



Energy Technologies Area

Lawrence Berkeley National Laboratory

Demand Side Efficiency, EM&V and the Clean Power Plan

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- Assistance is independent and unbiased

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Disclaimer on CPP Presentation



The information presented herein does not represent any U.S. Department of Energy (DOE) or Lawrence Berkeley National Laboratory (LBNL) positions with respect to the Clean Power Plan (CPP), CPP documents, or strategies/actions that states, electricity generating units (EGUs), or others should, can or may take with respect to CPP compliance.

The information presented is based in part on the following proposed Clean Power Plan documents:

- Federal Plan Requirements for Greenhouse Gas Emissions from Electric Utility Generating Units Constructed on or Before January 8, 2014; Model Trading Rules; Amendments to Framework Regulations; and
- Evaluation Measurement and Verification (EM&V) Guidance for Demand-Side Energy Efficiency.

The above listed EPA documents are in draft form for public input and are subject to change. Thus, the information presented is also subject to change. DOE and LBNL are not taking positions on the proposed documents. State, EGUs, or other parties should contact their local U.S. EPA regional office if they have questions concerning the CPP. Information on the CPP also can be found at the U.S. EPA CPP website: <http://www2.epa.gov/cleanpowerplan/clean-power-plan-existing-power-plants>.

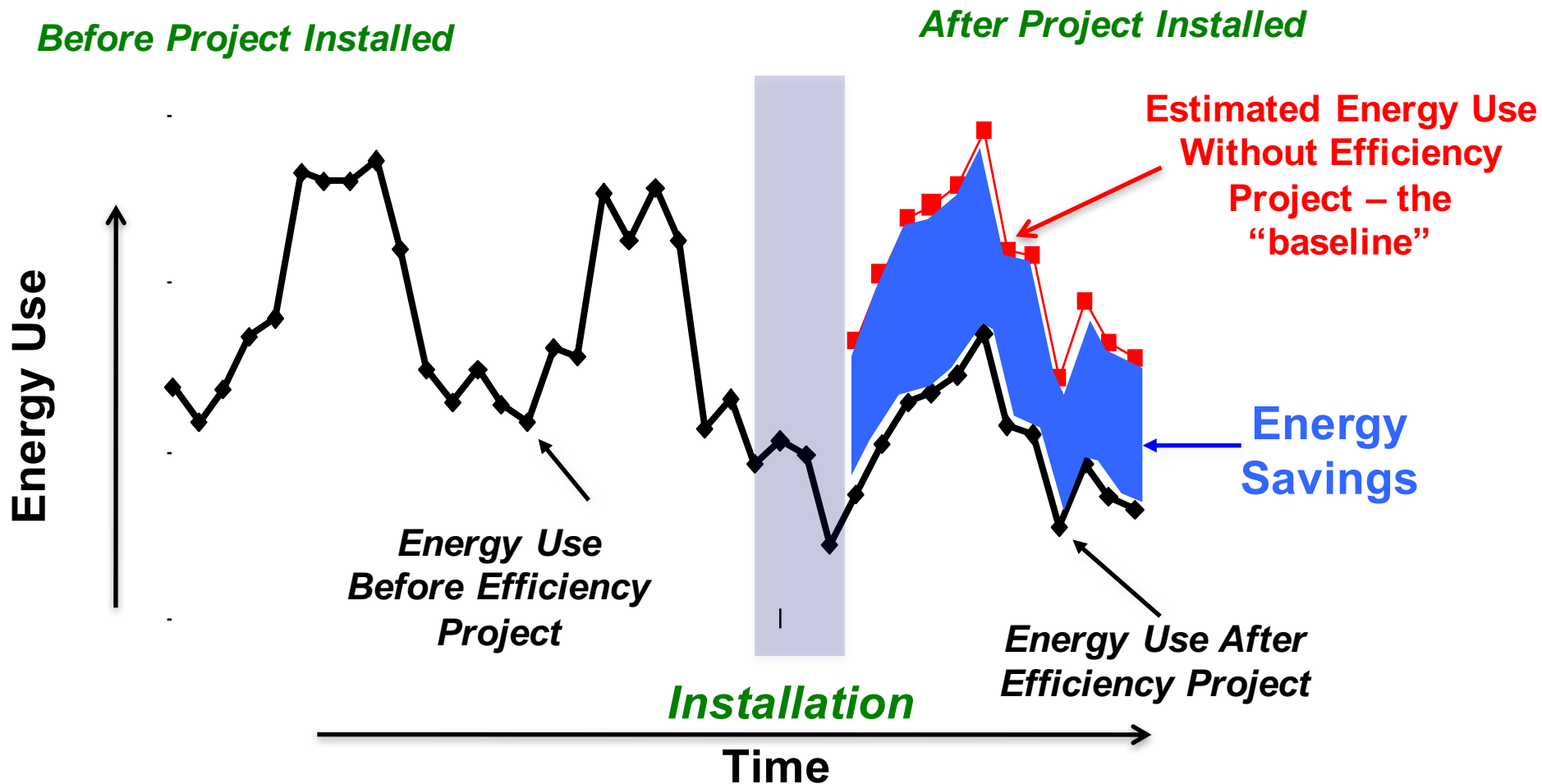
- Quick review of energy efficiency EM&V basics
- Overview – CPP pathways, efficiency in the CPP, and EM&V
- How demand-side energy efficiency (EE) fits into the CPP and overview of EM&V for mass-based plans and CEIP
- EE in rate-based plans
- EM&V requirements and guidance (for EM&V for rate based plans)
- Quick notes on tracking
- Possible next steps for states

