Considering an ENERGY STAR CAC/ASHP Specification for 2006

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Agenda for the Rest of Today

- Now: Overview
  - Need for revising CAC/ASHP spec
  - Background on specification revision process
  - Overview of the “strawman”

- After lunch: Discussion
  - Equipment specification options
  - Installation, verification, and labeling

The Need for Revision

- Federal minimum efficiency standard increases to 13 SEER in January 2006

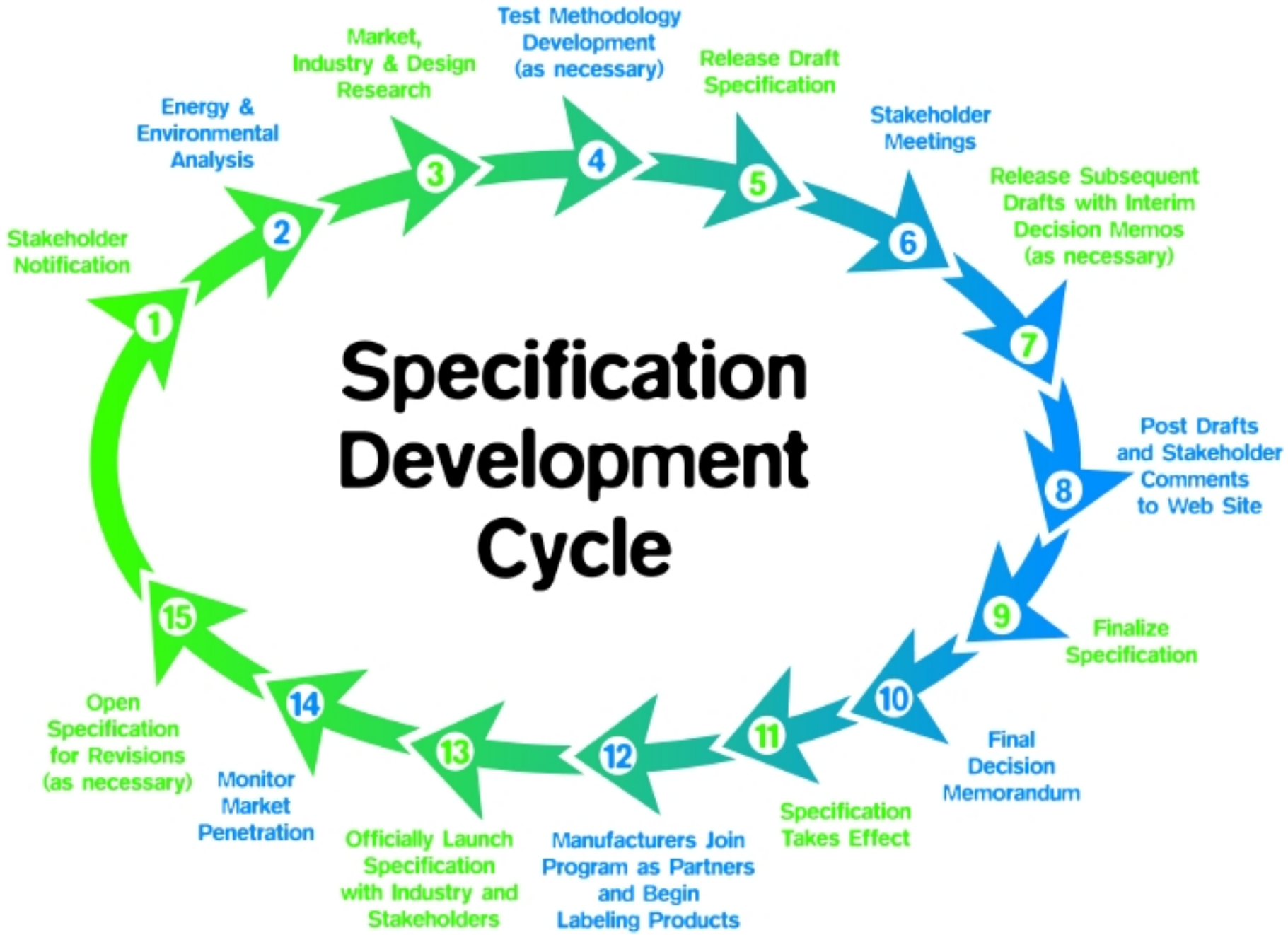
Federal Standard*	ENERGY STAR Spec*
13 SEER	13 SEER
7.7 HSPF	8.0 HSPF
	11 EER

* for split systems

How should ENERGY STAR continue to play a role?

