Expanding Efficiency Services and Advancing Utility Program Strategies with M&V 2.0

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2018 ACEEE Efficiency as a Resource

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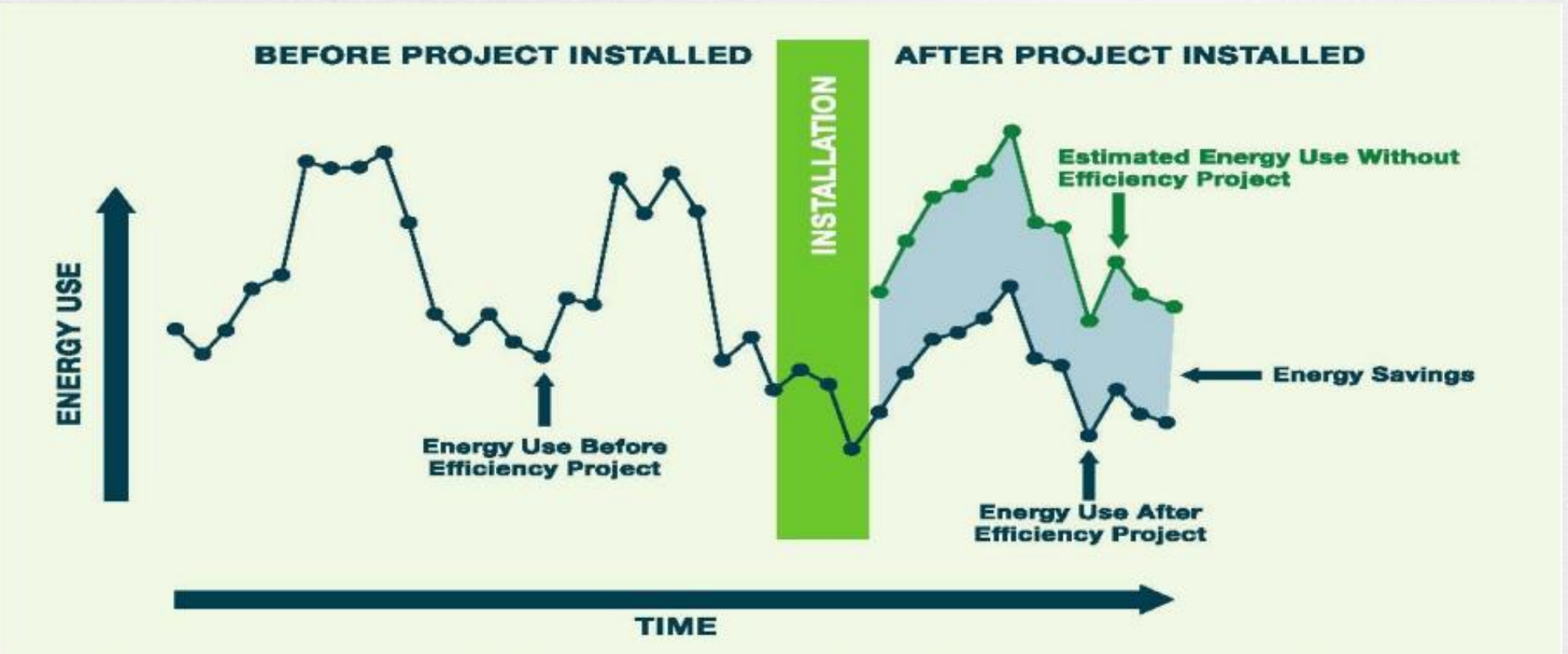
Measurement & Verification



