



ENERGY STAR[®]
Products Partner Meeting

Cooling Down the Grid with Connected Room Air Conditioners

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ENERGY STAR Appliances Product Manager
US Environmental Protection Agency





ENERGY STAR®

2020
Products Partner Meeting



- **Abigail Daken** *ENERGY STAR HVAC and Connected Product Manager*
U.S. Environmental Protection Agency



- **Brice Bowley** *Director, Engineering – Retail and Ductless AC*
GE Appliances, a Haier Company



- **Brian Buente** *Executive Director – Air Products*
GE Appliances, a Haier Company



Connected Criteria

Grid communications for ENERGY STAR Products

ENERGY STAR Products Partner Meeting, October 28, 2020
Abigail Daken, ENERGY STAR HVAC and Connected Product Manager



Why is this part of ENERGY STAR?

Rise of IoT/Smart Home technology

- Opportunity for insight into and control of energy use
- Growing load

Changing grid needs

- Efficiency critical – strong role for ENERGY STAR
- Rising grid importance of insight into and control of loads

Continue to serve our partners as demand-side management evolves.



EPA's vision of the future

- In our SHEMS work, developed a coherent vision of the future (20 years?):
 - Smart Home Energy Management Systems will seamlessly optimize energy use, storage, and production in the home for multiple priorities of cost, environmental impact, and convenience, while providing excellent customer experience.
- Partly in response to expected grid conditions:
 - Growing share of generation from intermittent renewables
 - Consumer cost of energy use will vary with time
- In the short term, large loads will remain worthwhile targets for load flexibility on their own
- Over time, as markets evolve, the SHEMS specifications and the criteria in the other specifications will evolve to support this vision



Diverse drivers & energy implications

Example products	What connectivity provides	Driver of market adoption	Energy Implication and/or Opportunity
Pool pumps, water heaters	Flexibility of large loads, no consumer impact	Grid services	Enable cleaner grid
Electric vehicle chargers, HVAC	Flexibility of large loads, some consumer impact	Grid services	Enable cleaner grid; protect consumer interest
White goods, HVAC, RAC	Convenience and quality of maintenance	Blended: consumer, brand owner, grid	Better maintenance saves energy
Door locks, window sensors	Safety and security	Consumer interest	Added load; occupancy info?
Color changing lights, smart speakers	Additional functionality	Consumer interest	Added load



Appliances

Example products	What connectivity provides	Driver of market adoption	Energy Implication and/or Opportunity
White goods, HVAC	Convenience and quality of maintenance	Blended: consumer, brand owner, grid	Better maintenance saves energy

- Balanced approach seeks energy savings, smart home integration, consumer convenience, and grid services where opportunity arises
 - Consumer amenity now, possibility of use for grid services in the future
 - A few (room AC) may be valuable DR resources in themselves; most will be more valuable when integrated into whole home solution
 - Opportunity for convenience and energy savings through remote monitoring
- Status: Test methods for some appliances; Connected criteria adjusted as specifications' energy efficiency criteria are revised



Interoperability is key

- For utilities: load control system talks to multiple companies' connected products
 - Less costly to implement grid response program
 - More choice for consumers/contractors
- For manufacturers: do not need a custom solution for every utility's grid response program
 - OpenADR favored by utilities that are playing around, or when cloud connection needed aside from grid services
 - CTA-2045 favored for large scale deployment, particularly for products (e.g. WH) where connectivity otherwise unneeded
- For consumers: in connecting to smart homes
 - Increases consumer choice
 - Simplifies set up and makes continued connection more likely
 - Energy info most useful when comprehensive



Other opportunities connectivity provides

- Remote management – e.g. turn on RACs on the way home to avoid tradeoffs of comfort and savings
- For controls, demonstration of savings through analysis of actual use
 - Savings result from control of other loads: complex interaction of technology, design, and user choices
 - Analyzed and aggregated data from users' homes demonstrates savings
 - Data submitted for certification, and twice a year ongoing
- Energy savings through better installation, maintenance, and operation
 - Many specifications include consumer alert criteria (e.g. prompt to turn off AC when home is empty, AC filter needs cleaning, etc.)
 - Over time, hope to emphasize these capabilities in specs with high potential, e.g. central AC

