NetOne

Commercial Efficiency Program

DRAFT - Program Implementation Plan

March 12, 2021

Program Overview

The NetOne Commercial Efficiency Program is a downstream program that will provide energy efficiency services, technical services and incentive processing. Over four years, our innovative program design provides a suite of incentives to commercial customers to install refrigeration, HVAC, lighting, and meter-based energy savings using the Deemed, Custom, and NMEC platforms.

Program Budget and Savings

Program Name: NetOne Commercial Efficiency Program

Program ID Number: PGE_Com_003

Exhibit 1. Program Budget Table

Category	2021	2022	2023	2024	2025	Total
Admin	$219,534	$453,846	$469,708	$188,317	$47,079	$1,378,484
Marketing and Outreach	$131,721	$272,308	$281,825	$112,991	$28,248	$827,093
Direct Implementation-Non-Incentive (DINI)	$810,6747	$1,679,147	$1,742,541	$699,250	$174,814	$5,106,424
Incentives	$1,455,454	$3,159,902	$3,490,268	$1,785,820	$0	$9,891,444
Total	**$2,617,383**	**$5,565,203**	**$5,948,342**	**$2,786,378**	**$250,141**	**$17,203,445**

Exhibit 2. Program Gross Impacts Table

NetOne CEP	2021	2022	2023	2024	2025	Total
Gross Energy Savings (kWh)	6,552,330	13,305,649	13,414,295	6,660,976	0	**34,479,519**
Gross Energy Savings (kW)	547	1,322	1,600	825	0	**3,543**
Gross Energy Savings (Therms)	150,880	376,725	482,859	257,014	0	**976,395**

Program Cost Effectiveness (TRC): 1.72 no admin. 1.25 w/admin.

Program Cost Effectiveness (PAC): 1.94

Type of Program Delivered: Local -Third-party

Market Sectors: Commercial, including the following NAICS Codes:

- 5311XX – Office
- 5411XX, 53XXXX and 2372 – Real Estate
- 4441XX – Home Centers
- 71-72XXX – Leisure, Hospitality and Accommodation
- 31-33XXX – Manufacturing
- 722XXX – Food Service
- 55-56XXX – Professional and Business Services
- 452XXX – Warehouse and Super Centers
- 4451XX – Grocery 4931XX – Warehousing and Storage
- 4411XX – Auto Dealerships
- 4539XX – Other Miscellaneous Store Retailers
- 48-49XXX – Transportation and Warehousing
- 44-45XXX – Retail Trade
- 11XXX – Agriculture

Program Type: Resource

Market Channels and Intervention Strategies, Campaign Goals, and Timeline:

- Market Channel: Downstream
- Intervention Strategies: Direct Install, Incentive, Finance, Audit and Technical Assistance.

- Campaign goals: 34,479,519 Gross kWh, 976,395 Gross therms.
- Timeline: 2021 – 2025

Implementation Plan Narrative

1. Program Description

With NetOne, Ecology Action's program design unlocks commercial market potential by bridging the gap between PG&E's goals, regulatory requirements, and the customer's needs. Ecology Action has built a reputation as one of PG&E's most adaptive and reliable implementers. Innovation and change management are the organizational strengths that have made this possible. Ecology Action has integrated these strengths into the program in anticipation of dynamic regulatory and market shifts during the rolling portfolio.

NetOne's flexible, customer-centric approach makes energy management simple and attainable. We ensure that customers receive outstanding service, substantial energy savings, tremendous value, and personalized project management.

We encounter a wide range of priorities, buying criteria, and energy management sophistication. Therefore, NetOne offers both Portfolio Planning and Implementation Services. Ecology Action is well-versed in providing end-to-end service, from marketing, auditing, specification, and engineering, to project management, compliance, and streamlined reporting. We meet customers where they are and close the gaps to move projects forward.

2. Program Delivery and Customer Service

Program Delivery

The NetOne Commercial Program will deliver downstream energy savings to commercial customers of all sizes and geographies. The platforms that will be used are:

1. NMEC – Population and Site Level
2. Custom
3. Deemed

Customer Acquisition and Outreach

NetOne will acquire customers in two distinct segments: larger enterprise-level accounts and smaller scalable accounts.

Enterprise-Level Deals

A targeted approach to enterprise-level outreach follows five key phases:

1. **Prioritize high-value accounts.** Align sales and marketing around target accounts that represent opportunity and may lack in-house capacity to act.
2. **Map contacts to accounts.** Identify contacts at these high value accounts.
3. **Develop account insights.** Research each account to understand customer specific needs, buying criteria and timelines.
4. **Generate account-relevant content.** Create content that reflects those account insights.
5. **Orchestrate account-focused campaigns.** Synchronize interactions into coordinated plays that align with account goals.

Scalable Smaller Customers

Our Open Partner Network provides scalability because it offers geographic reach, expertise on multiple technologies, and trusted relationships with customers, including HTR customers. We will drive customer acquisition in three ways:

1. **Co-Selling with Partner.** This works well when the deal is more complex and requires a deeper level of expertise. We also use this format to onboard new partners who are unfamiliar with the rebate process and compliance complexities.

2. **Partner Driven Sale.** Our partner develops the opportunity and our sales account manager closes the deal. This scenario works well with experienced partners who generate interest from customers and rely on support from our sales team to close the deal.

3. **Co-Selling with PG&E BES Team.** Relationships with BES reps are a great source for qualified leads. If customers do not have a preferred vendor, we can also pair them with partners in our network.

Timeline

The cyclical nature of this customer acquisition strategy means NetOne doesn't follow a traditional "waterfall" project timeline.

Both strategies are designed to be continuous with flexibility to scale. In terms of the results, most of our savings will come from enterprise-level accounts.

Enterprise-Level Accounts

Phase	Time Span
1. Prioritize high-value accounts	1-3 weeks, repeat as required
2. Map contacts to accounts	1-3 weeks, repeat as required
3. Develop account insights	Closed/disqualified
4. Generate account-relevant content	Closed/disqualified
5. Orchestrate account-focused plays	Closed/disqualified
Projects Closed	165*

**Assumes a 60% conversion rate.*

Smaller Accounts

Phase	Time Span
Recruit partners	Continuous
Train partners	Continuous
Support, co-sell	Continuous
Projects Closed	220*

**Assumes a 50% conversion rate*

3. Program Design and Best Practices

Program Strategies

Ecology Action employs two major strategies to serve commercial customers and achieve large-scale savings: (1) target enterprise-level (medium to large) customers with a portfolio of properties to achieve economies of scale, and (2) leverage our Open Partner Network (OPN) to serve smaller customers. Ecology Action will holistically assess building portfolios for enterprise-level customers and strategize with customers to meet their objectives. This establishes the foundation for long-term engagements and translates into multi-year implementation opportunities that keep PG&E's savings pipeline robust. Smaller customers will be served by our OPN, bolstered by our experience providing compliant projects to this market segment.

Market Barriers

Customer Barriers	**Problem: Solution**
MEDIUM/LARGE	Serve as the "broker" to simplify the entire customer experience.
Portfolio Planning Services	
▪ Inadequate resources / capacity to assess projects across their portfolio ▪ Rebate complexity ▪ Building portfolios that span multiple utilities ▪ Difficulty managing and tracking goals and budget across the portfolio	▪ Assess and prioritize implementation opportunities across the portfolio
▪ Remote decision makers with set budgets or buying criteria ▪ Fluctuating budget planning cycles	▪ Develop business case for retrofit projects to internal decision makers and secure implementation budget
Implementation Services	
▪ Inability to source and manage projects ▪ Various procurement relationships, ranging from pre-existing partners and suppliers to no existing relationships	▪ Facilitate comprehensive solutions ○ Work with customer's established supply chain network, as needed ▪ Negotiate bulk pricing for qualifying products ▪ Manage all aspects of installation
SMALL	Support Open Partner Network
Implementation Services	
▪ Minimal understanding of EE measures ▪ Low tolerance for business interruptions	▪ Bill interpretation to identify quick savings opportunities and benefits of investment
▪ No existing contractor relationships ▪ Language barriers	▪ Support OPN members through customer outreach, bilingual resources, customer decision-making tools, accelerated payment, and OBF assistance.
▪ Limited budget ▪ Limited procurement capacity	<u>Implementation Services</u> ▪ Provide rebate support and quality assurance to ensure compliance

Best Practices

NetOne builds from successful program delivery for the past 15 years, the strategies and tactics above are based on lessons learned and best practices identified through past program experience and innovation. NetOne will continue to leverage upon this experience to provide customer solutions and deliver cost-effective EE projects.

4. Innovation

Technology Innovation

In addition to traditional measures (lighting, HVAC, and refrigeration), when appropriate the program will promote DR-enabling controls for lighting and HVAC and is moving towards integrating IDSM and NMEC solutions.

New NMEC Technology Opportunities

The program will work to include BRO measures such as Strategic Energy Management (SEM), Building Energy Information Management, Retro-commissioning, and Benchmarking. Implementing these opportunities requires the ability to easily report and claim NMEC savings. We will pilot these measures in the market segments with the highest potential, embedding an M&V plan for evaluation.

NMEC Opportunities					
	Description	**Office**	**Retail**	**Grocery**	**Hospitality**
Strategic Energy Management	▪ Develop and execute long-term energy goal setting and strategic planning ▪ Integrate organization-wide energy practices	X			
Building Energy Information Management	▪ Monitor and control building system performance and energy use	X	X		X

Retro-commissioning	▪ Identify and implement operational strategies to improve performance at whole building systems level	X	X	X	
Benchmarking	▪ Score facility in comparison to peers ▪ Set goals, offer rewards	X	X		
Whole Building	▪ Install multiple efficiency measures simultaneously ▪ Target minimum15% savings	X	X	X	

Market Strategy Innovation

Portfolio Management Approach

The ability to holistically serve the enterprise-level customer portfolio is critical to scaling. These customers typically need support across their entire portfolio of properties and building types, often representing geographic distribution across multiple states and service from multiple utilities.

The NetOne approach enables us to serve customers at the portfolio level, for example, if we have worked with a customer on projects in another state, we can introduce that customer that also has facilities in PG&E's territories, to PG&E's EE programs. With this innovation, we leverage the well-developed elements of our long-established delivery model and customer relationship management and apply them to the enterprise-level customer segment to scale.

Prioritizing Investments for the Customer

NetOne will leverage lessons from past program implementation, market insights and data analytics, to advise customers on how to implement projects across their portfolio with a range of cost-effective measures.

Implementation Services Software Platform Enables Easy Program Delivery for all Stakeholders

Our software platform enables seamless transactions between all stakeholders in a retrofit project by reducing barriers for each stakeholder:

Stakeholder	Barrier	Software Solution
Customer	Understanding how to prioritize retrofit projects across portfolio	Estimation tools allow portfolio managers to compare investment opportunities across facilities
	Comparing energy savings to other investment opportunities	Proposals personalized to customer's key business metrics
PG&E	Managing to annual program goals	Real-time visibility into program pipeline via API connection with Energy Insight
	Collecting program performance data from disparate sources	Track KPIs and business plan metrics for clean reporting to PG&E
Partners	Tracking product eligibility	Maintain a library of eligible products at pre-negotiated pricing
	Producing compliant projects	System generates compliance paperwork

Delivery Approach Innovation

Flexible Delivery: Service and Procurement Options

NetOne will provide Enterprise-level customers a full suite of services: account management, project management, engineering, pricing support, procurement, invoice management, and reporting. Established partner and vendor networks allows NetOne to secure highly advantageous portfolio-level pricing, driving down prices across our entire PG&E portfolio.

Strategic Partner Management: Connecting Partners with a Pre-Qualified Pipeline

We develop pre-qualified pipelines of projects and match Work Order assignment to each trade ally's capacity. We assemble compliant, comprehensive proposals; provide project management; and serve as the customer's liaison so that trade allies can focus on doing the work.

Open Partner Network for Smaller Projects

In addition to managing a network of trade allies for jobs sold by Ecology Action, we have designed a way to serve smaller customers in a more cost-effective manner. Through our Open Partner Network (OPN), trade allies drive the sales process with the customer while Ecology Action supports the project on the back end. Our trade allies communicate project information through our cloud-based portal and use EA's proprietary "Vendor Rebate Tool" to quickly estimate incentives to guarantee that the customer is presented with a viable proposal. Ecology Action verifies the scope, ensures the project meets compliance requirements, processes the rebate application, and provides post-site verification. OPN members can also use our preferred product pricing, thereby extending the benefits of price negotiations to smaller customers.

Alleviating Cash Constraints

NetOne expedites rebate payments to partners on net 30-day terms to solve trade ally cash flow barriers caused by delayed payments. This enables them to maintain the substantial lines of credit they need to procure the volume of equipment required to deliver the program. It also allows them to stay current on their financial obligations to suppliers and staff, keeping projects moving so all aspects of the program can hit their delivery goals. As a result, projects are installed by competent, financially healthy firms, which in turn drives customer satisfaction. We also provide limited bridge financing to highly qualified allies on attractive terms.

Negotiated Product Pricing & Coordination with Manufacturers and Distributors

Our Supply Chain team works directly with manufacturers and distributors to negotiate advantageous pricing on premium products.

We connect manufacturers and distributors with end-use customers by bringing the latest technologies into our equipment library at negotiated rates. This creates a win-win-win situation: the customer benefits from vetted, premium products; the manufacturers and distributors have a solid pipeline; and Ecology Action drives quality projects at low cost. Small customers benefit from volume discounts they could not obtain individually. Larger customers receive broad support for product procurement across their portfolio that meets branding guidelines, standards, price points, and aesthetics.

5. Metrics

The program will be assessed by several measurable key performance indicators. These include the following:

- Savings Goal Attainment
- Cost Effectiveness
- Program Data Quality
- Savings Forecast Accuracy
- Engineering Quality
- Measure Installation Pass Rate
- Workforce Standards
- Pipeline Quality
- DAC Goal
- Opportunity Pass Process

6. For Programs Claiming To-code Savings

NetOne will be claiming to-code savings and complying with CPUC Decision 17-11-006, requiring that program delivery lends insight into to-code savings where appropriate. Often equipment is continually maintained, and the expected equipment turnover and replacement does not naturally occur. Offering to-code measures and accelerated replacement options will help accelerate equipment turnover for realized energy savings while screening projects for cost effectiveness.

The required data and documentation will be gathered through customer participation and stored in our project tracking database. Information that will be gathered could include:

- Equipment type
- Remaining useful life documentation
- Building type
- Locations
- Segment type

7. Pilots

Pilot projects are not part of the NetOne Commercial Program at this time.

8. Workforce Education and Training

The program will engage PG&E's Workforce Education & Training (WE&T) program where possible to help promote the creation of a skilled and knowledgeable workforce. The program team will encourage customers and Channel Partners to consider providing job access to Disadvantaged Workers through the application process.

9. Workforce Standards

HVAC Workforce Standards

Any project delivered through NetOne that triggers the HVAC workforce standards, will be served by a trade ally that meets PG&E's Workforce standards.

At least one of the following criteria will apply to trade allies selected for these projects:

- Trade ally has completed an accredited HVAC apprenticeship
- Trade ally is enrolled in an accredited HVAC apprenticeship
- Trade ally has at least 5 years of work experience at the journey level according to the Dept. of Industrial Relations Title 8 Section 205, has passed a practical and written HVAC system installation competency test, and has received credentialed training specific to the installation of the technology being installed
- Trade ally is a licensed C-20 HVAC contractor in good standing

Ecology Action uses only licensed contractors in good standing with the California State Licensing Board in their area of specialty. Our Project Management team will review all new projects to identify any that trigger the HVAC workforce standards. Those projects will be routed to one of our licensed C-20 HVAC partners for delivery. For compliance and reporting purposes, Ecology Action will keep records on file documenting compliance with the workforce standards. Records will be provided to PG&E as requested.