Energy Service Providers

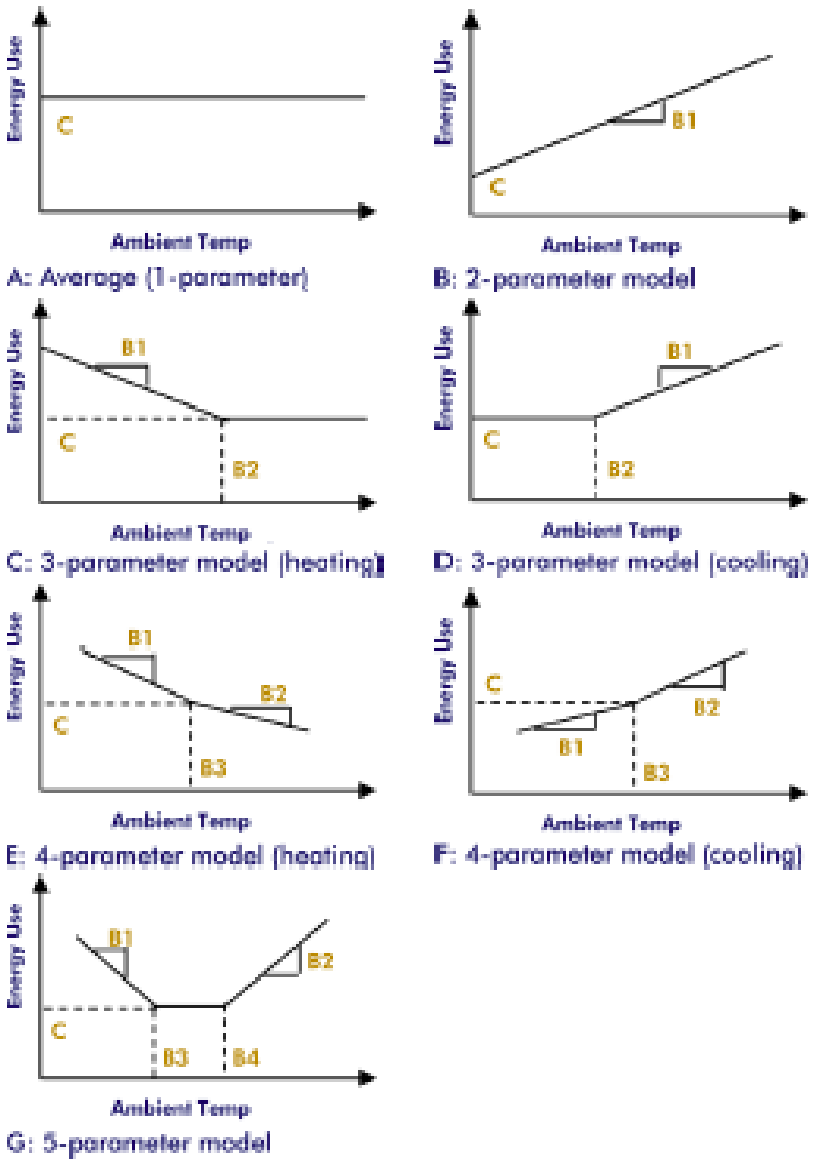
Baseline
Adjusted Baseline (Routine & Non-Routine)
Gross Savings
Site Specific

