ZNE AND CEC MODEL SOLAR ORDINANCE

BayREN Forum

June 27, 2017

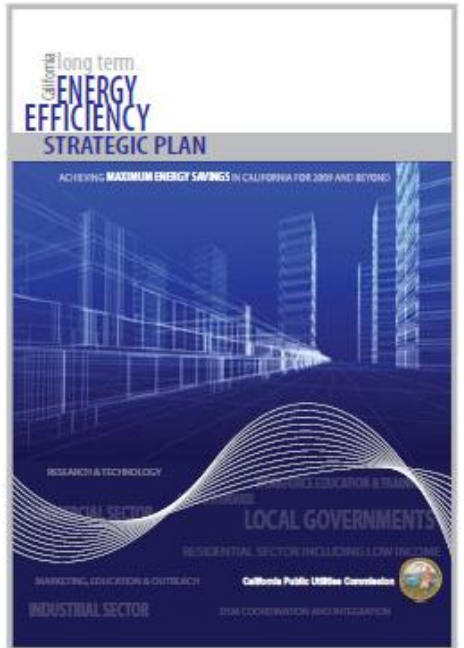
CALIFORNIA'S ZERO NET ENERGY

BACKGROUND

7 cycles - ZNE Commercial

3 cycles - ZNE Residential

2008 2013 2016 2019 2022 2025 2028 2031



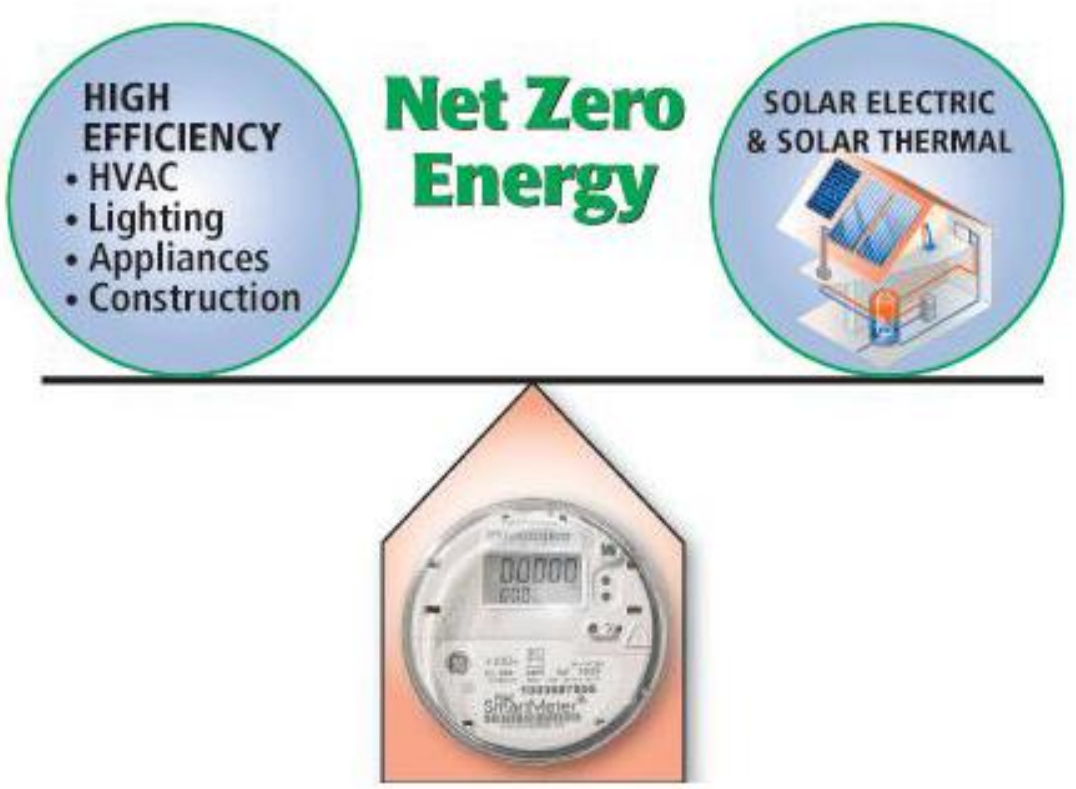
All new residential construction will be zero net energy by 2020

All new commercial construction will be zero net energy by 2030

ZERO NET ENERGY (ZNE) DEFINITIONS

- Zero Net Energy – in 2008, seemed simple enough…generate as much as you use over a year

