

The Western Cooling Challenge

Partnering to develop and market new rooftop cooling units optimized for dry western climates

Marshall Hunt, P.E - Programs Director, mbhunt@ucdavis.edu

University of California Davis - Western Cooling Efficiency Center

1450 Drew Avenue, Suite 100, Davis, CA 95618

www.wcec.ucdavis.edu

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3/27/08

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Electricity: Cooling is the Culprit

- July's peak demand is 35% above January's
- Cooling loads cause electricity peaks
- It's time to consider cooling peak reducers as the very best new peaking plants
- Long-term incentives based on "peaker value" would spur investment in advanced cooling technologies

WCEC Western Cooling Goals:

- By 2030, reduce cooling demand and energy use in the Western States by (2007 baseline):
 - New buildings-
 - peak demand 100%
 - energy use 50%
 - Existing buildings:
 - peak demand 50%
 - energy use 25%

CPUC Big/Bold Strategies

CPUC Decision #07-10-032 has three Big/Bold energy efficiency strategies:

1. All new residential construction in California will be zero net energy by 2020
2. All new commercial construction in California will be zero net energy by 2030
3. Network with HVAC industry for major product improvements

Emerging HVAC Technologies will be needed for success

Why Focus First on RTUs?

- Rooftop units cool 70% of non-residential floor space in the Western US
- Current RTUs not optimized for dry climates
- Current RTU efficiency ratings low compared to residential systems; field performance even lower at “above rating” peak conditions
- Can quickly affect significant capacity in both new and retrofit applications
- RTUs are a crucial element of Big Bold strategies

Dry Climate RTU Opportunities:

- Reduce over-dehumidification
- Reduce blowers sized for peak cooling
- Variable Speed Blowers
- Modulating Dampers with Economizer
- Apply direct & indirect evaporative cooling
- Use heat recovery from exhaust air
- Onboard controls and diagnostics for long term efficiency

