# It All Adds up to Zero

## California's Zero Net Energy Future (and What We're Doing About it)

**USGBC – Central California**

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# What is Zero Net Energy?

## CA Department of General Services Definitions

- **ZNE building** – An energy-efficient building where, on a source energy basis, the actual annual consumed energy is less than or equal to the on-site renewable generated energy.

- **ZNE campus** –An energy-efficient campus where, on a source energy basis, the actual annual consumed energy is less than or equal to the on-site renewable generated energy

- **ZNE portfolio** - An energy-efficient portfolio in which, on a source energy basis, the actual annual consumed energy is less than or equal to the on-site renewable generated energy

- **ZNE community** – An energy-efficient community where, on a source energy basis, the actual annual consumed energy is less than or equal to the on -site renewable generated energy.


California's ZNE Building Goals
All new residential construction in California will be ZNE by 2020
All new commercial construction will be ZNE by 2030
Legislation!
SB 350
AB 32/SB 32
AB 793/AB 758
AB 802
. . .
50% of existing commercial buildings will be retrofit to ZNE by 2030
All new & major renovations of state buildings shall be ZNE 2025; 50% at 2020
IBEW Zero Net Energy Center, San Leandro

# CA Policies Have Catalysed the Market

- Production Builders Envision, Meritage, DeYoung, Pulte all developing ZNE residential communities

- Local Governments with ZNE policies and codes
  - Lancaster – Solar Roofs
  - Palo Alto – ZNE Policy
  - Santa Monica – ZNE Policy
  - Hayward – ZNE public buildings
  - Sonoma and Marin CCAs
  - San Diego
- And more….


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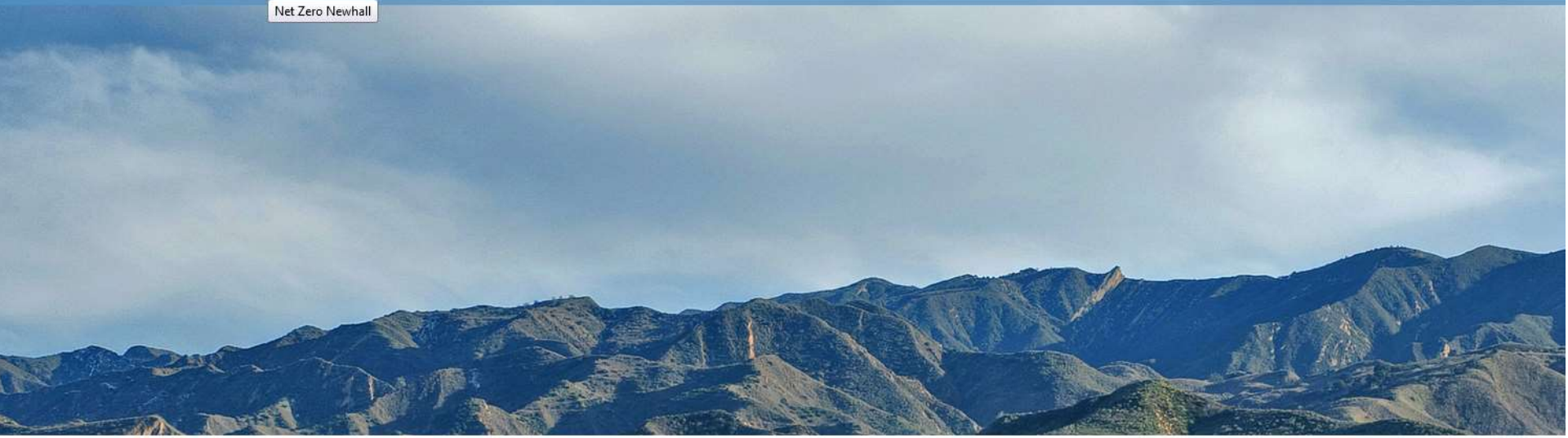
Net Zero Newhall



# A National Model for Sustainability

Newhall Ranch will set a new standard for sustainability through a comprehensive array of green innovations onsite and within L.A. County, as well as funding direct emissions reduction activities locally, in California, and around the world. From green buildings that encourage energy efficiency to a robust transportation management program, Newhall Ranch will create a model for living and working sustainably in California.

## Upholding Green Building & Design Standards

- ✓ Innovative energy efficiency measures and renewable energy generation (e.g., solar power) to design homes, commercial buildings and public facilities to meet Zero Net Energy standards within Newhall Ranch.

