



# **ENERGY STAR®**

## **Residential Climate Controls**

**Draft 3 Version 1.0**  
**Stakeholder Meeting**  
**April 17, 2012**

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**Doug Frazee, ICF International**



# Agenda



- Overview of the Draft 3 Version 1.0 specification
- Drivers & Context
- Draft 3 Version 1.0 Criteria
- Performance-Based Ease of Use Criteria
- Performance-Based Ease of Use Test Method
- Next Steps
- 3<sup>rd</sup> Party Certification Requirements
- Schedule
- Q&A

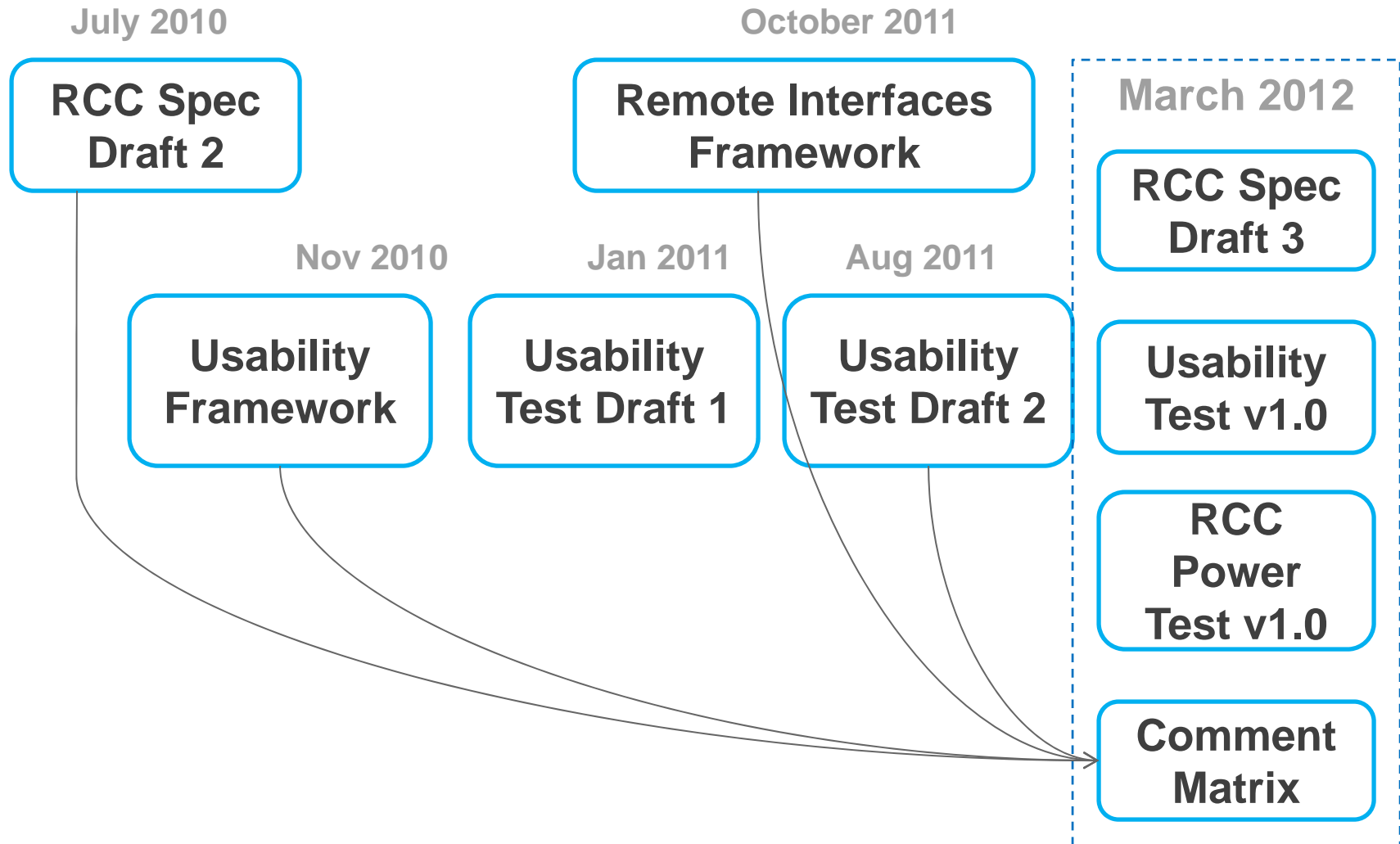
# Overview of the Draft 3 Version 1.0 specification