EM&V Basics



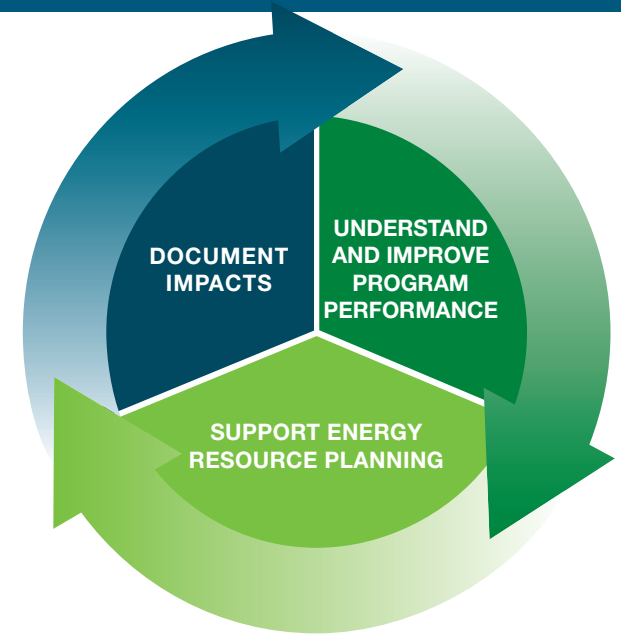
- Measurement and verification is for assessing projects and individual efficiency measures; evaluation is for assessing policies and programs
- Several types of evaluation: impact, process, market effects, cost-effectiveness. The CPP focus is on impact evaluation (EM&V) which produce estimates of energy savings
- Components of impact evaluation: verify potential to generate savings and determine savings
- Impact evaluation metrics are gross savings, net savings and non-energy impacts. The CPP focus is on gross electricity savings with a common practice baseline
- Three approaches to determine gross savings: deemed values, comparison group methods, and project based measurement and verification
- While there is a wide variety of efficiency activity categories, most EM&V has been developed for performance contracting and 'utility programs'

They Are Estimated



Graph of Energy Consumption Before, During And After Project Is Installed

- Key issues for EM&V
 - How good is good enough?
 - Defining baselines
- EM&V is integral to EE planning and implementation and supports documenting impacts, resource planning and understand why the effects occurred
 - *things that are measured tend to improve*
- EM&V is an established field with many resources available to support EM&V implementation; for example see this web portal:
 - EPA/DOE State and Local Energy Efficiency Action Network (SEE Action) – <http://www.epa.gov/cleanenergy/energy-programs/seeaction/index.html>



Thinking about EM&V with the Clean Power Plan



State Plan Types and Overall Approaches



- States pick a **mass-** or **rate-based goal approach**
- States submit a “State Plan” for affected EGUs to implement interim and final goals (or federal plan is implemented)
- Two State Plan types:
 - **Emission standards plan** – EGU source-specific requirements ensuring all affected EGUs meet their goals
 - **State measures plan** – mixture of measures implemented by the state, such as renewable energy standards and efficiency programs

Plan Type	Goal	EPA Model Trading Rule
Emissions Standard Plan	Rate or mass-based goal	Yes
State Measures Plan	Mass-based goal only	Can be made trading-ready but not covered by current versions of the Model Trading Rule

