Emerging Technologies

October 16, 2014
Oregon Utility Roundtable

Jennifer Williamson
Employee of VanderHouwen, on assignment at BPA
Agenda

• Two Focus Areas
  – Compressor technologies
  – Smart, connected devices
• DSM meets T&D
• E3TNW.org
HEAT PUMPS
Variable Capacity Heat Pumps

Ductless Heat Pumps

Residential Variable Capacity Heat Pump

VRF Systems

Advanced Rooftop Unit

CO2 Heat Pump Water Heater
Heat Pump Technology

- Japan Experience
- Next Generation HP
- Refrigerants
- Load Based testing
- Power Quality Assessments of HVAC
Next Generation Heat Pump
An EPRI Technology Innovation Breakthrough Project

Primary Ongoing Tasks

- Specifications Development
- Technical Development
- Market Development
Products Jack Callahan is Watching, Based on Japan Tour with 4 Mfrs

1. Sanden Eco Cute CO2 residential split-system HPWH
2. Residential forced air inverter heat pump (Daikin/Goodman)
3. Commercial/Industrial Eco Cute (air-to-air, and water-to-water)
4. Mitsubishi Hyper Heat (100% Capacity 5 degrees F)
5. Packaged Ammonia/CO2 Supermarket Refrigeration
6. Hybrid VRF / water loop fan coil
7. CO2 refrigerant grocery display case
8. Residential DHW / DHP combo unit
9. Ammonia Heat Pump for commercial applications
Steady-State vs. Load Based Evaluations

**Steady-state Testing**
- Fixed Temperature + Humidity
- Unit Supply
- Unit Return
- VC Indoor Unit
- Set Unit Speed

**Load-Based Testing**
- Fixed Load on Space
- Unit Supply
- Unit Return
- VC Indoor Unit
- Set Unit Controller

*Unit Operation is Fixed/Set
*Dynamic Unit Operation
Natural Refrigerants

• EPA Proposed Rulemaking in Aug 2014 would ban common refrigerants soon

• EPRI is working to make sure replacement refrigerants are chosen for energy efficiency AND GWP
Energy Management: *Smart Connected Devices*

- Low cost, high resolution, real-time, large scale performance data.
- Feedback used by manufacturers and providers for performance improvements.
Smart Connected Devices

Uses of AMI Data

Thermostats and RTU Controllers

LEDs and Advanced Controls

Non-Intrusive Load Monitoring

Online access to field research results
The Big Picture

Summary Home Performance

- Builder Home - HVAC (Watts)
- Efficient Home - HVAC (Watts)
- NZE Home - HVAC (Watts)
- Builder Home - Temp, Outdoor (F)
- Efficient Home - Temp, Downstairs (F)
- Efficient Home - Temp, Upstairs (F)
- Builder Home - Temp, Downstairs (F)
- Builder Home - Temp, Upstairs (F)
- NZE Home - Temp, Downstairs (F)
- NZE Home - Temp, Upstairs (F)

Detailed Home Performance

Energy, Primary (11 items)
- Home
- HVAC
- PV
- Water Heater
- Dryer
- Washer
- Dishwasher
- Refrigerator
- Range
- Outdoor Plugs
- TV

Temperature and Humidity (6 items)
- Temp, Upstairs
- Temp, Downstairs
- Temp, Attic
- RH, Upstairs
- RH, Downstairs
- RH, Attic

Weather (5 items)
- Temp, Outdoor
- RH, Outdoor
- Wind, Outdoor
- Solar Incidence
- Rain

Energy, Secondary (9 items)
- Bathrooms
- Fresh Air System
- HP Outdoor, Down
- HP Indoor, Down
Other orgs and other technologies

- Kiosks
- Data Centers
- Home audio devices
- Induction Cooking
- Power factor correction
- Adjustable speed drives
- TVs, Appliances, Streaming Media
- Design of retail buildings
- DC power for data centers and homes
- Dryers
- Aerators
- Engine generator block heaters
- Secondary glazing for commercial
- Drive/Motor/pump or fan packages
- ……
DEMAND SIDE IMPACTS ON THE GRID (EE’S IMPACT ON EE₅)
System Frequency during XLVII Super Bowl
Changing Nature of Electrical Loads

Transmission voltage during a fault in an area with mainly resistive loads

Transmission voltage during a fault in an area with high amount of residential air-conditioning load
Emerging Technologies Showcase (#28):
Energy Efficient Block Heaters

Wednesday, October 15, 2014 at 12:00 PM Pacific Time
A BPA Qualified product, energy efficient block heaters for stationary engine generators reduce energy use while still keeping generators ready to operate immediately.

Click here to register!

Emerging Technologies Showcase (#27):
CEA-2045 Standard for Demand Response

Tuesday, September 23, 2014
ANSI/CEA-2045 is a new standard for a modular communications interface (MCI) that makes appliances smart grid-ready by enabling any product to connect to any type of demand response system.

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