WHITE PAPER No. 61

Beyond Energy – ACT Sustainability Label for ULT Freezers

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Eppendorf is committed to Accountability, Consistency, and Transparency in reducing environmental impact and providing our customers with high quality, sustainable products. In addition to being ENERGY STAR® certified, multiple CryoCube® Ultra Low Temperature (ULT) freezer models have received the ACT Label, which scores a product's total environmental impact based on multiple sustainability factors, including manufacturing, packaging, energy consumption, and recyclability. Eppendorf freezers are the first ULTs to receive the ACT Label, provided by My Green Lab®.

Introduction

My Green Lab' s mission is to constantly and permanently improve the sustainability within research labs. As a non-profit organization, My Green Lab focuses on joining and leading a broad community in the laboratory towards a world in which all research projects reflect the highest standards of social and environmental responsibility. The organization, founded in 2013 by Allison Paradise, a neuroscientist turned environmental activist has grown rapidly from a local non-profit organization to an international agent for change and improvement in respect to sustainability in laboratories worldwide.

Self-described as "Run for scientists, by scientists", My Green Lab develops standards for greener labs and lab products. These improved or new standards also need to be overseen in respect to their implementation. One of the major challenges is the inspiration of the many behavioral changes that are needed throughout the scientific community.

my green lab.

This lab community encompasses a broad range of people in various roles, including scientists, vendors, designers, energy providers, and others.

Get more information at
https://www.mygreenlab.org/

Industry as well as academic trend

Sustainability in the lab is a topic that continues to grow in importance at organizations across the globe. The large global pharma companies have established sustainability programs to analyze their internal processes and make changes to improve efficiencies, to weigh the influence of their behavior and their processes in respect to sustainability. The goal of many of these programs is to provide benefits to society and the environment while also positively impacting the economics of the business

My Green Lab offers many different programs to help organizations improve their environmental health and resource utilization:

> **My Green Lab Certification:** The worldwide standard for laboratory sustainability best practices.
> **Green Chemistry:** Mainstreaming green chemistry into curricula, research, and manufacturing.
> **Freezer Challenge:** An international competition aimed at reducing the environmental impact of cold storage.
> **ACT:** Like nutrition labels, the ACT label shows how products 'rate' in sustainability-related categories.
> **CEEL:** The Center for Energy Efficient Laboratories (CEEL) conducts research into energy-efficiency opportu nities for laboratory equipment.
> **My Green Lab Ambassador:** A free, online program providing an introduction to laboratory sustainability and how to suggest change within your lab.

My Green Lab closely co-operates with I2SL, the International Institute for Sustainable Laboratories. **(https://www.i2sl.org/index.html)**

James Connelly, the CEO of My Green Lab: "The focus of My Green Lab's mission is to build a culture of sustainability through science. We offer a suite of leading-edge programs to transform the Life Science industry through sustainability, including Green Lab Certification, Lab Product Certification (the ACT label) and student and professional education. Our programs not only significantly reduce the environmental impact of science, they inspire similar changes in the culture and private lives of the millions of people who spend their time working in labs."

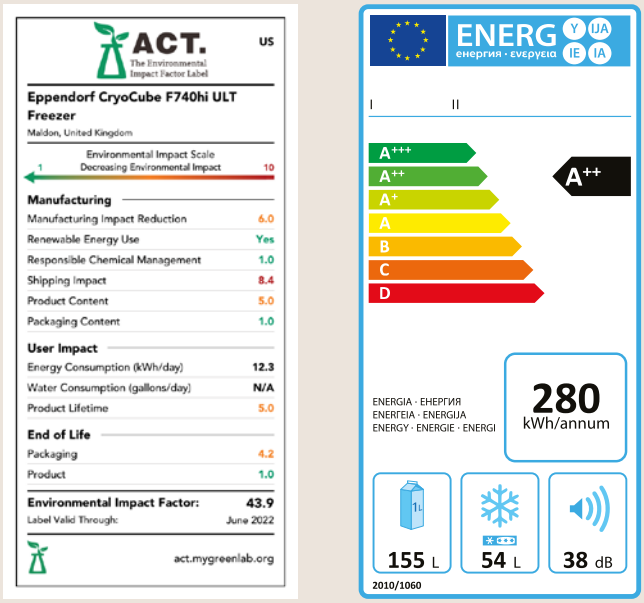

Figure 4: A: Sample ACT Environmental Impact Factor Label
B: Sample of an EU Energy Label established by European Union Directive

