



EEAC EM&V Briefing

Ralph Prahl and Bob Wirtshafter
EEAC Consultants

June 25th 2012





Organization of Presentation

- Refresher
 - What is EM&V?
 - How is EM&V used in Massachusetts?
 - How is EM&V organized in Massachusetts?
- Summary of current status
- What studies are covered in today's presentation
- Provisos
- Residential results
 - Consultant presentation
 - PA follow-up
- Non-Residential results
 - Consultant presentation
 - PA follow-up





Refresher: What is EM&V (Evaluation, Measurement and Verification)

- Impact Evaluation, yes
 - Measurement of Gross Savings
 - Methods: End-use metering, billing analysis, site visits, engineering re-analysis
 - Measurement of Net Savings or Net-to-Gross Ratio (NTGR)
 - Methods: Survey research, sales data analysis, quasi-experimental design, econometric analysis
- But also...
 - Process Evaluation (studying how a program has been implemented and operated)
 - Market Assessment (trying to understand the markets being targeted)
 - Other: measure cost studies, baseline research, analysis of non-energy benefits, analysis of environmental benefits, etc.





Refresher: How EM&V is Used in Massachusetts

- Impact evaluation:
 - Refine planning assumptions prospectively, via TRM
 - True-up savings retrospectively, via annual reports
 - Inform program screening and cost-benefit analysis
- Process evaluations
 - Improve program design and delivery
- Market assessment
 - Support program planning and implementation
 - Inform policymaking





Refresher: How Impact Evaluation Results Are Applied

- Initial savings estimates tracked and reported by PAs are only forecasts
- Ex-post impact evaluation generally produces more reliable estimates of actual savings
 - More intensive focus on a subset of the population
 - Able to take actual experience into account
- Impact results can take various forms
 - Realization Rate (Ratio of evaluated to forecasted savings)
 - Changes to engineering equations or parameter values
- There may be differences in the way results are applied retrospectively vs. prospectively
 - Different types of numerical adjustments
 - Some studies applied only prospectively because of when they are finished





Refresher: How EM&V Is Organized in MA

- All studies are statewide
- Studies are administered by individual PAs, with responsibility systematically distributed across PAs by research area
- Under 2009 agreement:
 - Studies planned and performed collaboratively with EEAC and its consultants
 - Consultants work with PAs to reach consensus on evaluation issues, but if consensus cannot be reached, authority for decision-making resides with EEAC or its designee.
- Six statewide research areas, each with a PA research manager, a standing contractor team, and an EEAC consultant liaison
- EM&V Management Committee (EMC) provides a forum for statewide evaluation issues, and guidance, planning and direction to each evaluation research area



Summary of Current Status

- First round of about 45 statewide EM&V studies was completed in 2010-2011.
- Second round of about 45 studies has been under way for the past 6-9 months. Most of these have recently been completed, produced draft reports, or are scheduled for completion by July.
- Wide range of studies:
 - Gross savings impact evaluations
 - Net savings impact evaluations
 - Process evaluations
 - Market assessments
 - Baseline research
- As a result we have many new results to present, although some of them are still in draft form.





What's Covered in Today's Webinar: Non-Residential

- 7 gross savings impact evaluations of Large C&I measure groups
 - Electric: custom lighting, prescriptive lighting, custom process, custom compressed air
 - Gas: custom, prescriptive
 - CHP
- 2 gross savings impact evaluations of Small C&I measure groups
 - Non-controls lighting
 - Lighting controls
- Net-to-gross study covering all C&I gas measures
- C&I non-energy impacts study
- New construction code compliance study
- Process evaluation of Large C&I





What's Covered in Today's Webinar: Residential

- Impact evaluations of HES, Multifamily, and Low-Income
- Process evaluations of Low-Income and Multifamily
- Multifamily potential study
- Several residential retrofit and new construction pilot studies
- Impact evaluations of behavioral programs (OPower and Efficiency 2.0)
- Residential New Construction Baseline and Code Compliance Study
- Residential Lighting On-Site Study and Consumer Survey
- Umbrella Marketing Study



