Emerging Technologies: Field Tests and New Technologies

Presented 5/8/12 by:
Jack Callahan, Program Manager
Jennifer Williamson, Technology Transfer Manager
BPA Energy Efficiency
Agenda

- Current research
- New research methods – ET Field Test
- Potential future field tests
- Utility experience
- Keeping abreast
Collaboration

Northwest Utilities

Washington State University

Pacific Northwest National Laboratory

eeea

CEE

Pacific Gas and Electric Company

SOUTHERN CALIFORNIA EDISON

SDGE

Southern California Gas Company

SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.

BChydro

POWER IN EFFICIENCY
Current Research

Focus Areas

- Heat Pumps (of various types)
- Rooftop Units
- LEDs
- Energy Management
Heat Pump Waterheaters

Photo From Kate Hudon, NREL PIX # 18667
Inverter Driven Heat Pumps

Ductless HP

Ducted HP

Variable Refrigerant Flow HP
Rooftop Units
Demand Controlled Ventilation

- 40% design occupancy
- 20% design occupancy
- 0% design occupancy
- 100% design occupancy

40% cfm of design outside air
40% exhaust air
20% cfm of design outside air
20% exhaust air
10% cfm of design outside air (Base Rate)
10% exhaust air
100% cfm of design outside air
100% exhaust air

Supply air
60% recirculated air
CO₂ sensor
Return air duct
80% recirculated air
90% recirculated air
0% recirculated air

Bonneville Power Administration
LED

LED’s Will Improve Rapidly

Efficacy of Good Luminaires of Each Technology

Adapted from Phillips Lighting presentation 2007, § Fig 3.4 “SSL R&D: Multi-Year Program Plan”, 3/2010 DOE
Energy Management

Track and Tune Example – Baseline to Implementation

- **Phase:** Historic Baseline Projection
  - Time: (30-90 days)

- **Phase:** On-site Tune Up
  - Time: (2-5 days)

- **Phase:** Implementation of Action Items
  - Time: (1-9 months)

- **Phase:** Sustained Savings Projection
  - Time: (90 days)

**Actions:**
- **Action:** Tune Up Report Generated
- **Action:** Completion Report Written, Action Item Incentive Paid
PNNL Lab Homes

Photo From PNNL Website
Non-Intrusive Load Monitoring (NILM)
Many new technologies....

Promising, but unproven...

1. Is this technology reliable?
2. Will customers purchase it?
3. Are there any energy savings?
4. How can we measure and verify the savings?
5. Where are the good applications?
6. Is this cost effective?
7. What are the qualifying specs?
8. What is an effective program design?
Field Testing

Required for measuring independent variables and user interactions

Opportunities

• Starting Field Tests Sooner
• Getting Results Sooner
• Applying results directly to new measure creation.
Example: Heat Pump Water Heaters (HPWHs)

- **2008**: Product Launched
- **2009**: Convene advisory committee
- **2009**: Northern Tier Specification
- **2010-11**: Lab tests (NREL)
- **2010-12**: Field tests (EPRI)
- **2011**: Estimated energy savings potential assessment
- **2012**: Program deployment
- **BPA & NEEA**: BPA emerging tech
- **NEEA emerging tech**: BPA E3T, NREL
- **BPA E3T, EPRI**: BPA E3T, NREL
- **BPA planning**: BPA programs

**BONNEVILLE POWER ADMINISTRATION**
Example Emerging Technology Timeline

HPWH Timeline

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Product Investigation

Scoping

Laboratory Testing

Field Testing

Program Development

Milestones

Product Launch

Early Field Test Results

RTF Approval

BPA Implementation Manual
There is a better way!

Introducing: **Limited Availability ET Field Tests**

1. New Reimbursement Method
2. New Field Test Approach
3. BPA M&V Support

- Get field experience sooner, rather than later
- Quick approval and pre-defined reimbursement
- Quick feedback, aggregate results
- Make Progress: Measures are redefined, eliminated, or advanced to pilot stage or RTF
Overview of ET Field Test Approach

Initial Measure: Heat Pump A1

Refined Measure: Heat Pump A2

Stage Gates:
- ET Field Test
- Pilot Program
- BPA Qualified Measure

Initial Measure Definition and Engineering Estimate of Energy Savings mean and distribution

Refine Measure Definition, Energy Savings Forecast and Estimate

Select or Build Forecast/M&V Tool

Refine Forecast/M&V Tool

ET Field Installations and Model Tuning

Pilot Program and Planning Analysis

BPA Qualified
Limited Availability Emerging Technology Field Test Projects

- On the BPA web site, BPA maintains a list of currently available emerging technology projects with defined:
  - Eligibility Requirements
  - Number of installations targeted
  - Participation obligations
  - Savings
  - Reimbursement

- Energy Savings and Reimbursement are pre-determined and fixed
- Field Tests projects are submitted as Option 1 Custom Projects.
- BPA will assist in development of the proposal, completion report, and M&V
ET Field Test Candidates

- Variable refrigerant flow heat pumps
- Rooftop unit packaged controls and VSD (e.g. Catalyst)
- Residential ducted heat pump water heaters (tier 2)
- Residential variable speed ducted heat pumps (e.g. Carrier Green Speed)
- Advanced design rooftop units (e.g. Daiken Rebel)
- Engine Generator Block Heaters
- Demand Controlled Ventilation for Commercial Kitchens
- Web Enabled Thermostats
Across North America, electric utilities are realizing that greater investment in energy efficiency helps to ensure a reliable, low cost supply of electricity for homes and businesses. BPA continues our leadership in this area by exploring opportunities to expand our current portfolio of energy efficiency measures.