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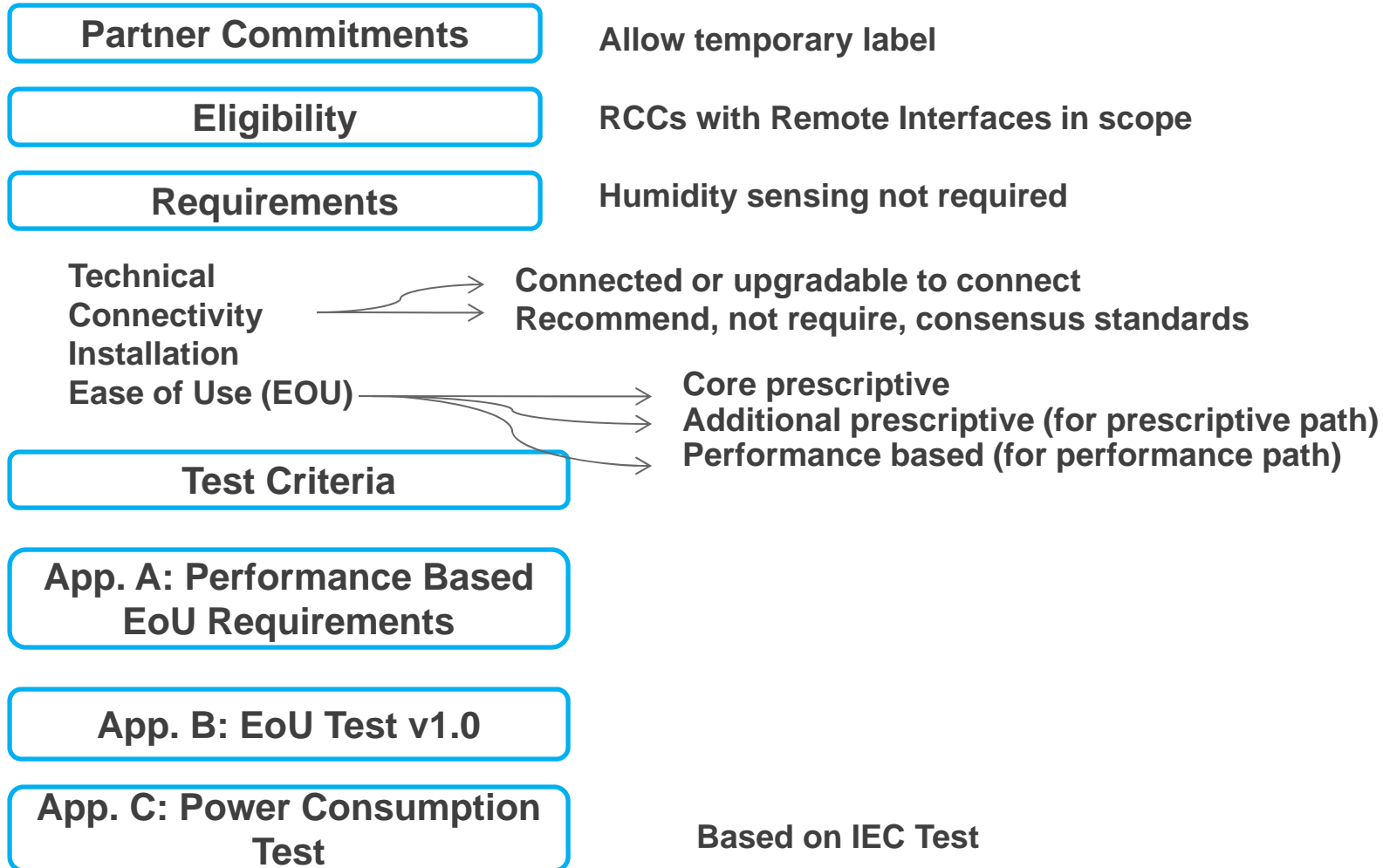


- Brings into a single document:
  - Energy Efficiency Criteria
  - Remote Interfaces
  - Ease of Use Metric & Test Method
  - Power Consumption Test Method

