Environmental Product Declaration

RAYCHEM Electronic Thermostats

RAYCHEM RAYSTAT V5, HWAT ECO, ELEXANT 450C

RAYCHEM electronic thermostats providing the most energy efficient pipe freeze protection or electronic floor heating as well as temperature maintenance control system.

chemelex
excellence is everything

Chemelex is a global leader in electrical heat tracing products and services, mineral-insulated fire rated wiring, electrical floor heating systems, and fluid Leak detection systems. The company supports customers with products and services in industries ranging from commercial and residential construction, data centers, energy, industrial process heating and transportation. Its products are marketed globally under leading brands including Raychem, Tracer, Pyrotenax, and NuHeat.

Chemelex's Raychem brand is at the forefront of the heat tracing industry. Products include industrial process heating systems, pipe freeze protection, surface snow melting & de-icing, floor heating, and hot water temperature maintenance. Raychem's solutions are vital in sectors including energy, infrastructure, and commercial & residential building. Applications ensure accurate temperature maintenance for operational efficiency, enhanced safety and customer comfort.

UL CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION UL.COM/EPD

ENVIRONMENTAL PRODUCT DECLARATION

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RAYCHEM RayStat V5, HWAT ECO, Elexant 450c
Electronic control unit

According to ISO 14025 and EN 15804+A2

EPD PROGRAM AND PROGRAM OPERATOR NAME, ADDRESS, LOGO, AND WEBSITE	UL Solutions www.ul.com 333 Pfingsten Rd, Northbrook, IL 60062 www.spot.ul.com
GENERAL PROGRAM INSTRUCTIONS AND VERSION NUMBER	UL Solutions General Program Instructions v.2.7 2022
MANUFACTURER NAME AND ADDRESS	Chemelex, 15375 Memorial Drive, Houston, TX 77079, United States
DECLARATION NUMBER	4791545949.108.1
DECLARED PRODUCTS	1 unit of RayStat V5 1 unit of HWAT ECO 1 unit of Elexant 450c
FUNCTIONAL UNIT	Control the ambient temperature set by the user in a defined temperature range, as per the product specifications, in one zone, for pipe freeze protection or floor heating applications, and for the reference service life of the product.
REFERENCE PCR AND VERSION NUMBER	Core PCR: EN 15804:2012+A2:2019 PCR: PEP-PCR-ed4-EN-2021 09 06 PSR: PSR-0005-ed3-EN-2023 06 06
DESCRIPTION OF PRODUCT APPLICATION/USE	Electronic control and monitoring unit for self-regulating heating cables
PRODUCT RSL DESCRIPTION (IF APPL.)	10 years
MARKETS OF APPLICABILITY	Global
DATE OF ISSUE	April 21, 2025
PERIOD OF VALIDITY	5 Years
EPD TYPE	Product-specific
RANGE OF DATASET VARIABILITY	N/A
EPD SCOPE	Cradle-to-grave
YEAR(S) OF REPORTED PRIMARY DATA	2023
LCA SOFTWARE & VERSION NUMBER	LCA For Experts 10.8
LCI DATABASE(S) & VERSION NUMBER	Sphera MLC 2024.2
LCIA METHODOLOGY & VERSION NUMBER	EF 3.1 (as per EN 15804+A2)
The PCR review was conducted by:	PepEcoPassport 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:	WAP Sustainability
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Peter Yeon, H.I.P. Pathway

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

Chemelex is a global leader in electric thermal and sensing solutions, protecting the world's critical processes, places and people. With over 50 years of innovation and a commitment to excellence, we develop solutions that ensure safety, reliability, and efficiency in diverse environments – from industrial plants and data centers to people's homes. Chemelex delivers future-ready technologies, advanced engineering capabilities and local expertise backed by global standards. Our offering includes a leading portfolio from our trusted brands: Raychem, Tracer, Nuheat and Pyrotenax.

1.2. Product Description

RAYCHEM RAYSTAT V5

RAYCHEM RAYSTAT V5 is an electronic line sensing or proportional ambient sensing (PASC) controller for self-regulating heating cables. Wall mountable for outdoor location, it measures ambient temperature and determines the cycle time when the heating cables will be energized, resulting in very significant energy savings.

RAYCHEM Elexant 450c

The reference product for RAYCHEM Elexant controller is Elexant 450c. This controller is designed for operation with the Chemelex RAYCHEM heating cables. It is available in 2 versions: Elexant 450c (standard version), and Elexant 450c-Modbus allowing flexible Modbus connectivity for remote monitoring, configuration, and ease of integration in a Building Management System (BMS).

Table 1: Products covered in the EPD

PRODUCT NUMBER	PRODUCT NAME	COMMUNICATION PROTOCOL
1244-022623	ELEXANT 450c-Modbus	Modbus RTU
1244-021970	ELEXANT 450c	None
1244-022835	ELEXANT 650c-Modbus	Modbus RTU

RAYCHEM HWAT ECO

The reference product for RAYCHEM HWAT-ECO is the HWAT ECO V5. It is an energy efficient control and monitoring unit for Chemelex RAYCHEM HWAT self-regulating single pipe hot water systems. It provides flexible temperature control and additional energy savings, with integrated functions that lower the maintain temperature during low use periods.

Table 2: Products included in the EPD, HWAT ECO

PRODUCT NUMBER	PRODUCT NAME
1244-022835	HWAT ECO-V5
P000002274	HWAT ECO-GF

1.3. Application

RAYCHEM RAYSTAT V5

RAYCHEM RayStat V5 control unit has been developed for operation with Raychem self-regulating heating cables: RAYCHEM XL-Trace LSZH, WinterGard, and ETL. The unit provides temperature control for freeze protection applications with both line sensing, and ambient sensing with PASC, for increased energy efficiency.

