

Connected Communities for Sustainable Solutions

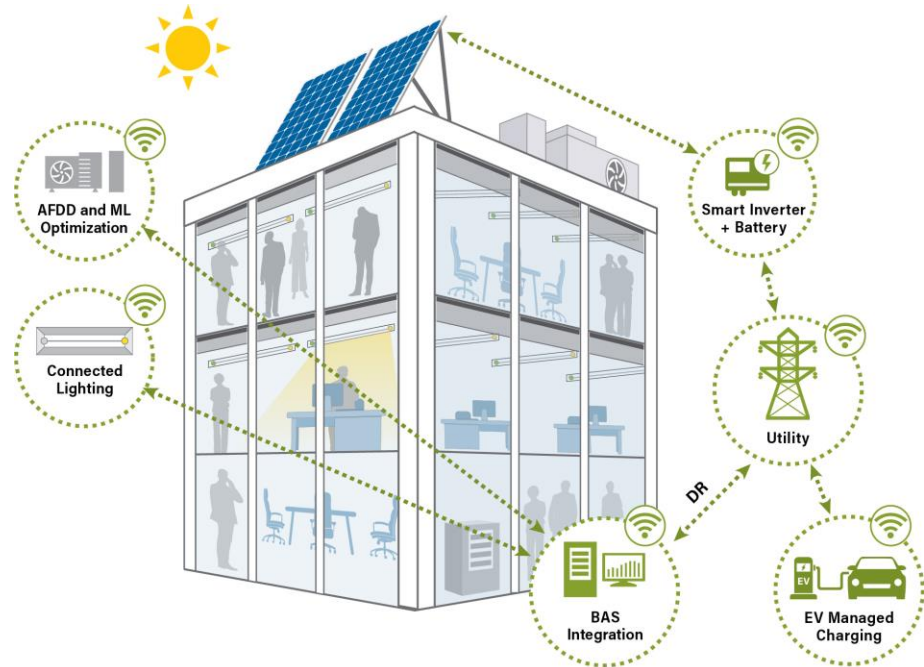
Scott Schuetter, Slipstream

July 2023

A decorative graphic at the bottom of the slide consisting of white line art outlines of various building shapes, creating a stylized city skyline.

GEBs for the middle: for a mid-size utility, mid-size city

This project will support increased integration of renewables into the grid, better maintain voltage limits on the transmission and distribution system and improve both the resilience of utility customer infrastructure and financial outcomes.



Project Goals

- Manage **load profiles** for better utilization of grid assets, lower cost, and lower emission
- Ensure cost control and reliability as building and vehicle **electrification** increase electric demand
- Reduce **emissions and utility cost for all** utility customers
- Improve indoor environmental quality, occupant comfort and operator **satisfaction**
- Increase ability of building systems and electric vehicle fleet to maintain **operations during grid outages**
- Scale via replicable GEB **implementation models** for building owners, designers, operators, MISO and policy makers

Grid Services

| Value to MGE | Grid Services Terminology | Distributed Energy Resources |
|--|------------------------------|---------------------------------------|
| Lower System-Wide Coincident Peak | Capacity (Peak Hours) | Load shed of HVAC, NLC, EVSE and BESS |
| Flatten Building Load | Distribution Capacity Relief | Continuous demand management by EMIS |
| MISO Energy Market Arbitrage | Economic Energy Dispatch | Load shift of EVSE and BESS |
| Maintain Nominal Conditions on Distribution System | Voltage Management | Smart Inverters |

2022 – 2024: Demonstrate GEB in existing City of Madison facilities.

| Application | Quantity | Strategies Demonstrated |
|-----------------------------|--|---|
| Building Load Shaping | 7 municipal buildings; 428,000 ft ² | Enhanced energy efficiency of HVAC and lighting |
| | | Automated Demand Response (ADR) of HVAC and lighting |
| EV Managed Charging | 23 Level 2 chargers serving 40+ EV passenger vehicles | Load shed and shift via managed charging |
| Smart Inverters + Batteries | Upgrade inverters on 15 arrays Add batteries to 2 sites | Smart inverter functionality Load shed and shift via batteries |

2023 – 2025: Develop a utility pilot GEB program

- For medium-to-large commercial and industrial customers.
- Centrally managed and optimized through a DRMS

2025 - 2026: Scale these impacts

- Replicable GEB implementation models for building owners, utilities, MISO and policymakers

Madison Municipal Sites

1625 Northport Dr



4151 Nakoosa Trail



215 Martin Luther King Jr Blvd



4020 Mineral Point Rd



3201 Dairy Dr































1501 W Badger Rd



1600 Emil St



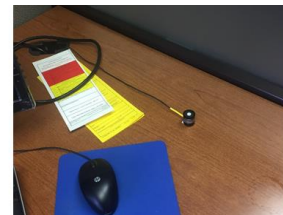
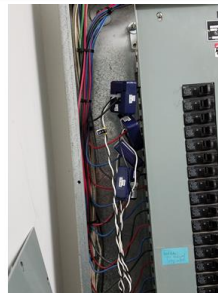
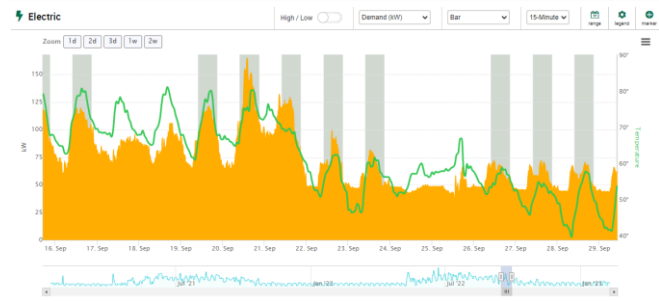
| Distributed Energy Resources | | | | | | |
|------------------------------|---|---|---|---|---|---|
| Site | HVAC Controls | Networked Lighting Controls | EV Managed Charging | Battery | EMIS | Smart Inverter |
| Fleet Headquarters | | | |  |  |  |
| Madison Municipal Building |  |  |  |  |  |  |
| Fire Station 14 | | | |  |  |  |
| Midtown Police District |  | | | |  |  |
| Engineering Operations |  |  |  |  |  |  |
| Streets West | |  | |  |  |  |
| Warner Park Rec Center |  | | | |  |  |

