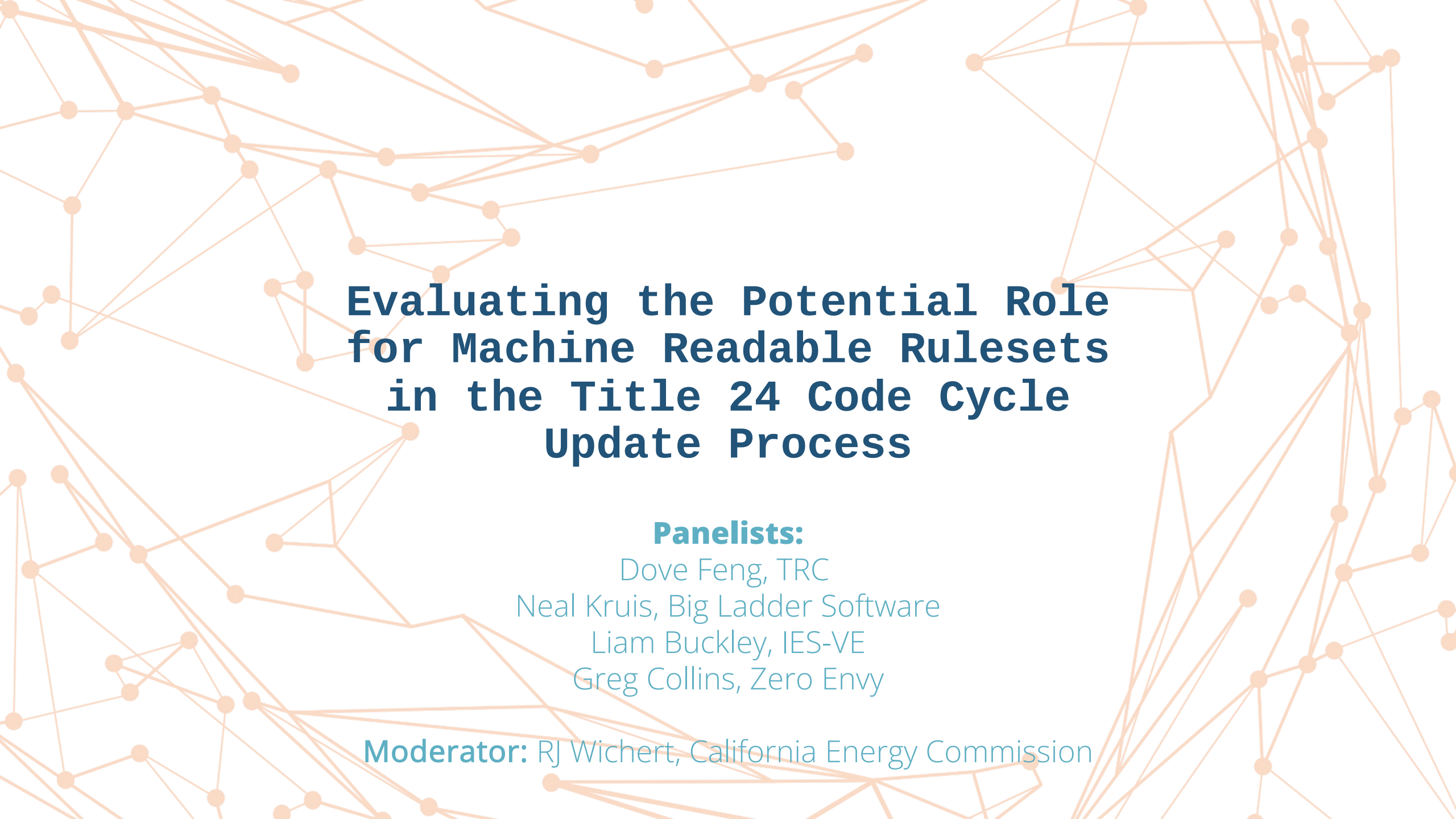


welcome to

CaIBEM  
2023

Day 1





# Evaluating the Potential Role for Machine Readable Rulesets in the Title 24 Code Cycle Update Process

## **Panelists:**

Dove Feng, TRC

Neal Kruis, Big Ladder Software

Liam Buckley, IES-VE

Greg Collins, Zero Envy

**Moderator:** RJ Wichert, California Energy Commission

# Background: What is a Ruleset?

**Rule:** A requirement for model inputs or performance metric calculation of a protocol that uses modeling for assessing building performance.

