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Labs and Their Vendors Work to Make Labs More Sustainable

While the scientific community is full of some of the most passionate advocates for climate change, the labs they work in are one of the contributors towards it. The scientific research is vast, with millions of labs still working in non-environmentally friendly conditions worldwide. These labs typically use 5–10 times more energy than the typical commercial office and consume 4 times as much water, according to the EPA. A 2019 study by Drs. Lotfi Belkhir and Ahmed Elmeligi found that the pharmaceutical industry globally consumes 55% higher carbon emissions than the automotive industry. In 2019, the climate footprint of hospitals and laboratories were estimated to produce 4.4% of total global emissions, equivalent to 2 gigatons of carbon dioxide, based on estimates by Healthcare Without Harm and ARUP. In 2015, a study by the University of Exeter estimated 20,500 scientific research institutions are disposing of 5.5 million metric tons of laboratory plastic waste annually.

As awareness of this issue grows, scientists worldwide are looking for new ways to make their labs more sustainable. However, while ambitious carbon commitments are a step in the right direction, laboratories are increasingly backing up their commitments with action. Making adjustments in one laboratory may seem negligible when compared to the larger picture, but scientists are realizing that individual sustainability efforts can lead to and accelerate change at the governmental level ultimately leading to much larger-scale waste reductions. Sustainability efforts include new options for the lab tools they chose.

While the desire to become more sustainable is there, many scientists are unsure where or how to start. My Green Lab is one notable group dedicated to lowering the barriers to and helping labs achieve their sustainable goals. My Green Lab is a nonprofit based in California with the goal of building a culture of sustainability through science. They start by providing a survey to better understand the current environment in a laboratory with which they are working. They then use that lab's responses to offer more sustainable alternatives. These adjustments may be anything from closing fume hood sashes to adjusting the temperature of the lab's deep freezer.

If the lab adopts at least 40% of My Green Lab's recommendations, they are certified a "Green Lab." My Green Lab also designed the Accountability, Consistency, and Transparency (ACT) Environmental Impact Factor Label to provide customers with information on the environmental footprint of laboratory products. Until now, researchers have not had a convenient way of comparing the environmental impact of various laboratory products, according to My Green Lab. The label provides an environmental-impact score based on the manufacturing, user impact and end of life of the product. The lower the score, the more environmentally friendly the product.

While change has been slow for the laboratory equipment industry, some companies are already taking the necessary steps to address the issue. Thermo Fisher Scientific has been one of the early

adopters of the tools provided by My Green Lab. The company has improved the sustainability of its products with a number of its products have become ACT certified.

Selected Thermo Fisher Scientific Products that Have Received the My Green Label

Thermo Scientific Nalgene Polypropylene Beakers	Thermo Scientific Nalgene Polypropylene Griffin Low-Form Plastic Beakers
Thermo Scientific Nalgene Polypropylene Graduated Cylinders	Nalgene Polypropylene Graduated Cylinders
	Nalgene Polypropylene Economy Plastic Graduated Cylinders
Thermo Scientific Nalgene High Density Polyethylene Lab Bottles	Nalgene Narrow-Mouth HDPE Lab Quality Bottles with Closure
	Nalgene Narrow-Mouth HDPE Economy Bottles
	Nalgene Narrow-Mouth Economy HDPE Bottles: Bulk Pack, Assembled
	Nalgene Square Narrow-Mouth HDPE Bottles with Closure
	Nalgene Rectangular HDPE Bottles with Closure
	Nalgene Wide-Mouth Lab Quality HDPE Bottles
	Nalgene Wide-Mouth HDPE Economy Bottles with Closure
	Nalgene Wide-Mouth HDPE Economy Bottles with Closure: Bulk Pack
	Nalgene Square Wide-Mouth HDPE Bottles with Closure
Thermo Scientific Nalgene Rapid-Flow PES Filter Units	Nalgene Rapid-Flow Sterile Disposable Filter Units with PES Membrane*
	*Does not apply to 124-0045, 124-0045PK and 524-0020
Thermo Scientific Matrix 2D Storage Tubes	Matrix 2D Barcoded Open-Top Storage Tubes
Invitrogen DNA Stains	Invitrogen SYBR Safe DNA Gel Stain
	Invitrogen SYBR Safe DNA Gel Stain in 0.5X TBE
	Invitrogen SYBR Safe DNA Gel Stain in 1X TAE
	UltraPure Ethidium Bromide
Ultra-Low Temperature Freezers	Forma FDE Series -40°C Ultra-Low Temperature Freezers
	Forma FDE Series Ultra-Low Temperature GP Freezers
	HERAfreeze HDE Series -40°C Ultra-Low Temperature Freezers
	HERAfreeze HDE Series Ultra-Low Temperature Freezers
	Revco RDE Series -40°C Ultra-Low Temperature Freezers

