White Paper: Energy Efficiency Measure Classification

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INTRODUCTION

This white paper provides guidance to third-party (3P) measure developers and innovators on the appropriate pathway for a new measure proposal to enter the California energy efficiency portfolios. The pathway that leads to the classification of a measure will determine the applicable ruleset that will govern how a measure is developed; how baseline, costs and other parameters are determined; and how measure savings are claimed and evaluated. Understanding how a measure can and may be classified will help 3P measure developers and implementers make informed choices when designing and implementing programs that include such measures.

Several well-known references to California stakeholders, such as the *Energy Efficiency Policy Manual*, broadly define the accepted measure types and an assortment of regulatory decisions, IOU rulebooks, and procedures manuals have defined more specific documentation and eligibility requirements. However, a single reference that provides the current definitions and distinctive characteristics of all measure types does not exist. Without a single reference, it has been and will continue to be challenging for 3P measure developers to know in advance the most appropriate path (e.g. custom, deemed, etc.) for a new measure proposal, and it is not possible for the IOUs (or the Cal TF Staff) to provide clear and consistent guidance.

This white paper provides definitions of energy efficiency measure types (new and emerging) that have been formally or informally adopted, key characteristics of each measure type, and the implications for key stakeholders (customers, implementers, and utilities) for how a measure is characterized. Finally, the paper provides a flow chart for determining how a measure should be characterized.

CALIFORNIA DEFINITION OF AN ENERGY EFFICIENCY MEASURE

Decision 05-04-051, Ordering Paragraph 1, adopted version 3 of the *California Energy Efficiency Policy Manual*, "including the policy rules (Rules), terms and definitions contained therein," which provided the following definition of an energy efficiency measure:

> *An energy using appliance, equipment, control system, or practice whose installation or implementation results in reduced energy use (purchased from the distribution utility) while maintaining a comparable or higher level of energy service as perceived by the customer. In all cases energy efficiency measures decrease the amount of energy used to provide a specific service or to accomplish a specific amount of work (e.g., kWh per cubic foot of a refrigerator held at a specific temperature, therms per gallon of hot water at a specific temperature, etc). For the purpose of these Rules, solar water heating is an eligible energy efficiency measure.*

This definition has been presented in subsequent versions of the *California Energy Efficiency Policy Manual.*

In California, an energy efficiency measure may be categorized as deemed (also referred to as "prescriptive"), custom, normalized metered energy consumption (NMEC), or emerging technology (ET) measure. A new measure type being explored by Cal TF is the "hybrid" measure, which is a blend of custom and deemed measure characteristics. The different measure types are described further below.

MEASURE TYPE DEFINITIONS: CURRENT AND EMERGING MEASURES

Deemed and Custom Measures (Mainstream Portfolio)

In California, energy efficiency measures implemented in mainstream ratepayer-funded programs (both IOU and third party programs) are currently categorized as either *deemed* or *custom*.[1] A deemed measure is an energy efficiency measure for which per-unit impacts and costs have been pre-determined.[2] Also, deemed measures must be approved by the California Public Utilities Commission (CPUC) prior to their use in IOU portfolios. A custom measure is an energy efficiency measure for which the financial incentive and the ex-ante energy savings are determined using a site-specific analysis of the customer facility (D.11-07- 030, p.31) and for which the incentive amount is calculated, reviewed, and approved in advance of the implementation of the measure(s).

