Title

Super-GX Scale Grid-flexible Supervisory Control for Multiple Commercial Buildings and EV Charging (poster presented at the CEC EPRI Electrification Summit 2026)

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Super-GX

Scale Grid-flexible Supervisory Control for Multiple Commercial Buildings and EV Charging

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Introduction

California has a statewide mandate to double demand response and load shifting capacity to 7,000 MW by 2030. Large commercial buildings have Demand Flexibility potential, but **adoption is slow**:

- "Siloed" energy systems (for example, Heating Ventilation and Air Conditioning (HVAC) equipment and lighting systems);
- Lack of education and training for
  - building owners and decision makers,
  - building managers, and
  - building engineers;
- Lack of trust in open-source solutions; and
- Cost of labor to interface with specific points in legacy Building Management Systems.

Goal

The goal of Super-GX is to **demonstrate and scale** demand flexibility (DF) in large commercial building Distributed Energy Resources (DER).

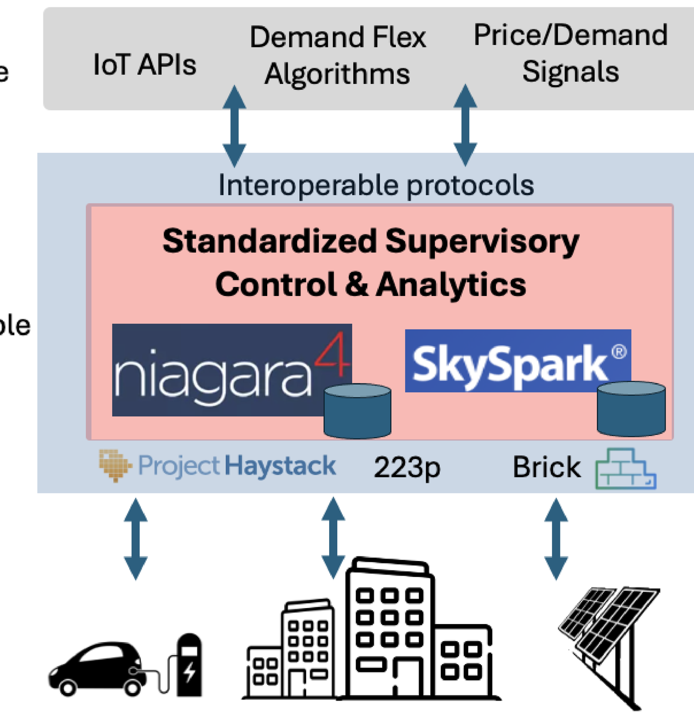
Objectives

1) **demonstrate** and evaluate a market-ready demand response supervisory control,
2) exhibit coordination of load shedding and shifting among buildings and EV chargers to support the electric grid,
3) validate using open standards, standard **semantic tagging and protocols** to improve interoperability; contribute novel **demand flexible strategies** to open libraries, and develop tools/guidelines to encourage adoption; and
4) work with communities to promote value to end-users, provide education and training to building owners, facility managers, building operators, and software system integrators.

1. Leverage industry standard open/ interoperable BAS: Tridium Niagara

2. Standardize supervisory control and analytics wrapping Niagara and SkySpark to enable grid flexibility through interoperable algorithms & signals to DER

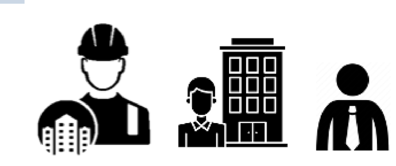
3. Inform building personnel with greater visibility & insight into their buildings with SkySpark



4. Demonstrate Super-GX in up to 10 buildings with HVAC, lighting, & EVCS, evaluating load shed/shift over different durations, seasons.

5. Train and educate:

- Building owners
- Facility managers
- Building engineers/operators
- Other System Integrators



Grid-Flexible Solution Development

This task creates the grid flexible measure package, implements the measure package, develops semantic modeling building assessment tools, and develops Measurement and Verification and forecasting methodology.

Progress to Date:

The *Grid-Flexible Measure Initial Report* describes individual **demand flexibility strategies** applicable to a wide range of commercial buildings and electric vehicle charging systems. Demand flexibility encompasses traditional demand-side management programs and demand response actions while also including a wider set of operational and control strategies that allow buildings and electric vehicle charging systems to adjust electricity demand dynamically in response to grid needs.