## Show your support

Sign up to stay informed

Your name

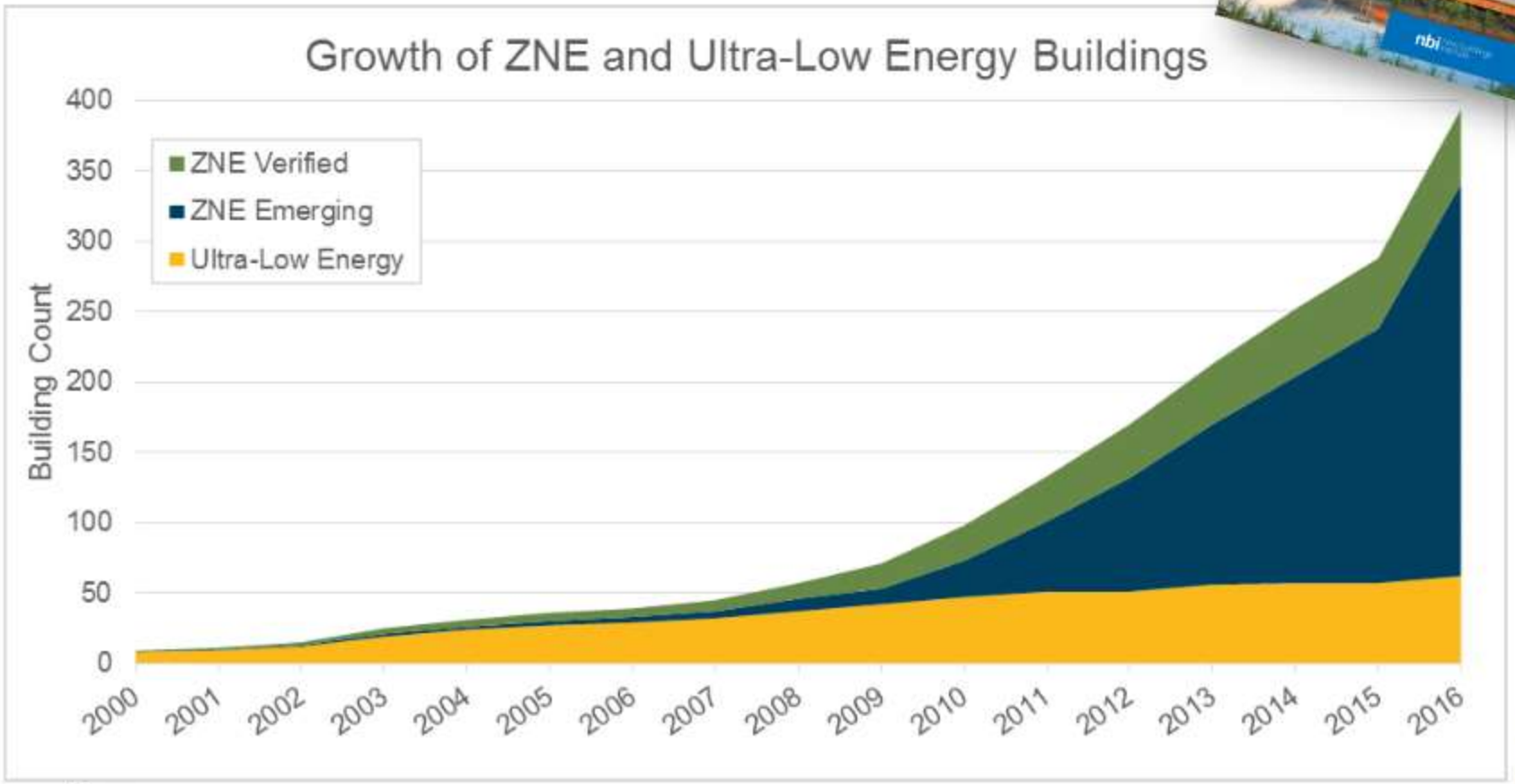
Your e-mail

Zip Code

SUBMIT

# ZNE is Growing…


 Source: New Building Institute (national data)

# CPUC's Role in Zero Net Energy

- Long-Term Energy Efficiency Strategic Plan
  - New Residential ZNE Action Plan
  - Working with CEC on meeting SB 350 + other goals
- Oversee and direct funds for IOU's new construction and key energy efficiency programs
  - California Advance Home Program (Res. New Construction)
  - Savings By Design (Commercial New Construction)
  - Emerging Technologies
  - EM&V Studies on Market, Feasibility and Costs for ZNE
  - Codes Programs
- Leading State Policy Maker/Advocate for ZNE

