

A STATEWIDE UTILITY PROGRAM

2019 Title 24 Codes & Standards Enhancement (CASE) Proposal High Performance Attics

September 14, 2016

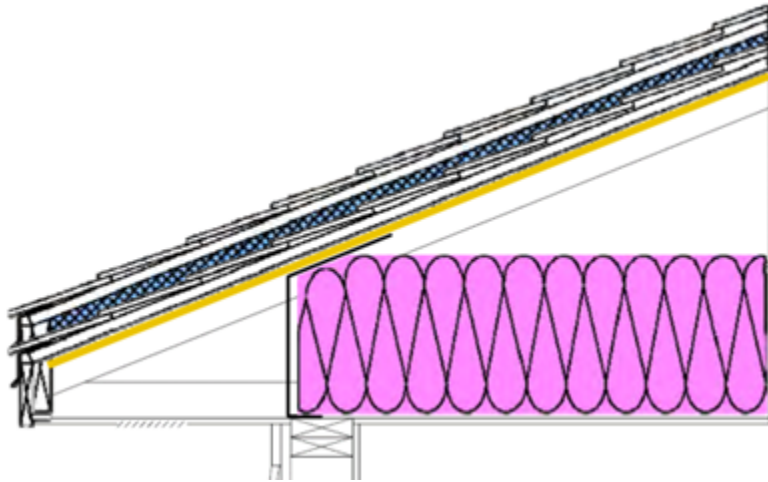


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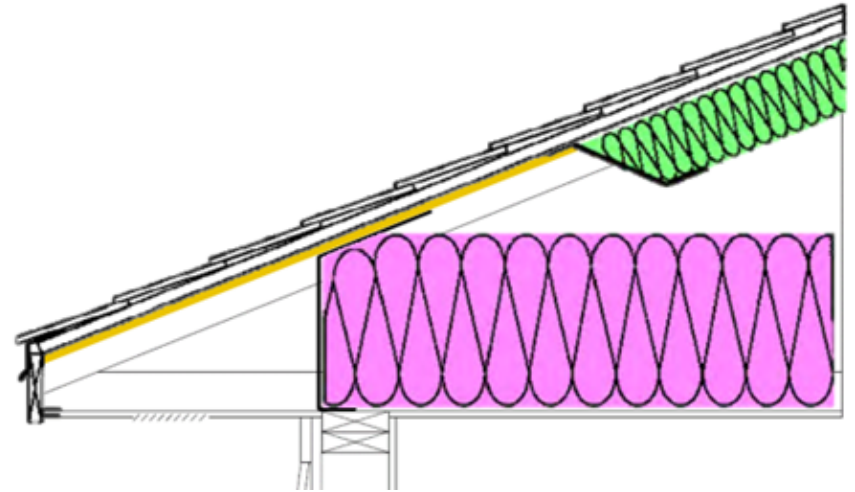


HPA Prescriptive Option Configurations

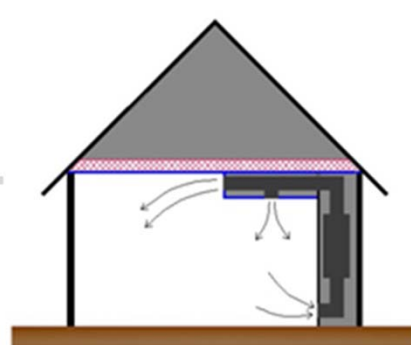
Option A: Above Deck



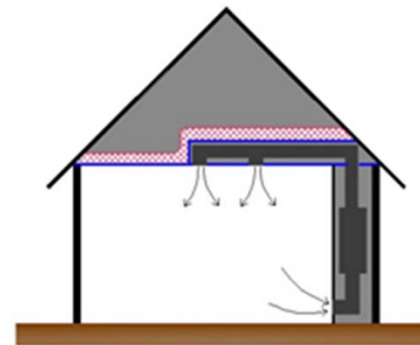
Option B: Below Deck



Option C: Ducts in Conditioned Space



DCS with Dropped Ceiling



DCS with Attic Chase

Proposed Code Change Overview

- Types of building impacted
 - Single family and low-rise multi-family
- Building system impacted
 - Attic/Roof/Ducts
- Anticipated type of change
 - Prescriptive Requirement
- Description of change
 - Prescriptively require R-19 underdeck insulation for tile roofs (Option B)
 - With corresponding equivalent performing cases for Options B & C, and asphalt roof cases

