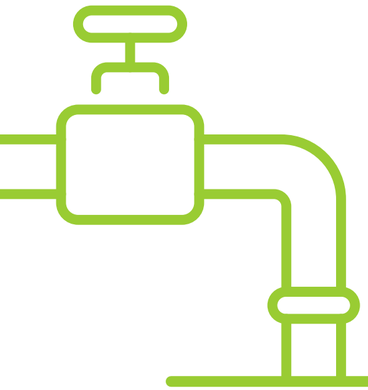
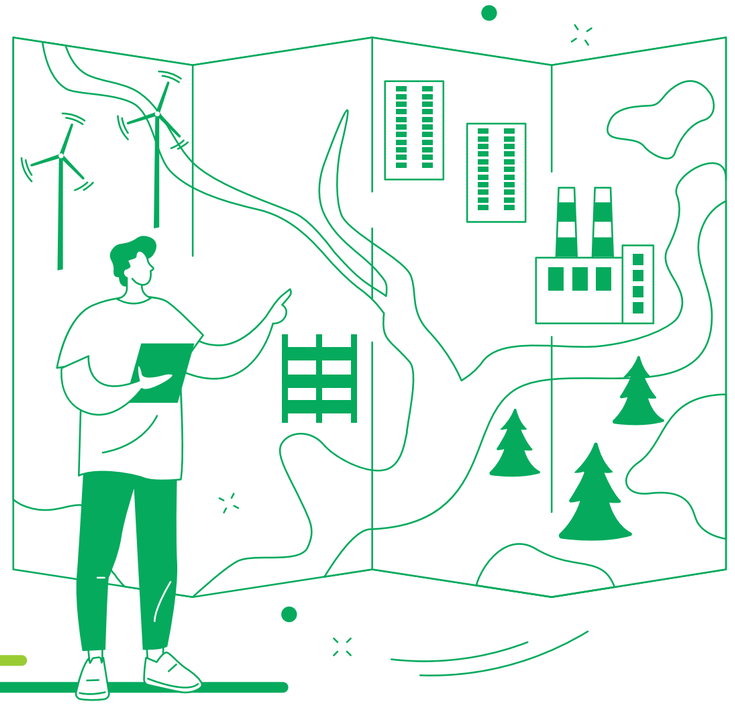
MichaelsEnergy



Saving Heat:

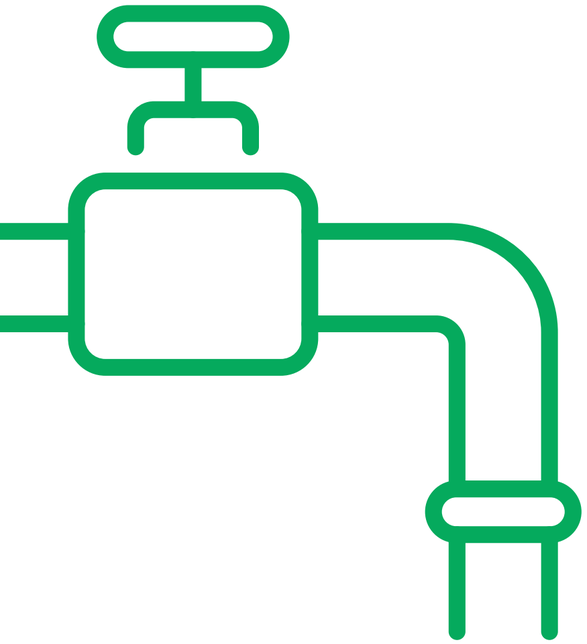
A Natural Fit for Gas Demand Response



Jeff Pritchard

Managing Consultant, Research and Evaluation

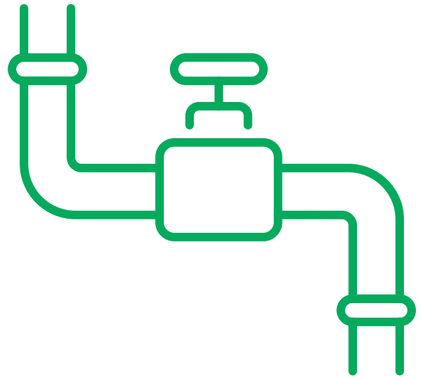
Colorado's Natural Gas Challenge



- Pipeline capacity in mountain regions is maxed out
- New infrastructure: expensive, invasive, and counter to state climate goals
- Residential DR one of several Non -Pipeline Alternatives included in the Mountain Energy Program
- Goal: Buy time for electrification while avoiding outages

Two long-term solutions for CO...