Estimated Impact – Madison Sites

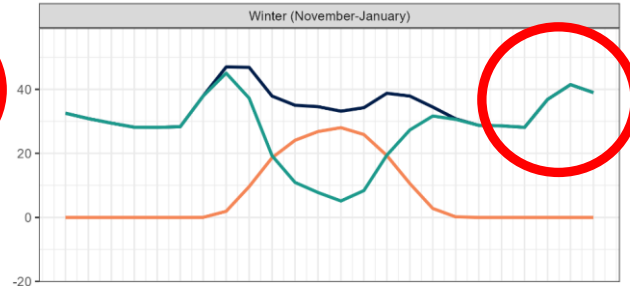
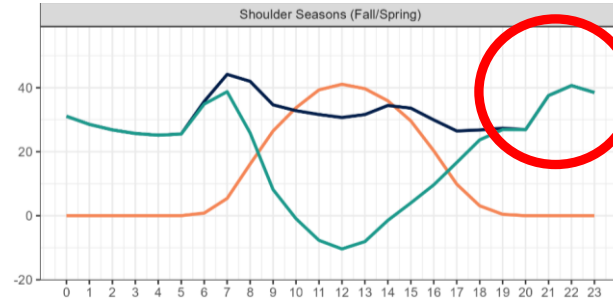
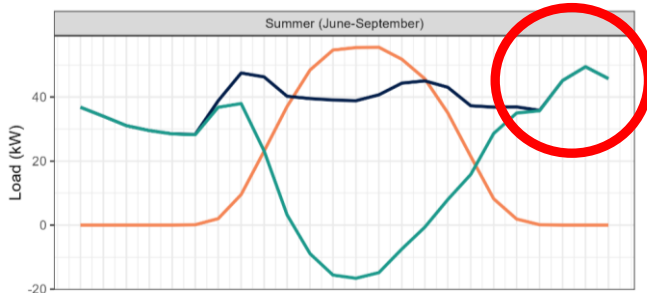
| | | | |
|------------------------------|------------------------|------------------|----------------|
| Energy Efficiency | HVAC – Electricity | 4.2% | Whole building |
| | Lighting – Electricity | 2.6% | Whole building |
| | HVAC – Natural Gas | 5.0% | Whole building |
| Load Shed | | 10.4% | Peak Demand |
| Continuous Demand Management | | 5.0% | Peak Demand |
| Load Shift | | 33 kW 783 kWh | 24 hr duration |

Measurement and Verification

| Data | Source | Interval |
|------------------------------------|----------------------------|-------------------------|
| Whole Building Interval Power (kW) | Utility portal | 15-minute |
| Submetered Interval Power (kW) | eGauge power meters | 1-minute |
| PV Inverter Metrics (V, VAR, kW) | Inverter portal | 1-minute |
| Natural Gas Consumption (therm) | Utility bills | Monthly |
| HVAC control points | Building Automation System | 15-minute |
| EV Charging Session | Vendor portal | Charging start/end time |
| Light Levels (fc) | Illuminance Meter | 5-minute |



Engineering Operations



Load Type: — PV Generation — Building — Utility Meter (Net)

Project Update

- Municipal sites identified
- Site characterization complete
- Monitoring equipment installation and Eval plan ongoing
- Occupant comfort surveys and stakeholder interviews approved
 - Pre-retrofit versions will be deployed this summer
- GEB solution procurement
 - EMIS RFP: evaluating responses
 - Battery and EV charging solutions in design



Project Challenges/Barriers

- Customer/occupant recruitment/engagement [**Phase 2 Challenge**]
- **Interoperability and controls**
- Technology packaging to customers and application
- **Utility coordination**
 - Grid services
 - Data privacy and security
 - Modeling and simulation
 - Others...



Opportunities for Collaboration

- Technology packaging approaches and application
- Technology funding [e.g., IRA, utility incentives, rebates]
- Grid services
- **DERMS, controls approaches**
- **Interoperability approaches**
- Evaluation [methods, customer engagement, resilience]
- Non-energy benefits [identifying value streams, other]
- Scaling [how to operationalize programs, utility programs, business model approaches, etc]
- Other



Any Questions? Suggestions?

Scott Schuetter, Slipstream

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Backup



Project Team

| Organization | Name | Email | Role |
|-----------------|-------------------|--|-------------------------------|
| Slipstream | Scott Schuetter | sschuetter@slipstreaminc.org | Principal Investigator |
| City of Madison | Jon Evans | jevans@cityofmadison.com | Municipal lead |
| MGE | Zach Billings | zbillings@mge.com | Utility lead |
| RMI | Brett Bridgeland | bbridgeland@rmi.org | Scaling framework |
| ACEEE | Rohini Srivastava | rsrivastava@aceee.org | Scaling framework |
| bluEvolution | Adam Rinderle | adam@bluevolution.com | Cybersecurity and integration |

- And many more...