RAYCHEM Elexant 450c

RAYCHEM Elexant 450c is the next generation touch screen heat tracing controller for dual independent heating zone control, with multiple integrated sensing modes and remote alarm capability, providing energy efficient pipe freeze protection and temperature maintenance control.

RAYCHEM HWAT ECO

RAYCHEM HWAT-ECO is an energy efficient control and monitoring unit for RAYCHEM HWAT self-regulating single pipe hot water systems. It provides flexible temperature control and additional energy savings, with integrated functions that lower the maintain temperature during low use periods and during “Tapping” times.

1.4. Technical Requirements

The technical requirements are available on the Chemelex product page under engineering specifications:
https://www.nvent.com/en-gb/raychem/products/raystat-v5-control-unit-0

https://www.nvent.com/en-lt/raychem/products/elexant-450c-control-unit-0

https://www.nvent.com/en-us/raychem/products/hwat-eco-electronic-control-unit-0

1.5. Properties of Declared Product as Delivered

The product is packaged in a cardboard box.

1.6. Material Composition

Table 3: Material composition, per unit

MATERIAL	WEIGHT [%]		
	RayStat v5	Elexant 450c	HWAT ECO
STEEL	12	2	11
PLASTIC	68	36	56
ELECTRONICS	19	62	33
TOTAL	**100**	**100**	**100**

1.7. Manufacturing

The manufacturing process of the RAYCHEM RAYSTAT V5, ELEXANT 450C or HWAT ECO begins with the reception of a purchase order from the customer, which the sales team processes to determine the required quantity and shipment details. After receiving the PO from the customer, the order is launched at the production site starting with the material orders and quality check upon arrival.

The store team then starts the kitting, while the mechanical team prints the housings, followed by a visual inspection. At the same time, the electronic components are being made (soldering paste printing on stencil printer, followed by component placement, reflow oven). The base assembly board is assembled with the THT components and sent to a solder wave oven. LED and touch operation test are then full functionality tested. The display board is installed as well as the necessary cables, followed by the PCB board installation, connection of display board and PCB board, then another full functionality test is performed. Finally, the M25 sealing plugs are installed and the housing parts are put together to complete manufacturing.

1.8. Packaging

The product packaging is made from recyclable materials.

The materials and components received from supplier for product manufacturing was also taken into account as per requirements from PSR section 3.1.5.1 (P.E.P. Association, 2023). An average packaging content of 5% of the reference input material has been considered and broken down as followed: 50% wood, 40% cardboard and 10% low-density polyethylene. This packaging is assumed to be disposed according to the European default scrap rates from Table 3 of the PSR in absence of specific data (P.E.P. Association, 2023).

1.9. Transportation

The units are assembled in Jordan and shipped from Jordan to the Chemelex EU distribution center in Leuven by boat or by air freight. From Leuven the units are shipped by truck or air to customers all over Europe and Asia.

1.10. Product Installation

Installation only requires the use of hand tools and no product loss is expected. The product packaging is removed during installation and sent to disposal. No maintainance is required after installation.

1.11. Use

The electronic controllers and thermostats operate on electricity during their use stage. Their full operation is estimated to be during 4 hours per day during four months over a year (480 hours), while they operate at steady state for the remaining time (8280 hours).

	RAYSTAT V5	ELEXANT 450C	HWAT ECO
POWER CONSUMPTION – FULL OPERATION	3 W	3 W	3 W
POWER CONSUMPTION – STEADY STATE	2.2 W	2.4 W	3 W

1.12. Reference Service Life

	RAYSTAT V5	ELEXANT 450C	HWAT ECO
REFERENCE SERVICE LIFE (YEARS)	10		

1.13. Reuse, Recycling, and Energy Recovery

The end-of-life disposal rates (recycling, energy recovery, and disposal) used in the study were based on EN 50639:2019 – Product category rules for life cycle assessments of electronic and electrical products and systems, Table G.4, and as shown in Table 4.

Table 4: End-of-life disposal rates

	MATERIAL RECOVERY RATE (%)	ENERGY RECOVERY RATE (%)	DISPOSAL RATE (%)
COPPER	60	0	40
ALUMINUM	70	0	30
STEEL	80	0	20
PLASTIC	20	40	40
ELECTRONICS	50	0	50
MINERALS AND OTHER ADDITIVES	0	0	100

1.14. Disposal

The thermostat must be disposed of as Waste Electrical and Electronic Equipment (WEEE directive) according to local regulations.

2. Life Cycle Assessment Background Information

2.1. Functional Unit

The functional unit is to "*control the ambient temperature set by the user in a defined temperature range, as per the product specifications, in one zone, for pipe freeze protection or floor heating applications, and for the reference service life of the product*".

The associated reference flow is one unit of electronic controller or thermostat installed.

2.2. System Boundary

This EPD is a Cradle-to-Grave study.

2.3. Estimates and Assumptions

All estimates and assumptions are within the requirements of ISO 14040/44 and EN 15804+A2. The primary data was collected as annual totals for electricity usage and production volume. The utility usage information was divided by the production to find a utility consumption per kilometer of cable produced.

