

Advanced Grid Responsive Technologies for Existing Multifamily Properties

Lead: Austin Energy

Subrecipient: New Buildings Institute (NBI)

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Award#: DE-EE0009462

FOA: Building Technologies Proving Ground –
Public Sector Field Validation



Project Summary

OBJECTIVE, OUTCOME, & IMPACT

- Goal/Impact: Increase multifamily demand response (DR) with dual incentive and dedicated device network for multifamily owners and tenants
- Scope: 'Smart Home Rewards' pilot at 6-7 properties; ~1,400 tenant units in Austin, TX
- Pilot will test effectiveness of: 1) dual incentives for property owner & tenant; 2) low-cost communication network; 3) 'opt-out' DR enrollment for smart thermostats and water heater controllers



Armada Water
Heater Controllers



DR-Enrolled EcoBee 3 Lite

TEAM & PARTNERS

- Multifamily Property Owners and Managers
- New Buildings Institute (NBI)
- Armada Water Heater Controllers
- Ecobee Thermostats
- Additional technology vendors

STATS

Performance Period: May 2021 through May 2026

DOE Budget: \$1M Cost Share: \$428k

Milestone 1 (2024): 1 property installed & participating

Milestone 2 (2025): 4 properties installed & participating

Milestone 3 (2026): 6-7 properties installed & participating

About Austin Energy

Public Power

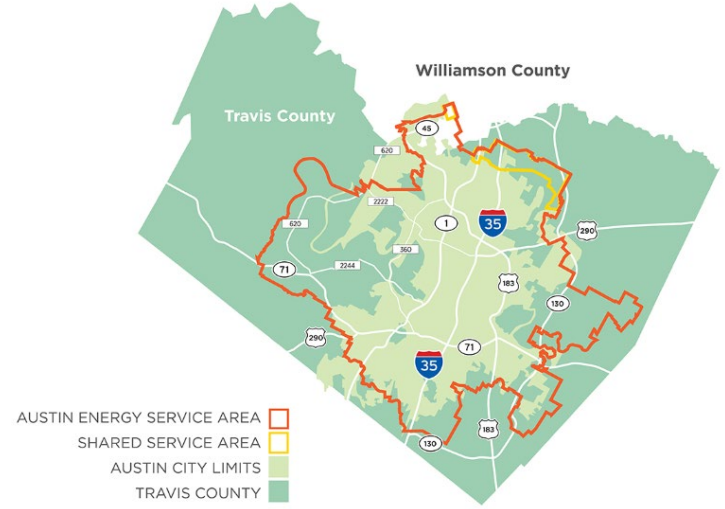
- 2nd largest municipally owned utility in Texas
- Reports to the City Manager, who executes the policy and direction of the City Council

Compact, Dense System

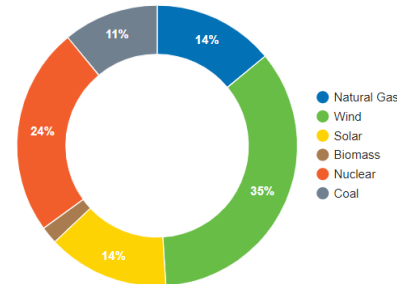
- ~550,000 customers across 437 sq miles of service area
- 3,067 MW Summer Peak; 2,628 MW Winter Peak (FY23)

Vertically-Integrated

- Vertically-integrated in a deregulated, wholesale, energy only market
- 100% carbon-free generation goal by 2035
- Leader in adopting innovative technologies