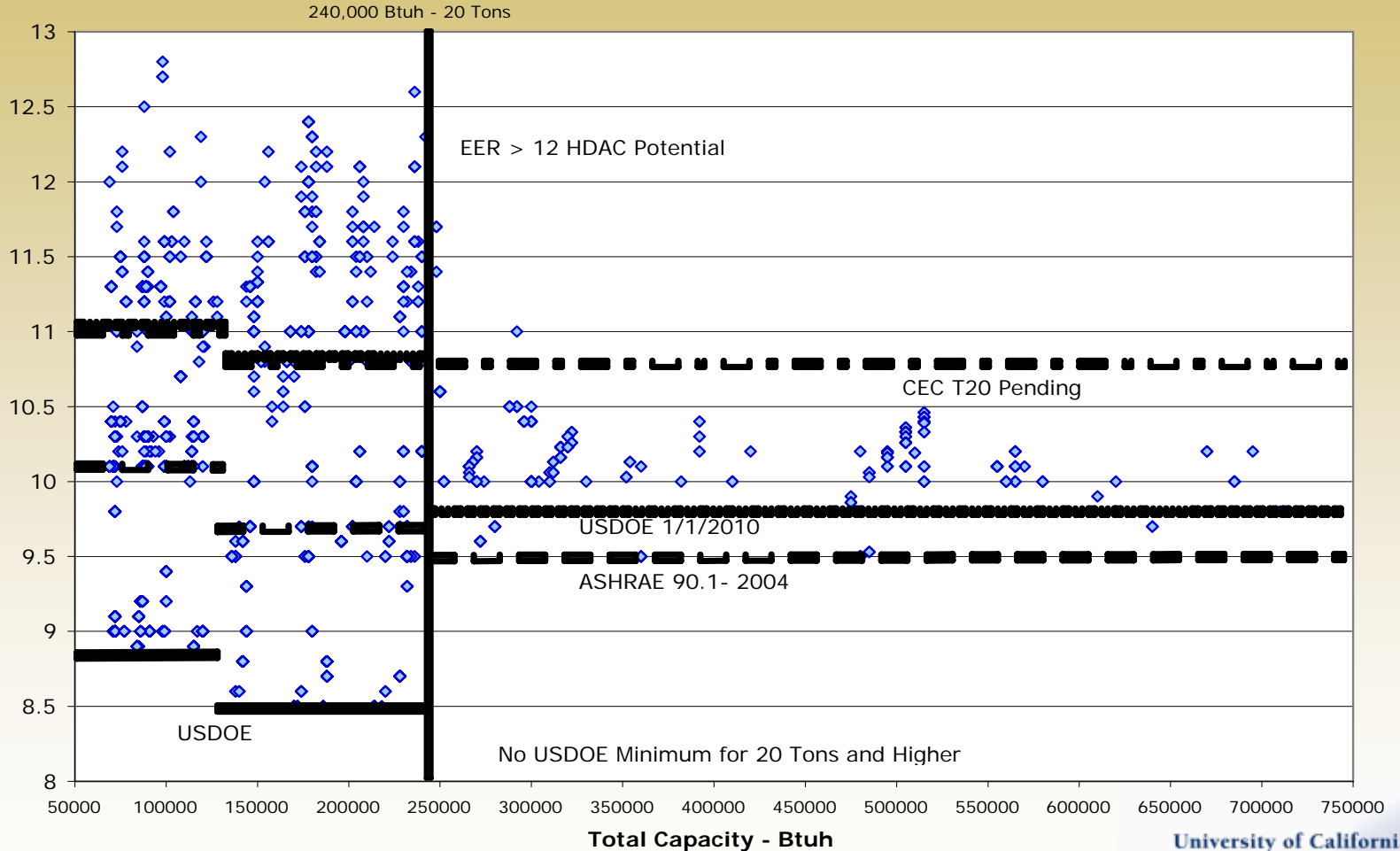


Why the Challenge?

- Emphasize the cooling opportunity in dry climates
- Create publicity that conveys the needs and potential
- Organize a comprehensive approach to the issues
- Bring focus on removing these barriers:
 - Water use and quality maintenance in small equipment
 - Difficult market paths for technology developers
- Encourage development of new RTU concepts
- RTU Installed in 2006 make almost 1000 MW demand on Western grid
- Commercialize technology needed to achieve the 2030 Big Bold goal

DOE EER of Existing RTUs

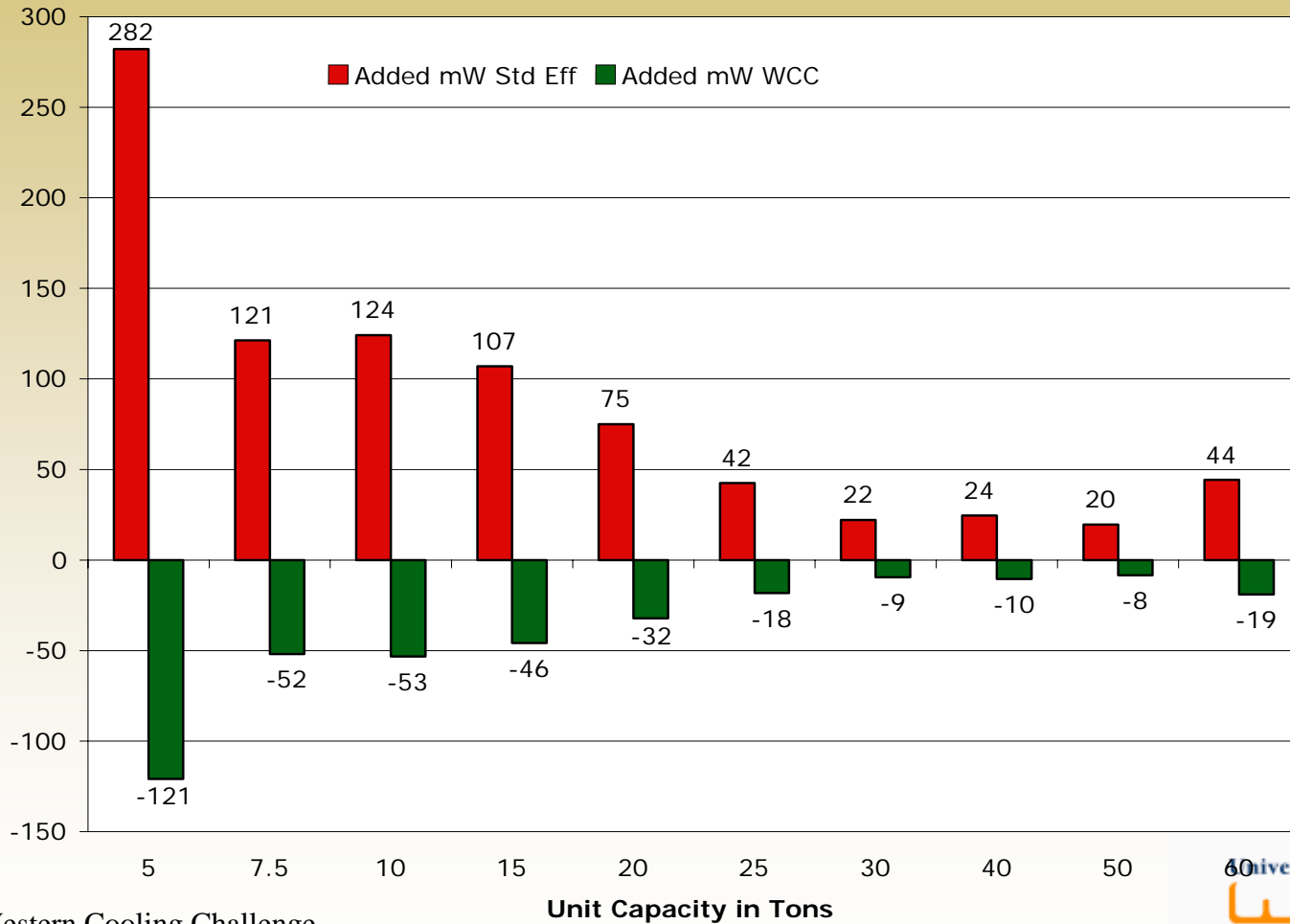
Total EER95 vs. Total Capacity 95 (Btuh) Cap