	Revco RDE Series Ultra-Low Temperature Freezers
	TDE Series -40°C Ultra-Low Temperature Freezers
	TDE Series Ultra-Low Temperature Freezers
	TSX Series Ultra-Low Freezers
TSX Series Freezers	TSX Series High-Performance -30°C Auto Defrost Freezers
	TSX Series High-Performance Plasma Freezers
	TSX Series High Performance -20°C Manual Defrost Freezers
	TSX Series High-Performance -20°C Manual Defrost Enzyme Freezers
	TSX Series High-Performance Flammable Material Storage - 20°C Manual Defrost Freezers
TSX Series Refrigerators	TSX Series High-Performance Lab Refrigerators
	TSX Series High-Performance Blood Bank Refrigerators
	TSX Series High-Performance Chromatography Refrigerators
	TSX Series High-Performance Pharmacy Refrigerators

Source: Thermo Fisher Scientific

Beyond the certification of its products, Thermo Fisher has also supported My Green Lab's International Laboratory Freezer Challenge. Around 20% of the energy consumed in a laboratory comes from equipment plugged into the wall. Laboratory refrigerators and freezers make up a large portion of this plug load. The Freezer Challenge is a free competition designed to encourage sustainable cold storage practices by choosing winners based on a labs' cold storage best practices. It is held January to July each year.

This focus on sustainable products is in line with lab tool companies' own commitments for their own companies' operations. Agilent is one of many laboratory tool companies making this commitment. In October 2021, Agilent Technologies announced its commitment to achieve net-zero greenhouse gas emissions by 2050. In addition to this promise, Agilent has also produced an annual sustainability report on its progress in reducing energy, waste, water and carbon emissions since its founding in 2000. Furthermore, since 2014, Agilent has reduced their carbon emissions intensity by 35%, their municipal water intensity by 22% and diverted 94% of its solid waste from landfills.

While the company is already making progress towards their goal, achieving net-zero emissions by 2050 will be no small task. As the company announced in 2021: "To ensure the company achieves its net-zero goals by 2050, Agilent has committed to interim greenhouse gas reduction targets. By 2030, Agilent will reduce absolute Scope 1 and 2 emissions by 50%, and Scope 3 emissions by at least 30%. Scope 1 covers direct emissions from owned or controlled sources, while Scope 2 covers indirect emissions from the generation of purchased electricity, steam, heating and cooling consumed by the reporting company. Scope 3 includes all other indirect emissions that occur in a company's value chain. To achieve these targets, Agilent will continue to invest in renewable energy and focus on

three areas where its carbon footprint is greatest: purchased goods and services, sold products, and transportation and distribution.”

Agilent’s goals also include products developed, how they work with customers and suppliers, how they manage their internal operations and being accountable for achieving their goals. Agilent has worked with My Green Lab to achieve ACT labels on a number of products. Agilent has also invested in renewable energy, is transitioning to electric vehicles and has reduced business travel. Agilent is also working with suppliers to reduce their emissions and favoring suppliers with a smaller carbon footprint. In addition to their own environmental goals, Agilent is also working with customers to help them run their labs more efficiently and to support their net-zero commitments.

Selected Agilent Technologies Products that Have Received the My Green Label

Mass Spectrometry	Agilent 6475 Triple Quadrupole LC/MS
	Agilent InfinityLab LC/MSD iQ
	Agilent Ultivo Triple Quadrupole LC/MS
Liquid and Gas Chromatography	Agilent 1220 Infinity II LC System (G4294B)
	Agilent 1220 Infinity II LC System (G4286B)
	Agilent 1260 Infinity II LC System
	Agilent 1290 Infinity II LC System
	Agilent 8860 GC System
	Agilent 8890 GC System
	Agilent Intuvo 9000 GC System

Source: Agilent Technologies

In addition, Agilent has engineered many of their products and services to be more sustainable. For example, its Intuvo 9000 Gas Chromatograph uses an efficient direct heating system that requires less than half the electrical power of a conventional GC, while also significantly reducing the heat energy emitted back into the lab. The InfinityLab SFC Solutions provide low solvent consumption and less waste for through uses of food-grade carbon dioxide instead of hazardous solvents.

