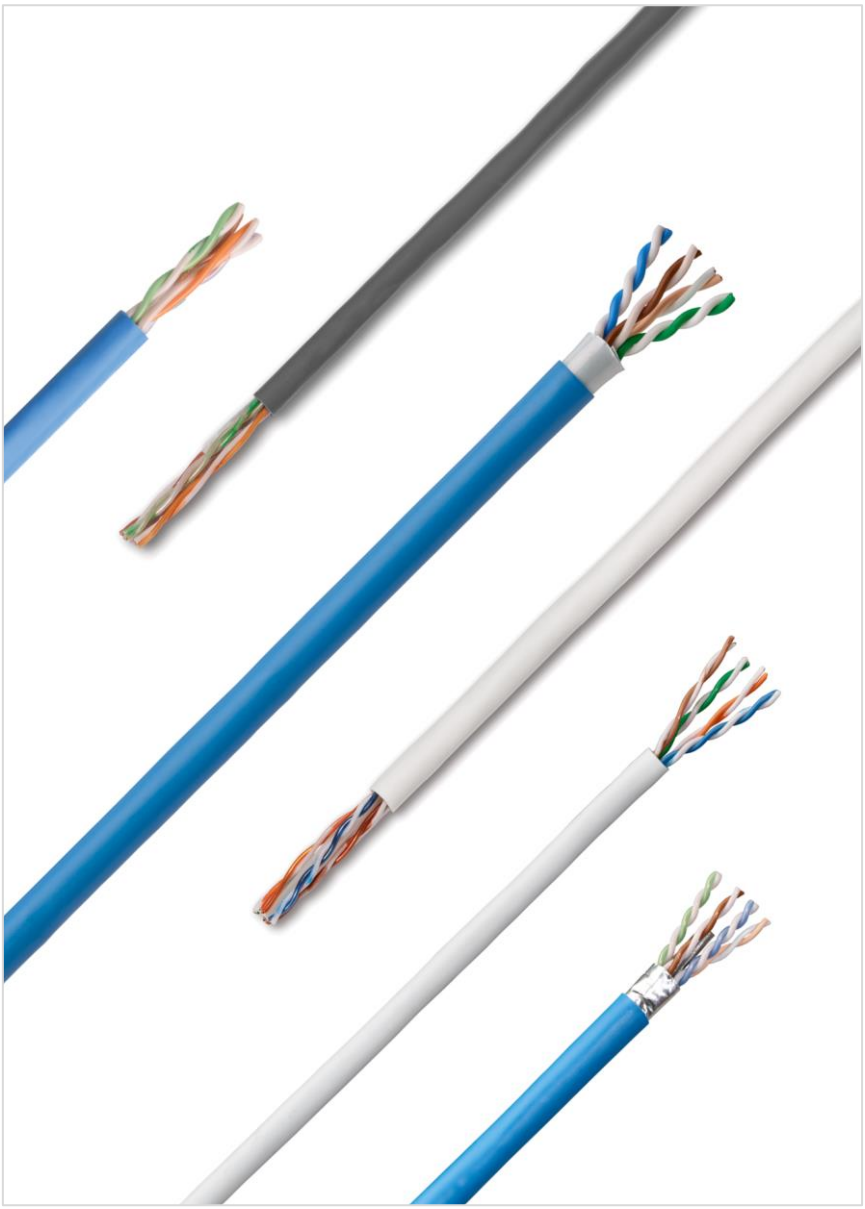
ENVIRONMENTAL PRODUCT DECLARATION

LEVITON COPPER DATA TRANSMISSION CABLE

PLENUM RATED



The image represents Leviton Network Solutions Plenum Copper 4 twisted pairs data communication cables

Every day, Leviton is engineering possibilities that make the future happen, meeting the needs of today's residential, commercial, and industrial customers globally. From electrical, to lighting, to data networks, and energy management, Leviton develops thoughtful solutions that help make its customers' lives easier, safer, more efficient, and more productive. Leviton is also driven by its commitment to sustainability. Leviton has created CN2030, a set of sustainability goals to achieve company-wide carbon neutrality by 2030, and to achieve net zero by 2050. The CN2030 program is based on the company's refreshed commitment to reduce its environmental impact in several key focus areas: energy, waste, recycling, water, and by creating innovations that empower and enable customers to be more sustainable.

ENVIRONMENTAL PRODUCT DECLARATION

Copper Plenum Cable: Hyper Plus 5e Plenum U/UTP Cable, LANMARK™-6 Plenum U/UTP, LANMARK-1000 Enhanced Cat 6 Plenum Rated Cable, LANMARK-6 FTP Plenum Category 6 F/UTP, LANMARK-10G FTP Plenum Category 6A, F/UTP, SST Cat 6A U/UTP Plenum Cable, LM-RDT Cat 6A U/UTP Plenum Cable, LANMARK-IP 5e Plenum Rated

According to ISO 14025 and ISO 21930:2017

EPD Program and Program Operator Name, Address, Logo, and Website	UL Solutions 333 Pfingsten rd, Northbrook IL, 60062 www.ul.com www.spot.ul.com
General Program Instructions and Version Number	Program Operator Rules v 2.7 2022
Manufacturer Name and Address	Leviton Network Solutions, 132 White Oak Road, New Holland, PA, 17557, United States of America
Declaration Number	4790742360.103.1
Declared Product & Functional Unit or Declared Unit	1 metre of Leviton copper plenum data communication cable at 70% utilization for 30 years
Reference PCR and Version Number	P.E.P Association. PCR for Electrical, Electronic and HVAC-R Products (2021) P.E.P Association. PSR Specific Rules for Wires, Cables and Accessories (2022)
Description of Product Application/Use	Data communication cable
Product RSL Description (if Appl.)	30 years with 70% use rate
Markets of Applicability	North America, International
Date of Issue	November 1, 2023
Period of Validity	5 Years
EPD Type	Product specific
Range of Dataset Variability	Manufacturer specific
EPD Scope	Cradle-to-grave
Year(s) of Reported Primary Data	2021
LCA Software & Version Number	Sphera's LCA for Experts v10.7
LCI Database(s) & Version Number	Sphera's Managed LCA Content, CUP 2022.2
LCIA Methodology & Version Number	IPCC AR6 , TRACI 2.1, and CML

The PCR review was conducted by:	P.E.P. Association PCR Review Panel contact@pep-ecopassport.org
This declaration was independently verified in accordance with ISO 14025: 2006. ☐ INTERNAL ☒ EXTERNAL	Cooper McCollum, UL Solutions
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	Sphera
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Thomas P. Gloria, Industrial Ecology Consultants

Limitations

Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc.

Accuracy of Results: EPDs regularly rely on estimations of impacts; the level of accuracy in estimation of effect differs for any particular product line and reported impact.

Comparability: EPDs from different programs may not be comparable. Full conformance with a PCR allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible". Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.

1. Product Definition and Information

1.1. Description of Company/Organization

Leviton Network Solutions is a single-source global manufacturer of copper and fiber cabling systems. Leviton Network Solutions is committed to protecting the environment through the design, manufacture, delivery of sustainable network infrastructure for data centers, businesses, schools, hospitals, government facilities, and commercial mixed-use markets around the world. All Leviton products are engineered to exacting standards while considering environmental impact through every step of our ISO 9001 certified product development process, from initial material sourcing to final packaging and logistics. Leviton's primary cable and connectivity factories are ISO 14001 and ISO 50001 certified for environmental and energy management systems and our EMEA headquarters was the first data communications factory to achieve BSI PAS 2060 Carbon Neutrality. Additionally, there are no substances of very high concern in Leviton's products.