Lighting Workforce Standards

The Lighting Controls Workforce Standard requires that all projects that include lighting control measures in a non-residential building and have a project incentive over $2,000 must use installation technicians that have been certified by the California Advanced Lighting Controls Training Program (CALCTP). We will comply with this standard on all qualifying projects.

10. Disadvantaged Workplan

The NetOne program delivery does not necessitate the services of any subcontractors or sub-subcontractors. However, as a CPUC-certified WBE, Ecology Action takes diversity, equality and inclusivity seriously. We will seek

to identify all partners in our network who qualify or have staff who qualify, as Disadvantaged Workers. Reporting of DBE and disadvantaged worker status is voluntary for all partners. However, partners will be voluntarily surveyed upon initial onboarding and once per year thereafter to provide updated statistics.

Recruitment:

In order to serve the entire PG&E territory, we will screen and recruit trade allies and OPN members in many geographies to minimize the travel required to perform work. This benefits local employers throughout PG&E territory, including those with Disadvantaged Workers.

Supporting our Partners:

Ecology Action will continue to encourage installation partners to adopt diversity and inclusion goals whenever possible.

11. Additional Information (if applicable)

No additional information to provide.

Supporting Documents

1. PROGRAM MANUAL AND PROGRAM RULES
2. PROGRAM THEORY AND PROGRAM LOGIC MODEL
3. PROCESS FLOW CHART
4. INCENTIVE TABLES, WORKPAPERS, SOFTWARE TOOLS
5. QUANTITATIVE PROGRAM TARGETS
6. DIAGRAM OF PROGRAM
7. EVALUATION, MEASUREMENT & VERIFICATION (EM&V)
8. NORMALIZED METERED ENERGY CONSUMPTION (NMEC)

1. NetOne Program Manual and Program Rules

Program Summary

The NetOne Commercial Efficiency Program is a downstream program that will provide energy efficiency services, technical services and incentive processing. Over four years, our innovative program design provides a suite of incentives to commercial customers to install refrigeration, HVAC, lighting, and meter-based energy savings using the Deemed, Custom, and NMEC platforms.

1. Eligible measures and measure eligibility

Ecology Action will employ multiple savings platforms, including Deemed, Custom, and NMEC. We will address major commercial end uses through HVAC, refrigeration, and lighting retrofits using Deemed, Custom and NMEC approaches. Deemed measures must have an approved and non-expired workpaper or be listed in the Database for Energy Efficient Resources (DEER) as an active measure. Custom measures must meet the criteria specified in the Statewide Custom Project Guidance Document. NMEC measures will follow guidance set forth in the CPUC NMEC rulebook.

Custom Measures

Custom measures or measures developed for a specific project using a site-specific analysis and not identified as a Deemed measure, will follow the Statewide Custom Project Guidance Document and all other applicable statewide documentation and workbooks. All custom measures must save kW, kWh, and/or therms.

Deemed Measures

Deemed measures, or prescriptive measures with predefined attributes, must have current, approved technical workpapers and be listed in the DEER or eTRM databases. Measure groups/categories that the program will utilize include but are not limited to follows:

Measure Name	***Workpaper***	***Other CPUC Guidance Within Workpapers***
Economizer Controls (Replacement on AC Unit with Gas Heat)	*PGE3PHVC152, Revision 6 (12/20/2018)*	*EAR team workpaper disposition on PGE SWCV010 (pending)*, CPUC Workpaper Disposition for Non-Residential HVAC Rooftop Quality Maintenance, 5/2/2013 *HVAC Commercial Quality Maintenance (CQM) Report (WO32, 1/28/2014) Database for Energy Efficient Resources (DEER) Resolution E-4818, Guidance on use of modeling (Doe2.2, eQuest, DEER prototypes), Workpapers SWSV005/SWSV010 (pending disposition)*
Evaporator Fan Motors (ECM replacing Shaded Pole Motors in Display Case Coolers R004/R005)	*PGECOREF109, Revision 6 (11/8/2016)*	*Federal Register, 10CFR Part 431 (1/9/2009), WO017 Ex Ante Measure Cost Study, Guidance on use of modeling (DOE2.2, eQuest, DEER prototypes)*

Enhanced Ventilation and VFD for Packaged HVAC Units with Gas Heating and Packaged Heat Pumps	*PGECOHVC143, Revision 3 (12/3/2018)*	*DEER 2014 Codes and Standards Updates, Title 24, HVAC CQM Report (WO32, 1/28/2014), Guidance on use of modeling (DOE2.2, eQuest, DEER prototypes), Workpaper SWHC023 (pending disposition)*
Anti-Sweat Heat (ASH) Controls	*PGEREF108, Revision 8 (12/14/2018)*	*EAR team workpaper disposition on SCE SWCR001 (pending), ESPI Reports, Energy Efficiency Policy Manual (v5), Title 20 Appliance Efficiency Regulations, Workpaper SWCR001 (pending disposition)*
Add Doors to Open Medium Temperature Cases	*PGE3PREF116, Revision 1 (4/28/2014)*	*EAR team workpaper disposition on SCE SWWP005 (6/27/2019), Guidance on use of modeling (DOE2.2, eQuest, DEER prototypes), Workpapers SWCR020/SWCR021 (pending disposition)*
Variable Frequency Drives (VFDs) for HVAC Fans	*PGECOHVC106, Revision 5 (3/8/2016)*	*Guidance on use of modeling (DOE2.2, eQuest, DEER prototypes), Workpaper SWHC018 (pending disposition), Industry Standard Practice Study SCE-ISP-14-004 Revision 2 (6/30/2014)*

NMEC Measures

NMEC measures will follow the guidance set forth in the CPUC NMEC Rulebook and will be further outlined in the NMEC Population and Site-Level M&V plans attached to this document. All allowable measures will be considered for NMEC.

2. Customer Eligibility Requirements

Customer sizes and types: All Commercial customer sizes and types are eligible except high tech, biotech and healthcare subsegments, except with approval from PG&E PM. NetOne Program services are offered at the discretion of Ecology Action.

***NAICS Codes Include but not limited to*:**

NAICS Code	Description of Customer Segment
5311XX	Office
5411XX	Office - Real Estate
2372XX	Real Estate
55XXX-56XXX	Professional and Business Services
4441XX	Home Centers
31XXXX-33XXX	Manufacturing
452XXX	Warehouse and Super Centers
4451XX	Grocery
4931XX	Warehousing and Storage
4411XX	Auto Dealerships
4539XX	Other Miscellaneous Store Retailers

44XXXX-45XXX	Retail Trade
11XXXX	Agriculture
48XXXX-49XXX	Transportation and Warehousing
722XXX	Food Service
71XXXX-72XXX	Leisure, Hospitality and Accommodation

Other eligibility requirements:

- Customers must be an established electric or natural gas customer of PG&E.
- Customers must pay the Public Purpose Program surcharge on the PG&E electric or natural gas meter where the EE project is to be installed.
- Projects are not potential for Double Dip – customers are not applying for savings and incentives between multiple programs or platforms for the same measure.
- All projects must adhere to all applicable federal, state and local laws and codes.

3. Contractor Eligibility Requirements

Ecology Action ensures quality trade ally performance through rigorous vetting, extensive training, and continual inspections. We verify valid licensure with the Contractors State Licensing Board and ensure that insurance is kept current. Trade allies are trained extensively on program operational details, including Ecology Action's strict quality standards for professionalism, customer engagement, workmanship, and warranty support.

In addition to the above requirements, the following Workforce Standards apply to all HVAC and Lighting Controls projects:

a. HVAC STANDARDS. For any non-residential project pursuant to this Agreement installing, modifying or maintaining a Heating Ventilation and Air Conditioning ("HVAC") system or component with incentives valued at $3,000 or more, Implementer shall ensure that each worker or technician involved in the project, including all employees and agents of its subcontractors, meets at least one of the following workforce criteria:
   - Completed an accredited HVAC apprenticeship.
   - Is enrolled in an accredited HVAC apprenticeship.
   - Completed at least five years of work experience at the journey level as defined by the California Department of Industrial Relations, Title 8, Section 205, of the California Code of Regulations, passed a practical and written HVAC system installation competency test, and received credentialed training specific to the installation of the technology being installed; or
   - Has a C-20 HVAC contractor license issued by the California Contractor's State Licensing Board.

This standard shall not apply where the incentive is paid to any manufacturer, distributor, or retailer of HVAC equipment, unless the manufacturer, distributor, or retailer installs or contracts for the installation of the equipment.

b. ADVANCED LIGHTING CONTROLS STANDARDS. For any non-residential project involving installation, modification, or maintenance of lighting controls with incentives valued at $2,000 or more, Implementer shall ensure that all workers or technicians involved in the project, including those of its subcontractors are certified by the California Advanced Lighting Controls Training

Program ("CALTP"). This requirement shall not apply where the incentive is paid to a manufacturer, distributor, or retailer of lighting controls unless the manufacturer, distributor, or retailer installs or contracts for installation of the equipment.

4. Participating Contractors, Manufacturers, Retailers, Distributors, and Partners

Ecology Action will not directly utilize any Partner firms or Subcontractors as defined by this solicitation. However, we will engage Recurve as a service provider as we transition to NMEC. Please note that the term "Partners" is used to reference our network of contractors and supply chain vendors.

5. Additional Services

N/A

6. Audits

NetOne audits are performed by Ecology Action (EA) or one of EA's allied trade partners. Audits can be performed both in-person or virtually.

Eligible and interested individuals will be given a Site Access Agreement to sign to allow both on-site and virtual audits. Customer signature is obtained on the Site Access Agreement prior to performing an audit. During the audit customer eligibility for all eligible measures by verifying the presence and types of qualified equipment and gathering related data sufficient to meet the needs of the program's contractors that specialize in those measures.

The audit information is entered into the program software and a proposal is generated.

7. Program Quality Assurance Provisions

There are two components that ensure a high-quality energy efficiency retrofit: 1. proper equipment and 2. installation standards. This document contains the program installation standards. Installations must meet the standards listed below. Equipment must be installed in a manner that yields energy savings and provides appropriate, long-term lighting levels, occupant comfort and safety.

Installation standards go far beyond how a piece of equipment is wired and attached to a structure. An approach involving the entire process, beginning at installation scheduling, and ending at final acceptance, is needed to ensure that both the Customer and Contractor are satisfied with the new customized retrofit, lighting, refrigeration or HVAC upgrade.

The Contractor is responsible, before proceeding with an installation, to verify the existing (pre-retrofit) site conditions as outlined in the proposal. The Contractor is responsible for reading and fully understanding the Contractor Work Order to verify what type of equipment shall be installed.

8. Other Program Metrics

The program is assessed by several key performance indicators (KPI's). The PG&E Program Manager in partnership with the Ecology Action Program Management team will review program metrics during weekly and/or quarterly meetings. These metrics include the following:

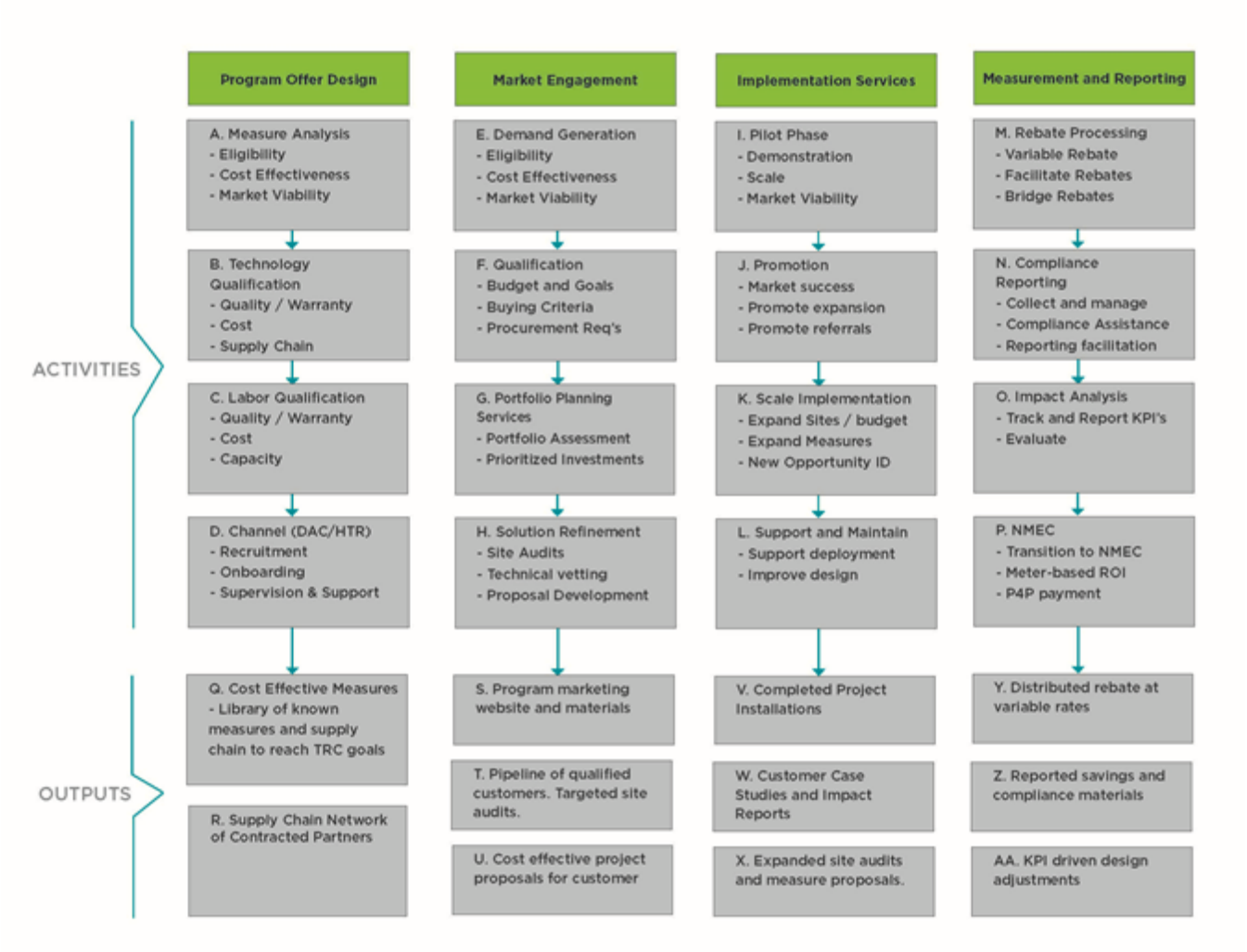
- Savings Goal Attainment
- Cost Effectiveness
- Program Data Quality
- Savings Forecast Accuracy
- Engineering Quality
- Measure Installation Pass Rate
- Workforce Standards
- Pipeline Quality
- DAC/HTR Goal
- Opportunity Pass Process

2. Program Theory and Program Logic Model

Program Theory

Ecology Action has developed a successful program design that targets the current barriers to energy efficiency for customers of all sizes, from the largest enterprise-level customer to the smallest customer represented by the HTR/DAC market. These customers have unique drivers, buying criteria, and capabilities. This program is designed to provide as much or as little assistance as each customer requires. The variation in customer need requires a program built around a flexible design to meet the changing dynamics of the energy efficiency market, which is subject to economic and regulatory drivers that necessitate constant re-evaluation and recalibration. The Logic Model illustrates the activities and outputs Ecology Action's program model will utilize to drive the outcomes anticipated over short-term (1-2 year), mid-term (3-5 years) and long-term (6-10 year) horizons. Our program design represents measurable, verifiable metrics to facilitate evaluation of program performance and cost effectiveness. We anticipate that key performance indicators will change over the lifecycle of the program due to regulatory pressures, and we are prepared to respond.

