

# “Best practices for developing cost-effective evaluation, measurement, and verification plans: Lessons learned from 12 northern California municipal utilities”

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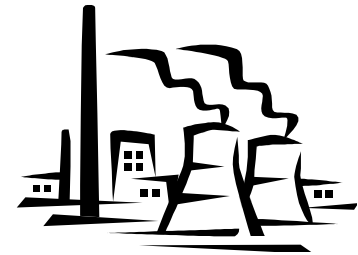
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# What is a Public Power Utility?

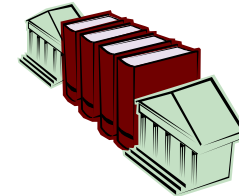
- Public power utilities not-for-profit electric systems owned and operated by the people they serve through a local or state government.
- Governed by elected or appointed citizen boards.
- Total of 2,010 Public Power Utilities in the US
  - 1,843 are operated by cities and towns;
  - 109 are operated by political subdivisions, such as public utility districts;
  - 43 are joint action agencies (a consortium of public power systems, usually located within a single state);
  - 15 are utilities established by states



# Overview

California Senate Bill 1037 (Kehoe), signed into law in September 2005, established several important policies regarding energy efficiency.

- Created a statewide commitment to cost-effective and feasible energy efficiency
- All utilities consider energy efficiency before investing in any other resources to meet growing demand.
- Assembly Bill 2021 (Levine) added supplemental provisions in 2006, including the need to verify energy efficiency program results.



# NCPA Participating Utilities

NCPA is a joint powers agency that provides support for electric utilities operations of seventeen member communities and districts in Northern and Central California. Participating utilities in the E, M&V approach:


- Alameda Power & Telecom
- City of Biggs
- City of Gridley
- City of Healdsburg
- City of Lompoc
- City of Ukiah
- Lodi Electric Utility
- Plumas-Sierra Rural Electric Cooperative
- Redding Electric Utility
- Turlock Irrigation District
- City of Shasta Lake (Non-NCPA member)
- Lassen (Non-NCPA member)





# CA Public Municipal Utilities Reporting Requirements

- Identify all potentially achievable cost-effective electricity efficiency savings
- Establish realistic annual savings targets
- Report annually the energy and demand targets
- Report program cost effectiveness reporting using standard tests defined in the California Standard Practices Manual and the National Action Plan for Energy Efficiency



# Guiding Principles of NCPA's Approach to Energy Efficiency

- Social and Environmental Responsibility
- Operational Energy Efficiency
- Demand-side Energy Efficiency
- Cost-effective Energy Efficiency