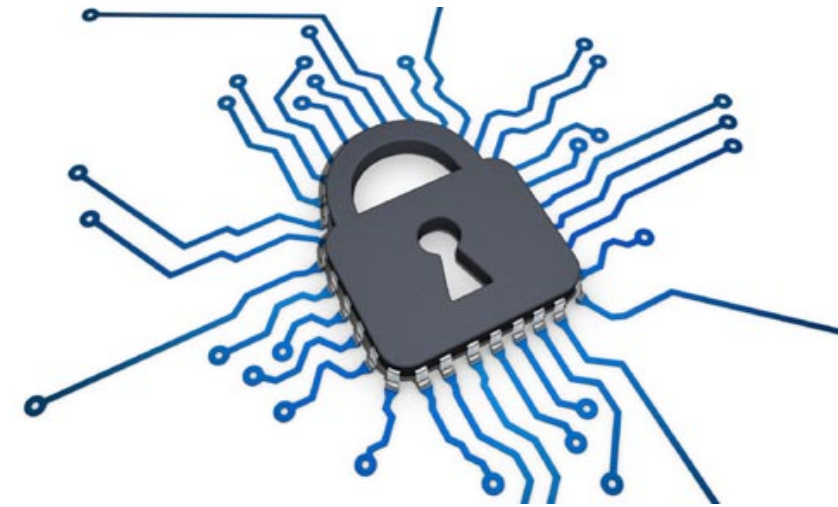


Reducing test burden: Alternate DR Validation (ADRV)

- Proposed adding an option to ease connected test burden for room air conditioners
- Based on tests of 2 basic models, manufacturers may establish a technically sound way to predict that additional basic models will meet DR criteria, and need not test them
- Certification bodies are responsible for ensuring
 - Method to predict models will meet DR criteria is technically sound
 - Records are kept for which models rely on which ADRV
- DR test is run as part of verification testing for connected models
 - A failure on the DR test for one model using a ADRV will potentially affect connected recognition for all models using it
 - Correction of the failure, however, may be a simple firmware update
- Currently applies only to room AC; may consider for other products

A Quick Note on Security

EPA understands there can be security risks associated with smart products and systems. Recognizing that this is not our area of expertise, we do not intend to take the lead on developing security standards in the smart home market. To the extent that sound security standards arise, EPA may point to them in ENERGY STAR specifications as appropriate.



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a Haier company

Cooling Down the Grid with Connected Room Air Conditioners

10.28.20



Brian Bunte
Executive Director – Air Products



Brice Bowley
Senior Director – Technology

October 28, 2020

TOPICS

- 01 THE EVOLUTION OF CONNECTIVITY
- 02 IMPLEMENTATION CONSIDERATIONS
- 03 DRIVING ADOPTION
- 04 DEMAND RESPONSE OBSERVATIONS & LEARNINGS





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EVOLUTION OF CONNECTIVITY

THE GOAL: BECOME THE LEADING SMART AC BRAND IN THE US

Providing solutions to solve some of the most fundamental consumer needs ... convenience & energy efficiency



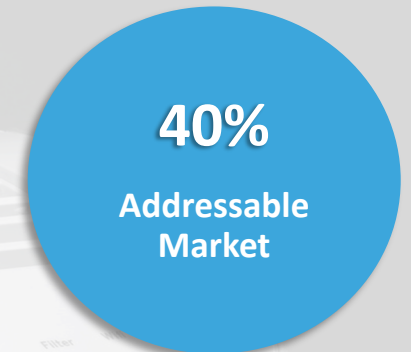
OPPORTUNITY

- *Consumer insights & trends*
 - Mobility
 - Digital
 - Energy Aware
- *Technology*
- *Regulatory Landscape*



