SHOWCASING INNOVATION:

GSA'S GREEN PROVING GROUND PROGRAM PAVES THE WAY FOR BUILDING ENERGY EFFICIENCY AND OPERATIONS TECHNOLOGY

BY MATTHEW CHESTER

The adoption of new technology in federal building retrofits is stunted by the fear that the technology is not proven—the risk of failure or underperformance is too high. Yet, at a time when the demand for advanced building technologies has never been greater, this caution could be counterproductive. To achieve ambitious carbon reduction targets, buildings must not only adopt but excel in energy efficiency. Recognizing this, the federal government has found it necessary to step up as a leader in fostering and promoting innovative American-made technology. Specifically, the Green Proving Ground (GPG) Program from the U.S. General Services Administration (GSA) has served as a shining example of how public sector initiatives can successfully drive advancements to the next generation of building performance.

THE IMPORTANCE AND VALUE OF THE GREEN PROVING GROUND PROGRAM

The GPG Program has already entrenched itself as an essential component of the federal government's broader push to reduce energy consumption, improve sustainability, and lower operational costs in its vast network of buildings (GSA reports owning and leasing almost 8,400 buildings with a total of 363 million square feet across the country). Established to evaluate and deploy emerging building technologies, GPG serves as a first testing ground where new technologies are piloted in real-world settings, providing engineers and program implementers with critical data on the technologies' performance in achieving their ultimate goals while also identifying weak spots or areas that risk user error. To date, the GPG has published the results of 54 different technologies they have tested, while 39 technology evaluations are currently ongoing at 51 test beds, all under the following categories:

- Building envelope;
- Energy management;
- Electric Vehicle Supply Equipment;
- Healthy Buildings;
- HVAC;
- Lighting;
- Materials;
- On-site power & renewables, and
- Water.

Implementation by the GPG aims to bridge the gap between innovation and practical application. Many cutting-edge technologies often face barriers to widespread adoption due to a lack of real-world performance data, with potential customers or even pilot programs feeling unwilling to invest in technology with unknown results. By implementing these technologies in federally owned buildings, the GPG helps to prove their effectiveness under real conditions, offering valuable insights that private sector companies can later adopt. This process not only accelerates the path to commercialization in a lower-risk setting but also strengthens the federal government's commitment to reducing the carbon footprint of its building portfolio.

Further, with federal initiatives like the push toward net-zero emissions buildings by 2045 and the commitment to lower greenhouse gas emissions, GPG directly supports the broader federal government sustainability targets. By identifying technologies that may improve energy performance, the program helps ensure that federal buildings—some of the largest and most energy-intensive in the country—are at the forefront of innovation.

HIGHLIGHTING THE CLASS OF NEW TECHNOLOGIES CHOSEN BY THE GPG PROGRAM IN JULY 2024

The GSA announced in July 2024 a new cohort of cutting-edge technologies aimed at transforming the energy efficiency and sustainability of federal buildings. These technologies were chosen in partnership with the Department of Energy (DOE), reflecting the government's commitment to pushing the boundaries of innovation and finding solutions that can contribute to the ambitious goal of achieving net-zero federal buildings.

These technologies, each potentially offering unique benefits in terms of energy savings, operational improvements, and environmental impact, will next undergo real-world testing in federal facilities across the country. This year's selection focused on several key areas critical to improving building efficiency, including advancements in HVAC systems, lighting controls, building automation, and renewable energy integration. Each technology represents an opportunity to not only reduce energy consumption but also make federal buildings more resilient, adaptable, and cost-effective in the long term.

Here are each of the chosen technologies and their respective vendors, demonstrating how the federal government continues to lead by example by testing emerging solutions for a sustainable future:

BUILDING ENVELOPE

Building Envelope Remote Sensing Drones

GPG is evaluating a technology from Lamarr.ai that uses drones with infrared sensors to detect heat loss and thermal anomalies in buildings. This approach promises a more efficient, cost-effective alternative to manual energy audits, particularly for large or complex structures. The data collected by the drones is processed using an AI-powered platform to generate 3D models and provide precise retrofit recommendations.

