Efficiency as Resilience

FEDERAL UTILITY PARTNERSHIP WORKING GROUP SEMINAR

San Diego, CA | May 2–3, 2019

GSA

FEMP
Federal Energy Management Program

SDGE
A Sempra Energy utility®

Agenda

- Overview of GSA’s Emerging Building Technologies Program
- Efficiency, Resilience and the Bottom Line
- 2020 Request for Information: Grid Interactive Efficient Buildings (GEBs)

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

8,721

PROPERTIES MANAGED, 377M ft^2

1,574

OWNED, 188M ft^2

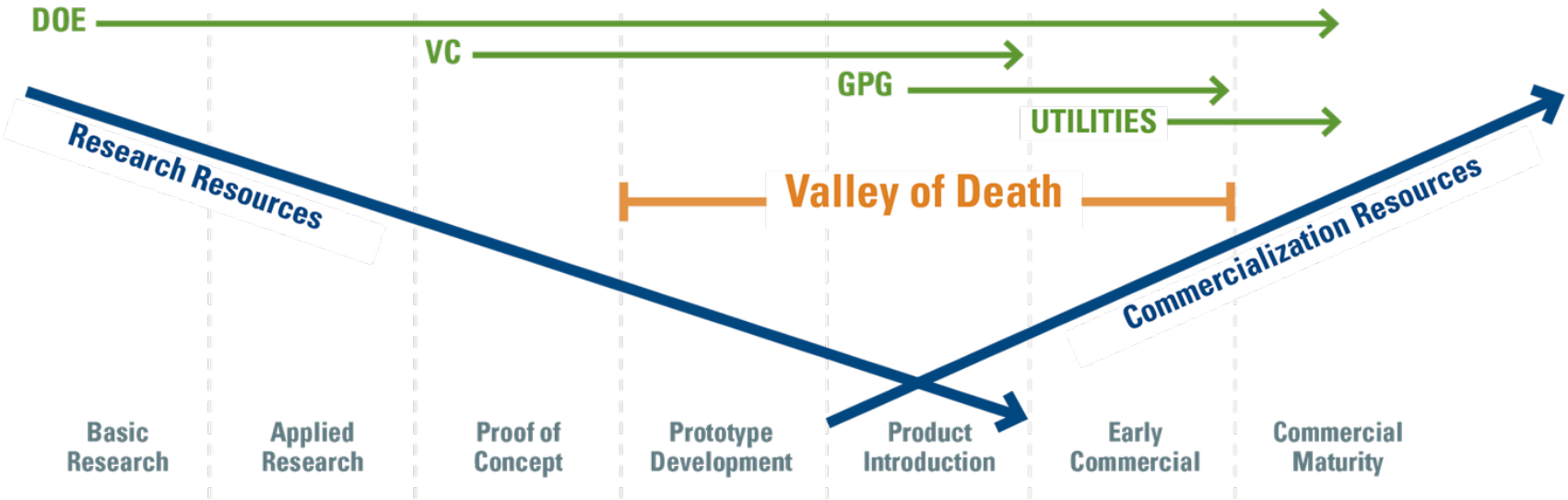
$325M

ANNUAL ENERGY COSTS
FOR OWNED REAL-ESTATE

Emerging Building 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 actual performance.

GSA Proving Ground – What Works Best?

GPG accelerates market acceptance by objectively assessing innovative building technologies in real-world environments.



