



Center for Emerging Building Technologies

Green Proving Ground

Joshua Banis | May 2024



Roadmap

The background of the slide is a photograph of a modern office interior. It features a prominent wooden wall and ceiling. In the foreground, there is a large, leafy potted plant. To the right, a person is sitting in a modern, dark-colored chair, looking at a device. The overall atmosphere is professional and contemporary.

1 | GSA Portfolio

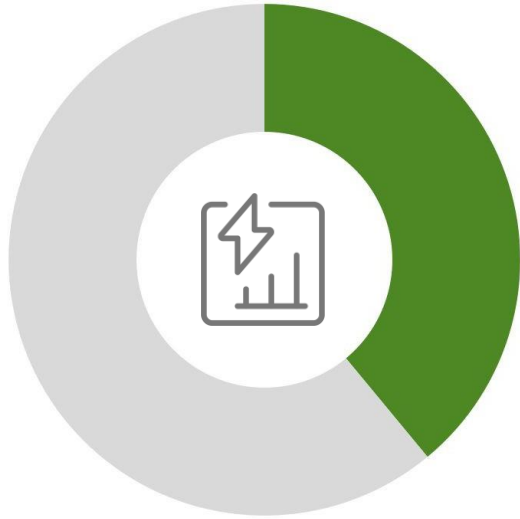
2 | Green Proving Ground (GPG)

3 | Current Projects

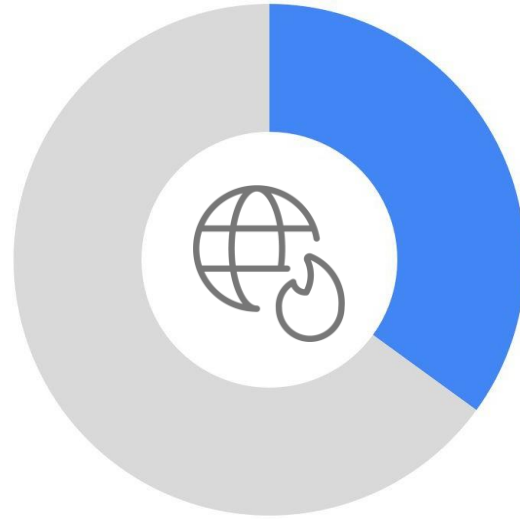
GSA Portfolio



»» Building Energy Use



39%
of U.S.
energy use




35%
of U.S. carbon
emissions



What Does
GSA Manage? >>>



- 
- » Single largest U.S. portfolio of commercial office space
 - » Large urban buildings (90% > 100,000 ft²) with central plants
 - » 80% in mild climates (ASHRAE 3, 4, 5)
 - » Majority are energy star 80 or better

1,500+
owned properties

8,100+
managed properties

377 M
rentable sq. ft.

BIG

Audacious REQUIREMENTS

Executive Order 14057: Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability

» 2030

- 100% carbon pollution-free electricity (CFE)
- 65% reduction of operational GHG (2008 baseline)
- Net-zero-ready new construction and modernization

» 2035

- 100% zero emission vehicles in federal fleet (450,000 vehicles)

» 2045

- Net Zero Carbon Operations across building portfolio

Federal Building Performance Standard

» 2030

- 30% of portfolio eliminates scope 1 emissions

Funds to Maximize GSA Building Performance & Minimize GHG Emissions



**Assistance for Federal
Buildings §60502 (HPGB)**

\$250M

available until Sept. 30, 2031

to convert GSA facilities to high-performance green buildings (as defined in Section 401 of EISA)



**Use of Low-Carbon
Materials §60503 (LEC)**

\$2.15B

available until Sept. 30, 2026

to acquire and install materials and products for construction or alteration of GSA buildings that have substantially lower levels of embodied greenhouse gas emissions, as determined by EPA