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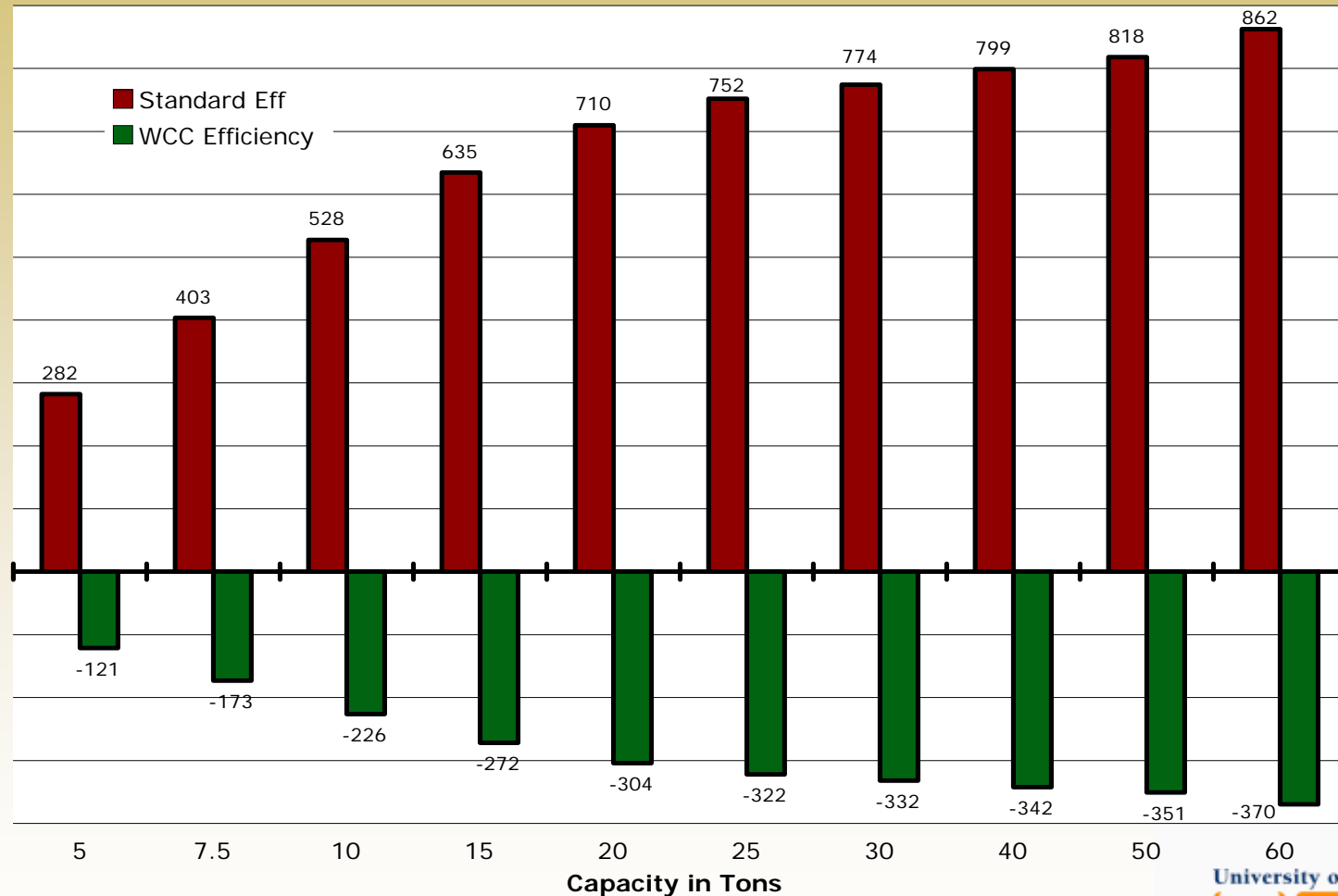
RTU Impact on Western US Demand