2.4. Cut-off Criteria

Material inputs greater than 1% (based on total mass of the final product) were included within the scope of analysis. Material inputs less than 1% were included if sufficient data was available to warrant inclusion and/or the material input was thought to have significant environmental impact. Cumulative excluded material inputs and environmental impacts are less than 5% based on total weight of the functional unit.

2.5. Data Sources

Primary data were collected by facility personnel and from utility bills and was used for all manufacturing processes. Whenever available, supplier data was used for raw materials used in the production process. When primary data did not exist, secondary data for raw material production was utilized from Sphera Managed LCA Content Database 2024.2.

2.6. Data Quality

The geographical scope of the manufacturing portion of all life cycle modules is North America. All primary data were collected from the manufacturer. The geographic coverage of primary data is considered excellent. Time coverage of this data is considered excellent. Primary data provided by the manufacturer is specific to the technology used in manufacturing their product. It is site-specific and considered of good quality. Data necessary to model cradle-to-gate unit processes was sourced from Sphera Managed LCA Content LCI datasets.

2.7. Period under Review

The period under review is the full calendar year 2023.

2.8. Allocation

General principles of allocation were based on ISO 14040/44. To derive a per-unit value for manufacturing inputs such as electricity, thermal energy and water, allocation based on total production by mass was adopted. As a default, secondary Sphera Managed LCA datasets use a physical basis for allocation.

3. Life Cycle Assessment Scenarios

It is assumed that all raw materials are delivered to the manufacturing facility via truck and ship, based on global region. Distances were calculated using the supplier location and the location of manufacturing.

Table 5. Transport to the building site (A4)

TRANSPORTATION DETAILS	UNIT	TRUCK	RAIL	SHIP	AIR
Vehicle type		Heavy Heavy-duty Diesel Truck / 53,333 lb payload - 8b	Rail transport cargo – Diesel, average train, gross tonne weight 1,000t/726t pay load capacity	Bulk commodity carrier, 1.000 to 250.000 dwt payload capacity, deep sea	Cargo plane, 65t payload
Fuel efficiency for full vehicle		42 l/100km	1.17E-05 kg / kg	15,134 l/100km	0.00175 kg / lb
Capacity utilization (including empty runs, mass based)	%	85	40	53	66

TRANSPORTATION INFORMATION	UNIT	RAYSTAT V5	ELEXANT 450C	HWAT ECO
Transport distance – truck	km	1.18E+03	6.36E+02	6.94E+02
Transport distance - ship	km	-	-	1.69E+04
Transport distance - air	km	5.11E+03	3.35E+03	4.52E+03
Gross density of products transported	kg/m^3	n/a		
Weight of products transported (if gross density not reported)	kg	7.84E-01	4.94E-01	8.69E-01
Volume of products transported (if gross density not reported)	m^3	n/a		

Table 6. Installation into the building (A5)

NAME	RAYSTAT V5	ELEXANT 450C	HWAT ECO	UNIT
Ancillary materials	0.00E+00	0.00E+00	0.00E+00	kg
Net freshwater consumption specified by water source and fate (amount evaporated, amount disposed to sewer)	0.00E+00	0.00E+00	0.00E+00	m^3
Other resources	0.00E+00	0.00E+00	0.00E+00	kg
Electricity consumption	0.00E+00	0.00E+00	0.00E+00	MJ
Other energy carriers	0.00E+00	0.00E+00	0.00E+00	MJ
Product loss per functional unit	0.00E+00	0.00E+00	0.00E+00	kg
Waste materials at the construction site before waste processing, generated by product installation	3.64E-01	5.75E-01	3.29E-01	kg
Output materials resulting from on-site waste processing (specified by route; e.g. for recycling, energy recovery and/or disposal)	0.00E+00	0.00E+00	0.00E+00	kg
Biogenic carbon contained in packaging	1.57E-01	2.48E-01	1.42E-01	kg C
Direct emissions to ambient air, soil and water	0.00E+00	0.00E+00	0.00E+00	kg
VOC content	0.00E+00	0.00E+00	0.00E+00	$\mu g/m^3$

Table 7. Reference Service Life

NAME	RAYSTAT V5	ELEXANT 450C	HWAT ECO	UNIT
RSL	10	10	10	years
Declared product properties (at the gate) and finishes, etc.	According to DIN EN 60730-1:2021-06			
Design application parameters (if instructed by the manufacturer), including references to the appropriate practices and application codes)	Temperature control of pipe freeze protection system			
An assumed quality of work, when installed in accordance with the manufacturer's instructions	100			%
Outdoor environment	According to DIN EN 60730-1:2021-06			
Indoor environment	According to DIN EN 60730-1:2021-06			
Use conditions	Winter period	Winter period	Year-round product	
Maintenance	No replacements are necessary.			

Table 8. Operational energy use (B6)

NAME	RAYSTAT V5	ELEXANT 450C	HWAT ECO	UNIT
Reference service life (product lifetime)	10	10	10	years
Power consumption over lifetime	2.55E+03	2.76E+03	3.41E+03	MJ/km

Table 9. End of life (C1-C4)

NAME		RAYSTAT V5	ELEXANT 450C	HWAT ECO	UNIT
Recovery (specified by type)	Reuse	0.00E+00	0.00E+00	0.00E+00	kg
	Recycling	1.55E-01	1.79E-01	2.06E-01	kg
	Landfill	3.66E-01	2.42E-01	4.21E-01	kg
	Incineration	2.62E-01	7.24E-02	2.42E-01	kg
	Incineration with energy recovery	0.00E+00	0.00E+00	0.00E+00	kg
Disposal (landfill)	Product or material for final deposition	3.66E-01	2.42E-01	4.21E-01	kg
Removals of biogenic carbon (excluding packaging)		0.00E+00	0.00E+00	0.00E+00	kg CO_2