CHALLENGE

- *Costs*
 - Hardware
 - Complexity
 - Connection Rates
- *Benefits*
 - Convenience
 - Scheduling
 - Efficiency
 - Education
- *Balancing consumer value proposition*



REALIZATION

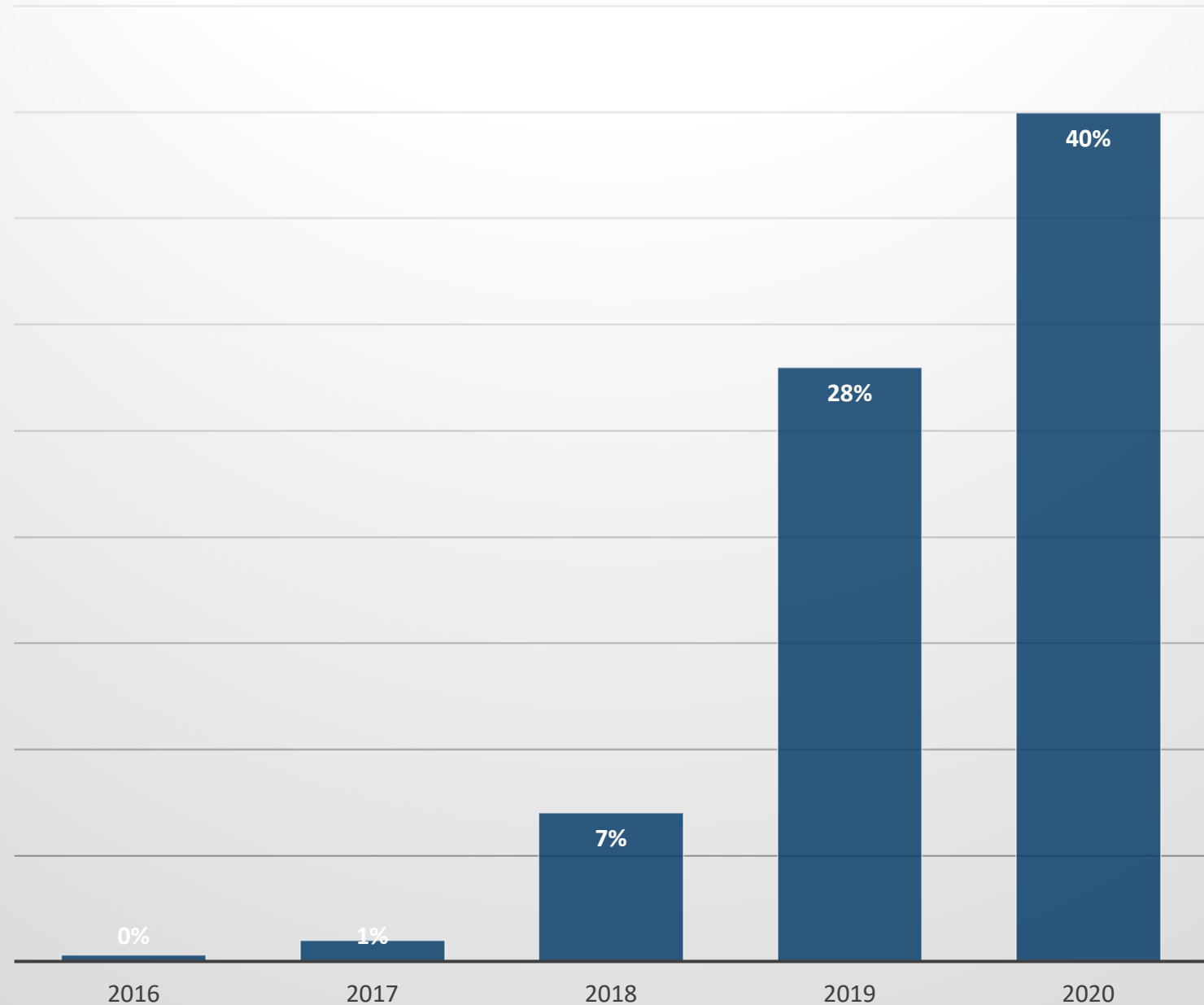
- *Narrowing the scope*
- *Key Enablers*
 - Capability
 - Scale
 - Demand Responsiveness

