Scope 3) Accounting and Reporting Standard

November 2018 we used the data mostly from 2017 and some available data from 2018. Our main databases from calculating CO₂ emissions are CCaLC2, Ecoinvent and DCF Carbon Factors 2018.

1.5 Reporting Principles

Corporate value chain report is based on the requirements of CO₂ Performance Ladder and GHG The Corporate Value Chain (Scope 3) Accounting and Reporting Standard. The following reporting principles were applied in this paper:

- Relevance
- Completeness
- Transparency
- Consistency
- Accuracy

2 Information about Alfen Charging Equipment

2.1 History

Alfen Charging Equipment (ACE) is a trading name of Alfen ICU B.V. which is a subsidiary of Alfen NV, an international organization that focuses on the development and delivery of innovative products and projects in the world of electric energy. The company brings together areas of expertise such as smart grids, energy storage systems and EV charging equipment.

As one of the founding fathers of EV charging solutions in the Netherlands, ACE realized over 40,000 charge points worldwide, and plays a leading role in development and standardization of the industry.

Important milestones in the history of ACE:

- 2008: Development and production of first charging stations for the Electric Vehicles (EV) market in the Netherlands
- 2011: Delivery of the 1000th public charge point in the Netherlands
Company take-over of EXENDIS, an expert in the field of converters and chargers
- 2014: Alfen expands to the United Kingdom, France and Germany
- 2016: Alfen introduces Eve Mini, the latest charging station for electric cars in the Eve range
ICU Charging Equipment selected as supplier for the world's largest electric vehicle smart charging project
Alfen is nominated as a finalist for the eCarTec Award in the Energy Infrastructure category
- 2017: Introduction of the new Eve
Alfen supplies the European Commission with Charging Infrastructure for Electric Vehicles
- 2018: Launch of the new integrated energy storage solution (fast EV charging system)
Alfen has been selected by Jaguar Land Rover to supply its EV charging equipment, covering the Netherlands, Belgium, Luxembourg, Switzerland, Portugal and Spain.

2.2 Product types

Alfen offers a full range of charging stations suitable for every Plug-in Hybrid and Electric vehicle for use at home, work or public areas and are available in a variety of power capacities and functionalities. With the help of its in-house products and services Alfen is connecting the megatrends in the energy sector.

			
	Eve Mini	Eve	Twin
Material	Polycarbonate	Sheet Moulding Compound	Stainless Steel
Size	S	M	L
Outlets	1	2 in same direction	2, back to back
Available outlet options	Type 2 socket (with and without shutter), fixed cable (type 1 and type 2)	Type 2 socket	Type 2 socket
Authorization	Plug & Charge or RFID	Plug & Charge or RFID	Plug & Charge or RFID
Safety related components: Installation flexibility	Full flexibility: MCBs and RCDs installed outside	Partial flexibility: MCBs (RCDs installed inside)	Flexibility determined by product configuration: Residual current and over current (short circuit) Type A protection fully on board
User Interface	Single LED or display	Display & authorization status indicator	Authorization status indicator. Language independent, pictograms showing user steps

2.2.1 Eve Mini

The Eve Mini is the most compact charge point in the Alfen product range. It offers charging speeds of 3.7kW up to 22kW, as well as all smart features that are also integrated in Alfen's other charge points. The Eve Mini features all elements needed for automated clearing of electricity consumption costs, and can easily be managed remotely.

Based on the smart technology integrated by Alfen, the Eve Mini autonomously carries out the local management of the installation. If more advanced options such as load balancing or the Alfen Smart Charging Network are used, the charge points always charges with the optimum output. Users have a comfortable experience too, as the bright colour display provides clear insights in the status of the charging process.

2.2.2 Eve

The Eve is Alfen's smart charging solution with two sockets and is optimally suited for private and semi-public locations. In 2017, Alfen has redesigned the Eve from the ground up taking into account the latest in charging technology and needs of EV drivers. With its large display and improved user interface, and a new high-tech and ultimately reliable hardware platform and several features allowing for easy configuration and operation.

The Eve is equipped with a DC sensor against hazardous electrical faults which allows a more cost-efficient installation. An externally accessible Ethernet Port makes it easy to connect the Eve to a PC and configure the charge point with the user friendly Installer.

With its redesigned soft and hardware, the Eve supports various features such as smart charging networks, load balancing and Open Charge Point Protocol 1.6.

2.2.3 Twin

The Twin is Alfen's robust and smart charging solution with two sockets. It is perfectly suitable for semi-public and public locations. Alfen completely redesigned the Twin in 2017 and renewed its interior with state of the art charging technology based on the preferences of EV drivers. With its clear user interface and highly reliable hardware platform, the Twin offers unparalleled user-friendliness and integrates advanced smart charging features.