Two Choices for Colorado



Install More Infrastructure

- More natural gas pipelines or storage facilities
- Potentially locks in fossil fuel use for 50+ years
- What is the public opinion?

Consume Less Natural Gas

- Who are the primary consumers during peak use?
- Is this feasible?
- What is it replaced with?
  - A: Electrification
- When is electrification happening?

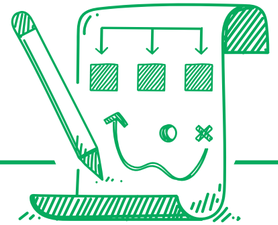
Pilot Program with Xcel Ener

- Partner: Xcel Energy’s Heat Savers program
- What: Residential Natural Gas DR program
- Region: Summit & Grand Counties
- Started in 2022, acquired 167 total participants to date
- Eligible smart thermostats were required for participation
- Incentive: $100 (bill credit) for enrolling and up to $250 for participating, OR a free smart thermostat.

Pilot Overview

Objectives:

- Can natural gas DR reduce peak demand?
- Do events lead to an overall net reduction in natural gas consumption?
- Which DR strategies work best?
- How consistent are the results produced by different baseline methodologies?



Logistics

- 19 Events held from January 11 -March 29, 2024
- Event Combinations:
  - All participants
  - Groups A & B
  - Pre-heat approved
  - Staggered start
  - Thermostat setpoints change by 3 or 4 degrees
- >90% participant for each event

M&V Innovation

- Traditional billing data = monthly
- Smart meter data largely unavailable
- Used thermostat runtime data to infer energy use
- Partnered with Residio to provide 15-minute interval furnace runtime, set point, and temperature data
  - They did not provide furnace capacity, data gathered via participant survey

M&V Approaches

Control and Treatment

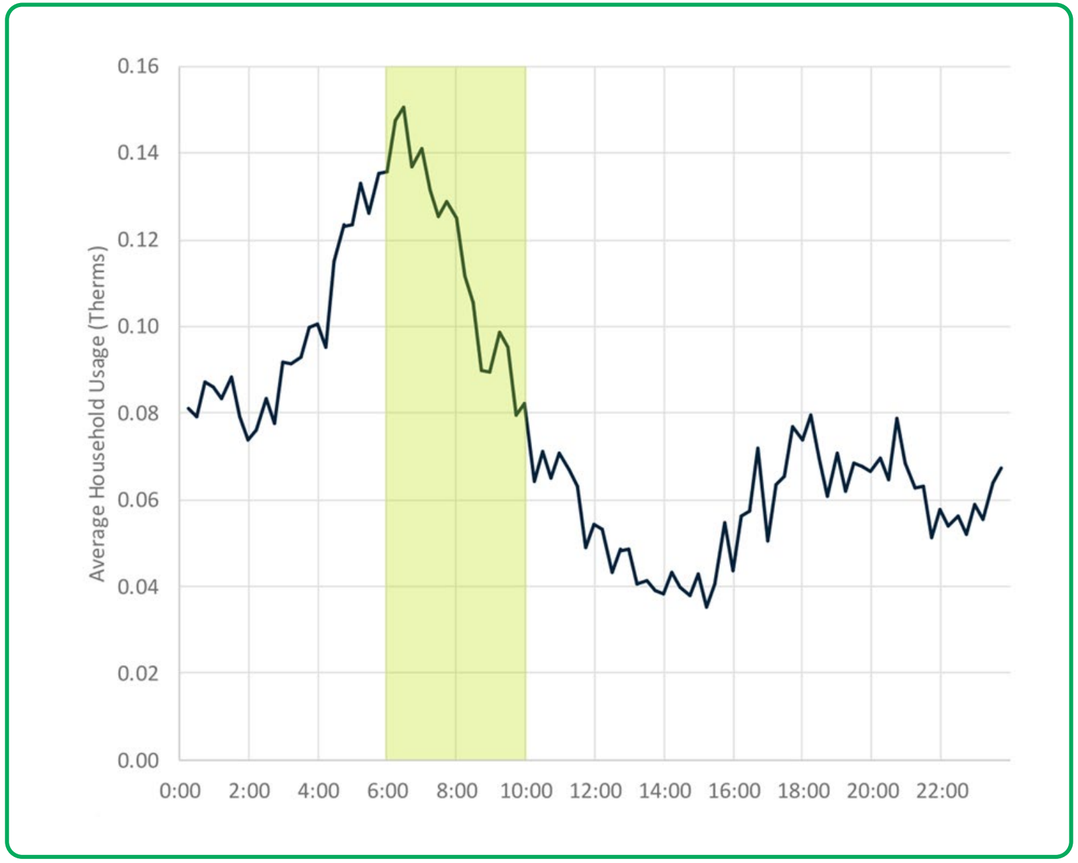
- Participants randomly categorized into Group A and Group B
- Events analyzed individually using Python
- Residio telemetry data was restricted to the day of the event, and only thermostats that recorded heating activity were retained for analysis
- 15-min heat intervals converted to BTUs