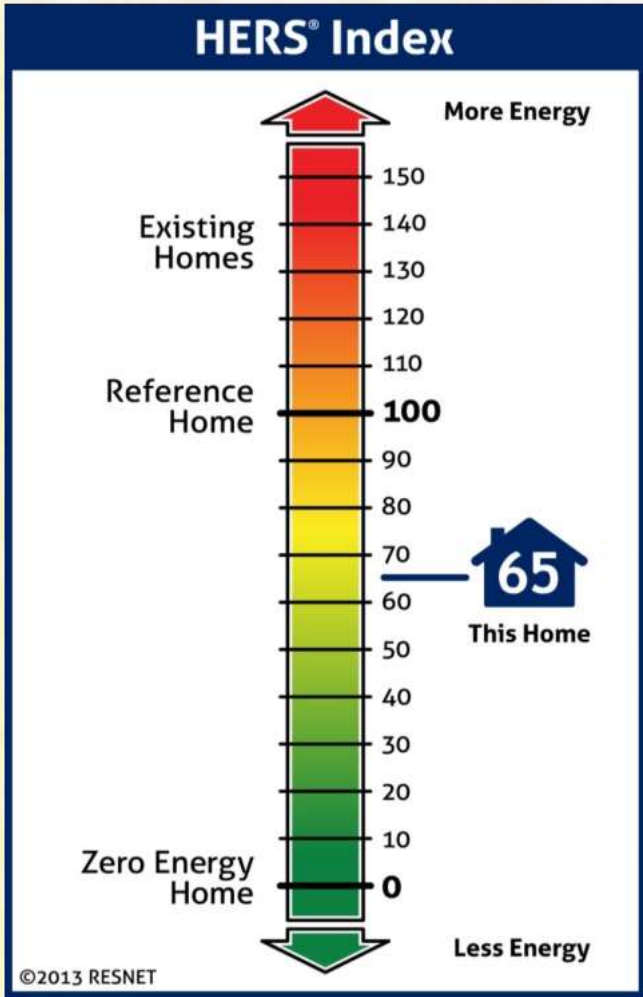
# Builds on Commission's Energy Design Rating Tool

- **Energy Design Rating (EDR) score show how close a home is to the ZNE target**
  - Aligned with RESNET
  - Reference home is a 2006 IECC compliant home, EDR=100
  - A score of zero means the house is a ZNE building

- **CEC's CBECC-Res software has the capability to calculate EDR scores for EE and PV**
- **Builders can use a combination of envelope energy efficiency features, better appliances, PVs, and other strategies to get to the target EDR**

## Download CBECC-Res here for free:

http://www.bwilcox.com/BEES/BEES.html



# Energy Design Rating Dashboard

2019_CZ12_2700ft2 - v30 12 S27 G20 M01

Compliance Summary | Energy Design Rating | Energy Use Details

EDR of Proposed Efficiency: 41.9 - EDR of Prop PV + Flexibility: 19.1 = Final Proposed EDR: 22.8

EDR of Standard Efficiency: 43.2 - EDR of Minimum Required PV: 18.5 = Final Std Design EDR: 24.7

| End Use | Reference Design Site (kWh) | Reference Design Site (therms) | Reference Design (kTDV/ft²-yr) | Proposed Design Site (kWh) | Proposed Design Site (therms) | Proposed Design (kTDV/ft²-yr) | Design Rating Margin (kTDV/ft²-yr) |
|---|---|---|---|---|---|---|---|
| Space Heating | 584 | 486.0 | 45.09 | 187 | 217.2 | 19.51 | 25.58 |
| Space Cooling | 1,729 | | 59.71 | 317 | | 17.22 | 42.49 |
| IAQ Ventilation | 194 | | 1.99 | 194 | | 1.99 | 0.00 |
| Other HVAC | | | 0.00 | | | 0.00 | 0.00 |
| Water Heating | | 176.3 | 13.03 | | 119.9 | 8.86 | 4.17 |
| Photovoltaics | | | | -5,022 | | -43.51 | 43.51 |
| Battery | | | | | | 0.00 | 0.00 |
| Inside Lighting | 2,615 | | 30.42 | 616 | | 6.98 | 23.44 |
| Appl. & Cooking | 989 | 73.4 | 15.65 | 1,040 | 45.1 | 14.46 | 1.19 |
| Plug Loads | 3,267 | | 35.06 | 2,371 | | 25.03 | 10.03 |
| Exterior | 328 | | 3.54 | 152 | | 1.61 | 1.93 |
| TOTAL | 9,705 | 735.7 | 204.49 | -146 | 382.3 | 52.15 | 152.34 |

