Chain analysis

E-mobility Charge Point Operator

2024

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1 | Introduction and justification

In the context of achieving level 5 on the CO_2 Performance Ladder, ubitricity conducts an analysis from an e-mobility charge point operator (CPO) perspective. This document covers how ubitricity determined the focus on the chain analysis and implementation plan.

1.1 Activities of ubitricity

ubitricity is a CPO dedicated to municipalities and local authorities (on-street public charging). Its business model consists of operating electric vehicle charging points in municipal territories across Germany (HQ), France, UK and the Netherlands. Its operation is regulated by public bids, determining the number of Charge Points (CPs), the duration of the concession (years) and the scope of work. To carry out its business, ubitricity relies on a network of external partners, such as: hardware supplier, Technical Services Providers (TSP) and Engineering, Procurement & Construction Management (EPCM), etc. ubitricity is responsible for providing chargers that will be installed and operated during the concession period.

1.2 What is a chain analysis

A chain analysis involves calculating the CO_2 emissions of the entire chain for a particular product or service. The entire chain refers to the entire life cycle of the product from extraction of the raw material to the end of its lifespan.

1.3 Objective of the chain analysis

The main objective for carrying out this chain analysis is to identify CO_2 reduction opportunities, define reduction targets and monitor progress.

A reduction target is formulated based on the insight into the scope 3 emissions and the chain analysis. The energy management system that has been introduced actively aims to reduce scope 3 emissions.

Providing information to partners within its own chain and sector being part of a comparable chain of activities plays a pivotal role, therefore, ubitricity will take steps based on this chain analysis to involve partners within the chain in achieving the reduction objectives.

1.4 Ambition level statement

Minimizing the physical and environmental footprint of a large-scale charging infrastructure is one of ubitricity's core principles.

As a company-wide initiative, ubitricity aims to achieve carbon neutrality by 2030. ubitricity's is continuously striving to realise the entire value chain of its public charging infrastructure including production, export, management and maintenance, with net zero emissions wherever possible.

In addition to this commitment at a corporate level, ubitricity extends this commitment to the partners that work for ubitricity.
Sustainable supply chain management is firmly integrated into ubitricity’s procurement processes and plays an important role in the selection and evaluation of suppliers. The sustainability expectations are clearly outlined in the Code of Conduct and guidelines. Suppliers and employees must follow these guidelines and comply upon agreement and contract signing.

ubitricity's robust Supplier Management Framework also helps to achieve and continuously improve their target to reach zero impact operations. This framework involves, for instance, ensuring suppliers track and communicate CO_2 emissions and conducting quarterly audits to monitor sustainable operation performance.

1.5 Reading guide

In this report, ubitricity presents the formation of chain analysis and implementation plan. The structure of the report is as follows:

- Chapter 2: Scope 3 & choice analysis
- Chapter 3: Identifying links in the chain
- Chapter 4: Quantifying emissions
- Chapter 5: Improvement opportunities
- Chapter 6: References

2 | Scope 3 & choice chain analysis

Before determining which chain analysis to be carried out, the table below provides an overview of the product-market combinations. This depicts where ubitricity has the most influence in limiting CO_2 emissions.

PRODUCTS AND MARKETS Clients	**GOVERNMENT** Local authorities	**% TOTAL TURNOVER**
Electricity through lamppost/bollard	45%	45%
Electricity through AC charging points	55%	55%
	100%	**100%**

Figure 1: Product-Market Combination Analysis

The underlying calculations can be found in the qualitative analysis appendix.

2.1 Selection chains for analysis

In accordance with the regulations of the CO_2 Performance Ladder 3.1, ubitricity must choose a chain analysis of one of the top two emission sources. The top two sources are: (1) Purchased Goods and Services from 'electricity through Stand Alone AC charging points' (2) Purchased Goods and Services from 'electricity through lamppost/bollard charging' as outlined in the figure below.