1.2. Product Description

Product Identification:

There are three cable construction categories covered in this declaration as detailed below along with the respective product families. Product specifications are shown in Table 1. These plenum (CMP) cables are available in a range of lengths, packaging options, and colors.

Table 1: Product Specification

PLENUM	CATEGORY	CABLE TYPES	CABLE FAMILY	DESCRIPTION
Plenum 1	5e and 6	U/UTP	Hyper Plus 5e Plenum U/UTP Cable, LANMARK-6 Plenum U/UTP, LANMARK-1000 Enhanced Cat 6 Plenum Rated Cable	Leviton Category 5e U/UTP cables exceed Category 5e performance standards. They are rated to 100 MHz and are suitable for use in all Category 5e structured cabling systems, supporting 10/100/1000 BASE-T ethernet and Power over Ethernet at frequencies up to 100 MHz. Leviton Category 6 U/UTP cables exceed Category 6 performance standards. They are rated to 250 MHz and are suitable for use in all Category 6 structured cabling systems, supporting 10/100/1000 BASE-T ethernet and Power over Ethernet at frequencies up to 250 MHz.
Plenum 2	6 and 6A	U/UTP and F/UTP	LANMARK-6 FTP Plenum Category 6 F/UTP, LANMARK-10G FTP Plenum Category 6A, F/UTP, SST Cat 6A U/UTP Plenum Cable, LM-RDT Cat 6A U/UTP Plenum Cable	Leviton Category 6 U/UTP cables exceed Category 6 performance standards. They are rated to 250 MHz and are suitable for use in all Category 6 structured cabling systems, supporting 10/100/1000 BASE-T Ethernet and Power over Ethernet at frequencies up to 250MHz. Leviton Category 6A U/UTP cables exceed the Category 6A performance standards. They are rated to 500 MHz and are suitable for use in all Category 6A structured cabling systems, supporting speeds up to 10G BASE-T Ethernet and Power over Ethernet at frequencies up to 500 MHz.
Plenum 3	5e	U/UTP	LANMARK-IP 5e Plenum Rated	Leviton Category 5e U/UTP cables exceed Category 5e performance standards. They are rated to 100 MHz and are suitable for use in all Category 5e structured cabling systems, supporting 10/100/1000 BASE-T Ethernet and Power over

PLENUM	CATEGORY	CABLE TYPES	CABLE FAMILY	DESCRIPTION
				Ethernet at frequencies up to 100 MHz.

1.3. Product Average

This EPD represents the manufacturer specific products for cables. All the cables are a four twisted pair construction for data networking. All the cables that are manufactured using the same processes and materials have been grouped together and a product average calculation applied.

1.4. Application

Leviton Plenum rated copper cables are designed for use within buildings to deliver Ethernet protocols, up to 10 Gigabit Ethernet, and Power over Ethernet applications up to 100 watts. Application performance varies by product. For specific application guidance please reference the relevant product datasheet.

1.5. Declaration of Methodological Framework

This EPD is declared as “cradle-to-grave,” i.e., all stages of the life cycle have been included: manufacturing, distribution, installation, use, and end-of-life. The net benefits and loads beyond the system boundaries (potential for reuse, recovery, and/or recycling), expressed as net benefits or impacts, is also included. The analysis follows the modular structure as defined by ISO 21930.

Per the product specific rules (PEPecopassport® Program, 2021), the functional unit selected for this assessment is 1 meter (m) of copper data cable, at 70% utilization for 30 years.

1.6. Industry Standards

Cables are technically compliant with the following standards below:

- ANSI/TIA-568.2-D Cat 5e, Cat 6, and Cat 6A
- IEEE 802.3
- Power over HDBaseT™ PoH (95 watts)
- UL 444
- NFPA 262
- NFPA 70, CMP-LP
- RoHS compliant

1.7. Delivery Status

Plenum cables are delivered in bulk to the customer’s specified location using various transportation to distribution centers or stores and cut to desired length.

1.8. Material Composition

Table 2 shows the percent (%) composition of the material components that are used in the production of plenum cables covered in the study. Copper wire, FEP total, and PVC have the maximum material content in all products.

Table 2: Material composition of plenum copper data cables

Material	Plenum		
	Plenum 1	Plenum 2	Plenum 3
	%	%	%
Copper Wire weight/1m	31.90%	28.90%	40.70%
FEP insulation	30.90%	47.20%	44.70%
FRPP insulation	9.60%	-	-
Alum/PET Tape	-	5.40%	-
PVC (Filler + Jacket)	27.40%	18.50%	14.60%
Nylon Rip cord	0.20%	0.10%	-

FEP=Fluorinated Ethylene Propylene, FRPP=Flame retardant polypropylene, PVC= Polyvinyl Chloride

1.9. Manufacturing

The manufacturing process is presented in the Figure 1. The first stage of manufacture is wire drawing, where the diameter of the copper is reduced before annealing and heating. Afterwards, molten plastic is applied to the copper under high pressure creating the insulated primary core. It is then cooled, dried, and measured before beginning the second process, twisting. Twisting begins with two individual cores being twisted together to create a balanced pair. Four pairs are twisted together to create the four pair cabled unit, additional materials can be included at this stage to further improve electrical performance. Secondary extrusion takes the four pair cable unit and applies a protective plastic jacket to the cable before cooling. The cable is finally spooled onto reels or into boxes for distribution.