- 2016 Standards Definition
  - Energy Design Rating = 0 (Efficiency measures plus renewables offset all TDV energy usage)

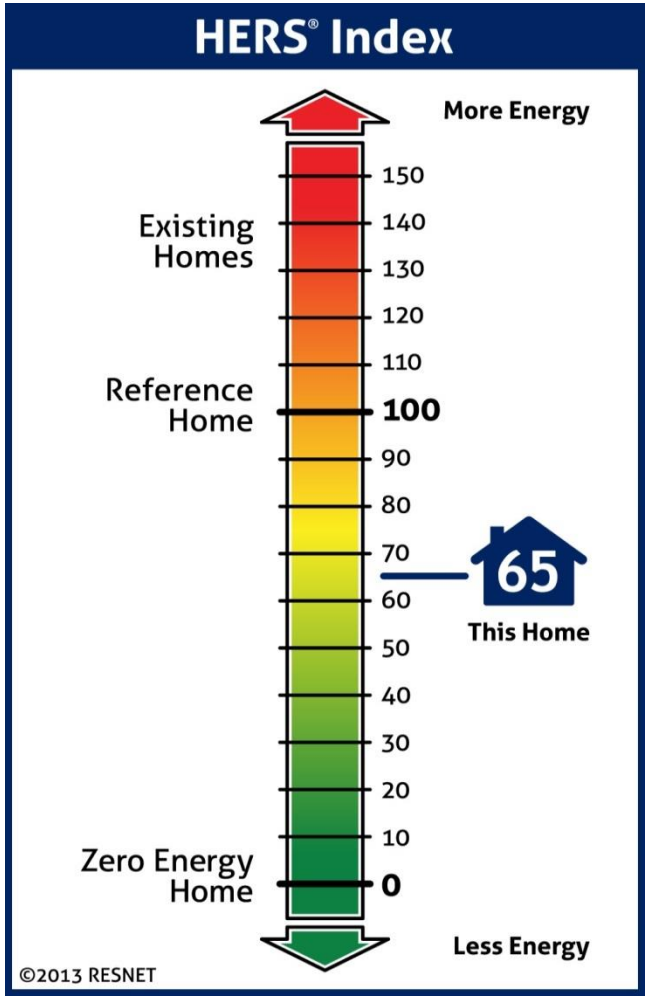


Source: Airtight Services, Inc.
http://www.airtightservicesinc.com/passive-house/high-efficiency-consultation/net-zero-energy/

