# White Paper: Energy Efficiency Measure Classification

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Prepared by Cal TF Staff:

Stefan Galiasso
Jennifer Holmes

CALIFORNIA
TECHNICAL FORUM

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# INTRODUCTION

The key objective of this white paper is to provide 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 administered by the California investor-owned utilities (IOUs). 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, NMEC, 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. Over time, program types and definitions may change, and the guidance provided by this whitepaper will adapt in response to those changes. How a measure is classified has significant implications for how a measure is developed, approved, used, claimed and evaluated. Understanding how a measure can and may be classified will help measure developers and implementers make informed choices when designing and implementing measures.

This Cal TF White Paper covers: California energy efficiency measure types (new and emerging), key characteristics of each measure type, and the implications for key stakeholders (customer, implementers and the 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 ENERGY EFFICIENCY MEASURE

The California Energy Efficiency Policy Manual, ver. 6.0 (April 2020) defines energy efficiency measures:

> *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-powered, non- generating technologies are eligible energy efficiency measures (D.09-12- 022, OP 1).*

In California, energy efficiency measures may be further categorized as deemed or prescriptive, custom, normalized metered energy consumption (NMEC), or emerging technology (ET) measures. A new measure type proposed and being explored by CAL TF is the "hybrid" measure, which is a blend of custom and deemed/prescriptive measures. How an energy efficiency measure is categorized has considerable implications – it impacts the selection of baseline, how the measure is developed, approved by the CPUC, implemented, verified, claimed, and evaluated. The different measure types are described further below.

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# 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, also known as a prescriptive 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 where the customer's financial incentive and the ex-ante energy savings are determined using a site-specific analysis of the customer's facility (D.11-07- 030 page 31) and where the incentive amount is calculated, reviewed, and approved in advance of the purchase and installation of the measure(s).

## Normalized Metered End-Use Consumption (subset of custom): NMEC[3]

Normalized Metered End-Use Consumption (NMEC) is a project savings calculation methodology with potential implications for the definition and application of a different measure type also called an NMEC measure. This measure type is possible in California due to SB 350 that established the policy framework for "Normalized Meter Energy Consumption" defined 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."*

NMEC measures refer to measures whose savings are developed by measuring energy consumption at the utility meter and using a sufficiently robust regression model to estimate the energy savings. NMEC measures can be site-level or population level[4], and savings need to be large enough (10% of annual consumption or more for site-level NMEC, though exceptions and submetering are permissible with Commission's approval) to be observable at the meter. NMEC measures quantify savings based on how customers view savings – actual savings based on reduced consumption from their meter. The NMEC savings approach has several advantages: 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

[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] California's Energy Policy Manual, ver. 6.0, defines a deemed measure as: "A prescriptive energy efficiency measure." (Appendix B: Glossary).

[3] SB-350 Clean Energy and Pollution Reduction Act of 2015. (2015-2016)

[4] 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

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expected savings do not materialize or degrade over time. NMEC measures use "existing conditions" as baseline[5], rather than "standard practice" baselines as is required for deemed and custom and may be required for hybrid.

A "NMEC" measure could also be a custom, hybrid or deemed measure. However, typically a NMEC measure would be either custom or deemed.

## Hybrid Measures (Cal TF proposed measure type)

This paper presents details to support a new, fourth measure type – hybrid, or partially deemed (or partially custom). While not yet a defined measure type in California (POUs have been using this measure type, sometimes referred to as semi-custom, but it is not yet approved for use by IOUs), hybrid measures have been developed and employed in other jurisdictions.[6] Hybrid measures, where appropriate, can offer several advantages compared to both custom and deemed measures. Compared to custom measures, hybrid measures offer greater customer certainty on requirements, timeline and incentives, because both 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). Like Deemed, Hybrid measures offer a streamlined, shorter approval process. Like Custom, Hybrid measures allow limited site-specific characteristics to be considered, but with pre-defined allowable input ranges specific to each permutation[7] of the pre-defined calculation approach, providing greater accuracy in savings and/or cost estimates. Similar to Deemed, 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 California for CPUC review and approval.