Guiding Principles for Labeling

- **Significant energy savings** can be realized nationally
- Product **performance** can be **maintained or enhanced** with increased energy efficiency
- **Purchasers** will **recover** their **investment** in increased energy efficiency within a reasonable time period
- Efficiency can be achieved with **several technology options**, at least one of which is non-proprietary
- Product energy consumption and **performance can be measured** and verified with testing
- **Labeling** would effectively differentiate products and be **visible** to purchasers


Specification Development Cycle
1
Stakeholder Notification
2
Energy & Environmental Analysis
3
Market, Industry & Design Research
4
Test Methodology Development (as necessary)
5
Release Draft Specification
6
Stakeholder Meetings
7
Release Subsequent Drafts with Interim Decision Memos (as necessary)
8
Post Drafts and Stakeholder Comments to Web Site
9
Finalize Specification
10
Final Decision Memorandum
11
Specification Takes Effect
12
Manufacturers Join Program as Partners and Begin Labeling Products
13
Officially Launch Specification with Industry and Stakeholders
14
Monitor Market Penetration
15
Open Specification for Revisions (as necessary)

Challenge

- To update the spec to capture cost-effective energy savings
  - Higher equipment efficiency levels, plus other possible equipment requirements provide modest incremental savings
  - Installation improvements could yield additional savings, but are harder to achieve and verify

→ ***New paradigm for ENERGY STAR***

Why Address Installation?

- With minimum SEER increasing to 13, marginal benefit of higher SEER equipment is less
- Many systems installed with incorrect refrigerant charge and/or airflow
- Studies illustrate performance degradation over time
  - Refrigerant leakage
  - Lack of maintenance
- Substantial savings possible with proper installation
  - Verification of installation is key

Where are the Potential Savings?

	Savings Range/Average
14 SEER	7%
Sizing*	2-10%
Refrigerant charge*	12.5%
Airflow*	8.1%
Duct Leakage*	16.8%

*From studies listed in Appendix B

Note: Potential installation savings are not additive

Equipment Criteria

Possible Equipment Criteria

Criteria	Possible Measures
Annual Efficiency	SEER, HSPF
Peak Efficiency	EER
Component Requirements	Expansion Devices
Maintainability	Evaporator Access
Diagnostics	On-board diagnostics for air flow, etc.

Equipment Specification Options

	Current		From Strawman	
	Split	Packaged	Split	Packaged
SEER	13	12	14	14
EER	11	10.5	12	11
HSPF	8	7.6	8.5	8

Implications

- Addresses peak load issues
  - Important for utilities
  - Continued reliance on ARI/CEE database
- Aligns with current CEE Tier 2 specs
- Limited product availability
- Cost effectiveness / payback may not be very compelling

Cost Effectiveness of 14 SEER

- Preliminary analysis shows cost effectiveness is limited
  - Better for southern climates
- Any additional data/estimates on costs and savings?
  - For example, over time incremental costs may decrease with new standard

Possible Equipment Requirements

- Evaporator access
  - Maintainability
  - Measurement
- Automatic refrigerant flow-metering devices

Evaporator Access

- For maintainability, possibly require:
  - Airtight means of access for inspection and cleaning, or
  - On-board diagnostic indicator of improper airflow or temperature change across coil
- For measurement, possibly require:
  - Airtight access port to allow for measurement of temperatures (wet and dry) and pressures, or
  - Indicator mark on housing to direct technician where to drill so measurements can be taken

Evaporator Access

- Addresses two key issues regarding installation:
  - Adequate airflow over evaporator coils
  - Maintainability of those coils over time
- Possible to address some installation issues using equipment requirements

Automatic Refrigerant Flow Metering Devices

- Possibly require TXV, EXV or "equivalent"
  - Retain efficiency benefits for some substandard HVAC installations
  - Cost differential ~$10 - $15
  - Current penetration in ≥SEER 13 is already high
- Require factory installation, insulation
  - Prevent incorrect field installation
  - Field benefit not guaranteed
- Possible to address some installation issues using equipment requirements

Other Criteria to Consider

- Improved cfm/watt ratios for air handling
  - Through variable speed fans, more efficient motors, or more efficient fan wheels
- Built-in pressure and temperature sensors to allow advanced diagnostics
- On-board diagnostics indicating need to:
  - Change filters
  - Clean evaporator coil
  - Evaluate refrigerant charge
- All system components from single vendor

