



## Nicor Gas ETP Study Smart Thermostat

*Presented to:*

Illinois Energy Efficiency  
Stakeholder Advisory Group

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# Study Sample Size

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- A sample size of 104 units were installed and monitored in 92 homes.
  - Each home has 1-3 central / force air furnaces
- 28 units in 27 homes were removed from analysis due to poor internet connectivity issues.
- Further, 14 units in 11 homes were removed from analysis due multi stage / modulating furnaces.
  - The detailed run time of furnace during each stage for multi-stage furnace was not available for analysis.
- Another 8 units from 5 homes were removed due to variety of reasons such as furnace operation discrepancy vs. billing analysis, uncertainty in t-stat operation with 50% AFUE furnaces
- Final sample of 54 t-stats in 49 homes.

# Installation and Furnace/AC Information

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The units were installed professionally.  
Following information was collected on-site.

## 1. Furnace nameplate information

- Btu/hr gas input
- AFUE

## 2. AC nameplate information

- cooling tons
- SEER

# Monitoring Data Collection

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Manufacturer supplied following hourly performance data points in monthly summaries for each thermostat installed

1. Average outdoor temperature (based on a local weather data source)
2. Average actual indoor temperature at thermostat
3. Average smart algorithm adjusted heating temperature setpoint
4. Average smart algorithm adjusted cooling temperature setpoint
5. Average homeowner programmed heating temperature setpoint
6. Average homeowner programmed cooling temperature setpoint
7. Percent time thermostat is in heating mode
8. Percent time thermostat is in cooling mode
9. Heating or cooling runtime (in minutes based on thermostat call time)
10. Percent time thermostat in auto fan mode
11. Percent time thermostat is connected to internet

# Savings Analysis Methods

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- Three sets of analysis were performed to determine savings.
  - Monitored Savings
    - Energy Savings derived from Pilot Data only
  - 30 year Weather Average Savings
    - Energy savings derived from Pilot data and normalized to the 30 year average weather data (O'Hare)
  - Energy Plus modeling
    - Monitored performance modeled to represent savings for 15 typical Chicagoland homes under a typical weather year (O'Hare)

# Monitored Results

Final Sample Size	Heating/Cooling (and Fan) Annual Savings With Smart Thermostat Over Programmable Thermostat	
	49 homes with 54 thermostats	gas
3.0%-4.1%		8.9%-10.6%

- Range of savings
  - Low includes overrides of smart thermostat beyond programmable thermostat setpoints that create negative savings
  - High excludes overrides of smart thermostat beyond programmable thermostat setpoints that create negative savings

# Other Savings Analysis Results

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Average Savings Vs. Conventional Programmable T-Stat	Monitored Results	30 Year Weather Average	EnergyPlus Modeling
Gas Savings (Therm/Yr)	40	35	89
Gas Savings (%)	3%	3%	12%
Electric Cooling and Fan Savings (kWh/Yr)	236	201	317
Electric Cooling and Fan Savings (%)	8.9%	8.7%	10.7%

# Summary Results

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- Gas savings of average smart thermostat compared to conventional, programmable thermostat
  - Monitored Results: 40 therms/yr, 3.0%
  - “Truncated” Monitored Results: 55 therms/yr, 4.1%
  - 30-yr Weather Avg Results: 35 therms/yr, 3.0%
  - Modeled EnergyPlus Results: 89 therms/yr, 12.0%
- Issues
  - Homeowner intervention overriding smart thermostat setbacks significantly impacted monitored results, even generating negative savings versus programmed setpoints
  - Modeling shows much higher savings potential if smart thermostat setback actions unhindered by the homeowner