ACT Label

Combining accountability (A), consistency (C), and transparency (T) in respect to manufacturing, energy consumption, water usage, packaging, and end-of-life disposal, the ACT label provides an easy and intuitive way to evaluate the sustainability of a selected product. The product is validated and scored based on a number of different "Environmental Impact Factors" (EIFs). Each EIF is rated on a scale of 1 to 10, with 1 indicating the least environmental impact and 10 the highest environmental impact. The scoring of the data is performed by the independent organization Sustainability Made Simple Collaborative (SMSC) and then verified and published by My Green Lab. The total score is finally summed up. In principle, the ACT label is basically a scoring card about sustainability. Reading the ACT label is simple: the lower the score, the lower the impact on the environment. The label can be read like a nutrition label or like the European performance card for a washing machine or dish washer. The ACT label shows how products 'rate' in different sustainability-related categories by value, which is supported by a color-code of red to green to indicate a high or low value.

ACT.
The Environmental Impact Factor Label

Figure 3: ACT Environmental Impact Factor logo of My Green Lab® organization

ULT Freezer

Eppendorf partnered with My Green Lab in 2017 and the CryoCube F740hi ULT freezer (Ultra-Low Temperature freezers) was the first ACT-labeled ULT freezer worldwide. With the knowledge gained in that process, we decided to expand the label to other CryoCube ULT freezers.

Why did we choose ULT freezers for the ACT label?
Sustainability and ULT freezers may seem like a strange combination: Even the most environmentally-friendly and energy-efficient ULTs still require a significant amount of energy to maintain extremely low temperatures of -80 °C 24/7. With today's high energy costs and focus on environmental consciousness, energy conservation has become even more important in the lab. But energy consumption is just one aspect in the environmental footprint of a freezer in your lab. The ACT label examines a product's energy efficiency in combination with multiple other sustainability factors to determine its overall environmental impact.

Cooling liquids
The refrigerant or cooling liquid within a ULT freezer is used to cool down the freezer chamber and to regulate the temperature. To reduce global warming, there has been a shift from classic cooling liquids such as R508B and R404A to green or natural cooling (e.g. R170, R290). These hydrocarbon coolants are future-proof and have a Global Warming Potential (GWP) of nearly zero. This move towards greener cooling is also supported by European Union Regulation (EU_517/2014) and other local and country-specific standard like the Senate Bill 32, California Global Warming Solutions Act of 2006: Emissions Limit (SB32).
Eppendorf launched its first ULT freezer with green cooling in 2008, far earlier than most ULT manufacturers. We now have more than 10 years of experience with these coolants in R&D, production, logistics, and service in the field.

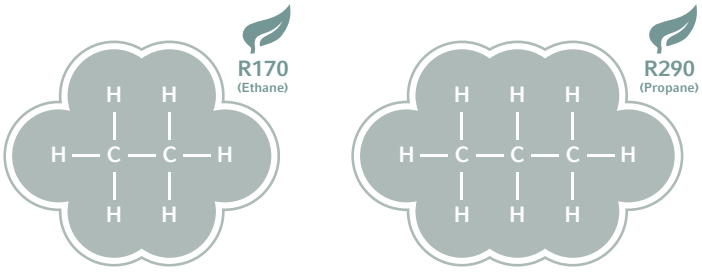

Figure 5: Hydrocarbon based cooling liquids ("green refrigerants") R170 and R290

Figure 6: ACT and ENERGY STAR® certified CryoCube® F740hi ULT freezer

Longevity
The longer the life of a freezer, the more favorable for you as the user and for the environment. Price often plays a decisive role when purchasing a new freezer, but it is important to keep in mind the expected lifespan of the instrument and the potential total cost of ownership over the years. Inexpensive freezers may use lower quality parts, making them more prone to failure and requiring frequent repairs, which can cost both time and money and put your valuable samples at risk. By starting with a high-quality product with advanced technology and high-end components, you can maximize uptime and further extend the life of your freezer simply by conducting regular cleaning, inspection and maintenance.
Energy efficiency, green cooling, and product lifespan are the most common aspects used to consider the sustainability of a freezer, but the ACT label goes a step further by combining these elements with aspects of production, shipment, and disposal to determine a product's true environmental impact factor.

