Smart Thermostats
Optimizing Multifamily Deployment

Ben Adams
2019 National Home Performance Conference, Chicago IL
Context

- A 942 unit pilot
  - “Lower income” (400% FPL) multifamily rentals
  - Recruitment & installation phases completed

- Determine challenges, lessons learned and impact:
  - Market characterization, recruitment & qualification
  - Technical compatibility
  - Resident & building operator experience
  - Energy savings
Implementation Team

- Evaluation
- Installation
- Design/Oversight
- Connectivity
- Technology
- Utility
A Broad Representation of Buildings

- 942 thermostats installed in 16 projects
  - 116 units in 2 buildings of 50+ units
  - 307 units in 8 buildings of 20-49 units
  - 65 in 6 buildings of 10-19 units
  - 454 in 73 buildings of < 10 units*

* Based on average units per building; Includes one project where less than 100% of units installed in each building
A Growing Choice of Technologies

- **LYRIC ROUND THERMOSTAT**
- **HONEYWELL LYRIC T6 PRO**
- **LUX KONO THERMOSTAT**
  - Available Q2 2018
- **ECOBEE4**
- **ECOBEE3 LITE**
- **NEST E THERMOSTAT**
  - Available Q4 2018
- **NEST THERMOSTAT**
  - Available Q4 2018
- **ZEN THERMOSTAT**

5
Our Pilot Selection

Honeywell Lyric T6 (Z-Wave)

Ecobee 3 (WiFi)

Nest E (WiFi)
Smart Strategies with Connectivity

- **App control**
- **Geofencing**

Both require in-unit connectivity plus cellular mobile device

* Functionality depends on model/configuration
What is Geofencing?
Smart Strategies Without Connectivity

- Occupancy sensing
  With integrated sensor

* Functionality depends on model/configuration
Smart Strategies Without Connectivity

- Occupancy sensing
  With integrated sensor

- Learning

* Functionality depends on model/configuration
Multifamily Challenges

- WiFi?
- Smartphones?
- Turnover?
- Seniors?
- Language?
- Occupancy Patterns?
- High/Low Temps?
- Vacant Units?
A Holistic Approach

Connectivity

+ Building Level Controls

+ Resident Education
Program Advantages Over Tenant WiFi

- **Participation**
  - Not dependent on resident’s own connectivity
    - Tenant WiFi availability may be less than 50% depending on market

- **Security & cost effectiveness**
  - Drastically decreases costs compared to “Hub per unit” deployments
  - Firewalled network infrastructure with Intrusion Detection System (IDS) and Intrusion Prevention System (IPS)

- **Property benefits when paired with device APIs**
  - Enables dashboard level monitoring & settings
  - Facilitates vacant unit, common area and tenant turnover control
  - Can support other device amenities and resident internet access
## Connectivity Solutions: Beamed WiFi

![Diagram of beamed WiFi network](image)

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Connectivity Solutions: Mesh/Z-Wave
Connectivity Solutions: LoRa WAN
### Connectivity Solutions: Tenant WiFi

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**Diagram Description**

- **Wireless Access Points** indicate the placement of Wi-Fi routers and access points.
- **Electronic Devices** represent the areas where wireless connectivity is needed.
- **Electrical Outlets** showcase the locations where power connections are present.
- **Hardware Components** highlight areas where networking equipment is installed.
- **Plumbing Components** demonstrate the integration of plumbing systems with connectivity solutions.
- **HVAC Systems** illustrate the connection of heating, ventilation, and air conditioning with wireless technology.
Solutions broadly represented in Pilot

- 5 Projects (259 units) Nest E with Stratis Wi-Fi
- 5 Projects (231 units) Nest E with tenant Wi-Fi if present
- 3 Projects (226 units) Ecobee 3 with tenant WiFi if present
- 2 Projects (154 units) Honeywell Lyric T6 Z-Wave with Stratis Mesh
- 1 Project (72 units) HW Lyric T6 Z-Wave with Stratis Mesh+LoRaWAN
Recruitment