Normalized Metered End-Use Consumption (NMEC, a subset of custom)

Normalized metered end-use consumption (NMEC) is a project savings calculation methodology with potential implications for the definition and application of a measure type called an NMEC measure. Senate Bill 350 established the policy framework and defined NMEC as follows:

> *The energy efficiency savings and demand reduction . . . achieving the targets established pursuant to paragraph (doubling of EE by 2030) shall be measured taking into consideration the overall reduction in normalized metered electricity and natural gas consumption where these measurement techniques are feasible and cost effective."* (p.7)

The savings of NMEC measures are developed by comparing 12 months of post-intervention energy consumption with at least 12 months of pre-intervention energy consumption at the customer utility meter, using a sufficiently robust regression model to estimate the energy savings due to a particular intervention. Thus, by definition, NMEC measures use "existing conditions" as baseline rather than "standard practice" baseline. NMEC measures can be site-level or population-level and savings need to be large enough to be observable at the meter (10% of annual consumption or more for site-level NMEC, though exceptions and submetering are permissible with CPUC approval).[3]

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[1] The custom measure type is sometimes referred to as "calculated" or "customized" approach. See 2019 SCE Energy Efficiency Programs Annual Report – May 2020

[2] The *California Energy Efficiency Policy Manual*, version 6.0, defines a deemed measure as: "A prescriptive energy efficiency measure." (Appendix B).

[3] Refer to *Rulebook for Programs and Projects Based on Normalized Metered Energy Consumption, v 2.0* for more details about qualifying measures, eligibility, and suggested savings measurement approaches.

The advantages of the NMEC savings approach are:

1) It creates a framework for accounting for savings for programs based on a "pay-for-performance" incentive model,
2) Ongoing monitoring of metered energy usage enables implementers and customers to take corrective action and/or to investigate problems if expected savings do not materialize or degrade over time, and
3) It has broad applicability so that measures traditionally claimed in custom, hybrid, or deemed programs are eligible under the NMEC framework.[4]

Hybrid Measures (Cal TF Proposed Measure Type)

This paper presents details to support a hybrid measure type, also referred to as partially deemed, partially custom, or semi-custom in other jurisdictions.[5] Even though hybrid is not an accepted measure type for the California IOUs, the POUs accept hybrid measures in the form of semi-custom measures.

Hybrid measures, where appropriate, can offer several advantages:

1) Hybrid measures offer greater customer certainty of requirements, application timeline, and incentives than custom measures. In particular, the savings and incentives can be determined in advance with less, if any, project-specific technical review by the IOU and possibly CPUC evaluators through the custom process review (previously called ex-ante review).
2) Hybrid measures offer a streamlined, shorter approval process, similar to deemed measures.
3) Hybrid measures allow limited site-specific characteristics to be considered, but with pre-defined allowable input ranges specific to each permutation[6] of the pre-defined calculation approach, providing greater simplicity than custom measures and greater accuracy than deemed measures in savings and/or cost estimates.
4) Hybrid measures could be given the advantage of more limited in-situ field verification requirements or a pre-defined site-verification plan that clearly identifies the inputs that require field verification.

Given the advantages of hybrid measures, Cal TF Staff is working with Cal TF, the IOUs, and POUs to define a *"hybrid"* measure category for consideration by the CPUC.

Emerging Technology Measure (Early Commercialization)

Another measure type is an emerging technology measure. It is important to distinguish an emerging technology project, or measure, from the Emerging Technology Program (ETP) that evaluates the performance of new measures for eventual inclusion into the energy efficiency programs (e.g. as a custom or deemed measure). The *California Energy Efficiency Policy Manual* version 6 defines an emerging technology measure as follows:

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[4] Ibid.

[5] See, e.g. Illinois Technical Reference Manual (TRM) and Massachusetts electronic Technical Reference Manual (eTRM). Both jurisdictions specify which parameters require the use of site-specific data in the savings calculation algorithm.

[6] A permutation is a unique combination of parameters for which energy consumption, demand, and/or impacts are calculated.