**Ruleset:** A collection of rules for demonstrating adherence with a protocol that uses modeling for assessing building performance.

# Background: Example Envelope Efficiency Rules

				Climate Zone															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Envelope	Maximum U-factor	Roofs/ Ceilings	Metal Building	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	
			Wood Framed and Other	0.034	0.034	0.034	0.034	0.034	0.049	0.049	0.049	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034
		Walls	Metal Building	0.113	0.061	0.113	0.061	0.061	0.113	0.113	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.057	0.061
			Metal-framed	0.060	0.055	0.071	0.055	0.055	0.060	0.060	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055
			Mass Light <sup>1</sup>	0.196	0.170	0.278	0.227	0.440	0.440	0.440	0.440	0.440	0.170	0.170	0.170	0.170	0.170	0.170	0.170
			Mass Heavy <sup>1</sup>	0.253	0.650	0.650	0.650	0.650	0.690	0.690	0.690	0.690	0.650	0.184	0.253	0.211	0.184	0.184	0.160
		Floors/ Soffits	Wood-framed and Other	0.095	0.059	0.110	0.059	0.102	0.110	0.110	0.102	0.059	0.059	0.045	0.059	0.059	0.059	0.042	0.059
			Raised Mass	0.092	0.092	0.269	0.269	0.269	0.269	0.269	0.269	0.269	0.269	0.092	0.092	0.092	0.092	0.092	0.058
	Roofing Products	Low-sloped	Other	0.048	0.039	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.039	0.071	0.071	0.039	0.039	0.039	
			Aged Solar Reflectance	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63
		Steep-Sloped	Thermal Emittance	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
			Aged Solar Reflectance	0.20	0.25	0.20	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
	Air Barrier	Thermal Emittance	Other	0.75	0.80	0.75	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
			Thermal Emittance	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
	Exterior Doors, Maximum U-factor	Non-Swinging	Other	0.50	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	0.50
			Swinging	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70

# Background: Example Energy Recovery Rules

TABLE 140.4-K: ENERGY RECOVERY REQUIREMENTS BY CLIMATE ZONE AND PERCENT OUTDOOR AIR AT FULL DESIGN AIRFLOW (≥8,000 HOURS / YEAR)

% Outdoor Air at Full Design Airflow	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
≥10% and <20%	≥10,000	≥10,000	NR	NR	NR	NR	NR	NR	NR	≥40,000	≥40,000	≥20,000	≥10,000	≥10,000	≥10,000	≥10,000
≥20% and <30%	≥2,000	≥5,000	≥13,000	≥9,000	≥9,000	NR	NR	NR	NR	≥15,000	≥15,000	≥5,000	≥5,000	≥5,000	≥5,000	≥5,000
≥30% and <40%	≥2,000	≥3,000	≥10,000	≥6,500	≥6,500	NR	NR	NR	≥15,000	≥7,500	≥7,500	≥3,000	≥3,000	≥3,000	≥3,000	≥3,000
≥40% and <50%	≥2,000	≥2,000	≥8,000	≥6,000	≥6,000	NR	NR	NR	≥12,000	≥6,000	≥6,000	≥2,000	≥2,000	≥2,000	≥2,000	≥2,000
≥50% and <60%	≥2,000	≥2,000	≥7,000	≥6,000	≥6,000	NR	NR	≥20,000	≥10,000	≥5,000	≥5,000	≥2,000	≥2,000	≥2,000	≥2,000	≥2,000
≥60% and <70%	≥2,000	≥2,000	≥6,000	≥6,000	≥6,000	NR	NR	≥18,000	≥9,000	≥4,000	≥4,000	≥2,000	≥2,000	≥2,000	≥2,000	≥2,000
≥70% and <80%	≥2,000	≥2,000	≥6,000	≥5,000	≥5,000	NR	NR	≥15,000	≥8,000	≥3,000	≥3,000	≥2,000	≥2,000	≥2,000	≥2,000	≥2,000
≥80%	≥2,000	≥2,000	≥6,000	≥5,000	≥5,000	NR	NR	≥12,000	≥7,000	≥3,000	≥3,000	≥2,000	≥2,000	≥2,000	≥2,000	≥2,000