GPG Objectives

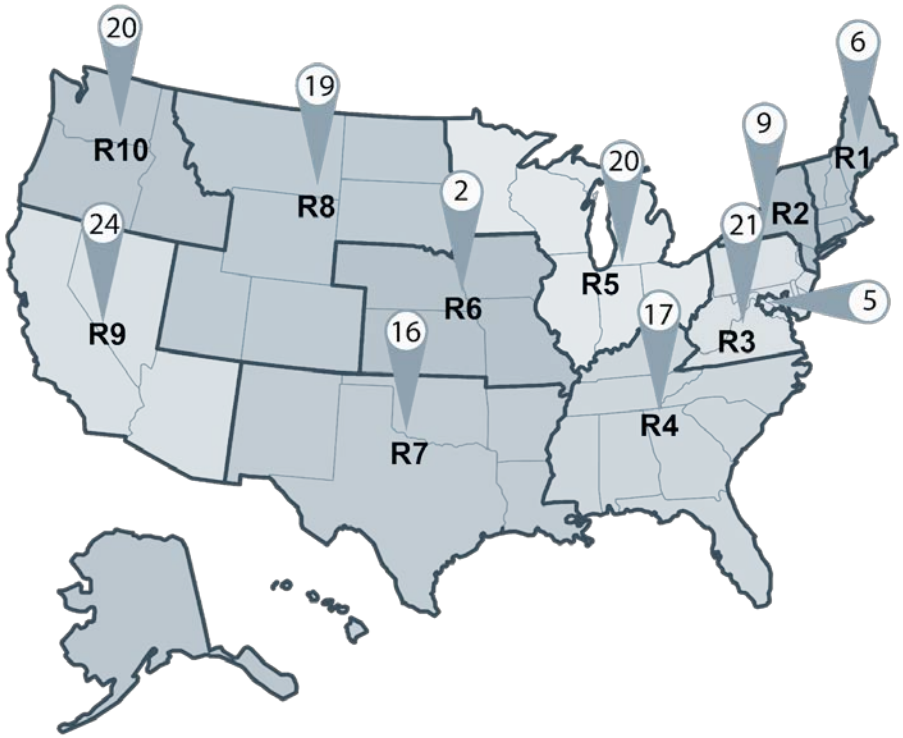
Identify promising technologies at the edge of commercialization

Pilot technology installations within GSA’s real estate portfolio

Partner with Department of Energy national laboratories to objectively evaluate actual 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

40 Technologies Tested by GPG with Published Results

Building Envelope	HVAC	Lighting	Energy Management	Water	On-Site Renewables
Electrochromic Windows	Small Circulator Pumps	Advanced Lighting Controls	Advanced Power Strips	Advanced Oxidation Process for Cooling Towers	Honeycomb Solar Thermal Collector
Hi-R Low-E Window Retrofit System	Condensing Boilers	Integrated Daylighting Systems	Chiller Plant Control Optimization System	Alternative Water Treatment for Cooling Towers	Photovoltaic System Performance
Low-E Window Film	Fan Belts: Synchronous and Cogged	LED Fixtures with Integrated Advanced Lighting Controls	Socially Driven HVAC for Personal Control	Catalyst-Based Scale Prevention for Domestic Hot Water Systems	Photovoltaic-Thermal Hybrid Solar System
Nanocoating Solar Control Films	Indirect Evaporative Cooler	LED Downlight Lamps for CFL Fixtures	Wireless Pneumatic Thermostats	Electrochemical Water Treatment for Cooling Towers	Wood-Pellet Biomass Boilers
Thermochromic Windows	High-Performing Commercial Rooftop Units	Occupant Responsive Lighting	Wireless Sensor Networks for Data Centers	Weather Station for Irrigation Control	
Vacuum Insulated Panels for Roofing Applications	Smart Ceiling Fans	TLED Lighting Retrofits with Dedicated Drivers		Wireless Soil-Moisture Sensors for Irrigation Control	
	Variable Refrigerant Flow	Wireless Advanced Lighting Controls			
	Variable-Speed Maglev Chiller				
	Variable-Speed Screw Chiller				

Technologies Under Assessment

Building Envelope	HVAC	Lighting	Energy Management	Water	On-Site Renewables
	Drop-In Smart Switched Reluctance Motor		Adaptive Control for Chilled Water Plants	Catalyst based Water Treatment for Cooling Towers	DC Microgrid
	Setpoint Reset		Circuit-Level Energy Monitoring	Monitoring and Partial Water Softening for Cooling Towers	
	Smart Scrubbers for HVAC Load Reduction		Connected Building Operating System		
			Wireless Sensors and Analytics		

Pilot to Portfolio – Deliver Value and Savings

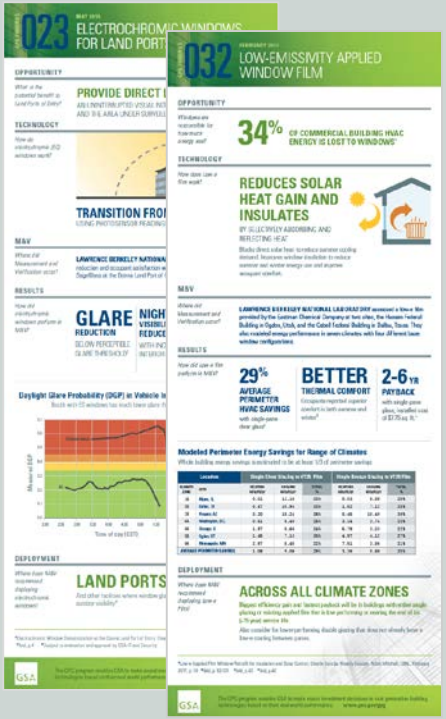
P2P guides GSA's investment decisions in next-generation building technologies

