

Aquatherm and LEED v4



How Aquatherm's polypropylene piping systems contribute to LEED v4 points and what the company's LCA and EPD mean to designers, engineers, and building owners.

Within this paper, we will look at the process of obtaining an Environmental Product Declaration (EPD), discuss Aquatherm's newly verified EPD, and show how Aquatherm piping provides significant environmental advantages over competing piping materials. Additionally, we will look at how Aquatherm products can be used to gain valuable LEED v4 points.

OVERVIEW OF RELATIONSHIPS AMONG PCRS, LCAS, AND EPDS

Product Category Rules (PCRs)

PCRs define specific data requirements for generating life-cycle assessments for manufactured products. Within a PCR, specific instructions for data collection and data reporting are provided⁴. There are more than 100 different product categories for which PCRs have been published. A couple of sources for published PCRs are the Environmental & Development Foundation's "PCR Public Library" and "UL's Product Categories (PCRs)," which can be found online^{6,10}. All rules and requirements for these PCRs are based on ISO 14025, "Environmental Labels and Declarations – Type III Environmental Declarations"³. Aquatherm utilized the PCR "Piping Systems for Use for Sewage and Storm Water (Under Gravity)" and a PCR addendum published by UL Environment to include general piping systems under gravity and under pressure to develop the Aquatherm EPD^{1,8,9}. A standard data-collection method is provided within the PCR that allows for evaluations of different products for set environmental impact categories. Environmental impact categories include Climate Change, Depletion of Stratosphere Ozone Layer, Eutrophication, Formation of Photochemical Oxidants, Depletion of Fossil Energy Resources, Depletion of

Mineral Resources, and Hazardous and Non-Hazardous Waste³.

Life-Cycle Assessments (LCAs)

LCAs provide a comprehensive evaluation of the upstream and downstream energy and environmental impacts associated with a product. Techniques used in creating the LCA are described within ISO 14040 "Environmental Management – Life-Cycle Assessment – Principles and Framework", and ISO 14044, "Environmental Management – Life-Cycle Assessment – Requirements and Guidelines" standards. This includes the LCA boundaries that are provided for the product being evaluated. Typical boundaries include cradle-to-gate (a boundary that encompasses the extraction of raw materials through manufacturing and product distribution) or cradle-to-grave (a boundary encompassing the extraction of raw materials through manufacturing, distribution, use, repair, maintenance, disposal, and recycling). LCAs use information from various databases to analyze the life cycle of the product. Performing the LCA for a product is the second step used in the creation of an EPD. LCAs are comprised of five parts: Goal, Scope, Life-Cycle Inventory Analysis, Results, and Interpretation. Aquatherm published its LCA, "Life Cycle of Polypropylene Pressure Piping Systems", a cradle-to-gate LCA, to demonstrate leadership in this industry through transparent communication of its products' environmental





performance and to enable purchasers of Aquatherm's polypropylene-random (PP-R) pressure piping systems to be eligible for LEED points under the LEED v4 standard.

Environmental Product Declarations (EPDs)

EPDs provide a mechanism for certifying the information on a product's life-cycle environmental impacts.

The EPD is the document used to convey the LCA's results to the products' users and specifiers. It focuses on information about a product's environmental impact such as global warming, ozone depletion, water pollution, ozone creation, and greenhouse gas emissions. It also can include other impacts that are of particular interest to the discloser such as human toxicity, risk, and corporate social responsibility. EPDs are disclosure tools that help purchasers better understand a product's sustainable qualities and environmental repercussions, allowing them to make a more informed product selection².

EPDs typically are verified following the processes described in ISO 14025, EN 15804, and ISO 21930 for construction products. These steps include: 1) Finding or developing a PCR; 2) Generating the input data and performing an LCA according to a specific PCR; 3) Compiling information in the EPD; 4) Verification of the EPD and LCA; and 5) Registration and publication.