# Background: CBECC Implementation

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// =====
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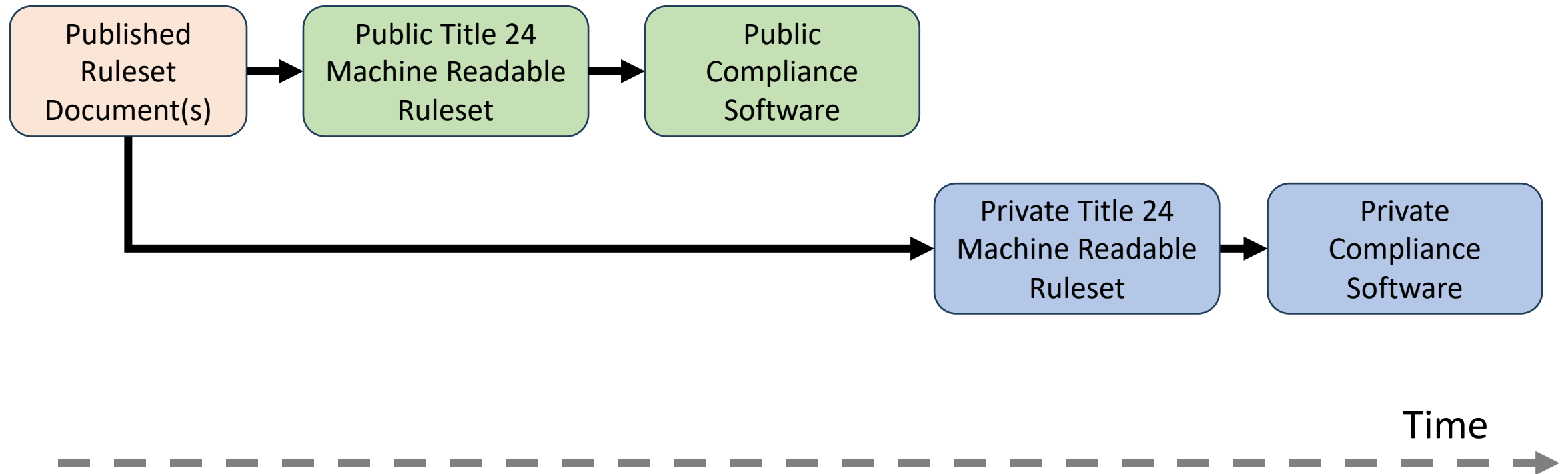
// Table 140.3-B Prescriptive Envelope Criteria For Nonresidential Buildings  
// Table 140.3-C Prescriptive Envelope Criteria For High-Rise Residential Buildings And Guest Rooms Of Hotel/Motel Buildings  
// Table 140.3-D Prescriptive Envelope Criteria For Relocatable Public School Buildings Where Manufacturer Certifies for Use In All Climate Zones  
// Baseline for new construction is always MetalFrameWall, but for alterations the baseline can be any type