Key Milestones

- 2012 – First connectable units ... WIFI module kits
- 2016 – Launched select units with embedded modules
- 2017 – First voice enabled units
- 2017 - Energy Star publishes Test Procedure for Connected AC
- 2018 – GEA first manufacturer to launch DR Certified products
- 2019 – Rollout of advanced features, geolocation & reporting

GE Branded Connectable Units

(% of total portfolio)



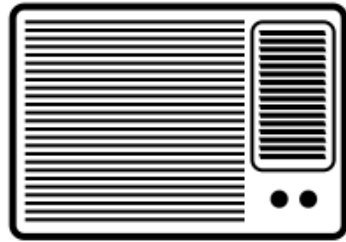


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IMPLEMENTATION CONSIDERATIONS

EXECUTION CONSIDERATIONS

Hardware



- AC – embedded Wi-Fi module
- Homeowner
 - Wi-Fi Modem
 - Smart phone
- Cloud Server

Software



- Firmware on AC
- Wi-Fi Module Software
- APP
- Cloud
- Translation Software for DR

Connectability



- For Utilities/DR Providers
 - GE Provides API
 - Translation software
- For Customers
 - Connect Wi-Fi AC
 - Register AC with DR provider

IMPLEMENTATION APPROACH

DEVICE



- Logic for commands/DR events embedded in AC
 - More up-front development
 - Reduces Cloud costs – improves accuracy of communication
- Upgradeable Wi-Fi module and APP
- Moving towards upgradeable firmware



- Sending, receiving, storing simple commands and data.
- Limiting communication minimizes cost & improves overall experience

CLOUD

Device vs Cloud drive trade offs between infrastructure cost & complexity

THE LAST HURDLE: COMMISSIONING

Minimal effectiveness without delivering the final step ... consumer connection

Awareness

good things, for life. **GE Profile**
Innovative Technology that Integrates Into Your Smart Home

Voice-Enabled
Use Amazon Alexa or Google Assistant to control your appliances and check status.

Scan to Set Up Google Assistant
Scan to Set Up Amazon Alexa

Need help?
The app offers installation troubleshooting along with FAQs and in-app access to the GE support team.

It All Starts with Our SmartHQ App.

- Automation**
Temperature settings automatically adjust based on whether you're home or away.
- Scheduling**
Set times for specific temperatures or plan on/off times for your unit.
- Voice Control**
Control your AC with hands-free assistance and WiFi connected smart devices.
- Reporting**
Monitor your daily energy consumption with helpful reporting.

Scan to Connect

- 1 Scan to Download the SmartHQ App**
from the App Store or Google Play Store.
- 2 Sign In**
to your existing account or create a new one.
- 3 Add & Connect**
your SmartHQ appliances.
- 4 Update Appliance Software***
and your smart features are ready to go.

*Software update may not be required.

POWERED BY **SmartHQ**
Smart Made Simple

Complexity Consideration

- Multiple Platforms
- Security Risks & Consideration
- Connection Reliability
- Variation in Application & Service Providers

Connection rates have improved 3x since 2018 ... Continue to be a focus

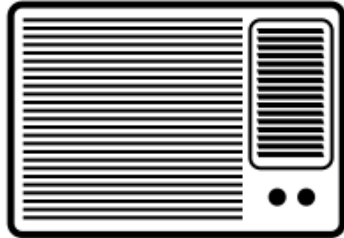


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DRIVING ADOPTION

ADOPTION DRIVERS

PRODUCT



Creating the right product ... leverage consumer insights to find the balance between innovation & value

MARKETING



Tell the story ... elevate packaging, point of purchase, and online tools to create awareness & demand