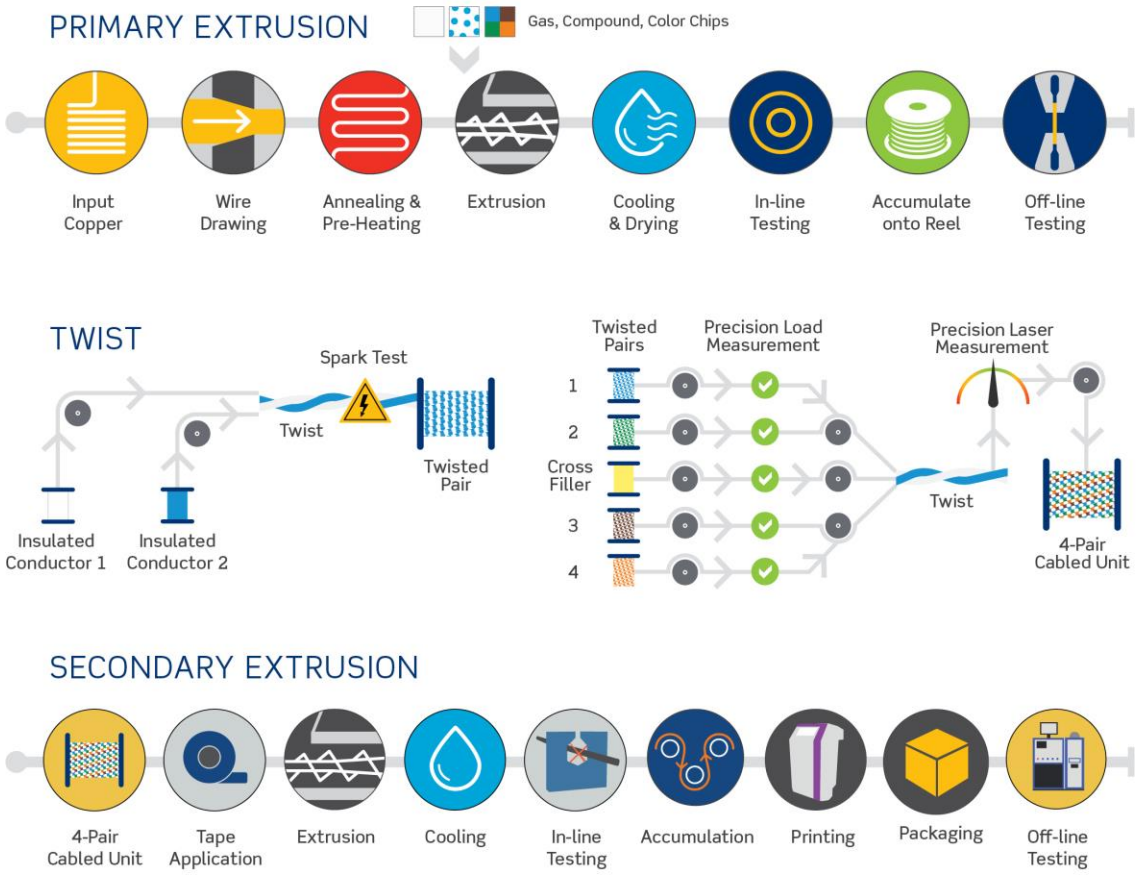


Figure 1: Cable manufacturing process diagram

1.10. Packaging

Cable can be packed and shipped using reels or boxes at 1000 ft and/or 1500 ft lengths. Most common products are sold in 1000 ft cardboard boxes or 1000 ft plastic and cardboard reels. Corrugated cardboard, wooden pallets, steel, and plastic film packaging materials are used in the reels and boxes. Cardboard packaging per meter of cable has minimal biogenic carbon and therefore, biogenic carbon from packaging is excluded from this assessment.

1.11. Transportation

Transportation includes the inbound freight of raw materials into the manufacturing stage, the outbound transportation of products to their installation sites, and the freight of wastes to their end-of-life disposal site. The only mode of transportation included in the study is by truck. Primary data on transportation distances was used when known, e.g., product distribution distances were provided by Leviton (i.e. 1000 km (621 mi) distribution distance in US). Unknown distances were modelled using the PCR (PEP Ecopassport® Program, 2021) default distances:

- International transport: 1,000 km (621 mi) by truck

- Domestic transport: 1,000 km (621 mi) by truck
- A range of transport distances between 800 km - 2100 km is considered in this study.

1.12. Product Installation

The installation of plenum copper data cables is assumed to be manual and therefore no energy use is accounted for in this stage. An installation loss of 5% is also assumed. Table 3 provides a list of input and output flows for the installation stage.

Table 3: Installation data for Plenum copper data cables

Type	Flow	Value	Unit
Inputs	Plenum data cable	0.038	kg/m
Outputs	Plenum data cable	0.036	kg/m
Outputs	Metal scrap	0.001	kg/m
Outputs	Plastic scrap	0.001	kg/m

1.13. Use

The product has operational energy consumption. The operational energy use stage (B6) specifies the operational energy use for each product as determined by the PCR (PEP Ecopassport® Program, 2021). As a conservative assumption, product groups were classified based on the highest power consumption product contained. Also specified in the PCR (PEP Ecopassport® Program, 2021) is a usage of 30 years and 70% utilization. For Plenum 1 cable, 1.134 mW/m is assumed, for Plenum 2 cable, 1.365 mW/m is assumed and for Plenum 3 cable, 0.462 mW/m is assumed.

1.14. Reference Service Life and Estimated Building Service Life

The plenum cables are assumed to have a reference service life of 30 years with 70% utilization.

1.15. Reuse, Recycling, and Energy Recovery

In the waste processing and disposal stage (C3 to C4), the PCR (PEP Ecopassport® Program, 2021) requires that all cables are assumed to be shredded, with the metal components recycled and the other (plastic) components incinerated. Energy and material credits are given to account for the electricity, thermal energy and secondary material generated from the incineration and recycling of wastes. The energy and secondary material generated during the disposal of these wastes can substitute an equivalent amount of virgin energy and materials. Recycling and incineration impacts are accounted in module C4.

1.16. Disposal

At the end of life, the cables are dismantled manually, metals are recycled, and plastics are incinerated. The waste from manufacturing, installation, and packaging are handled based on 20% incineration and 80% landfill. Regarding the transport to EoL (C2), according to the PCR (PEP Ecopassport® Program, 2021), the waste is transported 1000 km by truck. Metals are recycled and plastics are incinerated.

2. Life Cycle Assessment Background Information

2.1. Functional or Declared Unit

The functional unit selected for this assessment is 1 meter (m) of copper plenum data cable at 70% utilization for 30 years. This functional unit is consistent with the study's goals of calculating the environmental impact of copper wire which is used over distances of several meters. A reference flow is the quantity of product necessary for the system to deliver the performance described by the functional unit. Table 4 displays the linear densities for the analyzed product categories, i.e., the reference flows for each product category.

Table 4: Linear weights per functional unit of one meter of copper data cable.

PRODUCT	LINEAR DENSITY (KG/M)
Plenum 1	0.048
Plenum 2	0.079
Plenum 3	0.073

2.2. System Boundary

The system boundary of this study is cradle-to-grave, i.e., all stages of the life cycle have been included: manufacturing, distribution, installation, use, and end-of-life. The net benefits and loads beyond the system boundaries (potential for reuse, recovery, and/or recycling), expressed as net benefits or impacts, is also included.

Table 5 summarizes the major components included and excluded from the study, as required by the PCR (PEP Ecopassport® Program, 2021).

Table 5: System boundaries of the cradle-to-grave study

Production			Installation		Use stage*							End-of-Life				Next product system
Raw material supply (extraction, processing, recycled material)	Transport to manufacturer	Manufacturing	Transport from gate to building site	Installation into building	Use / application	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction / demolition	Transport to EoL	Waste processing for reuse, recovery, or recycling	Disposal	Reuse, recovery, or recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1*	C2	C3	C4	D
X	X	X	X	X	N/A	N/A	N/A	N/A	N/A	X	N/A	X	X	X	X	X
x: Declared module			N/A: Module not applicable		C1 is zero because deconstruction is done manually											

The impacts of the components excluded from the study are expected to be negligible compared to the impacts associated with the rest of the included stages.

As indicated by the PCR (PEP Ecopassport® Program, 2021), impacts related to production, transportation, installation, use, and end-of-life, up to final disposal of the flow required to supply the considered stage, shall be accounted in the corresponding stage. Likewise, all impacts related to waste (i.e., transport and processing) are considered in the modules in which the waste arises. In this way, each life cycle stage shall include all aspects related to its inputs and outputs. Key assumptions about the activities included in the declared modules within the system boundary are listed below.

Modules A1 to A3

The production stage includes provision of all raw materials and energy, as well as waste processing up to the disposal of final residues during the production stage.

These modules consider the manufacturing of raw materials, specifically copper wire and jacketing compounds, the transport to the production sites, and the manufacturing of the cables. This includes the drawing of the wire to the appropriate diameter, the extrusion of insulation, the twining of the paired cables, and the extrusion of the final jacket. The impact of packaging materials is included.