Percent of Energy Generated from Austin Energy Assets (MWh) FY23



Texas Generation Map FY23



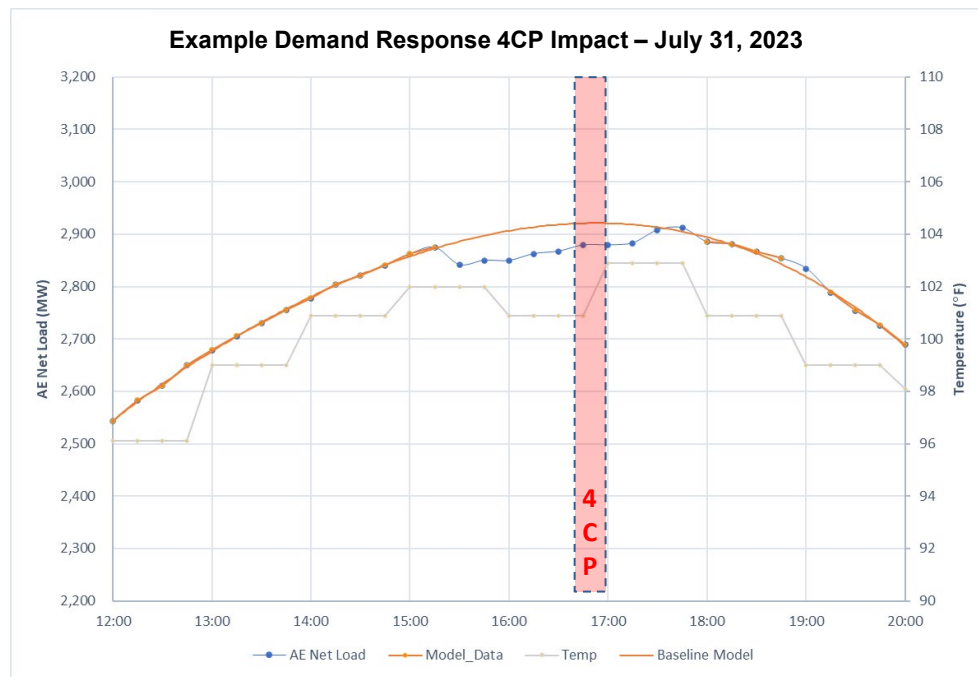


Problem: Residential DR Growth Needed

- **Limited DR:** semiconductor fab and data centers less able to participate
- **ERCOT Market:** 4CP (coincident peak) transmission cost; load zone price separation; other benefits
- **Resiliency:** clear mandate for grid resiliency and improved load management



2023 Winter Storm Mara



4CP: 4:45-5:00 PM
42 MW DR Curtailment
AE 4CP Ratio%: 3.47972%



Problem: Multifamily Challenges

- **Split incentive:** discourages owner and tenant alignment and investment on energy/utilities
- **High turnover:** tenant and staff turnover inhibits device enrollment and support
- **Connectivity:** lack of dedicated, low-cost, low-maintenance communication network
- **Equity:** reduce energy costs and improve quality of life for low- and moderate-income households



Alignment and Impact

- **Increase DR performance for multifamily water heating and smart thermostats**
 - Demonstrate minimum winter and summer DR event savings and participation for smart thermostats and water heater controllers
 - Expand residential DR strategies

DR Event Savings Target		
End Use	Summer Load Shift (kW)	Winter Load Shift (kW)
Water Heater	0.56	1.0
HVAC	0.76	0.5
Total	1.32	1.5

DR Event Savings Target (hypothetical 200 unit all electric property)	
Pilot Minimum (~25% participation)	50 kW
Pilot Target (~50% participation)	100 kW

- **Overcome multifamily split-incentive**
 - Increase current MF DR thermostat enrollment rate from <5% to 25-50%
 - Sustain property owner support for device maintenance
 - Develop new 'opt-out' DR enrollment for smart thermostats

Multifamily Property Smart Thermostat DR Participation Target	
Current	<5%
Pilot Minimum	~25%
Pilot Target	~50%



Alignment and Impact

- **Equity & Customer Satisfaction**

- Demonstrate positive experience for tenants and owners
- 50% of pilot properties to serve majority low- and moderate-income households

- **Dedicated Communication Network**

- Low-cost & low-maintenance
- Supports Wi-Fi thermostats compatible with existing utility aggregators & DR management system software (DRMS)

Customer Satisfaction	
Pilot Goal	3 out of 5
Long Term Goal	4 out of 5

Smart Thermostats – DR Event Connectivity	
Current Avg. Event Connectivity Rate (Existing Single-Family Participants)	85%
Pilot Target for Initial Connectivity Test	75%
Pilot Target for Avg. Event Connectivity Rate	50%



Approach: Dedicated Communication Network

Legacy: Radio Frequency (RF) Thermostats and Water Heater Timers

- Thousands installed in single and multifamily households
- Thermostats: no event override or ongoing incentives
- Water heater timers: no connectivity

Option 1: Cellular-backed WiFi from Water Heater Controller

- Armada Power LCS2400
- Low-bandwidth WiFi network from cellular Cat-M network
- 3 smart thermostats passed bench test
- 2 temperature probes +/-1 C accuracy
- Leak detection; UL 916 Listed