Table 10. Reuse, recovery and/or recycling potentials (D), relevant scenario information

NAME	RAYSTAT V5	ELEXANT 450C	HWAT ECO	UNIT
Net energy benefit from energy recovery from waste treatment declared as exported energy in C3 (R>0.6)	0.00E+00	0.00E+00	0.00E+00	MJ
Net energy benefit from thermal energy due to treatment of waste declared as exported energy in C4 (R<0.6)	2.13E+00	7.93E-01	1.96E+00	MJ
Net energy benefit from material flow declared in C3 for energy recovery	0.00E+00	0.00E+00	0.00E+00	MJ

4. Life Cycle Assessment Results

Table 11. Description of the system boundary modules

	PRODUCT STAGE			CONSTRUCT-ION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
	A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
	Raw material supply	Transport	Manufacturing	Transport from gate to site	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Building Operational Energy Use During Product Use	Building Operational Water Use During Product Use	Deconstruction	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling Potential
Cradle to Grave	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Modules B1-B5, B7 and C1 to be reported were all zero following the calculation, hence have not been included in the results tables for an easier reading experience.

4.1 Life Cycle Impact Assessment Results, RAYCHEM RayStat V5

Table 12. EF 3.1 Impact Assessment Results, RAYCHEM RayStat V5, per unit

EF 3.1	A1 – A3	A4	A5	B6	C2	C3	C4	D
GWP_{total} [kg CO_2 eq]	6.40E+00	3.60E+00	4.08E-01	2.92E+02	5.75E-02	6.55E-01	9.88E-03	-6.36E-01
GWP_{fossil} [kg CO_2 eq]	6.95E+00	3.59E+00	3.12E-02	2.88E+02	5.64E-02	6.55E-01	9.87E-03	-6.35E-01
$GWP_{biogenic}$ [kg CO_2 eq]	-5.55E-01	3.67E-03	3.77E-01	4.04E+00	1.36E-04	4.50E-06	-2.93E-05	2.16E-04
$GWP_{land\ use}$ [kg CO_2 eq]	3.01E-03	1.67E-03	3.65E-04	5.65E-02	9.57E-04	3.10E-05	3.66E-05	-1.11E-03
ODP [kg CFC-11 eq]	1.76E-11	2.29E-13	2.32E-14	9.04E-09	8.39E-15	1.39E-13	3.19E-14	-6.71E-12
AP [kg SO_2 eq]	6.62E-02	1.46E-02	2.74E-04	4.51E-01	6.07E-04	8.23E-05	5.96E-05	-4.69E-03
$EP_{freshwater}$ [kg N eq]	1.34E-05	1.06E-06	1.29E-06	1.80E-03	2.43E-07	3.38E-08	4.43E-06	-1.36E-06
EP_{marine} [kg N eq]	6.78E-03	6.65E-03	1.43E-04	1.41E-01	3.06E-04	2.27E-05	1.34E-05	-3.66E-04
$EP_{terrestrial}$ [kg N eq]	7.40E-02	7.28E-02	1.42E-03	1.45E+00	3.37E-03	3.80E-04	1.45E-04	-3.74E-03
POCP [kg O_3 eq]	2.27E-02	1.88E-02	3.25E-04	3.39E-01	5.80E-04	6.56E-05	4.21E-05	-1.25E-03
$ADP_{element}$ [kg Sb-eq]	2.77E-05	9.32E-08	2.24E-09	6.07E-05	4.96E-09	1.44E-09	6.69E-10	-1.88E-04
ADP_{fossil} [MJ, LHV]	1.20E+02	4.72E+01	4.27E-01	4.04E+03	7.51E-01	2.86E-01	1.66E-01	-8.24E+00
WDP [m^3]	6.24E-01	6.91E-03	1.10E-03	9.33E+00	8.82E-04	6.22E-02	1.24E-03	-1.57E-01

Table 13. Resource Use Indicators, RAYCHEM RayStat V5, per unit

PARAMETER	A1 – A3	A4	A5	B6	C2	C3	C4	D
PERE [MJ]	2.00E+01	2.77E-01	3.93E-02	4.34E+03	6.46E-02	7.60E-02	2.48E-02	-3.09E+00
PERM [MJ]	4.18E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT [MJ]	2.04E+01	2.77E-01	3.93E-02	4.34E+03	6.46E-02	7.60E-02	2.48E-02	-3.09E+00
PENRE [MJ]	1.04E+02	4.72E+01	4.27E-01	4.04E+03	7.51E-01	2.86E-01	1.66E-01	-8.24E+00
PENRM [MJ]	1.60E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT [MJ]	1.20E+02	4.72E+01	4.27E-01	4.04E+03	7.51E-01	2.86E-01	1.66E-01	-8.24E+00
SM [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
FW [m^3]	8.04E-02	3.43E-04	4.95E-05	1.37E+00	7.20E-05	1.48E-03	3.72E-05	-1.63E-02

Table 14. Output Flows and Waste Categories, RAYCHEM RayStat V5, per unit

PARAMETER	A1 – A3	A4	A5	B6	C2	C3	C4	D
HWD [kg]	1.30E-07	1.37E-09	3.74E-11	9.98E-06	2.87E-11	1.64E-10	4.07E-11	-1.52E-08
NHWD [kg]	2.06E-01	4.54E-03	1.11E-01	4.08E+00	1.23E-04	5.95E-02	3.65E-01	1.58E-01
RWD [kg]	1.21E-03	4.27E-05	2.38E-06	3.87E-01	1.37E-06	9.64E-06	2.30E-06	-1.83E-04
CRU [kg]	2.05E-02	0.00E+00	1.50E-01	0.00E+00	0.00E+00	1.55E-01	0.00E+00	0.00E+00
MFR [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

