Emerging Technologies

GSA's Proving Ground and Pilot to Portfolio Programs | U.S. General Services Administration

UC Davis Energy Affiliates Forum | April 19, 2018

GSA: Largest Single U.S. Portfolio of Commercial Office Space

8,721	1,574
PROPERTIES MANAGED, 377M ft^2	OWNED, 188M ft^2

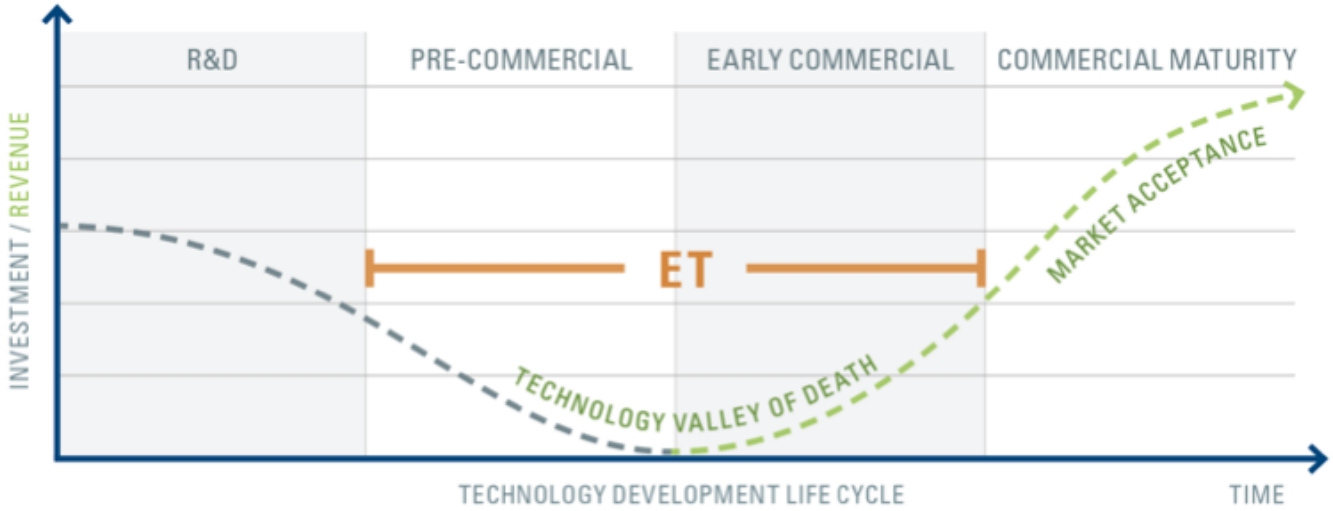
$280M annual energy costs for owned real-estate.

At 52.2 kBTU/ft^2/yr, GSA buildings are 33% more efficient than typical U.S. commercial buildings.

Emerging Technologies' two programs — GSA Proving Ground (GPG) and
Pilot to Portfolio (P2P) — enable GSA to make sound investment decisions in next generation building technologies based on their real world performance

Integrated Energy Solutions: Leading by Example

Emerging Technologies (ET) accelerates market acceptance by objectively assessing innovative building technologies in real-world environments (GPG), and deploying those that deliver (P2P)