Program Evaluators

Baseline
Counterfactual Baseline
Net Savings
Aggregated savings

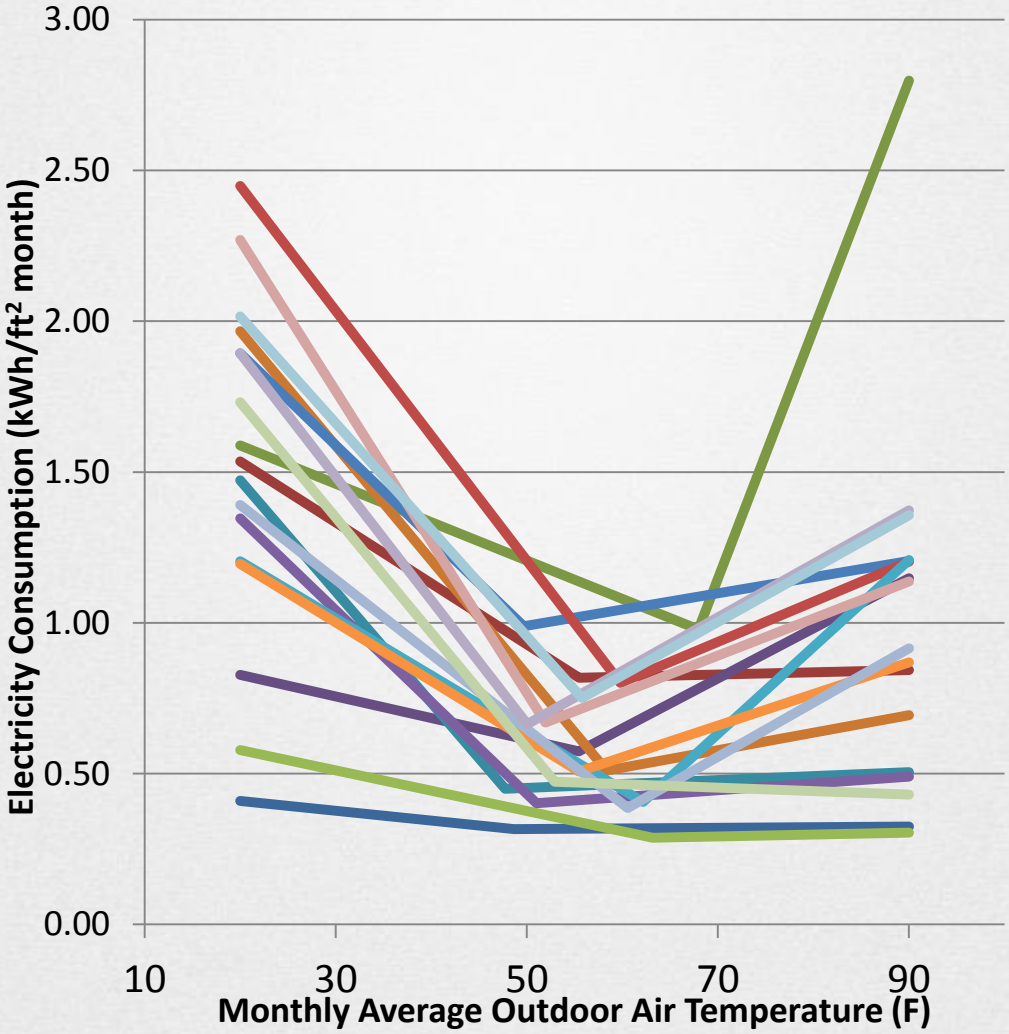
Measurement & Verification

Common M&V Regression Models



Source: CCC, 2012, Guidelines for Verifying Savings in Commercial Buildings,

Example: 4-P Monthly Models for 17 buildings



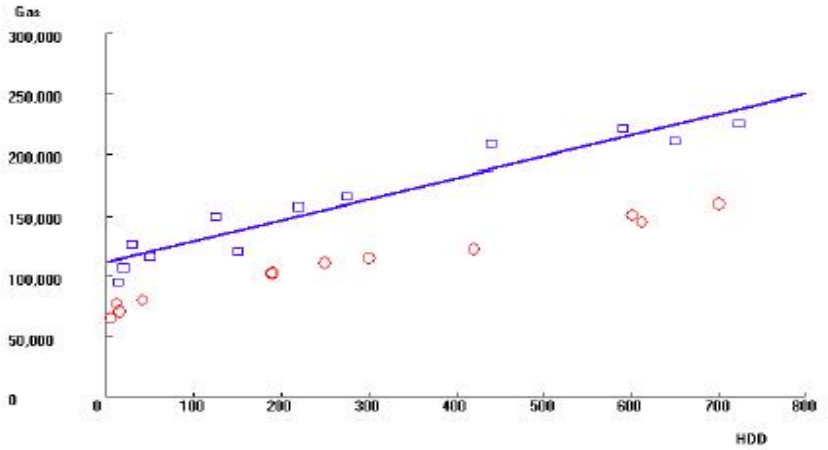
Source: Franconi, E. and D. Jump, ASHRAE Journal, September 2017