HEALTHY BUILDINGS

Biotech IAQ Verification and Energy Assessment

GPG will test a technology provided by SafeTraces that uses DNA-tagged particles to simulate infectious aerosol movement, allowing for precise tracking of indoor air quality (IAQ) and HVAC performance. HVAC upgrades to enhance IAQ often lead to over-ventilation, excessive spending, and accelerated equipment degradation. Biotech IAQ verification and energy assessment can help meet regulatory guidelines while minimizing energy use and costs.

Integrated Germicidal UV-C (GUV) Air Cleaners

GPG will test integrated GUV air cleaners from Louvers International that use UV-C light from low-pressure mercury lamps to deactivate airborne pathogens like bacteria and viruses. The vendor estimates that integrated GUV air cleaners can provide four or more equivalent air exchanges and reduce HVAC runtime by 50–70%, offering a cost-effective and energy-efficient solution for pathogen control in occupied spaces.

IoT Light Exposure Sensors

With technology provided by Blue Iris Labs, GPG is investigating the use of light exposure sensors to inform lighting design and support healthier circadian rhythms. IoT light exposure sensors measure spectral power distribution, offering insights into both visible and non-visible effects of light. Sensors can evaluate existing circadian lighting systems or integrate into lighting control systems to provide real-time data. Optimized lighting can improve occupant health and benefit mood, sleep, and hormone regulation.

HVAC

Cold Climate Air-to-Liquid Heat Pumps

GPG is evaluating cold climate air-to-liquid heat pumps provided by Trane Technologies that are designed to provide reliable and efficient heating in temperatures as low as -18°F (compared with the 0°F cutoff of conventional heat pumps). An enhanced vapor injection technology uses an economizer to improve system capacity and allows for higher hot water temperatures in colder conditions. Cold climate heat pumps can be used as a primary heat source or to supplement existing systems, with the vendor estimating up to 60% energy savings compared to a standard electric boiler heating system.

Modular Ice Energy Storage

GPG is testing modular ice energy storage systems from Nostromo Energy, which provide cooling by using water capsules to store and release thermal energy. The systems charge during off-peak hours and discharge during high demand, reducing peak-time cooling loads by up to 95% by vendor estimates. The offset is envisioned to lower energy costs, decrease grid pressure, and cut greenhouse gas emissions. Modular units can be stacked and allow for design flexibility.

Technical Specification for Very High-Efficiency HVAC

GPG is evaluating a technical spec for VHE HVAC systems provided by the Institute for Market Transformation. The spec calls for the separation of heating and cooling functions from ventilation and uses high-performance energy recovery ventilation to maximize efficiency. Airflow zones allow for precise system control and improve indoor air quality. Vendor case studies have shown an average 70% reduction in HVAC energy use. The spec supports building electrification without needing to upgrade existing electrical services.

MATERIALS

Low-Carbon Concrete

Low-carbon concrete is a sustainable alternative to traditional cement that matches or exceeds conventional concrete's strength and helps reduce CO2 emissions temperature kilns. The concrete can be used in any structural application and integrates seamlessly with existing industry standards and practices. GPG is evaluating two low-carbon concrete technologies: one by C-Crete Technologies, which uses an electric-powered pulverization process, and one provided by Sublime Systems, which uses an electrochemical process for manufacturing.

Phase Change Material (PCM) Ceiling Tile

GPG is testing phase change material (PCM) ceiling tiles provided by Armstrong World Industries. The tiles enhance building thermal mass by absorbing and releasing heat as the PCM shifts between solid and liquid states. Temperature stabilization improves occupant comfort and reduces HVAC loads, with the vendor estimating 15% in HVAC energy savings. The tiles improve acoustical performance and may be a cost-effective upgrade for buildings with significant daytime heat gains.