MER [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.19E+00
EEE [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.13E+00
EET [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 15. Additional Indicators, RAYCHEM RayStat V5, per unit

PARAMETER	A1 – A3	A4	A5	B6	C2	C3	C4	D
PM [disease incidence]	5.84E-07	6.38E-08	2.67E-09	3.55E-06	5.93E-09	1.01E-09	6.33E-10	-3.81E-08
IRP [kBq U235 eq]	1.14E-01	5.56E-03	3.53E-04	4.12E+01	1.98E-04	1.32E-03	3.14E-04	-1.67E-02
ETP [CTUe]	9.62E+01	3.51E+01	3.15E-01	1.50E+03	5.57E-01	1.92E-01	3.04E-01	-3.07E+00
HTCE [CTUh]	2.27E-09	6.34E-10	6.73E-12	8.57E-08	1.13E-11	9.47E-12	4.71E-12	-1.41E-10
HTnCE [CTUh}	2.92E-08	2.02E-08	4.81E-10	1.18E-06	5.06E-10	7.58E-10	1.04E-10	-5.83E-09
LU [Pt]	7.35E+01	7.25E-01	1.49E-01	2.83E+03	3.69E-01	7.52E-02	2.82E-02	-4.19E+00

4.2 Life Cycle Impact Assessment Results, RAYCHEM HWAT ECO

Table 16. EF 3.1 Impact Assessment Results, RAYCHEM HWAT ECO, per unit

EF 3.1	A1 – A3	A4	A5	B6	C2	C3	C4	D
GWP_{total} [kg CO_2 eq]	6.48E+00	3.51E+00	4.08E-01	3.91E+02	6.37E-02	6.04E-01	1.08E-02	-7.82E-01
GWP_{fossil} [kg CO_2 eq]	7.03E+00	3.51E+00	3.12E-02	3.85E+02	6.25E-02	6.04E-01	1.08E-02	-7.82E-01
$GWP_{biogenic}$ [kg CO_2 eq]	-5.59E-01	3.44E-03	3.77E-01	5.40E+00	1.51E-04	4.15E-06	-3.34E-05	1.86E-03
$GWP_{land\ use}$ [kg CO_2 eq]	3.06E-03	1.11E-03	3.65E-04	7.56E-02	1.06E-03	2.86E-05	4.01E-05	-2.08E-03
ODP [kg CFC-11 eq]	1.36E-11	2.27E-13	2.32E-14	1.21E-08	9.31E-15	1.28E-13	3.47E-14	-5.91E-12
AP [kg SO_2 eq]	7.12E-02	1.56E-02	2.74E-04	6.03E-01	6.73E-04	7.59E-05	6.58E-05	-8.37E-03
$EP_{freshwater}$ [kg N eq]	1.35E-05	9.12E-07	1.29E-06	2.41E-03	2.70E-07	3.12E-08	4.09E-06	-1.75E-06
EP_{marine} [kg N eq]	6.89E-03	7.03E-03	1.43E-04	1.88E-01	3.39E-04	2.09E-05	1.51E-05	-5.44E-04
$EP_{terrestrial}$ [kg N eq]	7.51E-02	7.70E-02	1.42E-03	1.94E+00	3.74E-03	3.51E-04	1.63E-04	-5.56E-03
POCP [kg O_3 eq]	2.32E-02	1.99E-02	3.25E-04	4.53E-01	6.43E-04	6.04E-05	4.70E-05	-1.89E-03
$ADP_{element}$ [kg Sb-eq]	1.34E-05	9.88E-08	2.24E-09	8.11E-05	5.50E-09	1.33E-09	7.46E-10	-3.60E-04
ADP_{fossil} [MJ, LHV]	1.18E+02	4.60E+01	4.27E-01	5.40E+03	8.32E-01	2.64E-01	1.81E-01	-9.00E+00
WDP [m^3]	6.18E-01	6.59E-03	1.10E-03	1.25E+01	9.78E-04	5.74E-02	1.33E-03	-2.84E-01

Table 17. Resource Use Indicators, RAYCHEM HWAT ECO, per unit

PARAMETER	A1 – A3	A4	A5	B6	C2	C3	C4	D
PERE [MJ]	1.95E+01	2.42E-01	3.93E-02	5.80E+03	7.17E-02	7.01E-02	2.70E-02	-3.37E+00
PERM [MJ]	4.58E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

*Modules B1-B5, B7 and C1 to be reported were all zero following the calculation, hence have not been included in the results tables for an easier reading experience.