Module A4

Plenum products are manufactured in the US. This module considers 621 miles (1000 km) truck transport to site.

Module A5

An installation material loss of 5% was assumed based on company data. No energy is required for the installation process.

Credits are given to account for the electricity and thermal energy generated from the incineration of packaging wastes and any produced landfill gas. The electricity generated during the disposal of these wastes can substitute an equivalent amount of energy produced from the electricity grid, while thermal energy substitutes thermal energy produced from natural gas. These credits are declared in Module D and affect only the primary materials not the secondary materials.

Modules B1 to B7

In the use stage, the PSR (PEP Ecopassport® Program, 2022) states that the use or application of the product installed (B1), maintenance (B2), repair (B3), replacement (B4), restoration (B5), and water requirements (B7) are not applicable modules in the analysis of copper cable products.

Regarding the operational energy use stage (B6),

Table 6 specifies the operational energy use for each product as determined by the PCR (PEP Ecopassport® Program, 2021). As a conservative assumption, product groups were classified based on the highest power consumption product contained. Also specified in the PCR (PEP Ecopassport® Program, 2021), the product has a usage of 30 years and 70% utilization.

Table 6: Operational energy use phase power consumption

Product	Classification	Power Consumption (mW/m)
Plenum 1	Cat5e/6 U/UTP	1.134
Plenum 2	Cat6/6A U/UTP, F/UTP	1.365
Plenum 3	Cat 5e U/UTP	0.462

Modules C1 to C4

For the deconstruction and demolition stages (C1), manual dismantling is assumed. No loading in trucks or containers is needed.

Regarding the transport to EoL (C2), according to the PCR (PEP Ecopassport® Program, 2021), a transport distance of 1000 km by truck must be assumed.

In the waste processing and disposal stage (C3 to C4), the PCR (PEP Ecopassport® Program, 2021) requires that all cables are assumed to be shredded, metal components recycled, and the other (plastic) components incinerated. Energy and material credits are given to account for the electricity, thermal energy and secondary material generated from the incineration and recycling of wastes. The energy and secondary material generated during the disposal of these wastes can substitute an equivalent amount of virgin energy and materials. Recycling and incineration impacts are accounted in Module C4.

Module D

The credits for avoided primary production of recycled metals are accounted for in Module D. For the thermal and electrical energy generated in modules A5 and C3 due to the incineration of packaging and product waste, credits have

been calculated by using a regionalized electricity grid mix and thermal energy from natural gas.

No mandatory life cycle stages, relevant processes, or data needs have been omitted.

2.3. Estimates and Assumptions

The analysis uses the following assumptions:

- If inbound transportation distances were not provided for materials used in manufacturing, a default assumption of international transport: 1,000 km (621 mi) by truck and
- domestic transport: 1,000 km (621 mi) by truck were made using the PCR default distance.
- Installation is assumed to be manual (no energy use), and 5% installation loss is assumed for cables.

Since primary data were not available to describe end-of-life treatment, the default values specified by the PEP PCR (PEPecopassport® Program, 2021) were applied.

2.4. Cut-off Criteria

No cut-off criteria are defined for this study. As summarized in section 2.2, the system boundary was defined based on relevance to the goal of the study. For the processes within the system boundary, all available energy and material flow data have been included in the model. In cases where no matching life cycle inventories are available to represent a flow, proxy data have been applied based on conservative assumptions regarding environmental impacts.

2.5. Data Sources

The LCA model was created using the LCA for Experts Software system for life cycle engineering, developed by Sphera Inc. (Sphera, 2023). Background life cycle inventory data for raw materials and processes were obtained from the Managed LCA Content 2022.2 database. The information is documented online at https://sphera.com/life-cycle-assessment-lca-database/. Primary manufacturing data were provided by Leviton.

2.6. Data Quality

Measured primary data are considered to be of the highest precision, followed by calculated data, literature data, and estimated data. The goal is to model all relevant foreground processes using measured or calculated primary data.

2.7. Period under Review

Primary data collected represents the 2021 production year. Therefore, the analysis is intended to represent production of plenum cables for 2021.

2.8. Allocation

No multi-output allocation was required in the foreground system of the study. Allocation of background data (energy and materials) taken from the Managed LCA Content (MLC) 2022.2 databases is documented online at https://sphera.com/life-cycle-assessment-lca-database/.

This study uses the substitution EoL allocation approach and reports credits in Module D. A summary of the application

of the substitution approach in the different end-of-life fates is given below.

Material recycling (substitution approach): In the study, copper at the end of life is recycled and material credits are applied. The original burden of copper input is substituted using the mass of recovered secondary material.

Energy recovery (substitution approach): Plastics from the product, paper/corrugated board, metal, plastics, and woods used as packaging materials are sent to waste incineration. Credits are assigned for power and heat outputs using the regional grid mix and thermal energy from natural gas. The latter represents the cleanest fossil fuel and therefore results in a conservative estimate of the avoided burden.

Landfilling (substitution approach): Paper/corrugated board, metal, plastics, and woods are sent to landfills, they are linked to an inventory that accounts for waste composition, regional leakage rates, landfill gas capture as well as utilization rates. Credits are assigned for energy recovery from landfill gas due to landfilling of wood and cardboard packaging materials.

Allocation of background data (energy and materials) taken from the Managed LCA Content (MLC) 2022.2 databases is documented online at https://sphera.com/life-cycle-assessment-lca-database/.

3. Life Cycle Assessment Scenarios

Table 7: Transport to the building site (A4)

NAME	PLENUM 1	PLENUM 2	PLENUM 3	UNIT
Fuel type				
Liters of fuel	55	55	55	l/100km
Vehicle type	Truck	Truck	Truck	
Transport distance	1000	1000	1000	km
Capacity utilization (including empty runs, mass based	70	70	70	%
Gross density of products transported	-	-	-	kg/m^3
Weight of products transported (if gross density not reported)	0.042	0.050	0.066	kg
Volume of products transported (if gross density not reported)	-	-	-	m^3
Capacity utilization volume factor (factor: =1 or <1 or ≥ 1 for compressed or nested packaging products)	<1	<1	<1	-

Table 8: Installation into the building (A5)

NAME	PLENUM 1	PLENUM 2	PLENUM 3	UNIT
Ancillary materials	0	0	0	kg
Net freshwater consumption specified by water source and fate (amount evaporated, amount disposed to sewer)	-	-	-	m^3
Other resources	-	-	-	kg
Electricity consumption	-	-	-	kWh
Other energy carriers	-	-	-	MJ
Product loss per functional unit	0.002	0.002	0.003	kg
Waste materials at the construction site before waste processing, generated by product installation	-	-	-	kg

NAME	PLENUM 1	PLENUM 2	PLENUM 3	UNIT
Output materials resulting from on-site waste processing (specified by route e.g., for recycling, energy recovery, and/or disposal)	-	-	-	kg
Biogenic carbon contained in packaging	0.001	0.001	0.001	kg CO2
Direct emissions to ambient air, soil, and water				kg
VOC content				µg/m^3

Table 9: Reference Service Life

NAME	PLENUM 1	PLENUM 2	PLENUM 3	UNIT
RSL	30	30	30	years
Load frequency	1	1	1	
Fugitive emissions	-	-	-	
Energy requirement	0.751	0.904	0.306	MJ

Table 10: End of life (C1-C4)