Energy Efficiency Supported in CPP



From EPA: *“Demand-side energy efficiency is an important, proven strategy that states are already widely using and that can substantially and cost-effectively lower CO₂ emissions from the power sector.”*

From US EPA Clean Power Plan Fact Sheet – Energy Efficiency in the Clean Power Plan, September 2015,
<http://www2.epa.gov/cleanpowerplan/fact-sheet-energy-efficiency-clean-power-plan>

CPP encourages states to consider efficiency as a compliance path:

- Under a **mass-based approach**, energy efficiency automatically “counts” toward compliance and states can use an unlimited amount to help achieve their state goals
- Under a **rate-based approach**, CPP enables states to get **credit for all eligible energy efficiency projects whose electricity savings are documented via EM&V**
- The **Clean Energy Incentive Program (CEIP)** provides additional incentives for **early investment** in demand-side energy efficiency in low-income communities

- Demand-side energy efficiency may include a range of eligible measures that are zero-emitting and avoid, rather than simply shift, the use of electricity. **Very wide range of programs, projects and measures** (examples provided in CPP documents).
- Primary **requirement is that the measures can be quantified and verified** in accordance with the EM&V requirements in the CPP Emission Guidelines
- Efficiency must take place at **grid-connected** sites
- Savings from **implemented projects from 2013 onward** that are still **achieving quantifiable and verifiable energy savings in 2022** may be applied during compliance period

Where does EM&V come into state plans



Do I need to do EM&V for CPP?

- Mass –
 - EGU Emission Standards Plan – Not really
 - State Measures Plan – Yes, but not fundamental to compliance calculations, but still helpful for meeting goals
- CEIP –
 - Mass or rate plans - Yes
- Rate –
 - EGU Emission Standards Plan - Yes, fundamental to compliance calculations

For the CPP, EM&V is primarily associated with successfully quantifying and verifying savings for adjusting an emission rate

How EE/RE Fits in the Clean Power Plan

- slide from U.S. EPA



State Plan Approach	Role of EE/RE in State Plan	State Strategies for EE/RE	EM&V Needed?	Considerations
Emission Standards	Mass <i>EE reduces cost, EE/RE lowers CO₂ emissions but are not enforceable or written into the state plan</i>	<ul style="list-style-type: none"> Allocate CO₂ allowances for EE/RE (e.g. through a set aside) Auction allowances, use \$ for EE/RE Secure matching allowances for solar, wind and low-income EE from Clean Energy Incentive Program (CEIP) 	<input type="checkbox"/> * <input type="checkbox"/> <input checked="" type="checkbox"/>	<ul style="list-style-type: none"> * EM&V generally not required for CPP purposes, except for CEIP and set asides specifically created to meet the leakage requirement Unlimited flexibility with EE/RE implementation
	Rate <i>Explicitly written into state plan; Used to generate ERCs and directly adjust reported CO₂ emissions rate of affected EGUs</i>	<ul style="list-style-type: none"> Include EE/RE ERC tracking, trading, and issuance provisions in the state plan Issue ERCs for quantified and verified MWh savings from eligible EE/RE measures Secure matching ERCs from CEIP for solar, wind, low-income EE 	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<ul style="list-style-type: none"> EM&V plans and M&V reports required EE/RE is explicitly tracked & credited Trading-ready plans facilitate broad access to ERCs EE/RE implemented after 2012 can generate credits starting in 2022
State Measures	State Demonstration Based on Mass <i>Explicitly included as supporting material for state plan – enforceable under state law; State EE/RE policies and measures can be used to help affected EGUs meet mass goal</i>	<ul style="list-style-type: none"> Implement state EE/RE policies and programs (e.g., EERS, RPS, building codes) that are enforceable under state law, either to meet goal or in conjunction with federally enforceable limits Secure matching allowances from CEIP for solar, wind and low-income EE 	<input checked="" type="checkbox"/> * <input checked="" type="checkbox"/>	<ul style="list-style-type: none"> Projection of EE/RE impacts required and EGU CO₂ performance required * EM&V Plan for EE/RE measures must be included as supporting material for state plan Backstop emission standards for affected EGUs if CO₂ reductions don't materialize