> *New energy efficiency technologies, systems, or practices that have significant energy savings potential but have not yet achieved sufficient market share (for a variety of reasons) to be considered self-sustaining or commercially viable. Emerging technologies include late stage prototypes or under-utilized but commercially available hardware, software, design tools or energy services that if implemented appropriately should result in energy savings.*

Emerging technologies can be underutilized measures whose prospects may change due to market conditions, thanks to the inclusion in the energy efficiency programs, or for other reasons. The ETP exists so the utility portfolios have access to independently verified performance and market information on emergent, potentially cost-effective energy efficiency measures and can keep pace with market changes. In addition, emerging technologies can help fill in technology gaps in the portfolios created by natural attrition as energy efficiency measures transition to industry standard practice/code baseline.

The ETP is a non-resource acquisition program, meaning that an ETP program administrator or implementer cannot claim savings for the emerging technology measures it evaluates. However, the project can be submitted and evaluated in parallel under the custom program for which the implementer can claim savings.

MEASURE TYPE CHARACTERISTICS

Each measure type has specific defining characteristics described below.

Deemed Measure Characteristics

As noted above, a deemed measure is an energy efficiency measure for which per-unit impacts and costs have been pre-determined; deemed measures implemented through the IOU portfolios must be reviewed and approved by the CPUC. A measure characterization in the eTRM (traditionally known as a "workpaper") documents the established methodology and all calculation inputs, assumptions and parameters across a variety of known applications of that measure to estimate per-unit impacts and costs for all measure permutations.[7]

The pre-determination of savings, costs and other parameters, and the associated documentation into a measure characterization is a process that may require a considerable amount of time given that it usually requires a considerable amount of data. The number of sample points to ensure a correct representation of the target population, including its most important segments and sub-segments, can be high. Measure proposers should be aware of these data requirements and consult the Cal TF developed New Measure

[7] The *Statewide Deemed Workpaper Rulebook v3.0*, maintained by the California IOUs, defines a deemed measure as: "a prescriptive energy efficiency measure that uses a predefined and CPUC-approved savings calculation, cost, eligibility, and other measure attributes. A deemed measure uses either values from DEER or an approved workpaper of measure savings assumptions that will be applied consistently to the same measure." (p.1)

The *Statewide Deemed Workpaper Rulebook v3.0* provides the following definition of a workpaper: "Energy efficiency savings are quantified via workpapers, which are technical engineering documents that prescribe pre-determined values for energy savings, measure costs, and other ex ante values. Workpapers are generally used for homogenous, high volume interventions and have historically been developed by the California Program Administrators (PAs) with California Public Utilities Commission (CPUC) input and approval. The CPUC-maintained Database for Energy Efficiency Resources (DEER) provides ex ante values that can facilitate workpaper development." (p.1)

Development and Review Process available on Cal TF website for the parameters required for inclusion into the eTRM as a deemed measure.[8] Ultimately, the measure needs to be submitted to and accepted by the CPUC. The benefit is that, once sufficient proof of savings, baseline, and cost data has been collected and adequately documented, deemed measures are the simplest pathway for customers to participate in the programs, requiring the least amount of data collection and site-specific review and providing the greatest assurance of incentive level than any other measure type, thus maximizing their market uptake.

Custom Measure/Project Characteristics

A custom measure is a measure that has not been established as deemed. Custom measure savings are estimated prospectively (e.g. site-specific engineering calculations), but unlike deemed measures, custom impacts are verified retrospectively (e.g. submetering or other project-specific M&V protocol).

The *2019 Customized Offering Procedures Manual for Business* provides the following definitions: "Customized incentives are only available when the measure is not offered through a Deemed [..] rebate program" (p.9) and "Incentives are paid on the energy savings and permanent peak demand reductions above and beyond a baseline energy performance, which include state-mandated codes, federal-mandated codes, industry-accepted performance standards, or other baseline energy performance standards as determined by the PA." (p.2)

As specified in D.11-07-030, custom measures/projects are "[e]nergy efficiency efforts where the customer financial incentive and the ex-ante energy savings are determined using a site-specific analysis of the customer's facility." (p.31)

Currently, custom measures do not require development of a workpaper and are thus not as data intensive as deemed measures to be introduced into the energy efficiency programs. However, data requirements are not waived as they instead apply at the project level, and the implementer needs to provide evidence of, among other things, energy savings, costs, and influence over the customer decision to install the equipment. For these reasons, it is relatively simple to introduce a measure into the programs under the custom program, but it is difficult to achieve scale and to maximize customer uptake of a particular measure because of the relative high implementation requirements at the project level. The custom program is best suited for unique or low volume energy efficiency measures that generate a sufficient amount of savings to warrant the additional site-specific data collection.