**GSA Emerging Tech
§60504 (E&ST)**

\$975M

available until Sept. 30, 2026

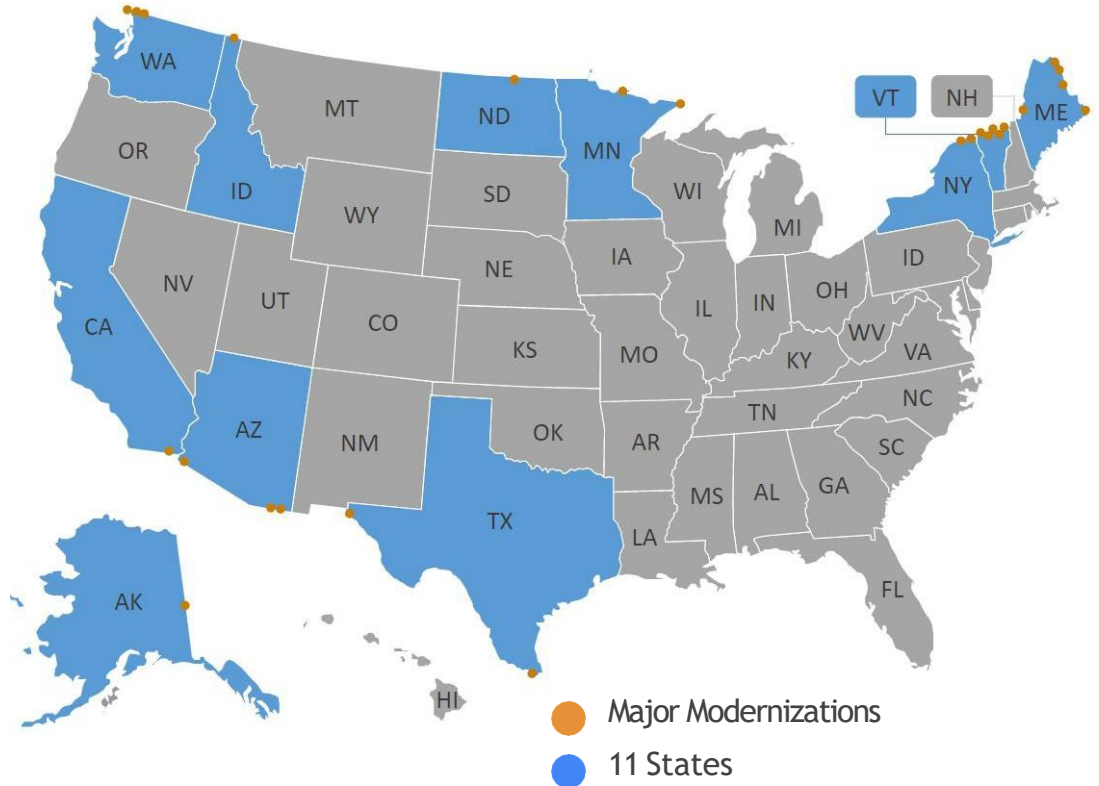
for emerging and sustainable technologies, and related sustainability and environmental programs

» Bi-Partisan Infrastructure Law, 2021

\$3.75B

To modernize
and improve

>60 LPOEs



Three Programs. One Mission.

Empowering GSA to invest wisely in next generation building technologies

CBT

»» CEBT Programs



» CEBT Strategic Goals



»» GSA Green Proving Ground (GPG)



Select promising emerging technologies at the edge of commercialization



Pilot emerging technology installations within GSA's real-estate portfolio



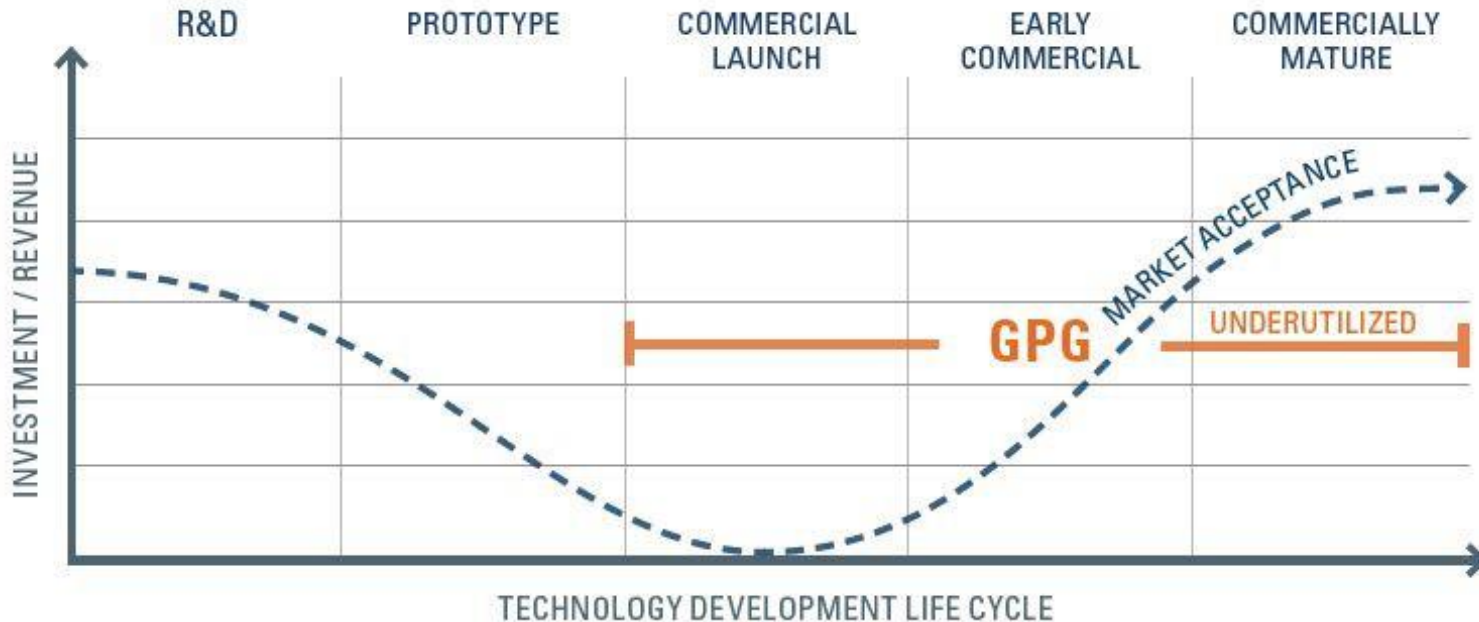
Partner with DOE national laboratories to evaluate real-world performance