Efficiency in Mass Plans



- Under a mass-based approach, efficiency automatically “counts” toward compliance
 - The impacts of energy efficiency measures implemented by states that choose the mass-based approach are automatically reflected in their reported EGU stack emissions
- Also:
 - Mass-based approach puts a price on carbon and therefore increases the relative cost of fossil sources relative to zero-carbon resources, which in turn incents efficiency and renewables
 - Under a mass-based goal approach there is no limit on the use of efficiency, and efficiency activities do not need to be approved as part of a state plan

- Efficiency is implemented through what the efficiency industry calls “**complementary programs**” that could operate outside of the CPP requirements.
- These can include the full list of EE activities, such as utility customer-funded programs, building energy codes and energy efficiency resource standards
- States can provide **further incentives for energy efficiency under mass-based approaches by auctioning CO₂ allowances and using portions of the resulting revenue to support efficiency programs.**
 - This funding approach is used for a wide range of efficiency programs as part of the Regional Greenhouse Gas Initiative in the Northeast (www.rggi.org).
- One scenario in which efficiency could receive allowances under a mass-based state plan approach is through a *set aside* for efficiency program and projects

Efficiency in Mass Plans – EM&V for Different Plan Types



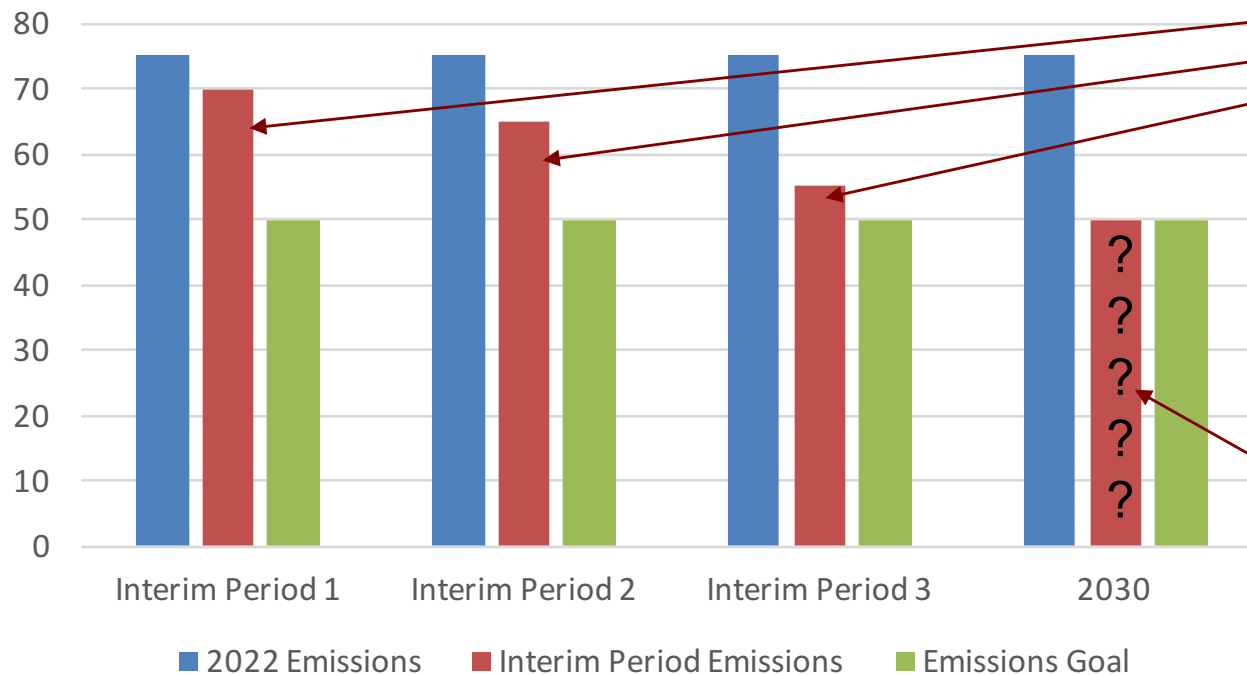
- Emissions Standards Plans - efficiency activities do not need to be described and no EM&V is required for compliance
- State Measures Plans - EE activities and EE EM&V do need to be included in a state plan, if they are part of the state's compliance strategy
- Thus:
 - EE EM&V is less of an issue with mass-based approach, because it is not fundamental to compliance calculations
 - Since EE is implemented with complementary programs, EM&V should still be done for all those reasons that EM&V is done in the first place
- However, EPA has indicated that EM&V will be required for CEIP EE (whether part of mass plan or rate plan):
 - EPA CEIP website: <http://www.epa.gov/cleanpowerplan/clean-energy-incentive-program>
 - The EPA is working with stakeholder input to finalize the design and implementation of the CEIP. See CEIP Next Steps document - http://www.epa.gov/sites/production/files/2015-10/documents/ceip_next_steps_10_21_15.pdf