[8] http://www.caltf.org/submit-a-measure
See also: *Cal TF Technical Position Paper No. 11: Statewide New Measure Development and Measure Update Process* available for download at http://www.caltf.org/tools.

NMEC Measures Characteristics

NMEC measures are characterized by the monitoring and analysis of the metered energy consumption before and after the intervention to estimate the energy savings. An important element of NMEC measures is the baseline estimation, which needs to be normalized for factors that are known to affect consumption, such as weather, occupancy rates, or schedule changes, and occasionally needs to be corrected to account for non-recurring events that can affect energy consumption independently of the intervention (as an example, the recent changes to HVAC schedules due to COVID-19 can be considered a non-recurring event and need to be factored in the baseline consumption through ad-hoc adjustments).

NMEC programs that use NMEC measures (qualifying measures can be both deemed or custom, or a combination of both, as well as behavioral, retro-commissioning, and operational, or "BRO" measures given certain minimum requirements) can be either "population-level", based on a group of homogeneous sites that are receiving the same intervention, or "site-level", based on individual sites. To operate a NMEC program, a pre-approved M&V plan with minimum expected statistical performance and measurement period is required. Given the relative novelty of the savings measurement approach, there is not a lot of program experience and typical measures and typical timelines are not available at the time of this writing.

Hybrid Measure Characteristics

The hybrid measure classification is not approved for the California IOU portfolios, though the approach has been adopted and applied successfully in multiple jurisdictions throughout the U.S. A hybrid measure type aims to improve upon the shortcomings of custom project applications (particularly to improve upon the customer experience and to speed up the application and incentive payment processes) while offering additional precision for certain parameters compared to the deemed approach without relying on statistical analyses that require extensive data collection[9]. The savings estimation algorithm of a hybrid measure is deemed (i.e., pre-established and approved), but site-specific data is collected for select parameters that account for most of the variation in savings (e.g. actual equipment size, actual efficiency level, site-specific hours of use instead of averages by building type or weighted averages across building types).

Emerging Technology Measure Characteristics

As defined above, emerging technologies are new, unproven technologies at the beginning of their lifecycle or more mature technologies with very low market penetration. An emerging technology may require a higher level of support and might not be cost-effective in the short-term due to low production volumes, but as it moves up the learning cost curve and/or its performance improves through technical advancements, cost-effectiveness and savings potential may increase. In addition, due to the low market penetration, the uncertainty of savings and cost-effectiveness is high, but should improve with experience and with number of installations. The emerging technology stage is a "transitory" phase in a measure's

[9] See e.g. Massachusetts electronic Technical Reference Manual (eTRM), Building Shell: Air Sealing – C&I Multi-Family (Measure code: COM-BS-ASREU). The algorithm for savings electricity savings is *kWh = (Vol x ACH x 0.018 x HDD x 24/nheating) / 3,413* where *Vol* is the air volume of the treated space and has to be an auditor input (site-specific), while *ACH* is the reduction in Air Changes per Hour and can be either default or coming from a blower door test (can be site-specific) and *nheating* is the efficiency of the heating system and has to be determined by the auditor (site-specific)

lifecycle, after which the measure may transition to one of the two mainstream utility programs and become either a deemed measure or custom measure (assuming the measure is determined to be a viable measure).