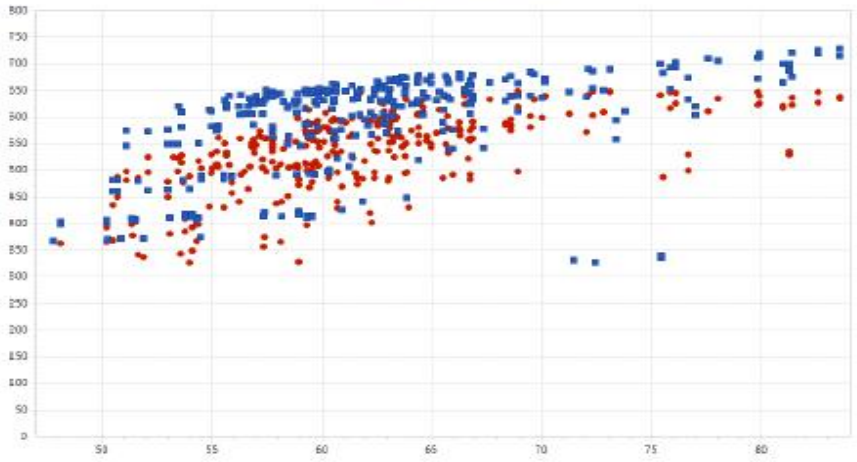
Measurement & Verification

Advancements due to better data access and more computing power

M&V 1.0 - Monthly

M&V 2.0 – Hourly or Daily





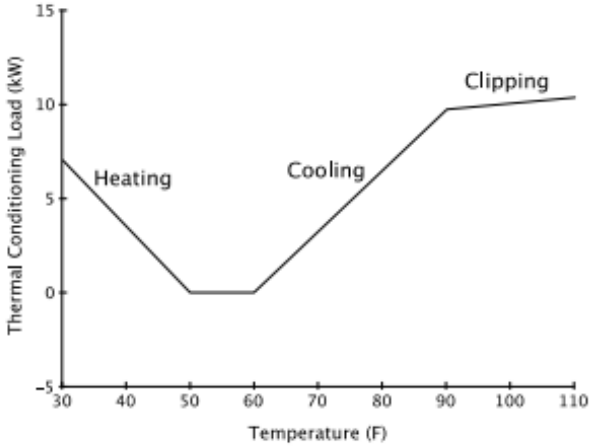
Source: David Jump. kW Engineering

Measurement & Verification

Advanced M&V models

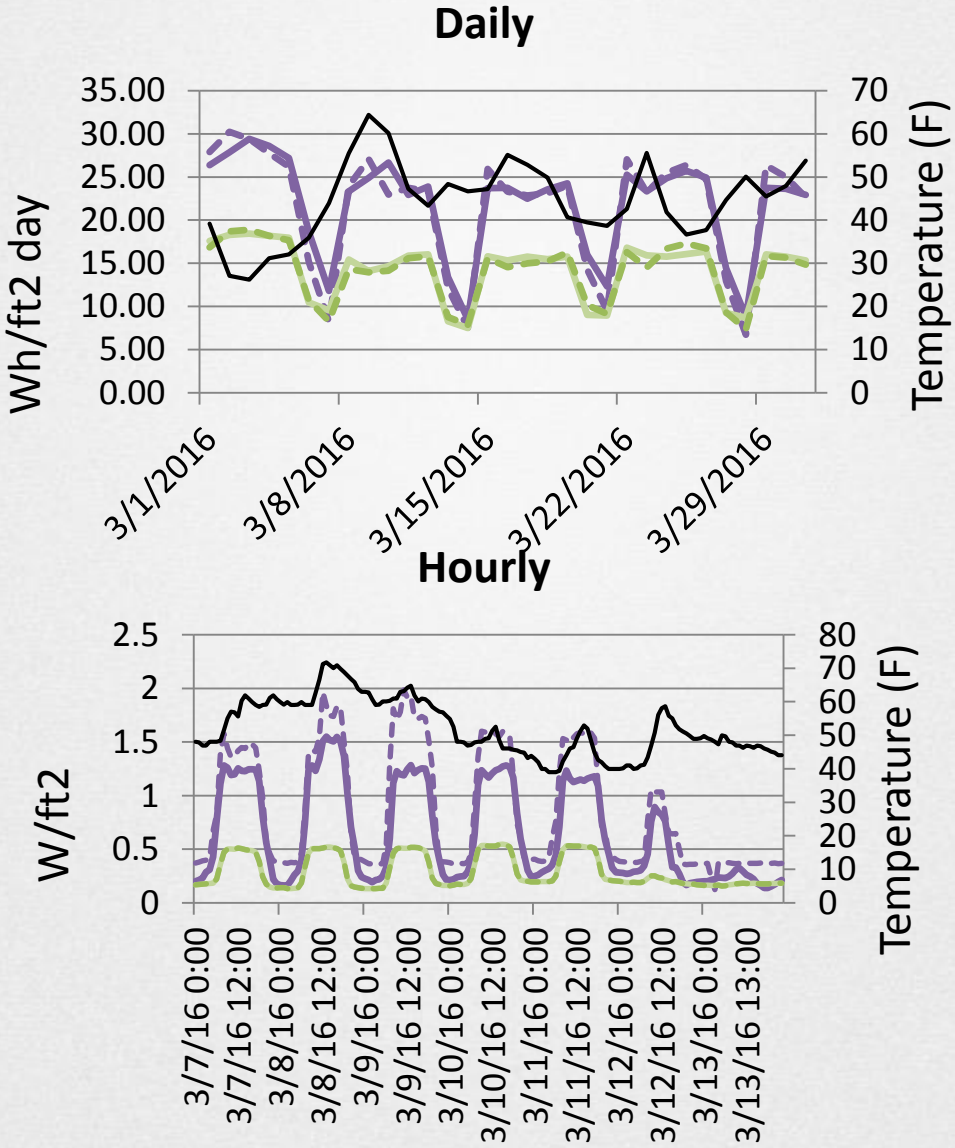
Example of an Advanced M&V Model:

LBNL Time of Week and Temperature Model



T (°F)	$T_{c,1}$	$T_{c,2}$	$T_{c,3}$	$T_{c,4}$	$T_{c,5}$	$T_{c,6}$
43	43					
57	50	7				
65	50	10	5			
76	50	10	10	6		
89	50	10	10	10	9	
92	50	10	10	10	10	2
108	50	10	10	10	10	18

Source: Price et al, "Using Whole Building Electric Load Data in Continuous or Retro- Commissioning," LBNL, July 2011.



Advanced M&V

Common M&V	M&V 2.0
Linear regressions	Non-linear/advanced analytics
12 monthly points / year	8760 hourly points /year
12 month monitoring duration	3 – 6 month duration
Energy Use = f(Temp)	Energy Use = f(Time, Temp)

Benefits

- Timely insights
- Ongoing feedback
- Risk management
- Demand response
- Grid friendly buildings
- Efficiency as a resource

Expanding Efficiency Services

Advanced M&V Benefits

New models, tools, and capabilities

Data rich intelligent efficiency

Considerations

- Building type or sector focus
- Tool design intent
- Degree of automation
- M&V method
- Transparency

Energy Service Provider Questions
about adopting an advanced M&V approach

Using Whole Building Electric Data

- How accurate are savings?
- Which is a better business model – a performance contract or service contract?