What's Not Covered Today

- Several studies are not covered, for one or more of the following reasons:
 - Still in progress
 - Received draft report too late to include
 - Has produced draft report but not yet finalized, and we believe results still have potential to change
 - Webinar time constraints
- Studies not covered:
 - Variable Frequency Drive (VFD) impact evaluation
 - Residential gas HEHE net-to-gross study
 - Community-Based evaluation
 - Umbrella marketing study (non-residential portion)
 - Integrated overall report on behavioral evaluations
 - Job impacts study
 - C&I HVAC supply-side market assessment study
 - Consumer electronics saturation study

Provisos

- Far too many results to be comprehensive; we can only scrape the surface
- This is therefore necessarily a very selective and impressionistic sampling of results
- We encourage people to look at the primary reports when available
 - All will eventually be posted on EEAC web-site
- Some of the results discussed here are still in draft form and thus could change by the time they are finalized
 - We have tried to avoid discussing draft results that have significant potential to change
- Due to time constraints we have focused solely on statewide results. However:
 - Impact evaluations are sometimes applied at a PA-specific level
 - Even when they are applied only at a statewide level, they may affect different PAs differently



Residential Sector

Bob Wirtshafter and Ralph Prahl





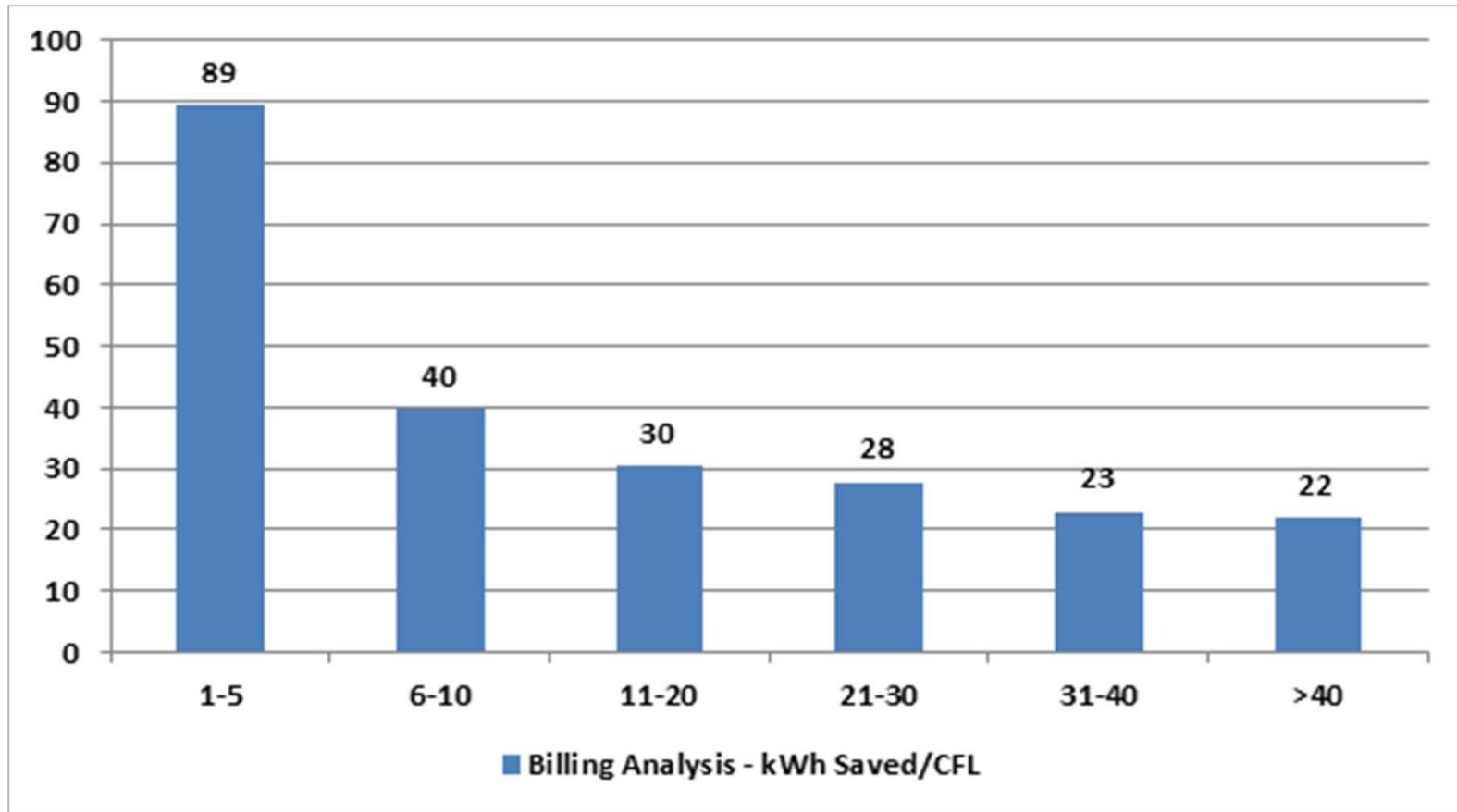
Home Energy Services

- Impact Evaluation
 - Still working on final numbers
 - Reduction in lighting estimates
 - Reduction in insulation savings
- NTG study found a NTG (free riders and spillover) ratio of 1.13
 - 1.2 NTG for insulation
 - .86 for refrigerators, and
 - .73 for installed CFLs (though there is still some adjustment needed to avoid double counting)



