U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

M&V Trends and Possibilities:
The Present and the Future

March 22, 2016

Cody Taylor

Building Technologies Office

U.S. Department of Energy

Cody.taylor@ee.doe.gov

How do you trust a measurement?

Whole Building M&V 2.0 Advantages

- <u>Comprehensive:</u> accounts for all ECM savings, including interactive effects

- <u>Simple:</u> few data streams required

- <u>Shorter monitoring requirements:</u> Baseline model development and savings estimations based on months, not years

- <u>Higher quality:</u> Estimates savings uncertainty

- <u>Persistence:</u> Fast feedback on building performance

- <u>Scalable:</u> one methodology for all buildings

- <u>Lower administration costs:</u> standardization & automation reduces time for savings analysis & technical review

- <u>Tool Availability:</u> public domain and embedded in EMIS

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Trends We Are Seeing

- Program Administrator interest in savings uncertainty
- Interest in EE by non-traditional audiences
- Increasing interest in pay-for-performance models
- Desire to support transactive energy in the future

U.S. DEPARTMENT OF **ENERGY** | Energy Efficiency & Renewable Energy

The Present: AMI-Based M&V 2.0 Is Here

■ Offered today in energy management and information systems (EMIS)

■ Baselines automatically created using historic interval meter data, and system-level or whole-building and weather data

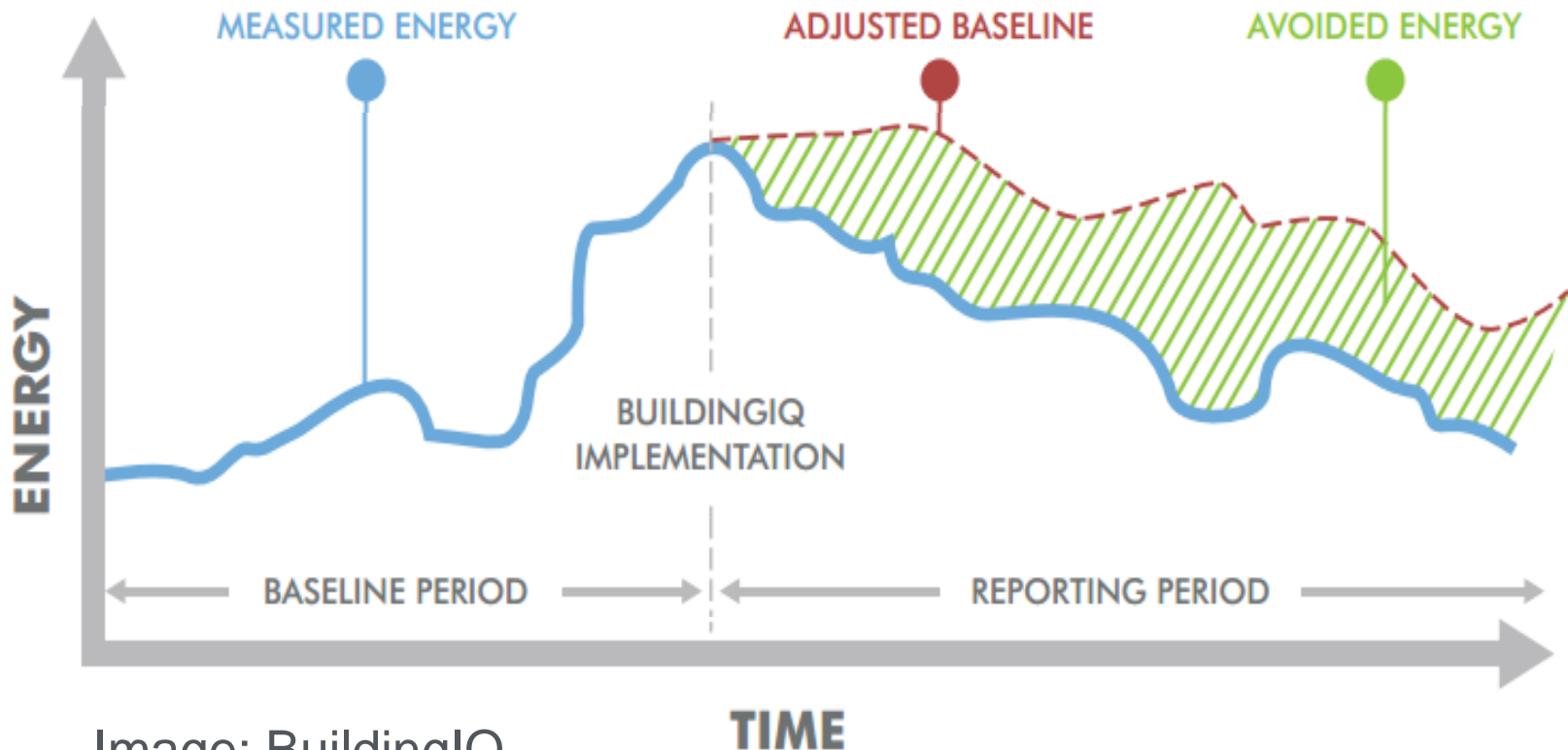■ Savings automatically calculated based on date of EEM