Within "LEED v4 for Building Design and Construction," Option 1 of the Materials and Resources (MR) Credit section, three types of EPDs are defined. The defined EPDs include the

Product-Specific Declaration with a life-cycle assessment that conforms to ISO 14044; the Industry-Wide (Generic) EPD that conforms to ISO 14025, ISO 14040, ISO 14044, and either EN 15804 or ISO 21930; and the Product-Specific Type III EPD that conforms to ISO 14025, ISO 14040 and ISO 14044 and either EN 15804 or ISO 21930. Aquatherm piping systems' EPD is a Product-Specific Type III EPD that conforms to ISO 14025, ISO 14040, and ISO 14044. It is a third-party-verified EPD, specific to Aquatherm's product lines, and is not an industry-wide or generic type of EPD. Of the three defined EPD types, Aquatherm's EPD provides the highest MR Credit value.

AQUATHERM'S LCA/EPD SUMMARY AND CONCLUSIONS

Aquatherm utilized an independent third party to conduct an ISO-conformant LCA for each of its product lines – Green Pipe®, Blue Pipe®, Lilac Pipe®, the Black System® for radiant heating and cooling, and Red Pipe®. In the study, one meter (3.2 ft) length of pipe was selected per the requirements of the PCR. The declared product was defined as a representative average of the five Aquatherm product offerings. See the following Aquatherm pipe descriptions:

- 1. aquatherm green pipe®:** Mechanical piping especially suited for potable water, compressed air, and food-grade applications.
- 2. aquatherm blue pipe®:** Mechanical piping suited for heated and chilled water, condenser water, compressed air, and industrial/chemical process systems.

3. aquatherm lilac pipe®: Mechanical piping specifically intended for non-potable, reclaimed, or recycled water; rainwater catch basins; and irrigation systems.

4. aquatherm black system®: A radiant panel system that is used to provide energy-efficient radiant heating and cooling for any size building, from single-family homes to large high-rise commercial facilities.

5. aquatherm red pipe®: Mechanical piping specifically intended for light-hazard-occupancy fire-suppression systems.



Two different test methodologies were chosen to analyze the products in the LCA: Tool for Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI) 2.1, and CML 2001. TRACI 2.1 was selected because it currently is the only impact-assessment methodology framework that incorporates U.S. average conditions to establish characterization factors (Bare 2012, EPA 2012)¹, and the UL PCR addendum to Norwegian PCR specifies TRACI 2.1 for EPDs to be used for the North American market. CML 2001 was selected by thinkstep for the European market¹. The TRACI



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2.1 method utilized impact categories, including Global Warming Potential (GWP), Acidification Potential (AP), Eutrophication Potential (EP), Ozone Depletion Potential (ODP), and Smog Formation Potential (SFP)⁴. CML 2001 utilized impact categories, including GWP, AP, EP, ODP, Photochemical Ozone Creation Potential, Abiotic Depletion Potential (ADP) Elements, and ADP Fossil⁴.

The results of the findings are summarized in Figure 1. It is quite apparent that Aquatherm PP-R piping systems and radiant panels can provide a more sustainable, lower environmental impact option to the

designer and building owner when compared with other piping and radiant panel systems.

Generally, the polypropylene comprises nearly 50% or more of the impact contribution depending on the impact category. Primary Energy Demand (PED) is shown to be primarily comprised of polypropylene resin; however, this is because of the embodied energy content of the resin rather than fuel consumption upstream. In other words, Aquatherm polypropylene has available energy within the material that can be recovered later in the product's life cycle. This differs greatly compared with metals. With metal systems, all

of the energy is used in the original processing of the raw material. Metals do not provide energy to the recycling process. The GaBi 2015 LCA dataset (GaBi 6 software system for life-cycle engineering, developed by thinkstep) for polypropylene states 55% of the embodied energy within polypropylene can be utilized in the recycling or recovery process; therefore, only 45% of the PED for PP-R is actually from consumed energy in the original material manufacturing¹.