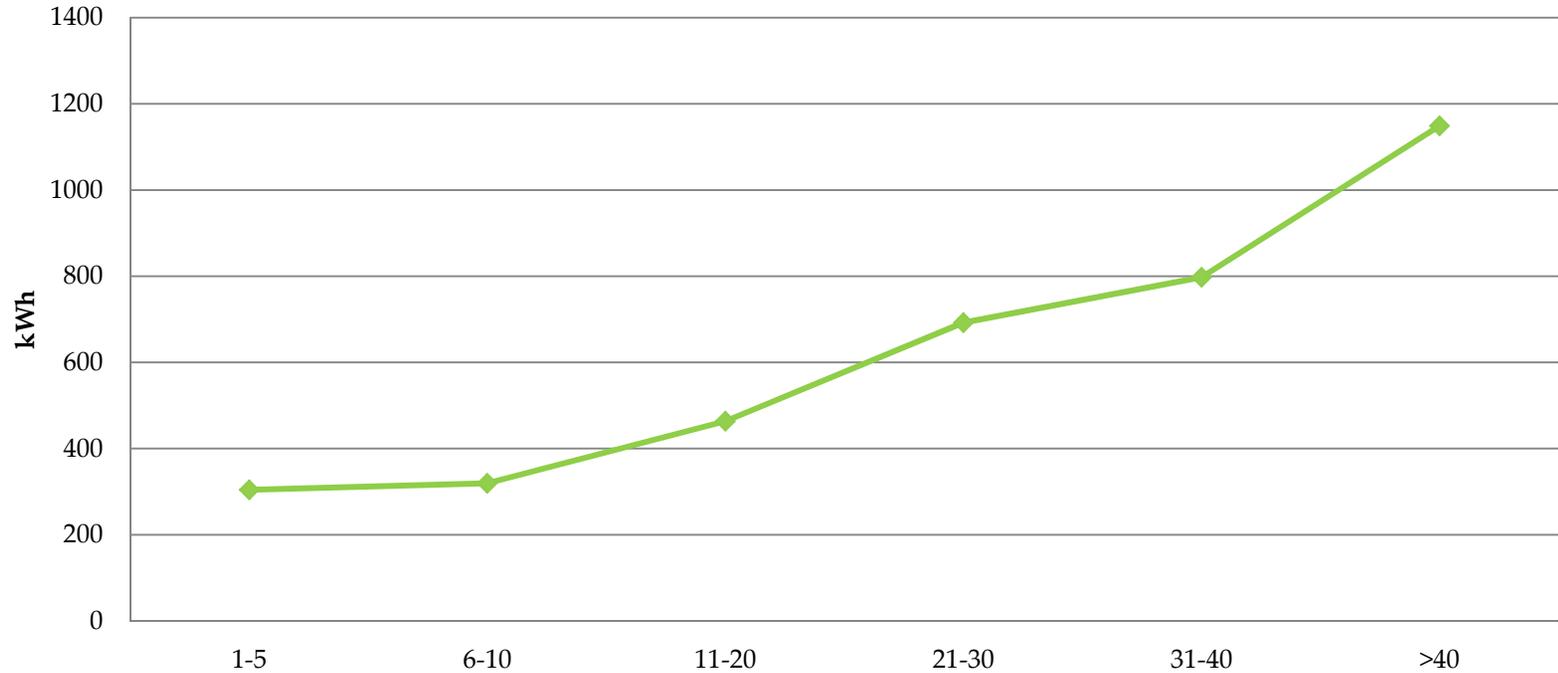
HES Program

Savings per CFL by Number Installed



HES Results

CFL Total Savings by CFL Group





HES: Packaged Measure Savings Pilot

- This pilot offered an additional incentive if participants did heater replacement and other measures together.
- Results show that bundling does encourage customers to go deeper.
- Recommend to try to create more bundled packages not limited to only those with heater replacement.





HES Program

- HES Roofing, siding and general contractor charrettes
 - Most of the contractors do not currently think about energy efficiency when providing their services
 - Awareness of the HES Program (by name and after reading a general description) is very low among contractors.
 - The majority of contractors are not looking to expand their services, however a few are interested enough to want to know more about how the program works and its benefits.



Residential New Construction Program

- Cost-effectiveness of RNC reduced by new code and change in home efficiencies observed through evaluation
- Evaluations done to measure baseline and assess code compliance
 - Mini Baseline Study of 50 homes built under old code with Emphasis on code compliance
 - Baseline Study of 100 homes built under new code
- Results
 - Baseline increases in boilers, water heaters, and air leakage.
 - Baseline decreases in floor insulation over unconditioned spaces and exterior wall insulation.
 - Reduction in appliance and lighting saving potential, again caused by market and standard changes
- Code compliance
 - Almost all inspected homes, 93%, failed to comply with at least one 2009 IECC prescriptive insulation requirements or mandatory duct insulation requirements.