REALIZATION



Drive connections & utilization ... eliminate barriers to maximize conversion and enable savings

DRIVING ADOPTION



Product Development

Addressing consumer needs ...
creating the right value proposition

Features Consumers Want

1

Mobility & Scheduling

2

Voice Command & Smart Home Integration

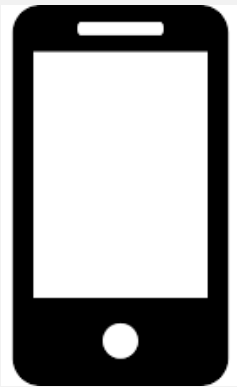
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Energy Reporting

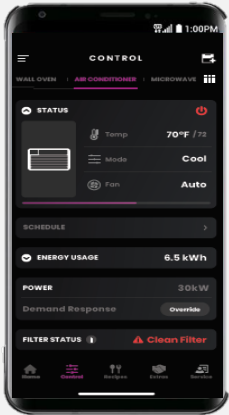
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Geo-fencing

BETTER WHEN CONNECTED



Competitor App



SMART HQ Home

- FAN ON/OFF
- SCHEDULE
- CHANGE MODES
- STATUS UPDATE
- AMAZON, GOOGLE
- DEMAND RESPONSE
- GEO-LOCATION
- REPORTING
- IoT SECURITY

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The most advanced smart portfolio in the industry

