



Redefining Sustainability in Immersion Cooling

A **White Paper** by Maarten Trautmann, Beau Van Vaerenbergh, Ben Deweert and Leopold Mottet

Executive Summary

As the digital economy accelerates, data centers are under increasing pressure to deliver higher performance while reducing their environmental impact. Cooling accounting for up to 40% of a data center's energy useⁱ —has become a critical focus area. Immersion cooling is emerging as a transformative solution, enabling high-density computing while improving energy efficiency. Next to energy, the key differentiator on sustainability for immersion cooling is the fluid that is chosen for the system.

QLOE IC 8313, developed by Oleon, is a next-generation plant-based dielectric fluid engineered for immersion cooling. This white paper outlines the four pillars that define QLOE's sustainability credentials:

- ✓ **Plant-based origin**
- ✓ **Zero Global Warming Potential (GWP) during use phase**
- ✓ **Biodegradability and PFAS-free formulation**
- ✓ **Low Product Carbon Footprint (PCF)**

Together, these attributes make QLOE the reference for environmentally responsible dielectric fluids —without compromising on performance.



QLOE IC 8313 is a state-of-the-art and all-round single-phase liquid, combining thermo-electrical performance, advanced fire & human safety and tailored material compatibility. Furthermore, in terms of safety this liquid is free from any hazard labels, making it one of the safest liquids in the market. Safety should not be compromised when IT engineers conduct maintenance or when immersion cooling systems are being installed.

1. Introduction: Cooling in the Age of Climate Accountability

The global demand for digital services—cloud computing, AI, streaming, and edge computing—is growing exponentially. This growth is driving a surge in data center construction and energy consumption. As processors become more powerful and rack densities increase, traditional air-cooling methods are reaching their physical and economic limits.

Cooling is no longer just a technical challenge; it is an environmental imperative. Estimates state that datacenters consume about 1.5% of the world's energy in 2024 at 415 TWh and is projected to grow to 945 TWh in 2030.ⁱⁱ Cooling is responsible for about 40% of a datacenters energy use. With a drive towards high power compute (e.g. AI) and a mass proliferation of this technology, the future energy consumed by IT is staggering. All of this happens as raw materials are getting scarcer and the impacts of climate change are being felt. The industry must adopt solutions that not only support high-performance computing but also align with global sustainability goals. Immersion cooling offers a path forward—and QLOE is designed to lead the way.



2. Oleon: Serving the Earth

Oleon is a global leader in oleochemistry, transforming renewable, plant-based raw materials into high-performance chemical solutions with its origins back in 1835. With operations across Europe, the Americas, and Asia, and a workforce of approximately 1,500 employees, Oleon serves industries ranging from cosmetics to lubricants—and now, data center cooling.

As part of the Avril, a French agrifood conglomerate with over 8,000 employees and €8 billion in annual revenue, Oleon benefits from strong vertical integration. This ensures transparency and traceability in raw material sourcing—critical for sustainability and ESG compliance. Moreover, our strong connection to Avril provides security of supply.

QLOE is yielding Oleon's expertise in ester chemistry, sustainability, responsible innovation and product leadership.

3. Defining Sustainability: Four Scientific Pillars

3.1 Plant-Based Origin

QLOE is derived from renewable, plant-based oils. Unlike conventional natural esters, which may be too viscous or chemically unstable for immersion cooling, QLOE undergoes advanced processing to optimize its viscosity, thermal stability, and material compatibility.

Plant-based raw materials are inherently more sustainable than fossil-derived alternatives. They are based on renewable carbon, replenished on a human timescale. QLOE's bio-based content is measured according to ASTM D6866.

QLOE IC 8313 is composed of >99% renewable carbon. The remaining percentage of additivation ensure its performance, stability and longevity.

3.2 Zero Global Warming Potential (GWP) During Use Phase

GWP during use refers to greenhouse gas emissions generated while the fluid is actively cooling IT equipment. Many synthetic fluids emit volatile organic compounds (VOCs) when heated, contributing to climate change and posing health risks. In addition to being sustainable, QLOE is also the safest dielectric liquid for IT, which is confirmed by volatility and eco-toxicity tests which is enclosed in our Material Safety Data Sheet (MSDS).

QLOE IC 8313 has low vapor pressure, minimizing evaporation and exposure, and has zero GWP during use phase.

3.3 Biodegradability and PFAS-Free

QLOE IC 8313 has a long lifespan, extended well beyond conventional server life. At the end of life, biodegradability ensures a natural break down through specific microbial activity. Together with a non-bioaccumulative nature QLOE IC 8313 is readily biodegradable and free from PFAS and other persistent chemicals. This reduces environmental risk in case of leaks or spills. The biodegradable nature alleviates our partners of end-of-life concerns, balanced with an optimal life span which opens the door for fluid recovery and recycling, closing the circle.