 - Opportunity for large savings with code enforcement



Multifamily Program

- Multifamily Impact Study
 - Emphasis on establishing one set of statewide assumptions
 - High rates of installation (98%) and persistence (99%)
 - Modest free ridership (18%).
- Multifamily Process Report
 - A significant barrier to participation in the program is reported to be a lack of awareness by owners/managers of what the program can offer.
 - Consistency of Program Offerings among PAs is progressing.
 - With its focus on relatively low cost measures, the program may be missing greater savings opportunities, especially when buildings undergo major renovations.
 - The Multifamily Program participants on average are highly satisfied with almost all aspects of the program.



Multifamily Program

- Multifamily Potential Study
 - **Electric**--Should all cost-effective potential be deployed, the result would be a 14% reduction in 2030 forecast energy consumption.
 - **Gas** --Should all cost-effective potential be deployed, the result would be a 24% reduction in 2030 forecast energy consumption.
 - Program needs to go deeper to achieve this potential



Low-Income Programs

- LI Impact
 - **Billing analysis and engineering assessments of large sample of participants**
 - insulation and air sealing achieved a 22% savings, a slight increase over planning assumptions.
 - heating replacement saved 17%, assumptions varied by PA
 - refrigerator replacement saving went down by 1/3 to 762 kWh, standards have raised the efficiency of refrigerators to be replaced.
 - refrigerator removal went down 10%
 - window AC savings estimate doubled to 204 kWh.
 - CFLs slight increase in estimated first-year savings—does not reflect EISA effects in later years