ASHRAE Guideline 14

- Linear model uncertainty calculations
- For billing data M&V (Option C), savings must be stated +/- 50% within a 68% confidence interval
- Generally less uncertainty with more data

$$\frac{\Delta E_{save}}{E_{save}} = t \frac{1.26}{F \, \mathrm{m} \, \bar{E}_{base,n}} \left[MSE' \left(1 + \frac{2}{n'} \right) m \right]^{0.5}$$

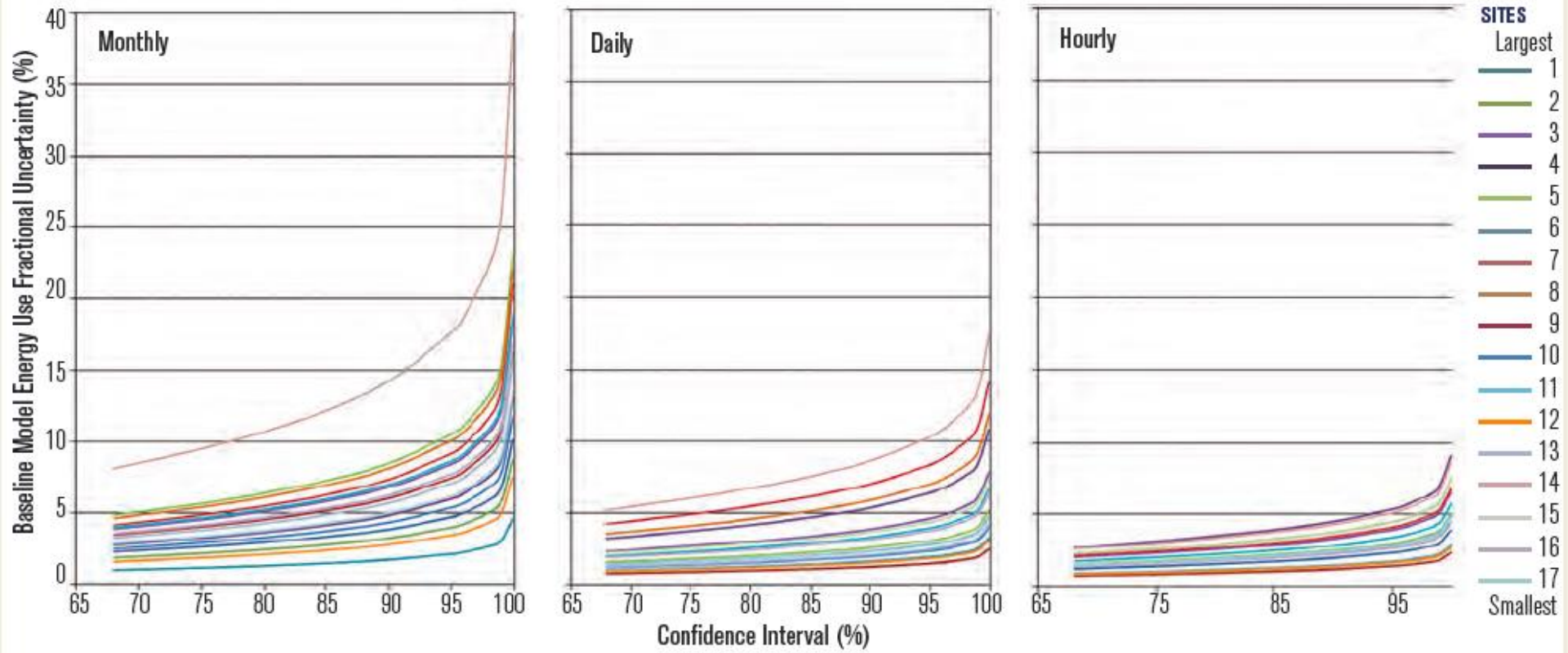
$$MSE' = \frac{1}{n' - p} \sum_{i=1}^{n} \left(E_i - \hat{E}_i \right)^2$$

Source: Franconi, E. and D. Jump, "Leveraging Smart Meter Data and Advanced M&V to Expand Efficiency Services," ASHRAE Journal, Vol. 59, No. 9, September 2017.

Uncertainty Analysis Results

Relative to baseline energy use

FIGURE 4 Uncertainty associated with monthly, daily, and hourly baseline electricity regression models.