MEASURE TYPE IMPLICATIONS

How a measure is classified has implications for implementers (ease and usability of a measure), customers (speed of project development/certainty of savings/certainty of incentive) and the regulatory approval process. Finally, measure classification impacts utilities' ex post evaluation risk, review, and claims process.

Key distinctions are described in the table below.

Measure Type Implications

		Emerging Technology [10] (part of ETP)	Custom	Deemed	Hybrid (POU-only)	NMEC
Customer	Incentive Risk	(Not applicable)	High Risk & Uncertain	Low Risk; prescriptive	Med Risk	High Risk & Uncertain
	Project Timeline	Depends on project specifics and data collection needs.	Long; influence / standard practice trigger / complex M&V (main factor for POUs) / CPUC parallel review, complex projects / equipment require long install lead times	Short; mostly a paperwork exercise post measure install	Short/Med; will depend on project-specific factors	Long; greater certainty but requires at least 12 months of data collection
	Data Collection Burden	Low; ETP program implementer mostly involved with data collection. Likely several touchpoints with the program.	Varies by project; higher than deemed/hybrid; data collection extends to program influence (IOUs), not just savings	Low	Low/Med; data requirements clearly set	Generally low unless there are a lot of non-routine events; upfront screening to see if facility is good for NMEC

[10] *Note on emerging technologies:* this white paper does not define measure eligibility for the Emerging Technology Program (ETP); rather the objective is to categorize characteristics of the IOU-funded ETP to a new measure proposer from different perspectives. Unlike deemed, custom, hybrid, and NMEC, which are measures that are implemented through resource programs (which provide direct energy savings), ETP is a non-resource program that does not provide direct energy savings. Rather, the ultimate objective of ETP is to identify technologies with low market penetration that are likely to produce cost-effective energy savings at scale. (D.12-05-015). ETP, therefore, involves considerable data collection to demonstrate cost effective savings and to derive the algorithms, inputs, and parameters needed to properly calculate the measure impacts and costs. The distinction between resource and non-resource measure types is important as the reader reviews the table.

		Emerging Technology [10] (part of ETP)	Custom	Deemed	Hybrid (POU-only)	NMEC
Implementer	Savings Claims Risk	(Not applicable)	Very High Risk & Uncertain Outcome; "investment" risk of time/effort in a project that might or might not get claimable savings	Low Risk; minimum TRC requirements as of 2021; some measures subject to retrospective savings claim risk	Low/Med Risk; depends if simple variation of existing deemed vs calculator-based approach	High Risk; need to see the impact on the utility meter and have the right M&V plan; non-routine events can cause additional disruption; need to ensure program criteria are met
	Project Timeline	Varies on project specific and dependent on data collection requirements, usually long	Long; multiple touchpoints; high uncertainty	Short; program does not impose potential delays that are outside of implementer control	Short; a bit more than deemed	Long, but known to include long term monitoring

	Emerging Technology [10] (part of ETP)	Custom	Deemed	Hybrid (POU-only)	NMEC
Administrative Burden	High; program usually entails multiple touchpoints, technology validation, customer experience verification, significant data collection and analysis	Low upfront (no workpaper necessary) High implementation burden, project-specific; effort to generate the same amount of savings varies and may require differing approaches; influence documentation; multiple touchpoints during review; reporting + forecasting; risk of changing rules during project life; standard practice; cost documentation	Low from implementation perspective (front-loaded / startup); High upfront for a new measure workpaper development, calculations, data collection, data analysis, etc. / ongoing deemed measure updates; "high impact measure" makes burden even higher	Low, similar to deemed; some light additional verification requirements High upfront for a new measure workpaper development, calculations, data collection, data analysis, etc. / ongoing deemed measure updates; "high impact measure" makes burden even higher	Med burden for implementation High for M&V + data collection infrastructure; also needs specialized statistical knowledge & software at hand to extract signal from the data
Customer Satisfaction Level	Variable and measure / project specific	Mixed; high variation; suffers from customer perception issues of delays, uncertain incentives, multiple reviews, getting project cost documentation and standard practice determination	High satisfaction: paperwork might affect it, but generally every program element is known: clear expectations, clear process, incentive level and timeline	High satisfaction; very similar to deemed with some variation due to project verification	Not enough data from this program design type to tell