Why does it make sense to use external certification?
Technical parameters of new ULT freezers need to be validated. On-going checks during the development phase are performed inhouse, by standard. For the final test, we at Eppendorf believe in an independent, external counter control. Published technical data of Eppendorf ULT freezers are based on an external, independent European test house which checks tree units of the same type in parallel. These data are based on European 230 V voltage and a dedicated test protocol including documentation.

Factors of Scoring

Manufacturing Impact Reduction
The Manufacturing Impact Reduction considers activities and initiatives within the production facility in recent years to reduce the environmental impact. This can include modifications of buildings, new heating systems, new production machines, or even educational advancements of the staff. The handling of waste is also addressed.

Renewable Energy Use
Renewable Energy Use is related to the power supply contract of the manufacturing facility. Similar to most of our production facilities, the UK-based freezer manufacturing site is supplied by 100% renewable power. The federal „Renewable Obligation" of April 2002 requests that the British power suppliers increase the share of green power within their normal power supply by 2020 to 20%. In 2017, about 30% of the complete British power production was already based on green power. According to the My Green Lab team, a "yes" in this field requires a dedicated green power contract which is given for the Eppendorf freezer facility.
Renewable Energy Use covers the handling of chemical reagents during production. The product needs to be EU RoHS/ REACH compliant, and Eppendorf as company must be ISO 140001 certified. Chemical substances like the refrigerants must be free of CMRs, PBTs, HCFCs, CFCs, GHS Category 1 Hazards, and red list chemicals. Eppendorf happily checks all of these boxes.

Shipping Impact
The Shipping Impact describes the transportation of the product from the production facility (in this case, the UK) to the country of usage, e.g. USA. The concept is based on reduction of shipment distance. Especially for food, this "preferred local production" concept makes sense. For specialized products like lab equipment, there are only a few facilities worldwide which are able to produce this equipment. Shipment, including long-distance shipment, is a necessity as the equipment is needed globally.

The type of shipment has an impact as well: Heavy and bulky freezers should be shipped by cargo ship only. Transportation by cargo plane is neither environmentally (CO_2) nor economically (cost) sustainable. Additionally, due to IATA rules, modern ULT freezers using green cooling liquids are not allowed on planes.

Product Content
In the Product Content category, My Green Lab focuses on the recycling quotes of raw material. Recycling quotes of metal work are especially challenging: steel and copper are melted in big reservoirs which are supplied with material from iron/ copper ore (= new steel/ copper) and from recycled steel/ copper. It is difficult to ascertain exactly what percentage of new or recycled materials end up in the metal sheets for a particular product. Averages and assumptions are needed as the actual value is variable. As of 2015, more than 50% of the produced steel in Europe was based on recycled material, and 90% of the steel in products was collected at the end of the product lifetime. The European copper demand is based on 44% recycled sources and 70% of the copper in products is collected (https://eu-recycling.com/Archive/26491).
Every ton of recycled steel saves about 70% of the energy needed for primary production, while every ton of recycled copper saves about 85% of the energy needed for primary production (EuRIC AISBL; https://www.euric-aisbl.eu/position-papers/; www.euric-aisbl.eu/position-papers/download/591/335/32).
The steel used in an Eppendorf ULT freezer is based on 10-40% recycled content, depending on the type of steel, such as mild steel, stainless steel, or galvanized steel. The freezer contains almost 10% by weight of recycled content, i.e. steel.
In some countries, the term "waste-free production" is used to describe an environmental improvement from landfill (waste-to-dump) to burning (waste-to-energy) or recycling (waste-to-raw material). Some manufacturers make this claim now to a show a recent improvement in their manufacturing practices. At Eppendorf's freezer manufacturing facility, this has been standard practice for many years already.

More Information

CMR = Carcinogenic, Mutagenic, or toxic for Reproduction
PBT = Persistent, Bioaccumulative and Toxic
HCFC = Hydrochlorofluorocarbon
CFC = Chlorofluorocarbon
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
EuRIC AISBL = European Recycling Industries' Confederation - Association without lucrative purpose

Packaging Content
The Packaging Content addresses the footprint of the packaging and its recyclability. The cardboard used in our freezer packaging is made from at least 70% recycled material due to different sub-sources for the materials. This number also fits with published data: In the European Union, nearly 100% of fiberboard is recycled. The German corrugated fiberboard industry consortium states that at least 80% of the national corrugated fiberboard production is made of recycled fiberboard. The recycling rate of this material in the UK is around 84% and on average, 70-90% of newly produced corrugated fiberboard is based on recycled material (https://www.gwp.co.uk/advantages/recyclable-packaging/#).
The packaging concept of a ULT freezer is designed to handle a 300 kg large-volume instrument during shipment. A significant reduction of material is very challenging, since the freezer must safely arrive at its destination without any damage to the instrument or the logistics team.
Potential environmental savings are higher ratios for recycled material in the cardboard, a source for the low density polyethylene (LDPE) dustcover foil with recycling content, and biodegradable cushion foam.