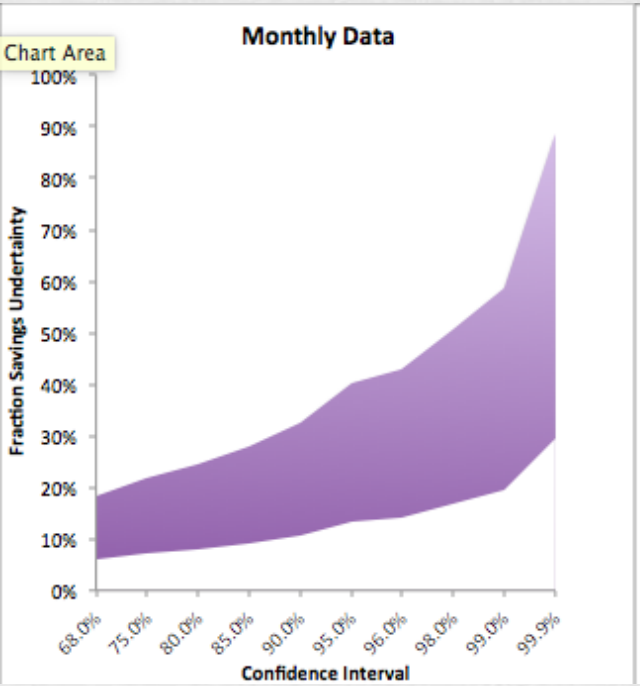


4-parameter change point LBNL TOWT LBNL TOWT

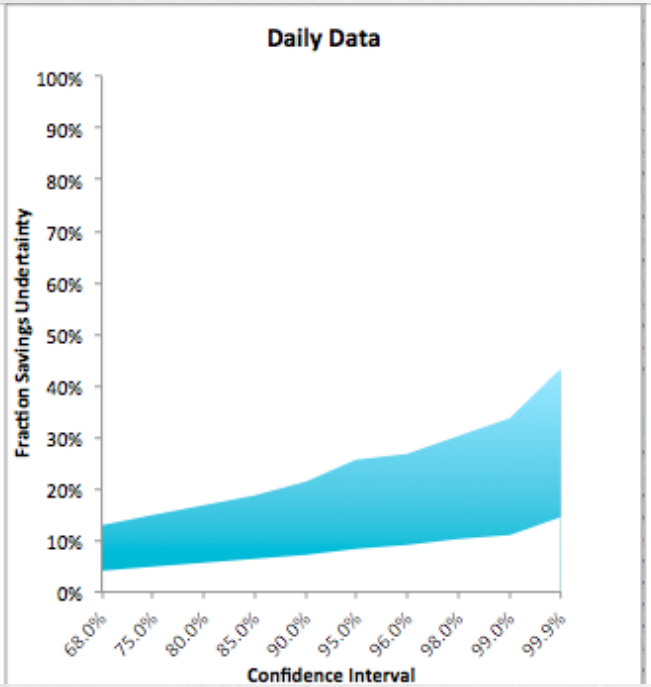
Source: Franconi, E. and D. Jump, "Leveraging Smart Meter Data and Advanced M&V to Expand Efficiency Services," ASHRAE Journal, Vol. 59, No. 9, September 2017.

Uncertainty Analysis Results

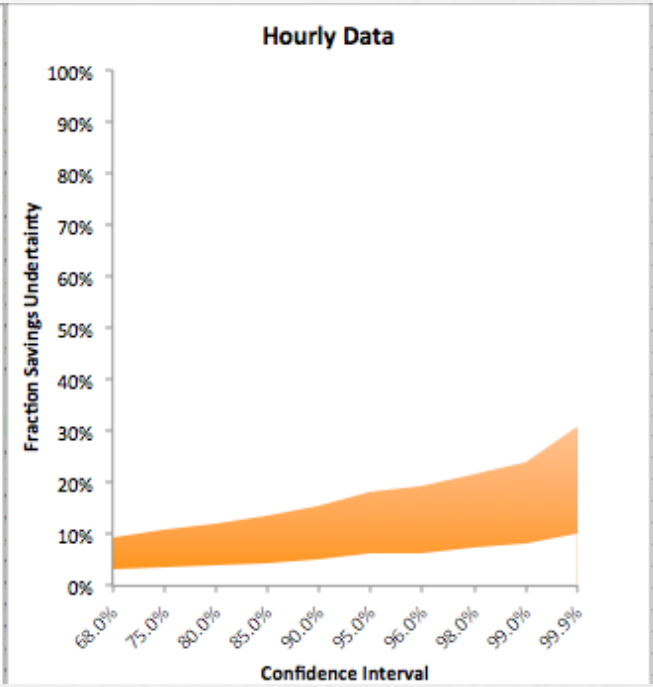
Relative to 5% to 15% savings target



4-parameter change point



LBNL TOWT



LBNL TOWT

Source: Franconi, E. and D. Jump, "Leveraging Smart Meter Data and Advanced M&V to Expand Efficiency Services," ASHRAE Journal, Vol. 59, No. 9, September 2017.

Summary: Expanding Efficiency Services

Advanced M&V Benefits

- More data => higher confidence in savings
- Granular data => shorter M&V period
- Granular data => temporal energy savings
- More robust models => operational savings opportunities and supporting services