TABLE ExteriorWallUFactor\_T24N\_2019

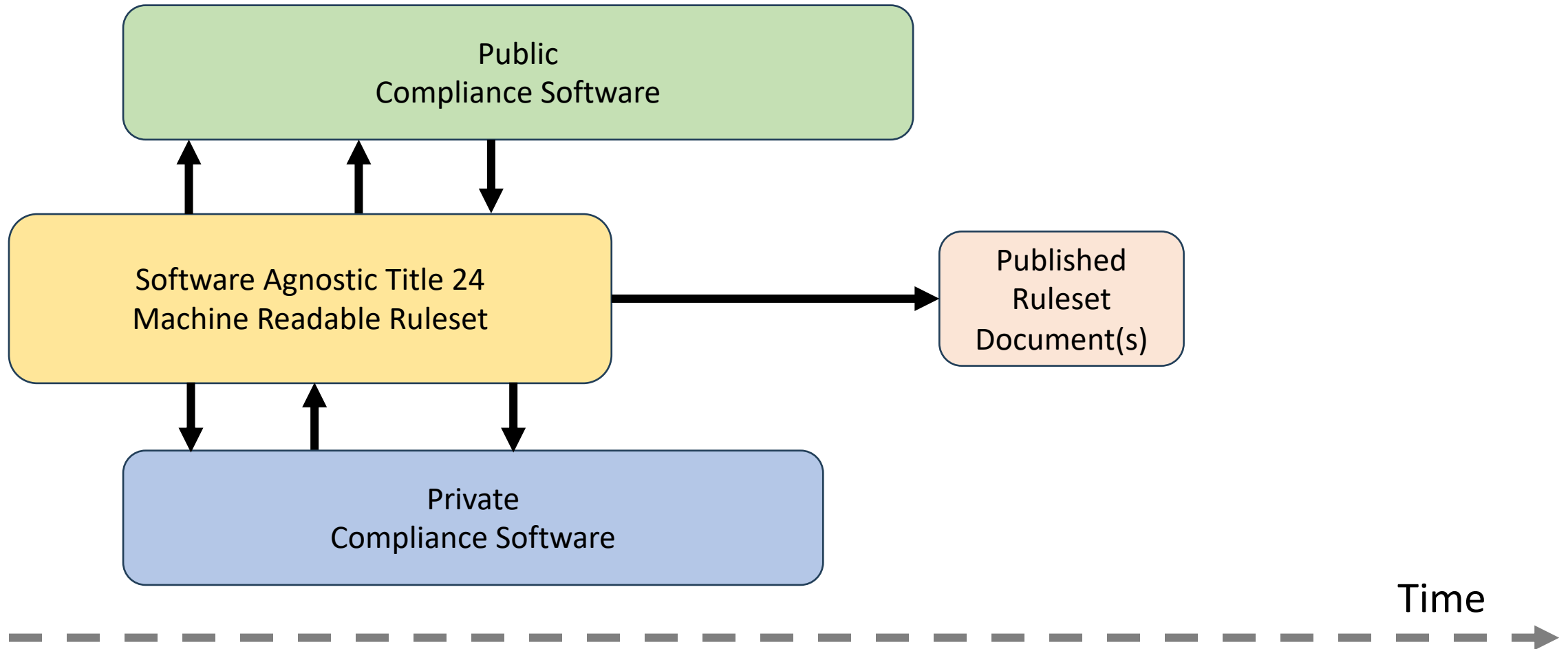
BldgType	TypeOfCons	UFactor	UFactor	UFactor	UFactor	UFactor	UFactor	UFactor	UFactor	UFactor	UFactor	UFactor	UFactor	UFactor	UFactor	UFactor	UFactor
ClimateZone=		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
NonResidential	MetalFrameWall	0.069	0.062	0.082	0.062	0.062	0.069	0.069	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062
NonResidential	MetalBuildingWall	0.113	0.061	0.113	0.061	0.061	0.113	0.113	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.057	0.061
NonResidential	MassLightWall	0.196	0.170	0.278	0.227	0.440	0.440	0.440	0.440	0.440	0.170	0.170	0.170	0.170	0.170	0.170	0.170
NonResidential	MassHeavyWall	0.253	0.650	0.650	0.650	0.650	0.690	0.690	0.690	0.690	0.650	0.184	0.253	0.211	0.184	0.184	0.160
NonResidential	WoodFramingAndOtherWall	0.095	0.059	0.110	0.059	0.102	0.110	0.110	0.102	0.059	0.059	0.045	0.059	0.059	0.059	0.042	0.059
NonResidential	SpandrelWall	0.095	0.059	0.110	0.059	0.102	0.110	0.110	0.102	0.059	0.059	0.045	0.059	0.059	0.059	0.042	0.059
Residential	MetalFrameWall	0.069	0.069	0.069	0.069	0.069	0.069	0.105	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.048
Residential	MetalBuildingWall	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.057	0.057	0.057	0.057	0.057	0.057
Residential	MassLightWall	0.170	0.170	0.170	0.170	0.170	0.227	0.227	0.227	0.196	0.170	0.170	0.170	0.170	0.170	0.170	0.170
Residential	MassHeavyWall	0.170	0.170	0.170	0.170	0.170	0.227	0.227	0.227	0.196	0.170	0.170	0.170	0.170	0.170	0.170	0.170
Residential	WoodFramingAndOtherWall	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.042	0.059	0.059	0.042	0.042	0.042
Residential	SpandrelWall	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.042	0.059	0.059	0.042	0.042	0.042
RelocClass	MetalFrameWall	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057
RelocClass	MetalBuildingWall	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057
RelocClass	MassLightWall	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170
RelocClass	MassHeavyWall	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170
RelocClass	WoodFramingAndOtherWall	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042
RelocClass	SpandrelWall	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042