# Overview – Our story so far...



# Overview – Structure of the Spec



# Overview

## – Structure of EoU requirements



### Core prescriptive

No longer includes period nomenclature

### Additional prescriptive

Period nomenclature  
No DR/pricing display

### Performance based

Moved to App. A to make spec easier to read

### App. A: Performance Based EoU Requirements

Tasks (define requirements)  
Administrator script (closely tied to tasks)  
Metric (to keep control)  
Required performance on metric

No DR task  
CC w/RI must use performance based path  
CC w/RI: minimum disconnected  
functionality defined by limited EoU test  
performed w/o RI  
Full test for CC as controlled through RI

### App. B: Ease of Use Test Method v1.0

Procedures  
User group requirements  
Facility requirements  
Equipment requirements  
Definition of reported data

No reference device  
28 member group – expanded to increase  
differentiation, repeatability  
No colorblind user  
Demographics follow US census

# Drivers and Context

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- EPA believes there are significant and realizable savings opportunities in Residential HVAC
- Advanced Climate Controls are expected to enable energy saving HVAC behavior thru:
  - Enhanced usability - Increased adoption of setbacks and energy saving modes
  - Connected functionality

# Draft 3 Version 1.0 Criteria

## – Qualifying Products

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- Low-Voltage and Line-Voltage Climate Controls
- Residential Climate Controls only, but...  
~~“Residential Climate Control – This product is designed only for use in homes and other dwellings.”~~
- Communicating Climate Control or end-user upgradeable to a Communicating Climate Control



# Draft 3 Version 1.0

## – Technical Criteria

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- Prescriptive schedule period nomenclature eliminated – otherwise HVAC scheduling and default schedule criteria are unchanged
- $\pm 1^{\circ}\text{F}$  Temp. stability criteria retained
- Humidity display no longer required
- Outdoor temperature criteria relaxed

# Draft 3 Version 1.0

## – Technical Criteria (cont.)



- Selectable Recovery Algorithms – new exception
- Power Consumption

Table 1: Residential Climate Control – Power Consumption Measurement		
Product	Average Power (W)	Measurement Parameters
Climate Control	1.0	<ul style="list-style-type: none"><li>• 5-minute measurement period</li><li>• Away mode cycled 1x</li></ul>
Connected Climate Control	2.0	<ul style="list-style-type: none"><li>• 5-minute measurement period</li><li>• Away mode cycled 1x</li><li>• Connection to device external to HVAC system, at least 1x</li></ul>

# Issue – power limits and comms upgradeable Climate Controls



- Current draft: test without communications
- What do when modules (OEM or 3<sup>rd</sup> party) become available?
- Goal: Avoid or minimize retesting
- Options
  - Do not indicate newly available protocols on QPL
  - Require all RCCs to ship communicating
  - Require test with prototype of all communications modules
  - Require test with prototype, at minimum, of expected most consumptive comms (WiFi?)

# Draft 3 Version 1.0

## – Communication Criteria

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- Open Access
  - API or Interface Spec.
- ***Recommended*** Connectivity Standards
  - On or being considered for the SGIP COS
  - Adopted by ANSI or other established international SDO
- Security and Data Reporting criteria are unchanged
- 5s Remote Management responsiveness criteria is revised to clarify an assumption that network latency will not exceed 1s

# Draft 3 Version 1.0

## – Ease of Installation Criteria

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- Unchanged
  - Installation Instructions
  - Availability of Documentation
- HVAC Wiring Terminal Designations
  - Terminal labeling that complies with NEMA DC 3-2008 that was previously required is now ***recommended***.

# Draft 3 Version 1.0

## – Ease of Use Criteria – 3 Paths

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- Ease of Use: Paths for Demonstration of Compliance
  - Path 1 – Prescriptive
  - Path 2 – Performance-Based Ease of Use
  - Path 3 – Alternate Performance-Based Ease of Use (with Remote Interface)

# Draft 3 Version 1.0

## – Prescriptive Requirements

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- Core Prescriptive Requirements
  - No required schedule period nomenclature
  - Low Battery Indicator clarification
- Additional Prescriptive Requirements
  - Access to Energy Saving Mode
  - Setpoint Adjustability
  - Operating Mode
  - Current Status
  - Relative Cost Indication
  - Character Size
  - Temperature Resolution

# Draft 3 Version 1.0 Criteria

## – Performance-Based Ease of Use



- Climate Controls may be evaluated by their performance in Ease of Use tests.
  - Eligible products must comply with core prescriptive requirements and must rate acceptably on a set of six typical tasks designed to evaluate Climate Controls.
- Performance-Based Ease of Use Criteria with Remote Interface (RI)
  - On its own, the Climate Controls is evaluated on fewer tasks to qualify (Appendix A).
  - Controlled thru an RI, it must rate acceptably on all tasks to qualify.