Researchers highlight the optimal order of operations:

1) identify and fix any existing issues, such as faulty sensors, overridden setpoints and schedules, failed actuators, and improper control protocols.
2) implement energy efficiency measures that reduce overall energy consumption and improve baseline performance.
3) Deploy load flexibility strategies

The team identified measures through literature review, input from industry experts, and current programs.

The resulting Demand Flexibility (DF) Feasibility Framework considers technical feasibility, stakeholder impacts, and ease of implementation of DF measures.

Evaluation criteria include:

- Required hardware and software
- Control system dependencies
- Stakeholder involvement and impact
- Implementation effort
- Scalability

A building's readiness for DF measures includes criteria such as:

- Building type
- HVAC equipment
- Control system capabilities
- Stakeholder impacts

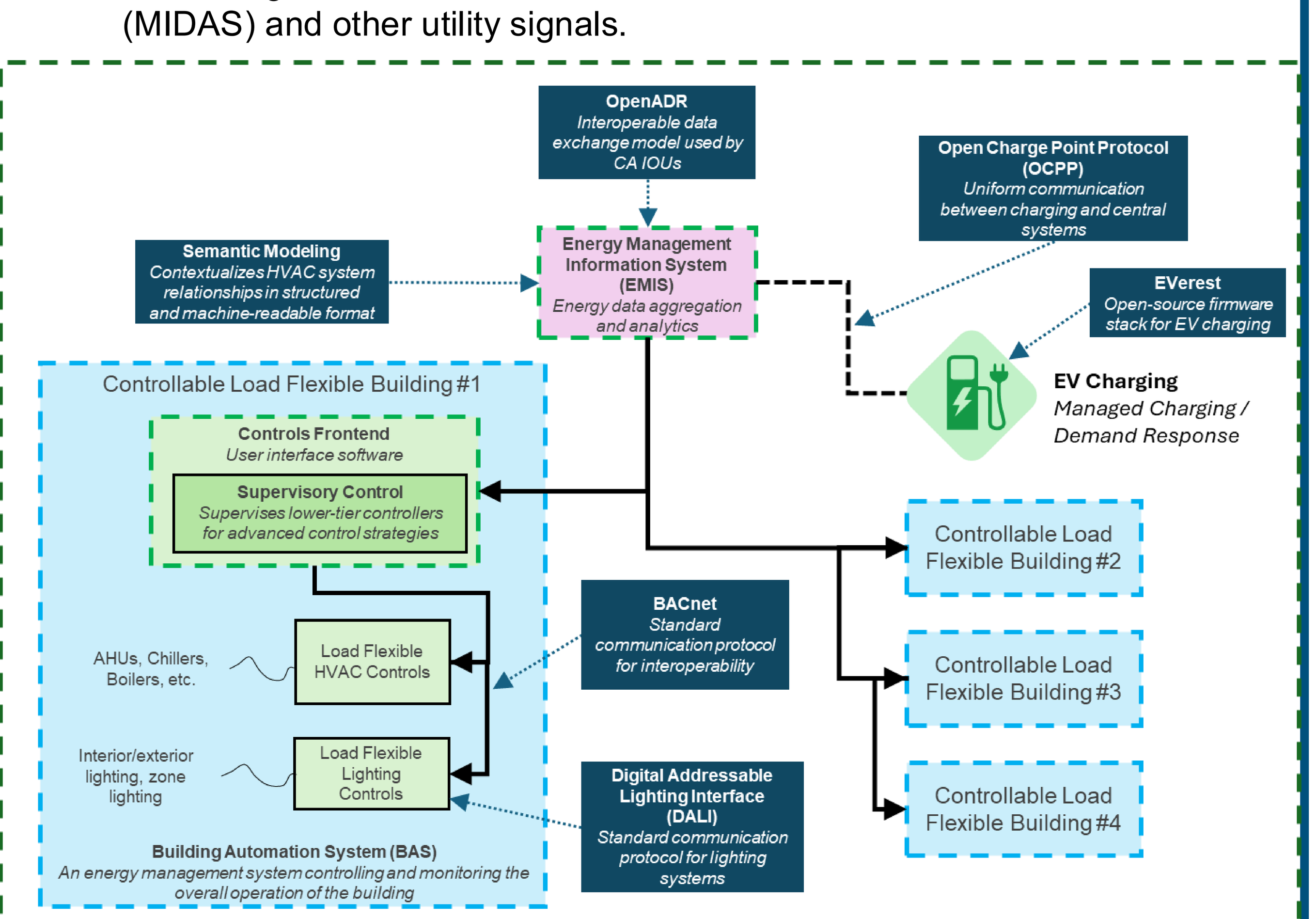
Summarized list of high and medium priority demand flexibility measures