Proposed Code Change History

- Why are we proposing this measure?
 - Incrementally improve HPA insulation levels above 2016 levels where appropriate under 2019 TDV
 - Industry providing an increasing number of attic/roof efficiency measures facilitating HPA
 - Under deck (netted blown, spray foam)
 - Above deck (insulating tiles, under tile insulation, SIPS, nail base systems)
 - New roofing materials
 - Support cost-effective envelope improvement opportunities prior to introducing PV

Current Code Requirements

- Existing Title 24 Requirements
 - Section 150.1(c)9 A and B
 9. **Space Conditioning Distribution Systems.** All space conditioning systems shall meet all applicable requirements of A or B below:
 - A. High performance attics. Air handlers or ducts are allowed to be in ventilated attic spaces when the roof and ceiling insulation levels meet Option A or B in TABLE 150.1-A. Duct insulation levels shall meet the requirements in TABLE 150.1-A.
 - B. Duct and air handlers located in conditioned space. Duct systems and air handlers of HVAC systems shall be located in conditioned space, and confirmed by field verification and diagnostic testing to meet the criterion of Reference Residential Appendix RA3.1.4.3.8. Duct insulation levels shall meet the requirements in TABLE 150.1-A.
- Existing Model Code Requirements
 - 2015 IECC: no requirement for either HPA or ducts in conditioned space

Typical Practices

- Current practices
 - Under 2013 Standards, standard practice is predominantly ducts & AHU in ventilated attics
 - Some penetration of sealed attic designs, but very little HPA or ducts in conditioned space
 - CalCerts registry data suggests high tile penetration
 - Jan 2015 - Apr 2016: 76% tile (SF) and 69% (MF)
- Trends
 - Some builders beginning to look at HPA options and ducts in conditioned space
 - Others are looking at 2016 PV credit as an alternative
 - **PV credit will be going away in 2019**

Market Overview and Analysis

- Current Market
 - Emerging market with many options to explore
 - Market transformation and field efforts underway
 - EPIC WISE: Workforce training effort; limited M&V
 - <http://www.wisewarehouse.org/>
 - CAHP: Master Builder Program assist builders
 - Monitor ~14 homes in Northern & Southern California
 - EPIC BIRA: attic moisture issues, durability
 - EPIC LBNL: detailed monitoring at two sealed attic homes
- Market barriers
 - Builder needs to evaluate new HPA techniques
 - e.g. Owens Corning early experiences
 - Workforce training is a key vehicle for builder training/education in identifying preferred options

Incremental Cost Estimation – Preliminary

- How we collected costs of base case technology and proposed technology
 - R-13 HPA underdeck as base case (2016 CASE)
 - R-19 HPA as proposed low cost prescriptive improvement option
 - Builder participating in code readiness project (\$.08/ft.2 added material costs for R-19, no labor increment)
 - Big box volume price for R-19 vs R-13 batts (\$.12/ft.2)
- We are estimating the incremental costs to be:
- \$.10/ft.2 of roof deck + 30% material markup
- *Do you find these costs to be reasonable?*

