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Sampling and Install Certificate Updates Proposal

Additional submitted attachment is included below.

STATE OF CALIFORNIA
CALIFONRIA ENERGY COMMISSION

In the Matter of 2028 Building Energy Efficiency Standards Pre-Rulemaking

Docket No. 25-BSTD-03

Proposed Measure Name: Sampling and Install Certificate Updates

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Summary Table:

Required Summary Element	Response
Measure Name & Proponent	Sampling and Install Certificate Updates - ARCXIS
Building Type	All Residential Buildings
Building Systems	Compliance Requirements for Installation and Verification of systems related to T24 Energy Compliance - Envelope, HVAC, Electrical, Plumbing, PV
Measure Description	This measure proposes a phased transition toward reduced reliance on sampling in residential energy compliance, with a full transition target by 2032. It introduces two compliance pathways—100% testing or a structured graduated sampling model—to improve the accuracy, consistency, and transparency of as-built energy performance verification. The intent is to strengthen alignment between modeled and actual performance while maintaining a practical implementation pathway. This measure improves reliability, transparency, and consistency in residential energy compliance by strengthening field verification while maintaining a structured implementation pathway.
Justification	Current sampling-based verification can introduce variability in compliance outcomes due to statistical limitations. Expanding field verification improves consistency, strengthens data integrity, and enhances confidence in energy code implementation while maintaining a phased adoption pathway.
Data Needs	Stakeholders to provide market info such as • Measured performance differences between sampled and fully tested homes • Cost of rework and warranty claims • Frequency of documentation errors • Energy performance gap data

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Required Summary Element	Response
Key Stakeholders	CEC, Builders, Trades, ECC Raters/, Providers (CHEERS, GSR), AHJs, Energy Analysts, Homeowners, Utilities
Estimated Energy Savings	This measure has the potential to increase energy savings in home by improving systems and envelop performance of $200-600 per year annually for homeowners; up to $6,000 10-year savings.
Estimated Costs	This measure will increase FV & DT inspections by a factor of 2 (on average). However, cost shifts also include improved quality reducing additional cost associated such reduced warranty issues and energy costs builder/consumer.
Economic Impacts	The measure shifts costs toward earlier stages of construction due to increased verification activity. While upfront costs increase, downstream variability associated with rework and compliance corrections may be reduced. Additional benefits may include increased employment in verification services and improved predictability in compliance outcomes.
Consideration for Readiness (high, medium, or low)	California's Title 24 registry infrastructure already supports statewide compliance tracking and verification workflows. This measure builds on existing systems, resulting in high market readiness and minimal structural disruption.

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Proposed Measure: Sampling and Install Certificate Updates for process and compliance forms simplification and consistency including a transition of sampling with more project specifics that support the original intent of the sampling protocol.

Building Types:

All residential Building Types including Single Family, Duplex, Townhomes, Low Rise Multifamily and Highrise Multifamily types—new construction, additions, and alterations.

Building Systems:

Compliance Requirements for Installation and Verification of systems related to T24 Energy Compliance - Envelope, HVAC, Electrical, Plumbing, PV, etc.

Key Stakeholders:

CEC, Builders, Trades, ECC Raters/, Providers (CHEERS, GSR), AHJs, Energy Analysts, Homeowners, Utilities

Measure Summary:

This proposed measure establishes a graduated transition away from reliance on sampling toward expanded and ultimately full field verification of residential energy code measures. The proposal is based on the assumption that current sampling methodologies, while statistically valid at a program level, do not consistently capture construction-level variability across trades, crews, schedules, and field conditions.

Under this proposal, builders may comply through either a 100% testing pathway or a graduated sampling pathway for larger projects. The graduated sampling pathway requires initial full verification to establish consistent performance before allowing reduced sampling. This structure is intended to ensure that sampling, where permitted, is supported by demonstrated installation quality rather than presumption.