Annual Demand Impact of New RTUs in the Western US



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Accumulated Annual Impact of New RTUs in Western US



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Principles of Technology Procurement

1. Program development process is buyer-driven
2. Program sponsors interact extensively with potential suppliers of the technology
3. Conventional delivery channels for the technology understood and utilized
4. Higher incremental cost of new technology makes procurement more difficult and expensive
5. Promotional/educational part of program easily underestimated
6. Sponsoring institution needs to have recognized objectivity, consumer interest and technical expertise

Challenge Overview - 1

Develop Challenge Concept

- Establish performance requirements
- Establish special committee for the project
- Assess, select, and identify rewards, incentives for winners
- Create scope and schedule
- Design review and selection process
- Review with WCEC Steering Committee

Challenge Overview - 2

Review concept with stakeholders

- **Major Manufacturers** – likely are essential for manufacturing, distribution, and sales capabilities to ramp up quickly
- **Emerging Technology Sources** - small firms with advanced cooling technologies can partner with major manufacturers
- **Buyer Groups** – major chain retailers and government facilities can offer large initial market for products and continuing pull for energy efficiency advances (DGS, REA)
- **Efficiency Implementers & Advocates** - utilities and regulators are responsible for achieving efficiency and demand reduction goals; can allocate incentives; NGOs influence all
- **Technical Experts** – WCEC and others provide analytical, organizational, and design expertise

Challenge Overview - 3

Confirm, announce, implement program

- Establish MOUs with reward providers
- Issue press release and hold conference
- Specify progress milestones
- Work with stakeholders to encourage responses
- Publicize proposing firms
- Expand the ongoing program plan
- Publicize status at milestones
- List Models that meet the Challenge on the WCEC website
- Work with Buyers and Energy Efficiency Incentive Providers to maximize market introduction and share of WCC models
- Models first to market encouraged with incentives

The WCCC

(Western Cooling Challenge Committee)

- Committee members from 4 California Utilities, SWEEP, NBI, NEEA, REA, NRDC, ACEEE, CEC, CPUC, DOE, WCEC
- Committee works with stakeholders and manufacturers to resolve technical issues and support technical developments as needed, all with strict confidentiality regarding proprietary information
- Committee arranges and evaluates lab and field testing using qualified, impartial technical experts
- Committee approves all press releases and other public documents about the project

Entry Assessment

- Test protocol to be approved by the WCCC
- Test protocol based on measurements at defined conditions, at NREL or other approved lab
 - Additional tests (to be specified) will assess persistence of rated efficiency
- In support of WCC systems, WCEC will support development of full-season simulations for use by evaluators and practitioners to project annual energy savings and peak demand reduction by application and climate

Entry Requirements

- Capacity (tons, ARI Test A): 5 - 30
- Complete Equipment Pricing: <\$1400/ton
- Refrigerant other than R22
- Integral heating, either heat pump or gas furnace section
- On-board fault detection and performance monitoring with communication to remote locations
- Controls and components for high annual efficiency - variable speed motors, variable position dampers, economizer
- Maintainability and Persistent Performance: evaluation criteria to be developed

Preliminary Performance Requirements

- **EERs 185% of Current DOE minimums at 105 test point and 247% at 90 test point**
- **Sensible EER** (sensible capacity/electricity consumed by all system components):
 - 105°db/73°wb ambient condition: 14
 - 90°db/64°wb ambient condition: 18.0

* sensible-capacity/electricity-draw (including all parasitics, e.g. blowers, pumps)
- **Minimum Capacities:**
 - 105°db/73°wb (RE: DOE Test A): 95%
 - 90°db/64°wb (RE: DOE Test A): 80%
- **Max Water Consumption (gal/ton-h)*:** 3.3
 - * at 300 ppm hardness mineral content
- **Test Configuration**
 - Return Air: 78°db/64°wb
 - Outdoor Air Supply: 120 cfm/ton (Test A)
 - External Static @ 350 cfm/ton: 0.7" H₂O