Convenience
Peace of mind
Rapid adoption





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Telling the Story

BETTER WHEN CONNECTED



Profile

REPORTING

BETTER WHEN CONNECTED



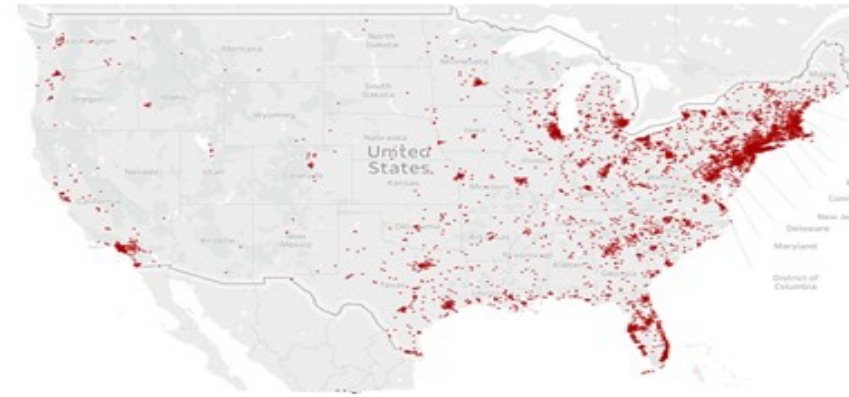
**SMART AIR
CONDITIONERS**

GE Appliances Connected Air Conditioners

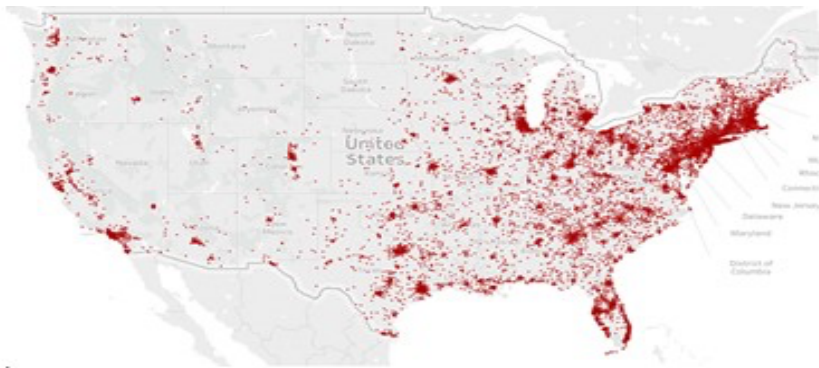
2017



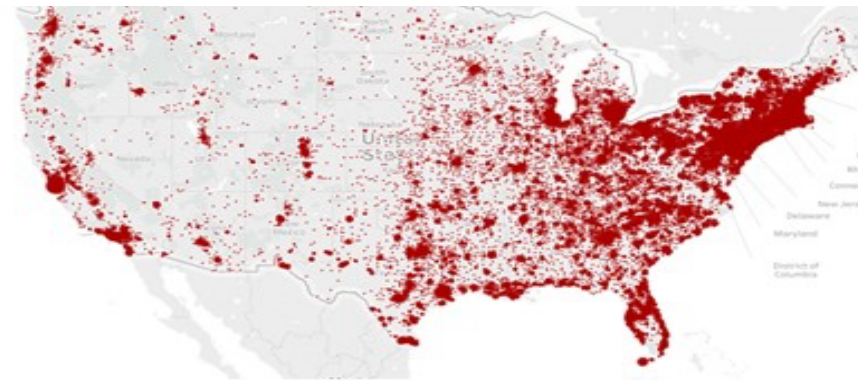
2018



2019



2020



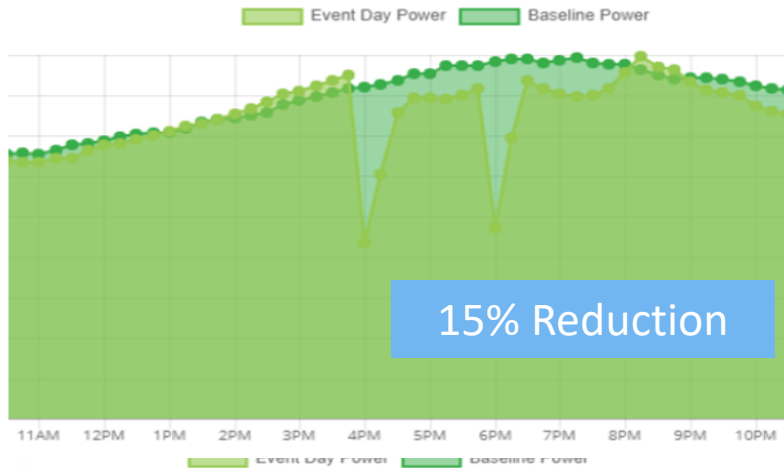


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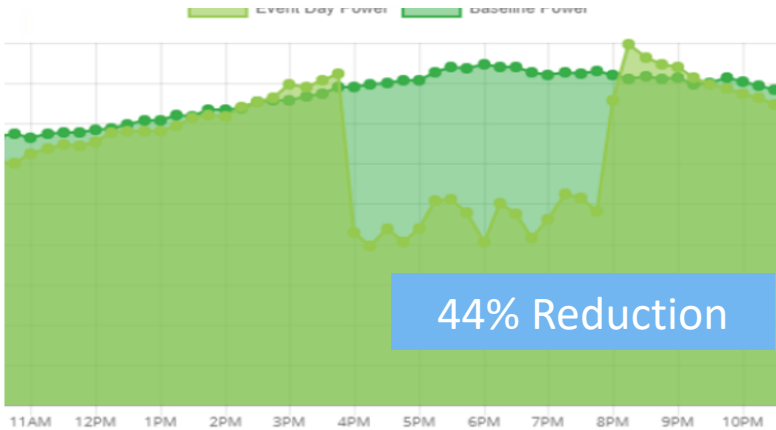
DEMAND RESPONSE OBSERVATIONS & LEARNINGS

The Demand Response Experience

Without Cycling



With Cycling



- Program can yield strong results ... but challenges exist
- Program adoption incentives key
- 66-79% online for each event
- Opt out percentages: 19-27% of online devices
- Significant opportunity to optimize and improve over time



Final Thoughts

- Smart Room Air Conditioners are becoming the norm
- Demand Response Programs can be effective ... but there is work to do to drive connections and adoption
- Partnerships & Programs between Manufacturers and Utilities best opportunity for optimizing results