NAME		PLENUM 1	PLENUM 2	PLENUM 3	UNIT
Assumptions for scenario development (description of deconstruction, collection, recovery, disposal method and transportation)					
Collection process (specified by type)	Collected separately				kg
	Collected with mixed construction waste	0.052	0.060	0.061	kg
Recovery (specified by type)	Reuse				kg
	Recycling	0.023	0.026	0.026	kg
	Landfill	0.004	0.004	0.005	kg
	Incineration	0.001	0.001	0.030	kg
	Incineration with energy recovery	0.024	0.029	0.029	kg
	Energy conversion efficiency rate	-	-	-	-
Disposal (specified by type)	Product or material for final deposition	0.004	0.004	0.005	kg
Removals of biogenic carbon (excluding packaging)		-	-	-	kg CO_2

Table 11: Reuse, recovery, and/or recycling potentials (D), relevant scenario information

NAME	PLENUM 1	PLENUM 2	PLENUM 3	UNIT
Net energy benefit from energy recovery from waste treatment declared as exported energy in C3 (R>0.6)	-	-	-	MJ
Net energy benefit from thermal energy due to treatment of waste declared as exported energy in C4 (R<0.6)	7.05E-02	8.48E-02	8.48E-02	MJ
Net energy benefit from material flow declared in C3 for energy recovery	1.63E-02	1.93E-02	3.45E-02	MJ
Process and conversion efficiencies	-		-	

Further assumptions for scenario development (e.g., further processing technologies, assumptions on correction factors);	-	-	-	

Plenum products are manufactured in the US. The energy datasets used to determine the impacts from the manufacturing and operation of use stage are provided in Table 12. No energy is used during the installation and end-of-life stages, as installation is assumed to be manual.

Table 12: Key energy datasets used in the inventory analysis

ENERGY	LOCATION	DATASET	DATA PROVIDER	REFERENCE YEAR	PROXY?
Electricity	US	Electricity grid mix	Sphera	2018	No
Thermal Energy	US	Thermal energy from natural gas	Sphera	2018	No

4. Life Cycle Assessment Results

Environmental Product Declarations (EPDs) created under different Product Environmental Profile (PEP) and Product Category Rules (PCR) are not comparable. Additionally, EPDs based on a declared unit shall not be used for comparisons between products, regardless of the EPDs using the same PCR.

There is no biogenic carbon in the product. the biogenic carbon in the packaging is minimal hence excluded from this assessment.

It shall be noted that the mentioned impact categories in this study represent impact potentials, i.e., they are approximations of environmental impacts that could occur if the emissions would (a) follow the underlying impact pathway and (b) meet certain conditions in the receiving environment while doing so. In addition, the inventory only captures that fraction of the total environmental load that corresponds to the functional unit (relative approach). LCIA results are therefore relative expressions only and do not predict actual impacts, the exceeding of thresholds, safety margins, or risks.

4.1. Life Cycle Impact Assessment Results

Cradle-to-grave results for the life cycle impact categories, use of resources, and generation of wastes for Leviton's Plenum's copper data cables are presented in tables below. The assessment results are provided as per IPCC AR6 and TRACI 2.1 that is relevant to North America for Leviton's copper cables. North American results are presented in Table 13 through Table 15 with corresponding figures. Since the products are intended for markets outside of North America and Europe, the Rest of the world impact assessment results using IPCC AR6 (GWP) and CML 2016 are also included in the report following part A of ULE PCR (ULE, 2022). Also, as per the PEP requirements, the total column of the result of the impacts calculated in the LCA does not include the results of the net benefits and loads (module D).

Table 13: North American results for Plenum 1- Cat 5e/6 U/UTP copper data cable

PARAMETERS	UNIT	TOTAL	A1-A3	A4	A5	B6	C2	C3	C4	D
GWP100	kg CO_2 eq.	5.88E-01	4.01E-01	4.88E-03	1.67E-03	1.06E-01	2.70E-03	0.00E+00	7.19E-02	-8.59E-02
ODP	kg CFC 11 eq.	1.40E-10	1.40E-10	9.19E-18	1.24E-17	8.46E-15	5.08E-18	0.00E+00	1.51E-15	-5.15E-15
AP	kg SO_2 eq.	1.90E-03	1.59E-03	1.75E-05	5.47E-06	1.48E-04	9.67E-06	0.00E+00	1.25E-04	-9.01E-04
EP	kg N eq.	7.68E-05	5.81E-05	1.68E-06	1.12E-06	1.18E-05	9.30E-07	0.00E+00	3.24E-06	-2.36E-05
SFP	kg O_3 eq.	1.54E-02	1.15E-02	4.05E-04	3.05E-05	2.09E-03	2.24E-04	0.00E+00	1.19E-03	-4.18E-03
ADPf	MJ	6.58E+00	4.97E+00	6.79E-02	3.88E-03	1.26E+00	3.76E-02	0.00E+00	2.41E-01	-1.20E+00

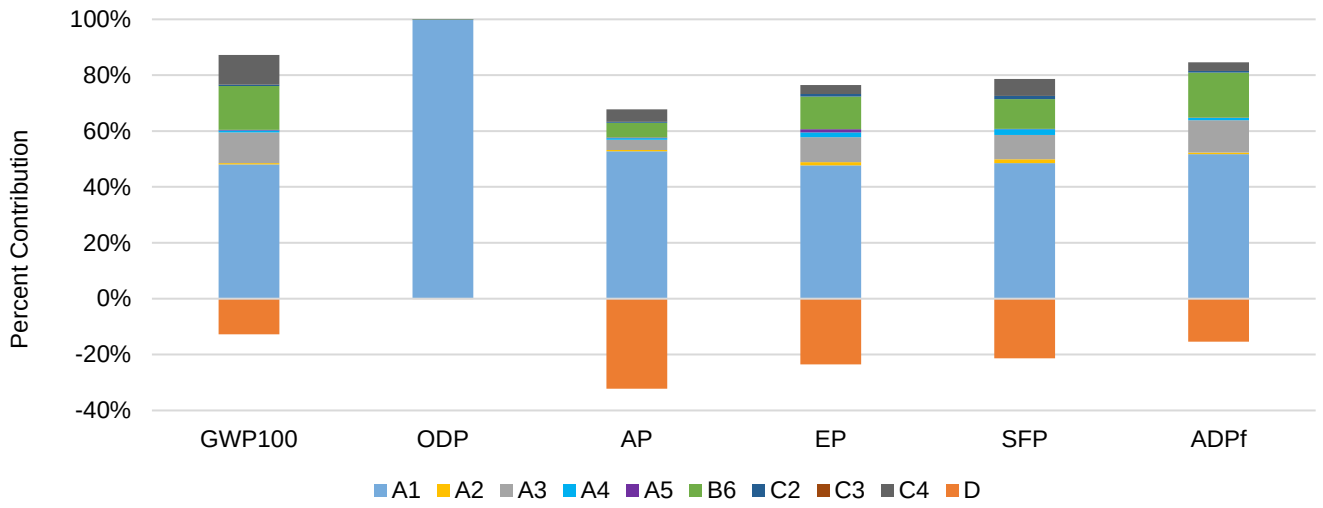


Figure 2: Contributions to the environmental impact categories for Plenum 1- Cat 5e/6 U/UTP copper data cable

Table 14: North American results for Plenum 2- Cat 6/6A U/UTP, F/UTP copper data cable