Image: BuildingIQ

Results of DOE testing of AMI-based M&V 2.0 models

- Tested offerings from: Gridium, Lucid, Performance Systems Development, Buildings Alive, UC Berkeley, others

- Differences between models are mostly small

- Across the group of models, for 12-month training and 12-mo prediction:

  - ☐ *Average* median percent error ~-1.2%

  - ☐ *Range* of median errors is ~-3% to 0.4%

- All models perform well overall, especially for the case of 12-months training

**More information on this research: http://eis.lbl.gov/auto-mv.html**

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Technology Evolution Facilitates M&V Evolution

Image: Enlighted

U.S. DEPARTMENT OF **ENERGY** | Energy Efficiency & Renewable Energy

Program Administrators are Beginning to Pilot M&V 2.0

- Example: 39 buildings, RCx program, savings & uncertainty at 95% confidence
- Portfolio aggregate: 3.96% savings within confidence interval of {3.66%,4.26%} at 95% confidence level
- Much better than ASHRAE Guideline 14 requirements

*Paper forthcoming

Energy Efficiency & Renewable Energy
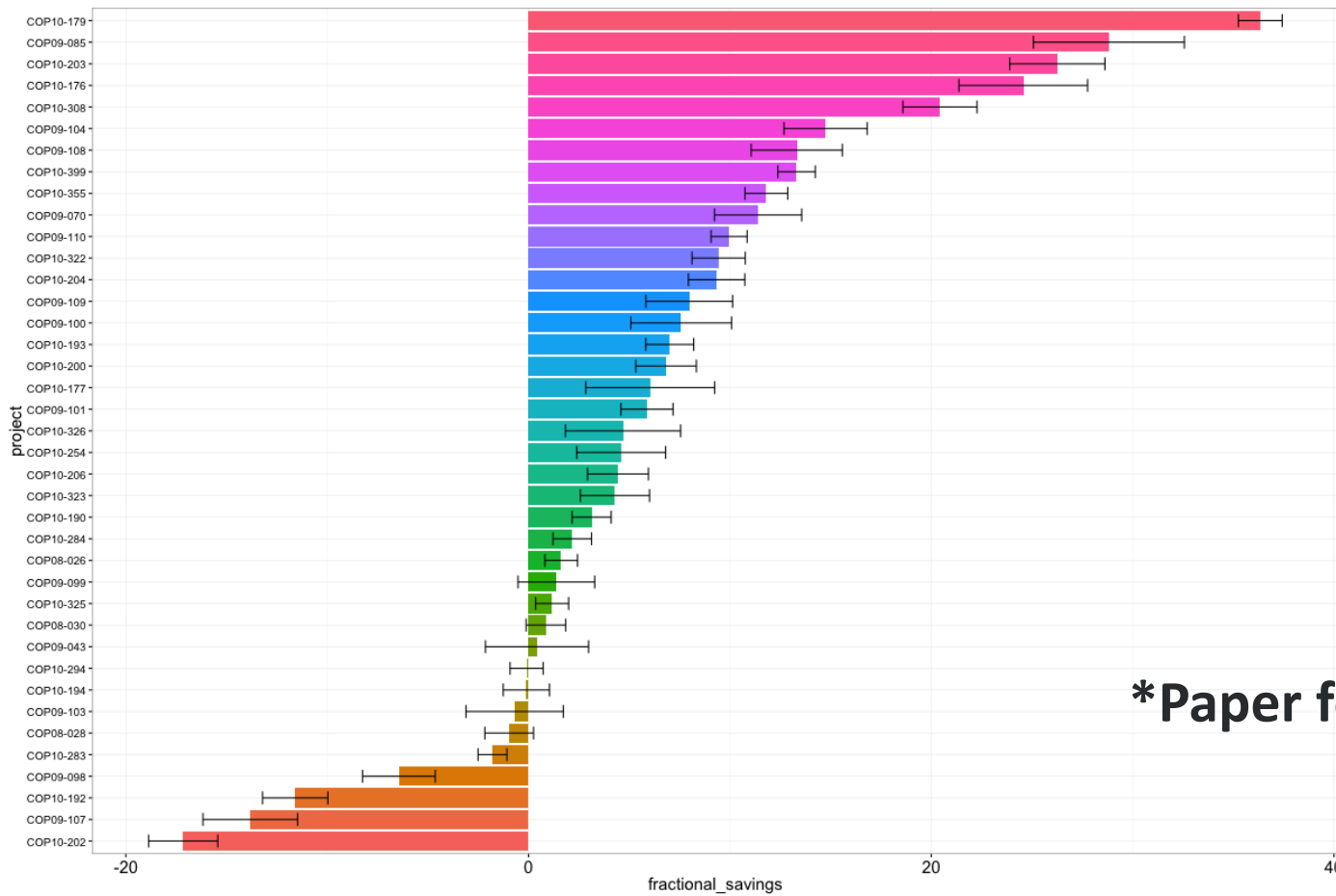
Policy Evolution is Setting the Stage for M&V 2.0

- 2015 California legislation directs the CPUC to authorize IOUs to provide incentives *"based on all estimated energy savings and energy usage reductions, taking into consideration the <u>overall reduction in normalized metered energy consumption</u> as a measure of energy savings."*

- CPUC has proposed that *"all calculations and methods must be made available for review"*, and *"models, methods and tools must be transparent, reviewable and replicable by peer reviewers."*

- CPUC is also requiring Programs and projects with an M&V plan that can *"reliably demonstrate savings estimate precision at standard confidence intervals in order to limit ratepayer exposure to risks associated with savings measurement error and uncertainty."*