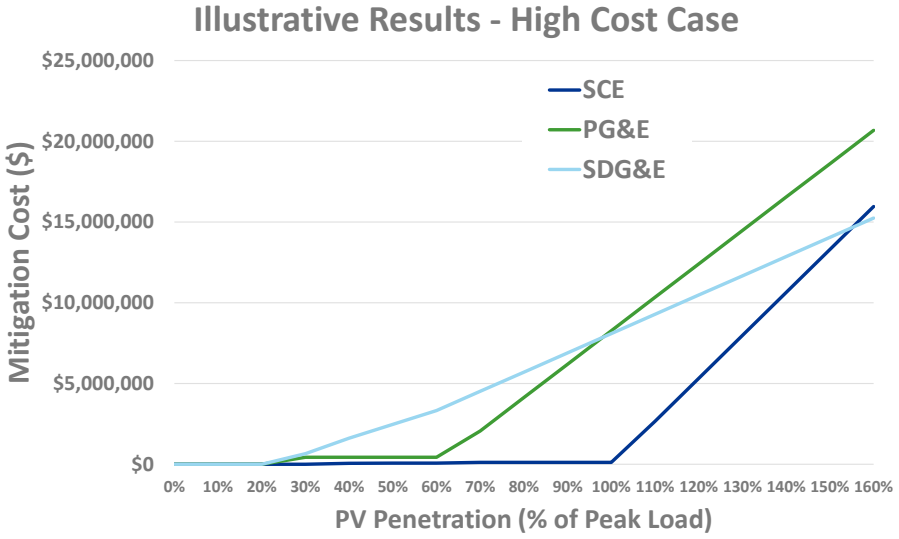
Done

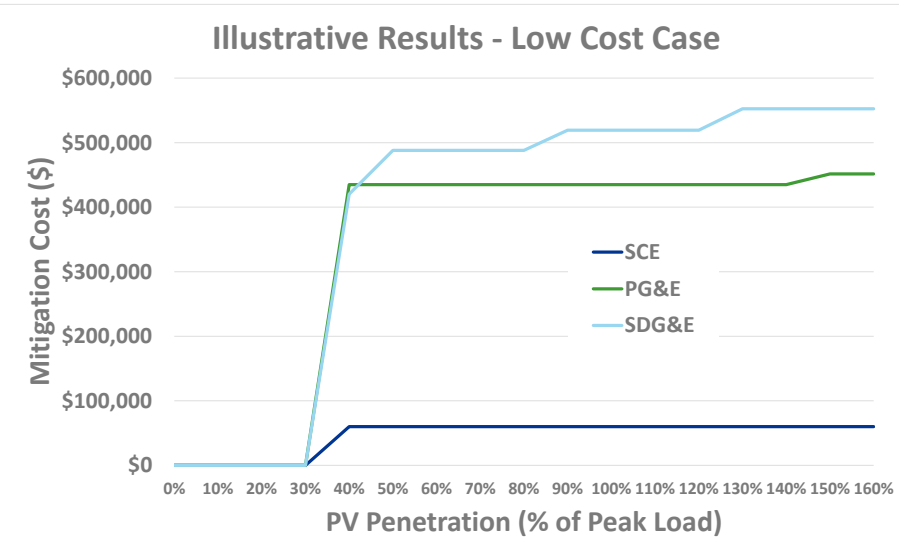
# CPUC's Grid Integration Study

- CEC is currently developing a ZNE residential building code
- CPUC managing study by DNV-GL regarding socialized cost, "ZNE Grid Integration Study"
- Purpose: Evaluate the impacts of ZNE on the distribution grid to be included in Title 24 cost-effectiveness method
- Scope: DNV GL's scope is to calculate the integration costs of ZNE to the grid and work with CEC to incorporate these costs into Title 24.