Residential Pilot Studies

- Brushless Fan Motors
 - Pilot monitored 40 sites
 - Savings is less than half of what was projected, largely because fans do not operate as much as was estimated.
 - Technology still viable though cost-effective in fewer homes
- Solar Water Heating
 - Pilot monitored 47 sites
 - Average payback well exceeded expected lives of systems
 - Continued support of solar water heating is not recommended
- Heat Pump Water Heaters
 - Pilot monitored 14 sites
 - The overall performance of the units shows great promise for this technology.
 - Paybacks ranged 3 years to 10 years with a mean of 6 years

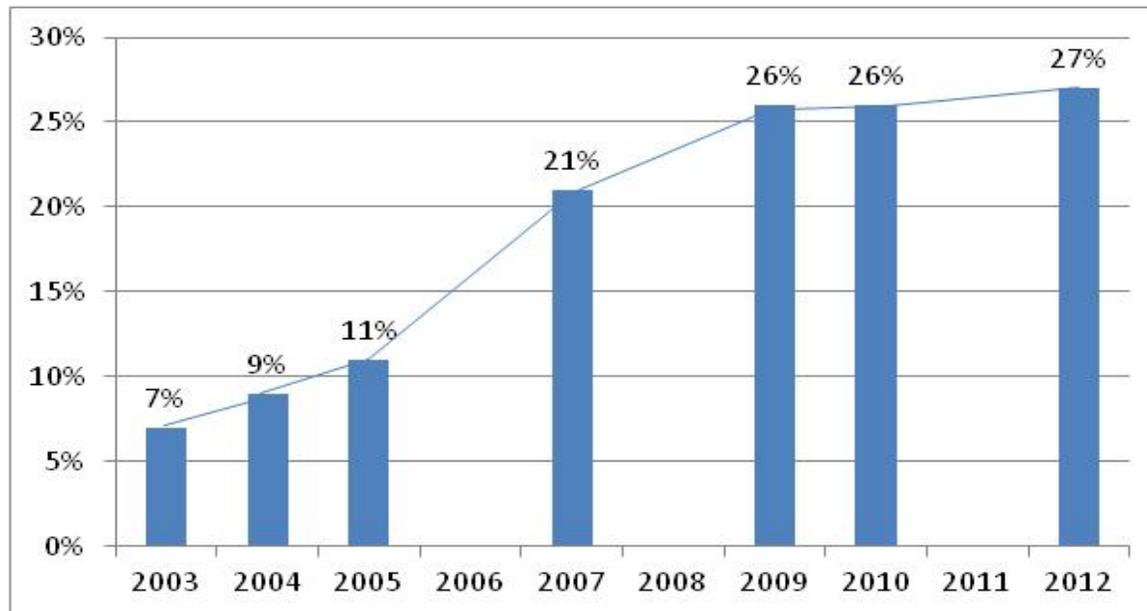


Residential Lighting Program

- Following a major study of net impacts in 2010-2011, EM&V Efforts this year have focused largely on tracking the market
- Intent is to help inform policy and programming decisions in a key market that is facing considerable uncertainty
 - Major source of savings up until now
 - EISA has begun to take effect, changing the ground rules
 - New generation halogens have been commercialized
 - LEDs are being commercialized, though pace is uncertain
- A few highlights from:
 - Residential on-site visits to track saturation and purchases
 - Consumer tracking survey



Residential Lighting Program: CFL Saturation in MA Since 2003



- Despite the best efforts of the MA program, socket saturation of efficient lighting appears to be stagnating
- We would not expect either EISA or LEDs to dramatically change this trend any time soon





Residential Lighting: Consumer Survey Results

- Self-reported satisfaction with CFLs among MA consumers appears to be falling.
 - % very satisfied:
 - 2010: 55%
 - 2011: 50%
 - 2012: 34%
 - Possible causes
 - Increased perception of alternatives due to LEDs and halogens?
 - Negative media coverage?
- Early indications that some consumers may hoard incandescent bulbs as EISA begins to take effect
 - Borne out by on-site results, although not a major issue yet





Residential Lighting: Possible Implications

- The stagnation of socket saturation, decline in consumer satisfaction with CFLs, and early evidence of hoarding seems to suggest that further updates to program design, and/or increased savings targets, might be called for.