Priority	End-Use	Measure	Measure Description	How does this reduce demand?
High	HVAC	Zone thermostat adjustment	Adjust or setback thermostat setpoint of all zones to reduce heating/cooling energy use.	Reduce heating, cooling, and fan energy
High	HVAC	Occupancy-based zone thermostat setback	Adjust or setback zone thermostat setpoints further based on occupancy sensing or assumed occupancy.	Reduce heating, cooling, and fan energy
High	HVAC	Zone VAV terminal unit minimums reduction	Reduce VAV terminal unit airflow minimums.	Reduce air flow rate (fan energy use) and heating (reheat) energy
High	Lighting	Turn off or dim lights	Reduce non-essential lighting loads by dimming or turning off	Reduce equipment load
High	EV	EV managed charging	Manage EV charging before/during/after LF events	Reduce equipment load
High	HVAC	Chilled water supply temperature setpoint increase	Raise chilled water temperature setpoint to raise chiller efficiency	Reduce cooling
Medium	HVAC	Pre-cooling	Pre-cool spaces to below cooling thermostat setpoint prior to demand flexibility event	Reduce cooling (shifting)
Medium	HVAC	Fan speed limiting	Adjust static pressure setpoint to reduce fan speed	Reduce air flow rate (fan energy use)
Medium	HVAC	Supply air temperature (SAT) reset	Increase supply temperature by predetermined interval to modulate AHU-level demand	Reduce cooling
Medium	HVAC	Chilled-water valve limiting	Set high-limit for CHW valve position	Reduce cooling and pump energy

Progress to Date continued:

Altura is developing the **supervisory software layer** with semantic model (Haystack tagging) and open APIs to:

- Create new algorithms, analytics, and asset / point level data modeling associated with demand control measures in a way that can be contributed to open libraries and existing ontologies (e.g., standard Niagara programming);
- Develop integrations of the measure package with any necessary APIs or other open protocols;
- Build integration with CEC's Market Informed Demand Automation Server (MIDAS) and other utility signals.



Scalable Load Flexibility

Expanding a coordinated load management strategy from one building to many buildings and electrical loads

Standards and protocols include:

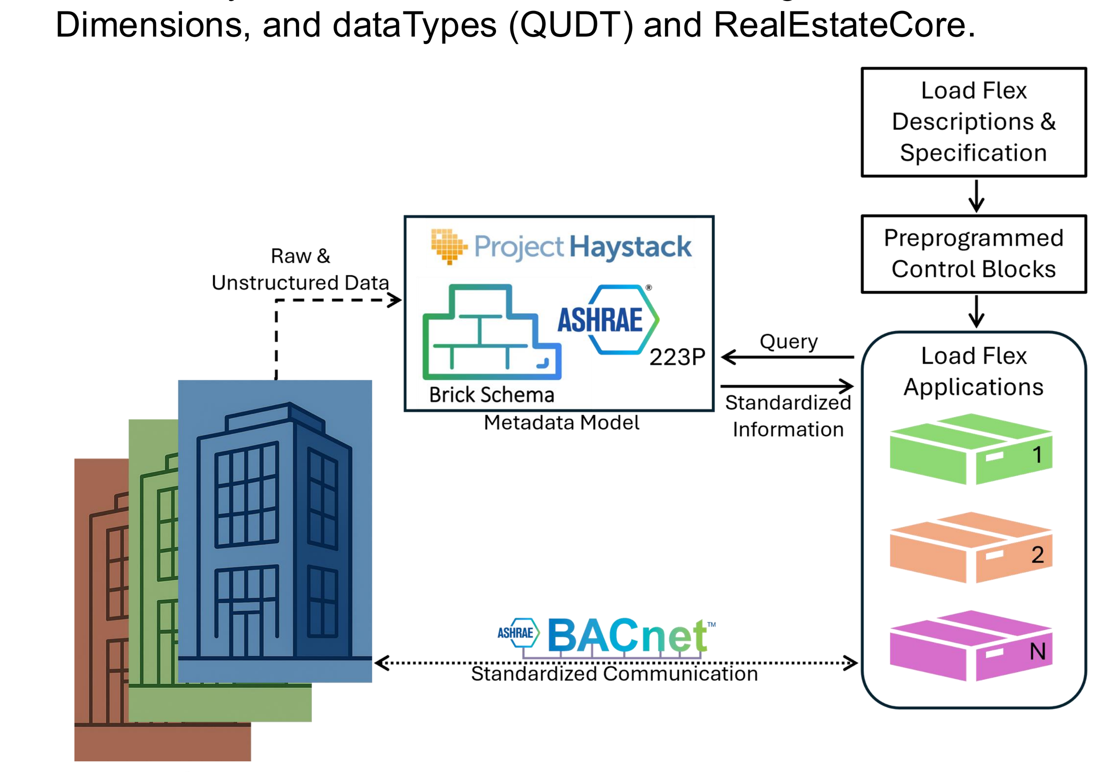
- **OpenADR:** An open and interoperable information exchange model and emerging Smart Grid standard.
- **ANSI/ASHRAE Standard 135 BACnet:** A standard that enables devices from different manufacturers to communicate.
- **ASHRAE 223P** Designation and Classification of Semantic Tags for Building Data.
- **EVerest**. An open-source firmware stack for EV charging stations.
- **Open Charge Point Protocol (OCPP)**. A protocol that provides a uniform method of communication between charge points and central systems.
  Digital Addressable Lighting Interface (DALI). A communication protocol for digital lighting control systems.
- **MIDAS** The Niagara supervisory system relies on enterprise IT integration and will require both inbound and outbound internet access to interact directly with the MIDAS server for receiving price signals.