PARAMETERS	UNIT	TOTAL	A1-A3	A4	A5	B6	C2	C3	C4	D
GWP100	kg CO_2 eq.	8.05E-01	5.80E-01	5.77E-03	1.80E-03	1.27E-01	3.23E-03	0.00E+00	8.63E-02	-9.99E-02
ODP	kg CFC 11 eq.	1.38E-10	1.38E-10	1.09E-17	1.41E-17	1.02E-14	6.08E-18	0.00E+00	1.80E-15	-6.10E-15
AP	kg SO_2 eq.	2.57E-03	2.20E-03	2.07E-05	5.73E-06	1.78E-04	1.16E-05	0.00E+00	1.50E-04	-1.06E-03
EP	kg N eq.	9.79E-05	7.56E-05	1.99E-06	1.18E-06	1.42E-05	1.11E-06	0.00E+00	3.85E-06	-2.77E-05
SFP	kg O_3 eq.	2.00E-02	1.53E-02	4.79E-04	3.23E-05	2.51E-03	2.68E-04	0.00E+00	1.41E-03	-4.85E-03
ADPf	MJ	8.82E+00	6.89E+00	8.04E-02	4.29E-03	1.52E+00	4.49E-02	0.00E+00	2.87E-01	-1.35E+00

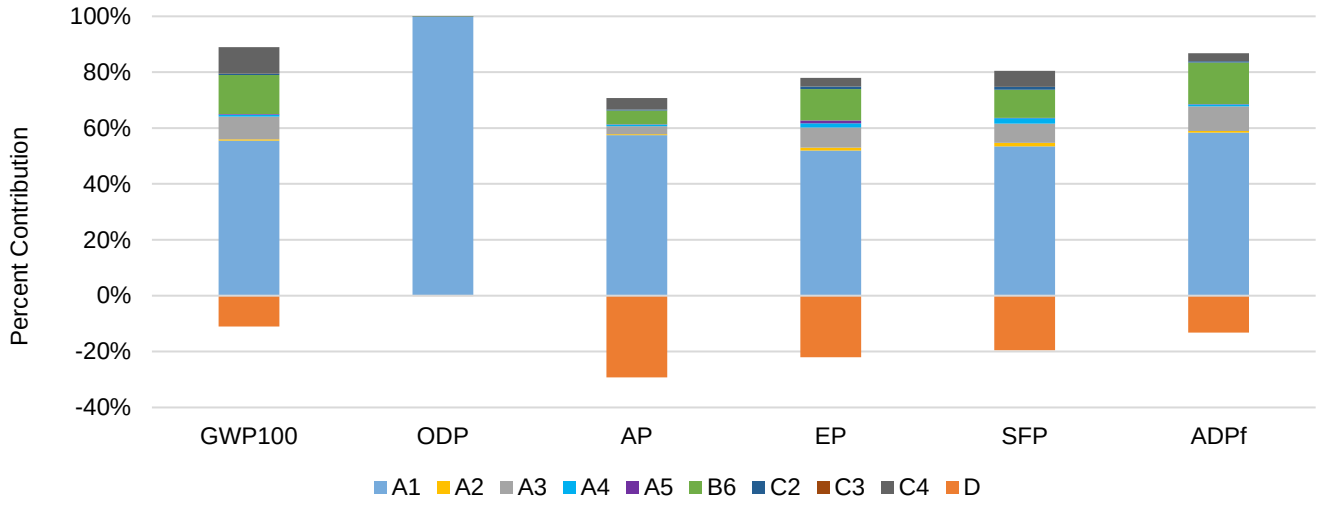


Figure 3: Contributions to the environmental impact categories for Plenum 2- Cat 6/6A U/UTP, F/UTP per 1 m of copper data cable.

Table 15: North American results for Plenum 3- Cat 5e U/UTP copper data cable

PARAMETERS	UNIT	TOTAL	A1-A3	A4	A5	B6	C2	C3	C4	D
GWP100	kg CO_2 eq.	8.29E-01	6.73E-01	7.46E-03	1.83E-03	4.31E-02	4.22E-03	0.00E+00	9.92E-02	-1.55E-01
ODP	kg CFC 11 eq.	1.38E-10	1.38E-10	1.40E-17	1.56E-17	3.45E-15	7.95E-18	0.00E+00	2.69E-15	-9.97E-15
AP	kg SO_2 eq.	3.36E-03	3.07E-03	2.67E-05	5.87E-06	6.02E-05	1.51E-05	0.00E+00	1.80E-04	-1.87E-03
EP	kg N eq.	1.16E-04	9.97E-05	2.57E-06	1.19E-06	4.80E-06	1.46E-06	0.00E+00	5.84E-06	-4.72E-05
SFP	kg O_3 eq.	2.33E-02	1.92E-02	6.19E-04	3.47E-05	8.50E-04	3.50E-04	0.00E+00	2.22E-03	-7.97E-03
ADPf	MJ	8.86E+00	7.75E+00	1.04E-01	4.83E-03	5.14E-01	5.88E-02	0.00E+00	4.26E-01	-1.88E+00

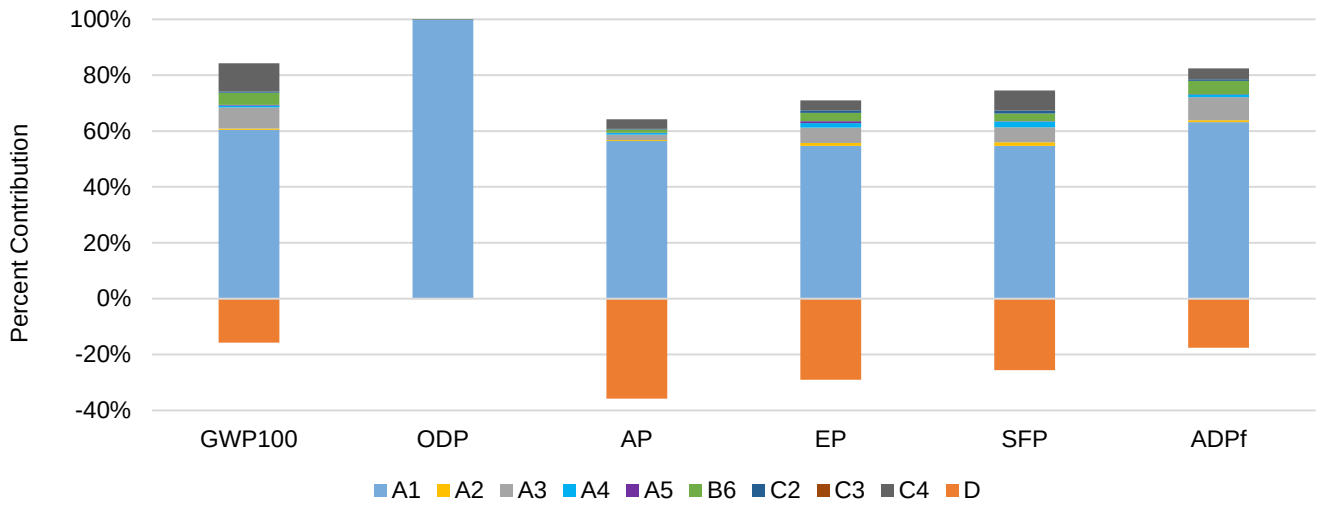


Figure 4: Contributions to the environmental impact categories for Plenum 3- Cat 5e U/UTP, per 1 m of copper data cable

Rest of World Results: International results are added in the following tables below from Table 16 to Table 18.