		Emerging Technology [10] (part of ETP)	Custom	Deemed	Hybrid (POU-only)	NMEC
Utilities	Savings Claims Risk	(Not applicable)	Variable risk; controversial / large projects have high risk; smaller projects lower risk, impacts ESPI score (IOU)	Variable risk; controversial (e.g. uncertain measures list) / high volume measures have high risk; otherwise low risk, impacts ESPI score (IOU), retroactive adjustments	Low Risk; currently low volume measure with limited exposure	Variable risk. In the short term, there is some risk due to variation from plan to actual In the long term there is low risk as M&V is done as part of program
Regulatory	Timeline & Process of Measure/Project Development	(Not applicable)	Med / Long; no need for workpapers on a project by project basis, but parallel review can slow project. Development process can be complicated, varies by project and is subject to changes from customer, measure, and reviews	Short/Med; for most existing measures process is simple. New measures require workpapers, EM&V /Standard practice informs updates (on all) so need maintenance; formal submittal and update timelines for all	Med; need approved workpaper, need to also review data on a measure by measure basis	Long; approve M&V plan then wait for up to 12 months for initial post results
	Regulatory Review Burden	(Not applicable)	Level of burden proportional to savings claims and the risk to the portfolio, some projects are high visibility as well.	Med – CPUC needs to approve new and existing measures and updates within strict timelines (stricter for existing measures)	(Not applicable for POUs)	High – need to approve M&V plan for every program and sometimes every project

	Emerging Technology [10] (part of ETP)	Custom	Deemed	Hybrid (POU-only)	NMEC
Ex Post Evaluation Risk	(Not applicable)	High, both GRR and NTG are uncertain and vary by project.	Varies; "Uncertain" measures are subject to ex post evaluation. NTG and ex post true up add uncertainties that vary by measure. Other factors such as life and cost may be impacted as well.	Low	High
Claims timing	(Not applicable)	Long; long review process means long delay between project and final savings claims	Short; important to ensure that savings approved at the time of approved date	Same as deemed	Long due to necessary M&V protocols and long-term metering
Net-To-Gross (NTG)	While ETP does not claim savings, ET measures can benefit from NTG of 0.85 or more for a pre-determined period	No default NTG; but NTGs vary by sector, historically, it has been low	NTG varies by measure groupings/sector typically (but many exceptions exist e.g. for measures in programs less than 2 years)	Same as deemed	Default NTG are 0.95 (nonres) 0.85 (res SF) and 0.55 (res MF)

The figure below provides a qualitative assessment of the five measure types according to key considerations listed in the table above.