QLOE achieves a top -class biodegradability score of 86% according to OECD 301B after 28 days.

3.4 Low Product Carbon Footprint (PCF)

PCF quantifies the total greenhouse gas emissions associated with a product's lifecycle—from raw material extraction to manufacturing. Oleon calculates QLOE's PCF from cradle to gate (Oleon gate).

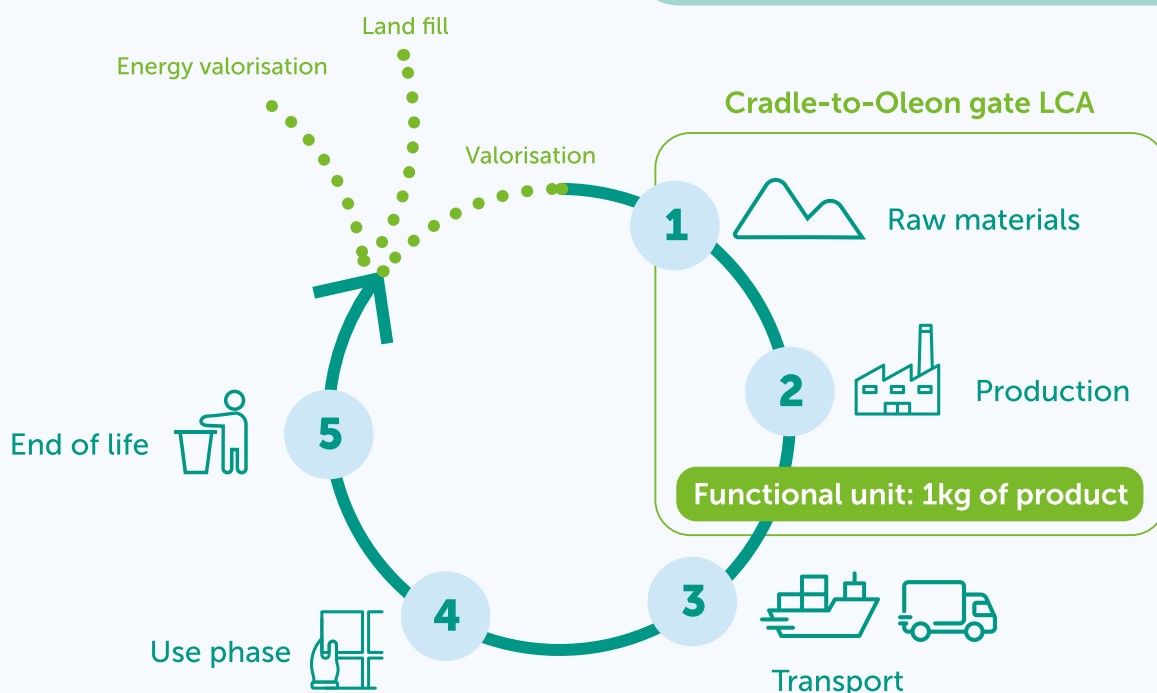
Transparent carbon accounting is essential for credible ESG reporting. Oleon is the first dielectric fluid provider to share PCF values in its Environmental Data Sheets.

With a near zero product carbon footprint QLOE IC 8313 is a leader in sustainable dielectric fluids available.

Sustainability without transparency means little. Oleon is a front runner when it comes to transparency on sustainability reporting. We can provide Environmental Data Sheets (EDS) upon request to our customers, to help them achieve their ESG targets. In these EDS, our partners can track the product carbon footprint evolution and consult the methodology behind the calculation. Going further, Oleon can provide a full list of environmental impact indicators such as water use, land use, ecotoxicity, etc.

Life Cycle Analysis

Life Cycle Analysis (LCA) is a method for evaluating the environmental impacts of a product across its entire life—from raw material extraction to disposal. A key application of LCA is calculating the **Product Carbon Footprint (PCF)**, which focuses specifically on greenhouse gas emissions (like CO₂, CH₄, N₂O) throughout each life stage. LCA also highlights **environmental burden shifting**, where reducing impact in one phase (e.g., manufacturing) may unintentionally increase emissions or resource use in another (e.g., transportation or end-of-life).