# NCPA Program/Member Characteristics

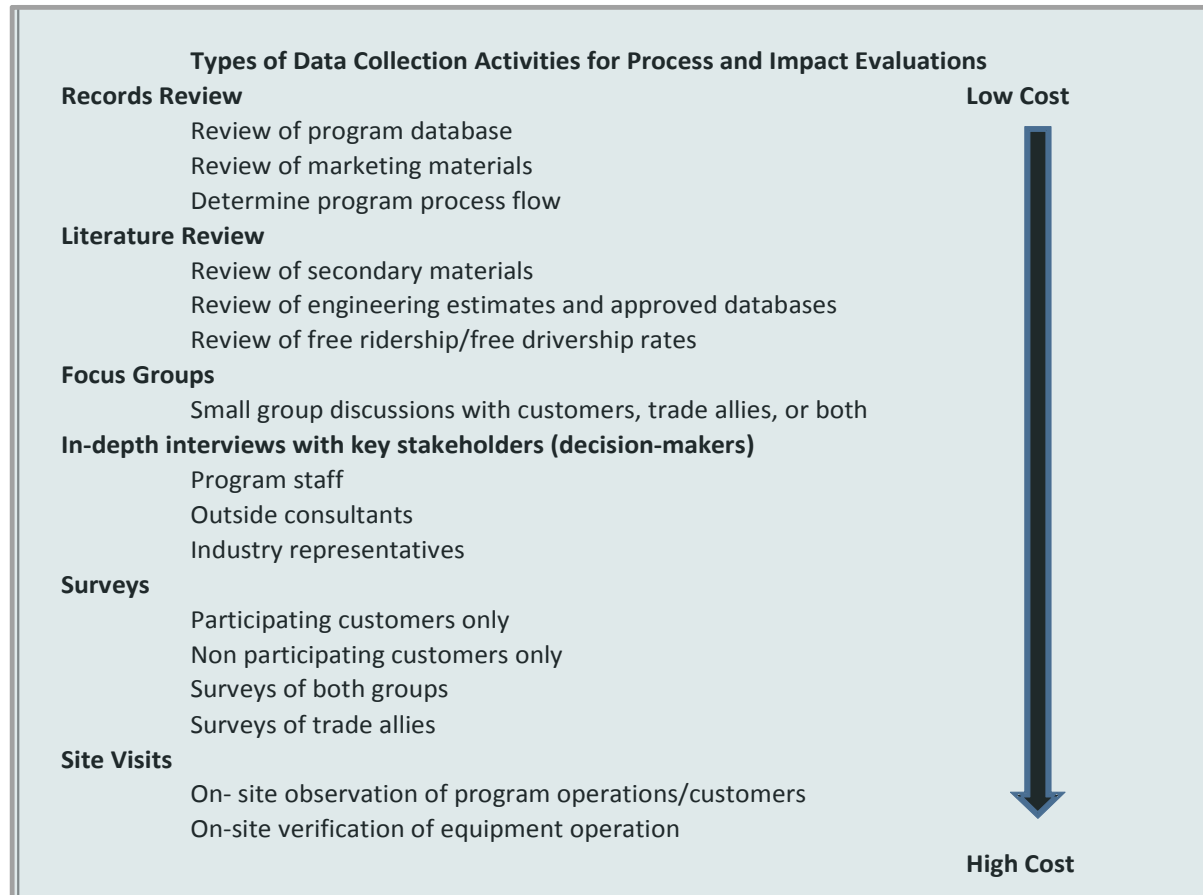
- **Varied Utility Size**
  - Small utilities with 500 customers to large utilities with 100,000+ customers
- **Varied Funding Levels**
  - From slightly under \$50K funding in the City of Lompoc, to approximately \$3.7 million in Silicon Valley Power (SVP), with the average funding level of \$249,000 annually
- **Varied Experience with Energy Efficiency Programs**
  - Some NCPA utilities have maintained energy efficiency programs for years while others are just starting.
- **Overall Project Goal**
  - Develop an E, M&V framework to properly document the results achieved through these programs.
  - Included both process and impact evaluations

# Definition of Process and Impact Evaluations

The American Evaluation Association defines evaluation as *“assessing the strengths and weaknesses of programs, policies, personnel, products and organisations to improve their effectiveness.”*

- **Process evaluation** describes and assesses program materials and activities.
- **Impact evaluation** examines the long-term effects from a program, including those unintended effects.

# Types of Data Collection Activities



# Successful and Cost Effective Elements of a Process Evaluation

- Review the database tracking system to streamline program reporting
  - Enhanced regulatory compliance reporting process by standardizing templates/reports
- Review measures targeted in utility's residential and commercial energy efficiency program portfolios
  - Identify most cost-effective measures and which ones had achieved market transformation