## Emerging Technology Program (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 inclusion into the energy efficiency programs (e.g. Custom or Deemed). The ETP is different from the programs that contain the measure types above, in that ETP does not claim energy savings for the measure it evaluates.

In the context of ETP, and emerging technology measure is defined as follows:

> *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*

[5] Ibid

[6] 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.

[7] A permutation is any of the possible legal combinations of inputs / parameters that characterize a measure

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> *prototypes or under-utilized but commercially available hardware, software, design tools or energy services that if implemented appropriately should result in energy savings.*[8]

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.

Given that ETP is not a program designed to claim savings, for some projects the measure might be evaluated by ETP while in parallel being evaluated under the Custom program to claim savings for the intervention, or while in parallel a workpaper is under development for inclusion into the Deemed program.

## MEASURE TYPE CHARACTERISTICS

Each measure type has specific characteristics, further described below.

### Deemed Measure Characteristics

As noted above, a deemed measure, also known as a prescriptive 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 California CPUC. A measure characterization in the eTRM (traditionally known as a workpaper) documents the established methodology as well as all calculation inputs and assumptions and parameters across a variety of known applications of that measure to estimate per-unit impacts and costs for all measure permutations.[9]

### 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).

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[8] Id.

[9] 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)

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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)

## NMEC Measures Characteristics

NMEC measures are characterized by the monitoring and analysis of the metered energy consumption before and after the intervention as a means 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 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 NMEC programs, 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 or Partially Deemed (or Partially Custom) Measure Characteristics

The "hybrid" (or "partially deemed" or "partially custom") 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[10]. 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

[10] 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)



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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 Program (ETP) Characteristics

In the context of the California energy efficiency portfolios, an emerging technology is defined as a new, unproven technology at the beginning of its lifecycle or a more mature technology with very low market penetration (that might change due to market changes or sponsorship by a program). The *Energy Efficiency Policy Manual* defines emerging technologies as "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." (Appendix B)

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 will increase. In addition, due to the low level of 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 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) and the regulatory approval process. Finally, measure classification impacts utilities' ex post risk, review and claims process.

Key distinctions are described in the table below.

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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 below. Elements of the table that do not apply to ETP are greyed out.

Note on Hybrid: Hybrid measures are currently not an available measure type for IOUs in California, but it is available for POUs and the table below is offering measure type implications that currently apply only to POU programs.

### Measure Type Implications

| | | Emerging Technology (part of ETP) | Custom | Deemed | Hybrid (POU-only) | NMEC |
|---|---|---|---|---|---|---|
| Customer | Incentive Risk | | 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 | Fast; mostly a paperwork exercise post measure install | Fast/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 | Med; generally low unless there are a lot of non-routine events; upfront screening to see if facility is good for NMEC |

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| | | Emerging Technology (part of ETP) | Custom | Deemed | Hybrid (POU-only) | NMEC |
|---|---|---|---|---|---|---|
| Implementer | Savings Claims Risk | | 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 | Fast; program does not impose potential delays that are outside of implementer's control | Fast; a bit more than deemed | Long, but known to include long term monitoring |
| | Administrative Burden | High; program usually entails multiple touchpoints, technology validation, customer experience verification, significant data collection and analysis | Low upfront (no workpaper necessary)<br>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 | Simple from implementation perspective (front-loaded / startup);<br>High upfront for a new measure workpaper development, calculations, data collection, data analysis, etc. / ongoing maintenance; "high impact" makes burden even higher | Similar to deemed; some light additional verification requirements | Med difficulty for implementation<br>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; historically suffering 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: what to expect, 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 |
| Utilities | Savings Claims Risk | | 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 | In the short term, there is some risk due to variation from plan to actual<br>In the long term there is low risk as M&V is done as part of program |