Residential Behavioral Programs: Impact Results

- OPower
 - Impact evaluation covered all cohorts, fuels, PAs, and years in the state to date.
 - Results indicates that these programs are generally producing savings consistent with initial forecasts (typically 1-2% of household consumption)
 - Savings increase a bit when a given cohort continues to receive mailers for a second year (consistent with results elsewhere in the U.S.)
- WMECo Efficiency 2.0 pilot
 - Impact evaluation of the mailer component yields somewhat disappointing savings estimate of .4% per household
 - Mailer is only one component of this pilot, with the web-site being another important piece of the puzzle.
 - Impact evaluation results on the web-site component are due shortly



Umbrella Marketing Study: Residential Component

- 39% have heard or seen the term Mass Save
 - However, awareness tends to be shallow
 - 6% very familiar
 - 14% somewhat familiar
 - Most aware that it involves energy
 - Few think it's just an audit program!
 - Attitudes are generally quite favorable
- Not surprisingly, awareness of utilities as EE service providers is still much higher, at 74%
- However, public awareness of Gas Networks and Cool Smart are quite low (7% and 4%, respectively)
- 17% aware of MassSave.com web-site
 - 37% of those aware visited in last six months
- Plan to repeat study after current wave of marketing



Residential: PA Follow-Up

Lynn Westerlind, NGRID
Monica Cohen, Columbia Gas of MA





Non-Residential Sector

Ralph Prahl





C&I Impact Evaluation Results: Large C&I Electric

- Custom Lighting: 98% realization rate
- Custom Process: 76% realization rate
- Custom Compressed Air: 85% realization rate
- Prescriptive Lighting: report not in yet, but results reportedly look good





C&I Impact Evaluation Results: Large C&I Gas

- Both prescriptive and custom measures studied last year. Results were unstable, so we repeated both studies this year.
- Custom: 67% realization rate
 - Results lower than last year; recommended improvements similar
 - Realization rate quite variable across PAs
 - Lack of improvement does not reflect badly on PAs, as they did not have time to respond to last year's recommendations.
- Prescriptive:
 - The good news: 104% realization rate overall
 - The bad news: 3 of 4 measure categories quite low
- Planning third wave of both custom and prescriptive studies
- C&I gas net-to-gross study: 79%, down from last year





C&I Impact Evaluation Results: CHP

- Realization rates of 90-100% depending on outcome measure
 - However, sites with savings estimates developed initially by vendors or other third parties did considerably worse than those by PAs.





C&I Impact Evaluation Results: Small C&I

- Non-Controls Lighting: 102% realization rate
- Lighting Controls (*Draft*): 43% realization rate
 - Study used pre-post metering – the gold standard for controls measures, but rarely done due to logistical challenges
 - Results highly variable across jobs
 - Study makes recommendations regarding both increasing and accurately forecasting lighting control savings
 - Contribution of lighting controls to SCI savings is relatively small, but growing rapidly
 - We believe these results raise questions about the reliability of lighting controls savings in Large C&I as well.
 - A pre-post controls study is now planned for Large C&I



C&I Impact Evaluation Results: What Does It All mean?