Example – Efficiency and Mass Based Goal

Why EM&V is Still Important

- Assume 2022 state CO₂ emissions are 75 MM tons, final goal is 50 MM tons, and thus required reduction is 25 MM tons.
- Assume demand-side efficiency is expected to account for 5 of 25 MM ton reduction

Emissions over time – MM tons/year



Even if not required for compliance EM&V tells you – is EE working, could it do better, what can a state do to improve the savings from EE, etc.

Will the state meet its goal, will EE do its part?

- Rate based approaches are where there are significant CPP EM&V and tracking requirements for EE
- Quantified and verified MWh from eligible measures can be used to generate **Emission Rate Credits (ERCs)** and adjust the CO₂ emission rate of affected EGU(s), regardless of where the emission reductions occur
- Rate-based state plans may provide for the interstate transfer of efficiency ERCs, which would enable an ERC issued for efficiency savings by one state to be used for compliance by an affected EGU operating under a rate-based emissions standard in another state

Efficiency in Rate Plans, continued

EE can be used to generate ERCs that are used to help meet the rate target – in fact, if not calculated, EE could make an emissions rate higher (if the EE displaced zero- or low-carbon EGUs)

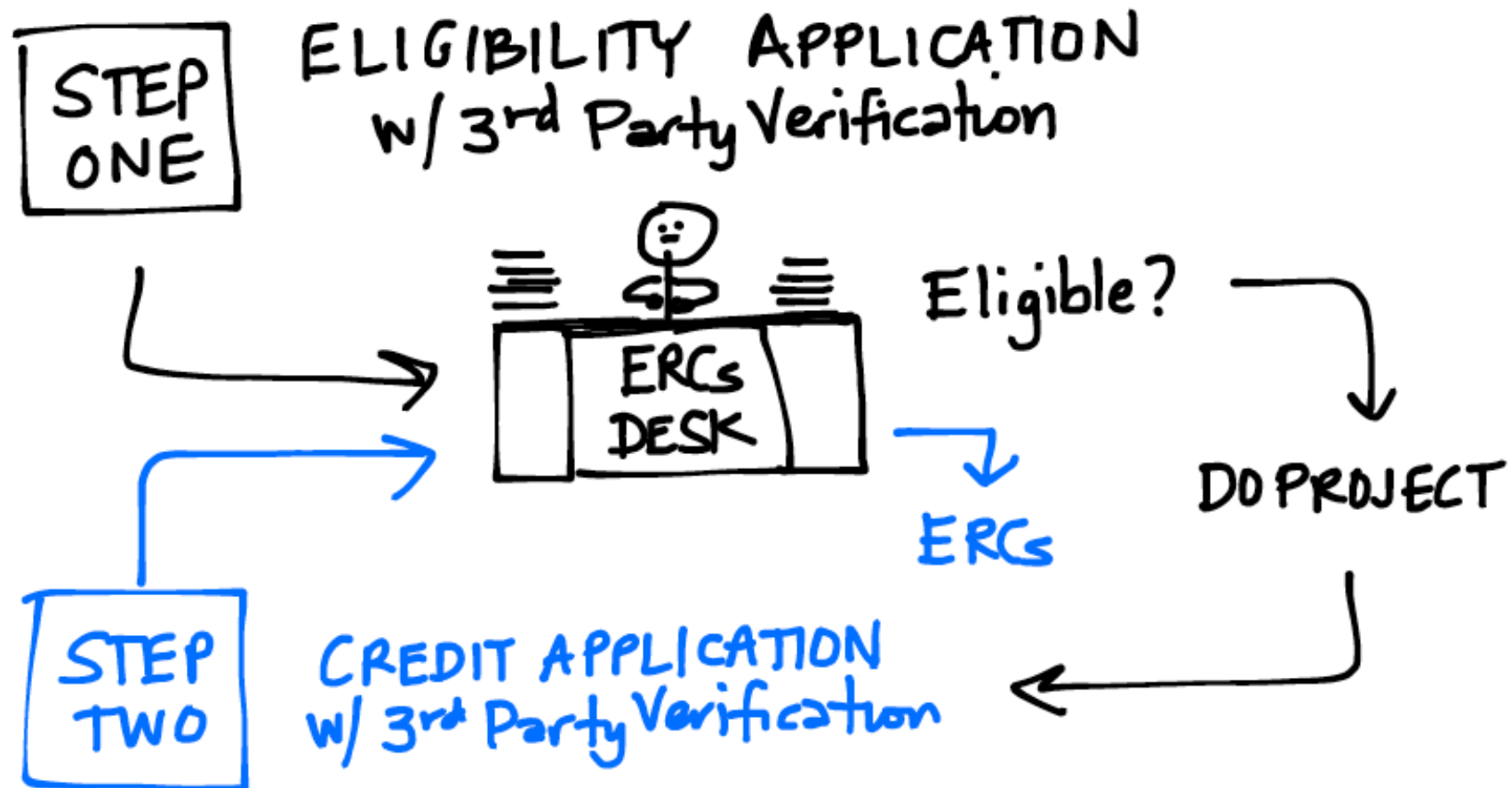
$$CO_2 \text{ emission rate} = \frac{\sum M_{CO_2}}{\sum MWh_{op} + \sum MWh_{ERC}}$$