Methodology and Assumptions for Savings Analysis – Preliminary

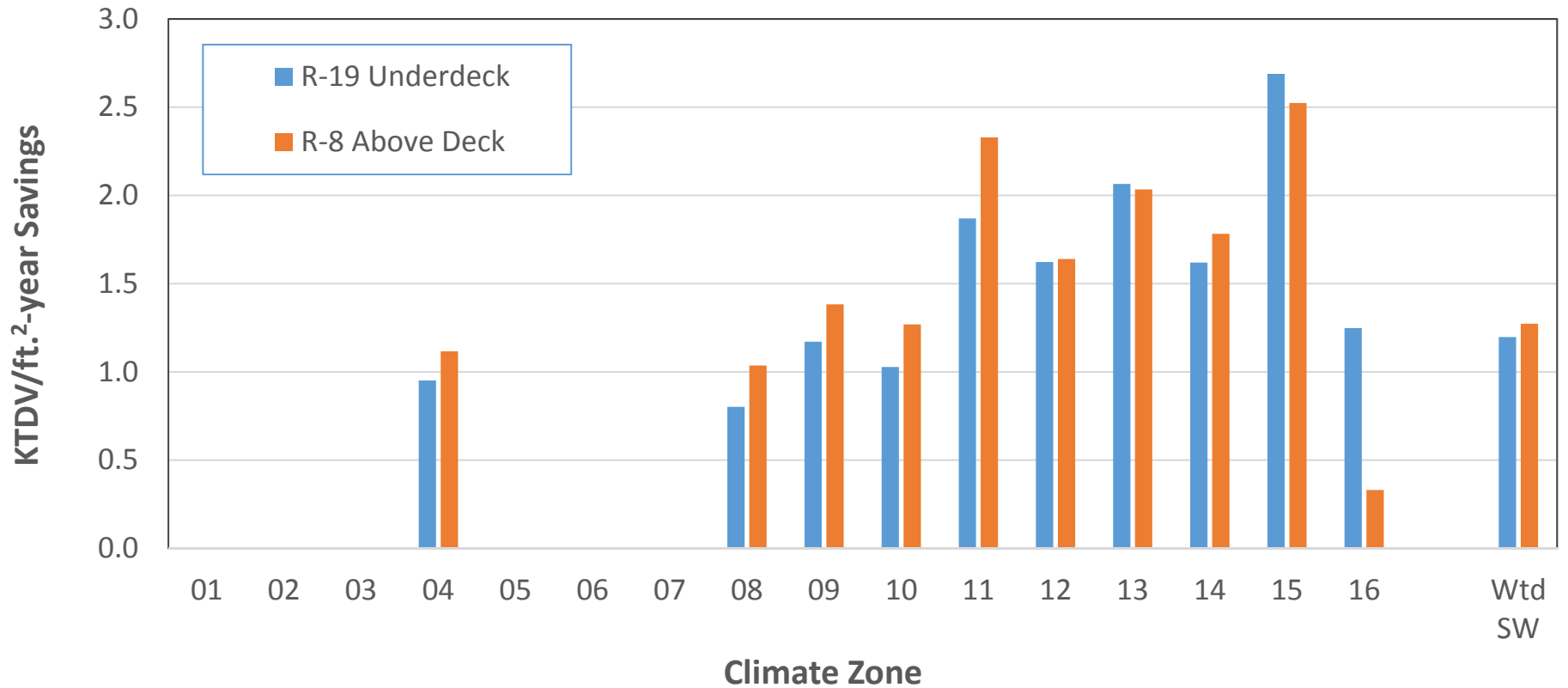
- Methodology for energy and demand impacts
 - CBECC-Res Title 24 using 2019 TDV values
 - Evaluate 2016 HPA CZs (excluding CZ 1-3, 5-7)
 - Prototype Buildings
 - Residential: 2,100 ft.2 single story and 2,700 ft.2 two story buildings used in Title 24 development activities
 - Results presented as blended average of 45% single story & 55% two story (2,430 ft.2 blend)
 - Based on 2016 prescriptive requirements

Incremental Cost Savings

- Approach
 - Incremental cost savings are calculated based on TDV cost savings associated with energy savings over the 30 year assumed period of analysis.
 - Net Present Value of savings based on 2019 TDV cost multiplier of \$0.1732/TDV kBTU saved.
 - Benefit to Cost ratio = $\frac{NPV\ TDV\ cost\ savings}{lifecycle\ cost}$
 - No replacement or maintenance costs associated with this measure