# DNV-GL Methodology

- **Mapped annual PV growth** to distribution circuits, using a geographic allocation method.
- Assumed **2kW system size** per home
- Categorized into **representative circuits**
- Performed flow studies on 75 **sample circuits** assuming up to 160% penetration
- Evaluated **technical criteria:** voltage, thermal, reverse power flow
- Added **mitigation measures:** traditional measures, energy storage, smart inverters, optimal location
- Examined 2 scenarios:
  - **High Cost case** - all ZNE homes lumped together in one place
  - **Low Cost case** – ZNE homes distributed throughout feeder



# Results: High Cost Scenario

Grid Integration Costs for new PV between 2016 and 2026

| High Cost Case | PG&E | | SCE | | SDG&E | |
|---|---|---|---|---|---|---|
| | Total Cost | Cost Per Ratepayer | Total Cost | Cost Per Ratepayer | Total Cost | Cost Per Ratepayer |
| **Without ZNE** | $850 M | $157 | $134 M | $27 | $605 M | $432 |
| **With ZNE** | $1,473 M | $273 | $179 M | $36 | $698 M | $498 |
| **Difference** | $623 M | $116 | $45 M | $9 | $93 M | $66 |

# Results: Low Cost Scenario

Grid Integration Costs for new PV between 2016 and 2026

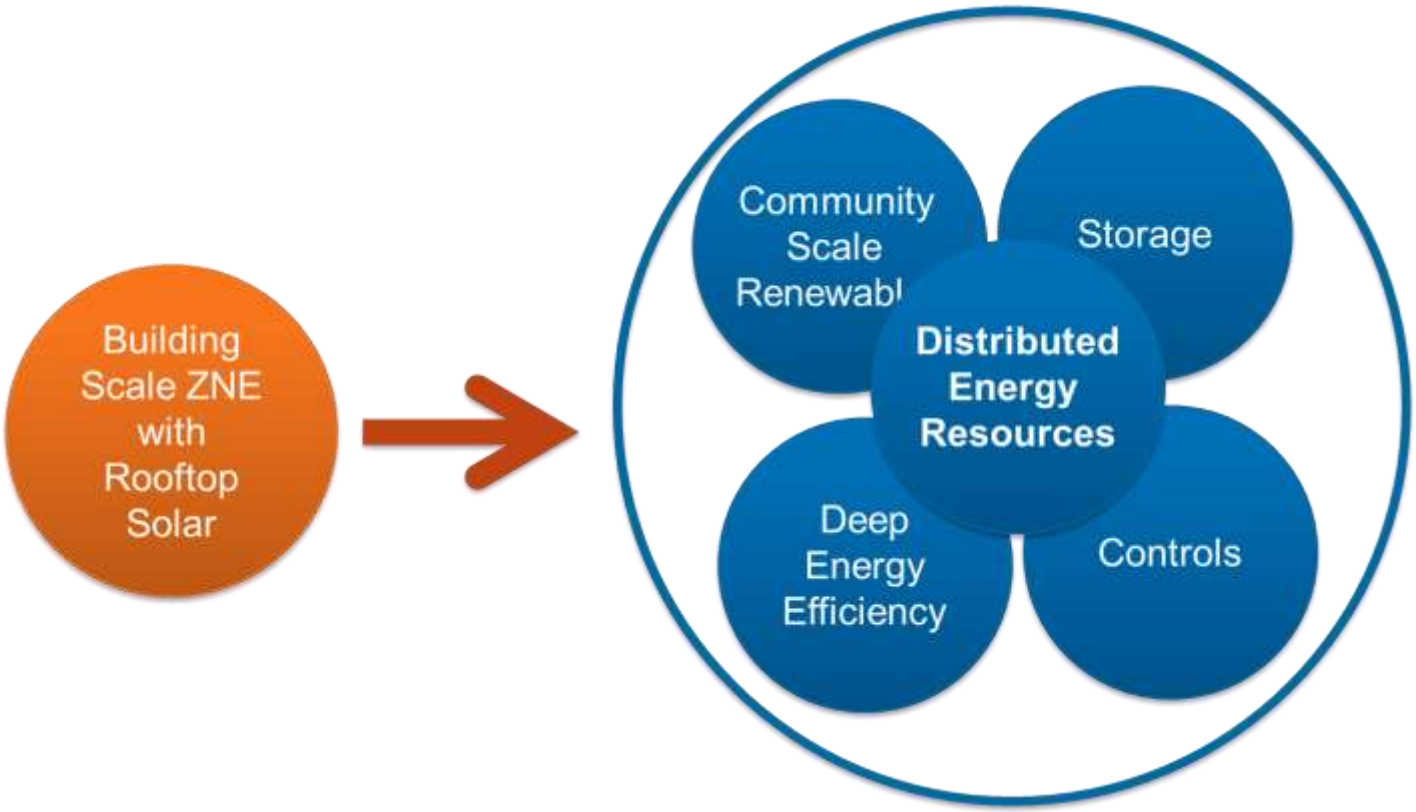
| Low Cost Case | PG&E | | SCE | | SDG&E | |
|---|---|---|---|---|---|---|
| | Total Cost | Cost Per Ratepayer | Total Cost | Cost Per Ratepayer | Total Cost | Cost Per Ratepayer |
| **Without ZNE** | $75 M | $14 | $51 M | $10 | $38 M | $27 |
| **With ZNE** | $117 M | $21 | $36 M | $7 | $43 M | $31 |
| **Difference** | $42 M | $7 | $15 M | $3 | $6 M | $4 |