Energy Consumption Measurement
One of the major aspects of ULT freezers in respect to sustainability is the Energy Consumption Measurement. Even energy-efficient ULT freezers still consume a significant amount of energy as they maintain extremely low temperatures, 24/7.
To meet the need for standardized, comparable, and published testing methods, My Green Lab uses the energy consumption values from ENERGY STAR as standard.

Figure 7: Logo of ENERGY STAR®

As a result, the power consumption values published in the ACT label are based on ENERGY STAR test results using the US-voltage of 115 V (or 208 V) as reference. Due to differences in the testing procedures (e.g. door opening versus closed testing period, room temperature of 24°C versus 20°C), the ENERGY STAR data vary slightly from the values which are published by Eppendorf based on data from a third-party test house (CryoCube F740hi [115 V; -80°C set point]: 12.3 KWh/ day with one unit using ENERGY STAR protocol versus 11.6 KWh/ day at the test house with three units using independent protocol). Eppendorf respects both measurements as the testing conditions are published and traceable.

Water Consumption
Water consumption is zero for freezers during usage. Water-cooled ULT freezers like the CryoCube F740hiw are connected to a facility's recirculating water system. The heated cooling water is reused for other heat demanding systems in the facility. Plus, the HVAC system consumes less energy due to less heat output into the building.

Product Lifetime
The Product Lifetime is a topic of much discussion, as proof is challenging: A 10 year-old instrument can be boxed for 9.5 years and only used for the last 6 months, so it looks like new in year ten. In contrast, a workhorse that has performed its job for 10 years and may now be showing the first signs of wear.
High-quality freezers, combined with maintenance and service, can run for 10 years or longer.

Packaging End of Life
The Packaging End of Life is reached after the shipment. Collection and recycling of all parts of the packaging is recommended. Cardboard and wooden pallets are commonly recycled goods, whereas dust covers made of LDPE foil and cushion foams are more specialized. Recommendations and descriptions can support users in improving the recycling of packaging material.

Product End of Lifetime
Even the most high-quality instruments will eventually reach their Product End of Lifetime. Large instruments like ULT freezers which are made of many different materials need to be recycled in a sustainable way. Check with your Eppendorf partner your local waste hauler or facility management team to understand the available recycling options for your organization.
Eppendorf freezers last for many years, but if they need to be replaced, kindly be sure to fulfill all local requirements for disposal of these instruments. We strongly recommend a certified local recycling partner with experience in instruments with active cooling. Keeping it "local" reduces the impact of transportation, and a „certified" partner ensures the safe and sustainable removal and recycling of the cooling liquids in compliance with local regulations.

Summary

The ACT certification process requires an in-depth review of a company's sustainability programs and an examination of all the environmental factors related to a selected product. It is a necessarily lengthy process that brings to light many insights and areas for improvement. With the certification of the CryoCube ULT freezers, Eppendorf remains more committed than ever to supporting the planet and its people through Accountability, Consistency, and Transparency in its efforts to reduce its environmental impact.

But there is still more work to be done. Eppendorf recognizes what it means to "go green" by focusing on the continuous development of new features and technologies to reduce raw material usage and energy consumption and to minimize the environmental impact of the business and its products.

None of these challenges can be solved quickly or easily. But all of them demand a community approach and a consistent effort to listen to one another and work together. Supporting organizations like My Green Lab is an important building block of this journey. A focus on the environment ultimately provides a more sustainable future for everyone.

About Eppendorf

Since 1945, the Eppendorf brand has been synonymous with customer-oriented processes and innovative products, such as laboratory devices and consumables for liquid handling, cell handling and sample handling. Today, Eppendorf and its more than 3,600 employees serve as experts and advisors, using their unique knowledge and experience to support laboratories and research institutions around the world. The foundation of the company's expertise is its focus on its customers. Eppendorf's exchange of ideas with its customers results in comprehensive solutions that in turn become industry standards. Eppendorf will continue on this path in the future, true to the standard set by the company's founders: that of sustainably improving people's living conditions.

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