4. Performance Without Compromise

Sustainability is only meaningful if it comes with performance. QLOE is engineered to meet the rigorous demands of modern data centers:

- ✓ **High thermo-electrical optimized for high-density compute**
- ✓ **High flash point for operational safety**
- ✓ **Material compatibility with a wide range of components**

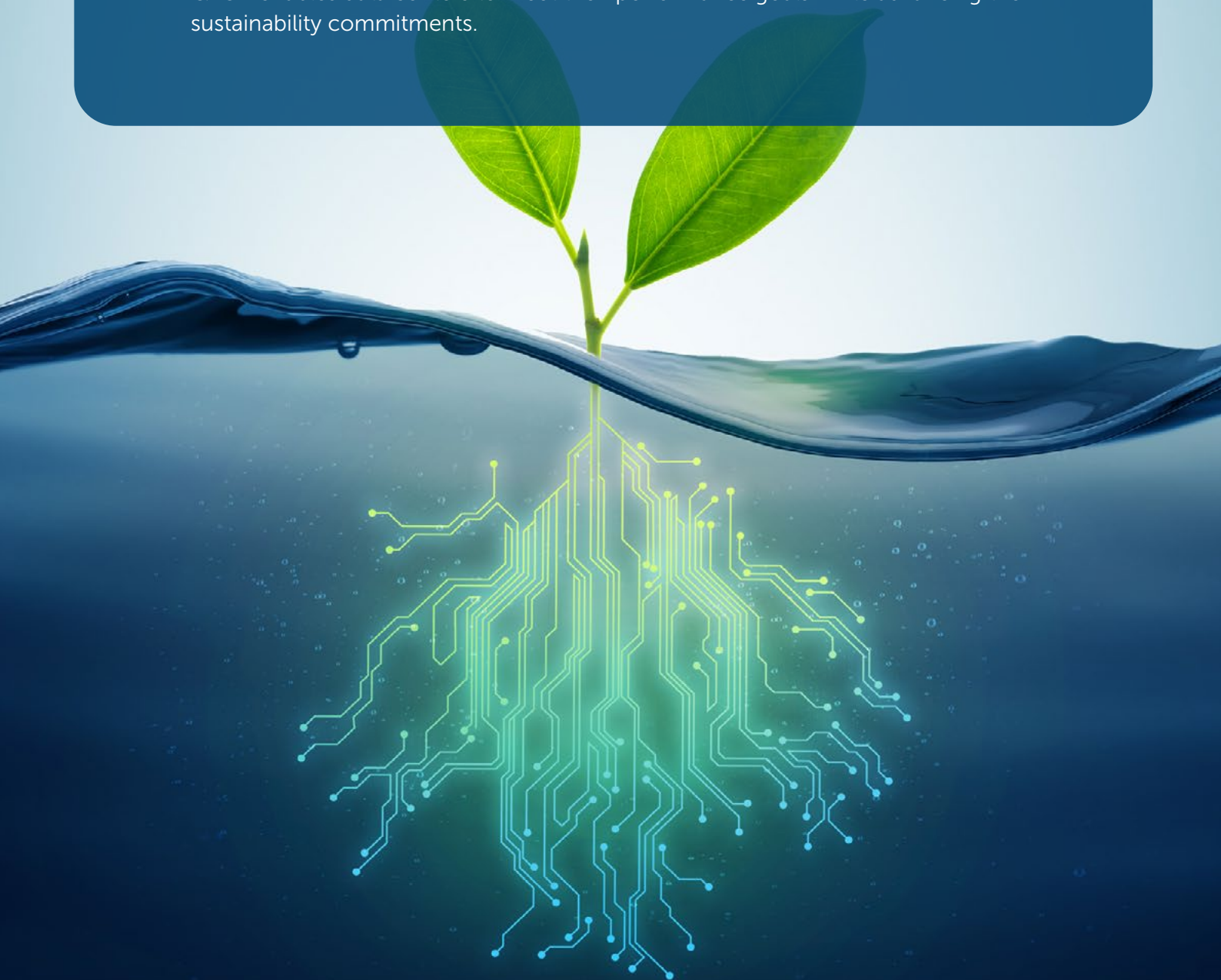
QLOE is not a compromise—it is a next-generation solution that delivers on both environmental and technical fronts.

Metric	Esters	Fluoro	Hydro
Origin	Plant based	Fossil-derived	Fossil-derived
GWP	0 during use phase	High	Moderate to high
Biodegradability	High	None	Low to moderate
Bioaccumulation	None`	High	Varies
Product Carbon Footprint	Near zero	High	Moderate
Safety	Nonhazardous	PFAS concern	GHS Cat 1

5. Conclusion: A Greener Digital Future Starts with Smarter Cooling

As the world digitizes, the environmental footprint of data centers must be addressed with urgency and innovation. Immersion cooling is a powerful tool in this transition—but only if the fluids used are as sustainable as the systems they support.

QLOE by Oleon is the most forward-looking dielectric fluid on the market. With its plant-based origin, zero GWP during use, biodegradability, and low carbon footprint, QLOE enables data centers to meet their performance goals while advancing their sustainability commitments.



¹Deloitte (2024) **As generative AI asks for more power, data centers seek more reliable, cleaner energy solutions**

²International Energy Agency (2025) **Energy and AI**