3 Corporate value chain

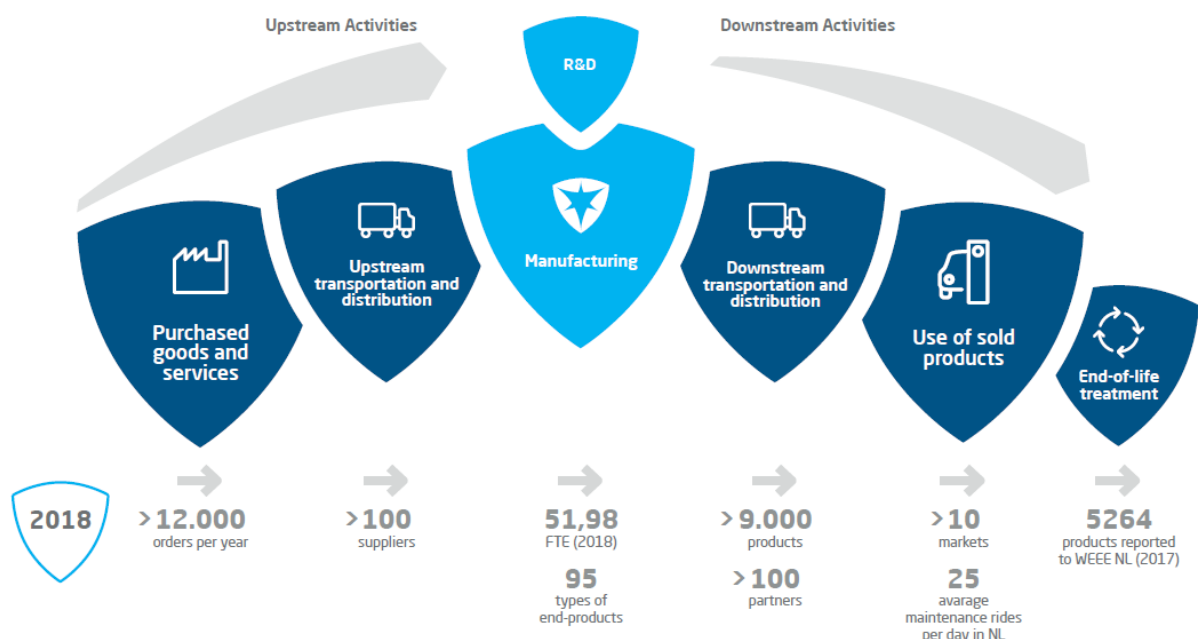
By performing a scope 3 inventory analysis we tried to understand the overall emissions profile of Alfen's upstream and downstream activities on the example of Eve charging station. This information helped us to clarify where potential emissions and associated risks lie in the value chain. Additionally, we could identify the relative risks and opportunities of the scope 3 emissions in comparison with the company's direct emissions.

The corporate value chain of Alfen Charging Equipment starts with Purchased goods and services and deliberately doesn't include raw materials. The reason for this is that the company has very limited knowledge of the supply chains of Alfen's suppliers and that's why it was agreed to see raw materials and suppliers under one category of Purchased goods and services.

Alfen traditionally operates its manufacturing of the EV charging stations using a linear value chain - make, use, dispose. Standing in the middle of the energy transition it is important for Alfen to focus on the transformation of linear value chain to a circular ecosystem business.

Research & Development is one of the key enablers of this transition as it requires better knowledge about value of the product, components and materials at their highest level. That's why we included R&D in our value chain as well.

Corporate value chain Alfen charging stations



4 Project analysis baseline description “Energy transition at Stedin”

As part of its program to electrify the fleet, Stedin is installing charging stations for electric cars at various Stedin locations throughout the Netherlands. Totally 84 Eves were installed at five different Stedin locations across the country during 2018. These charging points are all branded with the Stedin logo and equipped with Alfen's Smart Charging Network for simultaneously charging a large number of cars.

With approximately 2100 company cars, Stedin has one of the largest fleet in the Randstad.²

In 2017 the organization announced to bring its fleet to zero-emissions in the coming years. By changing the company's cars to fully electrical, Stedin wants to make a significant contribution to reducing CO₂-emissions and improving air quality in the Randstad.