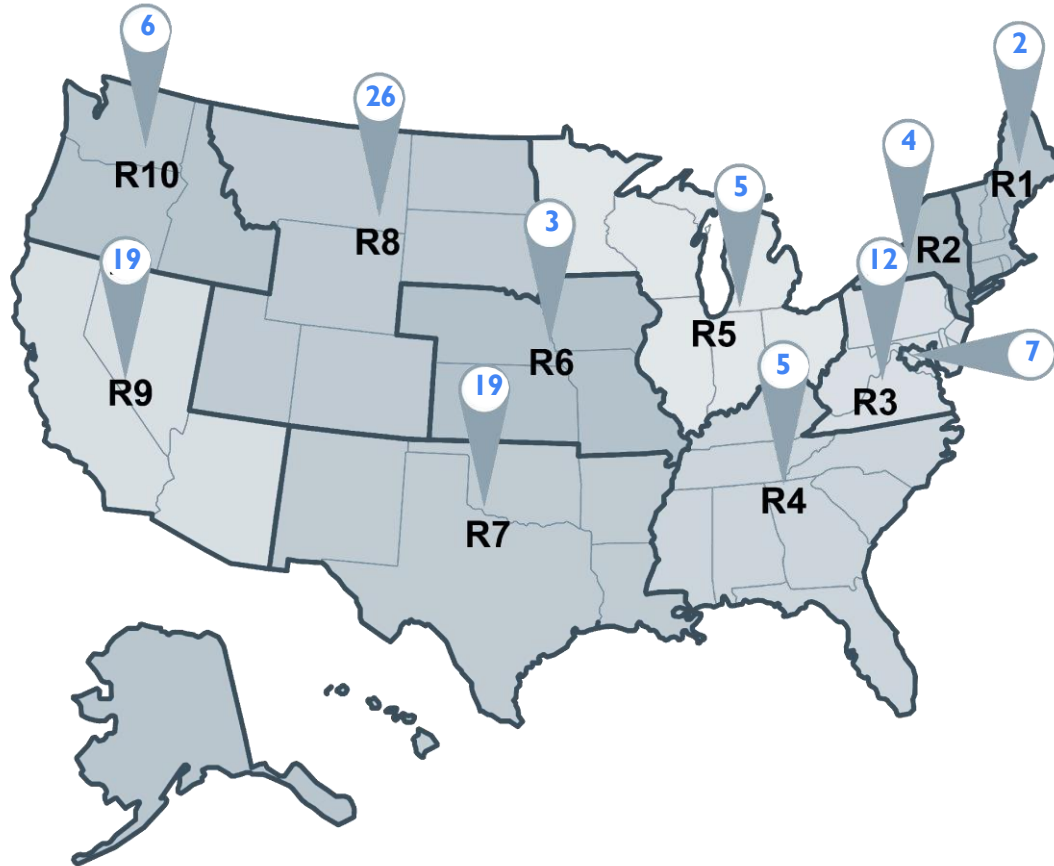
Identify proven technologies with broad deployment potential for GSA

» Field Validations Help Bridge the Gap

4 out of 5 innovative building technologies are never fully commercialized.
Why? Skepticism from facility managers, who live by the “tried and true.”



» GPG Test Beds 2011-2022



Test-bed locations are representative of diverse conditions

Publicly Available Test-bed Results

OPPORTUNITY
What is the potential benefit to Land Ports of Entry?

PROVIDE DIRECT
AN UNDISCOVERED VISUAL FEED AND THE AREA UNDER SURVEILLANCE

TECHNOLOGY
How do electrochromic (EC) windows work?

TRANSITION FROM
USING PHOTOCHROMIC READING

MAV
What are the advantages of MAV?

RESULTS
How do electrochromic windows perform in MAV?