PERT [MJ]	1.99E+01	2.42E-01	3.93E-02	5.80E+03	7.17E-02	7.01E-02	2.70E-02	-3.37E+00
PENRE [MJ]	1.02E+02	4.60E+01	4.27E-01	5.40E+03	8.32E-01	2.64E-01	1.81E-01	-9.00E+00
PENRM [MJ]	1.59E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT [MJ]	1.18E+02	4.60E+01	4.27E-01	5.40E+03	8.32E-01	2.64E-01	1.81E-01	-9.00E+00
SM [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
FW [m^3]	7.94E-02	3.07E-04	4.95E-05	1.83E+00	7.99E-05	1.37E-03	4.03E-05	-1.84E-02

Table 18. Output Flows and Waste Categories, RAYCHEM HWAT ECO, per unit

PARAMETER	A1 – A3	A4	A5	B6	C2	C3	C4	D
HWD [kg]	1.64E-07	1.47E-09	3.74E-11	1.33E-05	3.19E-11	1.51E-10	4.44E-11	-1.55E-08
NHWD [kg]	2.14E-01	4.35E-03	1.11E-01	5.46E+00	1.36E-04	5.49E-02	4.20E-01	2.91E-01
RWD [kg]	1.18E-03	4.36E-05	2.38E-06	5.18E-01	1.52E-06	8.89E-06	2.50E-06	-1.75E-04
CRU [kg]	2.27E-02	0.00E+00	1.50E-01	0.00E+00	0.00E+00	2.06E-01	0.00E+00	0.00E+00
MFR [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
MER [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.10E+00
EEE [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.96E+00
EET [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 19. Additional Indicators, HWAT ECO, per unit

PARAMETER	A1 – A3	A4	A5	B6	C2	C3	C4	D
PM [disease incidence]	6.27E-07	1.10E-07	2.67E-09	4.74E-06	6.58E-09	9.29E-10	7.08E-10	-6.77E-08
IRP [kBq U235 eq]	1.12E-01	5.50E-03	3.53E-04	5.51E+01	2.20E-04	1.22E-03	3.38E-04	-1.62E-02
ETP [CTUe]	9.50E+01	3.42E+01	3.15E-01	2.00E+03	6.18E-01	1.77E-01	2.99E-01	-4.36E+00
HTCE [CTUh]	2.36E-09	6.16E-10	6.73E-12	1.15E-07	1.26E-11	8.74E-12	4.78E-12	-2.55E-10
HTnCE [CTUh}	2.97E-08	1.93E-08	4.81E-10	1.58E-06	5.61E-10	6.99E-10	1.09E-10	-9.28E-09
LU [Pt]	7.49E+01	5.09E-01	1.49E-01	3.78E+03	4.09E-01	6.94E-02	3.07E-02	-6.76E+00

4.3 Life Cycle Impact Assessment Results, RAYCHEM Elexant 450c

Table 20. EF 3.1 Impact Assessment Results, RAYCHEM Elexant 450c, per unit

EF 3.1	A1 – A3	A4	A5	B6	C2	C3	C4	D
GWP_{total} [kg CO_2 eq]	5.35E+00	1.74E+00	4.06E-01	3.17E+02	3.62E-02	1.54E-01	5.67E-03	-6.14E-01
GWP_{fossil} [kg CO_2 eq]	5.89E+00	1.73E+00	3.10E-02	3.12E+02	3.55E-02	1.54E-01	5.67E-03	-6.14E-01

$GWP_{biogenic}$ [kg CO_2 eq]	-5.42E-01	1.76E-03	3.75E-01	4.38E+00	8.57E-05	8.52E-06	-1.89E-05	3.15E-03
$GWP_{land\ use}$ [kg CO_2 eq]	7.29E-03	6.66E-04	3.63E-04	6.13E-02	6.03E-04	2.45E-06	2.08E-05	-2.68E-03
ODP [kg CFC-11 eq]	4.23E-11	1.10E-13	2.31E-14	9.80E-09	5.29E-15	1.95E-14	1.76E-14	-9.57E-12
AP [kg SO_2 eq]	5.00E-02	6.99E-03	2.72E-04	4.89E-01	3.82E-04	1.16E-04	3.48E-05	-8.44E-03
$EP_{freshwater}$ [kg N eq]	1.28E-05	4.77E-07	1.28E-06	1.95E-03	1.53E-07	5.57E-09	1.23E-06	-1.35E-06
EP_{marine} [kg N eq]	5.53E-03	3.18E-03	1.42E-04	1.53E-01	1.93E-04	5.70E-05	8.45E-06	-5.17E-04
$EP_{terrestrial}$ [kg N eq]	5.98E-02	3.48E-02	1.41E-03	1.57E+00	2.12E-03	6.48E-04	8.89E-05	-5.34E-03
POCP [kg O_3 eq]	1.78E-02	9.04E-03	3.23E-04	3.68E-01	3.65E-04	1.46E-04	2.56E-05	-1.82E-03
$ADP_{element}$ [kg Sb-eq]	3.41E-05	4.44E-08	2.22E-09	6.58E-05	3.13E-09	2.19E-10	4.03E-10	-3.77E-04
ADP_{fossil} [MJ, LHV]	9.73E+01	2.28E+01	4.25E-01	4.38E+03	4.73E-01	5.15E-02	9.41E-02	-8.27E+00
WDP [m^3]	6.83E-01	3.22E-03	1.10E-03	1.01E+01	5.56E-04	1.95E-02	6.66E-04	-2.98E-01

Table 21. Resource Use Indicators, RAYCHEM Elexant 450c, per unit

PARAMETER	A1 – A3	A4	A5	B6	C2	C3	C4	D
PERE [MJ]	3.00E+01	1.25E-01	3.90E-02	4.70E+03	4.07E-02	1.14E-02	1.38E-02	-3.41E+00
PERM [MJ]	2.80E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT [MJ]	3.03E+01	1.25E-01	3.90E-02	4.70E+03	4.07E-02	1.14E-02	1.38E-02	-3.41E+00
PENRE [MJ]	8.70E+01	2.28E+01	4.25E-01	4.38E+03	4.73E-01	5.15E-02	9.41E-02	-8.27E+00
PENRM [MJ]	1.03E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT [MJ]	9.73E+01	2.28E+01	4.25E-01	4.38E+03	4.73E-01	5.15E-02	9.41E-02	-8.27E+00
SM [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
FW [m^3]	2.90E-02	1.56E-04	4.92E-05	1.48E+00	4.54E-05	4.59E-04	2.03E-05	-6.67E-03