BPA’s Emerging Technologies for Energy Efficiency (EST) initiative is a collaborative effort. We work with experts to identify promising new technologies. Through research and demonstration, we select for those technologies with greatest potential benefits to the region. Finally, we present a short list of investment opportunities to BPA and our partners. These opportunities include providing quality assurance in Northwest markets, subsidies for purchase of energy-efficient equipment, and incentives for manufacturers to develop better products. Through these efforts, we hope to sustain and enrich economic and environmental value in the Pacific Northwest.

Projects and Reports

EST staff apply a wide range of research methods to assess the case for investment in emerging technologies. Criteria are supplied by Energy Efficiency’s Conservation Programs. These include technology risk, regional energy savings potential, and barriers to delivery of cost-effective programs. Where gaps exist in our knowledge, we may choose to fund research that advances our understanding in those areas.

Introduced in the April 2012 Implementation Manual, Emerging Technology Field Test Projects will test promising new technologies at a small scale. Findings will inform larger scale research. BPA is creating the list of pre-approved technologies. Check here in coming months for details.

EST project details and links to reports are located here.

Technology Selection Process

Only a select few technologies will advance through the rigorous EST Technology Selection Process to qualify for further assessment. EST’s vision also benefits from the Northwest Energy Efficiency Technology Roadmap Portfolio. This Portfolio of residential, commercial, and industrial energy efficiency technology roadmaps details a shared research agenda involving BPA’s Technology Innovation Initiative and stakeholders throughout the Northwest and beyond.

Portfolio Appendix A provides more information about the roadmapping process, and Portfolio Appendix B identifies existing relevant research and development projects throughout the world.

For more on EST’s technology selection process, click here.

Send us your ideas!

You can help by suggesting new emerging technologies for EST to screen and assess for potential measure development in the Northwest. Here is a list of emerging technologies that are already under review by EST. You may wish to look at the list to determine if your idea has been suggested already.

This form will instruct you to enter some basic information about your emerging technology of interest.
Up and Coming Technologies
Variable Refrigerant Flow (VRF)

Also referred to as:
- Inverter Driven compressor
- Ductless Heat Pump with multiple indoor units
- Variable Capacity Heat Pumps
- Variable Speed Drive fan and variable refrigerant flow compressor
- Commercial Ductless Heat Pumps
- Variable Refrigerant Volume
Rooftop Unit Packaged Controls & VSD
HPWH Tier 2 - Ducted
Variable Speed Ducted Heat Pumps
Advanced Design Rooftop Unit

Daikin McQuay’s Rebel Heads to the Department of Energy

Photo From DOE Website
Engine Generator Block Heater
DCV Commercial Kitchen

Photo From Food Service Technology Center Case Study
Web-Enabled Thermostats (WEPT)
You Can Help Fill the Pipeline
Keeping Abreast
RETAC

- Regional Emerging Technology Advisory Committee
  - Advise NEEA’s portfolio
  - Forum for Regional ET Coordination and Collaboration
CA – ET Coordinating Council

Etcc-ca.com

PEC system components, as tested

Cold conditions

- Palm warmer
- Heated keyboard

Warm conditions

- Head cooling device
- Foot warmer
- Hand cooling device

Center for the Built Environment  March 2012
Other Websites

- BPA Database of ETs [www.e3tnw.org](http://www.e3tnw.org)
- Center for Built Environment [http://cbe.berkeley.edu/index.htm](http://cbe.berkeley.edu/index.htm)
- DOE LED work [www.ssl.energy.gov](http://www.ssl.energy.gov)
For more information, contact:

Name:  Jack Callahan  
Title:  Emerging Technologies Program Manager  
E-mail:  jmcallahan@bpa.gov  
Telephone number  503-230-4496  

Name:  Jennifer Williamson  
Title:  Emerging Technologies Technology Transfer Manager  
E-mail:  jcwilliamson@bpa.gov  
Telephone number  503-230-4536
Alternate slides
Examples of Coordinated BPA/NEEA ET Activity: Heat Pump Water Heaters

**NEEA:**
- Focus on next generation units made for Northern Climates
- Specification Development
- Identification of European and Asian Sources
- “Golden Carrot” for US manufacturers
- Revised test standards

**BPA:**
- Focus on current generation units
- Lab testing 3 domestic manufacture units
- Modeling of Lab performance
- EPRI field testing and demonstration of up to 30 units