PMC's sectors and activities	**Description of activity that releases CO2**	**Relative importance of the sector's CO2 tax and influence of its activities**		**Potential influence of the organization on CO2 emissions**		**Rank**
Relevant sectors (markets/themes) and business activities. Based on current size and forecast for the coming years.	*Identification of CO2-emitting activities, upstream and downstream. See list above.*	*CO2 emissions of the relevant sector, qualitatively substantiated with sources.*	*Estimation of the effect of adjustments or improvements on CO2 emissions.*	*Expected size of activities in the sector in own order book.*	*Expected influence on CO2 emissions*	*Most material emissions that can be influenced by the organization.*
Electricity through lamppost/Bollard charging	1. Purchased goods and services	Big	Medium	Big	Medium	**2**
	4. Upstream transport and distribution	Medium	Medium	Medium	Medium	3
	6. Business travel (not in scope 1 or 2)	Medium	Big	Klein	Medium	5
	7. Commuting	Small	Medium	Small	Medium	7
	11. Use of Products Sold	Small	Big	Small	Small	9
Electricity through AC charging points	1. Purchased goods and services	Big	Medium	Big	Medium	**1**
	4. Upstream transport and distribution	Medium	Medium	Medium	Medium	4
	6. Business travel (not in scope 1 or 2)	Medium	Big	Small	Medium	6
	7. Commuting	Small	Medium	Small	Medium	8
	11. Use of Products Sold	Small	Groot	Small	Small	10

Figure 2: Analysis of material emissions

After analysing a 10% higher share in the AC charge point segment based on the supplier turnover in 2023 (see Figure 1), ubitricity chose to focus on one chain analysis of the category: (1) Purchased Good and Services from 'electricity through Stand Alone AC charge points'. This aligns with the strategic approach of ubitricity within the boundaries analysis and allows to reflect on the chain of its Operations Management System.

2.2 Scope chain analysis

As the focus is on AC charge point segment, ubitricity has decided to put its focus in the Dutch market, especially with the potential growth opportunities.

ubitricity's chain analysis will focus on the value chain process starting from procurement until operation of the hardware. This analysis will be structured around five main steps.

1. Hardware Production
2. Transport from local assembly factory to its place of usage
3. Installation processes
   (comprising the steps to make the charge points available for public use)
4. Operations
   (comprising the technical visits required for preventive and reactive maintenance)
5. Final disposal

As a CPO, the core service begins after procuring hardware, therefore ubitricity has decided to **focus on steps 2 to 4**. While the CO_2 generated during the production of chargers is an important criterion for selecting suppliers, the influence of ubitricity on production is limited. This also applies to the final disposal stage, as hardware suppliers are responsible to dispose after its lifespan. Currently in the Dutch market, the active projects are new hardware with a lifespan of over 10 years, which is much longer than ubitricity's operating experience in the Netherlands. Thus, steps 2 to 4 will be the focus and further explained in Chapter 3.

2.3 Primary & Secondary data

This chain analysis uses primary and secondary data provided by ubitricity's additional substantiation.

DISTRIBUTION OF PRIMARY AND SECONDARY DATA	
Primary data	Driven km, weight of product, pallet quantity, quantities of material, installations per hour
Secondary data	CO_2 emission per km, average hourly equipment usage, estimation of installation hour per Charger, estimation of preventive maintenance visits

Figure 3: Distribution of primary and secondary data

2.4 Allocate data

Data allocation is not used.

3 | Identifying links in the chain

As briefly mentioned in Chapter 2.2, the Figure 4 shows the various phases of ubitricity's chain. These steps are described in detail below.

Figure 4: Chain steps of ubitricity

3.1 Chain steps

This chapter elaborates on the various phases of the chain analysis.

Production

- Source external hardware suppliers that design and procure charging stations. Ensure that the hardware meets technical and safety standards, is durable, and compatible with various EV models. This involves selecting appropriate components, such as connectors, cables, and internal electronics.
- Quality Control: Before purchasing, ubitricity tests the quality of charging station components. They conduct inspections to ensure that everything functions correctly and adheres to industry standards.

Transport

To Technical Service Partner (hereinafter referred to as "TSP")

- The supplier coordinates the logistics of transporting charging stations from their factory to the stock of the TSP for installation. This includes coordinating shipping, handling the storage, etc. This process ensures that stations arrive safely and on time into the TSP warehouse and close to the installation sites. Considering the hardware assembly plant, E-trucks are usually preferable for those transports.

From TSP to Installation site

- The TSP coordinates the transport of the charging stations from their warehouse to the installation site. This process ensures that the stations are on site when installing. TSPs are contractually required to use electric vehicles whenever possible.

Installation

Pre-Installation

- Site Selection: CPOs choose suitable locations for charging stations based on factors like accessibility, visibility, demand and user request (municipality).
- Permitting and Compliance: Obtain necessary permits and comply with local regulations for installation.