GPG Objectives

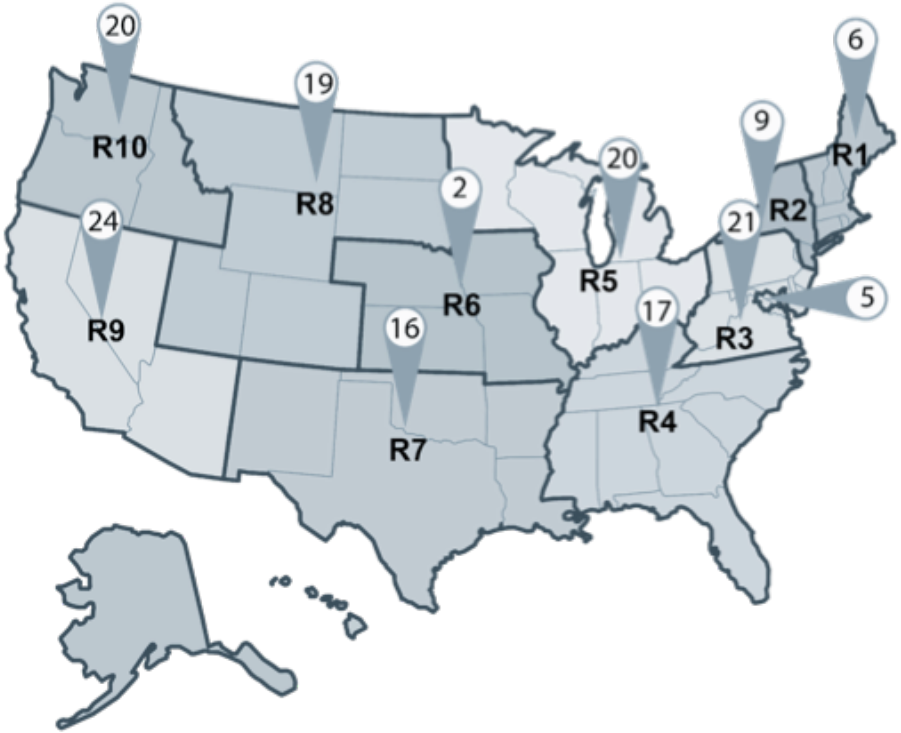
Identify promising technologies at the edge of commercialization

Pilot technology installations within GSA's real estate portfolio

Partner with Department of Energy national laboratories to objectively evaluate real-world performance

Identify technologies with broad deployment potential for GSA, coordinate results with broader federal and CRE community

GPG Test Beds



Test-bed locations are representative of broad conditions

Technologies Tested by GPG with Published Results

Building Envelope	HVAC	Lighting	Energy Management	Water	On-Site Renewables
High-R Window Panel Retrofits	Condensing Boilers	Occupant Responsive Lighting	Wireless Sensor Networks	Weather Station for Irrigation Control	Photovoltaics
Thermochromic & Electrochromic Windows	Variable Refrigerant Flow	Integrated Daylighting Systems	Advanced Power Strips	Wireless Soil Moisture Sensors for Irrigation Control	PV Guidance
Vacuum Insulated Panels for Roofing	Variable-Speed Maglev Chiller	Wireless Advanced Lighting Controls	Control Optimization System for Chiller Plants	Non-Chemical Prevention of Hard Water Scale	Photovoltaic-Thermal System
Solar Control Films	Synchronous & Cogged Fan Belts	LED Fixtures with Integrated Controls	Socially Driven HVAC Optimization		Wood-Pellet-Fired Biomass Boiler
Electrochromic (EC) Windows for LPOEs	Multi-staged Indirect Evaporative Cooler	LED Downlight Lamps for CFL Fixtures			Honeycomb Solar Thermal Collector
EC Windows with Dynamic Controls for General Office Space	Variable-speed Direct-drive Screw Chiller	Linear LED Lighting Retrofits			
Low-e Window Films	Wireless Pneumatic Thermostats				
	Smart Ceiling Fans				

Broad Deployment Potential for GSA

Technologies Under Assessment

Building Envelope	HVAC	Lighting	Energy Management	Water	On-Site Renewables
Dual Zone Indoor Shades	Drop-In Smart Switched Reluctance Motor	LED Retrofit Kits with ALCs	Adaptive Control for Chilled Water Plants	Non-Chemical Water Treatment Cooling Towers	
	High- efficiency RTU		Circuit-level Energy Monitoring	Chemical-free Water Treatment	
	Smart Circulator Pump		Predictive HVAC Optimization	Monitoring and Partial Water Softening	
	Intelligent Energy Valves for Hydronic Systems		Wireless Sensor and Analytics		
	Smart Air Scrubbers				

2018 DOE/GSA Joint Program: “Beyond Widgets”

Focus: technologies that optimize building components and/or help operators better understand when buildings are not functioning within operational or design parameters