# Example of Types of Data Captured

Measure	Measure Group	Number of Participants by Measure	Units per Installation	Units	Measure Fuel	Savings - Gas (Therms)	Savings - Electricity (kWh)
Custom	Custom	2	1,153,936	kWh	Electric	0	1,153,936
Heat Pump, Water Source < 11.2	HVAC	1	0	ton	Electric	0	0
Exit Sign New Exit Sign	Lighting	1	34	fixture	Electric	0	11,696
Hard-Wired Flourescent > 27 watts	Lighting	1	554	fixture	Electric	0	368,410
Hard-Wired Flourescent 5-26 watts	Lighting	1	154	fixture	Electric	0	43,120
Int. HID 0-35 watts	Lighting	1	81	fixture	Electric	0	20,817
Int. HID 36-70 watts	Lighting	1	24	fixture	Electric	0	12,360
Occupancy Sensor Wall or ceiling-mount lighting	Lighting	2	34	sensor	Electric	0	26,350
Occupancy Sensor Wall-box lighting sensor	Lighting	2	117	sensor	Electric	0	30,537
Pre.T5 or T8 w/ Elect. Ballast 4 ft.	Lighting	3	5,532	lamp	Electric	0	309,792
Reflec. w/Lamp Removal 4 ft.	Lighting	1	482	lamp removed	Electric	0	76,638
Motor 1 hp	Motor	1	1	motor	Electric	0	112
Motor 100	Motor	1	6	motor	Electric	0	91,476
Motor 5 hp	Motor	1	1	motor	Electric	0	336
Motor 50 hp	Motor	1	2	motor	Electric	0	19,876
Motor 60 hp	Motor	1	1	motor	Electric	0	10,009
Var. Freq. Drives Var. Freq. Drives	Motor	5	250	horsepower	Electric	0	188,250
Comm. Boiler Dom. Hot Water Heat (<300k Btuh, T1)	Hot Water	1	250	1k Btuh	Gas	17	0
Comm. Boiler Dom. Hot Water Heat (>=300k Btuh, T2)	Hot Water	1	1,500	1k Btuh	Gas	1,476	0
Comm. Boiler Hot Water Space Heat (>=300k Btuh, T2)	HVAC	1	500	1k Btuh	Gas	360	0
<b>TOTAL</b>		<b>29</b>				<b>1,853</b>	<b>2,366,262</b>

# Review Program Procedures and Inter-Relationships

- Review marketing materials used to recruit customers to participate in the energy efficiency programs.
  - Identified additional messages that the NCPA utilities may want to include in future program marketing efforts.
- Supplemented by interviews with program staff on the following topics:
  - Program process flow and inter-relationships
  - Program metrics including current enrollment, customer satisfaction, and savings estimates
  - Marketing and outreach activities
  - Areas for improvement



# Successful and Cost-Effective Elements of an Impact Evaluation

## Establish Good Quality Participation Data

- Conducted a coordinated review of the program files and databases
- Identified the type (deemed or custom calculated) and source of claimed energy savings
- Provided estimates of impacts by site and the review would also identify contact information at each site

# Match the Data Collection Strategy to the Data Needs

- On-site data collection is expensive and time consuming
  - So most saving estimates are derived from the deemed saving values
  - Some form of installation verification is needed; either on-site, by telephone, or through invoice reviews
- More complex measures, those installed under non-residential custom program, may more rigorous evaluation techniques.
  - May include an engineer reviewing the submitted custom calculations and assumptions, short term metering, or with specific weather sensitive measures

# Apply the Appropriate Analytic Approach

IPMVP M&V Option	Measure Performance Characteristics	Data Requirements
<b>Option A:</b> Engineering calculations using spot or short-term measurements, and/or historical data	Constant performance	<ul style="list-style-type: none"> <li>• Verified installation</li> <li>• Nameplate or stipulated performance parameters</li> <li>• Spot measurements</li> <li>• Run-time hour measurements</li> </ul>
<b>Option B:</b> Engineering calculations using metered data.	Constant or variable performance	<ul style="list-style-type: none"> <li>• Verified installation</li> <li>• Nameplate or stipulated performance parameters</li> <li>• End-use metered data</li> </ul>
<b>Option C:</b> Analysis of utility meter (or sub-meter) data using techniques from simple comparison to multi-variate regression analysis.	Variable performance	<ul style="list-style-type: none"> <li>• Verified installation</li> <li>• Utility metered or end-use metered data</li> <li>• Engineering estimate of savings input to SAE model</li> </ul>
<b>Option D:</b> Calibrated energy simulation/modeling; calibrated with hourly or monthly utility billing data and/or end-use metering	Variable performance	<ul style="list-style-type: none"> <li>• Verified installation</li> <li>• Spot measurements, run-time hour monitoring, and/or end-use metering to prepare inputs to models</li> <li>• Utility billing records, end-use metering, or other indices to calibrate models</li> </ul>