- CA is not abandoning attribution

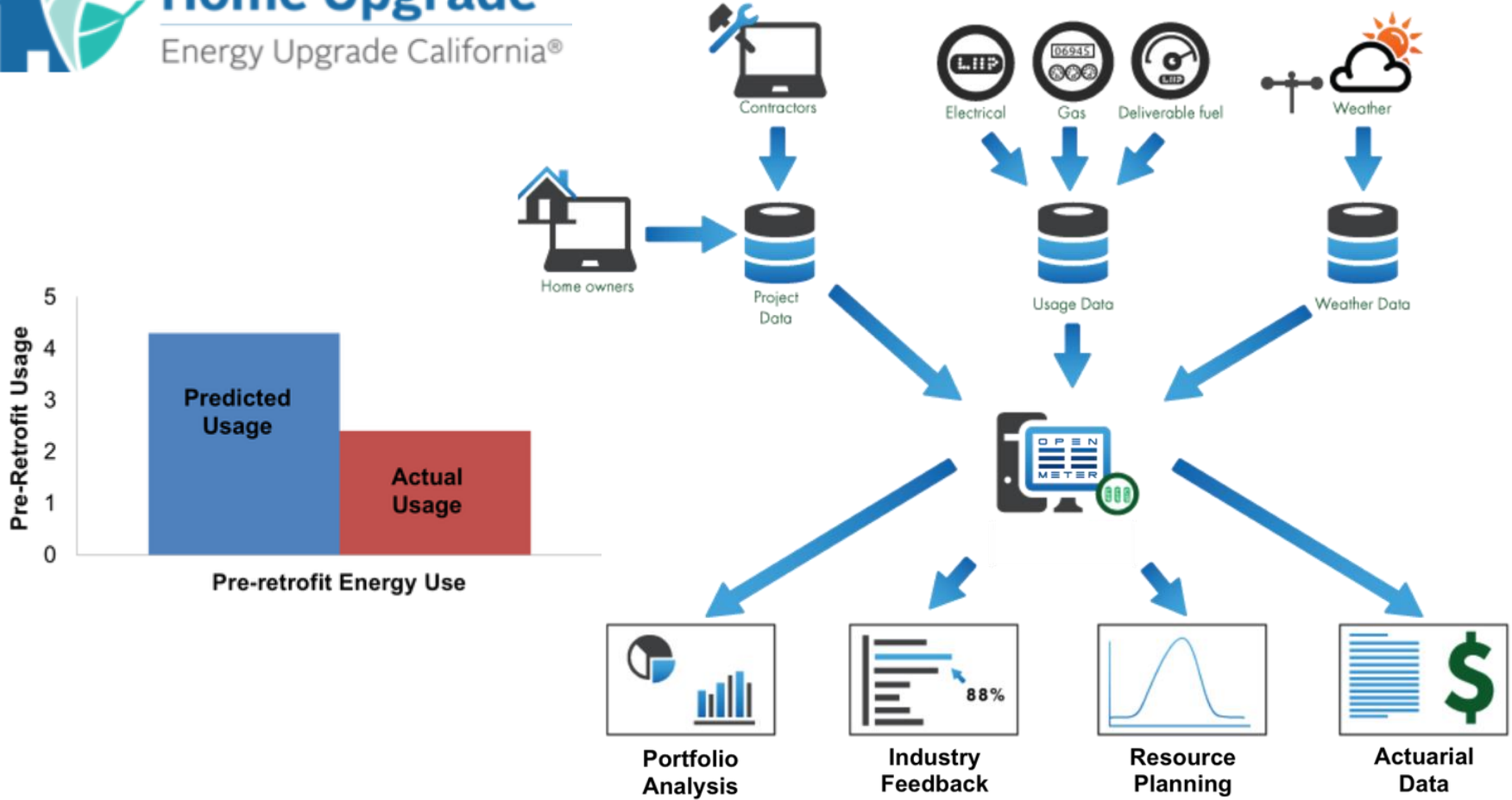**U.S. DEPARTMENT OF ENERGY** | Energy Efficiency & Renewable Energy