Option 2: Leverage existing property-wide WiFi

- Less common, helpful for properties with gas water heaters

Option 3: Z-wave, mesh, or other network (pending compatibility)

- Options available but properties opted for cellular option

Legacy RF Thermostats



Legacy Water Heater Timer



Armada Power LCS2400



DR-Enrolled Ecobee Lite 3





Approach: 'Smart Home Rewards' & Dual Incentive

- Tenant Receives
 - \$50 initial and \$25 annual recurring bill credits
 - \$5 bill credit for customer survey
 - New smart thermostat with dedicated connectivity and smartphone app
 - No penalty for event override
 - Cancel or opt-out at anytime and retain thermostat connectivity
- Property Receives
 - \$5/device/year for participating water heater controllers and smart thermostats
 - Water heater leak detection
 - ~5% of units receive data loggers
 - Optional: device management portal; integration of additional building controls/equipment

AUSTIN ENERGY Customer Driven. Community Focused.™

You are enrolled in Smart Home Rewards

You will get
\$50 one-time bill credit*
\$35 each year you stay enrolled

Austin Energy will adjust your thermostat by up to 4 degrees to reduce your energy use at peak times. You will always be able to adjust your thermostat, if needed.

Your participation helps conserve energy and benefits the whole community. Learn more at austinenergy.com/smarthome.

No Home WiFi Needed
Your new smart thermostat comes connected to a dedicated network. Please do not change the device's WiFi settings.

*You may unenroll from the Smart Home Rewards program any time at austinenergy.com/optout. Once you unenroll, you will no longer receive bill credits from Austin Energy.

AUSTIN ENERGY Customer Driven. Community Focused.™

Usted está inscrito en Smart Home Rewards

Usted recibirá
Un crédito único de **\$50** en su factura*
Un crédito de **\$35** cada año que permanezca inscrito

Austin Energy ajustará su termostato hasta 4 grados para reducir temporalmente su consumo de energía en las horas pico. Siempre podrá ajustar su termostato, de ser necesario.

Su participación ayuda a conservar energía y beneficia a toda la comunidad. Conozca más en austinenergy.com/smarthome.

No se necesita WiFi en el hogar
Su nuevo termostato inteligente viene conectado a una red dedicada. Por favor, no cambie los ajustes de WiFi del dispositivo.

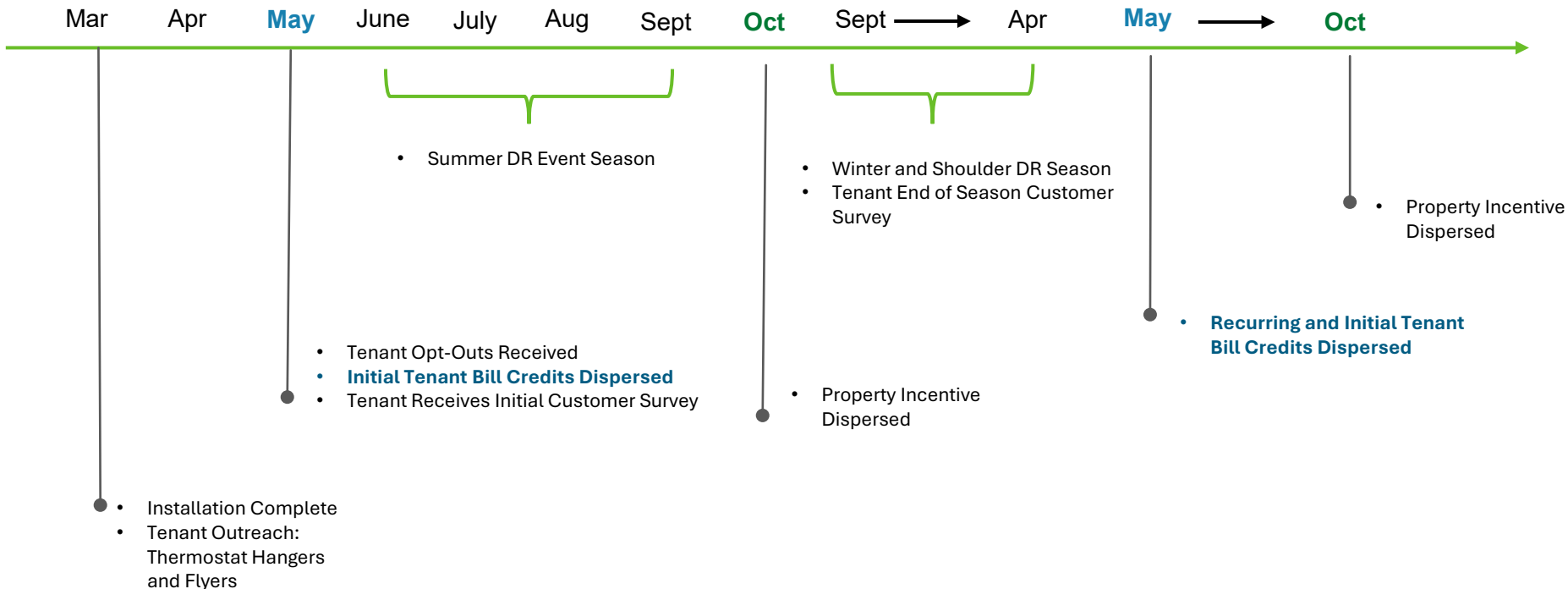
*Puede cancelar su inscripción en el programa de Smart Home Rewards en cualquier momento en austinenergy.com/optout. Una vez cancele su inscripción, ya no recibirá los créditos en su factura de Austin Energy.



