Disruptive Innovation & Implications for MT programs

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Session Goals

• What are Disruptive Innovations?
• Do they bite?
• How can we house-break them?
• If the value proposition is different, how do we capture it?
Who Killed the Electric Car?
Consider the pre-1911 Gasoline Car
We work a long time before we see any progress.

2. The S-Curve.
The infancy, explosion, then gradual maturation of technological progress.
Approaching Perfection. Whoops!
And then it gets supplanted…

12  S-Curves Almost Always Appear in Pairs. Together they represent a discontinuity—when one technology replaces another.
18 Months for 50% Market Share Shift

20 Tire Consumption in the United States. Bias-ply manufacturers lost 50 percent of the tire market to radials in 18 months.
Role of ENERGY STAR

ENERGY STAR
- mass market consumer
- cost-effective (2 to 3 year payback)
- two-thirds of ENERGY STAR products have no incremental cost
- proven technology
- no sacrifice in performance
- reliable savings – easy design, installation, and maintenance
Continuous Frequency Distribution of Appliance Efficiency: Mental Model
Disruptive Innovation: Cases of unmeasured efficiency

- HPWH
  - The value of dehumidification.
- Advanced RTU (integrated economizer and controls, proper housing, etc).
  - Better ventilation control, reduced infiltration
- Adaptive Controls (general)
  - Can’t rate with simulated use test or steady state test.
- E* shingles
- Clothes washer or dryers or electronix

ACEEE: American Council for an Energy-Efficient Economy
Consider the Commercial “Roof-top Unit” (RTU)
Features of an advanced RTU

• Integrated Economizer*
• Automated Diagnostics*
• Improved air handler
• Low-infiltration, insulated cabinet*
• Great dampers*

*NONE included in energy rating.

Is this really disruptive?
Consider the Commercial “Roof-top Unit” (RTU) (2)

<table>
<thead>
<tr>
<th>Rated</th>
<th>Saves Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>• EER (full load)</td>
<td>• Integrated Economizer</td>
</tr>
<tr>
<td>• IEER (part load)</td>
<td>• Variable speed fans</td>
</tr>
<tr>
<td></td>
<td>• Heat recovery?</td>
</tr>
<tr>
<td></td>
<td>• Smart Controls</td>
</tr>
<tr>
<td></td>
<td>• Good enclosure to reduce infiltration?</td>
</tr>
</tbody>
</table>
RTU Alternatives may be really disruptive:

• Ground Source Heat Pumps – or Water Loop Heat Pumps in General
• Advanced, low-mass, 2-pipe, boiler-chiller systems, with heat recovery chillers.
• Variable Refrigerant Flow “Multi-Splits”
Consider the Heat Pump Water Heater
Consider the Heat Pump Water Heater

**Advantages**
- < ½ as much energy
- Low LCC
- Dehumidifies!
- Filters the air!
- High Tech & Sexy
- Many “flavors”
  - Drop-in
  - Add-on
  - CO2

**Disadvantages**
- The what?
- High first cost
- What flavor do you want?
- Where to buy?
- Who to install?
- Oh, the noise!
- Cold blast all winter?
Are Equipment Standards Obsolete?

Standards v. energy models
Equipment v. systems
Some Reasons Standards might not capture savings

- Rating method defects
  - Across heterogeneous technologies
  - Smart controls not “seen” in test.
  - Ancillary benefits (like dehumidification) ignored
  - Regional issues
- Standards generally give relative comparisons, not energy use predictions
  - ASHRAE TC 4.7; AHRI Regional Standards offer engineering data prospect.
An Approach to Standards for Consumer Guidance

This Water Heater is Rated:

<table>
<thead>
<tr>
<th>Climate</th>
<th>Small home</th>
<th>Large home</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold</td>
<td>0.60</td>
<td>NR</td>
</tr>
<tr>
<td>Mixed</td>
<td>0.75</td>
<td>0.75</td>
</tr>
<tr>
<td>Hot</td>
<td>0.80</td>
<td>0.70</td>
</tr>
</tbody>
</table>

Measure & Certify

Product Label

ACEECE: American Council for an Energy-Efficient Economy
Some Implications

- Are Equipment and Appliance Standards Obsolete?
- How will we set incentives when standards can’t measure savings?
- How to capture “non-energy benefits”?
- Should we just focus on systems?
Thank You!

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