ENDTABLE  
// =====

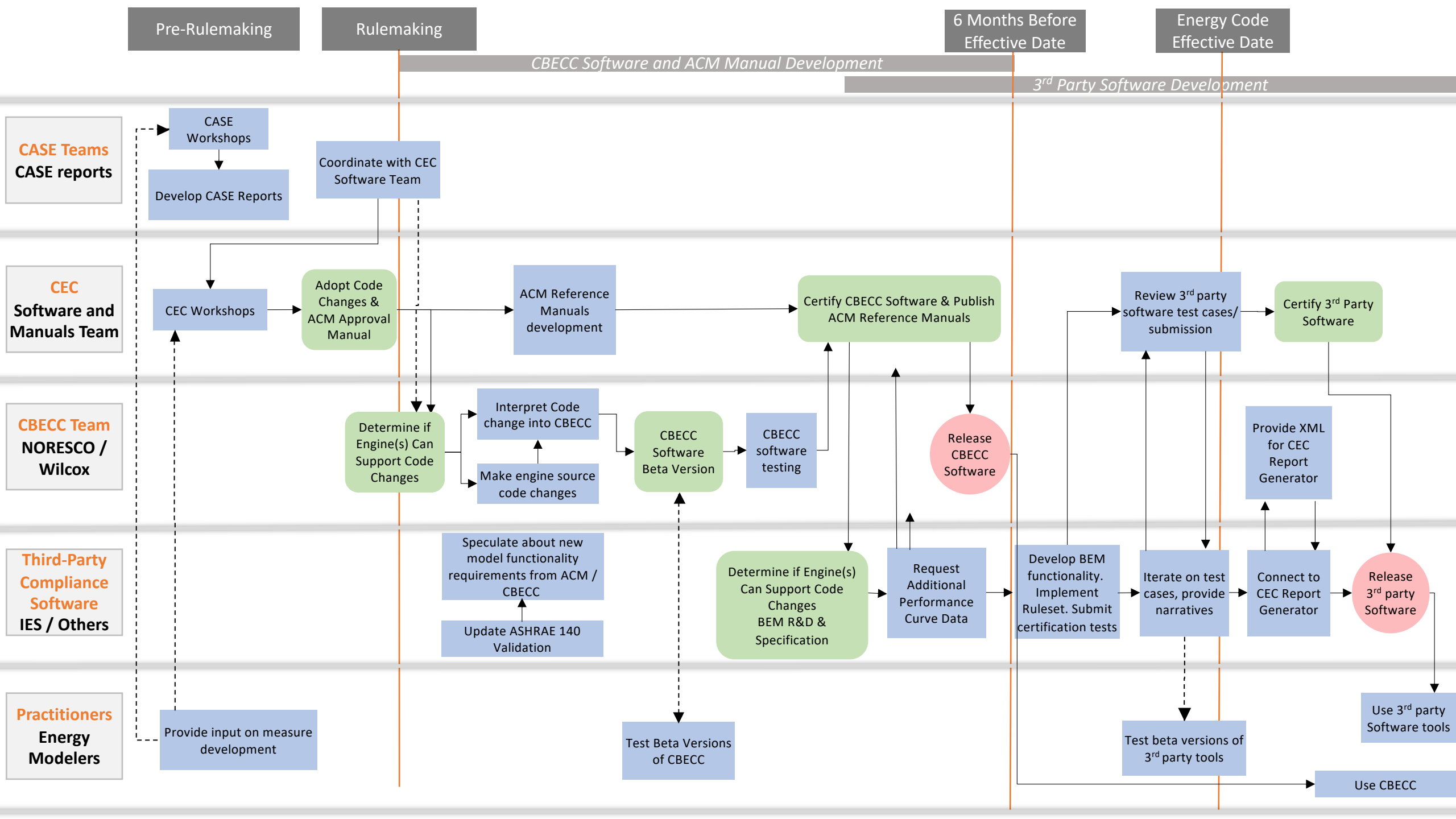
# Background: California Current State-of-Play