Installation process

- Electrical Installation: Install charging infrastructure, including wiring, power distribution, and connection to the grid.
- Physical Installation: Physically mount and secure charging stations, ensuring proper alignment and safety.

Operations and Maintenance Management (Reactive, Proactive and Preventive)

- Maintenance: Regular inspections and maintenance of charging stations. This includes cleaning, repairing, and replacing faulty components.
- Reactive maintenance: In case of a failure triggered by the EV driver, the customer service partner can be easily reached via helpline, and email, 24/7 and solves 69% of the cases remotely. In cases where it cannot be solved remotely, TSP will be sent onsite to fix the issue.

- Preventive maintenance: All ubitricity chargers are visited according to the frequency stated in the tender requirement align with the local regulation after asset commissioning.
- Proactive maintenance: This process is triggered when the AMS (Alert Management System) receives a failure signal from a charger, allowing us to act promptly and address the issue before it disrupts the charging session for future EV drivers.
- User Support: Provide customer support, troubleshoot issues, and address user inquiries related to charging, 24/7.
- Billing and Payments: Manage billing systems, ensuring accurate charging fees and payments.
- Software Updates: Update charging station software to improve functionality and security.
- Monitoring: Monitor charging stations remotely to detect any operational issues promptly.

Disposal

- End-of-Life Management: When charging stations reach the end of their life cycle, ubitricity handle their decommissioning. This involves safely disconnecting electrical connections, removing hardware, and disposing of components responsibly (e.g., recycling materials, disposing of hazardous waste).
- Environmental Considerations: ubitricity follow environmental regulations and guidelines during disposal to minimize the impact on the ecosystem.

3.2 Chain partners

Based on the justification mentioned in Chapter 2.2 in accordance to the overall explanation on aforementioned chain steps, ubitricity will focus on Transport, Installation and Maintenance of the chain. This section covers an overview of partners in the chain analysis across three different markets; NL, FR and DE.

For this specific chain analysis, ubitricity is focusing on the MRA-Elektrisch tender project which was awarded in February 2024. As this is the largest contract for the AC standalones, there will be an increase in emissions in all operational matters.

Therefore, this is a great opportunity for ubitricity to work closely with the suppliers to improve the emissions in the value chain. All the fonts highlighted in blue indicate the NL partners ubitricity works with to improve the emission targets.

- Transport: (Alfen, TNT, Beekman Transport; Base Logistics BV; UPS)
- Installation: (mraElectric; Van Gelder; Stam & CO; SPIE)
- Maintenance: (SPIE, Ensio, Enerveo, Lugger, CityTec, Roamler)

4 | Quantifying emissions

Based on the description of the chain as shown in Chapter 3, this section determines how much CO_2 is emitted during the various phases of the chain. Each paragraph describes a part of the chain and the associated CO_2 emissions per charging stations.

In this chapter, ubitricity used the classification from section 3.1 to calculate the CO_2 emissions for each phase/step in the chain. In the last paragraph, the overview of total CO_2 emissions per charging station is summarised.

4.1 Transport from Supplier to Location

This chain step refers to the transport from supplier (Alfen) to TSP warehouse in NL.

The calculation of emissions is based on the freely accessible web calculation of https://www.carboncare.org/en/co2-emissions-calculator. The results in kilogram are calculated using the following assumed parameters:

- Distance between location and warehouse (based on the shortest feasible distance)
- Weight of delivered quantity
- 13-18 T Truck as reference including cargo handling
- TOTAL, total emissions (comparable with WTW: Well-to-Wheel)

Figure 5 depicts how ubitricity measures and analyses the impact of the upstream transportation the first deliveries. As it is not possible to identify the exact logistics of the charging station with regards to the MRA-Elektrisch project, the average CO_2 emission per charging station is calculated.

TSP / Warehouse Location	Distance in km	Quantity of charging stations	Pallets delivered	Kg weight total	CO2 emissions in kg
Alfen to Stam&Co	72	136	17	7,024	46.91
Alfen to SPIE (Amsterdam)	55	48	6	2,479	11.67
Alfen to Van Gelder (Lunteren)	71	32	4	1,653	10.75
Alfen to Van Gelder (Lopik)	74	72	9	3,719	25.76
Total	**272**	**288**	**36**	**14,875**	**95.09**
Emission per charger					**3,03 kg CO_2**

Figure 5: CO2 emissions for MRA-Elektrisch project deliveries (July-August 2024), from Factory to TSP warehouse

4.2 Transport to Installation site

This chain step refers to the travel emissions from TSP warehouse to the site location. Currently, ubitricity has three TSPs contracted. TSPs are planning the installations based on the approved sites by the grid operators, which does not allow for bundling or efficient planning to reduce travel hours. The calculation is based on the average emissions of 157.7g / km of vans registered in Europe in 2020: CO2 emission standards for new cars and vans (europa.eu). The current average estimates per team installing one charging station as follows (see Figure 6).