# Assignment of IPMVP EMV& Protocols to a Sample of Program Measures

Measure Category	IPMVP Option				Comments
	A	B	C	D	
High-Efficiency lighting equipment	✓				Constant performance, low uncertainty in performance parameters
Lighting controls (occupancy sensors)	✓				
Lighting controls / daylighting		✓		✓	Can be analyzed with either end-use metered data set or simulation model
High-Efficiency HVAC equipment		✓		✓	Pre-/post-installation metering can be used alone or to prepare inputs to simulation models
HVAC Diagnostics		✓		✓	Datasets such as outputs from diagnostic tools may be used as analysis inputs
HVAC Quality Installation		✓		✓	Datasets such as outputs from diagnostic tools may be used as analysis inputs
High-efficiency motors	✓				
Variable speed drives		✓			
Building envelope measures				✓	
Weatherization			✓	✓	Billing record analysis is often used; since measures are envelope, simulation modeling is also effective
New construction whole house performance			✓		
Refrigeration measures		✓	✓		
Process measures			✓		
Appliances	✓	✓			
Water heaters and hot water measures	✓				

# Key Lessons Learned/Best Practices

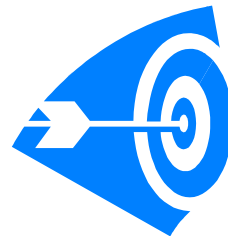
## Use Established Industry Protocols

- The resurgence of interest in the development, deployment, and evaluation of DSM programs has led to a greater standardization of industry requirements.
- Leveraged other existing work such as the National Action Plan Guidelines and the IMPVP E, M&V protocols and California Energy Efficiency Evaluation Protocols.



# Target the Most Important Programs

Evaluation Priorities by Utility	Residential Programs	Commercial Programs
Alameda Power & Telecom		√
City of Biggs	√	
City of Gridley	√	
City of Healdsburg	√	
City of Lompoc	√	
City of Ukiah	√	
Lassen	√	
Lodi Electric Utility		√
Plumas-Sierra Rural Electric Cooperative	√	
Redding Electric Utility	√	
Shasta Lake	√	
Turlock Irrigation District		√



# Allow Time in the Process for Mutual Education and to Build Trust

Small utilities face a steep learning curve when tackling program evaluation for the first time.

- CPA and the Summit Blue team developed a series of workshops and planning meetings.
  - Allowed the utilities to learn about evaluation concepts while helping the evaluation team to understand the unique aspects of each individual utility.
  - Led to better understanding by all on how to develop effective evaluation plans.





# Review, Streamline, and Integrate Data Collection and Data Tracking Systems

- Utility data collection and data tracking systems are typically set up to meet program administrator needs for internal reporting.
  - Essential to review and make recommendations for integrating evaluation-specific data collection into the program implementation process.
  - Not only will this reduce the costs of future program evaluations, it is also very likely to reduce costs of program implementation.
- Several utilities have already implemented the suggested changes in advance of the next program evaluation.
- These E,M&V activities provided an excellent learning opportunity and better managed programs

# Being Small Does Not Require Sacrificing Quality

- Small utilities can work together to collaboratively implement E,M&V for their energy efficiency programs.
  - Standardize around the EPA's ENERGY STAR Equipment Standards
  - Create a common database (DEER) with stipulated savings
  - Developing multi-year evaluations
- A common misconception in developing E,M&V programs is that the process has to be expensive.
  - For this collaborative effort, the evaluation team was able to identify cost-effective alternatives that met their needs without sacrificing the quality of the work or the validity



# Conduct Evaluations Across Multiple Utility Territories

NCPA utilities will consider pursuing a collaborative effort across their entire service territories as a way to cost effectively evaluate the following energy efficiency program measures that are not large enough to warrant separate E,M&V efforts.

- **Residential CFL Lighting:** These utilities plan to conduct a joint CFL lighting impact evaluation study to better assess current CFL savings estimates in a similar manner.
- **Residential Audits:** Several NCPA member utilities are considering participating in a larger impact evaluation.

# Report Findings Consistently to Facilitate Information Sharing


These E, M&V reports needed to offer reporting consistency for NCPA as a whole,

- The team developed a consistent, albeit somewhat generic, outline that was then modified for each utility report.



# Conclusion

- Utilize readily available and industry-accepted resources to optimize evaluation efforts
- Prioritize and target programs for evaluation
- Allow time to educate and build trust
- Review, streamline, and integrate data collection and data tracking systems
- By working together to collectively implement E, M&V utilities can produce consistent results and achieve economies of scale, while still allowing for tailored solutions to meet individual utility needs.
- Report findings in a consistent manner to facilitate information sharing



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