Table 22. Output Flows and Waste Categories, RAYCHEM Elexant 450c, per unit

PARAMETER	A1 – A3	A4	A5	B6	C2	C3	C4	D
HWD [kg]	5.12E-06	6.61E-10	3.72E-11	1.08E-05	1.81E-11	2.44E-11	2.28E-11	-7.58E-07
NHWD [kg]	1.55E-01	2.19E-03	1.10E-01	4.43E+00	7.72E-05	5.32E-03	2.42E-01	2.91E-01
RWD [kg]	3.71E-03	2.05E-05	2.37E-06	4.20E-01	8.61E-07	1.83E-06	1.27E-06	-4.96E-05
CRU [kg]	1.29E-02	0.00E+00	1.49E-01	0.00E+00	0.00E+00	1.80E-01	0.00E+00	0.00E+00
MFR [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
MER [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.36E-01
EEE [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.93E-01
EET [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 23. Additional Indicators, RAYCHEM Elexant 450c, per unit

PARAMETER	A1 – A3	A4	A5	B6	C2	C3	C4	D
PM [disease incidence]	4.94E-07	3.00E-08	2.65E-09	3.84E-06	3.74E-09	4.31E-10	3.86E-10	-6.83E-08
IRP [kBq U235 eq]	4.09E-01	2.67E-03	3.51E-04	4.46E+01	1.25E-04	2.76E-04	1.69E-04	-5.27E-03
ETP [CTUe]	4.03E+01	1.70E+01	3.13E-01	1.62E+03	3.51E-01	2.34E-02	1.14E-01	-5.45E+00
HTCE [CTUh]	2.23E-09	3.06E-10	6.69E-12	9.29E-08	7.15E-12	1.22E-12	2.03E-12	-4.01E-10
HTnCE [CTUh}	3.27E-08	9.71E-09	4.78E-10	1.28E-06	3.19E-10	1.03E-10	5.07E-11	-1.01E-08
LU [Pt]	7.43E+01	2.96E-01	1.49E-01	3.06E+03	2.33E-01	1.18E-02	1.58E-02	-6.03E+00

5. LCA Interpretation

The use stage contributes to the majority of impacts across the life cycle stages for all the reference products, and across all indicators, except for ADP – elements, (due to the raw materials required for electronics manufacturing), as shown in Figures 1 to 3. This is due to the electricity consumed during the use of the product over its lifetime of 10 years.