Approach: Smart Thermostat DR ‘Opt-Out’ Model

- DR enrollment linked to device instead of customer
- Provide customer notice via flyers, email, thermostat hanger, and multiple surveys
- Customer Experience
 - \$50 initial and \$25 annual recurring bill credit
 - No event override penalty
 - Opt-out via: smartphone app; webpage; phone; or email
 - Smartphone app and connectivity, even if opted-out
 - Future smart home capabilities
- Challenges
 - DR management system (DRMS) software updates required
 - Thermostat manufacturers

Approach: Incentive Timeline Example



Property 1: 'Riverside' 3 FI Garden Style

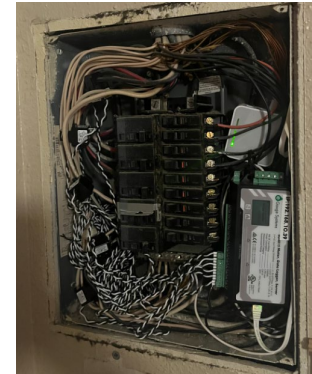
Property Info	
Zip code	78741
Tenant Unit Count	220
Building Count	15
Building Count / Style	3 Floor Garden Style
Year Built	1983
Fuel Type	All electric
LMI Status	1BR Rental Rate Target



HVAC and Water Heater Info	
HVAC Info	2 tons; 2015 install; electric resistance heating
Water Heater Info	Electric 30 & 40 gal; located in balcony closet
Thermostats Installed	194
Water Heater Controllers Installed	209



Event Data *	
Water Heater Connectivity	50-85%
Water Heater Events	2x daily since June 2024
Thermostat Connectivity	34-42%
Thermostat Events	8 events in Aug & Sept 2024



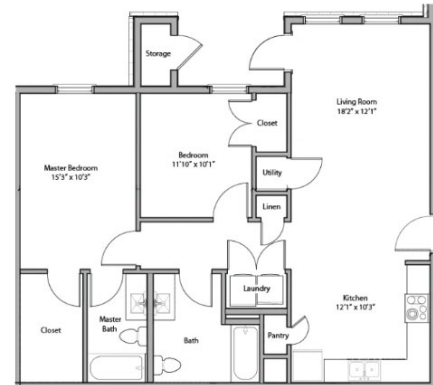
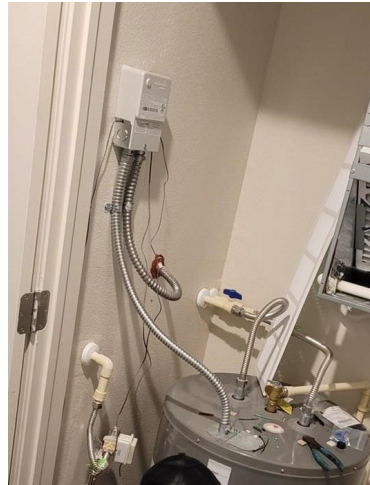
* Initial performance data - kW savings and other event data under review