GLARE HIGH VISIBLE REDUCTION
REDUCE BELOW PERCEIVABLE GLARE THRESHOLD

DAYLIGHT GLARE PROBABILITY (DGP) IN VEHICLE
Dash with EC window has much lower DGP

Modeled Perimeter Energy Savings for Range of Climates
While building energy savings is estimated to be at least 10% of perimeter savings

Location	Climate	Window Type	Energy Savings (\$/yr)	Energy Savings (\$/ft²)
Atlanta, GA	Humid Subtropical	EC	1,140	1.14
Chicago, IL	Humid Continental	EC	1,140	1.14
Denver, CO	Semi-Arid	EC	1,140	1.14
Los Angeles, CA	Semi-Arid	EC	1,140	1.14
Phoenix, AZ	Desert	EC	1,140	1.14
Portland, ME	Humid Continental	EC	1,140	1.14
San Francisco, CA	Mediterranean	EC	1,140	1.14
Seattle, WA	Oceanic	EC	1,140	1.14
Washington, DC	Humid Continental	EC	1,140	1.14
Yearly Perimeter Savings			1,140	1.14

ACROSS ALL CLIMATE ZONES
Retrofit efficiency gains and faster payback will be to buildings with either single glazing or existing applied film. Check air performance results from the EC 2.0 test review file.

LAND PORTS
And offer to reduce when window view is better visibility?

Overview Infographics

Low-e Applied Film Window Retrofit for Insulation

February 2017

Charlie Curcio
Howdy Gurd
Robin Mitchell

General Services Administration
Public Buildings Service

EC WINDOWS AT LAND PORTS OF ENTRY

Electrochromic Windows Reduce Glare While Preserving Line of Sight

All Land Ports of Entry (LPOE) military installations and other facilities where occupants view critical activities, security through windows is critical. LPOE facilities use surveillance cameras to monitor their surroundings, but officers often face glare from cameras in their "line of sight" or unobstructed view path between the interior and the outdoors. In sunny conditions, direct sunlight can be severely compromised by window glare. But conventional solutions to control glare, like tinted films and window coverings, can obstruct views and inhibit visual security. Electrochromic (EC) windows preserve line of sight and beneficial daylight while controlling glare.

With this technology, windows turn from clear to dark and block light, either automatically or in response to manual controls. To assess EC glass-modelling performance, GSA's GPG program commissioned Lawrence Berkeley National Laboratory (LBL) to conduct a field study at the Dover LPOE in the Texas border with Mexico. Researchers found significant reductions in glare with EC windows, along with high heat rejection. EC windows are also shown to reduce building energy consumption, which is the focus of other completed and ongoing GPG studies.

Technical Report & 4-Page Findings

GPG Program

Home > Governmentwide Initiatives > Sustainability > GPG Program

GPG Program

Occupants Prefer EC Over Legacy Windows
Implementations that both satisfy occupants and meet competing performance requirements can be challenging and time consuming to develop.

Learn more: EC Window Demonstration for General Office Space >

Outbrief Webinar Series
GPG Outbrief webinars present innovative, cost-effective technology solutions for GSA. Webinars are held once a month or as needed, as well as recording slides for past use.

Published Findings
GPG has recently completed assessments of the following technologies:

Ongoing Assessments
GPG is assessing technologies in the following areas:

GPG Outbrief 01: Low-Cost Window Retrofits

GPG Program | U.S. General Services Administration | March 30, 2017

Website & Webinars

» Provide Actionable Data



965

technology
applications

104

technologies
evaluated

53

published
reports

30

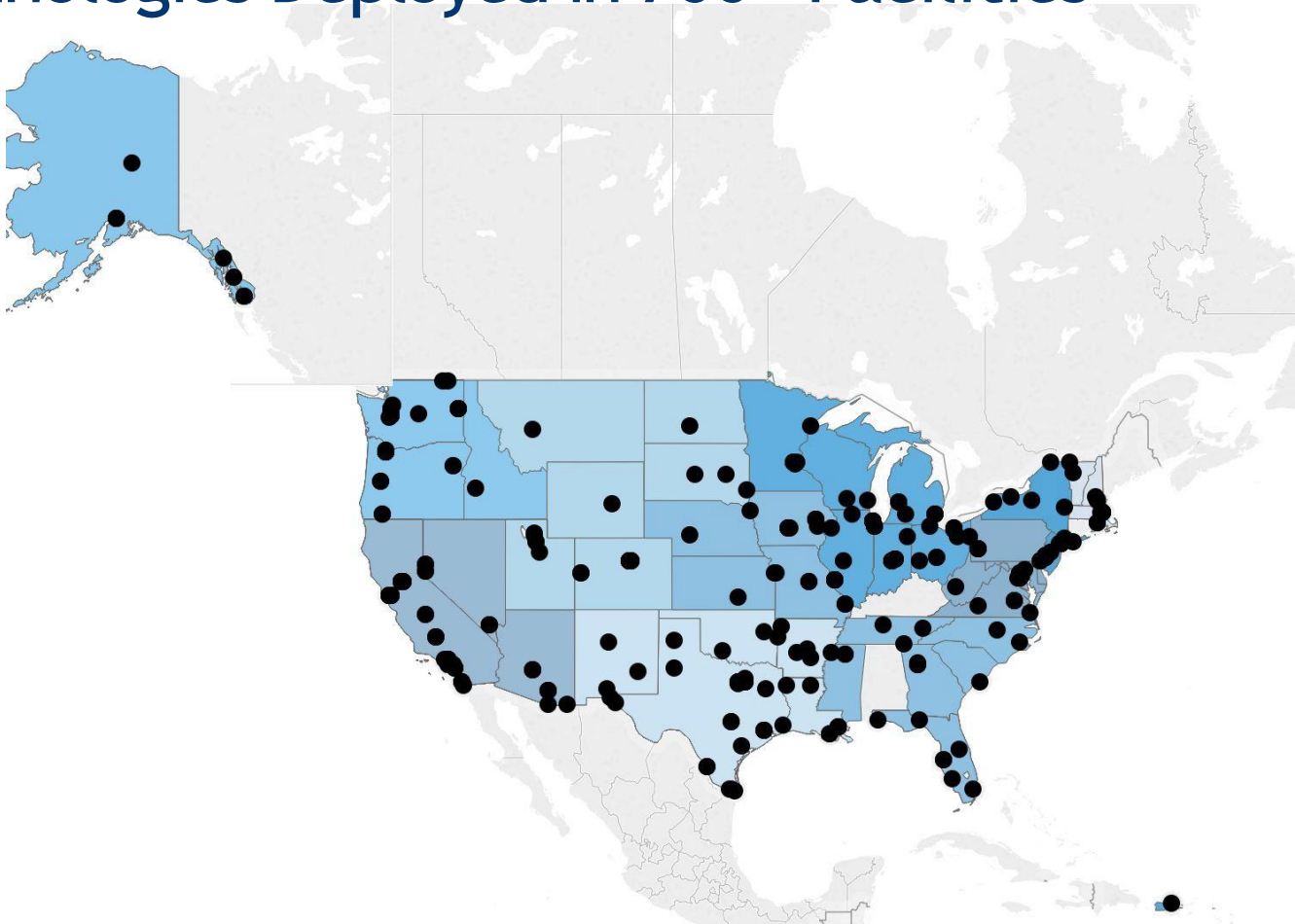
proven
technologies

» 23 GPG Technologies Deployed in 700+ Facilities

960K
MMBTU
total annual
energy savings

\$375M
total lifecycle
cost avoidance

116K tons
annual CO₂
Reduction



A photograph of a modern, multi-story building with a glass facade, set against a blue sky with scattered clouds. The building has a unique, angular design with a prominent glass section. In the foreground, there is a landscaped area with green grass, brown mulch, and dark grey rocks. A white box with a thin border is overlaid on the left side of the image, containing the text 'What We're Working On' and two white arrows pointing to the right.

What We're
Working On



» Grid Interactive Buildings (GEB) Cohort

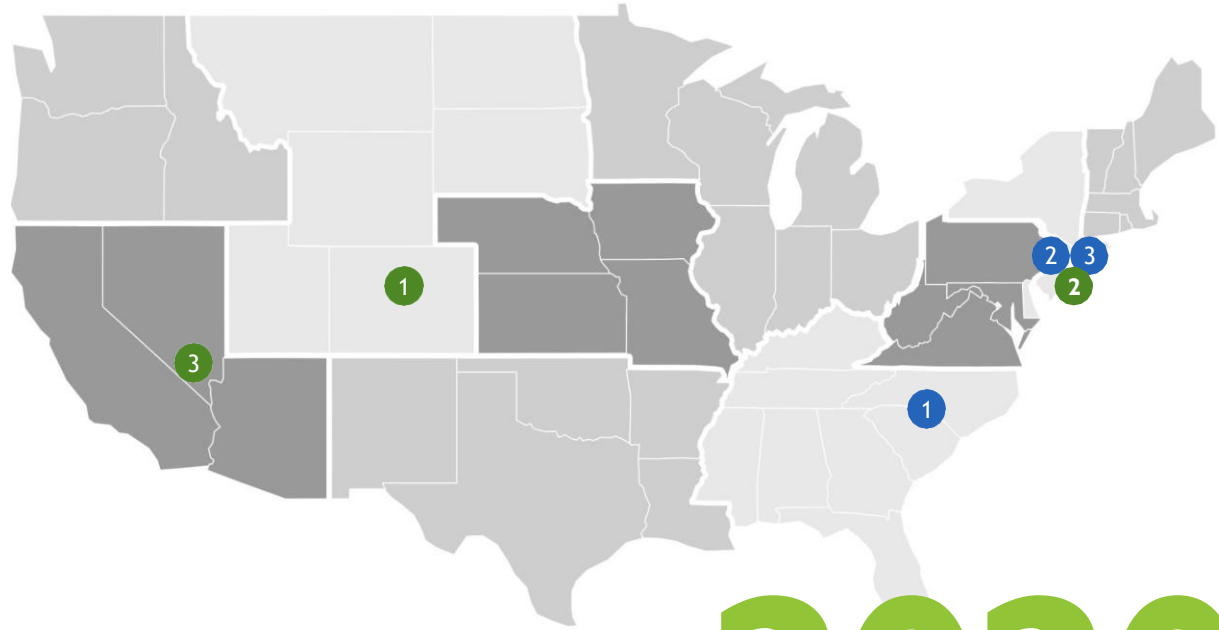
Continuous demand management and load flexibility