Program Logic Model

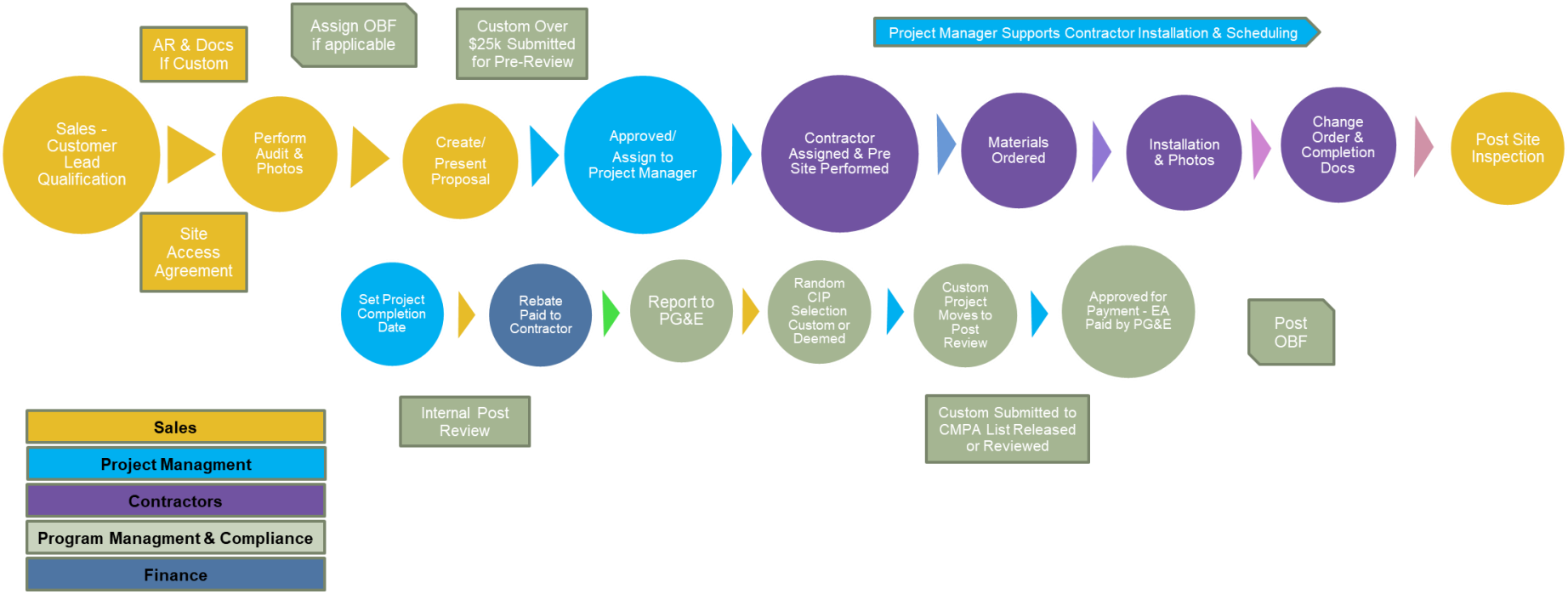


Program Logic Model (continued)

	Program Offer Design	Market Engagement	Implementation Services	Measurement and Reporting
Short-term Outcomes 1-3 years	BB. Reflection of technology innovation and market rates in expanded solution set	CC. Targeting of particular known measures sets to high impact segments.	DD. Solution improvement based upon market feedback and volume participation.	EE. Compliance efficiency via training, standardization and technical integrations.
Mid-term Outcomes 3-5 years	FF. Verifiable NMEC based savings based upon completed projects.	GG. Identification of new solutions that cost effectively meet evolved regulatory and customer needs. Iterate with new	HH. New compliance and KPI tracking to match these new requirements. Iterate on established model:	II. Iterate on established model based on new market and regulatory requirements
Long-term Outcomes 6-10 years	JJ. Evolution of this platform to deployment of measures beyond EE into IDSM, ZNE-ready, water, other sustainability	KK. Iterate with new solutions on established model	LL. Iterate on established model: new compliance and KPI tracking to match these new requirements.	MM. Iterate on established model based on new market and regulatory requirements

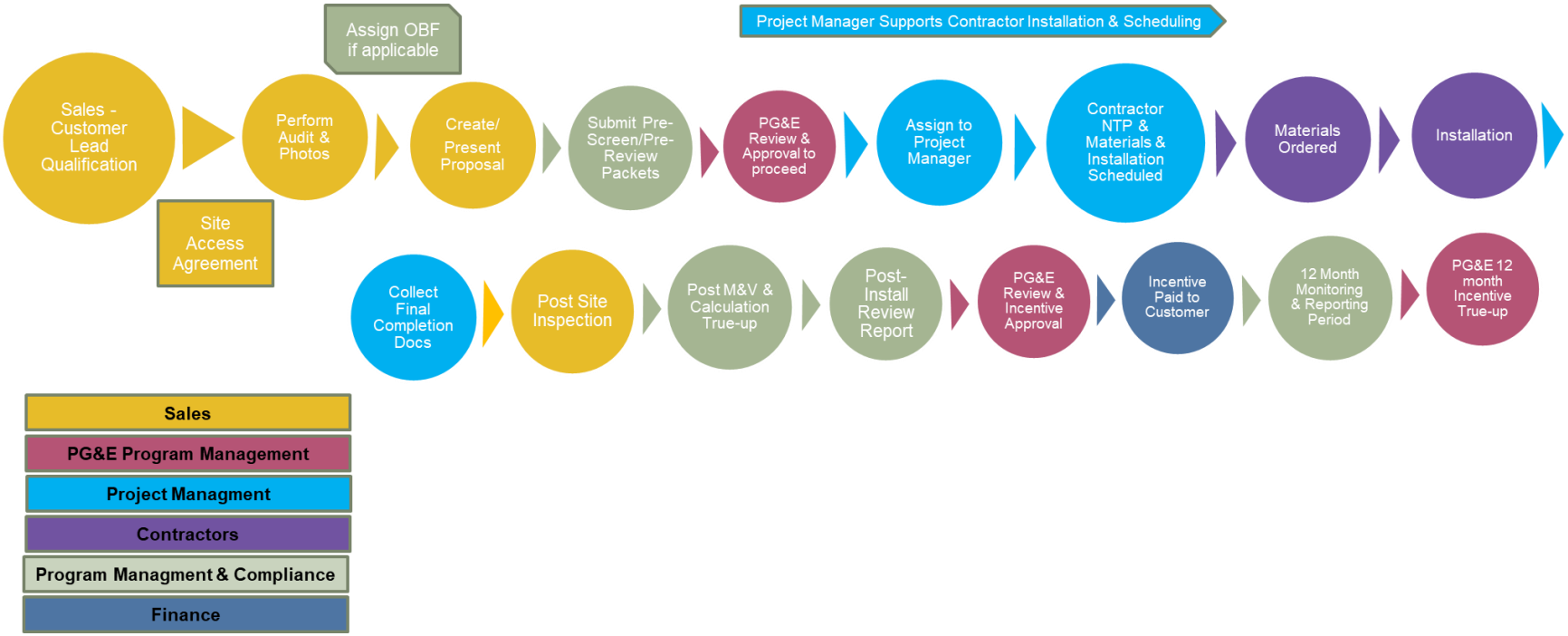
3. Process Flow Chart

Direct Install – Custom & Deemed



Process Flow Chart (continued)

NMEC



4. Incentives, Workpapers, Software Tools

Incentives

NetOne incentive design aligns with CPUC incentive best practices guidance outlined in D.18-05-041. Ecology Action shares the CPUC's preference for variable incentive mechanisms for several reasons. First and foremost, matching incentives to each customer's needs motivates customers to save energy. Second, by not providing all incentives to all customers as traditional programs do, we are able to significantly reduce programs costs, thereby improving cost effectiveness. Third, this approach minimizes free ridership by establishing at the outset whether customers require energy efficiency services and/or financial support to move forward. This enables us to exclude participants who do not need assistance. Importantly, the incentive structure described here is flexible and can be modified to accommodate the specific goals PG&E needs NetOne to address now and in the future. Incentive rates will be based on units of energy saved using net first-year savings. We will pay incentives directly to contractors or customers and be reimbursed by PG&E.

NetOne financing offerings will include On-Bill Financing (OBF), OBF with incentives, California Hub for Energy Efficient Financing (CHEEF), and other market-based offerings as available.

Workpapers

Measure Name	Workpaper	Other CPUC Guidance Within Workpapers
Economizer Controls (Replacement on AC Unit with Gas Heat)	PGE3PHVC152, Revision 6 (12/20/2018)	EAR team workpaper disposition on PGE SWCV010 (pending), CPUC Workpaper Disposition for Non-Residential HVAC Rooftop Quality Maintenance, 5/2/2013 HVAC Commercial Quality Maintenance (CQM) Report (WO32, 1/28/2014) Database for Energy Efficient Resources (DEER) Resolution E-4818, Guidance on use of modeling (Doe2.2, eQuest, DEER prototypes), Workpapers SWSV005/SWSV010 (pending disposition)
Evaporator Fan Motors (ECM replacing Shaded Pole Motors in Display Case Coolers R004/R005)	PGECOREF109, Revision 6 (11/8/2016)	Federal Register, 10CFR Part 431 (1/9/2009), WO017 Ex Ante Measure Cost Study, Guidance on use of modeling (DOE2.2, eQuest, DEER prototypes)
Enhanced Ventilation and VFD for Packaged HVAC Units with Gas Heating and Packaged Heat Pumps	PGECOHVC143, Revision 3 (12/3/2018)	DEER 2014 Codes and Standards Updates, Title 24, HVAC CQM Report (WO32, 1/28/2014), Guidance on use of modeling (DOE2.2, eQuest, DEER prototypes), Workpaper SWHC023 (pending disposition)

Anti-Sweat Heat (ASH) Controls	PGEREF108, Revision 8 (12/14/2018)	EAR team workpaper disposition on SCE SWCR001 (pending), ESPI Reports, Energy Efficiency Policy Manual (v5), Title 20 Appliance Efficiency Regulations, Workpaper SWCR001 (pending disposition)
Add Doors to Open Medium Temperature Cases	PGE3PREF116, Revision 1 (4/28/2014)	EAR team workpaper disposition on SCE SWWP005 (6/27/2019), Guidance on use of modeling (DOE2.2, eQuest, DEER prototypes), Workpapers SWCR020/SWCR021 (pending disposition)
Variable Frequency Drives (VFDs) for HVAC Fans	PGECOHVC106, Revision 5 (3/8/2016)	Guidance on use of modeling (DOE2.2, eQuest, DEER prototypes), Workpaper SWHC018 (pending disposition), Industry Standard Practice Study SCE-ISP-14-004 Revision 2 (6/30/2014)

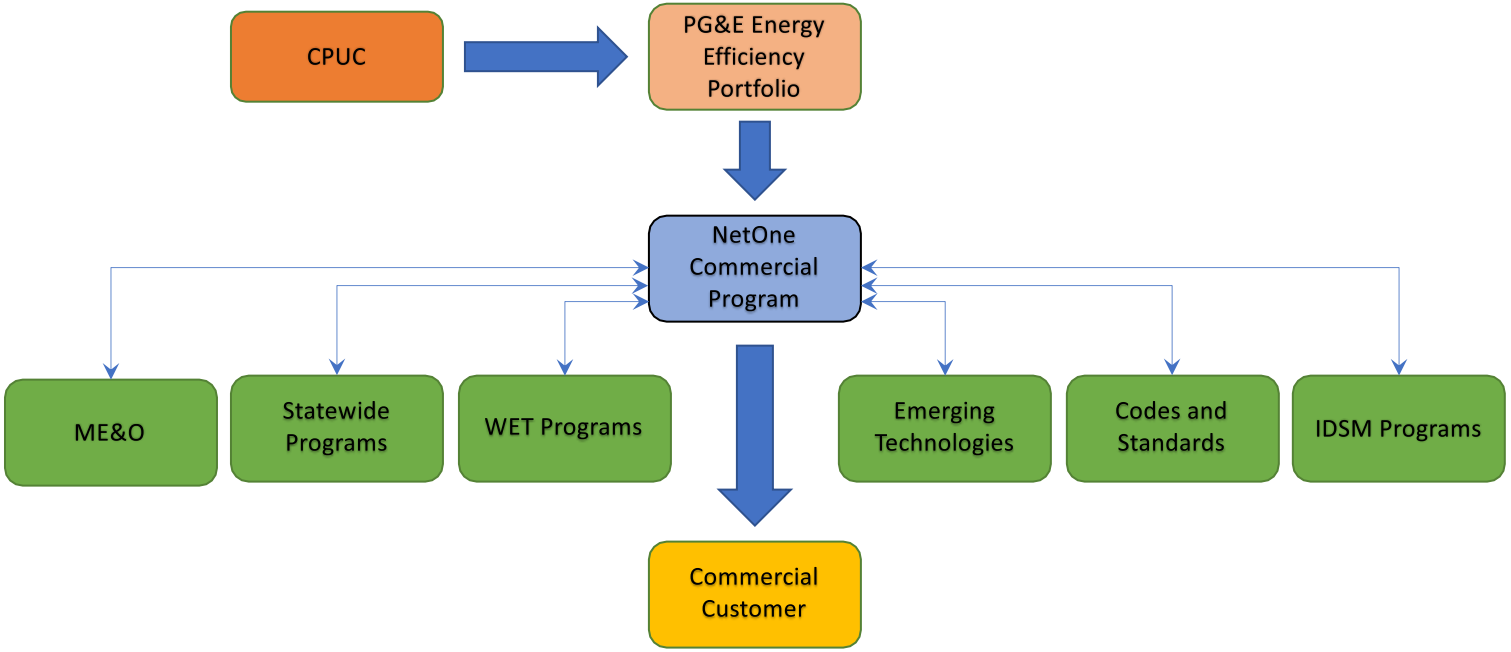
Software Tools

Ecology Action currently uses a Salesforce based platform called Energy Orbit for all customer relationship management (CRM), all project development and management, incentive and energy savings calculations and ongoing monitoring and reporting.

5. QUANTITATIVE PROGRAM TARGETS

Year	2021	2022	2023	2024	Total
Total Customers Served	30	150	150	55	385
Disadvantaged Community (DAC) Projects	5	31	31	10	77
Incentives Delivered	$1,455,454	$3,159,902	$3,490,268	$1,785,820	$9,891,444

6. DIAGRAM OF PROGRAM



7. EVALUATION, MEASUREMENT & VERIFICATION (EM&V)

The program will use a Salesforce based platform (Energy Orbit) to track and manage all program level data. The purpose of the EM&V at the program level is to provide ongoing performance feedback during implementation, provide data for evaluations and to inform planning and design for future program cycles. The program team ensures data integrity through structured Quality Assurance/Quality Control (QA/QC) procedures, and appropriate records retention. This level of EM&V promotes more accurate project and data reporting to optimize program performance.

Verification Plan

Direct Install:

A pre installation inspection will be conducted to verify existing baseline equipment, actual hours of operation, lamp wattage and fixture quantity.