*Metric is
Annual MWh*

Example:

- Emission = 1,000,000 lbs/year
- Generation = 1,000 MWh/year
- Emission rate = 1,000 lbs/MWh
- Target = 800 lbs/MWh
- ERCs required = 250 MWh/yr → CPP CO₂ Rate = 800 lbs/MWh



! Liability for improperly issued ERCs lies with the affected EGU who uses them for compliance !

Efficiency EM&V Coverage in the CPP



	Type of EM&V Information	Summary
<p>CPP Emissions Guidelines https://www.gpo.gov/fdsys/pkg/FR-2015-10-23/pdf/2015-22842.pdf</p>	Requirements	Must do for CPP compliance to quantify and verify savings
<p>Proposed Model Trading Rule <i>Proposed</i> https://www.gpo.gov/fdsys/pkg/FR-2015-10-23/pdf/2015-22848.pdf</p>	EM&V provisions that will be presumptively approvable if included in state regulations governing how EE is to be quantified by EE providers and verified by independent entities acting on behalf of the state.	Strongly recommended characteristics of EM&V for approvable State Plans. Any alternative EM&V approaches proposed by a state would have to “... demonstrate to the EPA’s satisfaction that its alternative provisions are as stringent as the presumptively approvable approach...”
<p>Proposed EM&V Guidance for Demand Side EE <i>Proposed</i> http://www.epa.gov/cleanpowerplanningtoolbox/draft-evaluation-measurement-and-verification-guidance-demand-side-energy</p>	Applicable guidance	Further information and recommendations covered in this companion document

The CPP documents cover wide range of EM&V topics to support State's planning and implementation of EE EM&V

- EM&V Plans and Reports
- EM&V Methods
- Electricity savings metrics and baselines
- Reporting timeframes and considerations
- Deemed savings
- Independent factors
- Accuracy and reliability
- Avoiding double counting
- Persistence of savings
- Savings quantification/verification cycles
- T&D savings adders
- Interactive effects
- EE EM&V Protocols and Guidelines

- Tracking and compliance systems
- Independent verification and review
- Additional EM&V guidance for several common EE program and project types
 - Programs implemented using utility customer funds ("utility EE programs")
 - Individual or aggregated EE projects, such as those implemented by ESCOs or at industrial facilities
 - Building energy codes
 - Appliance energy standards
- Glossary of key terms
- Templates for program and project EM&V plans
- Examples for several common measure types

Emissions Guidelines (EG) requirements are general and relatively limited

(see Federal Register version for complete version and descriptions)

- State plan would **include EM&V plan** for quantifying and verifying electricity savings using industry **best-practice EM&V protocols and methods** that yield accurate and reliable measurements of electricity savings; including explanations of the key assumptions and data sources used.
- **EE provider submit periodic M&V reports** to confirm and describe how each of the EM&V requirements was applied (i.e., the plan was followed). These reports must also specify the actual MWh savings or generation results, for the period covered, as quantified by applying EM&V methods on a **retrospective (ex-post) basis**.