Alfen works with Stedin together for decades in the field of medium voltage grid solutions and energy storage projects. This experience gave both parties the confidence that Alfen can roll-out a charging infrastructure at Stedin's locations. The ambitions of Stedin and a good knowledge of internal processes of this project allowed us to evaluate the most significant impact of the Eve charging station on the environment and achieve objective of the research

4.1 Research & Development

Obviously, manufacturing of a charging station has an impact on the environment during its complete life-cycle, such as use of raw materials and natural resources, manufacturing, packaging, transport, disposal and recycling. However, more than 80% of the environmental impact of a product is determined at the development stage.³

To drive the transition towards a more regenerative economy, we need to design differently.

A good design of a product takes into account all its environmental impacts, where uncoordinated product planning is avoided, energy consumption is minimized and quantities of recycled materials are increased. Alfen has an ambitious goal to facilitate a positive environmental impact in the energy transition and makes first steps towards circularity. The Eve charging station is designed in such a way that the product can be taken apart effortlessly and the necessary parts can be easily replaced.

4.2 Materials and suppliers

A sustainable environment is an essential value of Alfen. Environment not only in the sense of legal responsibilities, national and international law and guidelines, but also taking care of current and future generations.

To meet this value, it's our mission to develop and produce sustainable products.

4.2.1 RoHS/REACH declaration of conformity

Alfen takes great responsibility for the quality of its products and services as well as for the prevention of environmental pollution. This affects our choice of materials and the way we manufacture our products.

² <https://www.stedin.net/over-stedin/pers-en-media/persberichten/stedins-wagenpark-wordt-volledig-elektrisch>

³ Ecodesign your future, EC Enterprise and Industry: <https://www.afvalcirculair.nl/onderwerpen/beleid-circulaire/europese-richtlijn/ecodesign/downloads/ecodesign-your/>

Regarding the protection of the environment, amongst others, the following regulations and directives have been drawn up within the EU.

Alfen does not produce nor import chemical materials into the EU and that's why the registration obligations under the REACH (EU regulation for Registration, Evaluation, Authorisation and Restriction of Chemicals) regulation are not directly applicable to Alfen. However, Alfen fully supports the objective of REACH to advance public health & safety and protect the environment by informing our suppliers about their obligations in this regard.

The RoHS (Restriction of Hazardous Substances) is a European directive which restricts the possibility of using certain hazardous substances in electric and electronic equipment. In addition to reducing harmful effects on people and the environment, legislation aims to improve recycling options. Alfen closely monitors the development of RoHS and immediately responds to specifications. All our charging stations including Eve meet the material requirements of RoHS.

4.2.2 Alfen Supplier code of conduct

Environment and corporate social responsibility run like a thread not only through the operations and daily activities at Alfen. It also plays an important role with regards to our business relations. That is why we inform our suppliers about the standards that we apply to the entire supply chain.

Together with our suppliers we are continuously working on sustainable developments in the areas of company management, human rights, fair operational and business practices, health, safety & environment. Alfen Supplier Code of Conduct describes these principles. The document provides a framework for the suppliers in which the organization wants to operate.⁴

The Code of Conduct introduction helps Alfen to create an honest ecosystem for coexistent cooperation with partners. Protecting the environment, recycling and conservation of natural resources are of the highest priority to Alfen. Partners violating these regulations are requested to rectify the situations; furthermore, if violations continue, limitations are imposed on future transactions.

4.2.3 Emissions from the purchased goods and services

As a part of the scope 3 inventory we conducted an analysis of the purchased goods and services necessary for the production of Eve, or in other words – main components. Table 1 provides a list of the Eve's main components, which are comprised of roughly 78 subcomponents.