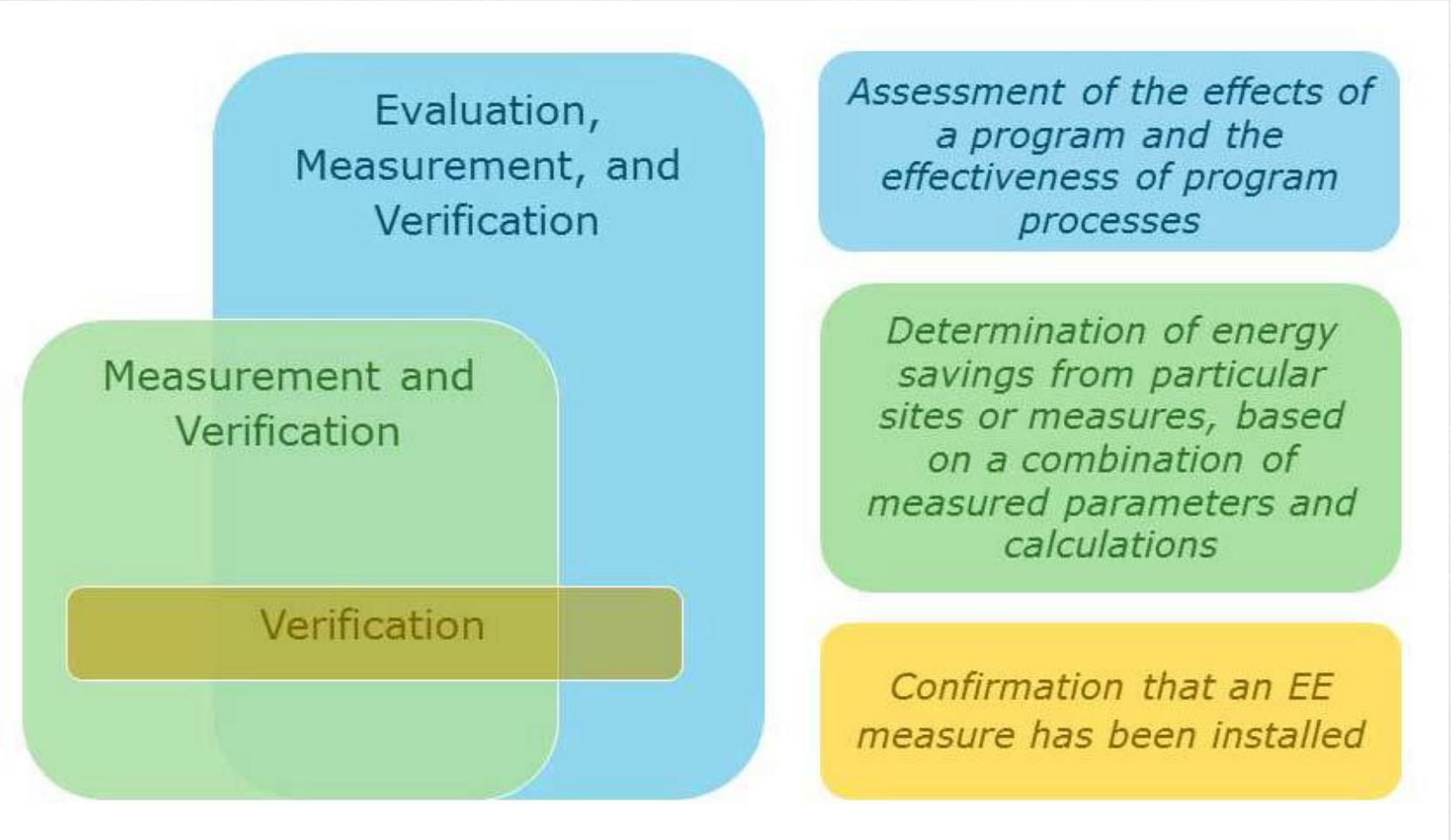
Challenges

- Need industry agreement on advanced M&V model acceptance criteria
- Testing methodology needed for “black box” models
- Need industry agreement of uncertainty analysis methods for non-linear models

Advancing Utility Programs

Measurement & Verification

Utility stakeholder perspectives



Source: The Changing EM&V Paradigm prepared for the Northeast Energy Efficiency Partnership by DNV GL

Advanced M&V

Timely, temporal and locational efficiency savings

- Owners will benefit from **early warnings** of performance issues and enhanced service offerings
- Service providers can apply **more robust methods** to identify and address under performance
- Program administrators can **adjust** program designs **more quickly**
- 3rd party evaluators can **provide early indicators** of savings and potentially hasten the evaluation process
- Regulators will appreciate the increased detail and **improved claims accuracy**
- Grid Planners can **receive temporal and locational** verification of **savings**

https://rmi.org/news/report-release-status-promise-advanced-mv/

Next Generation Utility Programs
Moving towards meter-based savings

SB350

- Double the end use energy efficiency goals
- Pay for performance utility programs with goals, budgets, savings, and incentives linked to metered-based performance

AB802

- Utilities must provide owners with utility metered energy data
- Must determine how to incorporate meter-based performance into program design, incentives, and evaluation

CPUC Guidance

- Encourage savings not yet accounted for – e.g. operational, behavioral, and retro-cx activities
- Lead with high opportunity programs and inform programs that follow

Next Generation Utility Programs
Pay for Performance

Better aligns market forces

- More accountability for rate payers
- More accountability placed on service providers
- More flexibility in efficiency solutions
- Shifts risk from utilities to market operators
- Less PUC expense to obtain data required for program evaluation