ON-SITE POWER AND RENEWABLES

Buildings Integrated Photovoltaic (BIPV) Sunshades

GPG will evaluate BIPV sunshades from Vitro Architectural Glass and OldCastle BuildingEnvelope. The technology combines solar panels with sun-shading to generate on-site power and reduce solar heat gain. The shades are intended to enhance energy generation, especially on south-facing sides in sunny climates, while also improving occupant comfort by reducing glare.

Modular Vertically Integrated Microgrid

GPG is testing modular vertically integrated microgrids from Gridscape Solutions for localized power generation and distribution. Modules consolidate all necessary components into a single box of hardware. The boxes are scalable and stackable, simplifying installation and hardware replacement. The vendor estimates 60-80% reduction in installation time and costs and around 70-80% independence from the utility grid.

Precise Geothermal Drilling

GPG will evaluate technology provided by Brightcore Energy, that enables the efficient installation of closed-loop geothermal heating and cooling systems in urban areas. This method reduces space requirements and minimizes noise and disruption during installation, making it more suitable for densely populated environments. Geothermal systems offer substantial energy savings, as demonstrated by a vendor case study of a historic building in New York City. The study reported a 60% reduction in energy consumption for heating, an 18% reduction for cooling, and a 41% decrease in greenhouse gas emissions.

DOE's Building Technologies Office (BTO) will work with commercial building partners to test the following technologies:

IoT-Based Building Management Solution

BTO will work with the building management system provider, 75F, to evaluate how their solution leverages IoT sensors and cloud-based software to optimize building performance in real-time. This evaluation will determine how such a system can improve energy efficiency by continuously adjusting HVAC, lighting, and indoor air quality based on occupancy and external weather conditions. Such technology can help unlock benefits of predictive maintenance, reduced energy consumption, and enhanced occupant comfort.

Liquid Desiccant Dedicated Outdoor Air System

Coordinated with Blue Frontier, BTO will evaluate how the use of liquid desiccant technology to improve air conditioner efficiency. This technology aims to reduce cooling energy consumption by removing humidity from incoming air before it enters the HVAC system, which not only improves cooling efficiency but also enhances indoor air quality by controlling moisture levels. The system's integration of energy storage capabilities also allows for peak load management.

Refrigerant Lifecycle Management Strategy

êffecterra's approach to refrigerant management offers a comprehensive solution for reducing greenhouse gas emissions related to refrigerants. In the demonstration with BTO, these efforts will investigate how the life cycle management strategy for refrigerants can streamline their tracking, recovery, and recycling throughout their use in HVAC systems. This strategy can minimize refrigerant leaks and ensure proper disposal, reducing the environmental impact of refrigerant use while helping buildings meet sustainability goals.

MOVING FORWARD WITH PROVEN SOLUTIONS

The GPG Program is more than just a federal initiative—it's a powerful engine driving the future of building efficiency, sustainability, and technological innovation from manufacturers across America. By selecting, testing, and validating cutting-edge technologies in real-world federal building environments, GPG plays a pivotal role in reducing energy consumption and operational costs across some of the nation's largest energy consumers.

The GPG Program should be seen as a strategic ally, with these advancements empowering federal building owners to achieve smarter and more efficient solutions while mitigating the risks associated with unproven technologies. As GSA continues to push the boundaries of what's possible with energy management technologies, the GPG Program serves as a beacon of progress, proving that innovation is not just necessary—it's achievable. The set of new technologies selected in 2024 is a testament to that vision, and their successful implementation in federal buildings promises to open new doors for energy efficiency across the broader market.

WHO LEADS THE GPG PROGRAM?

Kevin Powell is the Director of Emerging Building Technologies for the General Services Administration's Public Buildings Service (PBS) and program director for the GSA Proving Ground (GPG). Powell focuses on identifying innovative technologies, practices, and processes that optimize how PBS designs, delivers and operates more than 185 million square feet of Federal real estate. He brings two decades of experience in building science, design research, and policy analysis. He has a longstanding commitment to smart asset management, deployment of next-generation building technologies, and indoor environmental quality. Powell received his master's degree in architecture from the University of California at Berkeley.