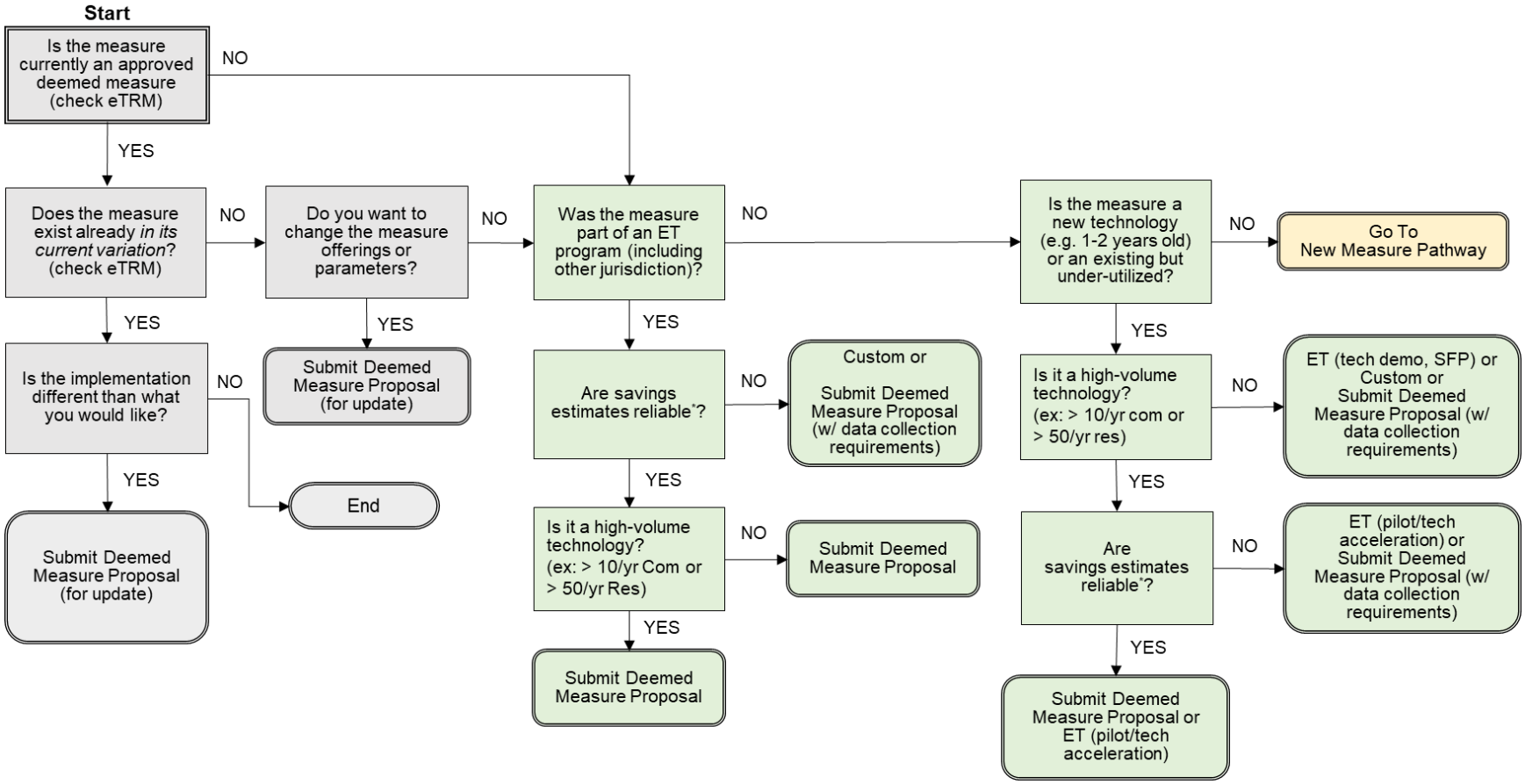
		Emerging Technology	Custom	Deemed	Hybrid	NMEC
Customer	Incentive Risk					
	Project Timeline					
	Data Collection Burden					
Implementer	Savings Claims Risk					
	Project Timeline					
	Administrative Burden: Upfront					
	Administrative Burden: Implementation					
	Customer Satisfaction Level					
Utilities	Savings Claims Risk					
Regulatory	Timeline & Process of Measure/Project Development					
	Regulatory Review Burden					
	Ex Post Evaluation Risk					
	Claims timing					
	Net-To-Gross (NTG)					

Low Risk OR Short Timeline
Med Risk OR Med Timeline
High Risk, Long Timeline
Not Applicable, Unknown, Undetermined

DETERMINATION OF THE APPROPRIATE PATHWAY

The key objective of this white paper is to provide guidance on the appropriate pathway for a new measure proposal to enter the California energy efficiency portfolios. The most appropriate path for a new measure depends on the characterization of the technology, its stage of commercialization, program design choices of the implementer, and future program implementation and delivery choices.