10-in-10

- Created a unique 24-hour baseline for each thermostat and each event
- Average baseline profile collected from each event day's ten most recent non-event weekdays, excluding DR days
- 10-in-10 baseline algorithm in Python, using 15-min heat interval data
- Adjustment factor is applied to correct for real-time variability

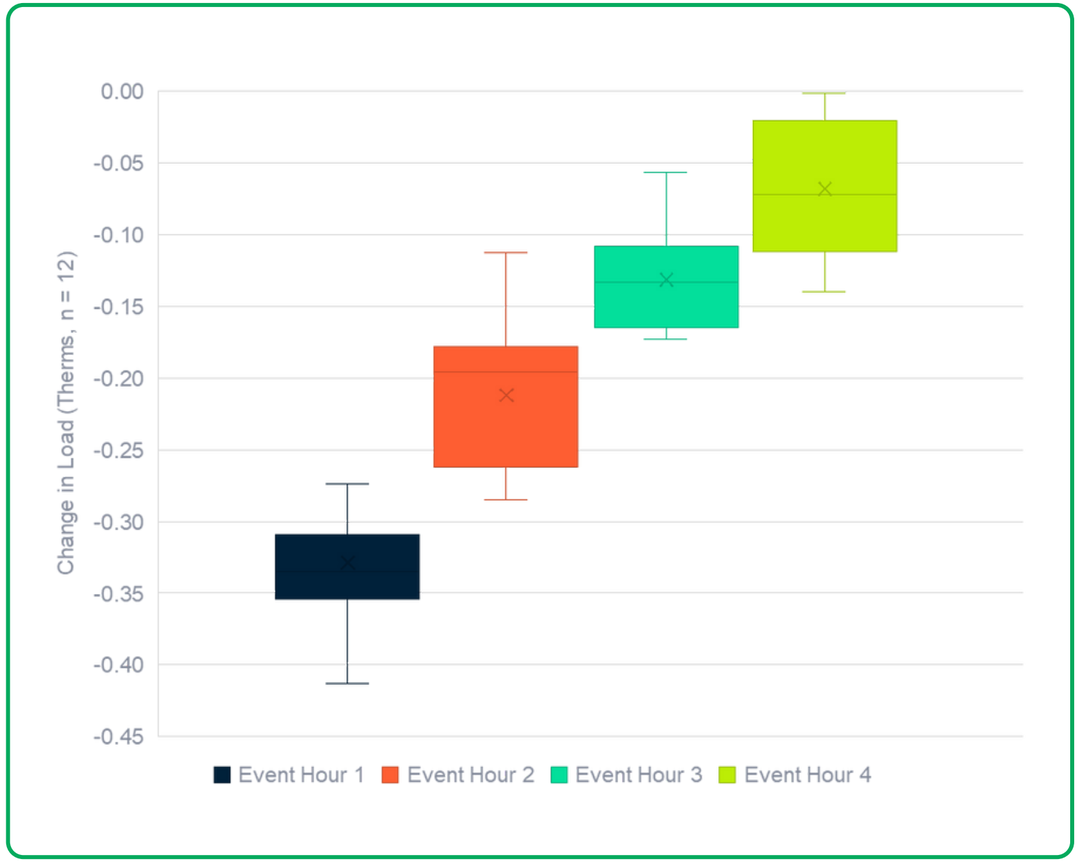
Heat Savers: Baseline Consu

- Peak hours of use typically occur around 6 A.M.
- Events last 4 hours and typically start at 6 A.M.