Expanded ECC Rater field verification would replace portions of the current reliance on installer documentation alone, improving alignment between modeled compliance and as-built conditions. This approach supports Title 24 objectives by improving accuracy, transparency, and consistency of compliance outcomes while maintaining feasible implementation pathways during the transition period.

Measure Description:

Graduated approach to eliminating sampling by 2032.

1. 100% Testing Option
    - ECC Rater performs full field verification on every home.
    - Added ECC Rater verifications on previously Certificate of Installation efficiencies and key mandatory code items such as windows, hot water heating, electrical, and PV systems previously only on Installation documents.
    - Trade liability acknowledgement per project required and uploaded to Registry covering liabilities for Installation to code mandatory measures and CF1R document.
    - Installer certificates are verified by ECC Rater and then retained for each plan type; any changes must be reported through an installation form and reverified by ECC Rater.

2. Graduated Sampling Option *(Projects ≥40 homes)*
    - First 10 homes must be 100% tested to establish consistency.
    - Upon meeting consistent performance, the builder may graduate to sampling.
    - Recommended sample group ratio: 1:4 per plan type.
    - Installer certificates for each plan type and verified by ECC Rater, there after Installer certificates are required for all dwelling units and alerts ECC Rater for any changes in data.
    - Enhanced regulation, QA, and oversight to ensure testing completion, including accuracy of as-built installations.

Additional Provision:

- Allow ATTs (Accredited Technical Trainers) equivalent oversight authority for Multifamily High-Rise (MFHR) projects as ECC raters.

Justification:

Increasing the testing protocols will address current market issues with process inconsistency and quality issues due to risk transfer mechanism that is inherent to parameters in the current sampling protocol, helping positively impact consumers and builders.

The variability in construction processes, as well as trade and building officials knowledge, skill and practice surrounding the energy code on the project means that sampling may not be truly representative of the entire project's quality.

Shifting towards 100% testing helps ensure the integrity of the code and that we are giving the homeowner a 3rd party verified home.

Further, this solution offers the builder choice during the transition with benefits to choose 100% testing that reduce coordination and paperwork delays.

This shift to 100% testing simplifies the process and allows for higher quality with more consistent and predictable costs as well and presents opportunities to reduce costs to the consumer and statewide energy costs, which are often over in the initial savings of sampling lower upfront costs. This also allows AHJ's to have consistency repeatable enforcement practice.

Expected Outcomes:

- Gradual elimination of sampling with increased verification quality.
- Improved consistency and accuracy in as-built energy compliance.
- Reduced risk of errors in system installation and documentation.

Data Needs:

This measure could be further supported with additional data collection and evaluation to help refine the estimates in our proposal as well as additional advances through the CASE process, such as:

- Measured performance differences between sampled and fully tested homes
- Cost of rework and warranty claims
- Frequency of documentation errors
- Energy performance gap data

Estimated Energy Savings:

Estimated energy impacts associated with this measure are derived from the difference between fully verified installations and homes where deficiencies remain undetected due to limited sampling. The underlying assumption is not that expanded testing creates new efficiency measures, but that it improves delivery of the efficiencies already required by the Energy Code.

Ranges presented for avoided energy waste reflect variability due to climate zone, housing type, system configuration, and occupant behavior. The methodology considers cumulative effects across building envelope integrity, HVAC system performance, and air distribution rather than assigning savings to any single component. As a result, the estimates are illustrative of potential magnitude rather than precise forecasts.

Although direct statewide energy savings are uncertain, reducing underperformance risk supports Title 24's intent by improving the probability that modeled savings translate into actual, measurable reductions in energy use over the life of the building stock.

Elimination of sampling and enhanced field verification increases the guarantee that building owners will be getting what they paid for in terms of an energy efficient building that is tested and passes compliance vs. wasted energy on buildings that were not tested.