Vendor Locations

- 1 Direct Energy Partners | DC Microgrid
- 2 Logical Buildings/Comcast | Gamified GEB
- 3 Prescriptive Data | Occupancy-Based GEB

Testbed Locations

- 1 Direct Energy Partners | Denver Federal Center
- 2 Logical Buildings/Comcast | Newark, NJ
- 3 Prescriptive Data | Las Vegas, NV



2020

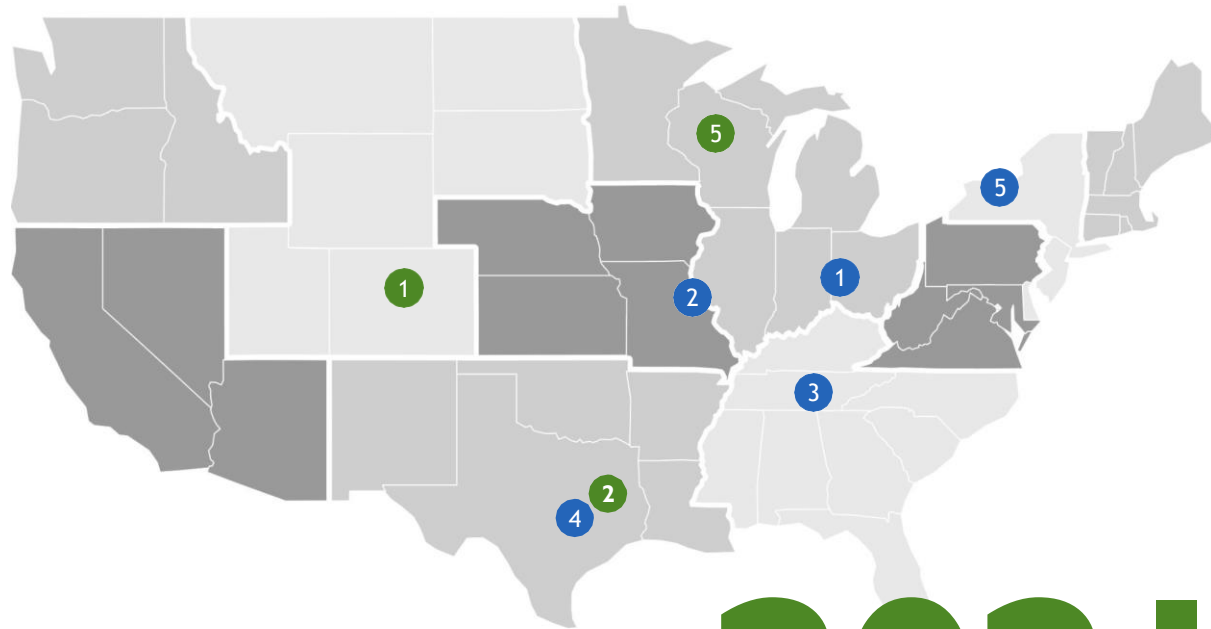
» Healthy & Resilient Buildings Cohort

Vendor Locations

- 1 Aeroseal | Automated Air Sealing
- 2 Altaire | HVAC Pretreatment Dehumidification
- 3 eSpin | Nanofiber Air Filters
- 4 Infinitem | Coreless Axial Flux Motor
- 5 WexEnergy | Window Insulation Panels

Testbed Locations

- 1 Aeroseal | Denver Federal Center
- 2 Altaire | Burke USCH, Texas
- 3 eSpin | Inconclusive
- 4 Infinitem | Inconclusive
- 5 WexEnergy | Eau Claire FB, Wisconsin