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| | | Emerging Technology (part of ETP) | Custom | Deemed | Hybrid (POU-only) | NMEC |
|---|---|---|---|---|---|---|
| Regulatory | Timeline & Process of Measure/Project Development | | Med / Long; no need for workpapers on a project by project basis, but parallel review can slow project. Development process is fairly complicated, varies by project and is subject to changes from customer, measure, and reviews | Fast/Med; for most existing measures fairly 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 | | 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) | N/A for POUs | High – need to approve M&V plan for every program and sometimes every project |
| | Ex Post Evaluation Risk | | High, both GRR and NTG are uncertain and very 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 | | Long; long review process means long delay between project and final savings claims | Fast; 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) |

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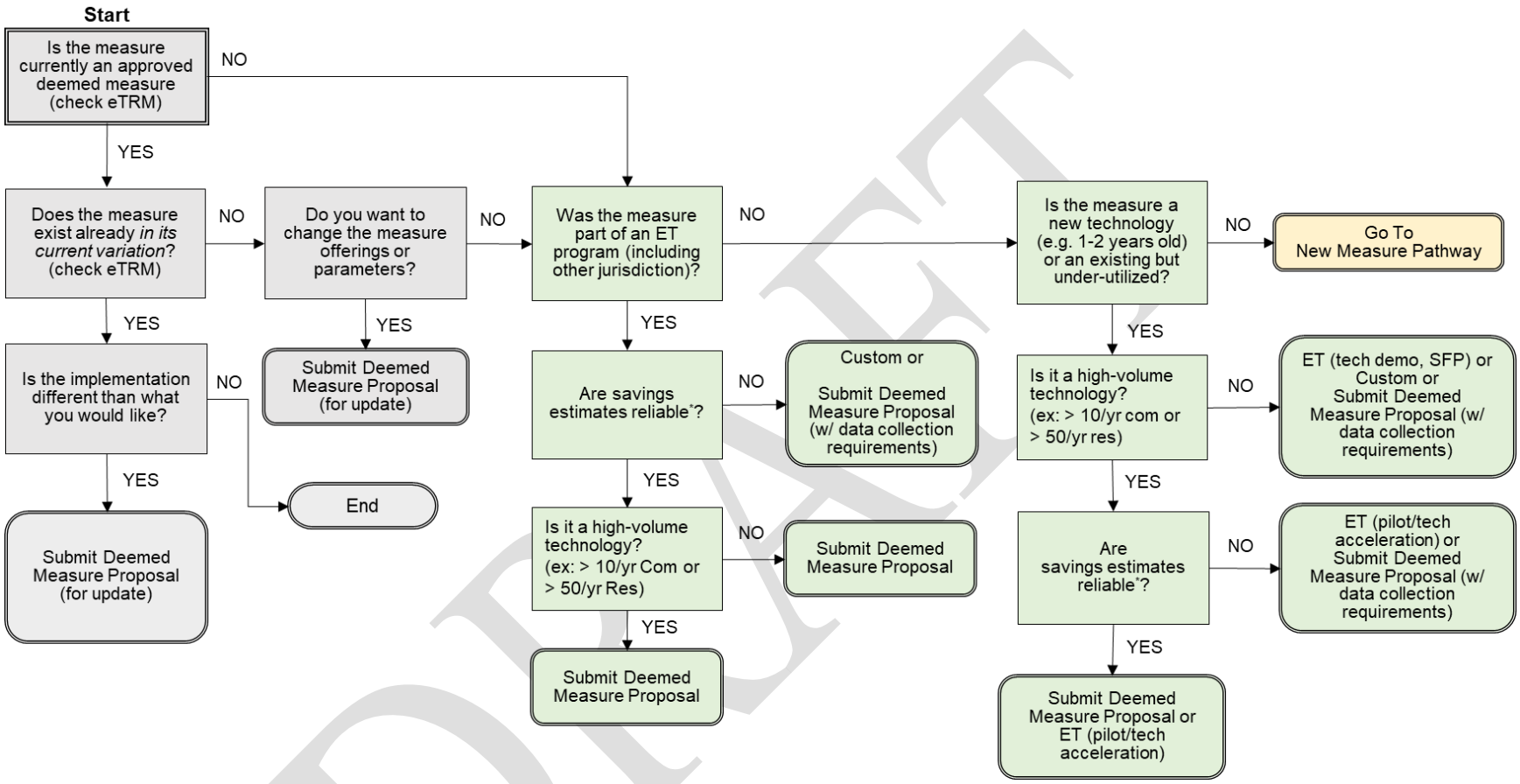
The figure below provides a qualitative view of the five measure types according to key considerations listed in the table above.