Table 16: Rest of world results for Plenum 1- Cat 5e/6 U/UTP copper data cable

Parameter	Unit	Total	A1-A3	A4	A5	B6	C2	C3	C4	D
GWP100	kg CO_2 eq.	5.88E-01	4.01E-01	4.88E-03	1.67E-03	1.06E-01	2.70E-03	0.00E+00	7.19E-02	-8.59E-02
ODP	kg R11 eq.	1.25E-10	1.24E-10	5.20E-16	7.23E-16	4.87E-13	2.88E-16	0.00E+00	8.76E-14	-2.97E-13
AP	kg SO_2 eq.	1.98E-03	1.71E-03	1.28E-05	3.73E-06	1.42E-04	7.07E-06	0.00E+00	1.06E-04	-1.02E-03
EP	kg Phosphate eq.	1.13E-04	8.36E-05	3.81E-06	1.41E-06	1.53E-05	2.11E-06	0.00E+00	7.24E-06	-3.10E-05
POCP	kg Ethene eq.	1.21E-04	1.10E-04	-2.31E-06	6.52E-07	1.05E-05	-1.28E-06	0.00E+00	3.56E-06	-4.85E-05

Table 17: Rest of world results for Plenum 2- Cat 6/6A U/UTP, F/UTP copper data cable

Parameter	Unit	Total	A1-A3	A4	A5	B6	C2	C3	C4	D
GWP100	kg CO_2 eq.	8.05E-01	5.80E-01	5.77E-03	1.80E-03	1.27E-01	3.23E-03	0.00E+00	8.63E-02	-9.99E-02
ODP	kg R11 eq.	1.23E-10	1.23E-10	6.16E-16	8.21E-16	5.87E-13	3.44E-16	0.00E+00	1.04E-13	-3.52E-13
AP	kg SO_2 eq.	2.70E-03	2.37E-03	1.51E-05	3.94E-06	1.71E-04	8.45E-06	0.00E+00	1.27E-04	-1.20E-03
EP	kg Phosphate eq.	1.46E-04	1.11E-04	4.51E-06	1.48E-06	1.84E-05	2.52E-06	0.00E+00	8.62E-06	-3.60E-05
POCP	kg Ethene eq.	1.56E-04	1.42E-04	-2.73E-06	6.55E-07	1.26E-05	-1.53E-06	0.00E+00	4.23E-06	-5.69E-05

Table 18: Rest of world results for Plenum 3- Cat 5e U/UTP copper data cable

Parameter	Unit	Total	A1-A3	A4	A5	B6	C2	C3	C4	D
GWP100	kg CO_2 eq.	8.29E-01	6.73E-01	7.46E-03	1.83E-03	4.31E-02	4.22E-03	0.00E+00	9.92E-02	-1.55E-01
ODP	kg R11 eq.	1.23E-10	1.23E-10	7.95E-16	9.08E-16	1.99E-13	4.50E-16	0.00E+00	1.56E-13	-5.75E-13
AP	kg SO_2 eq.	3.59E-03	3.35E-03	1.95E-05	4.05E-06	5.78E-05	1.11E-05	0.00E+00	1.51E-04	-2.11E-03
EP	kg Phosphate eq.	1.71E-04	1.41E-04	5.82E-06	1.50E-06	6.24E-06	3.30E-06	0.00E+00	1.32E-05	-5.95E-05
POCP	kg Ethene eq.	1.96E-04	1.90E-04	-3.53E-06	6.56E-07	4.26E-06	-2.00E-06	0.00E+00	6.65E-06	-9.77E-05

4.2. Life Cycle Inventory Results

Use of resources, generation of wastes and carbon emissions and removals for Leviton's jacks and panels as per ISO 21930 (ISO, 2017) are presented from Table 19 through Table 24.

Table 19: Resource Use for Plenum 1- Cat 5e/6 U/UTP copper data cable

Parameter	Unit	Total	A1-A3	A4	A5	B6	C2	C3	C4	D
RPRe	MJ	1.19E+00	7.73E-01	2.66E-03	4.36E-04	3.64E-01	1.47E-03	0.00E+00	4.68E-02	-2.19E-01
RPRm	MJ	4.10E-02	4.10E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRPRe	MJ	7.60E+00	5.55E+00	6.84E-02	4.05E-03	1.68E+00	3.78E-02	0.00E+00	2.69E-01	-1.25E+00
NRPRm	MJ	1.14E+00	1.14E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	MJ	-	-	-	-	-	-	-	-	-
RSF	MJ	-	-	-	-	-	-	-	-	-
NRSF	MJ	-	-	-	-	-	-	-	-	-
RE	MJ	-	-	-	-	-	-	-	-	-
FW	m3	3.72E-03	2.81E-03	9.56E-06	3.74E-06	6.90E-04	5.29E-06	0.00E+00	1.99E-04	-8.51E-04

Table 20: Resource Use for Plenum 2- Cat 6/6A U/UTP, F/UTP copper data cable

Parameter	Unit	Total	A1-A3	A4	A5	B6	C2	C3	C4	D
RPRe	MJ	1.53E+00	1.03E+00	3.15E-03	4.88E-04	4.39E-01	1.76E-03	0.00E+00	5.57E-02	-2.59E-01
RPRm	MJ	4.10E-02	4.10E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRPRe	MJ	1.01E+01	7.64E+00	8.09E-02	4.48E-03	2.02E+00	4.52E-02	0.00E+00	3.21E-01	-1.41E+00
NRPRm	MJ	1.33E+00	1.33E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	MJ	-	-	-	-	-	-	-	-	-
RSF	MJ	-	-	-	-	-	-	-	-	-
NRSF	MJ	-	-	-	-	-	-	-	-	-
RE	MJ	-	-	-	-	-	-	-	-	-

FW	m3	5.16E-03	4.07E-03	1.13E-05	4.06E-06	8.31E-04	6.32E-06	0.00E+00	2.38E-04	-9.97E-04

Table 21: Resource Use for Plenum 3- Cat 5e U/UTP copper data cable

Parameter	Unit	Total	A1-A3	A4	A5	B6	C2	C3	C4	D
RPRe	MJ	1.48E+00	1.24E+00	4.07E-03	5.46E-04	1.48E-01	2.30E-03	0.00E+00	8.59E-02	-4.23E-01
RPRm	MJ	4.10E-02	4.10E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRPRe	MJ	9.91E+00	8.58E+00	1.05E-01	5.06E-03	6.84E-01	5.92E-02	0.00E+00	4.81E-01	-1.94E+00
NRPRm	MJ	1.46E+00	1.46E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SW	MJ	-	-	-	-	-	-	-	-	-
RSF	MJ	-	-	-	-	-	-	-	-	-
NRSF	MJ	-	-	-	-	-	-	-	-	-
RE	MJ	-	-	-	-	-	-	-	-	-
FW	m3	5.59E-03	4.97E-03	1.46E-05	4.38E-06	2.81E-04	8.27E-06	0.00E+00	3.12E-04	-1.66E-03

Table 22: Output Flows and Waste Categories for Plenum 1- Cat 5e/6 U/UTP copper data cable