Distance in km	Van: CO2 per km (g)	Estimate CO_2 Emission per charging station (kg)
250	158	**39,5 kg CO_2**

Figure 6: Estimated Emissions per charging station from transport to installation site per TSP team

4.3 Process of Installation

This chain step refers to the emissions estimated on-site per AC standalone as shown in Figure 7 below.

Equipment	Fuel	Hours	Consumption (L/hour)	CO_2 emissions (kg) per charging station
Mini-digger	Diesel	2	7	46
Compressor	Gasoline	1	3.5	10
Wacker rammer	Gasoline	0.25	1.2	1
Tiresaw	Petrol	0.17	1.2	1
Mounting box	Diesel	1	2.5	8
Total		**4.42**	**15.4**	**65 kg CO_2**

Figure 7: Estimated emissions per one charging station / per location site

The following CO_2 factors were used, which have been imposed by the central government: www.CO2 emissiefactoren.nl.

- Diesel: 3.256 kg CO2 per liter
- Gasoline: 2.821 kg CO2 per liter

4.4 Process of reactive and preventive maintenance

This chain step refers to the maintenance process (see Figure 8) including reactive, proactive, and preventive. On average, 69% tickets are solved remotely within 2 hours when the alert management system from the backend office or EV drivers notifies the customer service. This minimizes the CO_2 emissions significantly.

For MRA-Elektrisch project of the existing network size of 736 AC chargers, there are approximately 50 reactive maintenance visits per month on average. The estimated average value of CO_2 emissions per visit is shown in Figure 9. As the reactive maintenance is per case basis, the visit usually takes place from Amsterdam, which is at least 50 km one-way.

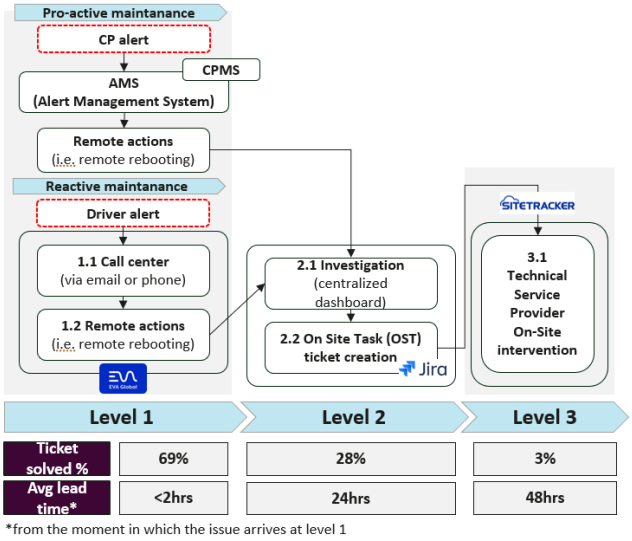

Figure 8: Maintenance management system

For reactive maintenance (under the assumption that the reactive maintenance visits happen once per day). The calculation is based on the average emissions of 157.7g / km

of vans registered in Europe in 2020: CO2 emission standards for new cars and vans (europa.eu).

Distance in km	Van: CO_2 per km (g)	Estimate CO_2 Emission (kg) for reactive maintenance per charging station
140	158	35 kg CO_2

Figure 9: Estimated emissions per reactive maintenance visit

For the new project with MRA-Elektrisch, the contracted maintenance TSP is looking after the entire process of both reactive and preventive maintenance, including the long-term year-on-year planning, which reduces CO_2 emissions, improves efficiency, and increases uptime.

4.5 Overview CO_2 emissions in the chain

To provide an overview of the total CO_2 emissions in the chain, the total summary is presented in Figure 10 below.

DISTRIBUTION EMISSIONS	
PHASE	**EMISSIONS**
4.1. Transport from supplier to location	3,03 kg
4.2.Transport to Installation Site	39,5 kg
4.3.Process of Installation	65 kg
4.4. Process of reactive and preventive maintenance	35 kg
Total (kg CO_2)	**142,53 kg**

Figure 10: CO_2 emissions per chain step for one AC Stand Alone charging station.