Estimates:

Performance Factor	**Not Tested / Underperforming Home**	**100% Tested Home**
Envelope	Leaky/Heat Transfer	Verified Performance
HVAC Airflow	Imbalanced / restricted	Verified & balanced
Refrigerant Charge	Often incorrect	Verified correct
Duct Leakage	Higher leakage losses	Within spec
System Efficiency	10–25% below design	Operating at design
Annual Energy Cost	$1,800 – $2,400	$1,200 – $1,800
Annual Waste	**+$200 – $600/year**	Minimal
10-Year Energy Cost	$18K – $24K	$12K – $18K
10-Year Energy Waste	**$2K – $6K+**	Near zero

Estimated Costs:

The proposed measure increases upfront compliance costs due to expanded field verification requirements associated with reduced or eliminated sampling.

Under current sampling protocols, verification costs are typically distributed across the project, resulting in a blended cost of approximately $200–$400 per dwelling unit, depending on project size and sampling ratios. Under a 100% testing approach, costs are estimated to increase to approximately $600–$1,000 per dwelling unit, reflecting additional field labor, verification scope, and documentation.

Scenario	Estimated Cost per Unit	Cost Characteristics
Sampling	$200–$400	Lower upfront cost, higher variability
100% Testing	$600–$1,000	Higher upfront cost, more consistent and predictable

While 100% testing increases initial costs, it may reduce downstream variability associated with:

- rework and corrective actions
- failed inspections or re-testing
- project delays related to compliance documentation

Sampling offers lower initial costs but may result in higher total project cost variability when installation deficiencies are not identified early.

At this stage, cost estimates are based on typical market ranges. Additional data collection and evaluation could refine these estimates as the proposal advances through the CASE process.

Economic Impacts:

The proposed transition toward expanded testing is expected to shift costs earlier in the construction process rather than introduce entirely new costs. Increased upfront verification may raise initial compliance expenditures for builders but can reduce downstream costs related to warranty claims, customer complaints, rework, and closing delays.

Economic impacts are expected to vary by project scale, builder type, and market conditions. As projects gain experience with expanded verification, improved feedback loops are expected to drive more consistent installation practices, potentially stabilizing costs over time. The proposal assumes that these learning effects mitigate long-term economic impacts.

Overall, the measure supports consumer protection and compliance certainty while promoting higher confidence in delivered energy performance, consistent with the policy objectives of the Energy Code.

Examples of the proposed measures for potential economic impacts are stated below; however additional data collection and evaluation could refine these estimates as the proposal advances through the CASE process.

Positive Impacts:

- Increased upfront testing may create additional work for ECC raters, supporting local jobs and energy compliance services.
- Reducing sampling and improving as-built verification can decrease downstream costs associated with system rework, warranty claims, and customer service for builders.
- More accurate and consistent energy performance may enhance buyer confidence, potentially supporting market value and smoother home closings.
- Broader testing may contribute to long-term energy savings for building owners, reducing operational costs over time.

Potential Considerations:

- Higher upfront costs for builders due to evaluating every dwelling unit, including labor and administration.
- Slight increases in construction cycle time, which may impact scheduling and carrying costs.
- Implementation may require additional oversight and QA resources to ensure compliance and accuracy.

Overall, while precise quantification is difficult at this stage, the measure is anticipated to shift costs upfront while reducing long-term variability and risk for both builders and building owners.

Market Readiness & Support:

This proposal assumes high market readiness due to the existence of established compliance infrastructure. California's Title 24 registry platforms, ECC Rater networks, provider oversight systems, and enforcement workflows already support expanded testing without requiring creation of new regulatory systems.

While adoption rates may vary during transition, the technical feasibility of increased testing is well established. By leveraging existing tools and roles, the proposal minimizes implementation risk while strengthening compliance integrity.

Expanded field verification directly supports Title 24 objectives by improving documentation accuracy, reducing reliance on statistical assumptions, and increasing confidence that required efficiency measures deliver intended health, safety, and energy savings benefits statewide.