The following decision diagram provides a roadmap for measure developers to follow to help determine which of the three measure types could be the starting point pathway into the energy efficiency portfolios.

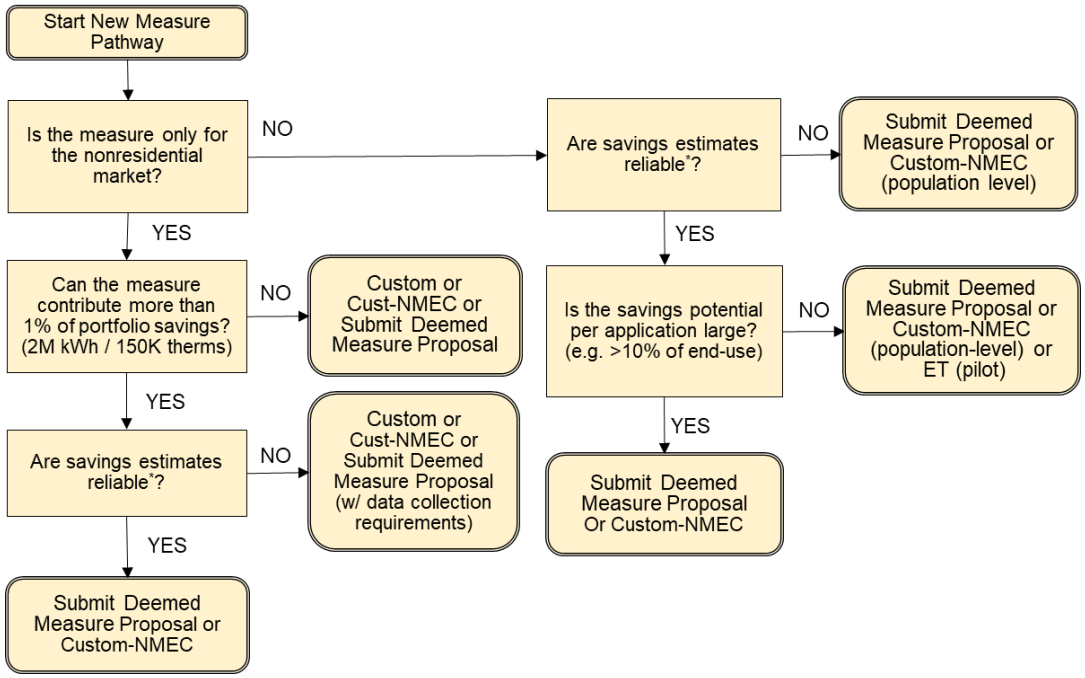


* Reliable means that the measure has achieved high penetration level in a market and the following parameters can be determined with statistical significance (80/30 minimum, 90/10 for high impact measures):

Baseline energy consumption (homogeneous, or multiple baselines can be clearly defined)

Measure case energy consumption (homogeneous, with data for different tiers / variations as necessary)

Cost data (should not be highly site dependent, but mostly dependent on baseline and measure case choices)


Start New Measure Pathway
Is the measure only for the nonresidential market?
NO
Are savings estimates reliable*?
NO
Submit Deemed Measure Proposal or Custom-NMEC (population level)
YES
YES
Can the measure contribute more than 1% of portfolio savings? (2M kWh / 150K therms)
NO
Custom or Cust-NMEC or Submit Deemed Measure Proposal
Is the savings potential per application large? (e.g. >10% of end-use)
NO
Submit Deemed Measure Proposal or Custom-NMEC (population-level) or ET (pilot)
YES
YES
Are savings estimates reliable*?
NO
Custom or Cust-NMEC or Submit Deemed Measure Proposal (w/ data collection requirements)
Submit Deemed Measure Proposal Or Custom-NMEC
YES
Submit Deemed Measure Proposal or Custom-NMEC

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