Progress to Date continued:

CBE is developing an automated screening/initial assessment and ongoing building monitoring using semantic model, documented in the *Semantic Model Building Assessment Tool Report.*

The Super-GX project will focus on a few metadata schemas, given their current adoption in the building industry and future prospects:

- Project Haystack
- Brick Schema
- ASHRAE Standard 223P (potentially)
- supporting and complementary schemas that extend the functionality of the main selected schemas, e.g. Quantities, Units, Dimensions, and dataTypes (QUDT) and RealEstateCore.



Integration of metadata models to develop portable and scalable building load flexibility applications. The metadata model serves as the interface between the building and load flexibility applications. Adapted from (Jayarathne et al. 2026)

Screening buildings for demand flexibility potential includes the following:

- Does the building have the metering, controls, and automation needed to respond to marginal-cost-based or time-varying prices?
- Does the building provide predictable load impacts without compromising comfort, operations, or equipment constraints?
- Are available BAS, meter, and equipment data sufficient to quantify baseline load, flexible load, event response, and persistence?
- Can the building systems communicate across HVAC, lighting, EV charging, DERs, supervisory controls, aggregators, and utility or CAISO interfaces?
- Can the resulting load flexibility be mapped to resource adequacy, distribution, transmission, emissions, or customer cost-saving value streams?

Demonstration of Grid-Flexible Supervisory Control

This task demonstrates the grid flexible system in up to 10 buildings and EV chargers, showing the capability to interface with existing utility programs and using the MIDAS price signal to achieve the project goals of 10%/5% peak reduction in summer/winter.

Progress to Date:

The team has been working with UC Irvine facilities personnel on the below measures for testing June-Sept 2026. The team is working on replacing the Honda America site. A third site is a TBD community college to create a living lab for students.

#	Measure	Operator Impacts	Occupant Impacts
1	Zone thermostat adjustment	Yes	Yes
1a	Occupancy-based zone thermostat setback (only for zones with occupancy sensors)	Yes	Yes
2	Zone variable air volume (VAV) terminal unit minimums reduction ("dispatchable airflow management")	No	No
3	Turn off or dim lights	Yes	Yes
4	EV managed charging	No	Yes*
5	Chilled water supply temperature setpoint increase	No	No

Market Deployment

This task will overcome barriers to scale and facilitate market adoption by partnering with an industry system integrator and relevant software vendor products to incorporate research findings into product offerings, recommend strategies, tools and incentives, and introduce DF algorithms into standards.

Progress to Date:

The team has conducted an initial *Market Assessment* (literature review, interviews with OEMs/ building owners.

Several barriers are limiting the growth of load flexibility:

- Facility managers do not know that load flexibility is an option to pursue, due to a lack of communication of benefits and standardized approaches that they can apply.
- They are risk adverse to load flexibility strategies with concerns around occupant comfort, perceived harm to system reliability, cybersecurity, and lack of technical expertise.
- Multiple stakeholders must collaborate across an organization to coordinate a scaled load flexibility strategy.
- Legacy building systems often have existing issues and are difficult to integrate.

This assessment concludes that the market is driving scaled load flexibility as a high potential way for campuses to save utility costs and enable energy resiliency, and the barriers can be overcome through standardized organizational approaches.

Presented at the CEC EPRI Electrification Summit on June 10, 2026