Behind-the-Meter Load Optimization

Improving Overall Building Operations and Maintenance

$175B/YR

commercial real-estate utility bills

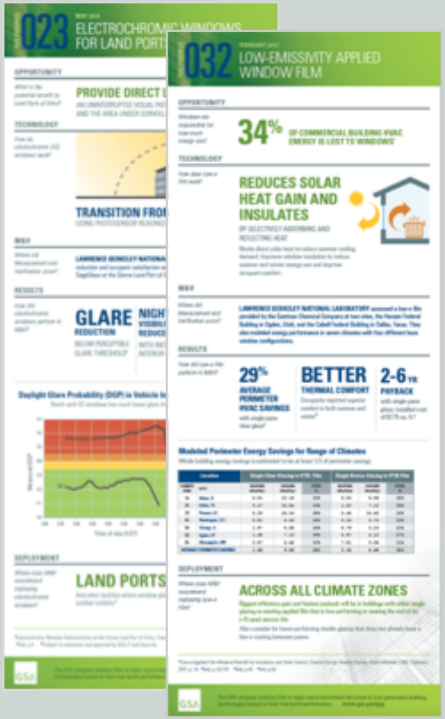
Pilot to Portfolio supports the deployment of proven next generation technologies through process influence, portfolio analysis, project initiation support, and dynamic training

Transitioning Research into Practice

Providing actionable insights guides GSA's investment decisions in next-generation building technologies

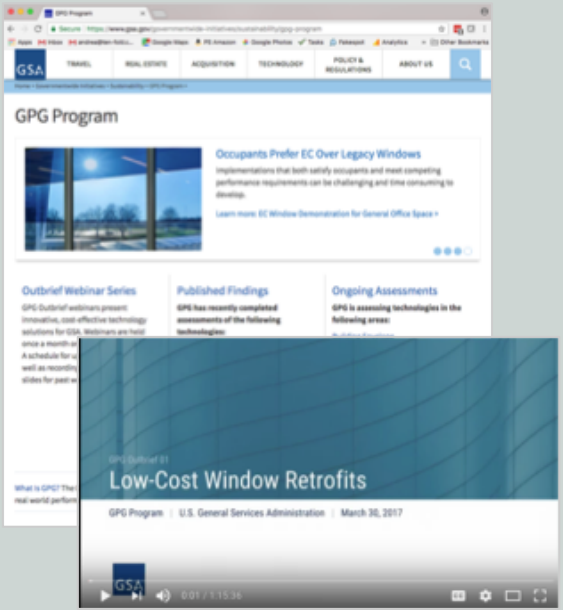
63	33	20	13	$7M
TECHNOLOGIES EVALUATED	REPORTS PUBLISHED	TECHNOLOGIES PROVEN FOR GSA	TECHNOLOGIES DEPLOYED	ESTIMATED ANNUAL SAVINGS

Stakeholders: Test-bed Outcomes Publicly Available



Overview Infographics

Technical Report & 4-Page Findings



Website & Webinars

Influencing Internal Processes

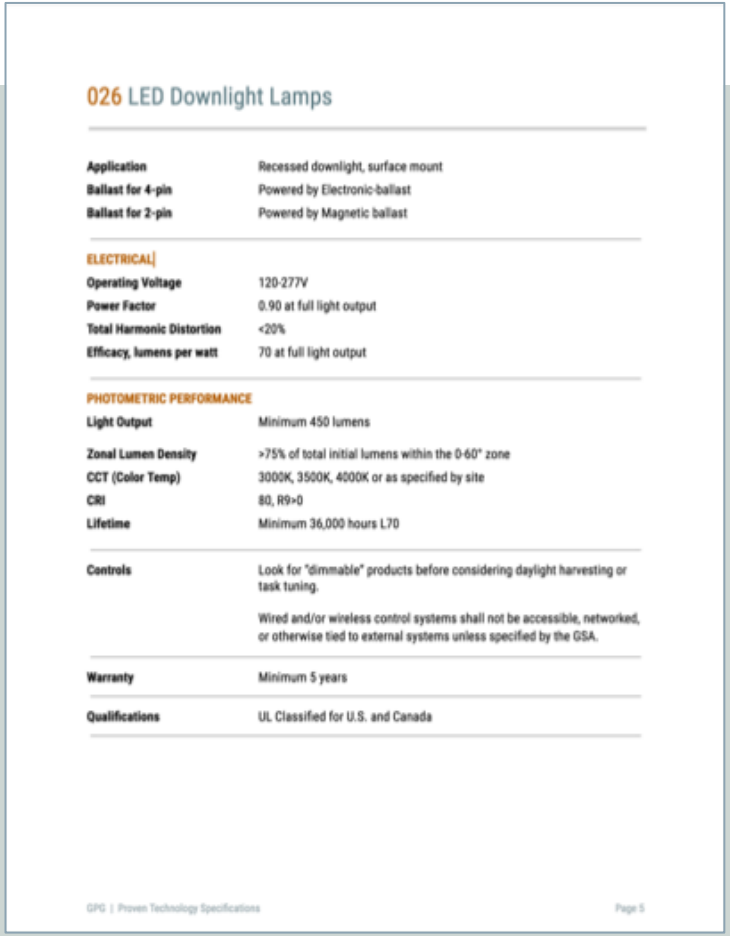
GSA processes and guidance support the introduction of next-generation technologies at key lifecycle entry points—end-of-life replacement, retrofits and new construction