5 | Improvement opportunities

ubitricity is committed to reducing its footprint by setting up specific targets and an action plan. This section highlights reduction options in the chain.

5.1 Opportunities for CO_2 reduction in the chain

Figure 11 depicts the quantified reduction opportunities within the chain analysed.

DISTRIBUTION EMISSIONS	
PHASE	**EMISSIONS**
4.1. Transport from supplier to location	2,9 kg
4.2.Transport to Installation Site	39,5 kg
4.3.Process of Installation	63 kg
4.4. Process of reactive maintenance	33 kg
Total (kg CO_2)	**~138 kg**

Figure 11: Reduction potential per chain step for one AC Stand Alone charging station

Plan of Approach:
Figure 12 (see below) is the overview of the targets, the plan of approach to reach the targets and the people responsible.

Activity	Target and Planning	Person responsible	Deadline	Reduction measure
4.1. Bundling of transport	**Target**: Change the on-demand pallet delivery to bundling based on track load **Planning**: Adjustment of production + Call-off orders	Roll-out managers (AC) /Procurement Manager (LP) in collaboration with supplier	Q4/2024	With the increase of the pallet volume and bundling of transport, to save 4 truck deliveries for the total project volume. 4 truck less reduce emission to 106 kg until 2027. ~5% reduction in transport emission compared with 2024
Increase pallet volume	**Target**: reduce packaging, more charger to fit on a pallet, higher transport volume, less driven miles and thus lower CO_2 emissions **Planning**: adjustment of carton dimension, less plastic and Styrofoam	Supplier	Q4/2024	
Measure CO_2 emission for delivery of goods	**Target:** reduce actual CO_2 emission per truck delivery **Planning**: Agree with forwarder on tracking of emissions per truck delivery and close cooperation with logistic companies to achieve more efficient distribution planning	Supplier	Q2/2025	
4.2. TSP to use electrical car for site visit	**Target:** For TSP to shift to electrical van by the end of 2025 **Planning:** To have a contractual agreement: - NoX& CO_2 Zero policy ensuring no local emissions of nitrogen oxides, particulate matter or CO_2 OR any CO_2	Each TSP • Van Gelder • Stam&Co • SPIE • Citytec • Roamler	Q4/2025	Once the electrical cars are in use, this will have zero tailpipe emissions. (1) quarterly meeting to discuss the

	reduction policy / initiatives at a company-level - Electrical vehicles by 2025. If not, to compensate the CO2 emissions per project.			bundling of chargers (2) CO_2 emissions will be compensated until the electrical cars are implemented. Measurable target: 2% CO_2 emissions reduction YoY during the annual contract review
To increase the number of chargers to install: better planning and bundling of chargers during installation	**Target**: When the ramp up begins, a total of three TSPs to install at least 2 chargers per day per team. **Planning:** To have a contractual agreement: - Be responsible and accountable of the installation planning to bundle chargers to minimise CO_2 emissions. Roll-out manager monitor during monthly meetings: Ramp up from 1 to 2 charger(s) per day. To monitor through roll-out meetings.	Roll-out manager (NL) in collaboration with TSPs	Q1/2025	
4.3. Training for environmental awareness	**Target:** To reduce the emissions during the installation phase **Planning:** To conduct an annual environmental awareness for the technicians: alignment during the meetings.	Each TSP • Van Gelder • Stam&Co • SPIE • Citytec • Roamler	Ongoing	N/A
4.4. Bundle preventive maintenance	**Target:** To bundle the preventive maintenance and synchronise reactive if preventive maintenance scheduled around the same time. To have CO_2 reduction reporting/commitment from TSPs. **Planning:** To implement the CO_2 reduction plan in the contract. Continuously monitor through monthly meetings.	Each TSP • Citytec • Roamler	Ongoing	Measurable target: 2% CO_2 emissions reduction YoY during the annual contract review
Prioritising remote resolution	**Target:** To maintain remote resolution to 70% for NL **Planning:** To continuously monitor through backend system.	Roll-out Managers	Ongoing	Always monitor and maintain at 70% for remote resolution

Figure 12: Plan of Approach of improvement targets within ubitricity's chain

Translate insight into chain analysis into scope 3 analysis.