For each project, pre-installation photos will be taken by the contractor and/or Energy Specialist to establish lamp existing baseline conditions. This includes, at a minimum, backstock photos, nameplate information, each unique lighting fixture, area, lamp wattage, and ballast factor of fixtures in operation. Energized photos for exterior lighting is optional during daytime hours.

In cases where there is no backstock and a lift is required, photos of existing wattage and ballast factors are confirmed with photos during installation and wattages are updated with a Change Order at the end of the project.

Upon completion, a post-installation inspection of the newly retrofitted system shall be conducted for completeness and operation as specified and installed.

Post-installation photos of the installed fixtures and areas in operation will be taken to confirm installation of each fixture and area.

Written acceptance by the Customer is required for final acceptance and incentive payment.

Custom:

Pre-Implementation External Review

Upon completion of the detailed investigation, the results of the Pre-Implementation Report and supporting documentation will be delivered to PG&E's Custom Implementation Team (CIT) for review of measures and energy savings, costs, and incentive amounts. After incorporating CIT suggestions or revisions and receiving final approval from PG&E, the final recommendation list is delivered to Customer along with a notice to proceed. Once the Customer has approved any changes from the original scope, implementation begins.

Post-implementation Review:

Verification will commence upon completion of implementation to confirm all recommended Customized and RCx measures have been appropriately implemented.

Upon Completion of the Custom project, the results of the Post Implementation Report and supporting documentation will be delivered to PG&E's Custom Implementation Team for final review and energy savings, costs, and incentive amounts. After incorporating any Technical Review suggestions for revisions, the Final Post-Installation Report will establish final energy savings and rebate values.

Corrections

If during the process of a quality control post-installation inspection there are found discrepancies from the Contractor Participation Agreement, Channel Contractor Participation Agreement, installation standards, equipment specifications, or Contractor Work Order, the Contractor/Channel Contractor is responsible for bringing the installation into compliance before the incentive will be paid. Future incentives on other projects may be withheld until the installation in question is brought into conformance. Corrections as identified during quality control post-installation inspections shall be performed within three normal business days.

8. NORMALIZED METERED ENERGY CONSUMPTION (NMEC)

NetOne

PG&E Commercial Energy Efficiency Program

DRAFT Site -Level M&V Plan

March 12, 2021

1. Appropriateness of Meter-Based Platform

Pursuant to the CPUC guidance issued on January 31, 2019, NMEC is approved for use in the commercial sector and Ecology Action's NetOne Program will use a site-level NMEC approach as applicable and will conform to the latest version of the Meter-Based NMEC Rulebook (currently version 2.0, released January 7, 2020). In the site-level NMEC approach, savings are determined for each project after measures are installed, based on an analysis of pre- and post- installation meter data. In this approach, the post-installation energy use data provides important feedback to assure savings are achieved. This aligns the goals of customers and ratepayers, who both require assurance of the return on their investments.

Site-level NMEC follows the well-known International Performance Measurement and Verification Protocol (IPMVP) Option C approach. Traditionally applied with billing data, this approach has been updated with advanced modelling methods applied to short-time interval data from California's advanced metering infrastructure (AMI data), enabling much more accurate savings analysis. Our approach allows multiple advanced modeling algorithms and independent variables to be assessed, to find the best fitting model for any NMEC project. This enables the methodology to be applied over a much wider range of building use types.

Several attributes of site-level NMEC approach make it an appropriate methodology for some customers.

- The savings methodology aligns with how customers think of their savings investments: at the meter.
- The short-time interval data and savings analysis provides fast feedback on a project's performance, enabling timely identification and resolution of issues that prevent savings.
- The approach focusses on achieving savings and verifying the return on the customer's and the program's investment.
- The method is scalable because it is applicable across multiple commercial building types and its uniform approach enables more participation by customers, implementers, and contractors.

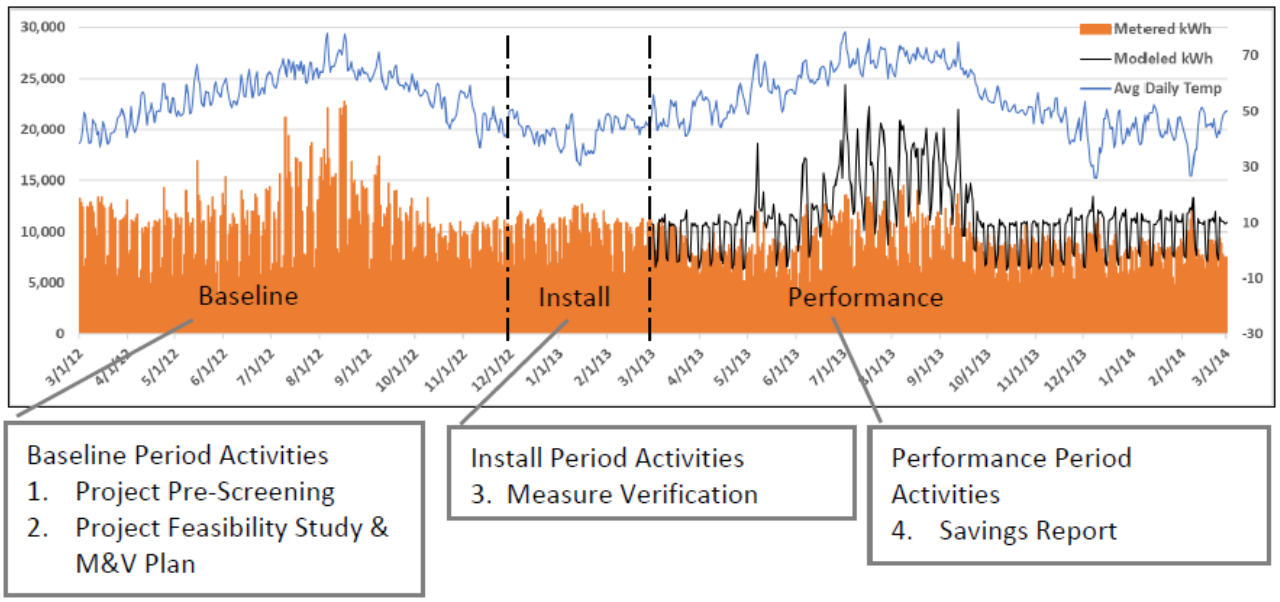
2. Methodology

This NMEC M&V Plan describes the requirements for each participating customer site-level NMEC project. While specific site-level M&V plans for each participating customer project are required, this program M&V Plan has a broader scope with additional elements including customer pre-screening, measure savings analysis, and lifecycle cost requirements.

The approach to each site-level NMEC project is designed following the guidance on measurement and verification (M&V) plans LBNL provided to the CPUC[1] (LBNL Guidance) and is compliant with the CPUC NMEC Rulebook version 2.0[2]. The approach assesses each potential site-level NMEC project prior to acceptance, collects the necessary information at key milestones of the process, and manages the inherent risks with meter-based methods. Figure 1. provides an illustration of the site-level NMEC project process, showing how customer engagement, measure development, and verification is integrated with the overall M & V process.

The chart shows how baseline energy use was adjusted to model energy use in the performance period conditions (black line) and how much daily energy use was reduced (gap between black line and orange bars) in the performance period after installation of the energy efficiency measures. In each phase, several reports document key project requirements and milestones. Each program report is based on a template to assure all the required information is collected.

Figure 1. Site-level NMEC Project Process



Baseline Period

Project Pre-Screening. For each potential site-level NMEC project, the M&V Plan requires an initial site visit and discussion with the building owner to assess the facility baseline condition, the efficiency measure opportunities, and their savings potential, and to ascertain the potential for non- routine events (described below) occurring in the baseline period or planned in the future. A year of past interval energy use and weather data is collected, and an analysis completed to determine whether an energy model may be developed to meet the program's goodness of fit and accuracy requirements.[3] The pre-screening activity is used to determine whether the project is an acceptable site-level NMEC candidate.

[1] Guidance for Program Level M&V Plans: Normalized Metered Energy Consumption Savings Estimation in Commercial Buildings, version 1.0, March 1, 2018, available at: ftp://ftp.cpuc.ca.gov/gopher-data/energy_division/EnergyEfficiency/RollingPortfolioPgmGuidance/LBNL_NMEC_TechGuidance_Draft.pdf.

[2] Rulebook for Programs and Projects Based on Normalized Metered Energy Consumption, version 2.0, January 7, 2020, available at: https://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442463694

Project Feasibility Study. A more in-depth assessment of potential energy efficiency measures is provided in the measure feasibility study. This step may include an ASHRAE level I or II energy audit. Individual measure savings and costs are provided, and effective useful life (EUL) is determined for each measure. The feasibility study provides a description of the baseline systems and equipment, their operations, energy use, and the list of measures, with their savings, costs, and EULs. NMEC project savings forecast estimates may be based either on approved deemed-measure workpapers or may be calculated using engineering or modeling methods consistent with Commission adopted custom project savings-calculation guidelines. A weighted average EUL for the group of measures is determined based on CPUC guidance. The study is submitted to PG&E for approval and includes documentation of program influence on customer decision-making and references the M&V Plan for the project.

The Site-Level M&V plan documents how savings will be determined. Following the LBNL Guidance and the NMEC Savings Procedures Manual,[4] it describes the building, the potential savings, the meters and data required for NMEC analysis, identifies the modeling algorithms chosen to develop baseline energy models, their acceptance criteria, expected savings uncertainties, how Non-Routine Events (NREs) will be identified, and their impacts determined, how savings will be reported, and how often. The NMEC Savings Procedures Manual provides templates for the M&V Plan and Savings Reports, which will be followed to capture all required information and provide complete descriptions of the savings analysis. Data, spreadsheets, and analysis code will be provided for technical reviewers and evaluators to understand how models were developed and assessed.

Installation Period

Post-Installation Report. The Post-Installation Report that will be provided to PG&E will include:

1. Summary of installed measures, including any differences to proposed measures.
2. Verification of measure installation.
3. Updated savings estimates and EUL.
4. Documentation of the final project cost.
5. Incentive calculation.

[3] Per the "Guidance for Program Level M&V Plans: Normalized Metered Energy Consumption Savings Estimation in Commercial Buildings" guidance document provided CPUC by LBNL for the NMEC rulings, these criteria are: CV(RMSE) < 25%, NMBE < 0.5%, and $R^2 > 0.7$, where CV(RMSE) is the coefficient of variation of the root mean squared error (a measure of model random error), NMBE is the net mean bias error (a measure of model bias error), and R^2 is the coefficient of determination (an indication of how well the independent variables, e.g. temperature, 'explains' the dependent variable, e.g. energy use).

[4] Normalized Metered Energy Consumption Savings Procedures Manual. SCE Emerging Technology Project ET15SCE1130, available at: https://www.etcc-ca.com/reports/normalized-metered-energy-consumption-savings-procedures-manual.

Performance Period

M&V Progress Check. Periodic checks will be made throughout the performance period at a frequency determined by individual projects to ensure that energy savings are accumulating. To complete the check, energy use data will be collected, and a savings-to-date analysis will be conducted. The analysis will show whether the savings have accrued as expected and will identify the presence of any NREs that must be addressed. Changes in energy savings +/- 50% will be recorded and provided to PG&E to improve program forecasting.

The 12-Month Site-Level M&V Report. The M&V report will document the raw data collected, preparations for its analysis, and analysis to determine savings, as described in the project's M&V plan. It will be based on the savings report template provided in the NMEC Savings Procedures Manual. It will contain a narrative description of the models used, meter calibrations (as required), baseline period, model acceptance criteria, and savings analysis. All data, spreadsheets, and analysis code used in the analysis will be provided for technical review and evaluation. Savings reports will be issued at the end of the NMEC M&V period and will document program-claimed savings.

Additionally, the report shall discuss the "Goodness of Fit" statistics, model uncertainty, NREs, missing data and or "zeros", as well as relationships between weather data and savings claims. The potential interactive effects, and possibility of fuel switching at the measure level, should also be included.

Software/Tools Employed

Ecology Action will utilize kW Engineering's NMECR tool which is an integrated suite of peer-reviewed and publicly available statistical data modeling algorithms to quantify savings achieved by energy efficiency projects following the NMEC approach. The suite enables the use of multiple modeling algorithms and quick assessment of their applicability and validity to determine the algorithm best suited for each site. The diverse number of modeling algorithms available allow their application to a variety of building types. Moreover, the suite is extensible, designed to accommodate new modelling algorithms and other developments in the application of NMEC, including new capabilities based on kW Engineering's own experience and research efforts.

The public-domain R programming environment is the NMEC analysis platform. R is a programming language and free software environment for statistical computing and graphics. It is supported by the R Foundation for Statistical Computing.[5] Along with its integrated development environment RStudio, R is widely used by statisticians and data analysts in academic and professional environments. As an alternative to applications developed using Microsoft Excel which has limitations when managing large volumes of data and when conducting advanced regression analysis, kW Engineering selected R and RStudio because of its focus on statistics, its wide use and support, its availability in the public domain and ready availability, and most importantly its transparency to anyone tasked with reviewing the analysis methods in NMEC programs. Use of the R code has streamlined all of the analysis required by site-level NMEC projects. With every project, the data and R code used for pre-screening and savings analysis is provided for technical review, along with instructions for setting up R, RStudio, and running the analysis. This R-based, public domain code has been successful in passing multiple technical reviews to-date.

[5] R Core Team (2016). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org/.

The following are the key features of our M&V analysis portfolio:

1. **Transparency**: The algorithms are coded in the R programming language (an open-source programming language), making them transparent and reviewable.
2. **Model Applicability Assessment**: All site data and models are assessed, visually and statistically, to ensure that data integrity is upheld, and the underlying regression modeling assumptions are met. These include:
    a. Linearity of data: The relationship between the predictor (e.g. temperature) and the predicted (energy use) is assumed to be linear.
    b. Normality of residuals: The residuals are assumed to be normally distributed. Residuals are the difference between the actuals and predicted values.
    c. Homoscedasticity (homogeneity of residual variance): The residuals are assumed to have a constant variance.
    d. Independence of residuals: The residuals are assumed to be independent of each other.
3. **Quantification of the time value of energy saved**: The analysis is performed on PG&E AMI data or submetering (with short time intervals: 15 min or 1 hour), enabling time dependent valuation of savings.
4. **Timely feedback, reduced labor costs and improved accuracy**: The data-driven modeling algorithms are scripted in R and have run times in seconds. This upgrade from point-and-click M&V software reduces analysis time and provides detailed feedback on savings as they accrue. Moreover, scripting of the M&V data analytics provides a high level of computational accuracy while reducing the associated labor costs.
5. **Risk Quantification**: Data-driven modeling enables quantification of the uncertainty and risk associated with the savings projections and is calculated in accordance with the formulations provided in ASHRAE Guideline 14.

Analytical Methods

The following modeling algorithms are available in our analysis portfolio:

Time-of-Week and Temperature (TOWT) Model: The TOWT model[6,7] is a linear regression-based load prediction method that has a time-of-week variable to characterize the load of each interval within a week, and a piecewise linear and continuous outdoor air temperature variable to describe the temperature dependency of the load. kW Engineering provided R code for the model in its GitHub Repository.[8].

[6] Mathieu, J.L., Price, P.N., Kiliccote, S. and Piette, M.A., 2011. Quantifying changes in building electricity use, with application to demand response. IEEE Transactions on Smart Grid, 2(3), pp.507-518.

[7] Price, P., 2010. Methods for analyzing electric load shape and its variability. Lawrence Berkeley National Laboratory Report LBNL-3713E.