Using Analytics to Drive Uptake

Work across GSA databases to identify buildings with aging, inefficient equipment and tenant comfort issues, provide decision makers with recommended technologies that solve these problems

Supporting Project Initiation

Provide project and property managers with technology specifications and cybersecurity approval needed to easily select innovative technologies



026 LED Downlight Lamps

Application	Recessed downlight, surface mount
Ballast for 4-pin	Powered by Electronic ballast
Ballast for 2-pin	Powered by Magnetic ballast

ELECTRICAL

Operating Voltage	120-277V
Power Factor	0.90 at full light output
Total Harmonic Distortion	<20%
Efficacy, lumens per watt	70 at full light output

PHOTOMETRIC PERFORMANCE

Light Output	Minimum 450 lumens
Zonal Lumen Density	>75% of total initial lumens within the 0-60° zone
CCT (Color Temp)	3000K, 3500K, 4000K or as specified by site
CRI	80, R9>0
Lifetime	Minimum 36,000 hours L70
Controls	Look for "dimmable" products before considering daylight harvesting or task tuning. Wired and/or wireless control systems shall not be accessible, networked, or otherwise tied to external systems unless specified by the GSA.
Warranty	Minimum 5 years
Qualifications	UL Classified for U.S. and Canada

Delivering Training

Provide training resources architects, engineers, asset managers and facility managers need to successfully program, engineer, and operate next generation technologies

For more information: gsa.gov/GPG

GSA Opportunity — Technologies with Broad Deployment Potential

Category	Technology	% Saved at Test Beds	Projected Payback (yrs)	Best Suited to
Energy Management	APS for Workstations	26%	2	Deploy broadly.
	Chiller Plant Control Optimization	35% Cooling	5	Chilled water plants with cooling loads > 3 million tons per year.
	Socially Driven HVAC	20% cooling, 47% heating	NA	Facilities where thermal comfort is an issue.
	Wireless Sensor Networks	48% Cooling	2	Data centers.
Lighting	LED Downlight Lamps	40%	3	Spaces where advanced lighting controls are not desired or useful.
	TLED Retrofit Kits	30%	5	Fixtures where lenses/sockets are in good condition and ALC is useful.
	LEDs with Integrated Controls	60%	9	Retrofits with EUI > 3.25 kWh/ft²/yr and utility rates > $0.10 kWh.
Building Envelope	EC Windows for LPOEs	9%	NA	Facilities where window glare compromises mission-critical visibility.
	Hi-R Low-E Window Panels	41%	7	Cold climates; single-pane windows.
	Low-E Film	29% perimeter HVAC	2-6	All climate zones. Most cost-effective for single-pane clear windows.
HVAC	Condensing Boilers	14%	7	End-of-life replacement. Life-cycle cost effective when 3 -5 % more efficient than high-efficiency boilers.
	Fan Belts	2 - 20%	4	VAV Fans, retrofit with synchronous drive belts. CV Fans, replace at end-of-life with cogged V-belts.
	Magnetic Bearing Chiller (MBC)	42%	5	End-of-life replacement.
	Variable Speed Screw Chiller	11% compared to MBC	3	End-of-life replacement.
	Wireless Pneumatic Thermostats	20% cooling, 43% heating	6	Facilities with pneumatic control.
Water	Non-Chemical Water Treatment	NA	2	Facilities with hard water > 121 MG/L.
	Weather Station Irrigation	26%	1	Areas with intermittent rain. Typically weather based irrigation