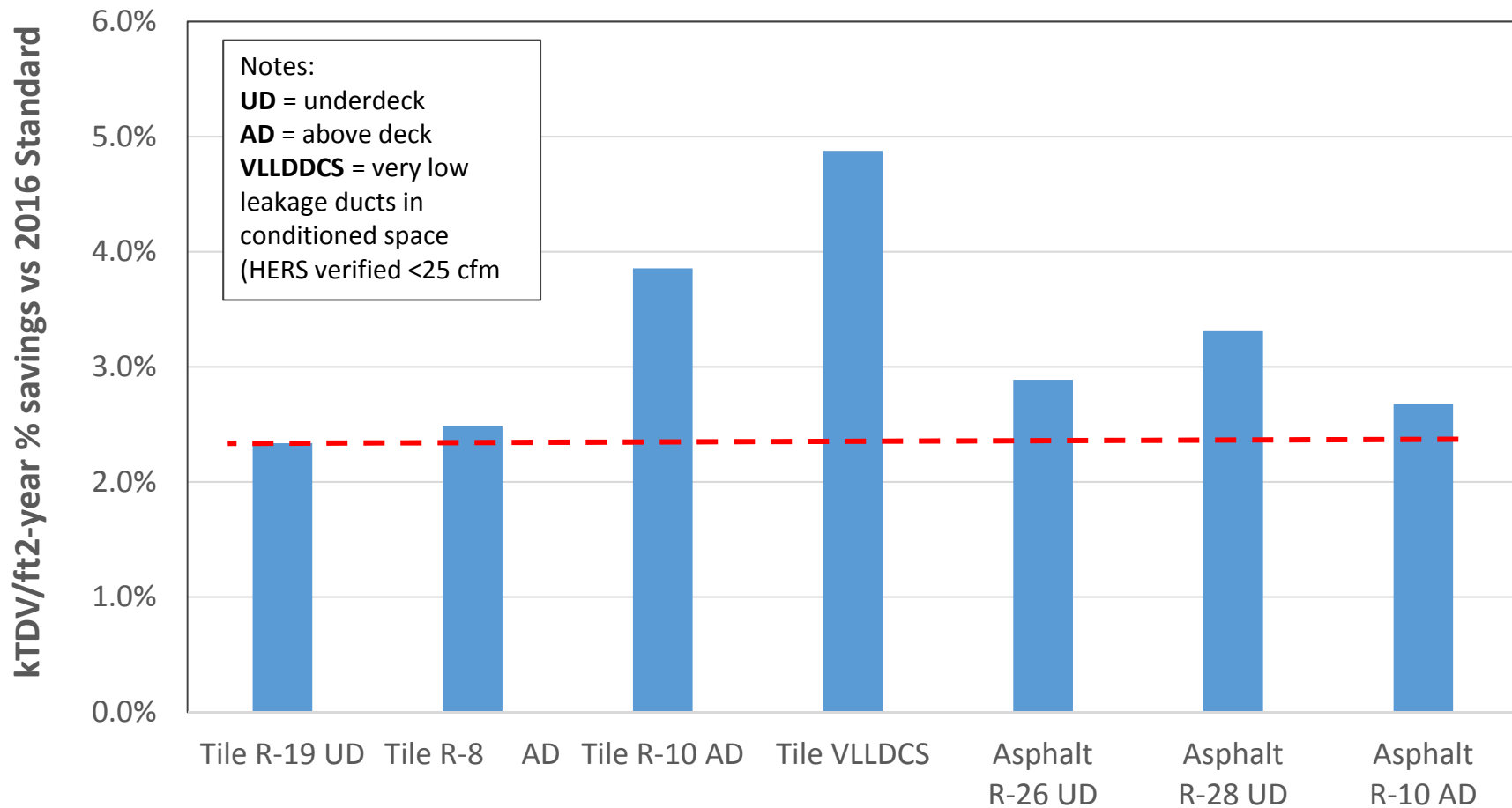
CBECC- Res Preliminary HPA Projections with 2019 TDV (excluding CZs 1-3, 5-7)