Table 1. Main Components of Eve charging station

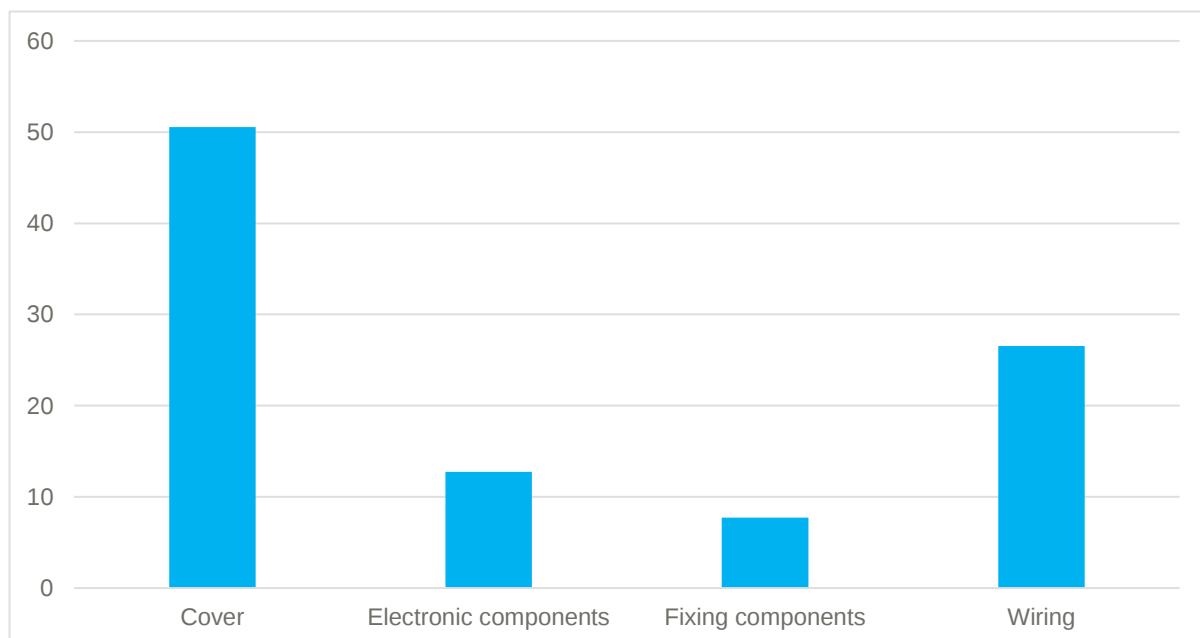
Component	Material	kg CO ₂ / Eve
Casing	Fibre-reinforced polyester (Sheet Moulding Compound - SMC)	50,6
Electronic Components:	Plastic	
• Residual Current Devices		
• Load switch		
• kWh meter		12,7
• Fuses		
• PCB (Printed Circuit Board)		

⁴ Alfen Supplier Code of Conduct <https://alfen.com/sites/alfen.com/files/downloads/Alfen-Supplier-Code-of-Conduct-lowres.pdf>

Fiberglass & aluminium ⁵		
Fixing components	Pressed steel	7,7
Wiring components	Copper	26,5

The total carbon footprint of this category is 97,52 kg CO₂ or 0,098 ton CO₂ per Eve. The measurement is based on the CO₂ emission factors of each subcomponent of the product. Table 2 shows the ratio of the emissions. The detailed information is provided in the Annex 1 Emissions from the components of the Eve charging station.

Table 2 CO₂ emissions from the main components of Eve



⁵ https://en.wikipedia.org/wiki/Printed_circuit_board#Materials

4.3 Logistics

Alfen Charging Equipment works with about 100 suppliers from the Netherlands and Europe, where about 50 of them are active suppliers. Annex 2 provides an overview of the top ten suppliers with the highest turn-over.

In order to reduce the environmental impact from logistics activities orders are being planned depending on their stock availability, delivery time and volumes. Efficient planning contributes to an efficient delivery where more pallets are being dispatched at the same day. Also, a lot of deliveries are combined with the shipments to another neighbourly location of Alfen at Hefbrugweg 28.

In order to measure the impact of the upstream transportation and distribution we analysed the whole list of suppliers. As it wasn't possible to identify the exact logistics of the product's components with regards to Stedin project we calculated the average CO₂ emission per charging station produced in 2017. A starting point for the measurement was the quantity and traffic of transportation consisting of two parameters: ton amount and distance in kilometres. We assumed that every delivery contains one ton of cargo transported by a gasoline truck using the shortest route from supplier's main office in the Netherlands to Alfen at Vlotbrugweg 24 in Almere.

In the end we received the following results:

Total kilometres	: 18.865
Total amount of ACE products:	: 5264
CO ₂ emission factor for a truck, a type of a gasoline is unknown:	: 0,259 kg CO ₂ /km
Emission per charging station	: 0,928 kg CO₂/Eve

In the circular economy a close cooperation throughout the value chain has a lot of value. A good example of such partnership is cooperation with a supplier of Eve's casing. The supplier delivers casings for the charging stations in cardboard boxes which are being reused for shipments to Alfen's clients.

4.4 Manufacturing

The Eve charging station is not manufactured in a single process but assembled after its various components have been produced and delivered to Alfen.

According to the CO₂ Performance Ladder the environmental impact of direct manufacturing falls under the scope 1 and 2.

However, we see some activities related to indirect emissions in the manufacturing process as well. These activities are employee commuting and waste generated in operations.

4.4.1 Employee commuting

Employee commuting between their homes and worksites are considered as a part of Manufacturing processes. So, we conducted a survey among 54 employees of Alfen ICU B.V. on how they usually commute to work.