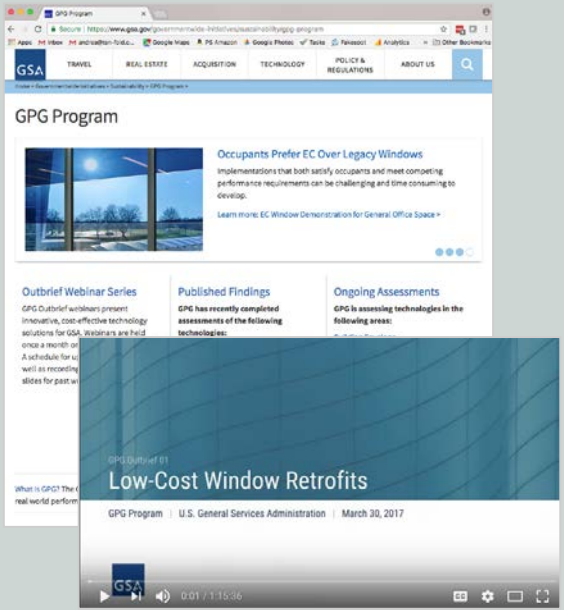
68	40	26	13	$7M
TECHNOLOGIES EVALUATED	REPORTS PUBLISHED	TECHNOLOGIES PROVEN FOR GSA	TECHNOLOGIES DEPLOYED	ESTIMATED ANNUAL SAVINGS

Influencing Internal Processes

P2P works with GSA's existing policies and processes to support the introduction of next-generation technologies at key life-cycle entry points—end-of-life replacement, retrofits and new construction.

Stakeholders: Test-bed Outcomes Publicly Available





Overview Infographics

Technical Report & 4-Page Findings

Website & Webinars

Efficiency, Resilience and Grid-Interactive Buildings

Opportunity favors the prepared mind

"Sir, the following paradigm shifts occurred while you were out."