# Draft 3 Version 1.0

## – Other Criteria

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- Indicate Supported HVAC Equipment
  - relocated from Qualifying product to other criteria
- RoHS Requirements
  - Additional clarity provided, consistent with RoHS criteria
  - Exempt from testing; but consistent with RoHS, EPA may, at any time, request manufacturer documentation supporting compliance.

# Draft 3 Specification Appendices



- To enhance readability, in draft 3 EPA has included the following as Appendices:
  - Appendix A – Performance-Based Ease of Use Criteria
  - Appendix B – Performance-Based Ease of Use Test Method
  - Appendix C – Climate Controls Power Consumption Test Method

# Appendices A and B Incorporate results from UCD study

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- Method of test generally supported
- Composite tasks confusing – break up
- Larger user group & tighter demographics provide better differentiation
- Timekeeper out of sight of user during test
- More colloquial language in Test Administrator script
- Usability of manual mixed up with usability of device

# Appendix A – Performance-Based Ease of Use Criteria

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- Climate Control User Tasks:
  1. Set Date & Time
  2. Identify Room Temperature
  3. Identify Setpoint
  4. Turn on Heat
  5. Modify Program Schedule
  6. Activate/Cancel Energy Saving Mode
- Metric calculation and requirements
- Test Administrator script

# Appendix A – Ease of Use Metric & Performance-Based Ease of Use Criteria

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- A common metric  $M_i$  is used for each task
- $k_i$  chosen for each task to balance task success and time to complete
- $M_i$  is a calculated numeric score from 0 to 100, based on time to complete, task success and  $k_i$
- Average  $M$  must be  $\geq 40$  for each task, average  $M$  across all tasks must be  $\geq 70$
- Calculations and requirements may be adjusted based on round robin testing