[8] kW Engineering, NMECR, Github repository, https://github.com/kW-Labs/nmecr

Time Only Model: The Time Only model is a subset of the TOWT model, with the time-of-week variable as its sole predictor. As in the TOWT model, the time-of-week variable is developed to characterize the load for each interval within a week.

Simple Linear Regressions with Outside Air Temperature and Change-Point Models: The simple linear regressions and multi-parameter change-point models are based on the ASHRAE Research Project 1050-RP Inverse Modeling Toolkit[9,10]. It includes 2-parameter (linear regression), and 3-, 4-, and 5-parameter models.

Heating and Cooling Degree Day Models: Modeling algorithms based on heating degree days and cooling degree days are well known within the industry and have most widely been used in daily and monthly electric consumption/demand data analysis.[11]

3. Key Data Points

The following data are required for site-level NMEC analysis:

1. ***Energy Consumption Data***: This can be sourced from a whole-building meter or a submeter, and should ideally be short interval data, i.e., 15-minute or hourly. The customer is requested to authorize access for our Program via PG&E's 'Green Button Connect My Data.' Data from a facility owner's submeters, along with calibration documentation, may also be requested to access energy consumption data.
2. ***Outside Air Temperature Data***: This can be sourced from the facility's nearby weather station through National Oceanic and Atmospheric Administration (NOOA) or other similar weather data websites.
3. ***Normalized Weather Data***: This data can be sourced from the California Energy Commission's CZ 2010 weather datasets, defined for 16 California climate zones, or the CZ 2018 weather dataset when it becomes available.
4. ***Operating Schedule Information***: If a building has more than one operating mode, this information will be needed to model the separate operating modes appropriately. Examples of operating modes include school's holidays and summer sessions, different occupancy periods in office buildings, and so on.
5. ***Additional Predictor Variables' Data***: For certain buildings, additional predictor variables, such as customers served, production rate, etc., may be essential to modeling the building's energy use. For these cases, we will determine the appropriate predictor variables (through interviews with building owners) and request data access for modeling.

[9] Kissock, J. K., Haberl J.S., Claridge, D.E., 2002. Development of a Toolkit for Calculating Linear, Change-point Linear and Multiple-Linear Inverse Building Energy Analysis Models.

[10] Killick, R. and Eckley, I., 2014. changepoint: An R package for changepoint analysis. Journal of Statistical Software, 58(3), pp.1-19.

[11] Multiple websites describe the methodology, for example: https://www.degreedays.net/calculate-energy-savings

Data Collection Plan

As part of the participation requirement, customers must provide access to their utility data, or provide a year (minimum) of energy use data from their submeters. The program data collection plan is similar for each participant and includes the key data described above. For individual projects, data for estimating measure savings and measure verification analysis will be requested though a data request process.

The NMEC process requires data from multiple sources, and there are always challenges in obtaining reliable data for analysis. Metering and network connectivity issues may result in sporadic loss or erroneous energy data. Weather data files are notoriously 'gappy' over a few time intervals or might be missing weeks of data. Often data sets have repeated values for many time instances.

Customer-owned energy meters may be used provided they meet the meter type and accuracy requirements listed in the NMEC Rulebook Version 2. Non-utility meters have resolution issues, requiring use of longer time interval models. Additional independent variables beyond weather must be collected from the participant. These data sources must be reliable throughout the project. Their forms and recording time intervals must coincide with the energy data to be made useful for the M&V analysis.

Depending on the duration, the missing data may be ignored, interpolated from adjoining data points, filled-in using data from nearby weather stations, or the monitoring period may be extended. Each data cleaning step will be reported.

Good modeling practice requires that models be developed from a dataset that includes the maximum range of energy and independent variable values. Models should not be used for predictions more than 10% beyond the range (max – min) of independent variables used in the baseline period. Weather coverage factors, which describe how much of the range of baseline period temperature data includes the range of normalized conditions temperatures, will be part of the model assessment.

We will use the most complete and representative weather dataset for each savings quantification.

Precision of Program Savings Measurement

To assure that the NetOne NMEC Program will provide savings estimates within the maximum allowable uncertainty of 50% (90% confidence interval) for each site-level NMEC project, we will estimate the savings using hourly models created with 15-minute interval data for an entire year. Site-level NMEC models' goodness-of-fit between energy use and independent variables will meet thresholds suggested in the LBNL NMEC Technical Guidance Document, which is also mentioned in the Pre-screening section of this M&V plan.

Adjustments for Covid-19

If during initial customer screening, either through conversations with the customer or through visual inspection of the 12-month baseline usage data, shows that a customer has been impacted by COVID-19, the Program will account for those impacts. To account for the impacts of COVID-19 on energy consumption, an adjustment to the estimated gross savings will be used to ensure savings claims are not over/underestimated.

The most straightforward method of adjustment for site-level NMEC will be to adjust the COVID-19 impacted baseline period data associated with a project to reflect more accurately, expected future site behavior. This adjustment could take the form of moving the baseline data collection window to look at a period unaffected by COVID-19 (e.g., 12-months prior to February 2020). More elaborate adjustments to the baseline models could also be made based on the site behavior as observed during the implementation period or reporting period. One example of this would be to incorporate the use of an index variable. Methods to perform this adjustment will be submitted in the Project Feasibility Report.

4. Approach to Ensure Adequate Monitoring in Reporting Period

Monitoring in the reporting period is critical for two reasons: 1) to assure savings are accumulating as expected, and 2) to periodically check for the occurrence of NREs, determine their cause, and remove their impacts from the final savings analysis. For each project, the NetOne Program will run simple savings checks every two to three months during the performance period, as described earlier. Requests for participating customer energy data will be made, and the progress checks will be completed quickly using the R code. Customers find the progress checks helpful and useful for reporting energy savings successes to management.

5. Approach to Determining EUL Values

The feasibility study will identify and recommend energy efficiency measures for each NMEC project. Each measure's effective useful life (EUL) will be determined or approximated from Database for Energy Efficient Resources (DEER) records. The feasibility study will establish a preliminary weighted EUL at the project level, based on the proportional energy savings of each individual measure to the total. After installation, this weighted EUL will be updated based on the actual measures installed and reported with the final savings report.

6. Adjusting for Non-Routine Events (NREs)

Non-routine events (NREs) can be short-term, long-term, or permanent changes in building energy use. They may be additions or removal of constant or variable loads. Major occupancy changes, equipment maintenance, and addition of new equipment are typical examples of NREs. Because they may occur at any time without the participant's or implementer's knowledge, NREs occurring in the post-installation period present risks to the final savings estimation, and if not sufficiently documented may bias the energy savings calculation. Savings progress reporting will be used in the performance period to identify and follow-up on any peculiar or unexpected behavior in the participant's energy use patterns and determine if an NRE has occurred. NREs will be identified by a significant increase or decrease in energy usage that cannot be fully explained or predicted by the models.

One of the following techniques will be used to identify NREs:

- Visual inspection of baseline and performance period energy use profiles
- Savings deviation from ex-ante estimates is more than 50%
- Model fit deterioration with a CV(RMSE) of more than 75%

NREs occurring in the baseline period may be accounted for when developing the baseline model.

During the performance period, the most common method to identify NREs is through visual inspection of metered energy use data. Even in sites where NREs are not anticipated, they may be impacted by unforeseen events. Time-series charts of energy use data may be used to identify shifts in energy use patterns that may be caused by NREs. When a significant amount of performance period energy use data is available, a TOWT model may be developed. When the energy use data begins trending significantly outside expected values as determined by the model, an NRE may be present. Many other NRE detection algorithms, including automated ones, may be used. Each NRE approach will be described in the project-level Energy Savings Reports and final M&V reports.

Some NREs may have de minimis impact on expected or realized savings. If NRE's are determined to have an impact within the expected uncertainty in savings at the site, they will be considered de minimis and ignored in savings determinations.

Quantifying NREs

Because NREs can vary widely, the best method for quantifying them must be determined based on each individual scenario. Methodologies to quantify the impact of significant NREs include:

- Removing data from a short period of time during which the NRE occurred, developing a performance period model with the remaining data, and using it to quantify savings for the project. The NRE impact may be determined from the difference in actual energy use and the performance period model prediction during the time the NRE occurred.
- Using an indicator variable in the model for the time period when the NRE occurred. A simple indicator variable may be appropriate for an NRE that creates a constant addition or removal of energy. More sophisticated variables may be used when the NRE has variable energy use impacts.
- Custom calculation of NRE impacts may be used to account for the NRE using engineering models, as used in custom projects. Due to the complexity of this approach, it is a measure of last resort to keep the program approach cost-effective.

Quantification of performance period NRE impacts will be documented in the Savings Reports.

[12] Killick, R., Fearnhead, P. and Eckley, I.A., 2012. Optimal detection of changepoints with a linear computational cost. Journal of the American Statistical Association, 107(500), pp. 1590-1598

[13] Killick, R. and Eckley, I., 2014. changepoint: An R package for changepoint analysis. Journal of Statistical Software, 58(3), pp.1-19

7. Method of Determining Program Influence and Net-To-Gross

Project influence documentation will be consistent with other custom program requirements and as outlined in the *PG&E M&V Requirements for Site-Level NMEC Rulebook*, these are described below.

A narrative and supporting evidence will be provided to document the actions performed by the program that induced the customer to implement, add scope to, enhance, or modify the energy efficiency project. The narrative will include a record of the NetOne team's engagement and communications with the customer, the customer's decision-making criteria and the project timeline, and will describe how the project was initiated, how the measures were identified, alternative viable options that may also meet the customer's needs, and the energy and non-energy benefits. Supporting evidence may include one or more of the following:

- Marketing materials, including website links, or other communication about program details. Marketing materials provide program details and allow program staff to intervene and promote efficiency measures.
- Audits or site visit results where energy efficiency opportunities are assessed. Site visits can illuminate additional opportunities and validate/quantify known opportunities.
- Energy savings and/or financial calculations for measures. Showing the value of savings and effects of incentives can motivate a customer to pursue a project they otherwise would not have in absence of program intervention.
- Email correspondence or meeting minutes with timestamps that discuss any of the above or that support the narrative.
- Customer decision-making policies such as corporate sustainability policy or investment criteria.
- Internal customer communications or communications with design team that discuss design alternatives, cost estimates, or the customer's decision-making process.

The NetOne Program will use the net-to-gross (NTG) ratio of 0.95 per CPUC Resolution E-4952.

[14] James, N.A., Kejariwal, A., Matteson, D.S., 2014. Breakout Detection via Robust E-Statistics, Github repository, https://github.com/twitter/BreakoutDetection

[15] Vallis, O.S., Hochenbaum, J., Kejariwal, A., 2014. Anomaly Detection Using Season Hybrid Extreme Studentized Deviate Test, Github repository, https://github.com/twitter/AnomalyDetection

[16] SBW Consulting, April 30, 2018, Potential Analytics for Non-Routine Adjustments. Prepared for Bonneville Power Administration

[17] https://github.com/LBNL-ETA/nre

Savings vs. Normal Variations in Consumption

Screening projects to assure savings can be determined with reasonable uncertainties is good practice to ensure individual projects generate valid savings estimates. Since savings uncertainty is inversely proportional to the amount of savings achieved, the higher the savings, the less the savings uncertainty. The NetOne Program will seek projects with a high level of savings but will not turn away projects with low savings as long as the savings can be determined with uncertainties that meet accepted statistical requirements, lower than 50% (of savings) at a 90% confidence interval. As described earlier, monthly models will be developed, and ASHRAE's fractional savings uncertainty formulation[19] used to estimate the uncertainty for each project's estimated savings. The analysis will also yield the minimum detectable amount of savings, which will help assess how low savings can be and still meet the precision requirement. Each savings check will describe how savings are distinguishable from consumption variations, as based on this statistical analysis.

8. Customer Compensation and Incentives

This section focuses on incentive payments to utility customers. For a broader discussion of the relation of payments and incentives between the PA, the Program Implementer, and utility customers, see program contract.

The goal of incentive design is to offer each customer just enough incentive to motivate them to move forward, without providing unnecessary assistance that increases costs and reduces TRC.

NetOne incentive design completely aligns with CPUC incentive best practices guidance outlined in D.18-05-041. Ecology Action shares the CPUC's preference for variable incentive mechanisms for a number of reasons. First and foremost, matching incentives to each customer's needs motivates customers to save energy. Second, by not providing all incentives to all customers as traditional programs do, we are able to significantly reduce programs costs, thereby improving cost effectiveness. Third, this approach minimizes free ridership by establishing at the outset whether customers require energy efficiency services and/or financial support to move forward.

The program will pay (at its discretion) up to 100% of the estimated net 1st year energy savings, approved customer incentive, following verified installation, for measures with submitted and approved installation completion documentation, including itemized invoices. The program may offer less than 100% based on assessment of risk to savings. For Site-level NMEC, there will be no secondary incentive payment to the customer.

[18] 2013-2015 Program Performance Assessment of the Nonresidential Downstream Programs. Submitted to CPUC by Itron, December 2017.
[19] ASHRAE Guideline 14-2002, Appendix B. Fractional savings uncertainty for models with uncorrelated and correlated residuals.

For details regarding program payments to the Implementer, refer to the "Compensation & Performance" section of the program implementer's contract.

	When Paid	What payment is based on	% of total payment
Customer Incentive	At project completion by EA to Customer	Estimated 1st year net energy savings	100%
1st Incentive Payment to EA	At project completion	Estimated 1st year net energy savings	80%
2nd Incentive Payment to EA	12 months after project completion	Net 1st year meter-based savings	Actual

Method(s) and Tools Utilized in the Calculation of Incentives and/or Compensation

Customer incentives are calculated by multiplying the net first year estimated project energy savings by the incentive rate for the project. The net first year estimated project energy savings are determined by Ecology Action using a combination of Deemed and engineering approaches depending on the measures, building characteristics and use. As stated in the previous paragraph, Ecology Action bears the risk of incentive overpayment and PG&E and ratepayers are protected.

Quality Assurance Practices

Several quality assurance and quality control steps will be taken to assure savings estimations are reliable, transparent, and repeatable. These have been described above. In addition, other steps have been included in the process to assure the savings are due to the measures and not NREs. These include:

- Measure verification, based on site inspections, photos and trend analysis,
- Periodic tracking of savings progress throughout the reporting period
- Check-ins with building owners and operators when anomalous energy use is detected.

Report templates will be used throughout the NMEC project process, to assure the correct information is collected and analysis is properly explained.

Data quality checks are used to assure data integrity for each project. These include graphical checks for outliers, gaps, and repeated values, logical checks to assure the data makes sense, and statistical checks on distributions of data.

Each model will be evaluated by checking the assumptions underlying the modeling algorithm, such as normal distributions of points and patterns in the residual plots.

Providing raw data, prepared data, and R code as part of M&V Plans and Savings Reports to assure all data and analysis is completely transparent and reviewable. We will provide internal quality assurance by requiring each report be reviewed by an engineer not involved in the project. Comments will be addressed, and corrections made to each report prior to their delivery. All data and analysis R code for the specific project will be provided with each savings check. Ecology Action will support every technical review and evaluation process.

To be noted, that no referenced document herein is to be construed as to supersede the CPUC NMEC Rulebook (latest version), but only to inform and enhance the project savings claims.

NetOne

PG&E Commercial Energy Efficiency Program

DRAFT Population-Level M&V Plan

March 12, 2021

Normalized Metered Energy Consumption (NMEC)

1. Population Measurement & Verification Overview

This is a Population-Level Measurement and Verification (M&V) Plan for the PG&E NetOne Commercial Energy Efficiency Program. The program is eligible for and complies with the population-level NMEC requirements defined in the CPUC NMEC Rulebook v.2.[1] Based on the definitions provided by the CPUC, population-level NMEC is used when savings claims are made for a portfolio of projects using fixed, standardized, verifiable measurement methods established before the program starts and that are uniformly applied to all sites in the group.[2] All NMEC approaches are based on pre- and post-intervention energy usage data observed at the meter.