9 people from the respondent group use a lease car and therefore fall under scope 1 and not considered in the outcome of the questionnaire. 31 people responded to the survey which allows us to make an assumption of the total emissions of all 45 employees commuting by their own cars or public transportation.

The total emissions from the transportation of the employees between their homes and the worksite in 2018 is 74,51 ton CO₂ (Annex 3, Table 1). As the amount of the staff members is increased with 68% in 2018 (from 32 in 2017 to 54 in 2018) we had to use the forecasted amount of the charge points (9.000) in 2018 which is resulted as 8,28 kg CO₂ per Eve.

4.4.2 Waste generated in operations

Waste avoidance, separation and recycling is one of the ambitions of Alfen to become a sustainable company. We closely monitor waste streams generated during the manufacturing processes and regularly report on the progress under the environmental management system ISO 14001:2015. The main waste streams are:

- Paper
- Cardboard
- Wood
- Metal
- E-waste
- Chemical waste

To measure the waste produced per charging station we used the financial results consolidation approach. Alfen Charging Equipment has 12% in the turn-over of Alfen group of companies in 2017, therefore we used the same 12% to calculate the waste ratio from the total waste generated (Annex 3, Table 2). The e-waste and chemical waste are not taken in consideration due to insignificant amounts.

The total carbon dioxide emissions from waste are resulted in 391 kg CO₂ per year and 0,07 kg CO₂ per Eve.

4.5 Distribution

Alfen Charging Equipment works with more than 800 clients across the Netherlands and other European countries. With nearly 120 of them ACE has a service agreement. Together with them we make it possible that EV charging stations are available anywhere anytime for anyone.

Below is the short overview of a few distribution partners who Alfen has the agreement with.



Allego
The Netherlands, Belgium, Germany



Van Leeuwen Oplaad
The Netherlands



Technische Unie
The Netherlands

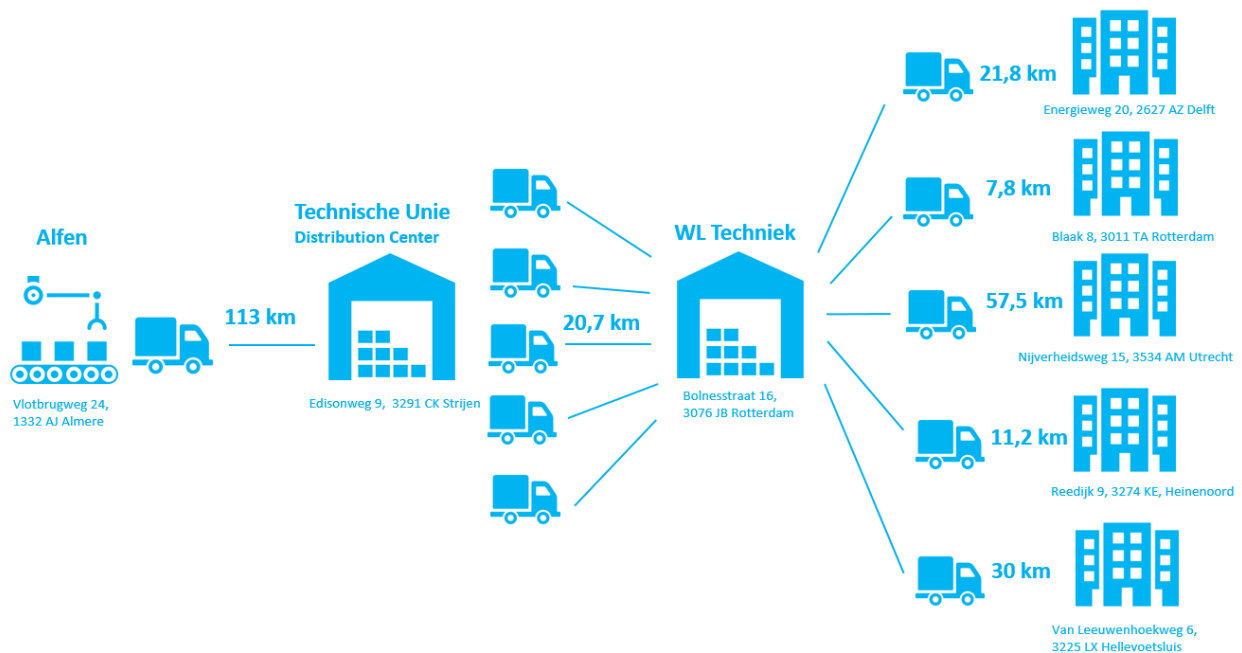


NewMotion
The Netherlands, United Kingdom, Germany, France



GreenFlux
United Kingdom, the Netherlands, Germany, Norway

In this chapter we focus on the downstream transportation and distribution of the charging stations specifically on the Stedin project where Technische Unie and WL Techniek acted as Alfen's partners. The details of the distribution are presented below.