# Background: Vision







Pre-Rulemaking

Rulemaking

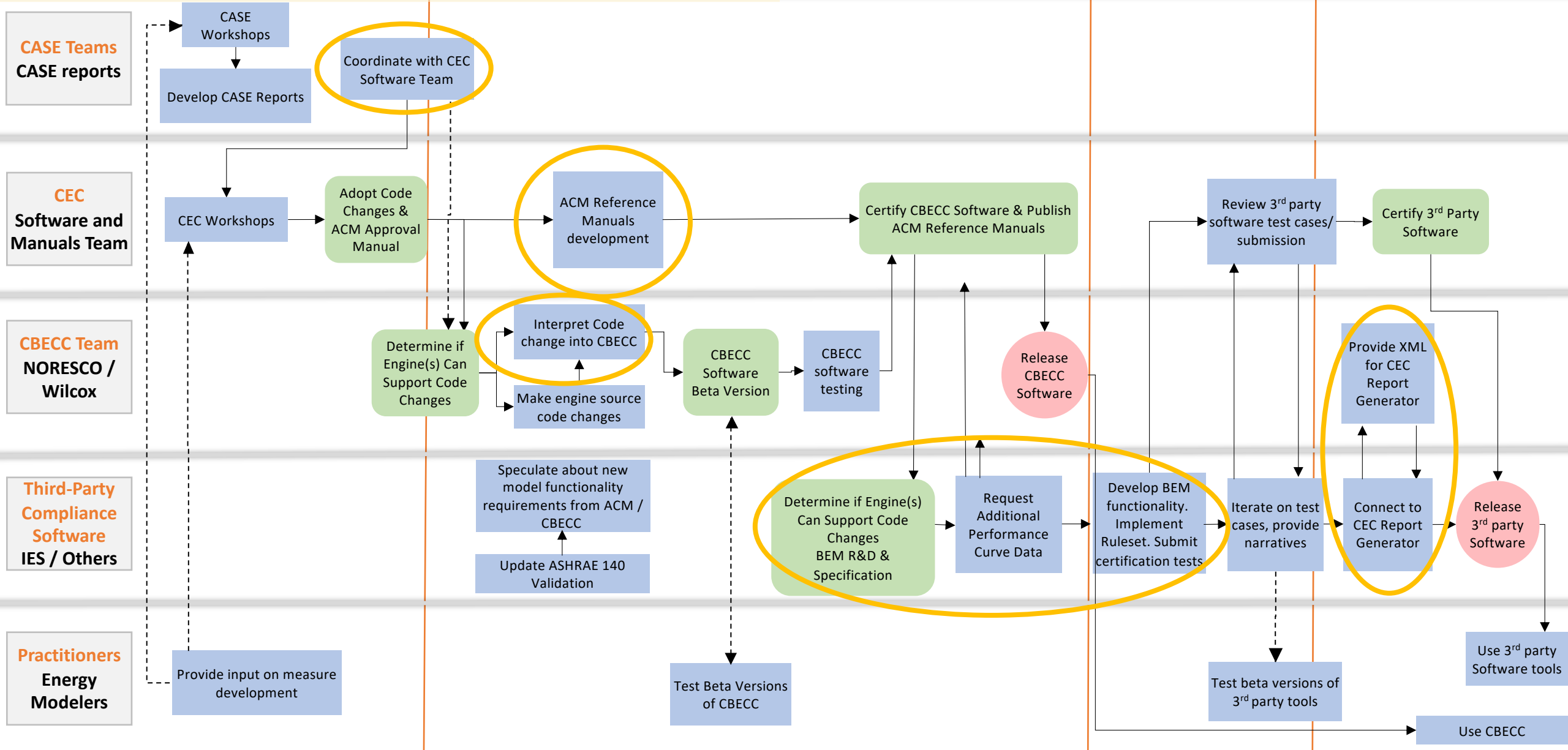
6 Months Before Effective Date

Energy Code Effective Date

# Areas for Machine Readable Rulesets to Plug-In

CBECC Software and ACM Manual Development

3rd Party Software Development



# CASE Efforts Supporting Ruleset Development

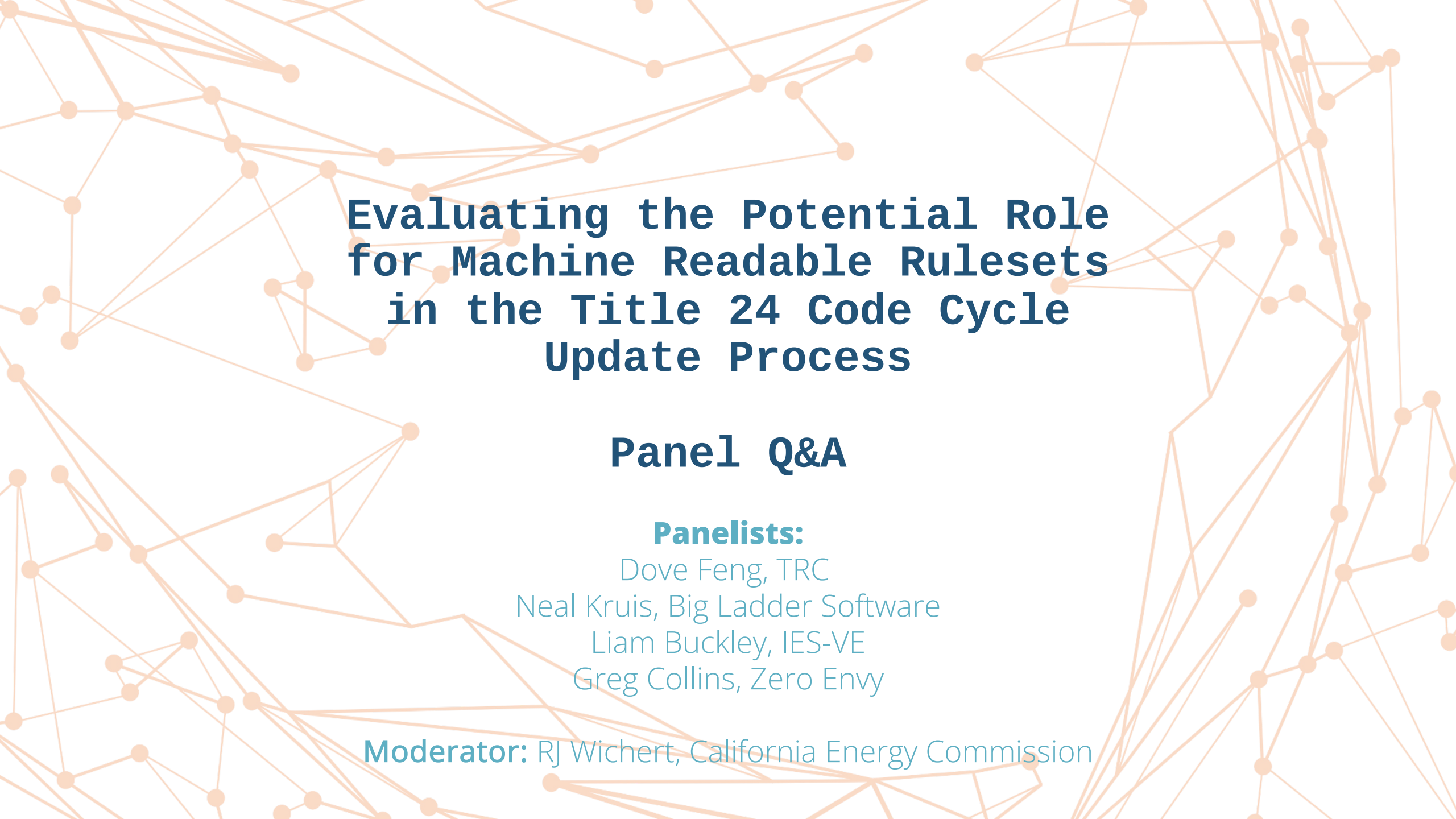
**CASE:** Research and gathering of information to develop the **documents** required to conduct a formal rulemaking proceeding, including the **energy impacts and the algorithms to evaluate the impact** of the proposed measure

- Market Analysis
- **Energy Savings Analysis**
  - **Methods**
    - Modify existing ruleset
    - Alternative analysis tool
    - Lab testing/field demonstration
- Cost and Cost Effectiveness analysis



## **Content in CASE Report: Ruleset**

- Proposed Revisions to Code Language
  - ACM : proposed model inputs/ algorithms/rules for modeling and code compliance
- Proposed changes to CBECC Software Specification



# Evaluating the Potential Role for Machine Readable Rulesets in the Title 24 Code Cycle Update Process

## Panel Q&A

### Panelists:

Dove Feng, TRC

Neal Kruis, Big Ladder Software

Liam Buckley, IES-VE

Greg Collins, Zero Envy

**Moderator:** RJ Wichert, California Energy Commission