Population-level NMEC is an energy savings calculation approach in which results are based on pre- and post-intervention energy usage data observed at the meter and calculated across a group of sites, rather than a Custom engineering forecast, Deemed value, or site-level metered savings calculation. For Population-level NMEC, measurement methods are fixed before the program starts and applied to all sites in the group in a uniform fashion, as opposed to Site-level NMEC measurement methods which may differ on a site-by-site basis.

The Program Implementation Plan[3] for the PG&E NetOne Commercial Energy Efficiency program provides the details for how the program shall be implemented. The population-level NMEC M&V approach is appropriate for this program because it meets the program design criteria for expected savings and permissible project types related to building-type similarity. Given this program will have multiple tracks for savings claims[4], the population-NMEC approach will be used for projects that meet the following criteria:

- Project site data sufficiency and a threshold baseline model fit.
- Project is not tracked to Deemed, Custom, or Site-Based NMEC claimable savings pathways.
- Projects not exhibiting baseline NREs, unless there is an approved non routine adjustment that can be made.

This program will utilize independent, transparent measurement and continual tracking of changes in pre- and post-intervention energy usage observed at the meter. Standardized, open-source CalTRACK and OpenEEmeter, and GRIDmeter for comparison groups, executed on the Recurve Platform, are the foundation of this M&V plan. The remainder of this document details compliance with the CPUC NMEC Rulebook 2.0 requirements for the program-level M&V Plan for Population NMEC which must be included in any implementation plan.

Population-level NMEC Program M&V Plan

3.1. Population-level NMEC Overview

The PG&E Resource Savings Rulebook provides the following definition for population-level NMEC approaches:

- Savings are determined based on the aggregation of many buildings and claimed at the program level

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[1] Rulebook for Programs and Projects Based on Normalized Metered Energy Consumption, January 7, 2020 https://www.cpuc.ca.gov/General.aspx?id=6442456320

[2] CPUC's full definition: "*Population-level NMEC is an energy savings calculation approach in which results are based on pre- and post-intervention energy usage data observed at the meter and calculated across a group of sites, rather than a modeled engineering forecast or deemed value (or a Site-level metered savings calculation). For Population-level NMEC, measurement methods are fixed before the program starts and apply to all sites in the group in a uniform fashion, as opposed to Site-level NMEC measurement methods which may differ on a site-by-site basis.*" Rulebook p. 24

[3] Templates for implementation plans can be found here: http://eestats.cpuc.ca.gov/StandardTables/GuidanceDocument.aspx

[4] See M&V plans for the alternate savings tracks for the NetOne program

for a group of participants.

- A consistent methodology is used to estimate savings across all sites or projects. This may include a pooled approach, in which savings from all sites or projects are estimated in a single model, or an approach in which the same model is applied to all sites or projects.
- Data collection is consistent across all sites or projects, data cleaning steps are applied consistently across all sites, and any eligibility rules are applied consistently across all sites.

The NetOne Commercial Energy Efficiency program will adhere to all these requirements, conducting population-level NMEC M&V following the framework in the International Performance Measurement and Verification Protocol (IPMVP), using the Option C-Whole Facility method.

3.2. Analytical Methods and Software

The public, open source CalTRACK methods and OpenEEmeter, along with the GRIDmeter, have been chosen as the analytical method(s) and calculation software for the Population NMEC portion of this program. The CalTRACK methods were developed using empirical testing to define replicable methods for calculating NMEC using either monthly or interval data from an existing condition baseline. These methods are transparent and peer-reviewed protocols for Option C implementation.[9]

The CalTRACK 2.0 hourly methods will be used to determine electric savings and CalTRACK 2.0 daily methods for gas savings. These methods provide the foundation for payable savings. The CalTRACK methods will be implemented using the open-source OpenEEmeter (curated within Linux Foundation Energy). Background on development of CalTRACK and the OpenEEmeter can be accessed through www.caltrack.org. References to technical specifics are provided throughout this M&V plan.

The CalTRACK methods[5], which describe how to quantify the weather normalized change in energy use for each hour compared to past usage, and the OpenEEmeter[6], which is the Python codebase for CalTRACK calculation implementation, and the GRIDmeter for comparison group sampling, are publicly available for download and inspection. The CalTRACK methods are based on industry guidelines established by The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE Guideline 14)[7] and the Uniform Methods Project (Chapter 8 - Whole Building Methods)[8] and meet all International Performance Measurement and Verification Protocol (IPMVP Option C[9]) requirements. These methods are an appropriate match for this program given it is targeting a range of commercial buildings and combination of interventions. Hourly methods have demonstrated appropriate fit based on historic applications and technical review, and discrete project baseline fit review. Additionally, recent tests conducted by the Efficiency Valuation Organization's (EVO) demonstrate that the OpenEEmeter 2.6.0 CalTRACK hourly methods, performs on par with the LBNL Time of Week Temperature

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[5] The current v. 2.0 CalTRACK methods documentation and technical appendix are available at http://docs.caltrack.org/en/latest/methods.html

[6] The python code base for the OpenEEmeter (eemeter and eeweather) can be downloaded from Github at: https://github.com/openeemeter

[7] ASHRAE Guideline 14-2014 –Published guideline. Supersedes ASHRAE Guideline 14-2002. Measurement of Energy, Demand and Water Savings https://www.ashrae.org/technical-resources/standards-and-guidelines/titles-purposes-and-scopes

[8] *The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures*, National Renewable Energy Laboratory, https://www.energy.gov/eere/about-us/ump-protocols

[9] International Performance Measurement & Verification Protocol: Concepts and Options for Determining Energy and Water Savings, Volume I, Revised March 2002 DOE/GO-102002-1554, International Performance Measurement & Verification Protocol Committee https://evo-world.org/en/products-services-mainmenu-en/protocols/ipmvp

(TOWT) model, and better than all other models tested as of July 2019, including more complex machine learning models that are based on decision trees and genetic programming.[10]

Payable savings will be adjusted via a comparison group adhering to the protocols and recommendations described in the report *Comparison Groups for the COVID Era and Beyond.*[11] These methods were developed in partnership with the United States Department of Energy and in consultation with a working group of industry experts. Comparison groups are described in the section on Adjusted Gross and Net Savings.

The CPUC has specified criteria for "Tools, Methods, Analytical Approaches, and Calculation Software" in the NMEC 2.0 rulebook. Compliance with each of the criteria is provided in Attachment A in table format.

3.3. Calculation of Gross and Net Energy Savings and Peak Impacts

Gross Savings

The basic calculation process for gross savings is conducted in four parts using the CalTRACK calculation methods after data collection and sufficiency checks. The first is establishing the baseline calculation or model fit (see CalTRACK Section 3(b): Modeling - Hourly Methods). The second is normalization of weather and occupancy (section 3.8 and 3.9). The third is computing the results of the avoided energy use (sections 3.10-3.12) and the fourth is the formation of comparison groups and adjustment to savings via the difference of differences calculation (Chapters 3 and 4 of *Comparison Groups for the COVID Era and Beyond*).

Baseline Calculation

The CalTRACK Hourly model draws from 365 days of pre-intervention data in order to deliver a fully specified baseline model for a weather-normalized savings calculation.

Customer AMI data for a full year prior to program enrollment, customer location (address or latitude/longitude coordinates), initial project intervention date, and blackout period that encompasses the duration of project installation are minimal requirements to fully specify the CalTRACK model and assess savings. Aggregators will report project installation and completion dates in addition to various project metadata, which will enable Recurve to assign baseline, blackout, and reporting periods and to create project cohorts that can be tracked separately.

Normalization for weather and other factors

The CalTRACK Hourly methods normalize for weather and assignment of occupancy, as described in detail in section 3.8 and 3.9 of CalTRACK technical documentation.

For occupancy, the sensitivity of building energy use to temperature may vary depending on the "occupancy" status. This is handled by segmenting the hours-of-week into periods of high load and low load (also referred to as occupied/unoccupied, although the states may not necessarily correspond to specific occupancy changes). The segmentation is accomplished using the residuals of a linear HDD-CDD model fit at an earlier stage.

For weather normalization, for each data point (hour) in the baseline dataset, the outdoor dry bulb air temperature is used to calculate up to 7 temperature bins (<30, 30-45, 45-55, 55-65, 65-75, 75-90, >90). These bin endpoints are validated for each model by counting the number of hours with temperatures within these bins. Bins with fewer than 20 hours are combined

[10] EVO's testing portal <http://mvportal.evo-world.org/ > allows users to compare Advanced M&V implementations and methods against each other using a single standardized dataset comprised of one year of hourly electricity data and outdoor temperature from 367 buildings from different regions in North America.

[11] Report available at: https://grid.recurve.com/methods.html

with the next closest bin by dropping the larger bin endpoint, except for the largest bin, where the lower endpoint is dropped. The N valid bin endpoints are then used to develop the binned temperature features.

For the purpose of calculating claimable savings, the same modeling approach is applied to the reporting period using the same rules as for the baseline period. For claimable savings, the coefficients of both the baseline and reporting period are fit to the weather conditions of a Typical Weather Year using CZ 2010 weather data. Savings are calculated as a difference in difference between the energy consumption forecasted in a typical weather year under the baseline energy use conditions and under the reporting period energy use conditions.

These methods have been tested and demonstrate that they yield appropriate model fit for most commercial building types in California (as measured by the coefficient of variation of the root-mean-squared error, CVRMSE).[12]

Adjusted Gross and Net Savings

For population NMEC-based projects the site-specific gross savings will be adjusted to quantify the relative grid impacts of the program interventions using a comparison group and adjusted for free ridership using a default net to gross value of 0.95 established by the CPUC.[13] Both adjustments will be reflected in the payable savings and in the claimable savings to the CPUC.

A comparison group will be maintained throughout the measurement period for a gross savings adjustment. The same savings calculation as described in the "gross savings" section including method and software will be applied to understand participant and comparison group changes in energy consumption. The calculated incremental impact of the program relative to the comparison group will adjust both payable and claimable savings for the portfolio. The adjusted gross[14] will be the difference of differences on a percentage basis applied to the participant counterfactual to determine the value of the savings.

Comparison groups used in meter-based programs have the unique challenge of needing to quantify impacts in the midst of implementation as well as address responses to exogenous factors, including unpredictable exogenous events. As such, the comparison group selection process in meter-based programs needs to utilize a more standardized and consistent methodology than what might be found in traditional impact evaluations.

The methodological approach for establishing comparison groups in the NetOne Commercial Program was developed in an intensive, collaborative research project led by Recurve and funded by DOE in the summer of 2020. More detail on the research informing this method is described in a comprehensive working group report funded by the Department of Energy and peer reviewed by industry leaders.[15] The comparison group analytic approach comports with best practices in the Department of Energy Uniform Methods Project on Estimating Net Savings[16], and is an evolution of standardized approaches for developing matched comparison groups documented by the Energy Trust of Oregon.[17]

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[12] *Technical Report: Testing and Analysis of Residential and Commercial Billing Data*, Recurve (Prepared for the California Energy Commission)

[13] CPUC Resolution No. E-4952

[14] "adjusted gross" is, in this context, net of other activity on the grid, whereas the final "net" adjustment is considering free ridership alone.

[15] *Comparison Groups for the COVID Era and Beyond*, Recurve, 2020 https://grid.recurve.com/uploads/8/6/5/0/8650231/recurve_comparison_group_methods_final_report_2.pdf

[16] *Chapter 21: Estimating Net Savings – Common Practices* https://www.nrel.gov/docs/fy17osti/68578.pdf

[17] *Comparison Group Identification for Impact Evaluation*, OpenEE, for Energy Trust of Oregon, 10/2018 https://www.energytrust.org/documents/open-ee-technical-report-comparison-group-identification-for-impact-evaluation/openee-technical-report-comparison-group-identification-methods-final-wsr/

To formulate a comparison group, Recurve will require business type and location (latitude/longitude or zip code) data along with daily gas and hourly electric consumption data for a sample of commercial non-participants. Consumption data should be provided dating back to 365 days before program launch in order to establish a relevant baseline period. For this comparison pool customers should not have participated in another energy efficiency program within this baseline time period. To limit sensitive data, PG&E can provide pseudo customer IDs for the purpose of data mapping. This dataset should be refreshed each month for the purpose of tracking savings, which will need ongoing comparison group adjustment. Recurve will work with Ecology Action and PG&E to identify the expected treatment group business types and geographic considerations that can focus the data request on relevant non-participants.

Comparison Group Method Synopsis - Adapted to PG&E NetOne Commercial Program

Recurve will conduct comparison group sampling according to the methods summarized below and discussed in greater detail in reference 15. Because the NetOne Program will serve commercial customers, the primary comparison group selection strategy will be to weight the comparison group by business type (determined by NAICS codes) to achieve the same proportionality as the treatment group. If the resulting comparison group is of sufficient size, Recurve will perform additional usage-based filtering to ensure the comparison group represents the treatment group to the maximum extent possible

1. **Identify program-eligible participants**

   The eligibility rules for this program are included in the implementation plan. These classifications will guide the classification of comparable customers.

2. **Limit comparison pool to eligible customers that meet program requirements.**

   a. Fit a CalTRACK 2.0 model on all comparison pool meters.

   b. Remove outlier customers from the comparison pool.

   c. Remove customers with daily baseline CVRMSE values in excess of 0.75.

   d. Remove any remaining customers failing to meet program eligibility criteria

3. **Selection of Comparison Group from within Stratified Sample of Sub-Population**

   a. If a treated group is substantially different from the comparison group selected, the sub-population may be resampled to select a comparison group more similar to the treatment group.

   b. Resampling should only occur once enrollment in the program has reached a sufficient level to support stratified sampling from the broader population of eligible non-participants. Chapter 3 provides a detailed procedure for conducting and optimizing stratified sampling.

   c. Sample proportionally according to business type as determined by NAICS Groups (see Appendix A for NAICS code mapping to NAICS Groups).

4. **Creation of Comparison Group Vintages and Difference of Differences**

   a. Once a comparison group has been created, the baseline period of the comparison group must be aligned temporally with the baseline period of the participating customers.

   b. Where programs enroll customers over a period of time longer than 30 days, the comparison group must be re-baselined for each month of enrollment and a new vintage created that is assigned to a monthly cohort of enrolled participants.

   c. For each monthly cohort of participants, calculate a difference of differences of percentage savings between the treated customers and the associated vintage of the comparison group.

   d. The difference of differences in percentage terms can be multiplied by the raw total for the purposes of aggregation of multiple treated cohorts.

e. The difference of differences calculation should be applied to the model counterfactual for the determination of savings. More detail is provided in Chapter 4 on conducting the difference of differences savings calculations.

Recurve will adjust the comparison group as needed to reflect the most up-to-date treatment group. For instance, if over time the program's focus shifts from grocery stores to office buildings, the comparison group will be re-proportioned accordingly. While Recurve will calculate both treatment and comparison group savings on an individual-meter basis, the comparison group adjustment will be made at a portfolio level.

Net Savings Determination

NetOne Commercial Energy Efficiency program projects using the population-level NMEC approach will install a combination of measures and will therefore use a Net-to-Gross (NTG) ratio of 0.95, per CPUC Resolution No. E-4952.