ENERGY DESIGN RATING

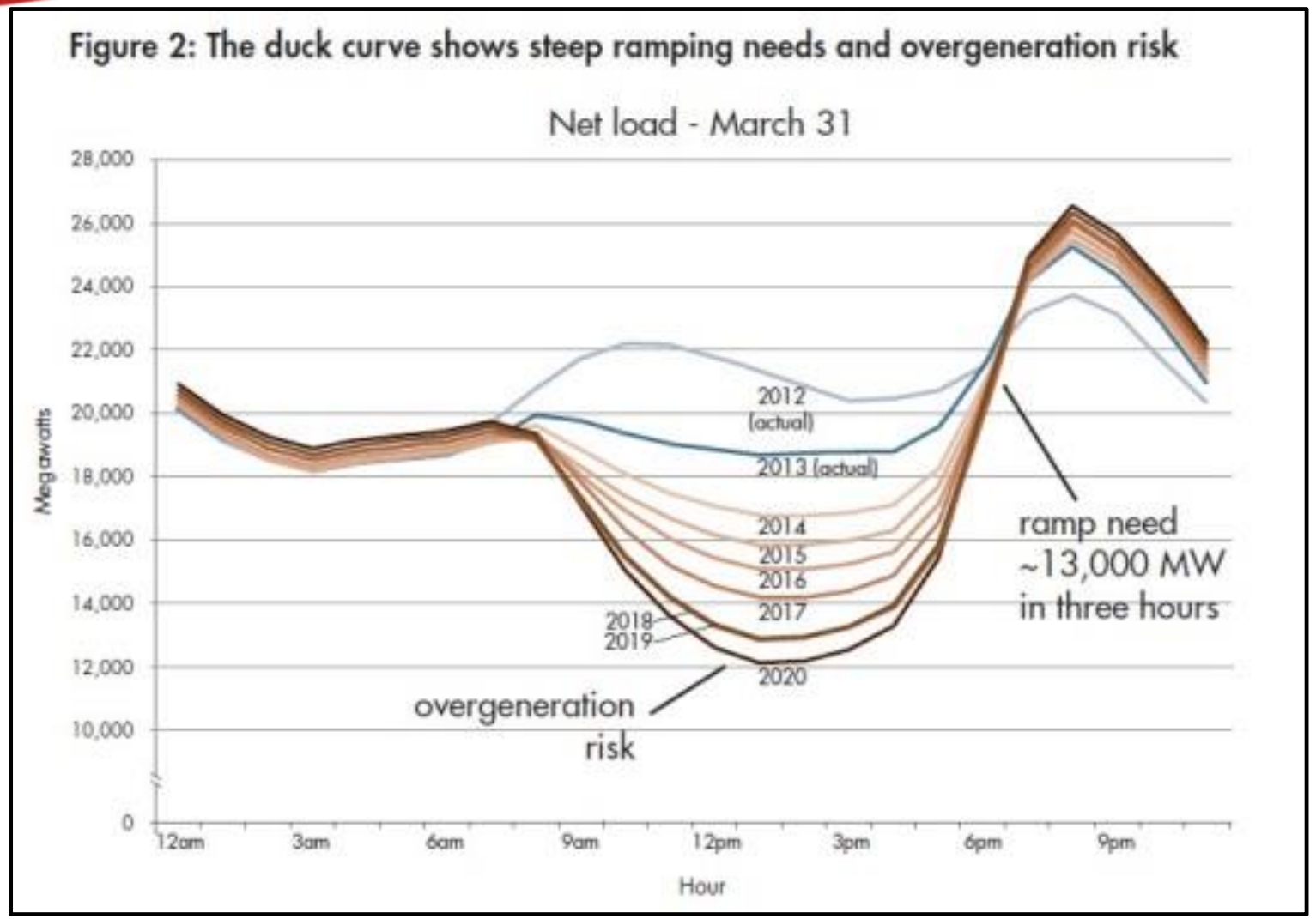
- Based on 2006 IECC
- Includes energy efficiency and renewables
- Regulated and Non-Regulated Loads
  - Space Heating, Cooling and Water Heating; plus
  - Lighting, Appliances, Plug Loads