**kTDV/ft.²-year Savings for 2,430 ft.² Blended Prototype
(Tile Roof: R-19 Underdeck HPA & R-8 Above Deck)**



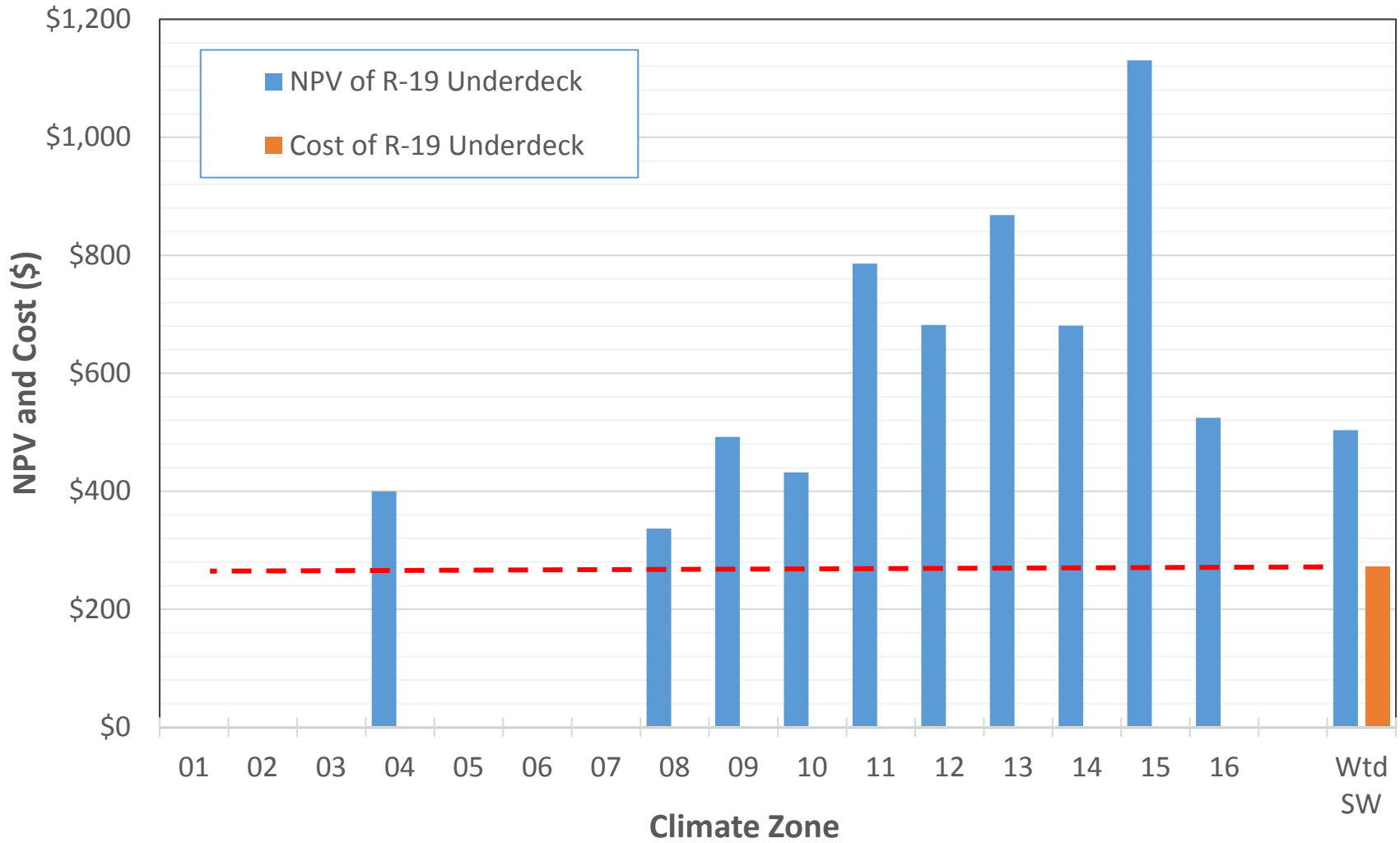
Single Family 2,430 ft.2 Prototype CBECC-Res Results – R-19 Tile Underdeck Equivalence with other Approaches

Weighted Statewide TDV Impacts vs 2016 Standard
(all CZs except 1-3, 5-7)



CBECC-Res Preliminary Economic Results

30 Year NPV and Measure Cost for 2,430 ft.² Blended Prototype



Preliminary Energy Impacts – Single-Family

Preliminary Energy Savings Estimate				
Annual per Unit Electricity Savings* (kWh/yr)	Annual per Unit Natural Gas Savings* (Therms/yr)	First Year Statewide Electricity Savings (GWh/yr)	First Year Statewide Natural Gas Savings (Million Therms/yr)	Confidence Level (high, medium, low)
33	3.1	3.5	0.34	High

- Per building savings based on blended 2,430 prototype
- Excludes CZs 1-3, 5-7
- Based on 2016 construction starts – to be updated with 2019 data.