Building 2030: Three Key Trends

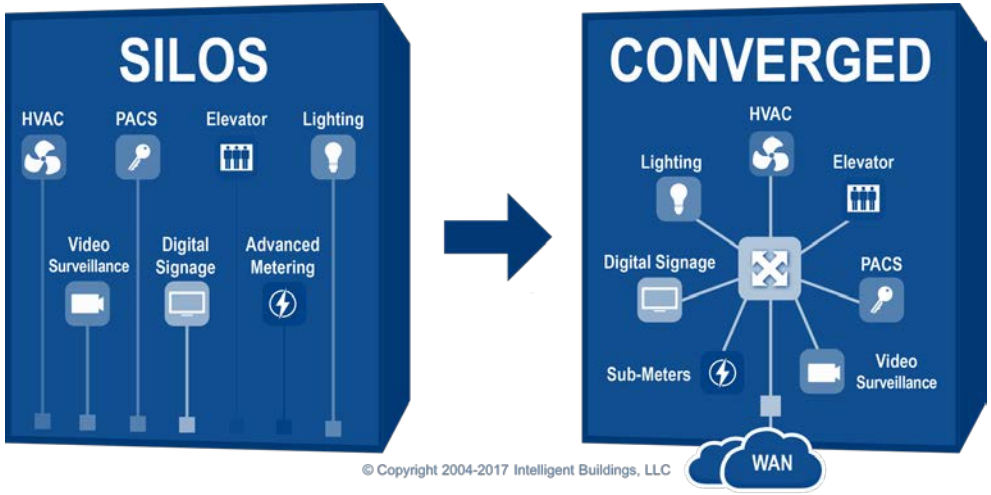
IoT

Resilience

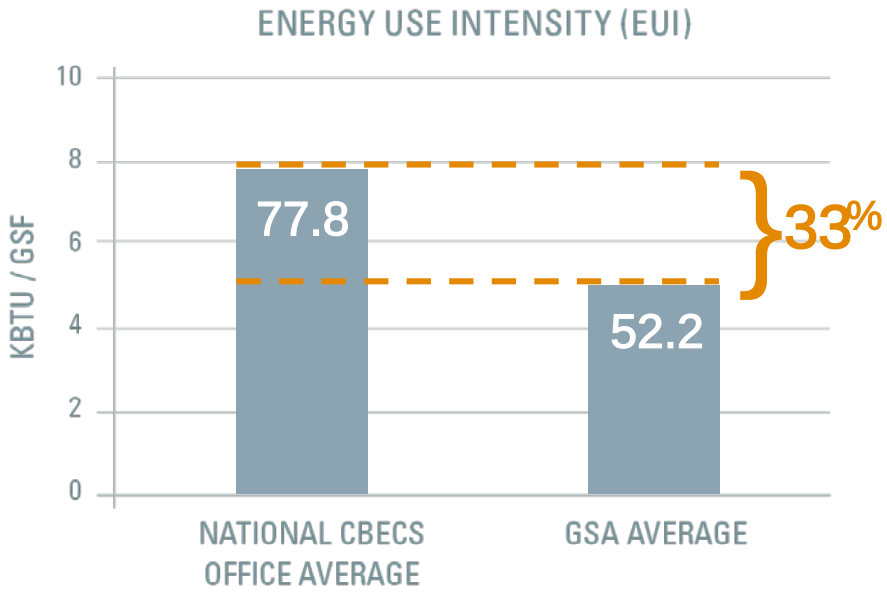
Grid-Smart Buildings

NextGen-Facilities Architecture: Digital/Connected/Converged

- Migrating to IP and wireless communication standards
- Converged systems enable improved building operations
- Integration provides cost savings via analytics, fault detection and grid-responsive control of systems



Efficiency, Resilience and the Bottom Line



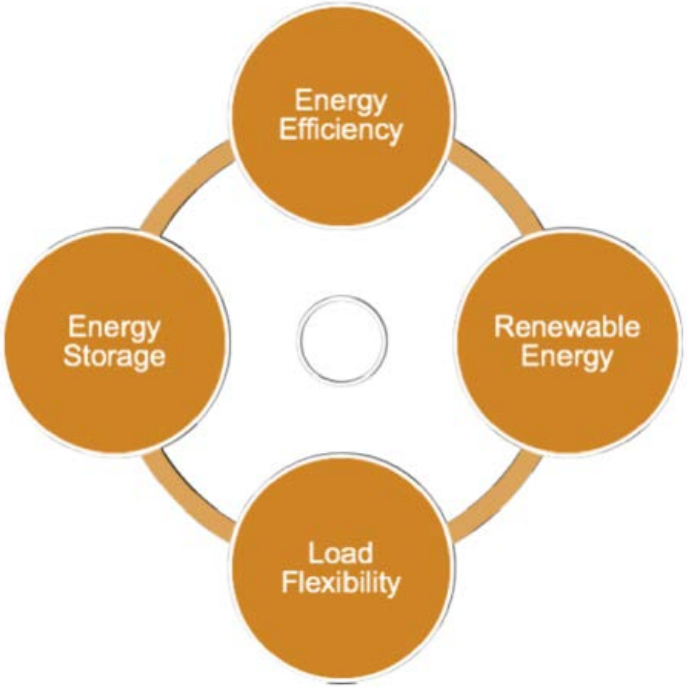
GSA buildings are **33%*** more efficient than typical U.S. commercial buildings.

On-site resources & storage deliver cost savings and maintain core operational functionality in the face of power interruption.