- Implementation Challenge:
  - EDR = 0 requires offsetting all TDV-energy with renewables (including natural gas)



CAISO Net System Load

March 31, 2012-2020

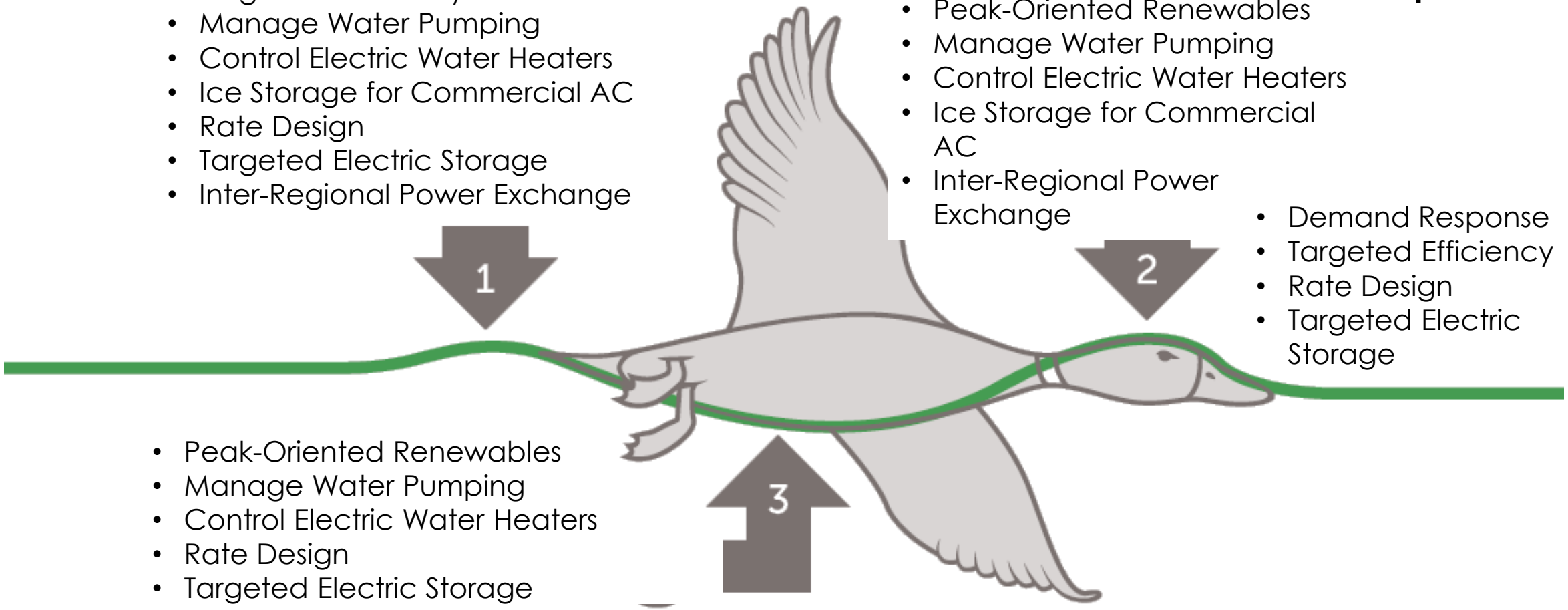


- Renewables changing system demand shape
- Risk of over-generation (resulting in curtailment)
- Need grid interactivity and harmonization to maximize benefits

Source: Flexible Resources to Help Renewables
http://www.caiso.com/Documents/FlexibleResourcesHelpRenewables_FastFacts.pdf

Teaching the Duck to Fly An Example

- Targeted Efficiency
- Manage Water Pumping
- Control Electric Water Heaters
- Ice Storage for Commercial AC
- Rate Design
- Targeted Electric Storage
- Inter-Regional Power Exchange



- Peak-Oriented Renewables
- Manage Water Pumping
- Control Electric Water Heaters
- Ice Storage for Commercial AC
- Inter-Regional Power Exchange

- Demand Response
- Targeted Efficiency
- Rate Design
- Targeted Electric Storage

- Peak-Oriented Renewables
- Manage Water Pumping
- Control Electric Water Heaters
- Rate Design
- Targeted Electric Storage
- Inter-Regional Power Exchange

Source: Lazar, J. (2016). *Teaching the "Duck" to Fly, Second Edition.* Montpelier, VT: The Regulatory Assistance Project. http://www.raponline.org/document/download/id/7956

REFINING THE VISION FOR THE 2019 STANDARDS

- Revised Zero Net Energy to Zero Net Electricity
  - Compliance baselines fuel-neutral
- Offset site electricity use only, system sized for mixed-fuel home
- Two separate scores: Efficiency, Renewables
  - Must meet minimum level of efficiency before renewables
- EDR required score likely ~20
- Focus on ensuring PV systems deliver value to customer and grid
  - Credits for storage (basic and utility-controlled)

ACHIEVING THE GOAL

- 2016: approx. 10% of new homes installing PV
- CEC identified need to ramp up more quickly to reach 100% by 2020
- Proposed local ordinance requiring PV systems on new homes
- Worked with PG&E to develop cost-effectiveness study