Parameter	Unit	Total	A1-A3	A4	A5	B6	C2	C3	C4	D
HWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD	kg	2.85E-02	0.00E+00	0.00E+00	4.91E-03	0.00E+00	0.00E+00	2.36E-02	0.00E+00	0.00E+00
HLRW	kg	4.63E-07	2.58E-07	2.25E-10	7.58E-11	1.95E-07	1.24E-10	0.00E+00	9.11E-09	-2.37E-08
ILLRW	kg	4.00E-04	2.26E-04	1.89E-07	6.60E-08	1.63E-04	1.05E-07	0.00E+00	1.11E-05	-2.00E-05
CRU	kg	-	-	-	-	-	-	-	-	-
MR	kg	-	-	-	-	-	-	-	-	-
MFR	kg	2.33E-02	7.02E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.63E-02	0.00E+00	0.00E+00
EE	MJ	1.48E-01	0.00E+00	0.00E+00	3.78E-03	0.00E+00	0.00E+00	0.00E+00	1.45E-01	0.00E+00

Table 23: Output Flows and Waste Categories for Plenum 2- Cat 6/6A U/UTP, F/UTP copper data cable

Parameter	Unit	Total	A1-A3	A4	A5	B6	C2	C3	C4	D
HWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD	kg	3.38E-02	0.00E+00	0.00E+00	5.30E-03	0.00E+00	0.00E+00	2.85E-02	0.00E+00	0.00E+00
HLRW	kg	5.78E-07	3.31E-07	2.66E-10	8.47E-11	2.35E-07	1.49E-10	0.00E+00	1.08E-08	-2.80E-08
ILLRW	kg	5.03E-04	2.93E-04	2.24E-07	7.38E-08	1.96E-04	1.25E-07	0.00E+00	1.31E-05	-2.36E-05
CRU	kg	-	-	-	-	-	-	-	-	-
MR	kg	-	-	-	-	-	-	-	-	-
MFR	kg	2.63E-02	7.02E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.93E-02	0.00E+00	0.00E+00
EE	MJ	1.78E-01	0.00E+00	0.00E+00	4.07E-03	0.00E+00	0.00E+00	0.00E+00	1.74E-01	0.00E+00

Table 24: Output Flows and Waste Categories for Plenum 3- Cat 5e U/UTP copper data cable

Parameter	Unit	Total	A1-A3	A4	A5	B6	C2	C3	C4	D
HWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD	kg	3.40E-02	0.00E+00	0.00E+00	6.04E-03	0.00E+00	0.00E+00	2.80E-02	0.00E+00	0.00E+00
HLRW	kg	4.59E-07	3.61E-07	3.43E-10	1.02E-10	7.95E-08	1.94E-10	0.00E+00	1.74E-08	-2.87E-08
ILLRW	kg	4.11E-04	3.23E-04	2.89E-07	8.88E-08	6.64E-05	1.64E-07	0.00E+00	2.17E-05	-2.44E-05
CRU	kg	-	-	-	-	-	-	-	-	-
MR	kg	-	-	-	-	-	-	-	-	-
MFR	kg	4.15E-02	7.02E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.45E-02	0.00E+00	0.00E+00
EE	MJ	1.75E-01	0.00E+00	0.00E+00	4.05E-03	0.00E+00	0.00E+00	0.00E+00	1.71E-01	0.00E+00

5. LCA Interpretation

The supply of raw materials (including their extraction and processing, module A1) is the main driver (55%-100%) of the potential environmental impacts associated with the production of 1 m of plenum copper data cables. (A3) manufacturing (9%-15%), operational energy use (B6) (5%-18%) and end-of-life disposal (C4) (4%-12%) also contribute to noticeable impacts.

Installation (A5) has minimal contribution (1%) across all impact categories for all products. Outbound transport of products (A4) (1%-2%) and transport for end-of-life disposal (C2) (0%-2%) are minor contributors to all impact categories.

End-of-life disposal (C4) has noticeable contributions to acidification, smog formation, and global warming potential. Recycling metal components at the end of copper cables life provides significant benefits by avoiding environmental burdens associated with the production of the cables. Credits at the end-of-life (D) are earned from both the recycling of metals and the thermal and electrical energy benefits from incineration. The greatest benefits are derived from recycling.

Raw material (A1) contributes the most (55%-72%) to GWP, followed by operational energy use (B6) (5%-18%), manufacturing (A3) (9%-13%), and disposal of waste (C4) (11%-12%). Recycling of copper contributes to reducing some (12%-19%) of the environmental burden. Almost all (99%) of all ODP originates during extraction and processing of raw materials.

6. Additional Environmental Information

6.1. Environmental Activities and Certifications

This report has been generated through Leviton's System Verification Laboratory (SVL). Leviton Network Solutions has long been motivated by sustainability goals. Our copper and fiber cable manufacturing facility in Glenrothes, UK, has been carbon neutral since 2011, a first step toward accomplishing CN2030, our initiative to achieve carbon neutrality across our operations by 2025, with an ambition to be net zero by 2050. Also, Leviton Network Solutions' environmental activities include: the first data communications cable factory to achieve BSI PAS 2060 Carbon Neutrality, all manufacturing facilities are ISO 9001 Certified, and primary cable and connectivity factories are ISO 14001 and ISO 50001 Certified. Also, all manufacturing facilities comply with Conflict Minerals regulations, including supply chain contracts and supplier reviews.

6.2. Further Information

Leviton's CN2030 sustainability program to achieve carbon neutrality is based on the company's refreshed commitment to reduce its environmental impact in several focus areas: energy, waste, recycling, water, and by creating innovations that empower and enable customers to be more sustainable. Learn more about Leviton Network Solutions' sustainability commitments: www.leviton.com/sustainability.

7. References

EPA. (2020). *Advancing Sustainable Materials Management: 2018 Fact Sheet, Assessing Trends in Materials Generation and Management in the United States.* EPA.

IPCC. (2022). *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge UK and New York NY: Cambridge University Press.*

ISO. (2006). *ISO 14040: Environmental management - Life cycle assessment - principles and frameworks.*

ISO. (2006). *ISO 14044: Environmental management - Life cycle assessment - Requirements and guidelines.*

ISO. (2011). *ISO 14025: Environmental labels and declarations - Type III environmental declarations - principles and procedures.*

ISO. (2017). *ISO 21930 Sustainability in building construction - Environmental declaration of building products.*

PEP Ecopassport® Program. (2021). *PCR Product Category Rules for Electrical, Electronic and HVAC-R Products.* Paris: PEP Ecopassport® Program.

PEP Ecopassport® Program. (2022). *Product Specific Rules for Wires, Cables and Accesories.* Paris: PEP Ecopassport® Program.

Sphera. (2023). *LCA for Experts Documentation. Retrieved from Sphera: https://sphera.com/life-cycle-assessment-lca-software/. Sphera.* Sphera.

Tarluz. (n.d.). *Which type to use? 8 types of copper patch cord UTP, STP, FTP etc*. Retrieved from Tarluz, Quality and Service: http://www.tarluz.com/copper-network/which-type-to-use-8-types-of-copper-patch-cord-utp-stp-ftp-etc/

ULE. (2022). *Product Category Rules for Building-Related Products and Services-Part A: Life Cycle Assessment Calculation Rules and Report Requirements, v4.0.*

ULE. (March 2022). *UL Environment General Program Instructions v2.7.*

8. Contact Information

Study Commissioner

Leviton
201 N. Service Road, Melville,
NY 11747
United States
http://leviton.com

LCA Practitioner

Sphera Solutions, Inc.
130 E Randolph St, #2900
Chicago, IL 60601
sphera.com/contact-us
sphera.com