States may not allow MWh values that are quantified using ex-ante (pre-implementation) estimates of savings

- **Independent verification** – A verification report from an accredited independent verifier that verifies the eligibility of the eligible resource to be issued an ERC and that the EM&V plan meets the requirements of the EPA approved State plan

- **Baselines that represent what would have happened in the absence of the EE intervention**, such as the equipment that would most likely have been installed—or that a typical consumer or building owner would have continued using—in a given circumstance at the time of EE implementation
- Effects of changes in **independent factors** affecting energy consumption and savings; that is, factors not directly related to the EE action, such as weather, occupancy, or production levels
- The **length of time the EE action is anticipated to continue** to remain in place and operable
- **Skill certification** is also discussed – (see page 64910)
 - The EPA is therefore **recommending** in conjunction with the EM&V requirements ... that states are encouraged to include in their plans a description of how states will ensure that the skills of workers installing demand-side EE ... as well as the skills of workers who perform the EM&V of demand-side EE and RE performance will be certified by a third party entity

From Emission Guidelines:

Tracking system must: (starting on page 64906)

- Record the issuance, transfer and surrender of ERCs for compliance or retirement
- Provide electronic public access
- Provide for transfers of ERCs to/from another ERC tracking system

From Model Trading Plan:

EM&V plans must describe how: (page 65007)

“...double counting will be avoided through the use of tracking and accounting procedures to ensure that the same MWh of electricity savings is not claimed more than one time (for example, two EGUs claiming savings from the same lighting retrofit). The types of double counting that may arise are discussed in the EPA’s draft EM&V guidance.”

From EM&V Guidance: (page 21)

Implement “**systematic tracking and accounting procedures**, including the use of well-structured and well-maintained tracking and reporting systems such as those already being used by many states and EE providers.”

Possible Next Steps for States



Using Your Current Practices? Selected Topics - *how does this compare with what your state does?*



Selected Topics	What CPP Says
EM&V approaches	<p>From EG: All electricity savings must be quantified and verified based on methods and procedures detailed in an industry best-practice EM&V protocol or guideline. “States may not allow MWh values that are quantified using ex-ante (pre-implementation) estimates of savings.” <i>From Model Plans –presumptively approvable – “all electricity savings must be quantified by applying one or more of the following methods: PB-MV, comparison group approaches, or deemed savings.”</i></p>
Baselines	<p>From EG: “<i>Common practice baseline or CPB</i> means a baseline derived based on a default technology or condition that would have been in place at the time of implementation of an EE measure in the absence of the EE measure (for example, the standard or market- average or pre-existing equipment that a typical consumer/building owner would have continued to use or would have installed at the time of project implementation in a given circumstance, such as a given building type, EE program type or delivery mechanism, and geographic region). <i>From Model Plans – CPB is presumptively approvable</i></p>
Independent verification	<p>From EG: “... results are verified by an accredited independent verifier, and its verification assessment must be included as part of the M&V report submitted to the state regulatory body.” Further guidance provided in Model Trading Rule</p>
Persistence of savings	<p>From Model Trading Rule: “All EE programs, EE projects, or EE measures must be quantified at time intervals (in years) sufficient to ensure that MWh savings are accurately and reliably quantified.”</p> <ul style="list-style-type: none"> • C&S: every four years • Utility and public funded programs: every 1, 2 or 3 years • Commercial and industrial projects: every year (unless can justify...)

Possible EM&V Infrastructure Development Areas



- Guidance resources – examples (state or regional)
 - Standard reporting formats for projected, claimed and evaluated energy savings
 - Database of consistent values for deemed (stipulated) energy savings and effective useful life (persistence values)
 - Standardized efficiency EM&V plans. (methodologies) for determining energy savings
- Tracking systems – EE registry
- Human resources - examples
 - Training on EM&V
 - Retaining EM&V professionals – staff or consultants
 - EM&V professional standards or accreditation processes
- Establishing EM&V criteria and frameworks (regulations and policy) – examples
 - EM&V administrator
 - Allowable evaluation methods
 - Budgets
 - Schedules
 - Reporting
 - Stakeholder participation

LBL is preparing a report for the Western Interstate Energy Board (WIEB) on options for coordinating EM&V among western states for implementation of the clean power plan and other utility-sector air pollution control programs

Planned publication – February 2016
See <http://westernenergyboard.org>

For further information and support please contact:

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LBNL may be able to provide technical assistance for state agencies, funded by U.S. DOE - see <https://emp.lbl.gov/projects/technical-assistance-states>