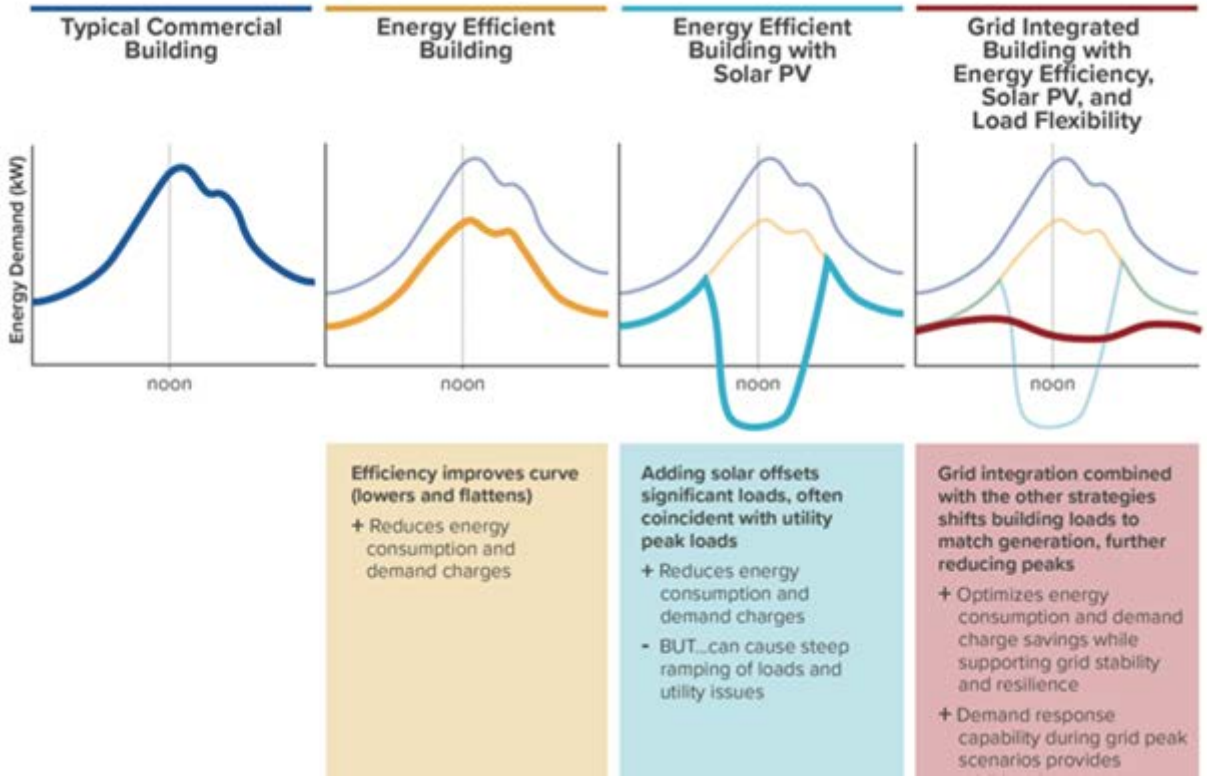
*January 2016, GSA Average EUI = 52.2 kBTU/GSF/yr, as reported per legislative mandate; 2012 CBECS, eia.gov

Grid-interactive Efficient Buildings (GEBs)

- Goes beyond traditional demand response to reshape a building's demand profile and enable load flexibility.
- Provides controls capability to maintain continuity of operations in the event of power interruption.
- By reacting to utility price signals, the building can reduce costs to the building and the utility.



Grid Integrated Buildings: Illustrative Load Profiles



GEB Measures Fall Into 4 Categories

Efficiency

focused on reducing energy

- Primarily $/kWh savings
- e.g. LED fixture upgrades

Peak-Focused Reductions

peak-demand focused ECMs

- Primarily $/kW savings
- e.g. controls for peak-focused LED dimming

Dynamic Demand Shifting

load flexibility

- Primarily time of use cost savings
- e.g. thermal storage for peak reduction

Demand Response and District Level Grid Services

point-in-time events

- $/event, $/contract term or $ custom
- e.g. batteries for demand response

Modeled GEB Strategy, GSA Facility, Fresno CA

High-level Bundle Economics	
Baseline energy cost	$1,043,122
Annual energy cost savings	$612,178
First Cost (GEBs investment)	$2,458,955
Rebates and Incentives	$217,051
Payback of Bundle (yrs)	4.0
Payback w Incentives (yrs)	3.7
NPV with Incentives	$2,394,044

Cost-Effective Measures

- LED Fixture Retrofit with Full Control
- LED Fixture Retrofit Without Controls
- Stage AHU fans to prevent coincident peaks
- Solar PV array
- Sequence laptop battery charging
- Zone space temperature setpoint setback for peak demand management
- Battery storage
- Low-E Window Film