All Eves were transported to the distribution centre of Technische Unie at Edisonweg 9 in Strijen located at a distance of 113 km from Alfen. By driving smart routes Technische Unie decreases the amount of empty trucks.⁶ The route for this particular project is not known to us, therefore we calculated the shortest distance to the distribution centre via the website <https://www.anwb.nl/verkeer/routeplanner>.

From the distribution centre the charging stations were delivered to WL Techniek separately for every location of Stedin according to the installation schedule.

Again, we used the same method of calculating the average CO₂ emission per charging station as in the Chapter 4.3. According to our measurement the average CO₂ emission per Eve charging station is resulted at 1,06 kg (Annex 4).

4.6 Use of sold products

The greatest impact we have is through our products. We are continuously improving our products and services to shape the energy transition and the experience of driving electrical vehicles. Alfen's products have been approved by the Office for Low Emission Vehicles. Moreover, the chargers are tested by all major electric car manufacturers and have been approved by notified certifying bodies such as DEKRA.

Alfen's decade-long experience ensures that our products including Eve are easy to install and configure, contain clear user-interfaces and realize high uptimes. This high-tech robust charging station comes with many functionalities and meets the latest technical standards and innovations.

⁶ <https://www.technischeunie.nl/portal/themas/duurzaamheid/mvo-technischeunie/>

For example, Alfen introduced the Smart Charging Network (SCN) which is the most advanced charging station technology on the market. It operates as a social charging network and aligns the charging speed among electrical vehicles. With the Smart Charging Network, the available power capacity is evenly distributed among the users. When a vehicle is fully charged, other connected vehicles will automatically be supplied with more power.⁷

However, as any other electrical appliance the charging station has an impact on the distribution network. To determine the impact during the Stedin project we calculated the carbon emissions of electric power distribution losses of the Eve charging station.

Stedin's energy network is not 100 % fossil fuel energy free. Therefore, we assumed that in the worst case scenario the charging infrastructure at all Stedin locations is powered by non-renewable energy. The average energy consumption of the Eve is 9,3 watts. The consumption will be resulted 81,468 Kwh and 0,0529 ton of CO₂ per year or 0,529 ton CO₂ per the life cycle of ten years (Annex 5).

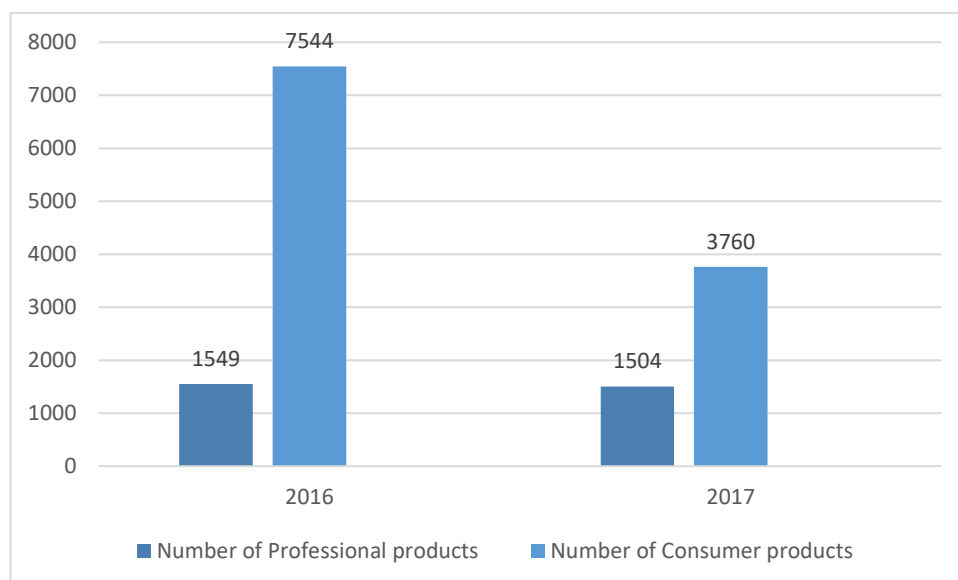
4.7 End-of-life treatment

Alfen Charging Equipment is classified as a producer of electrical/ electronic equipment and in this respect falls under European directive 2002/96/EC WEEE which stands for 'Waste Electrical and Electronic Equipment'. This legislation entails a take-back obligation of discarded electrical equipment, batteries and packaging material on basis of a producer responsibility.