2021

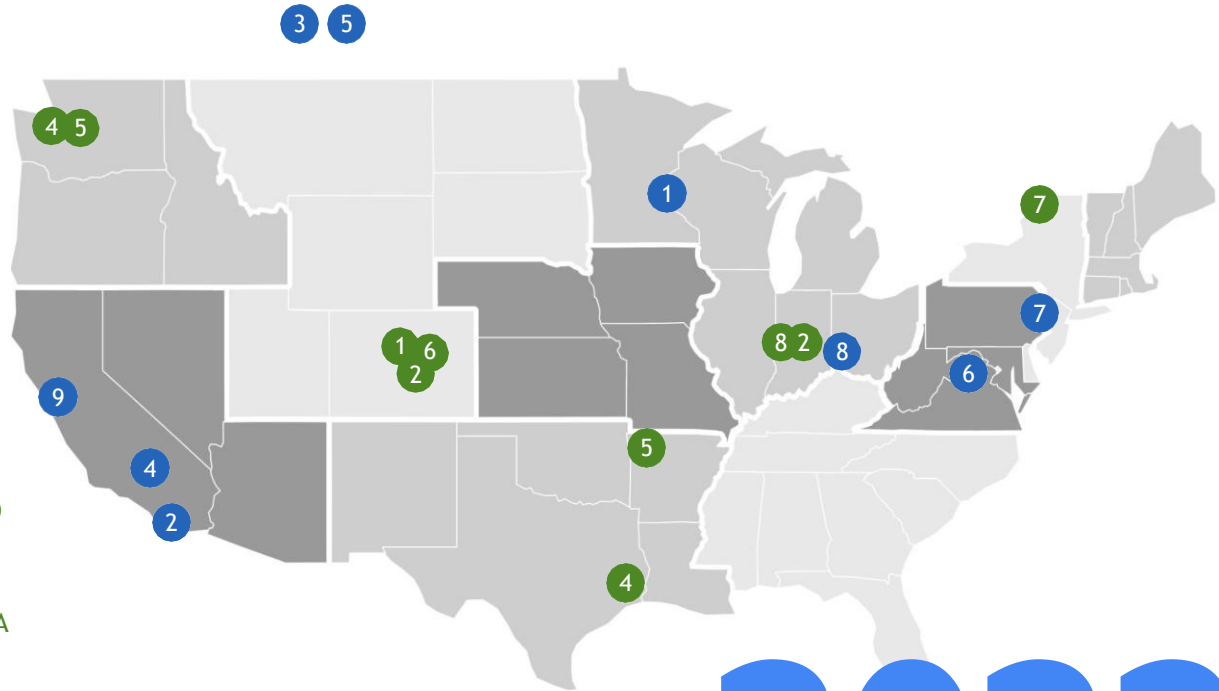
» 2022 Cohort: Net Zero Carbon Buildings

Vendor Locations

- 1 3M | Non-Metalized Window Film
- 2 BEAM Global | Portable EV Charging
- 3 CleanO2 | Carbon Capture
- 4 Dalrada | CO2-Based Commercial Heat Pump
- 5 Endo Enterprises | Hydronic Additive
- 6 Fermata Energy | Bi-Directional EV Charging
- 7 Legend Power | Electrical Power Improvement
- 8 Rocking Solar | Solar PV Tracking
- 9 WeaveGrid | Managed EV Charging

Testbed Locations

- 1 3M | Lakewood, CO
- 2 BEAM Global | Indianapolis, IN + Lakewood, CO
- 3 CleanO2 | On Hold
- 4 Dalrada | Beaumont, TX + Seattle, WA
- 5 Endo Enterprises | Fayetteville, AR + Seattle, WA
- 6 Fermata Energy | Lakewood, CO
- 7 Legend Power | Alexandria Bay, NY
- 8 Rocking Solar | Indianapolis, IN
- 9 WeaveGrid | Cancelled