CEC SOLAR ORDINANCE C-E STUDY ASSUMPTIONS

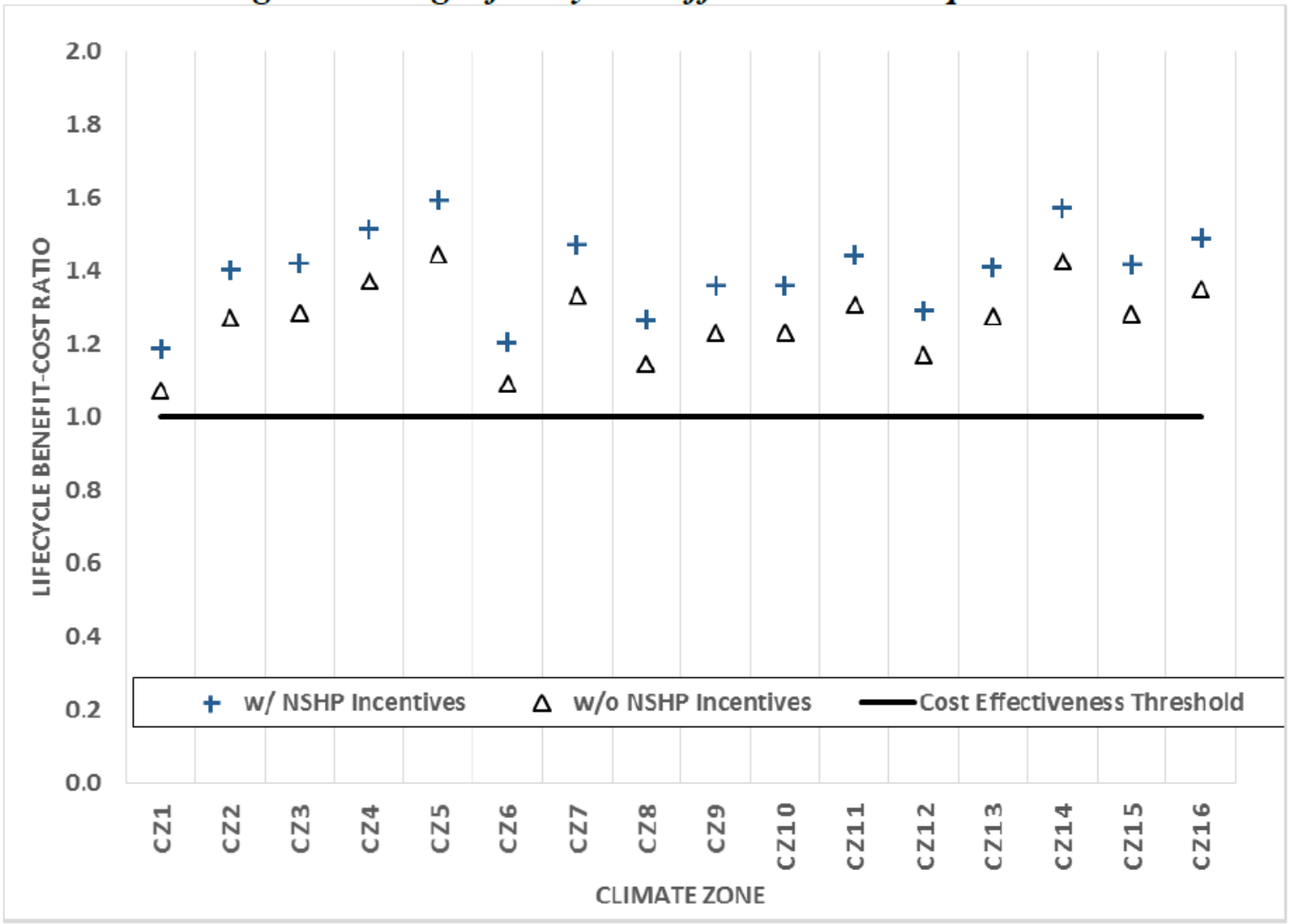
- May not use PV credit to achieve compliance
- No efficiency measures beyond compliance required
- Ensure PV systems appropriately sized
  - Offsets approximately 80% of site electricity usage
  - Estimates based on total TDV energy
- Baseline is mixed-fuel home
- Cost-effectiveness based on customer utility savings (not TDV energy)
- Prescriptive (<4,500 sq.ft) **and** performance options

Table 1: *Minimum Nameplate System Size (kW_{DC}) Required* **[SAMPLE CZ12]**

Conditioned Space (ft^2)	Minimum kW (DC) Required
Less than 1000	1.5
1000 - 1499	1.9
1500 - 1999	2.3
2000 - 2499	2.7
2500 - 2999	3.1
3000 - 3499	3.4
3500 - 3999	3.8
4000 - 4499	4.2