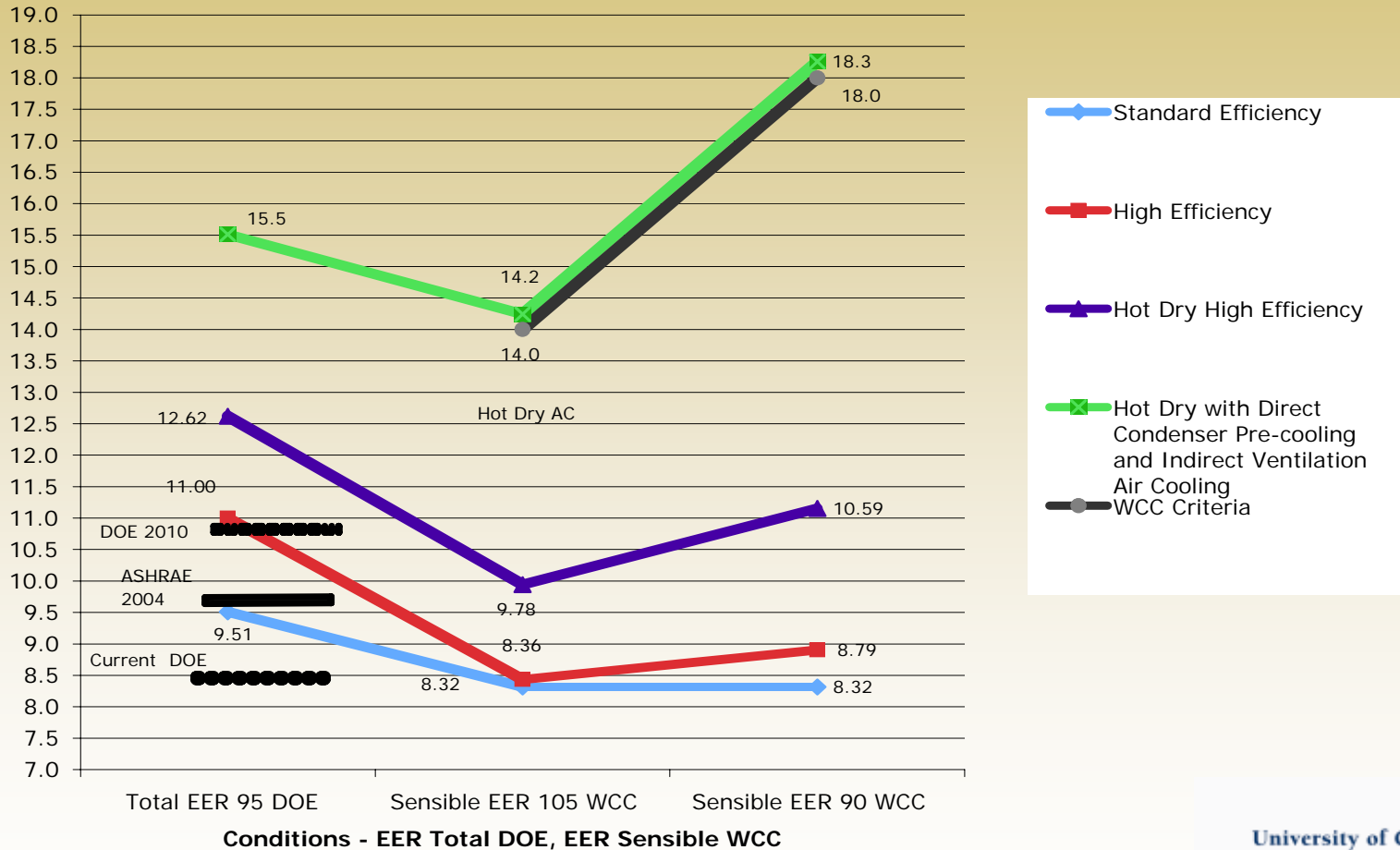
Reward Structure

Major rewards for participating firms that meet challenge are:

- Independent lab and field testing supported by utilities (Free to first three systems that pass challenge specifications)
- Purchases through major retailers and the Retail Energy Alliance (REA), and potentially California Green Team
- Expected ~\$600/ton demand reduction incentive from utilities
- GHG credits for manufacturers and buyers
- Established extra credits for LEED projects
- Partnership support on maintenance, code and other implementation issues

Comparison of Performance Levels

EER Levels at Three Conditions



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Challenge Schedule

- Announce April 2008, public conference May 2008, letter of intent for entries by July 2008
- WCCC defines test protocols and performance-based utility incentives by October 2008
- Firms submit progress reports every six months and internal prototype test results by 1/1/2010 with protection of intellectual property rights
- WCCC conducts independent lab tests for first three verified applicants by April 2010 or earlier
- Utilities support field tests starting June 2010 or earlier if compliant models are available
- WCCC verifies field performance and 500 unit/yr production capability by January 2011 or earlier, to begin sales, incentive payments, and other rewards