Property 2: 'Airport' 3 FI Garden Style

Property Info	
Zip code	78617
Tenant Unit Count	240
Building Count	7
Building Count / Style	3 Floor Garden Style
Year Built:	2024
Fuel Type	All electric
LMI Status	Affordability set-aside

HVAC and Water Heater Info	
HVAC Info	2-3 tons; 2024 install; electric resistance heating
Water Heater Fuel & Size	electric 40 gal; located in utility closet
Thermostats Installed	240
Water Heater Controllers Installed	240

Event Data *	
Water Heater Event Connectivity	52-81%
Water Heater Events	2x daily since June 2024
Thermostat Event Connectivity	28-35%
Thermostat Events	8 events in Aug. & Sept. 2024



Property 3: 'Allandale' 5 FI Mid-Rise

Property Info	
Zip code	78617
Tenant Unit Count	321
Building Count	1
Building Style	5 Floor Mid-Rise w/ Property WiFi
Year Built	2024
Fuel Type	Gas water heater
LMI Status	market rate

HVAC and Water Heater Info	
HVAC Info	2-3 tons; 2024 install
Thermostats Installed	328
Water Heaters Installed	n/a

Event Data *	
Thermostat Event Connectivity	59-61%
Thermostat Events	3 events in Sept. 2024

* Initial performance data - kW savings and other event data under review





Progress and Future Work

- **Obstacles & Lessons Learned**

- Maintenance and local management turnover
- Cat-M cellular network reliability not yet consistent
- Tenant turnover requires low-touch recurring incentive model
- Shift smart thermostats DR from customer enrolled (opt-in) to device enrolled (opt-out)
- Water heater summer baseline load lower than expected

- **Multifamily Housing Diversity & Program Design Challenges**

- Fuel and Equipment Types
 - HVAC: Heat pump or split system (gas or electric resistance)
 - Water Heating: Electric, Gas, or Boiler systems
- Property-wide Wi-Fi: rare, especially for LMI-focused properties
- Water heat location: impacts connectivity and temperature
- Property demographics: impact smart thermostat acceptance



Progress and Future Work

- **Austin Energy Next Steps**

- Identify & complete installation and test event for additional 3-4 properties
- Implement efficient ongoing incentive model
- Enroll 2nd water heater controller vendor
- Enroll additional smart thermostats for 'opt-out' DR enrollment
- Evolve DR curtailment strategies
- Assess savings and program cost effectiveness

- **Knowledge Transfer**

- Final report, case studies, and energy market analysis (NBI supporting)
- Planned presentations: Peak Load Mgmt Association (PLMA) 2024 conference; ACEEE Multifamily Group; others in 2025-26
- Additional publications, webinars, etc to be planned

Thank You

Austin Energy

<https://austinenergy.com/smarthome>

Subrecipient: New Buildings Institute (NBI)

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**2024 PROJECT
PEER REVIEW** 

U.S. DEPARTMENT OF ENERGY
BUILDING TECHNOLOGIES OFFICE



Team



Austin Energy

Prime Recipient
Program Design and
Implementation



New Buildings Institute

Research, M&V, and
Technical Reporting



Armada Power

Water Heater Controllers
and Network
Water Heater
Curtailment



Ecobee

Opt-Out DR-Enrolled
Thermostats



Project Execution

	FY2021-24				FY2025				FY2026			
Planned budget	\$694,847				628,985				107,740			
Spent budget	~\$520,000				TBD				TBD			
					Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Past Work												
Milestone: Contracts and Rebate Agreements Final												
Milestone: Potential Technology Vendors Identified												
Milestone: 1 st Property Installed and Test Completed												
Milestone: Bill Credits and Property Incentives Dispersed												
Current/Future Work												
Milestone: 4 Properties Installed and Tests Completed												
Milestone: Bill Credits and Property Incentives Dispersed												
Final Report and Case Studies Published												

- BP1 GNG: 1 Property Installed and Test Completed; tests and property pipeline confirm meeting minimum targets
- BP2 GNG: 4 Properties Installed and Tests Completed; customer satisfaction minimum 3/5
- Delays:
 - Contracting and rebate process for properties and vendors
 - Cellular network reliability
 - Property staff turnover