SINGLE FAMILY COST EFFECTIVENESS RESULTS

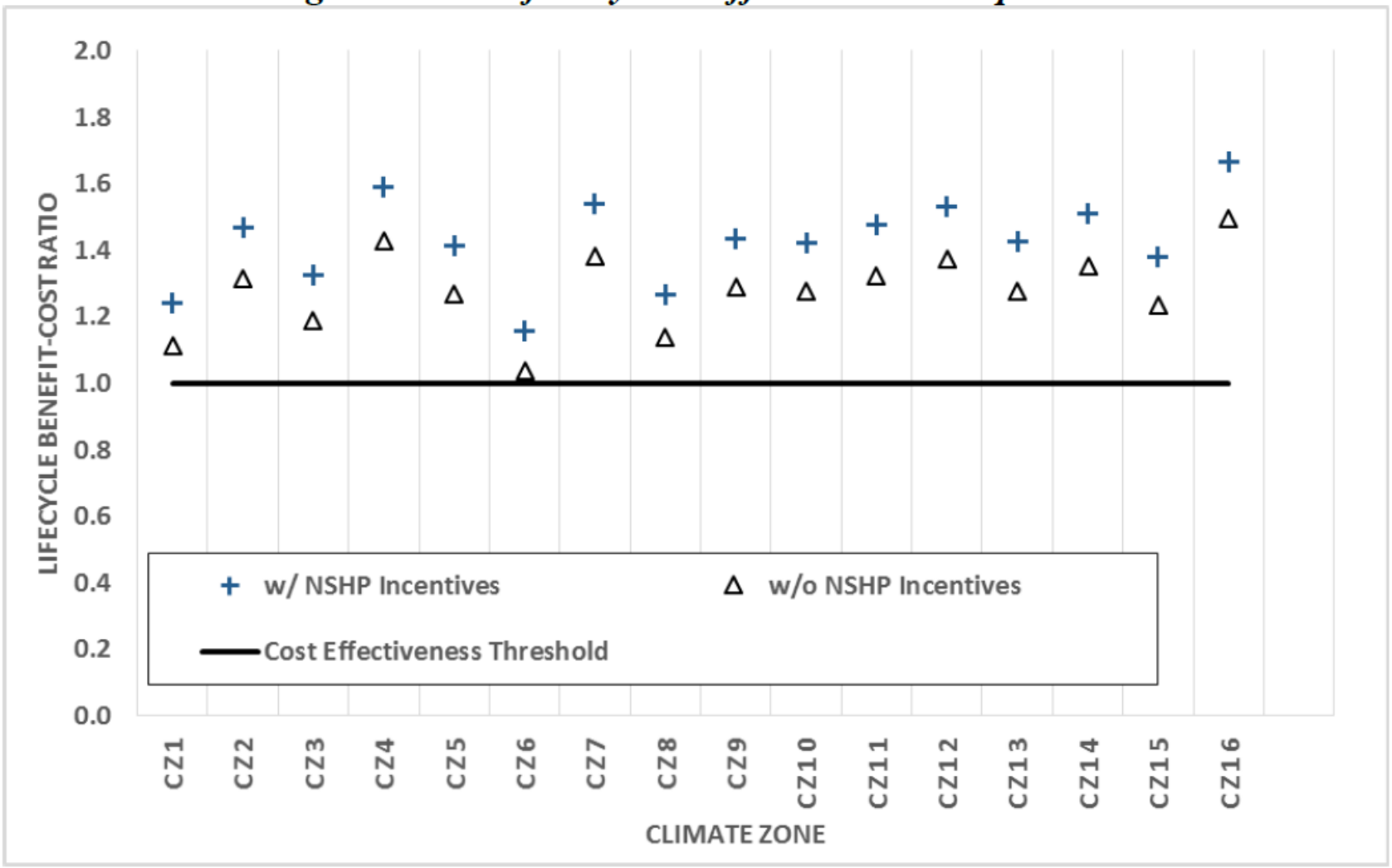
Figure 1: Single family cost effectiveness comparison



- **Cost effective in all climate zones**
- PV System Capacity: 2.2 – 4.6 kW
- Simple payback: 12.7 yrs in CZ5 – 17.1 yrs in CZ1
- CO2 emissions reduction: 25.7 – 64%