- Lighting non-controls savings are generally being forecasted accurately. This is important given the large contribution of lighting to savings.
- For most other measure categories studied this year, actual savings are typically falling below forecasts – in a few cases well below.
- Custom measures remain challenging to forecast accurately.
- All C&I gas measures remain challenging – perhaps a function of the relative dearth of national experience.
- It matters how much quality control is in place in the engineering estimation process.
- Overall, these results will tend to reduce C&I savings somewhat going forward (more for gas than electric)



C&I Non-Energy Impacts (NEI) Study

- C&I programs can produce a variety of NEIs, such as:
 - Reductions in O&M costs
 - Reductions in water usage
 - Increases in productivity
- Draft report on this comprehensive study is finding NEIs with significant aggregate value.
 - A key source of NEIs appears to be reduced repair costs associated with keeping older equipment running
- PAs currently vary in claiming of NEIs, but this study is likely to lead to a boost for all
- Study is therefore likely to increase estimates of C&I benefits going forward, partially offsetting the shortfall in energy savings



C&I Code Compliance Study

- Research objectives:
 - Understand the energy code enforcement process;
 - Understand level of compliance in recently constructed commercial buildings through plan reviews and site visits
 - Understand the future energy savings potential for recently constructed buildings.
- Included on-site visits, review of plans and specifications, interviews about specific projects, and interviews with market actors
- Study is near completion, but full first draft received only on 6-22
- Following results rely on interim deliverables and quick review of 6-22 draft





C&I Code Compliance Study: Interview Results

- A majority of interviewees in all categories have not yet mastered the latest energy code
- Code officials require additional staff resources, and/or assistance from other sources, in order to properly address the energy code
- Code enforcement for equipment specification relies primarily on written certification from architects and engineers
- Design community, and code officials rely heavily on consulting design engineers
 - But for their part, design engineers say they would like more direction and clarity!
- Across the board, there is strong interest in training opportunities



C&I Code Compliance Study: Compliance Results (*Draft*)

- Study finds substantial opportunity for savings from improvement in C&I code compliance
- Overall *compliance rate* of 80%
 - Definition of *compliance rate* based on method developed for DOE to support requirements associated with Federal ARRA funding
 - Does *not* mean that 80% of buildings complied with all code requirements; **in fact, none did**
 - Rather, means very roughly that new commercial buildings use 20% more energy than if all were fully compliant
- Study provides much detail on where compliance can be improved
- Study makes numerous specific suggestions for programming approaches to enhancing code compliance



Large C&I Process Evaluation

- Comprehensive study included:
 - Interviews, surveys, and focus groups with:
 - Participating customers and trade allies
 - Program staff and EEAC program consultants
 - Non-participating trade allies
 - Dormant participants
 - Review of tracking systems
 - Review of best practices elsewhere



Large C&I Process Evaluation: Selected Findings

- Participating end-users are generally satisfied with the program, but participating trade allies less so
- Tracking systems are performing adequately to support project management, but:
 - Many inconsistencies (even within individual PAs) as to how data are entered and validated
 - Many variations in the extent to which fields are populated
 - Inability to link projects for participants who participate in both gas and electric
 - These findings have been echoed more informally by other evaluation teams
- Some indications that participants without account reps might have more unmet needs than those with -- but they are no less satisfied
 - A dedicated study is planned on this issue



Large C&I Process Evaluation: Selected Recommendations

- Improve consistency, compatibility, and in some cases quality, of tracking systems
 - This will be challenging, but EEAC consultants believe it is critical
 - The report provides many specific recommendations
- In order to improve trade ally satisfaction:
 - Simplify paperwork and accelerate rebate processing
 - Do a better job of warning about changes in program funding
- Be more proactive in reaching out to trade allies
 - Many with limited awareness
 - Perhaps use trade associations more as a vehicle



Non-Residential: PA Follow-Up

Lynn Westerlind, NGRID
Monica Cohen, Columbia Gas of MA





The End

- This presentation will be posted on the EEAC web-site:
<http://www.ma-eeac.org/>



Contact Information

- Ralph Prahl
EEAC Consultants, Team Lead for EM&V
Ralph.Prahl@gmail.com
- Bob Wirtshafter
EEAC Consultants, Liaison for Residential Retrofit and Residential
New Construction
Wirtino@verizon.net
- Lynn Westerlind, NGRID
Lynn.Westerlind@us.ngrid.com
- Monica Cohen, Columbia Gas of MA
mcohen@nisource.com