Agilent also reduces the amount of waste from instruments by offering customers the ability to trade-in a used instrument for a new one, sell back a pre-owned instrument, or return decommissioned instruments for recycling even if the instrument was purchased from another vendor. After refurbishing pre-owned instruments and conducting QC inspections, the instruments can be resold through Agilent’s Certified Pre-Owned Instrument program. Any instruments that cannot be refurbished are scrapped for parts and recycled as much as possible. In 2021, through the Agilent instrument return program, Agilent bought back over 900 used instruments from customers, sold over 3,500 certified pre-owned instruments and received 2,000 instruments.

While any lab can cut down on energy consumption by turning off lights and unplugging equipment, some changes require more innovation. Grenova is a company that is creating novel products to address one of the more difficult issues in the lab. The company is focused on reducing plastic waste

by providing a system for washing and reusing consumables. The company's devices clean and sterilize consumables allowing the plastics to be repeatedly reused. Every year, laboratories discard more than 36,000 tons of pipette tips after a single use, according to The Pathologist.

Anyone who has worked in a lab has witnessed this immense plastic waste. While it is a clear issue and a sizable expense for labs, science experiments rely on reproducibility, which requires sterile equipment. Plastic has been favored in the lab due to its durability and sterility, but the durability of plastic becomes an issue when it comes to disposal. It takes approximately 450 years for a plastic bottle to decompose and as it decomposes it leaches toxins out into the environment, according to My Green Lab.

Grenova addresses this issue with its product line of pipette tip washers. Grenova offers a number of washers and accessories that enable laboratories to wash and sanitize pipette tips for re-use numerous times. The washers have been validated for use with ELISA, MS, toxicology, RNA, PCR and COVID-19. Thanks to Grenova's technology, an estimated 912,931,680 pipette tips have been reused, which equates to 2,620,664 lbs of plastic, according to the company. Not only do the washers significantly cut down on waste, they also cut the associated consumable costs by up to 96%, states Grenova. Grenova estimates its products have collectively saved labs \$73,480,381 so far.

Grenova's founder and CEO Ali Safavi discussed some of the biggest challenges in entering the lab equipment market with a product dedicated to sustainability. "Scientists have to be proven wrong in order to accept something, so that is the biggest resistance. But once there's awareness and support behind it and evidence that this is actually better, then this new thing becomes the norm," he told *IBO*. "We are seeing that transition, but we're still not there. We still need more companies with sustainable solutions coming into the market and offering solutions so that labs start thinking on a larger scale in terms of sustainability."

In 2020, Grenova found an unlikely ally in this challenge. During the early days of COVID, delays in the supply chain forced lab equipment providers to look for new solutions. Grenova's products gained popularity because the company already had a lot of data and validation behind them. Labs began realizing they did not have to rely on vendors and could instead control their inventory in-house, said Mr. Safavi. He estimates the pandemic expedited the adoption of the technology to the market by three years at least.

Once labs began using Grenova technology, many of their misconceptions were proven false and they realized the value behind the sustainable practice, according to Mr. Safavi. "The labs have seen the benefits of implementing this new technology," he commented. "There are three value propositions to the customer: (1) the cost reduction is pretty significant, (2) it's a huge sustainability movement and (3) mitigating the supply chain."

These changes are recognized by Grenova's customers. "We've seen in recent reports that labs have actually seen improvement in the experimental results they're getting because the pipette tip washers produce very consistent sterilization," noted Mr. Safavi. These results challenged previous conceptions. "They say the pipettes are cleaner than when they're brand new because when they're brand new, [the pipette] comes from a factory; they open up the seal, use it and never question it. Based on how the manufacturing process was done, they were seeing variation in their results

sometimes," he emphasized. "Now they can wash the consumables in house, they can get consistent quality of results. So the quality has improved."

When looking forward, Mr. Safavi is optimistic labs of the future will be able to achieve zero waste. "It is achievable as long as the whole industry supports it—but everyone has to work hand in hand because it's not just the lab, it's the suppliers to the lab, customers of the lab, regulations, the government. Everybody has to be in support of this effort, this change, regulations and funding this. We can reach the future lab of 100% sustainable practice."

When it comes to tackling waste in the lab tool industry, labs appear to be willing to put in the effort and be open to new solutions, especially now that vendors are providing more sustainable products.