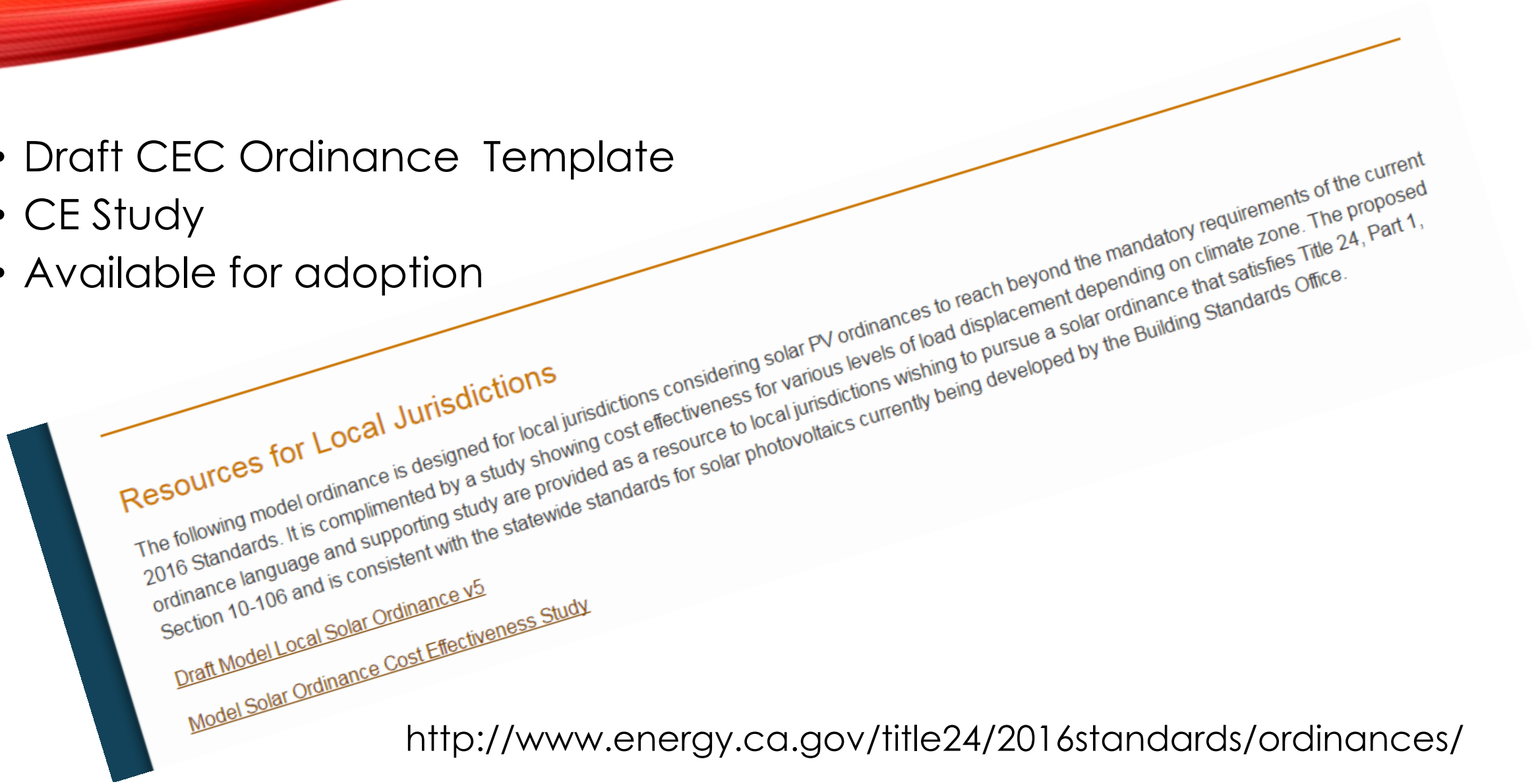
MULTIFAMILY COST EFFECTIVENESS RESULTS

Figure 2: Multifamily cost effectiveness comparison



- **Cost effective in all climate zones**
- PV System Capacity: 1.3 – 2.1kW (per dwelling unit)
- Simple payback: 12.3 yrs in CZ16 – 17.7 yrs in CZ6
- GHG emissions reduction: 31 – 55%

- Draft CEC Ordinance Template
- CE Study
- Available for adoption



http://www.energy.ca.gov/title24/2016standards/ordinances/

ADDITIONAL ORDINANCE OPTIONS

GARNERING ADDITIONAL EFFICIENCY ("PV-PLUS")

- Performance-Based format requires achieving savings beyond compliance
- "PV-Plus" cost-effective compliance margins:
  - Single Family
    - 30% in most climates (1, 2, 4, 8-16)
    - 20% in milder climates (3, 5)
    - 10% in CZ 6 and 7 (no PV credit available)
  - Multifamily
    - 25% in most climates (4, 9-16)
    - 20% in some coastal climates (1, 2, 8)
    - 15 % in parts of bay area (CZ 3)
    - 10% in very mild climates (5-7)

- Strongly encourages, but does not require PV systems

GARNERING ADDITIONAL EFFICIENCY ("PV-PLUS")

- PV-Plus (EE + PV) measure package results in incremental cost above PV-only cost equal to:
  - Single Family $300 – $1,800
  - Multifamily $0 - $300
- Decrease in simple payback time (SF and MF): 6 months to 1.5 years
- Increased GHG emissions reductions
  - Single Family: 39 - 72% (from 30 - 64%)
  - Multifamily: 41 - 62% (from 31 – 55%)

EFFICIENCY-ONLY ORDINANCE

- Performance-Based format
- "EE-Only" cost-effective compliance margins:
  - Single Family
    - 15% in most climates (1-3, 5, 9-16)
    - 10% in CZ 4
  - Multifamily
    - 15% in most climates (1, 11-16)
    - 10% in CZ 10
    - QII Only in CZ 2
- Does not allow using PV system credit in performance calculations
- Reduces incremental costs significantly
  - Single Family: $600 - $1,500
  - Multifamily: $150 - $1,100