Utility Rate Structure(s) Modelled

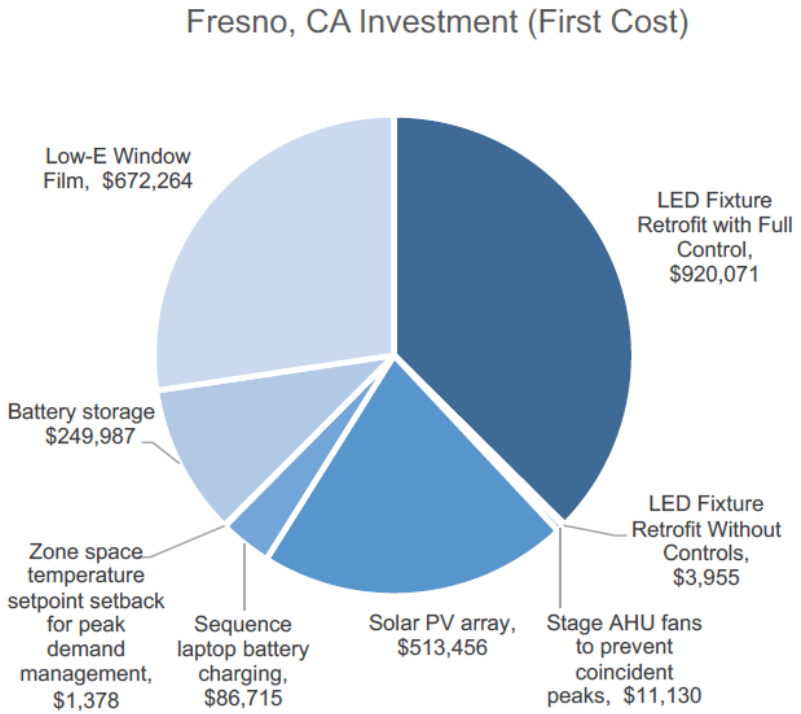
Utility: *Pacific Gas and Electric*

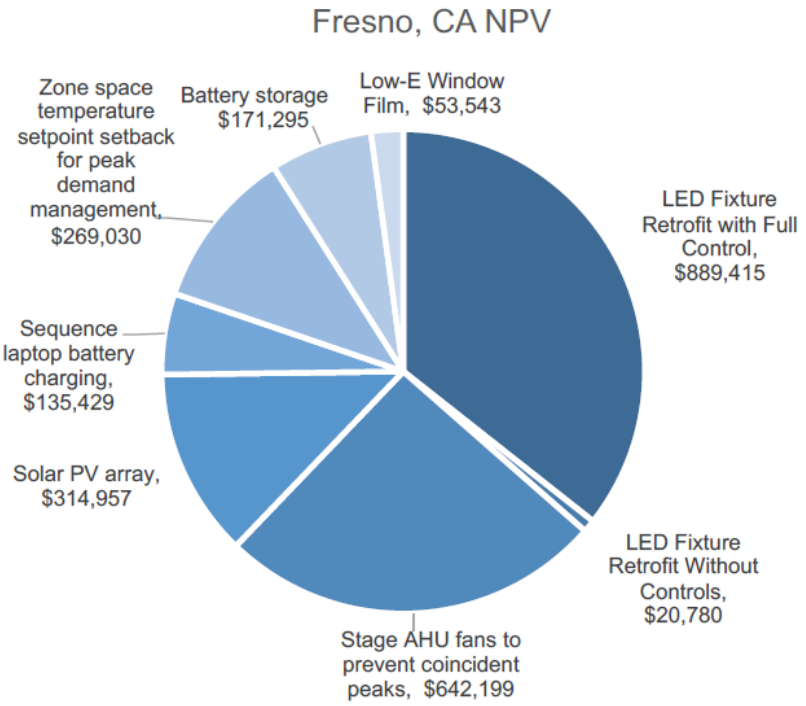
Rate Modeled: *E20S Extra Large General*

- Moderate-to-high consumption charge ($0.08–$0.15/kWh)
- Moderate-to-high demand charge ($19–$37/kW)
- Seasonal variation in rates and structure
- Time-of-use rates

Other rates to consider: *E19S Large General Time of Use*

Modeled GEB Strategy, GSA Facility, Fresno CA





2020 DOE/GSA Joint Program: Grid Interactive Efficient Buildings (GEBs)

Technologies submitted to the GEB RFI should:

Integrate – enable multiple building systems to interact and operate as an optimized system.

Aggregate– realize collective value of ECMs, storage, and on site renewables.

Coordinate– dynamically manage loads, generation and storage to reduce, shift, or modulate energy use in response to demand events.

Save– demonstrate payback and value at the whole building level.

Portfolio-Wide Deployment

350MW/YR
PEAK LOAD REDUCTION

$100M/YR
ENERGY COST SAVINGS
1/3 GSA annual energy spend

DRAFT

For more information:

gsa.gov/GPG

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