Upon completion of the Aquatherm product-specific LCA, Aquatherm submitted its products, the LCA, and supporting documentation for independent verification by NSF International. The verification process included a review by an independent panel of experts, an audit of the manufacturing facilities and records, and a confirmation of material formulations. Aquatherm's Product-Specific Type III third-party-verified EPD was published Dec. 18, 2015⁴. Within the EPD, you will find information on Aquatherm, its product descriptions, data quality requirements, raw-materials origins, a manufacturing diagram, a declaration of parameters per the PCR, and the life-cycle-impact conclusion for Aquatherm pipe.

To view Aquatherm's EPD, go to: <http://info.nsf.org/Certified/Sustain/ProdCert/EPD10069.pdf>.

How Is Aquatherm's EPD Relevant to LEED v4 Points?

Aquatherm's EPD has been developed in accordance with ISO 14025 and ISO 14044/14040. The EPD enables

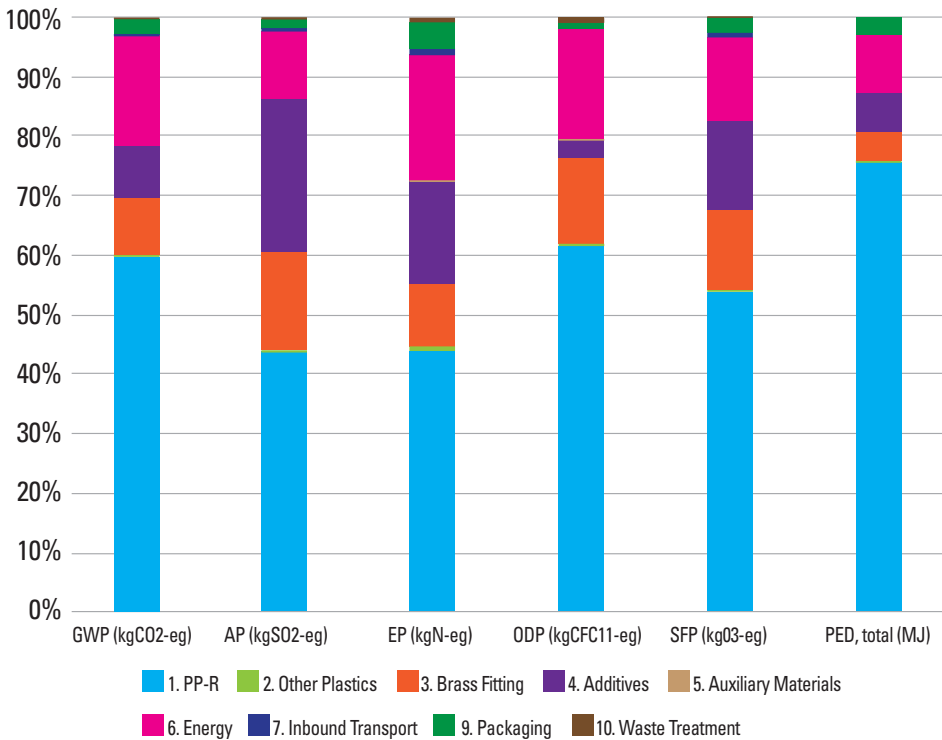


Figure 1: TRACI 2.1 impacts and Primary Energy Demand indicator shown for cradle-to-gate system boundary of the representative Aquatherm piping system.



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purchasers of Aquatherm's PP-R pressure piping systems to be eligible for points under the LEED v4 rating system⁴.

All of Aquatherm's piping products offered in North America have attained Type III EPD status through independent verification by NSF International. They now can be utilized as a portion of the 20 permanent products engineers must have throughout their LEED-certified buildings. Aquatherm's EPD also carries double the weight of the Industry-Wide (Generic) EPD in terms of LEED product value and four times the weight of a self-certified Product-Specific Declaration by a manufacturer⁷.

LEED v4 incorporates point structures to encourage the use of products/materials that environmentally, economically, and socially support preferable life-cycle impacts. Point structures were developed to reward the selection of products from manufacturers who have verified improved environmental life-cycle impacts⁵.