Preliminary Cost Effectiveness Estimates

	Benefit (2020\$)	Cost (2020\$)
Total Per Unit Incremental Cost over Period of Analysis		
<ul style="list-style-type: none"> • <i>Incremental first cost (supplies, equipment, installation)</i> • <i>Incremental maintenance cost (replacement equipment, regular maintenance) over period of analysis</i> 		<ul style="list-style-type: none"> • \$272 • (\$0)
Per Unit TDV Cost Savings over Period of Analysis	\$503	
TOTAL	\$503	\$272
Benefit/Cost Ratio		1.85

Compliance and Enforcement – Market Actors

- Who would be involved in implementing this measure?
 - Architect
 - Title 24 consultant
 - Builder
 - Manufacturers
 - Subcontractors
 - Insulation, roofing, framing, HVAC
 - Plans examiner / Building inspector
 - HERS Rater
- Others?

Compliance and Enforcement – Tasks

Market Actor	Task(s)	Success Criteria
Architect/designer	<ul style="list-style-type: none"> - Identify any application issues (i.e. climate) - Select HPA method - Develop building details & sections 	<ul style="list-style-type: none"> - Balances form/function to satisfy owner desires - Documentation prepared with minimal clarifications - Meet project budgets
Title-24 consultant	<ul style="list-style-type: none"> - Provide feedback on the energy impact of HPA approach on compliance - Ensure builder is aware of code requirements - Complete forms & upload to HERS registry 	<ul style="list-style-type: none"> - Project team is clearly aware of requirements - Energy goals are met - Minimal plan check comments

What are we not capturing?

Compliance and Enforcement – Tasks

Market Actor	Task(s)	Success Criteria
Builder	<ul style="list-style-type: none"> - Coordinate with design team & trades - Ensure trades are aware of all requirements - Ensure proper installation - Schedule inspections & posts forms onsite 	<ul style="list-style-type: none"> - Meet project budgets & schedule - Minimal inspection failures - Minimal paperwork required - Owner satisfied - No warranty issues
Subcontractors (framer, insulation, HVAC, roofer)	<ul style="list-style-type: none"> - Install product to meet requirements - Ensure work does not negatively impact other trades 	<ul style="list-style-type: none"> - Meet builder's schedule - Finish within budget - Minimal inspection failures & callbacks - Minimal paperwork required

What are we not capturing?

Compliance and Enforcement – Tasks

Market Actor	Task(s)	Success Criteria
Building inspector/ Plans Examiner	<ul style="list-style-type: none"> - Understand code requirements and verify they are met - Verify that CF-1R is consistent with building plans and meets compliance criteria for local jurisdiction - Sign occupancy permit 	<ul style="list-style-type: none"> - Minimal paperwork
HERS Rater	<ul style="list-style-type: none"> - Review CF2Rs - Make sure parties are aware of requirements - Verify QII is being met - Communicate any inspection issues - Submit CF-3R's 	<ul style="list-style-type: none"> - Project meets QII requirements - Minimal inspection failures & callbacks - Minimal paperwork needed - Maintain positive relationships with team

What are we not capturing?

Compliance and Enforcement – Resources

Market Actor	Resource(s)
Architect	- Title-24 consultant
Title-24 consultant	- CBECC-Res compliance software - Title-24 standards & support documents - Energy Code Ace tools - CEC hotline
Builder	- Building officials - Title-24 consultant - HERS rater - Subcontractors - CalCERTS/CHEERS/Utility training
Subcontractors	- CalCERTS/CHEERS/Utility training - HERS rater - Builder
Building Inspector, Plans Examiner	- Energy Code Ace tools - Title-24 standards & support documents
HERS Rater	- CalCERTS/CHEERS/Utility training

Are we missing any resources or tools?

Strawman Code Change Language

- Title 24 Standards
 - Section 150.1(c)9 A and B
 - Revise Table 150.1-A prescriptive requirements
- Title 24 Appendices (JA, RA, or NA)
 - RA3.5
- Alternative Compliance Method (ACM) Reference Manual
 - Updates as required for HPA inspections
- Rationale for prescriptive requirement
 - Builds on 2016 Title 24
- Exceptions
 - No HPA requirements for additions <700 ft.2 (consistent with 2016 approach)

Request from Stakeholders

- *We would like your input...*
 - Builder/construction industry feedback on implementing HPA strategies
 - Cost information on alternative HPA strategies
 - Identifying barriers to implementation
- Please provide input to
 - CASE author or to Title24Stakeholders.com

Thank you.

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