Electrical and electronic equipment (anything that uses a plug or battery) can contain materials that can be harmful if released into our environment. In addition, such equipment contains valuable materials that can be recycled and used again in the manufacture of new items of equipment.⁸

Alfen makes sure that the organization is WEEE compliant and regularly reports to the relevant authorities on the amount products entering the market. Table 3 shows the amounts of the reported charging equipment for the past two years.

Table 3. Charging Equipment reported according to the WEEE Regulation



⁷ www.alfen.com

⁸ <http://www.weee.nl/en>

After expected lifetime of 10 years, Eve charging stations enter the phase of the end of their useful life. It means that Alfen has right to stop providing any technical support, service and updates of the product's software. It also means that the product can to be treated as a waste.

To gain an optimal benefit for the environment Alfen always encourages its clients to bring the EV charge equipment to recycling stations where the products will be disassembled and recycled.

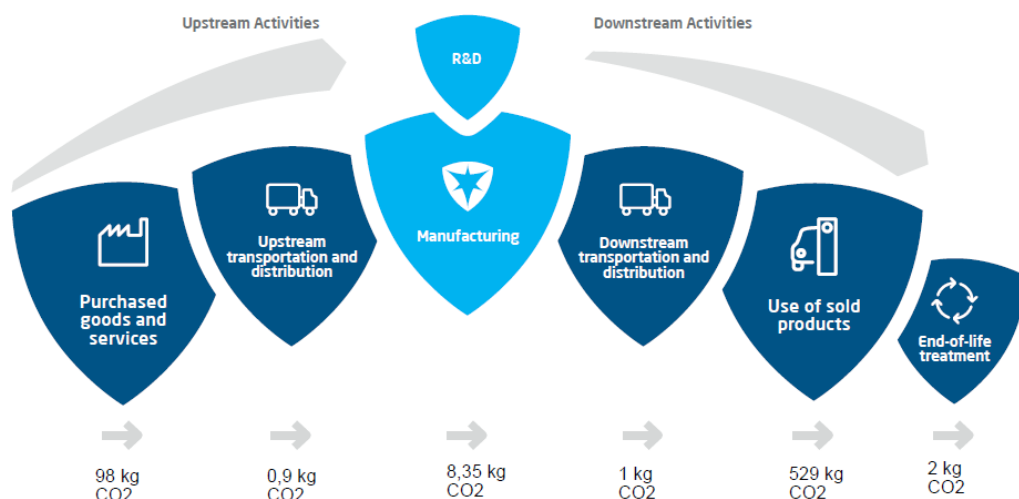
Knowing that Stedin is an environmentally aware organization, we assume that all 84 charging stations will be recycled at the end-of-life stage. In this case the CO₂ emissions will be 2 kg CO₂ per Eve charging station or 175 kg CO₂ per 84 stations.

5 Key findings and opportunities for improvement

The world of electrical vehicles and charging infrastructure is rapidly growing and policies are changing along. According to International Energy Agency (IEA) only 35% of the publicly accessible charging points required by 2020 have been deployed in the EU⁹. These developments provide a strong outlook for Alfen in the coming years.

The organization certainly contributes to decarbonisation in the area of electric mobility. However, the environmental footprint across the corporate value chain remains negative. Alfen is committed to reduce its negative footprint by setting up specific targets and an action plan which you can read in the next chapter.

Environmental footprint of the Eve charging station



The total CO₂ emissions per Eve charging station is 0,64 ton CO₂. Our study shows that the most significant environmental impacts of the Eve lies outside of Alfen's direct operational control - at the stage of use of manufactured products (82%) and in the materials (15%). See Annex 6 for further information.

Using these findings we have developed the following number of recommendations for improvements:

Impact 1: Material use

Key findings:

- The information on the use of raw materials is not available.
- Eve's casing made of Sheet Moulding Compound produces 52% of the total CO₂ emissions originated in Purchased goods and services, followed by wiring – 27%.

Recommendations for improvement

⁹ Global EV Outlook 2018 Report, International Energy Agency

Alfen can look for light weighted and/or natural fibre reinforced polyester alternatives to glass-fibre, for example hemp fibre (H-SMC). Additionally, Alfen's R&D specialists could investigate a possibility to minimize the weight of the charging station and to reuse some parts of the product.

To create a handbook for developers including list of materials according to REACH and RoHS requirements, list of critical raw materials – to make a deeper analysis of the suppliers Tier 2 category.

Challenges: The quality of the product may be negatively influenced if the material structure will be changed. Also, Alfen's clients may demand a specific design of the product which limits the company to implement any changes.