- Pre-he at period begins 2 hours before the event.
- The snapback period lasts for 2 hours after the event.

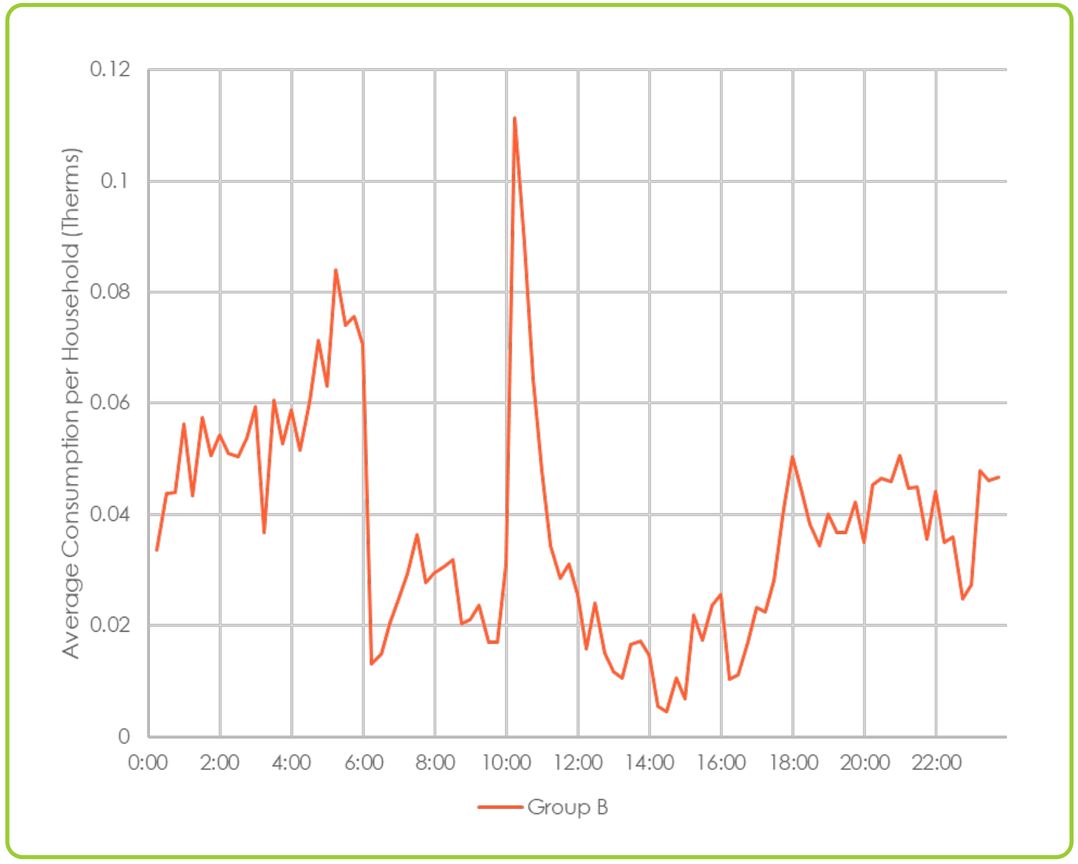


Heat Savers: Findings

- Natural gas demand is shifted downward during events
  - Over the four-hour event period, 0.74 Therms/household are shifted
- Events shift 0.33 Therms per household during the first hour of the event
- Snapback demand peaks are often higher than the control peak demand
  - Peak shifts to post-event and in almost all cases, supply-side issues for Xcel are made worse