Set a goal: ubitricity will reduce 2% of CO_2 emissions per charging stations YoY, in the chain of new MRA-Elektrisch project from procurement to operations until the end of roll-out period, which is expected to be Q3 of 2027.

5.2 Uncertainties and opportunities for improvement in information

The calculations are currently based on using mainly secondary data and partially primary data.

To gain more insight into the actual CO_2 emissions in the chain in the future, especially with regard to the collection of primary emissions data from chain partners, ubitricity will work more closely with partners on solutions that ensure transition from the current secondary data to the primary data.

By working closely with suppliers, ubitricity ensures that every hardware delivery and journey for installation and maintenance are tracked (e.g. with the use of a logbook, GPS-Tracking or Telematic-System).

Opportunity for Improvement

- Improving driving behaviour
- Route optimization
- Transport by smaller tracks or by electrical trucks
- All transport companies to calculate the CO_2 amount of their shipment using the latest and most comprehensive global emissions calculator based on the European standard EN16258.

Emissions resulting from work (installation and maintenance) carried out by the TSPs are currently estimates using comparative values from similar used cases as a benchmark. With the introduction of the asset management system, Sitetracker, a comprehensive dashboard provides insight into the entire installation process, which will allow us to track installation times, site assignments and more.

With this information, ubitricity will be able to evaluate the scope of each job and calculate emissions more accurately.

Opportunity for Improvement:

- Reduce installation time
- Increase installation per day
- Implementation of efficient installation planning
- Investigate on reactive maintenance visits per month
- Regular training
- Sustainability report or equivalent in which shows yearly achievements and reduction of overall emissions by suppliers as a proof point (tracked with quarterly contract meetings)

6 References

SOURCE / DOCUMENT	FEATURE
Handboek CO_2-prestatieladder 3.1, 22 juni 2020	Stichting Klimaatvriendelijk Aanbesteden & Ondernemen
Corporate Accounting & Reporting standard	GHG-protocol, 2004
Corporate Value Chain (Scope 3) Accounting and Reporting Standard	GHG-protocol, 2010a
Product Accounting & Reporting Standard	GHG-protocol, 2010b
Nederlandse norm Environmental management – Life Cycle assessment – Requirements and guidelines	NEN-EN-ISO 14044
www.ecoinvent.org	Ecoinvent v2
www.bamco2desk.nl	BAM PPC-tool
www.milieudatabase.nl	Nationale Milieudatabase
http://edepot.wur.nl/160737	Alterra-rapport 2064
Calculator - CO2-CALCULATOR (carboncare.org)	CO2 calculator for transport (CarbonCare calculated according to ISO 14083:2023
CO2 emission standards for new cars and vans (europa.eu)	EPRS I European Parliamentary Research Service

Figure 13: Reference list for chain analysis E-mobility hardware supplier

The structure of this document is based on the Corporate Value Chain (Scope 3) Standard. In addition, where necessary, the methodology of the Product Accounting & Reporting Standard has been followed (see the table below).

CORPORATE VALUE CHAIN (SCOPE 3) STANDARD	PRODUCT ACCOUNTING & REPORTING STANDARD	CHAIN ANALYSIS
H3. Business goals & Inventory design	H3. Business Goals	Chapter 1
H4. Overview of Scope 3 emissions	-	Chapter 2
H5. Setting the Boundary	H7. Boundary Setting	Chapter 3
H6. Collecting Data	H9. Collecting Data & Assessing Data Quality	Chapter 4
H7. Allocating Emissions	H8. Allocation	Chapter 2
H8. Accounting for Supplier Emissions	-	Part of implementation of CO_2 Performance Ladder level 5
H9. Setting a reduction target	-	Chapter 5

Figure 14: Theoretical standard and substantiation of chain analysis E-mobility hardware supplier

7 | Signature

De Duurzame Adviseurs has extensive experience in drawing up chain analyses and is therefore considered a professionally recognized knowledge institute. See also the Declaration of Expertise (included with the chain analysis or can be requested separately). This lists which chain analyses have been drawn up by De Duurzame Adviseurs, including the subject, client, date and Certifying Institution by which the chain analysis has been approved. It also describes which advisors work for De Duurzame Adviseurs and what their knowledge and education level is.

This chain analysis was drawn up by Nadine Zabel and Asami Morita. The chain analysis was also checked by Jauk Cohen from the Duurzame adviseurs.

Signed for agreement:

ubitricity

Nadine Zabel/Asami Morita

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