# Appendix A – Use of time to complete

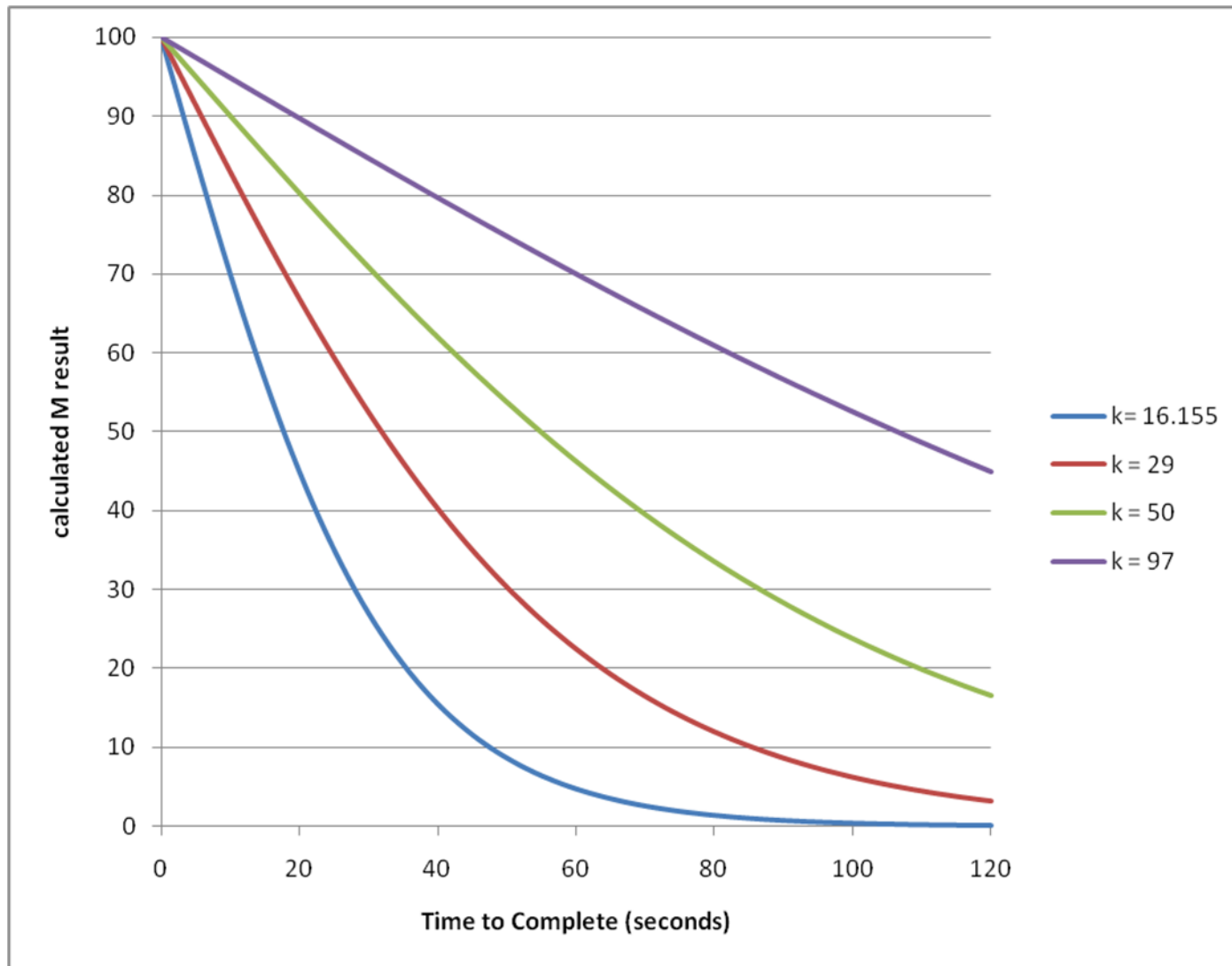
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- UCD report highlighted some problems with maximum time to complete per task
  - No correlation demonstrated with success
  - Manual/familiarization as confounding factor
- Originally included because
  - Test labs need a sense of how long to budget
  - As a proxy for subjective Ease of Use (harder to quantify)
- Formula for M means that, past a certain point, essentially a failure anyway

# Appendix A

– M, time to complete and k



# Appendix B – Test Method – Performance – Based Ease of Use



- Test parameters including user group composition.
  - Age Groups
    - Age 21–34 – 28.6% of users
    - Age 35–49 – 28.6% of users
    - Age 50–64 – 28.6% of users
    - Age 65–79 – 14.2% of users
  - Gender
    - Male – 50% of users
    - Female – 50% of users
  - Level of Education
    - Less than High-School Education – 14% of users
    - High-School Graduate & Less than Bachelor's Degree – 57% of users
    - Bachelor's Degree or Higher – 29% of users



# Next Steps

## – Round Robin Usability Testing



- Next step – can begin now that draft is released
- Will be administered by ACEEE
  - Introduction to ACEEE & Dr. Susan Mazur-Stommen
  - Recruitment and setting up protocols April and May
  - Testing over the summer
  - Hope to complete by September

# Next Steps

## – Round Robin goals

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- Show that results are repeatable at different labs
  - Minimum 3 devices tested at 3 labs
- Gather data
  - Examine data analysis questions raised by UCD report
  - Confirm levels
- Improve test method
- Develop testing infrastructure

# Third-Party Certification Requirements

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- Enhanced qualification and verification testing requirements across ENERGY STAR program.
- [www.energystar.gov/testingandverification](http://www.energystar.gov/testingandverification)
- Qualification: Test reports from recognized labs will be reviewed prior to qualification.
- Verification: third-party testing of products acquired from distribution channels.

# Schedule – best estimate



- Apr 2012      Labs start accreditation
- Sep 2012      Round Robin Results  
Face to face meeting?
- Dec 2012      Draft 4, webinar, comments
- Feb 2013      Final Draft requirements  
V2.0 Usability Test?
- Mar 2013      Final Version 1.0  
Residential Climate Controls
- Effective immediately, if labs are ready

# Contact Information

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And for the Round Robin....  
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# Thank you