Impact 2: Employee commuting

Key findings:

- Minimum 42 % of the respondents are travelling by car to work which brings carbon dioxide emissions to 9,75 ton per charging station in average.
- The company is not very easily accessible by a public transportation and it is faster for many people to come to work by car .

Recommendations for improvement

Alfen doesn't have any direct influence on the employee commuting besides providing lease electrical vehicles to a number of employees. Economically it will be very challenging to provide every employee with a possibility to lease a car and therefore we do not consider this option as a solution. Nevertheless, to bring the carbon dioxide emissions of the employee commuting to a minimum, Alfen can use the following options:

- Stimulating carpooling among the employees. For example via the platform <https://www.carpoolworld.com>
- Additional public transportation coverage such as NS Business cards and OV-chip cards
- Work from home policy for office employees
- Provide employees who live in Almere with an e-bike

Challenges: To implement these solutions the company should reconsider its travel and reimbursing policy and therefore strategic decisions have to be made.

Impact 3: End-of-life treatment

Key findings:

- No trace of the products at the end of their useful life
- No reporting from WEEE NL
- No information on the recyclability rate

Recommendations for improvement

The company can tremendously improve its performance with regards to the end-of-life treatment of the product's useful life, if more information will be collected and processed at the design development stage. For instance, the knowledge about inactive charging stations and detailed reports from the recycling centre will help to determine an approximate amount of recovered raw materials.

It's important to mention, that Alfen can develop and communicate Product End-of-life instructions to the clients. These instructions will identify the components that optimize the recycling performances of the product, contact details of recycling centres and any other special recommendations concerning the product.

As another option we can suggest to establish a take-back procedure which will make it possible to reuse and remanufacture parts of the products.

Challenges:

There is no additional agreement with WEEE NL about the reporting processes and the information we receive is not sufficient. The new arrangements have to be made.

Take-bake procedure can be implemented only if the management will include it into company's business model.

Impact 4: Distribution and transportation

Key findings:

- Distribution and transportation of the products is not efficient
- At the moment Alfen has limited influence on the logistics of the partners

Recommendations for improvement

To reduce greenhouse gas emissions in the distribution and transportation sector Alfen will need to work closer with the partners and logistics companies for more efficient distribution planning. For example, products can be transported by smaller trucks or by electrical trucks. Also, transportation of the charging stations can be done directly to an end-client or an installing company.

Challenges: Partners may need to switch to another type of transportation which could be economically not possible for them. Additionally, new arrangements have to be made in order to change delivery scheme.

Impact 5: Energy consumption during stand-by mode

Key findings:

- Electric power distribution loss during the stand-by mode negatively influences the environment

Recommendations for improvement

To take a further look on improvement of energy loss and possibility to minimize it from 9,3 to 5 Watt/hour

Challenges: The company doesn't set this project as a priority as there are other important matters that should be resolved first.

Impact 6: Design

Key findings:

- Lack of circular design approach has a negative impact on other aspects in the corporate value chain

Recommendations for improvement

A close cooperation between QHSE, R&D, Purchase departments and suppliers is vital. Therefore, a collaborative project should be initiated for defining goals, boundaries for life-cycle impact assessment and action plan. Suppliers should be notified about this project and encouraged to participate.

Challenges: At the moment priorities of the departments lie on other projects. In this case management will need to actively promote company's ambitions and set this project on a priority list.

6 Targets and action plan

The overview of the key findings and challenges made it clear that there are plenty of opportunities for Alfen to reduce emissions that are contributing to a climate change.

As the most material emissions in the corporate value chain lie in the materials and in the stage use of sold products. In order to reduce company's environmental impact we need set up reduction goals, actions and responsible persons. Table below gives an overview of the required information:

The most significant emission	Reduction goal	Action	Schedule	Responsible person or department
Use of sold product	2022: 30% reduction in energy consumption (standby) compared with 2017.	1. To announce a vacant research internship for at least 6 months in order to conduct a research on the topic.	2019 Q1/Q2	Research & Development
		2. The selected intern to conduct a research and to share his/her findings with the R&D department and QHSE.	2019 Q3/Q4	
		3. Management decision on scope implementation plan	2020 Q1	
		4. Execution of the implementation plan during regular product update process	2020-2021	
Purchased goods and services	2020: 5% reduction in CO ₂ emissions of the components compared with 2017	5. Investigation on alternative materials for the casing	2019 Q2/Q3	Research & Development ACE Production
		6. Management decision on scope implementation plan	2019Q4	
		7. Execution of Implementation plan during regular product update process	2020 Q1-Q3	

The annexes are available only upon the request of the corporate value chain partners.