## 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 appropriate starting point is not always straightforward, as there are multiple viable paths a new measure can take, depending on the characterization of the technology, its stage of commercialization, and on the program implementation and delivery choices in the future.

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)

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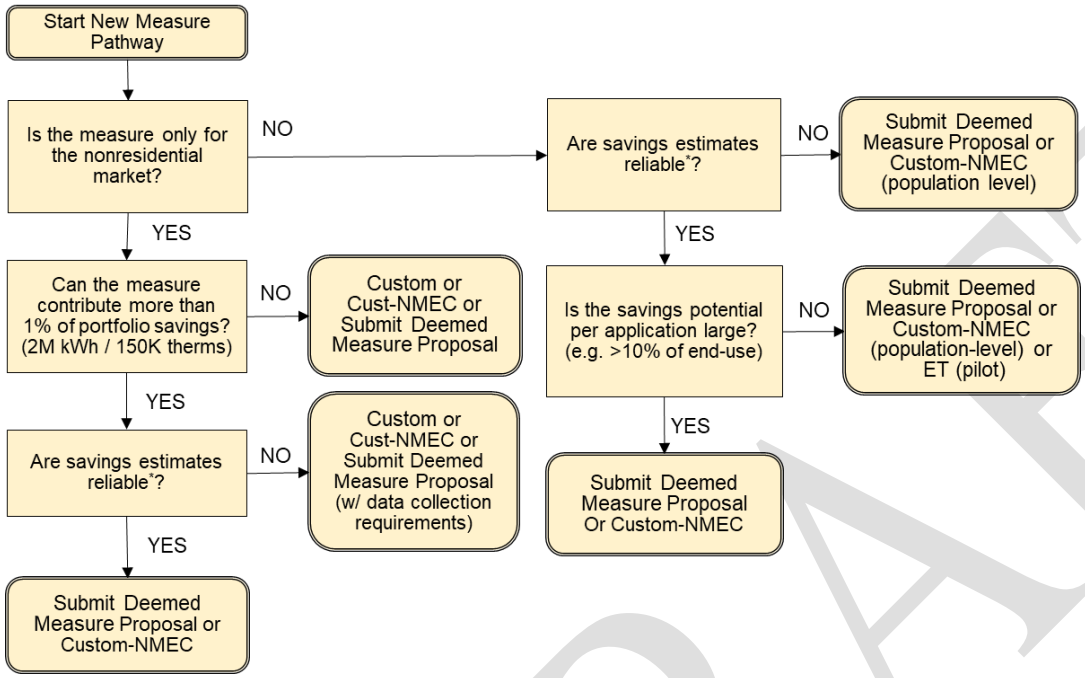
Start New Measure Pathway
Is the measure only for the nonresidential market?
NO
Are savings estimates reliable*?
NO
Submit Deemed Measure Proposal or Custom-NMEC (population level)
YES
YES
Can the measure contribute more than 1% of portfolio savings? (2M kWh / 150K therms)
NO
Custom or Cust-NMEC or Submit 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)
YES
Submit Deemed Measure Proposal Or Custom-NMEC
Submit Deemed Measure Proposal or Custom-NMEC

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