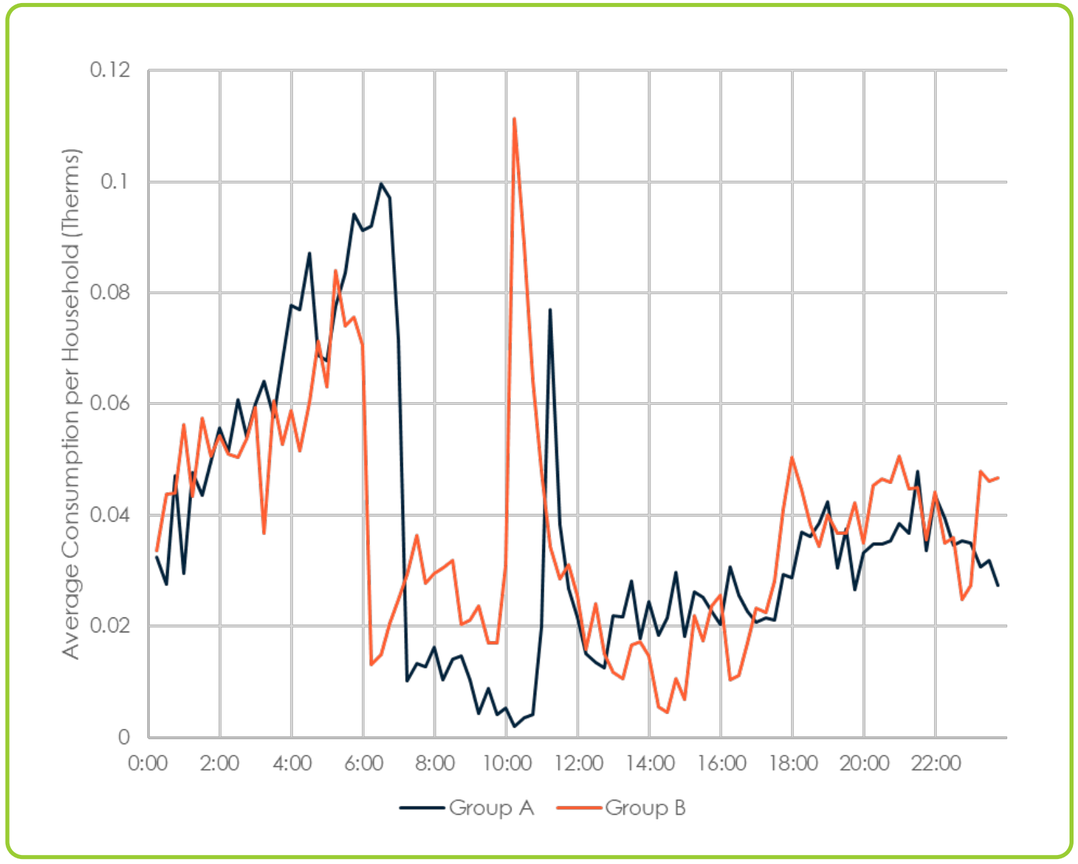
Heat Savers: Findings



Staggered Events

- Group A and Group B both have four-hour events, but Group A starts an hour later.