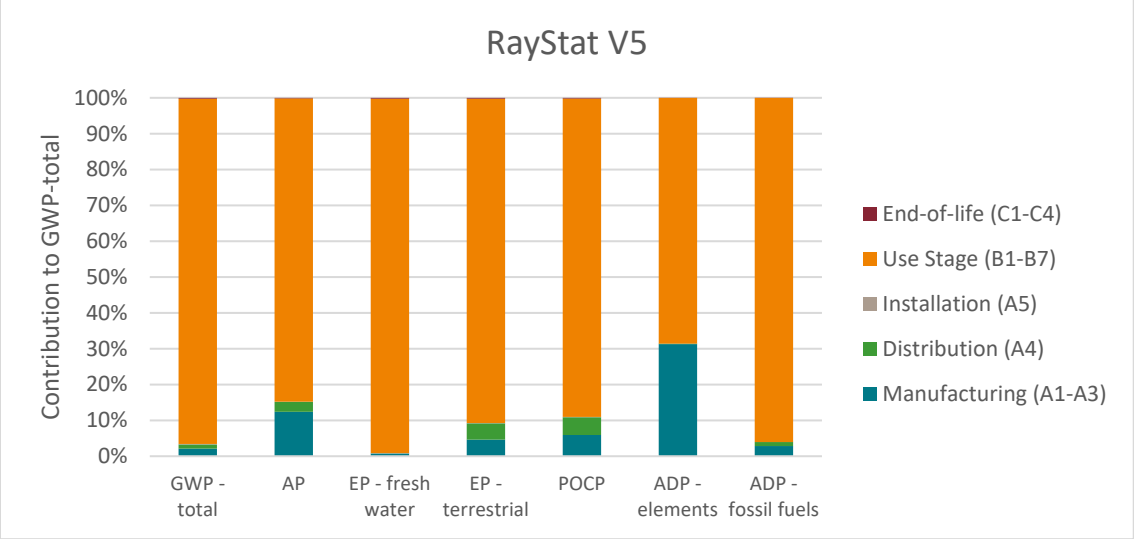

Figure 1: LCA Results for RayStat V5, by life cycle stage

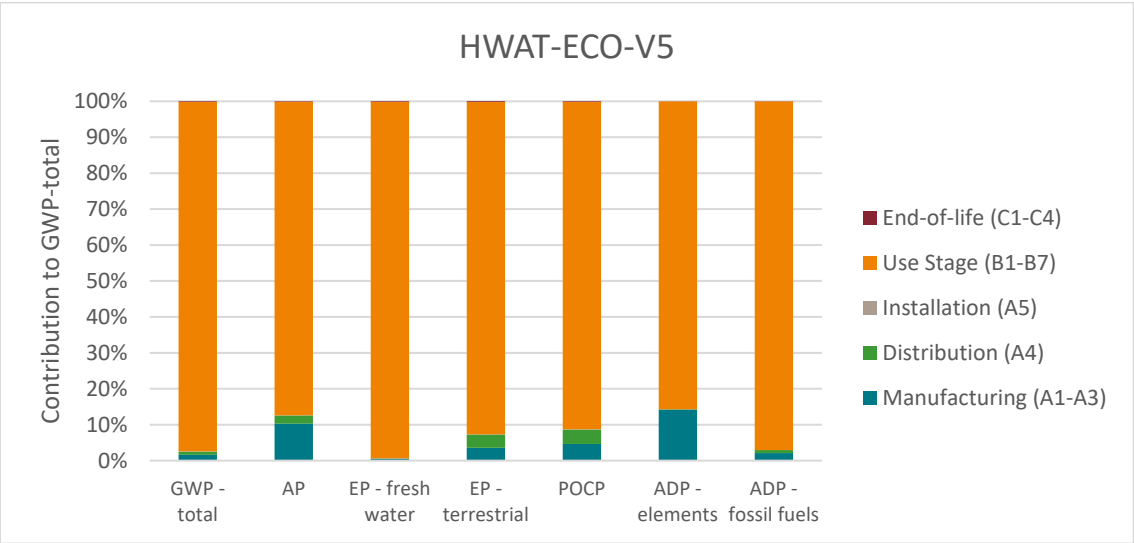

Figure 2: LCA Results for HWAT ECO, by life cycle stage

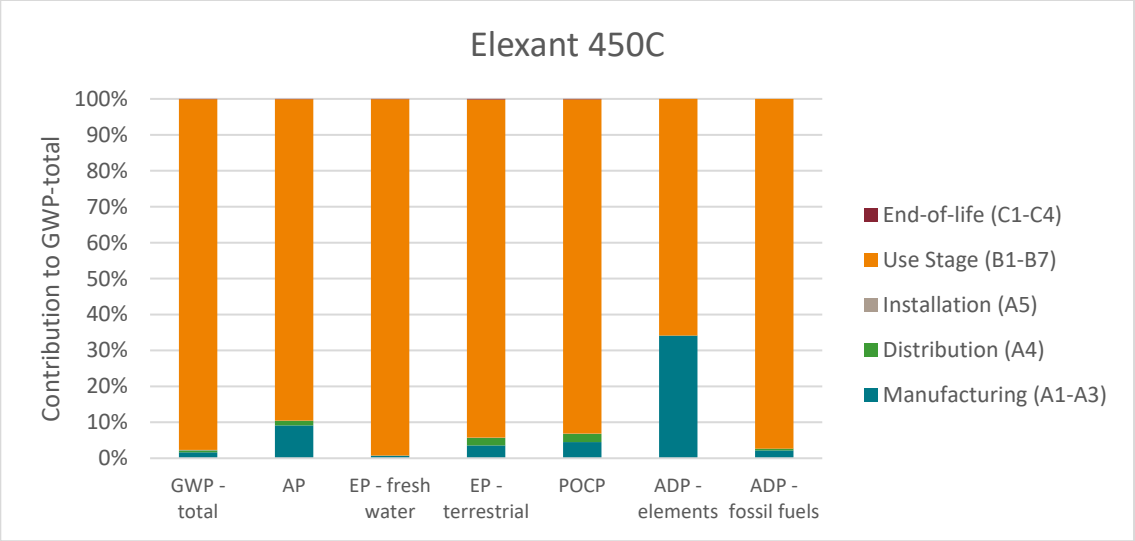

Figure 3: LCA Results for Elexant 450c, by life cycle stage

6. Additional Environmental Information

6.1 Environment and Health During Installation

Further information about the product installation can be found on the Chemelex RAYCHEM website product page:

https://www.nvent.com/en-gb/raychem/products/raystat-v5-control-unit-0
https://www.nvent.com/en-lt/raychem/products/elexant-450c-control-unit-0
https://www.nvent.com/en-us/raychem/products/hwat-eco-electronic-control-unit-0

6.2 Further Information

Further information about the product can be found on the Chemelex RAYCHEM website product page:

https://www.nvent.com/en-gb/raychem/products/raystat-v5-control-unit-0
https://www.nvent.com/en-lt/raychem/products/elexant-450c-control-unit-0
https://www.nvent.com/en-us/raychem/products/hwat-eco-electronic-control-unit-0

7. References

CEN. (2019). *EN 15804+A2: Sustainability of construction works – Environmental product declarations – Core rules for* the product category of construction products. European Committee for Standardization.

EN 50639:2019 – Product category rules for life cycle assessments of electronic and electrical products and systems.

ISO. (2006). *ISO 14040/Amd 1:2020: Environmental management - Life cycle assessment - Principles and framework.* Geneva: International Organization for Standardization.

ISO. (2006). *ISO 14044/Amd 1:2017/Amd 2:2020: Environmental Management - Life cycle assessment - Requirements and Guidelines.* Geneva: International Organization for Standardization.

P.E.P. Association. (2023). *PEP ecopassport® Program: Specific Rules for Electrical Switchgear and Control Gear Solutions*. PSR-0005-ed3-EN-2023 06 06

P.E.P. Association. (2021). *PEP ecopassport® Program: Product Category Rules for Electrical, Electronic and HVAC-R Products*. PCR-ed4-EN-2021 09 06