PRESCRIPTIVE (SINGLE MEASURE) OPTIONS

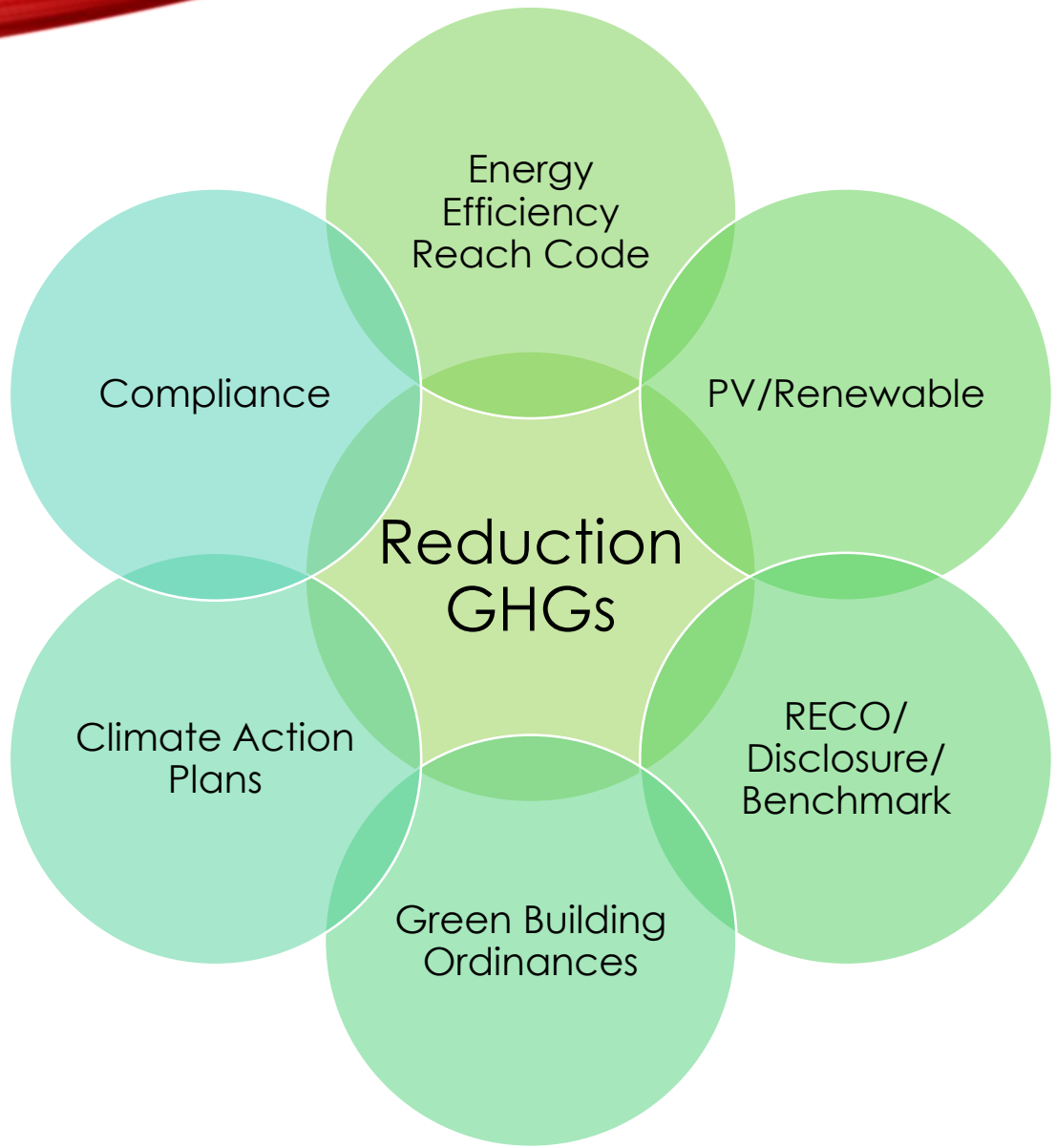
Cost-Effectiveness Studies Available

- Cool Roofs (Res, Non Res)
- Non Res Outdoor Lighting
- Plug-in Electric Vehicle Infrastructure

Coming Soon: Prescriptive ordinance addressing substantial residential remodels

RESOURCES

- LocalEnergyCodes.com (coming soon)
- BayREN Codes and Standards website
- California Energy Commission
- California Building Standards Commission
- New Buildings Institute



SUMMARY

- Aggressive State goals can be met but can use support
- Local governments have options
- Ordinances can support market transformation and code readiness

THANK YOU

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