Image: CalTrack

Transactive Energy
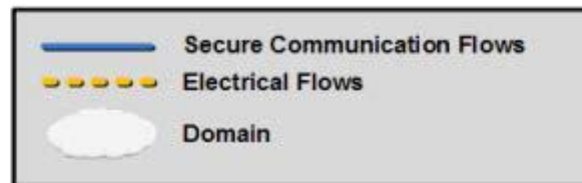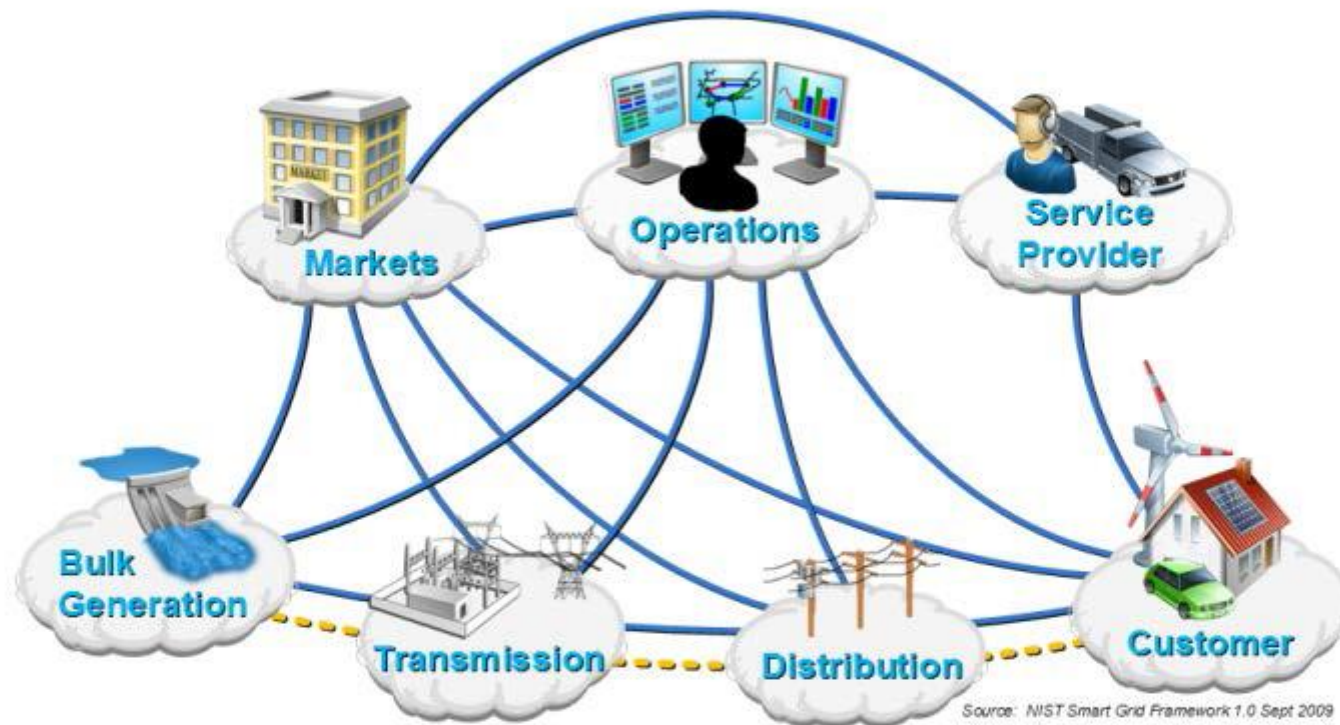

Source: NIST Smart Grid Framework 1.0 Sept 2009

Image: NIST

What We've Seen so Far

- AMI and interval data models hold great promise to speed whole-building measured savings calculations

- Program administrators are beginning to pilot use of M&V 2.0 in their portfolios

- DOE Study shows objective evidence that current M&V 2.0 models/tools are generally robust

- Errors in predicting energy are on the order of a couple of percent for many buildings and many models
  - This is the floor of performance from the *fully automated case*, with no 'non-routine' adjustments from an engineer
  - Oversight of an engineer could improve accuracy even further

- 12 months pre/post data may not always be required for accurate whole building M&V

U.S. DEPARTMENT OF **ENERGY** | Energy Efficiency & Renewable Energy

How You Can Use These Results

- Growing availability of intelligent analytics tools, and metered building energy data present a big opportunity for our industry

- Evaluators:
  - Consider the role of new tools to speed gross savings calculations

- Program Administrators:
  - Pilot the use of these M&V methods for gross savings
  - Assess value of rapid feedback during program implementation
  - Use CEE Savings Estimate Toolkit to apply whole building savings calculation and uncertainty analysis during program development, implementation, and evaluation

- Regulators:
  - Assess role of transparent, automated or semi-automated M&V for some program types
  - Begin developing "acceptance criteria" that inform M&V plan development by describing the target ranges of uncertainty and confidence in reported savings

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Questions?

Why is the speedometer stuck on 35?

The car only collects speed data once a year.

freshspectrum.com

Cody Taylor Cody.taylor@ee.doe.gov

U.S. DEPARTMENT OF **ENERGY** | Energy Efficiency & Renewable Energy