Installation Criteria

Possible Installation Requirements

- Design/Sizing
- Refrigerant charge
- Airflow
- Duct systems
- Collection/analysis of performance data
- Commissioning report for the owner

Design and Sizing

- Equipment frequently oversized
  - Average of 47% in newer homes
  - Causing short cycling - inability to dehumidify, degrading efficiency, and shortening equipment life
  - Annual savings potential ranges from 2-10%
- Technician must be competent with methods
  - Prescribed by manufacturer
  - ACCA Design Manuals
- Possibly require that technician is NATE certified
  - Accredited contractors (e.g. by BPI)

Refrigerant Charge

- Essential to maintain capacity
  - Improper charge can lead to premature compressor failure
  - Up to 41% systems undercharged, 33% overcharged
  - Average savings of 12.5% with proper charge
- Adjusted by technician in accordance with manufacturer's instructions
  - Systems with more than ±3° deviation in subcooling from manufacturer spec would not qualify

Air Flow

- Essential for comfort
  - 70% of systems tested are operating at less than 350 cfm/ton (ideal is 400 cfm/ton)
  - Annual savings of 8% possible
- Technician verifies system is flowing at 400cfm/ton (or cfm specified by manufacturer) during full-speed testing
  - Systems incapable of 350 cfm/ton or greater must be corrected by improving ducts or would not qualify

Duct Systems

- Duct leakage causes reductions in capacity, efficiency, and comfort.
  - Proper sealing can yield energy savings on average of 17%
- For new construction or new ducts
  - Design using ACCA Manual D
  - Seal all joints with appropriate mastic or sealant

Data Collection and Reporting

- Technician would collect and analyze data to ensure installation meets manufacturer's specs at steady state
- Technician would provide to the owner
  - Commissioning data report
  - ENERGY STAR maintenance checklist
  - Manufacturer's product manuals
  - Manufacturer's warranty information

Other Considerations for Installation

- Installation by NATE certified technicians?
- Contractors analyze airflow capabilities of retrofit applications prior to equipment selection?
- Specifically address duct leakage?
  - ENERGY STAR recommends duct leakage <10% of rated system flow (based on 400 cfm/ton)

Verification Options

Possible Verification Options

- Energy Efficiency Program Sponsor (EEPS)
- Manufacturer
- Contractor Accreditation
- Third-party Verification Service
- Home Energy Rating System
- EPA
- Self-certification

Verification by EEPS

- Such as a local utility offering a rebate
  - Verify the installation or a sample of installations
- Would need a formal agreement with EPA to verify
  - EPA would need to develop a suitable agreement
  - EPA would need to provide technical guidance on running a verification program

Verification by Manufacturer

- Correctly installed systems perform better and may last longer
  - Fewer warranty claims
  - Opportunity to offer additional warranty periods for verified systems
- Could use electronic data collection
- EPA could initially screen data submitted and forward to manufacturer for verification

Verification via Contractor Accreditation

- Contractors accredited by independent organization
  - Building Performance Institute
  - Other TBD
- Contractor performance overseen by accrediting organization
  - Accreditation system defines standards for contractors
  - Additional third-party verification not required

Verification by Third-party

- Contractor (or manufacturer) could use a provider of verification services such as:
  - *CheckMe*
  - Service Assistant
  - Other deemed appropriate
- Helps prevent gaming of an automated system via data review

Verification by HERS

- Local HERS rater (trained on HVAC verification) could inspect installation
  - Or sample of installations by contractor
- Question of infrastructure
  - Are there HERS raters who could do this?

Verification by EPA

- Contractor would electronically submit a copy of commissioning report to EPA
  - Random sample of reports selected and analyzed
  - If >10% do not meet specs, contractor could no longer label installed systems

Self-certification

- Allow NATE certified technicians (or equivalent) to perform their own post installation inspection
  - Using ENERGY STAR checklist
  - Self-certify as qualified
- Least involvement by EPA or third-party
  - But also least assurance of increased efficiency

Labeling Options

- Label shipped with (not affixed to) unit
  - Affixed by contractor only after completing and self-certifying installation
- Obtained by qualified contractors
  - Those who agree to follow proper procedures and have met accreditation requirements
- Affixed by Third Party verifier
  - EEPS, HERS, mailed by EPA after data check

Timeframe

- Comments on “Strawman” due to EPA by October 27th.
- Equipment specification will need to change by January 2006
  - Finalize spec in April 2005
  - Provide 9 months lead time for manufacturers
- Installation component could take effect simultaneously or be phased in over a period of time