Outlier Site & Non-Routine Event Identification

In addition to targeting Commercial customers, this section of the M&V plan augments generic qualification criteria for participants with specific considerations regarding project eligibility criteria, screening, and handling of non-routine events to ensure that the savings from the program are reflective of the impacts of the program intervention. The pre-screening and event detection are described below.

1) **Pre-screen portfolio** to identify eligible customers.
   a) 12-month data sufficiency
   b) CVRMSE < 0.75
2) **Identify NREs** quarterly on three dimensions:
   a) Savings v. Baseline: top and bottom 1% and > 50% change
   b) Model fit deterioration; CVRMSE > 0.5
   c) Covid usage: <50% normal consumption for 2 months

Eligibility Criteria and Screening

STEP 1. Recurve will utilize CalTRACK modeling to pre-screen the population to identify customers that have data sufficiency and baseline model fit that will allow for tracking in the performance period. Customers must have 12 months of data and a CVRMSE (pre intervention) that is under 0.75. This screening effort is a critical step to ensure that the customer experience is optimal and that enrolled projects are feasible for a population NMEC program. A pre-screening step in which Recurve runs CalTRACK calculations on all commercial meters in the relevant geographic locations will streamline program operations and save effort throughout the implementation. Ecology Action will request PG&E's support in providing population data for this screening step.

Customers who experience a temporary non-routine event or erratic energy consumption that exceeds the prescribed threshold during the baseline period will use the Deemed, Custom, or site-based NMEC methodologies unless:

(i) the impacted metered consumption can be excluded from the analysis without violating minimum data sufficiency standards; or

(ii) the NRE can be adequately controlled by comparing customer energy consumption to a matched nonparticipant comparison group. Aggregators will be able to check potential projects against this pre-screened list.

In the process of customer acquisition, Ecology Action will verify with customers that they have not nor do they

plan to install major new load additions or subtractions, solar PV, or EV charging in the reporting year (post-program implementation). In addition, Ecology Action will work with PG&E to ensure that customers are not participating in another energy efficiency program, have not installed an EV charging system, or solar PV or battery storage within the baseline year. Finally, Recurve will work with PG&E to ensure that savings claims will not be duplicated for deemed measures by cross-referencing known participants in other programs.

Non-Routine Events and Treatment

STEP 2. Once projects have been initiated, Recurve shall regularly conduct screening of all projects in the aggregators' portfolios for possible non-routine events in three dimensions:

- **Savings relative to baseline consumption.** Recalculate savings as a percentage of baseline consumption for all participating projects on a quarterly basis. Flag the highest and lowest one percent (1%) of projects, plus any projects with savings exceeding ±50 percent of baseline (after adjustment by comparison group).
- **Deterioration in normalization model goodness of fit.** Fit CalTRACK model to the Year 1 post-retrofit consumption data and recalculate CVRMSE at the end of Year 1, prior to a savings claim. If the Year 1 model has a CVRMSE of greater than 0.75, then the Project will be flagged as a non-routine event.

STEP 3 & 4. If it has been determined that metered savings results are invalid, the project savings will be estimated using a consistent transparent adjustment that will be applied uniformly to all disqualified projects. This value is based on the realization rate for the other projects (without non-routine events) in the aggregators' portfolio and calculated for electric and gas savings separately.

Estimated Savings = Realization Rate * Predicted Annual Project Savings

Where:

Estimated Savings = Annual non-routine-adjusted savings to calculate performance payments

Realization Rate = Aggregators total portfolio actual savings divided by total predicted portfolio savings;

$\sum S / \sum P$

Where:

S = Actual annual project savings in kWh or therms as calculated in Recurve platform

P = Predicted annual project savings in kWh or therms as reported by the Aggregator during Project submission to Recurve

Each project in the sub-portfolio designated for approved non-routine adjustments will be adjusted by the appropriate amount relative to its "home" portfolio. Recurve will calculate non-routine adjustments, review with the aggregator, and apply to annual performance payments in the place of measured savings.

Ecology Action will utilize this standard approach for the identification and treatment of non-routine events as part of their program implementation. Systematic and predictable treatment of non-routine events tied to overall portfolio performance to manage risk comports with the Population-NMEC expectation of consistent calculations and treatment of projects across the portfolio. No custom calculations of non-routine adjustments will be conducted for population NMEC projects in this program.

3.3.1. IPMVP Option and Measurement Boundary

IPMVP Option C, Whole Facility will be used for savings determination. Option C was selected because NetOne Commercial Energy Efficiency program includes upgrade projects that encompass multiple EEMs and may have interactive effects.

PG&E's revenue meters will be used to provide reference consumption data for both natural gas and electricity savings calculations. These meters account for all energy use of the facilities. If a facility is served by more than

one meter, then all EEMs must be properly attributed to the meter that tracks the associated load. Alternatively, meter- level consumption can be summed to the whole-building or site level so long as all meters are included that serve loads affected by the adopted EEMs. In rare cases, if a system submeter of appropriate accuracy is present, the submeter may be used for analysis with prior approval from PG&E.

3.3.2. Adjustments for COVID19

To account for the impacts of COVID19 on energy consumption, a routine adjustment to gross savings will be used to ensure savings claims are not over/underestimated.

Methods to perform this adjustment are described above and have been developed by the Department of Energy-funded Comparison Groups Working Group led by Recurve Analytics, Inc. The working group facilitated open discussion via bi-weekly meetings and a public GitHub forum. The methods to be used for adjustment are found in their final report: *Comparison Groups for the COVID Era and Beyond*[10].

The NetOne Commercial Energy Efficiency program will follow the methods described above or other approved methods as they are developed and approved.

3.4. Hourly Load Shape Impacts

Hourly load shape and peak impact calculations

CalTRACK V.2.0 hourly methods, which quantify the change in energy use for each hour in the reporting period compared to baseline usage at the same hour of the year, will be used to assess electric savings including load shape impacts, to ensure an accurate valuation of savings and marginal greenhouse gas (GHG) impacts.[18,19] Comparison group adjustments will be made on an hourly basis as well. Measurement of metered savings on an hourly basis will give PG&E and CPUC essential information to accurately gauge the GHG and avoided cost impacts of the Demand Flexibility Marketplace program. For gas savings the CalTRACK V.2.0 daily methods will be used.[20]

At this time, actual load shape impacts cannot be reported to the CPUC via CEDARS - Cost-Effectiveness Tool.[21] Deemed load shapes or proportional deemed load shapes are used to mirror the impacts of meter-based programs (see Home Energy Reports Filing). For the Demand Flexibility Marketplace program, actual load shapes will be submitted. If actual load shapes are not accepted, a proportional multi-deemed load shape that is the closest reflection of the actual load shape achieved by the program can be used.

Peak impact calculations will leverage the hourly data to estimate the peak impacts achieved by the program during the peak periods defined in the October 11, 2019, DEER Resolution.[22] Timing of peak load is 4:00 p.m. to 9:00 p.m. over a three consecutive weekday "heatwave" that occurs between June 1st and September 30th, does not include weekends or holidays, has the highest value for the sum of the average temperature over the three-

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[18] A careful study of the CPUC's 2019 Avoided Cost Calculator reveals that over-generation and renewables curtailment is forecast for 25% of all hours in 2025 with the majority of these hours occurring during mid-day time periods and mild shoulder months.

[19] Golden, M., A. Scheer and C. Best. 2019. "*Decarbonization of Electricity Requires Market-Based Demand Flexibility*". The Electricity Journal. Vol 32. Issue 7 (August-September).

[20] Gas data is generally available but hourly gas data are only available in part of the state.

[21] Ecology Action is hopeful functionality to submit actual load shapes will be available by the time savings can be reported for this program.

[22] http://docs.cpuc.ca.gov/publisheddocs/published/g000/m232/k459/232459122.pdf

day period, plus the average temperature from noon to 6 p.m. over the three day period, plus the peak temperature over the three-day period.

3.5. Data Collection Plan

The availability and quality of AMI consumption data for proper baselines is fundamental to identifying population NMEC program participants. CalTRACK details necessary data and sufficiency requirements for the establishment of appropriate baselines in Section 2. Data Management.

Ecology Action will collect the site and meter information required for proper weather station matching, project start, and end dates needed for identification of baseline, blackout, and reporting periods to meet the CalTRACK with the specification. Ecology Action will collect relevant project and site metadata which includes participant, location, meter id, date of installation, technology installed, and project costs. Any or all of these data will be utilized for more granular cohort (program subgroup) tracking and management and could be used to facilitate future EM&V studies.

For developing a comparison group, a sample of non-participant customers will be identified to perform accurate matching and comprise a reliable comparison group. As discussed in more detail above, Recurve will need access to PG&E commercial non-participant data to select and track a robust comparison group.

For the purposes of NMEC savings evaluation, models of energy use at site level meters will be created for the baseline period (pre-implementation) and reporting period (post implementation) using 12 months of input data as required by NMEC guidelines.

Because the Program will be using the "difference of differences" approach for population-level NMEC analysis, baseline period and reporting period data will be collected for both comparison groups and treatment groups, for creations of energy use models for both groups. Four datasets and associated models are needed for this approach:

- Treatment group baseline period data and models (Sites included in program pre-implementation)
- Comparison group baseline period data and models
- Treatment group reporting period data and models (Sites included in program post-implementation)
- Comparison group reporting period data and models

Data requirements and sources for the creation of population-level NMEC energy use models are listed in Exhibit 21.

Exhibit 21 – Population-level NMEC Data Sources

Description of Data	Data Sources	Notes
PG&E Utility Data: Electricity (15- minute or hourly); Natural Gas (daily)	PG&E: Automated "Share my Data" and Building Benchmarking Portal for program participants (treatment group) Comparison Group Program Partner: Partner obtains comparison group data directly from PG&E.	Collected for all comparison groups and treatment group sites. Comparison group data will be anonymized prior to transfer to Implementer.
Weather data (hourly or daily dry- bulb ambient temperatures)	Automatic download from NOAA or Dark Sky websites into NMEC Tools	

3.6. Monitoring and Documentation over the Reporting Period

The CalTRACK modeling process specifies quality assurance and quality control procedures. Ecology Action will maintain quality data management and monitoring throughout the program life to ensure the reporting period results generate an accurate representation of the savings impacts. As part of this M&V plan Recurve will provide a fully auditable and verifiable record to track each meter that is modeled and its fate over the course of the program. PG&E will oversee the QA/QC process to verify measure installation through a separate agreement.

[10] https://grid.recurve.com/uploads/8/6/5/0/8650231/recurve_comparison_group_methods_final_report_2.pdf

3.7. Program Plans for Population-level NMEC

3.7.1. Permissible Project Types

Projects meeting the following criteria will be considered to use the program's population-level NMEC approach:

- Project site data sufficiency and a threshold baseline model fit.
- Project belongs to sufficiently homogenous population group.
- Project is not tracked to Deemed, Custom, or Site-Based NMEC claimable savings pathways.
- Projects not exhibiting baseline NREs, unless there is an approved non routine adjustment that can be made

If a project initially qualifies for population-level NMEC but is later found to not meet the above criteria, attempts will be made to change the approach to site-level NMEC, deemed, or custom as circumstances dictate. Changes in individual project approach will be submitted to PG&E for prior approval.

3.7.2. Program Design Criteria

Program Design Criteria

The NetOne Commercial Program has been designed to meet the CPUC criteria for population-level NMEC programs for designated projects. Ecology Action is currently forecasting 60 to 100 projects per year, that encompasses lighting, RFG and HVAC.

Fractional Savings Uncertainty

As a preliminary step in assessing the feasibility of population NMEC, Ecology Action contracted with Recurve to assess the Fractional Savings Uncertainty (FSU) of 53 energy efficiency projects that Ecology Action completed in PG&E's service territory from 2018 - 2020. The CVRMSE values for these projects were generally low (below 0.25) and the FSU achieved was under 5%. While there will be a greater diversity of customers and projects in the NetOne program, there will also be a substantially larger number of projects, which will tend to drive down the FSU. With the results of very low FSU from this meter-based "backcast" of these historical projects, and the plan to serve many more customers Ecology Action anticipates that achieving a low FSU will not be a significant barrier to a successful program.

Calculation of FSU used in this plan complies with industry best practice and specifically reflects Section 4.3 of the CalTRACK methods. The two key metrics for uncertainty are the Coefficient of Variation of the Root Mean Square Error (CVRMSE) and Fractional Savings Uncertainty (FSU). The FSU depends on a number of interactive factors, several of which have non-linear dependencies. In general, driving deeper savings, recruiting customers with good model fit, and serving a large number of customers will improve FSU at a given confidence interval. FSU at an individual site level is defined by the following equation:

$$FSU_i = \frac{\Delta U_{save,Qi}}{U_{save,Qi}} = \frac{t(aM^2 + bM + d)CV(RMSE) * \sqrt{\frac{P}{P'}(1 + \frac{2}{P'})\frac{1}{Q}})}{F}$$

where

t is the t-statistic and a, b, and d are empirical coefficients described further in the online CalTRACK documentation

M is the number of months in the reporting period

Q is the number of periods in the reporting period (days or billing periods for example)

F is the savings fraction defined as the savings divided by the counterfactual baseline usage

CVRMSE is the coefficient of variation of the root-mean-squared error and provides a measurement of the quality of model fit (lower CVRMSE equates to better model fit) and is defined as follows:

$$CV(RMSE) = \frac{\sqrt{\frac{\sum_{p=1}^{P}(U_p - \hat{U}_p)^2}{P-c}}}{\overline{U}}$$

where

U_P is the total energy use during period P

Uhat is the predicted energy use during period p

Ubar is the mean energy use during the baseline period

P is the total number of periods

c is the number of explanatory variables in the model

Fractional savings uncertainty at an aggregated (portfolio) level is calculated via the following equation:

$$FSU_{portfolio} = \frac{\sqrt{\sum_{i=1}^{N}(\Delta U_{save,Qi})^2}}{\sum_{i=1}^{N} U_{save,Qi}}$$

The CalTRACK methods model each site individually before aggregating to the portfolio level with savings uncertainty reported as a first-class output. Savings uncertainty, as opposed to savings depth, is the ultimate parameter of concern (e.g. savings of 4+/-1% may be acceptable, but savings of 10+/-3% may be unacceptable). Aggregating results to a portfolio mitigates issues related to model noise and increases confidence in savings estimates. An extensive discussion of model uncertainty is included in CalTRACK documentation and was leveraged for this analysis.[23]

Based on assumptions, if the NetOne Commercial Program is able to achieve 60 – 100 annual installations, of the planned technologies, and achieve the forecasted average savings, FSU will fall well within the bounds of the CPUC requirements. Ecology Action expects to achieve the CPUC's stated desired FSU of +/- 25% at the 90% confidence level by recruiting a sufficient number of projects, supporting aggregators in recruiting customers with a reasonable CVRMSE (generally less than 0.75), monitoring savings for a sufficient number of days (FSU will be calculated with the CalTRACK daily model), and delivering a reasonable savings depth measured from existing conditions baseline.

3.7.3. Payments and Incentives

This section focuses on incentive payments to utility customers. For a broader discussion of the relation of payments and incentives between the PA, the Program Implementer, and utility customers, see the section "Payable and Claimable Savings" below.

The goal of incentive design is to offer each customer just enough incentive to motivate them to move forward, without providing unnecessary assistance that increases costs and reduces TRC.

[23] See CalTRACK issue: https://github.com/energy-market-methods/caltrack/issues/71.

NetOne incentive design completely aligns with CPUC incentive best practices guidance outlined in D.18-05-041. Ecology Action shares the CPUC's preference for variable incentive mechanisms for a number of reasons. First and foremost, matching incentives to each customer's needs motivates customers to save energy. Second, by not providing all incentives to all customers as traditional programs do, we are able to significantly reduce programs costs, thereby improving cost effectiveness. Third, this approach minimizes free ridership by establishing at the outset whether customers require energy efficiency services and/or financial support to move forward.

