

Siemens study results redefine standards for safety, efficiency and flexibility in life sciences labs

- **World's first independent comparison test of lab ventilation systems under real-world stress conditions reveals groundbreaking insights**
- **Results can be directly applied to design, optimization, and operation of laboratories worldwide**
- **Siemens further develops its Smart Lab Ecosystem to help create labs of the future that are safer, as well as more adaptable and sustainable**

Siemens has unveiled the results of a comprehensive and independent study on laboratory ventilation in the area of life sciences. The study was conducted between November 2024 and February 2025 together with H. Lüdi + Co. AG, a supplier of core components and system solutions for modern laboratories and a Siemens Xcelerator partner. The Lucerne University of Applied Sciences and Arts (HSLU) in Lucerne, Switzerland, was contracted as the independent research and testing institution to execute all measurement activities. The project, named "PEARL", was the world's first to compare different lab ventilation and air distribution systems under controlled, real-world conditions.

During the test phase, three different air supply systems were controlled and measured in seven different configurations under comparable situations and were stressed to their limits. The results are a unique set of data insights for each system, where specific situations can be compared, addressing various elements like safety and contamination control, user comfort, system flexibility, adaptability, and ventilation efficiency.

The study found that precise control of airflow is paramount, leading to safer, more efficient, and comfortable lab environments. In fact, oversupplying air can disrupt controlled conditions, elevate costs, and increase CO₂ emissions. Remarkably, some scenarios required less than half the volume of air, achieving 45 percent better ventilation efficiency and demonstrating

superior removal of dangerous gases and heat. Better-controlled airflow also led to up to 29 percent faster recovery times after simulated spills, directly improving user safety and comfort. Furthermore, project PEARL advocates for a shift from designing lab spaces for a single, specific use to creating flexible, next-generation environments capable of scaling from zero up to 300 Watts per square meter. These advanced systems are right-sized and well-controlled, delivering the exact amount of air needed to maintain safety and comfort while simultaneously saving energy and reducing emissions.

While conducting the physical tests, Siemens built a digital model of the complete project setup, including a simulation of the tests themselves. "Comparing our project PEARL digital model with real-world measurements revealed amazing accuracy. This validated knowledge allows us to fine-tune and optimize performance, safety, and comfort for future lab designs directly within their digital twin," said Tim Walsh, Global Solution Director for Life Sciences at Siemens Smart Infrastructure.

The demand for laboratory space is on the rise in all key geographies, fueled by R&D investments, biotech innovations and a growing pipeline of new drugs. In the UK alone, estimates call for one million square meters of additional lab space in the next five years to cover predicted research needs. The study's findings help address the critical needs for safer, more flexible, and energy-efficient laboratories.

Based on the insights from project PEARL, Siemens has further improved the Smart Lab Ecosystem (SLE), a modular infrastructure kit that allows for the creation of highly adaptable and scalable lab environments that can be tailored to specific research needs, from basic research to high-containment facilities. The SLE enables up to 80 percent faster design and configuration of all types of lab environments up to bio-safety level 2.

"Project PEARL is a game-changer for the laboratory industry," Walsh added. "For the first time, we have real-world data that not only confirms our digital models but allows us to refine them and design laboratories that are truly optimized for safety, comfort, and efficiency. The Smart Lab Ecosystem builds on this foundation, offering our customers a complete, turnkey solution that is both innovative and future-proof. We are not just building laboratories; we are creating intelligent environments that will accelerate scientific discovery and drive progress for years to come."

This press release as well as press pictures are available [here](#).

Link to PEARL project website: <https://www.siemens.com/project-pearl>

For more information on Siemens Smart Infrastructure, please see [Siemens Smart Infrastructure](#).

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