Heat Savers: Findings



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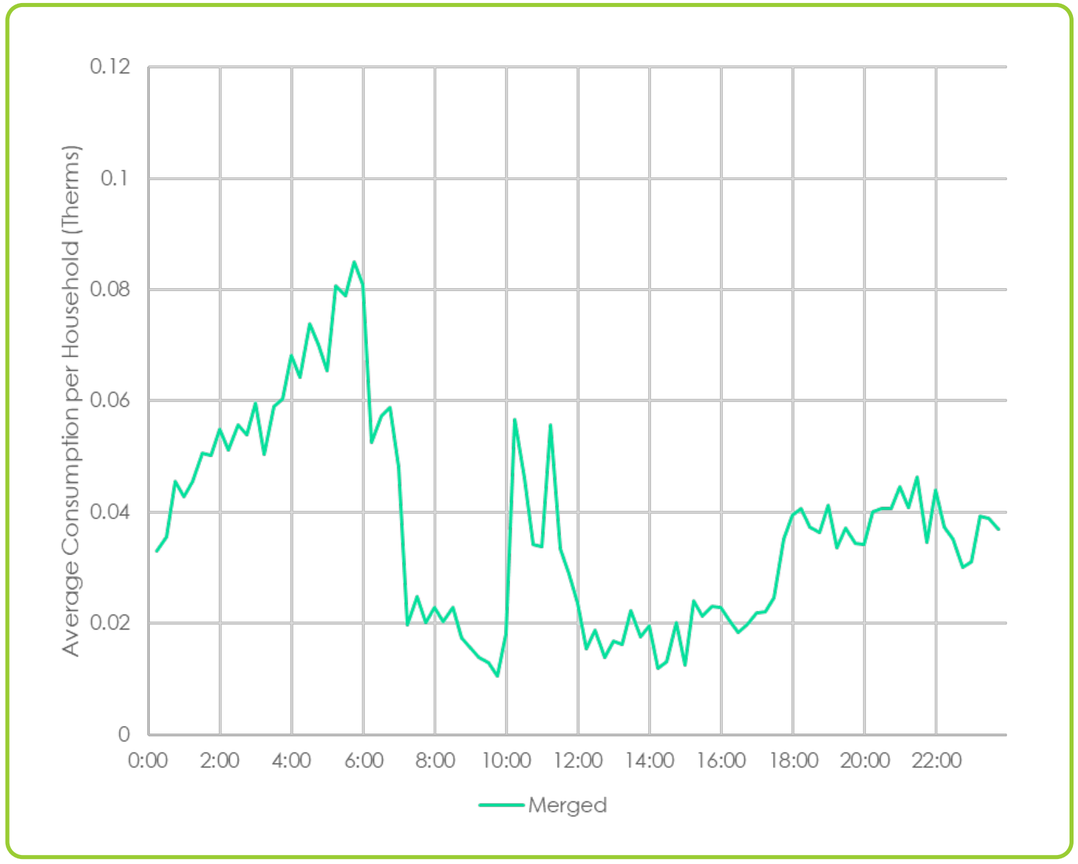


Staggered Events

- Group A and Group B both have four-hour events, but Group A starts an hour later.
- Combined usage for all group participants resulted in lower snapbacks, and saved customers energy overall.

Analysis Method Learning

Control and Treatment

- Real-time baseline under identical conditions (weather, behavior, timing)
- Strong for event -level impact measurement
- Reduces confounding variables → higher accuracy & validity
- Limited in tracking long-term, household-level trends

Better for precise, event-specific peak reduction estimates

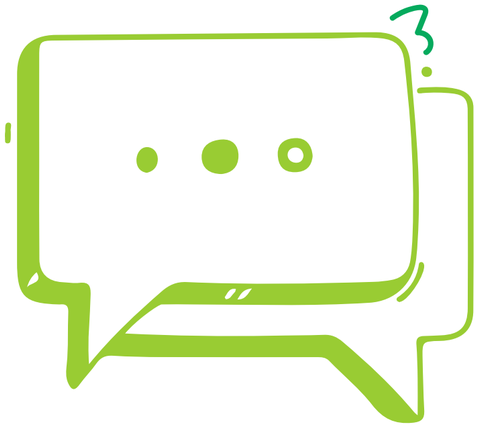
10-in-10

- Adjusts with scaling factor for real-time conditions
- Allows individual, longitudinal analysis across events
- More susceptible to variability from weather & occupant behavior
- Less precise for isolating event-specific impacts

Better for understanding household behavior and consistency over time

Heat Savers: Takeaways

- Natural Gas use peaks in the morning. Existing usage data is **not granular enough** for M&V.
- Administration of events and data-driven design are **necessary for a successful program.**
- There is **no standard for determining a baseline** for consumption during the analysis of natural gas DR
- Staggered start events **shift load and inhibit peak demand** .



Questions?

Jeff Pritchard

Managing Consultant, Research and Evaluation

JAPritchard@MichaelsEnergy.com

734.864.6844