- **Challenges**
  - Interest/response at owner level
  - Decision making process and timelines

- **What’s worked**
  - Simple application/agreement plus “concierge”
  - Engagement at property staff level
  - Robust technical discovery
  - “Embedded champions”
  - Problem solving
  - Persistence
Compatibility

- **Challenges**
  - All central systems in older buildings (>20 years)
  - Some individual systems (certain heat pumps, minisplits, PTACs)*
  - C-Wire
  - System condition

- **What’s worked**
  - Newer buildings with individual systems
  - Broad compatibility (conventional, Magic-Pak, hydronic forced air)
  - Creative wiring solutions
  - Few mounting issues

*Other connected thermostat solutions are available but were not included in this pilot*
What’s worked

- Range/flexibility of coverage options
- Creative solutions for power & ISP access
- Pre-commissioning of WAPs/thermostats
- Maintenance staff collaboration
Tenant Experience

- What’s worked
  - Advance notice
  - Installer interaction
  - Leave-behind education materials
  - On-site “help desk” during installs
  - Multiple support options
  - Post installation workshops
  - Seasonal tip cards
Property O&M Experience

- What’s worked
  - Collaboration at scoping
  - Staff training & advance installs
  - Anticipation of benefits
    - Fewer tenant operation issues
    - Building level support/controls
Pilot completions
- Accepted 16 properties (942 units) out of 43 considered (8,281 units)
- Approx. 37% of properties reviewed (11% of units)

Pilot rejections
- Rejected 27 properties (7,339 units)

<table>
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<tr>
<th>Rejections</th>
<th>Projects</th>
<th>Units</th>
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<tbody>
<tr>
<td>HVAC compatibility</td>
<td>19</td>
<td>4,787</td>
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<tr>
<td>HVAC age/condition</td>
<td>2</td>
<td>1,404</td>
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<tr>
<td>Withdrawn</td>
<td>6</td>
<td>1,148</td>
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</table>

Ultimately, no compatibility rejections due to wiring or mounting issues
## Market Potential

### Eligible Households

<table>
<thead>
<tr>
<th>Building Size</th>
<th>Eligible Households</th>
<th>% of Total</th>
<th>Potential Units</th>
<th>% Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;10 Units</td>
<td>48,733</td>
<td>29%</td>
<td>27,656</td>
<td>57%</td>
</tr>
<tr>
<td>10-19 Units</td>
<td>42,751</td>
<td>26%</td>
<td>5,789</td>
<td>14%</td>
</tr>
<tr>
<td>20-49 Units</td>
<td>35,634</td>
<td>21%</td>
<td>3,252</td>
<td>9%</td>
</tr>
<tr>
<td>50+ Units</td>
<td>39,398</td>
<td>24%</td>
<td>1,257</td>
<td>3%</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>166,516</strong></td>
<td><strong>100%</strong></td>
<td><strong>37,954</strong></td>
<td><strong>23%</strong></td>
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Source: 2012-2016 ACS

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<th>Potential Bldgs</th>
<th>% Potential</th>
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<tbody>
<tr>
<td>&lt;10 Units</td>
<td>6,962</td>
<td>61%</td>
<td>3,971</td>
<td>57%</td>
</tr>
<tr>
<td>10-19 Units</td>
<td>2,948</td>
<td>26%</td>
<td>385</td>
<td>13%</td>
</tr>
<tr>
<td>20-49 Units</td>
<td>1,033</td>
<td>9%</td>
<td>59</td>
<td>6%</td>
</tr>
<tr>
<td>50+ Units</td>
<td>394</td>
<td>3%</td>
<td>23</td>
<td>6%</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>11,337</strong></td>
<td><strong>100%</strong></td>
<td><strong>4,437</strong></td>
<td><strong>39%</strong></td>
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Source: 2012-2016 ACS; NJDCA
Thank You

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