The program will pay (at its discretion) up to 100% of the estimated net 1st year energy savings, approved customer incentive, following verified installation, for measures with submitted and approved installation completion documentation, including itemized invoices. The program may offer less than 100% based on assessment of risk to savings. For Population-level NMEC, there will be no secondary incentive payment to the customer.

For details regarding program payments to the Implementer, refer to the "Compensation & Performance" section of the program implementer's contract.

	When Paid	What payment is based on	% of total payment
Customer Incentive	At project completion by EA to Customer	Estimated 1st year net energy savings	100%
1st Incentive Payment to EA	At project completion	Estimated 1st year net energy savings	100%
2nd Incentive Payment to EA	12 months after project completion	Net 1st year meter-based savings	Actual – True-up if needed

*Maximum customer incentives will be calculated based on 1st year net energy savings estimates.

3.7.4. Qualifying Measures

The NetOne program will install a wide range of measures to address as much customer potential as possible. All measures that are eligible according to the NMEC Rulebook are eligible to be included in the program offering.

3.7.5. Cost-Effectiveness

Cost-effectiveness estimates for the NetOne program were included in PG&E's 2021 ABAL filed with the Commission. The values presented were calculated according to existing cost-effectiveness policies and using the latest version of the CET. Annual updates on cost effectiveness will be included in subsequent ABAL filings as well as being posted on CEDARS.

3.8. Program Target Population and Eligibility

The NetOne program serves Commercial customers of all types and all sizes across all of PG&E territory, including hard-to-reach and disadvantaged customers. Customers who are not good candidates for population NMEC treatment due to data insufficiency, prior or expected NREs , participation in other EE programs or other demand-side management offerings such as solar and EV will be served by the program through Deemed, Custom, or site-based NMEC approaches instead.

3.9. Project and Program Level EULs

Project level EULs will be calculated as weighted averages of the energy savings of individual measure level EULs that make up a given project. Likewise, Program level EULs will be calculated as weighted averages of individual project level EULs that make up the Program. Savings for the purposes of both calculations are estimated first-year savings. Program level EULs will be calculated and updated on an annual basis, as program measure mix estimates are informed by prior program year(s) performance.

Individual measure level EULs will be based on the 2014 DEER EUL table. If a DEER EUL does not exist for a measure, the implementation team will propose an estimated EUL for PG&E approval. To facilitate EUL estimation, the implementation team will collect site-level data for the implemented measures, and document any equipment being replaced. Where applicable, the CPUC's "Combining Measures Claims" workbook[11] will be used to facilitate calculation of project and program level EULs.

3.10. Payable and Claimable Savings

Population-level NMEC savings will be claimed by PG&E when the projects are installed, prior to the end of performance period data collection. These savings will be calculated based on ex-ante savings estimates, adjusted as needed by changes in project details (e.g., scope, operating parameters) found during post-implementation inspections and reviews. Software and calculation methods are discussed in Subsections "Analytical Methods and Software" and "Calculation of Energy Savings and Peak Impacts".

Once the performance period data collection period is over and true NMEC savings are calculated, the program savings will be trued-up against the prior savings claimed at the end of project installation. This savings true-up will be implemented in the form of changes in current project savings at the time the true-up process is implemented.

Payments to the Implementer (Ecology Action) will be made in a fashion similar to program savings claims. When savings claims are trued-up at the end of the performance-period, Implementer payments will be similarly trued-up.

Program payments to customers will be paid upon project completion. See Subsection "Payments and Incentives" for more detail. If savings degrade during the performance period to the point that the upfront payment was found to be in excess (i.e., greater than the NMEC verified savings multiplied by the appropriate incentive rates), Ecology Action will evaluate whether excess incentive paid is above a threshold value and assess the responsibility for savings degradation and decide whether or not to recover incentive funds from the customer.

3.11. To-Code Savings Insight

The NetOne Commercial Program will deliver both "above-code" and "to-code" savings as described in the implementation plan. Compliance with D. 17-11-006 Ordering Paragraph 2 is met in [SECTION 6] of the implementation plan.

The M&V plan described herein will quantify the savings achieved compared to an existing conditions baseline as authorized in AB802, SB350 and detailed in the methods sections of this M&V plan.

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[11] ftp://ftp.cpuc.ca.gov/gopher-data/energy_division/EnergyEfficiency/RollingPortfolioPgmGuidance/Combining_Measures_Claims.DRAFT.xlsm

3.12. Bid M&V Plan

An M&V Plan was included in the Implementer's original bid. See Appendix.

Appendix: Bid NMEC M&V Plan

The following M&V plan was included in the implementers original bid. This is for reference only.

Ecology Action will utilize both population-level and site-level NMEC approaches. There are multiple factors that will inform our decision on which approach will be used for each building or set of buildings. Primary factors include CPUC guidance and model fit. While final guidance is still forthcoming, the CPUC is likely to encourage aggregated NMEC programs to forecast a fractional savings uncertainty (FSU) of 25%. Model fit will be calibrated based on CPUC guidance.

The population-level NMEC approach will be used when there are sufficient commonalities (such as in building use, occupancy factors, climate zone, size, etc.) and a large enough number of homogeneous buildings are available for treatment to successfully deploy an aggregated approach.

When population-level NMEC is not an option due to excessive projected FSU given the building set available (such as when there are extreme differences between customers and large Custom projects), we will employ site-level NMEC.

While Ecology Action is open to including other more experimental methods, such as RCT, these approaches and samples are not expected to be readily constituted for this program design and would likely hinder customer acquisition efforts and dampen program participation.

When carefully tracking non-routine events and assessing baseline model fit, site-level NMEC may be the appropriate method. In these cases, we will use CalTRACK 2.0 methods at site level, ensuring that the risk associated with unforeseen events is manageable.

Finally, recent research done by Recurve for the California Energy Commission[i] found that, while CalTRACK methods can provide sufficient confidence for aggregated NMEC in most building types, certain building types/end uses do not lend themselves well to CalTRACK. For instance, schools and hospitals may not be good candidates for CalTRACK because they have highly impactful independent variables that are not included in the model or usage. This can create great variability and therefore make it difficult to make predictions with a whole building model. For schools, scheduling is not a standard CalTRACK variable due to non-standard break schedules, which requires the model to be adjusted accordingly. For hospitals, usage is highly variable and depends on a host of factors. Submetering or Custom are likely better paths. For buildings that display a poor model fit, neither aggregated nor site-level calculations may be appropriate and a Deemed and/or Custom pathway may be necessary.

The proposed program will utilize CalTRACK methods (v2.0) for population-level NMEC. The methods description (docs.caltrack.org) and Python implementation (https://github.com/energy-market-methods/caltrack) are open source and available for inspection. The CalTRACK methods are based on guidelines from ASHRAE (Guideline 14) and UMP (Chapter 8 - Whole Building Methods) and meet IPMVP Option C requirements.

The CalTRACK methods are appropriate for both population-level and site-level projects. CalTRACK methods rely on consumption and weather data and were specifically developed to quantify population-level impacts. CalTRACK methods have the ability to handle site-level NMEC projects with acceptable statistical accuracy/precision and include guidance for qualifying buildings, handling outliers and reporting savings uncertainty. Normalization will occur with weather data for the pre-retrofit and post-retrofit (reporting or performance) periods and the typical (normal) weather year. Ecology Action will employ Recurve as our service provider to perform analysis.

NMEC savings will be calculated using open-source tools that are developed out of the CalTRACK 2.0 working group and EM2 projects. This is a collaborative and ongoing forum with industry stakeholders that refines and optimizes NMEC tools in real time. Generally, these will involve regression models using weighted least squares (WLS). In the future they could

include monthly fixed effects (MFE) methods.

Necessary Data and Sources
Measurement methods require 15-minute or hourly interval electric data and hourly gas data. Data sources include PG&E Share My Data, weather data from NOAA and 2013 CA Climate Zone information for normalization, and the California Energy Efficiency Policy Manual v5 for EULs. There may be instances in which we will require meter data from PG&E if the data for a given building from Share My Data is corrupted, questionable, or of poor quality.

Data Acquisition and Challenges
These data sources are typically reliable and are currently used in existing PG&E programs. The most likely meter data issues are missing, incomplete, erroneous, or dirty data for pre- and post-monitoring periods. Ecology Action will work with PG&E when necessary to obtain source data, pinpoint causes of data problems, and resolve them. If adequate and appropriate meter data cannot be obtained reasonably, the subject building will be measured with Deemed and/or Custom approaches.

Weighted Average EUL
Ecology Action is prepared to develop weighted average EULs across the set of measures deployed in a given site or population of sites. When measure EULs vary significantly, we will apply measure or site-specific EUL values.

Non-Routine Events
Accuracy and completeness of NMEC savings calculations are crucial to ensure that performance risk for aggregators and administrators is manageable, especially for the smaller portfolios of projects. As such, Ecology Action will adjust savings for a predefined set of non-routine events (NREs). The categories, triggers, and actions for NRE adjustments will be agreed to in advance by contracting parties. Triggers for non-routine events can be defined algorithmically and tracked in the Recurve platform. NREs may also be defined based on demonstrable knowledge of changing building conditions brought forward by Ecology Action.

In these cases, Ecology Action will:

1. Identify event
2. Quantify the duration of the event
3. Quantify magnitude of impact of those events from Custom savings approaches
4. Adjust pre- and/or post-meter data as appropriate to account for the NRE
5. Analyze the adjusted data set with typical CalTRACK methods

One option that would be simpler but not as precise would be to establish savings outliers as NREs. For instance, any customer with savings that are beyond a +/- percentage basis relative to baseline usage may be deemed an outlier and removed, with an average savings value from the rest of the population applied. Setting an outlier threshold (for instance +/- 50%) may be appropriate. NRE adjustments must be addressed symmetrically for both under- and over-performing projects, which is critical to avoid adjustment bias.

CPUC's 10% guideline is general guidance for all models including those using monthly metered data. The 10% guideline may not be appropriate for models that employ interval and hourly consumption data. Model noise depends on the underlying consumption patterns and varies from building to building. Aggregating results to a portfolio level, whether using site-level or population-level NMEC, mitigates issues related to model noise and increases confidence in savings estimates.

The CalTRACK methods model each site individually before aggregating to the portfolio level, thus benefiting from aggregation effects. For any individual project (or measure), if the projected savings are less than 10%, it has no impact on

the program evaluation, since the results will be reported at the program level with the associated uncertainty. If savings are not sufficient to be detected using NMEC methods, we will use Deemed or Custom as needed.

The program will ensure that savings are detectable beyond data variation and model error by screening candidate buildings for model fit using ASHRAE Guideline 14, LBNL's Guidance for Program Level M&V Plans: Normalized Metered Energy Consumption Savings Estimation in Commercial Buildings, Version 1 (Draft), LBNL for CPUC ED, 3/1/2018, and the Rulebook for Custom Program and Projects Based on Normalized Metered Energy Consumption (NMEC), Version 1 (Draft), 3/28/2018 (with referenced CPUC rulings, decisions, and resolutions).

Model fit will be evaluated by considering fractional savings uncertainty (FSU) calculations based on the following characteristics of a given population of treated buildings: number of buildings, building types, and expected depth (%) of savings.

Research performed for NYSERDA by Recurve found that in order to keep FSU to less than 25% for small retail buildings, a population of at least 40 projects would be needed if savings are expected to be on the order of 10% of total usage. This finding and others like it for other building types can serve as the initial guidelines for assembling populations to meet FSU thresholds. Likewise, because their usage patterns tend to be more variable, industrial and warehouse facilities would require nearly 125 buildings at the same savings depth. Because increasing the number of buildings and/or the depth of saving will further reduce FSU and model error, Ecology Action will screen participants for these characteristics as well.

We assume that achieving an accurate FSU calculation is based on the veracity of the projected number of buildings, building types, and expected depth (%) of savings.

As such, Ecology Action will utilize our historic commercial program data on customer uptake and actual depth of saving across measures, climate zones, and building types to ensure the greatest possible accuracy. Backcasting will also yield valuable insights on expected depth (%) of savings, which we will use to improve FSU.

Recurve will assist Ecology Action by screening buildings for reasonable model fit (measured by the coefficient of variation of the root-mean-squared error or "CVRMSE") and agreed-upon targeting parameters (usage characteristics indicative of savings potential for specific interventions). Doing so can help increase savings and savings depth and limit the total number of buildings required to achieve a good FSU.

Ecology Action will utilize CalTRACK 2.0 methods to verify NMEC platform savings. CalTRACK methods have been developed through an open, collaborative stakeholder process that was initiated by the CPUC, the four major California IOUs, and the CEC. Industry experts, both in and outside California, have provided input and testing. These results are available for public review (https://github.com/energy-market-methods/caltrack).

The CalTRACK methods have been thoroughly tested and vetted in a transparent stakeholder process, with all results and discussion available publicly online. In addition, results from the Efficiency Valuation Organization's (EVO) Advanced M&V Testing Portal demonstrate that Recurve's implementation of the OpenEEmeter 2.6.0 CalTRACK hourly methods performs on par with the LBNL Time of Week Temperature (TOWT) model and better than all other models tested as of July 2019, including more complicated machine learning models based on decision trees and genetic programming.

NMEC M&V Plan

Our NMEC M&V Plan utilizes IPMVP Option C and implements CalTRACK 2.0 methods, which supports both site-level and population-level NMEC measurement. To develop the Plan, we have drawn from three sources: BayREN's M&V Plan for its proposed P4P commercial pilot, LBNL's Guidance for Program Level M&V Plans, and lessons from Recurve's work with both NYSERDA and PG&E.

In adherence with LBNL guidance, the M&V Plan tracks three metrics for each building (CVRMSE, R^2, and NMBE) at a 90% confidence interval. We will provide ongoing summary reporting for expected uncertainty and fractional uncertainty due to model error. Likewise, we will aggregate results at the portfolio level for FSU reporting. Scenario analysis will determine the percentage of buildings with uncertainty greater than expected savings, as well as fractional uncertainty greater than 25% and 50%, across the range of expected savings. Projects with high CVRMSE may be moved to Custom or Deemed.

CalTRACK relies on a weighted least squares regression. The dependent variables are kWh, kW, and therms. The independent variables are temperature and occupancy. The time resolution is expected to be at the daily level (the monthly level is also possible).

Site verification activities document measure installation and retrofit dates and identify concurrent energy efficiency interventions.

Baseline periods are 12 months before the project, while reporting periods are 12 months after the project.

PG&E revenue meters will provide energy consumption data. Weather data sources will include NOAA and California Climate Zone data (CZ2010/CZ2013) and will be used to calibrate models and to normalize energy consumption.

We will use the criteria of ASHRAE Guideline 14 to verify that all independent variables are adequately covered. For example, temperature is confirmed to be within a certain range within the one-year baseline period and is not forecast to vary more than 10% above the maximum or more than 10% below the minimum values for any period of time during the reporting period.

The definition and triggers for non-routine events (NREs) will be determined jointly with PG&E as part of contract negotiations. Expected NREs include changes in onsite generation, EV charging, square footage, hours of operation, and other efficiency interventions. NREs may be identified via interval data monitoring and through customer interviews. Adjustments will be made accordingly using CPUC-approved Custom calculation methods and Deemed workpapers.

[i] Technical Report: Testing and Analysis of Residential and Commercial Billing Data, Recurve 2018 (Prepared for the California Energy Commission)