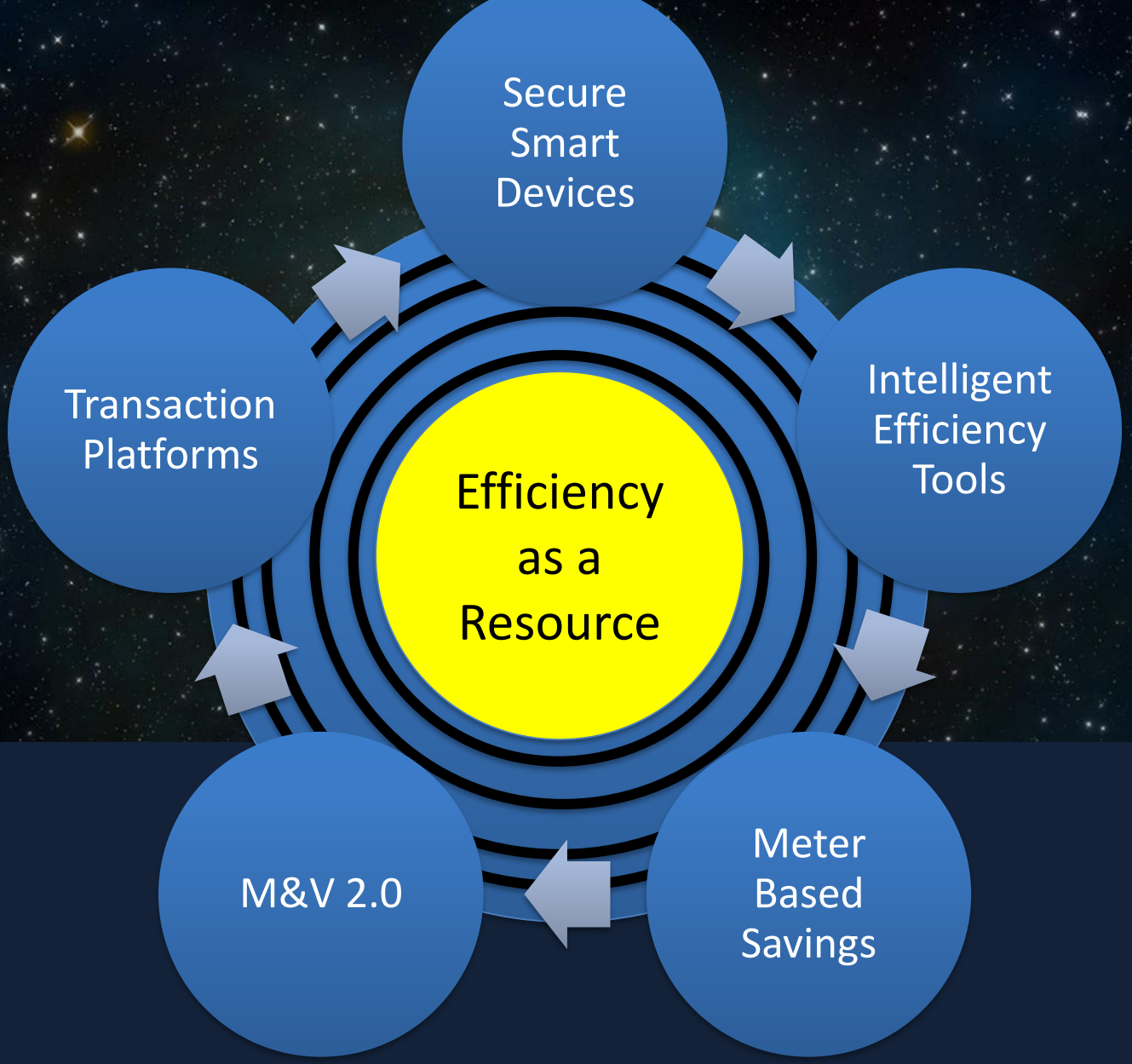
Implications

- Existing conditions baselines appropriate for efficiency as a DER
- Impacts programs with code baselines
- Driving development of standardized platforms for M&V and data sharing

Next Generation Utility Programs

Planning for the future

Scenario	Key Features	Details
Stage 1	Meter-based savings assessed alongside current programs	• Identify appropriate programs • Discuss baseline definitions • **Discuss standardization of M&V** • Ramp up smart meter installation
Stage 2	Viable programs incorporate meter-based savings	• Execute programs through rolling RFP requests of demonstrated technologies • **Standardize methods for determining savings** • 100% smart meter installation
Stage 3	Start initiating efficiency dynamically	• Dynamic implementation driven by TOU rates and aggregator bidding • **Automated DR/EE platform supports DER integration**
Stage 4	Realize price-signal driven transactional energy	• **IT platform** provide data access, security, standardized, and automated transactions • System operator provides 15-minute price signals • Aggregators and Balancing Service Providers deliver DERs



Summary and Discussion