LEED v4's "MR Credit in the Building Product Disclosure and Optimization - Environmental Product Declarations" allows LEED v4 credits to apply to the following uses: New Construction (1-2 points), Core & Shell (1-2 points), School (1-2 points), Retail (1-2 points), Data Centers (1-2 points), Warehouses & Distribution Centers (1-2 points), Hospitality (1-2 points), and Healthcare (1-2 points)⁵.

There are four methods to obtain MR Credits described in Option 1 of "MR Credit in the Building Product Disclosure and Optimization - Environmental Product Declarations." All four methods require the designer/owner to use



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20 various permanently installed products sourced from at least five different manufacturers that meet the requirements of one of the four methods. The four ways to obtain MR Credits include 1) a **Product-Specific Declaration** that conforms to ISO 14044; 2) an **Industry-Wide (Generic) EPD** that conforms to ISO 14025, ISO 14040, and either EN 15804 or ISO 21930 and has at least a cradle-to-gate scope; 3) a **Product-Specific Type III EPD** that conforms to ISO 14025, ISO 14040, and either EN 15804 or ISO 21930 and has at least a cradle-to-gate scope; or 4) a **USGBC approved program**⁵.

A Product-Specific Declaration is a declaration created by the manufacturer but not third-party verified. Without third-party verification, this type of EPD can have misleading or incorrect information regarding the product.

Product-Specific Declarations only provide ¼ of a product toward the MR Credit⁵.

An Industry-Wide (Generic) EPD requires a third-party certification and external verification but is not specific to a manufacturer's product, and, therefore, may be too generic to accurately describe the product being specified. Industry-Wide (Generic) EPDs count as ½ of a product toward the MR Credit⁵.

A Product-Specific Type III EPD is both manufacturer and product specific. It is third-party certified and verified by an independent listing organization; therefore, the data provided within this declaration is considered more reliable. A Product-Specific Type III EPD has the highest point value, as the Aquatherm EPD counts as one full product toward the MR Credit⁵.

Aquatherm has continued its industry leadership position by becoming the first piping manufacturer to have an independently verified, Product-Specific Type III EPD for all of its product lines used in North America. 

References

1. Thinkstep, AG, "Life Cycle Assessment of Polypropylene Pressure Piping Systems", December 15, 2015, pp. 10, 12, 13, 16, 33.
2. "Environmental Products Declarations by UL", "industry.ul", <http://industries.ul.com/environment/certificationvalidation-marks/environmental-product-declarations>".
3. "Product Category Rules, Life Cycle Assessments, and Environmental Product Declarations", nsf, https://www.nsf.org/newsroom_pdf/SU_PCR_EPD_White_Paper_LT_EN_LSU27230612.pdf".
4. Aquatherm, "Environmental Product Declarations", NSF Verified, December 15, 2015, pp 2, 5, 8, 9.
5. US Green Building Council, "Lead v4 for Building Design and Construction", USGBC, April 5, 2016, pp. 93.
6. "Product Category Rules (PCRs)", UL, <http://industries.ul.com/environment/transparency/product-category-rules-pcrs>".
7. Aquatherm, "LEED v4 and Piping System Design", Aquatherm
8. "UL Addendum Product Category Rules for preparing an environmental product declaration (EPD) for PCR", UL, industries.ul.com/wp-content/uploads/sites/2/2014/09/UL-Environment-PCR-Addendum-for-Piping-7-24-2014.pdf".
9. "PRODUCT-CATEGORY RULES (PCR) For preparing an environmental declaration (EPD) for Product Group Piping systems for use for sewage and storm water (under gravity), Norwegian EPD Foundation, <http://pcr-library.edf.org/tw/data/norway/NPCR%20019%20pipes.pdf>".
10. "PCR Library, Environmental And Development, Foundation, http://pcr-library.edf.org/tw/product_category/all_list.asp".

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