Here are some potential stakeholder outcomes:

Builders & Developers

Builders will recognize value through more accurate verification, smoother closing documentation, and reduced warranty exposure. Many are already moving toward increased testing to reduce risk, improve homeowner satisfaction, and better manage trade performance. While upfront costs increase, they become more transparent and predictable.

Trades/Installers

Trades benefit from reduced administrative burden and less repetitive paperwork, allowing greater focus on installation quality. Increased testing also provides clearer feedback loops from ECC raters, improving consistency and reducing rework.

Building Officials

Building officials benefit from clearer documentation, improved timing of compliance verification, and more reliable as-built data. Tools such as the Project Status Report (PSR) are ensured and enable faster review and validation, supporting a more streamlined and consistent enforcement process.

Energy Analysts

Energy analysts benefit from improved alignment between modeled and as-built conditions. Increased field verification strengthens confidence in energy modeling outcomes and supports better feedback loops when field conditions differ from design assumptions.

ECC Raters/Acceptance Testers

3rd Party inspections benefit from an expanded and more consistent role in field verification. Increased testing provides clearer expectations, reduces ambiguity associated with sampling, and supports greater consistency in compliance outcomes.

Providers (e.g., CHEERS, GSR)

Providers are well positioned to benefit as increased testing enables a shift from reactive quality control to proactive quality assurance. With more consistent field data, providers can streamline QA processes, identify trends earlier, and focus more on rater training and performance improvement—driving higher overall quality and consistency across the market.

Homeowners / Buyers

Homeowners benefit from improved confidence in system performance, reduced likelihood of comfort issues, and lowering long-term energy costs. Increased testing supports more consistent delivery of expected energy efficiency outcomes.

California Energy Commission (CEC)

The CEC benefits from improved alignment between modeled and as-built performance, increased transparency in compliance outcomes, and greater confidence in statewide energy savings realization. A transition toward expanded testing strengthens the integrity of Title 24 implementation by improving data quality, reducing reliance on statistical assumptions, and enhancing overall program accountability. This also supports long-term policy objectives by ensuring that efficiency measures deliver consistent, verifiable results across building types and regions.

REFERENCES

Add This Section: Supporting References

(Place at end of report or as footnotes in key sections)

Supporting References

1. California Energy Commission (CEC)
   Building Energy Efficiency Standards (Title 24, Part 6)
   - Establishes the regulatory framework for HERS verification, sampling protocols, and compliance documentation.
   - Provides the basis for current sampling methodologies and registry requirements.

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2. California Public Utilities Commission (CPUC)
   Energy Efficiency Program Evaluation Studies
   - Consistently identify a **performance gap** between modeled and actual energy use in residential buildings.
   - Highlight the importance of installation quality and verification in achieving expected savings.

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3. U.S. Department of Energy (DOE)
   Residential Energy Code Field Studies
   - Demonstrate that field verification and compliance enforcement significantly impact realized energy savings.
   - Identify common deficiencies in HVAC installation, duct sealing, and airflow that reduce system performance.

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4. Lawrence Berkeley National Laboratory (LBNL)
   Building Performance and HVAC System Studies
   - Show that improper installation (e.g., refrigerant charge, airflow imbalance) can reduce HVAC efficiency by **10–30%**.
   - Reinforce the importance of field verification for achieving modeled performance.

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5. Residential Energy Services Network (RESNET)
   HERS Rating Standards and QA Framework
   - Emphasize the role of third-party verification and QA in ensuring consistency and reliability in residential energy performance.

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6. National Institute of Standards and Technology (NIST)
   Cost of Poor Quality (CoPQ) Research
   - Identifies that undetected defects and rework significantly increase total project costs.
   - Supports the concept that early detection (via testing) reduces lifecycle cost variability.

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7. American Council for an Energy-Efficient Economy (ACEEE)
   Energy Efficiency Program Impacts
   - Highlights that realized energy savings depend heavily on proper installation and verification—not just design compliance.