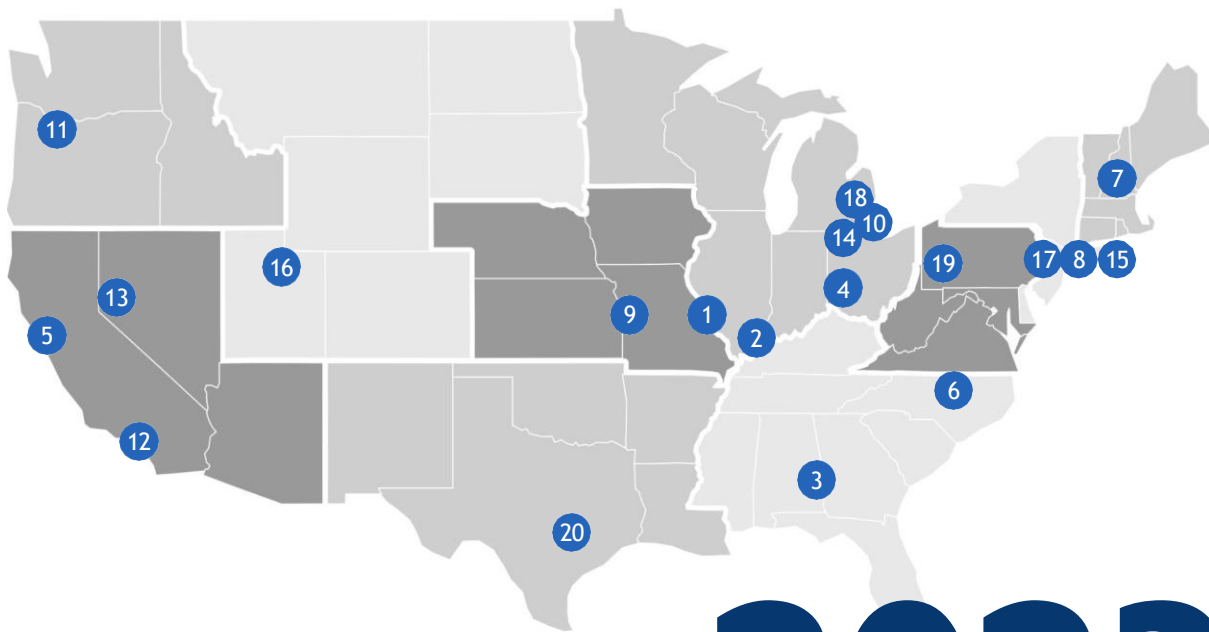


2022

» 2023 Cohort: Net-Zero Carbon Buildings II

Vendor Location

- 1 Accelerate Wind | Parapet-mounted turbines
- 2 Academy Energy/PURO | Upper & whole room GUV
- 3 ADS-TEC | Battery buffered DC fast charger
- 4 Aeroseal | Duct sealing
- 5 BP Pulse Fleet | Optimized fleet charging
- 6 Biomason | Bio-crete
- 7 Cambio AI | Portfolio decarbonization prioritization
- 8 COI Energy | GEB/DR management
- 9 Far UV | Whole room GUV
- 10 GM | Vehicle-to-Grid (V2G) solution
- 11 INDOW | Secondary glazing
- 12 Loop | Turnkey EVSE fleet charging
- 13 nZero | Carbon management platform
- 14 Pilkington | Vacuum-insulated glazing (VIG)
- 15 Radiator Labs | Thermostatic radiator cover
- 16 R-Zero Systems | Upper room GUV
- 17 Signify | Modular lighting + controls
- 18 Toggled | Plug load control
- 19 Vitro Glass | R14 secondary glazing
- 20 Yotta Energy | Modular PV and storage



2023

»» What Technology Disruption Looks Like

1900

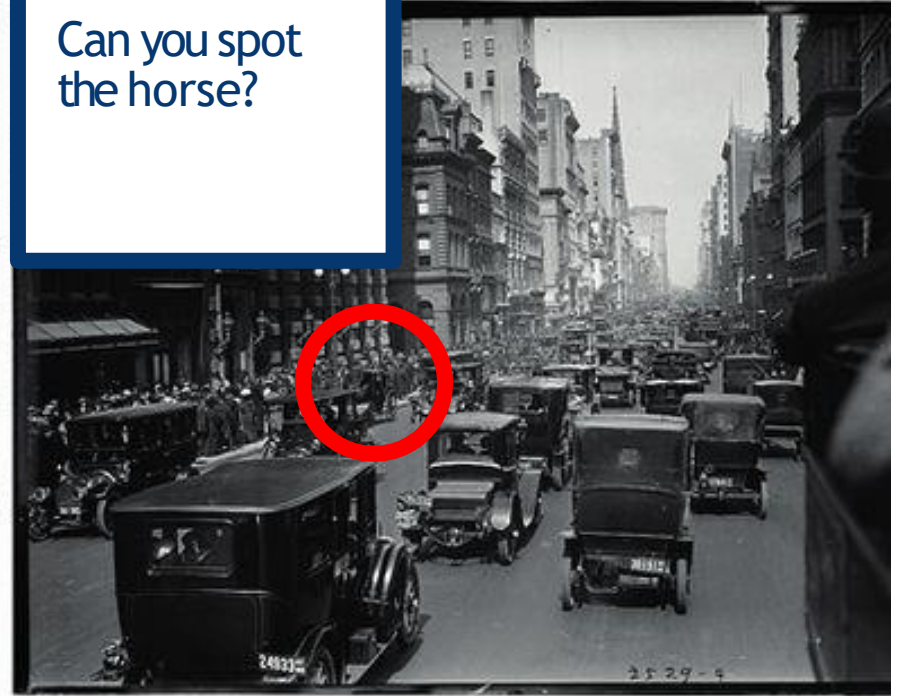
Can you spot
the car?



NYC Easter Parade, 5th Avenue

1913

Can you spot
the horse?





Center for Emerging Building Technologies

For more information: gsa.gov/GPG

Joshua Banis, GPG Program Manager
joshua.banis@gsa.gov