**80% – 95% lower than High Cost Scenario**

# Key Takeaways for New Residential ZNE

- High volumes of ZNE homes should be developed with “eyes wide open” with regards to grid harmonization
- Grid harmonization can happen with energy storage and “smart inverters”
- Location matters! The IOUs’ Integration Cost Analysis (ICA) tool should be helpful to indicate low cost locations.

# Commercial ZNE Action Plan and Tool



# Update the Commercial ZNE Goal & Objective

**Goal:** Beginning in 2030, all new commercial buildings and major renovations of existing buildings achieve zero net energy performance (onsite/offsite renewables) and grid optimization.

**Objective:** ZNE Buildings and Districts are integrated as key distributed energy resources that reduce carbon emissions, enhance customer experience and create more resilient communities.

"First Street North Vision" developed by the Little Tokyo community, Los Angeles.

# Community Decision-Making Tool

Informed by CPUC, CEC policy goals

- Grid Friendly/Load Balancing
- Locational Value
- Cost Effective
- Equity for Ratepayers
- Reduce Transmission
- Distributed Energy Resources
- Reliability


Powered by Customer needs and objectives

# Community Decision-Making Tool

## Who Makes the Decisions?

- Developers
- Local Governments
- Property Owners

## Who Helps to Make the Decisions?

- Architects
- Builders
- Energy Consultants

# Example 1. Sustainability Focused Customer

| | ZNE Option | Building Scale (Solar + Storage Onsite) | | Community Solar Plus Storage | | District ZNE/Grid Connected Microgrid | | Utility Scale Renewables | |
|---|---|---|---|---|---|---|---|---|---|
| Value | Objective | Value | Score | Value | Score | Value | Score | Value | Score |
| 5 | Sustainability | 4 | 20 | 4 | 20 | 5 | 25 | 3 | 15 |
| 5 | Resiliency | 4 | 20 | 4 | 20 | 5 | 25 | 1 | 5 |
| 5 | Carbon Zero/Neutral Development | 3 | 15 | 4 | 20 | 5 | 25 | 3 | 15 |
| 1 | Infrastructure Modernization | 1 | 1 | 3 | 3 | 5 | 5 | 1 | 1 |
| 2 | Local Energy Supply | 5 | 10 | 5 | 10 | 5 | 10 | 1 | 2 |
| 1 | Monetization of Energy | 3 | 3 | 4 | 4 | 5 | 5 | 1 | 1 |
| 2 | Economic Development | 1 | 2 | 3 | 6 | 5 | 10 | 1 | 2 |
| 1 | Asset Control/Management | 5 | 5 | 2 | 2 | 4 | 4 | 1 | 1 |
| 1 | Ease of Access | 5 | 5 | 3 | 3 | 2 | 2 | 5 | 5 |
| 2 | Architecture Flexibility | 3 | 6 | 5 | 10 | 5 | 10 | 5 | 10 |
| 1 | Load Management | 2 | 2 | 4 | 4 | 5 | 5 | 4 | 4 |
| 2 | Costs | 3 | 6 | 3 | 6 | 2 | 4 | 5 | 10 |
| 3 | Financing Options | 3 | 9 | 2 | 6 | 5 | 15 | 1 | 3 |
| | **Score** | | **104** | | **114** | | **145** | | **74** |

# Example 2. Economic Focused Customer

| ZNE Option | | Building Scale (Solar + Storage Onsite) | | Community Solar Plus Storage | | District ZNE/Grid Connected Microgrid | | Utility Scale Renewables | |
|---|---|---|---|---|---|---|---|---|---|
| Value | Objective | Value | Score | Value | Score | Value | Score | Value | Score |
| 5 | Sustainability | 4 | 20 | 4 | 20 | 5 | 25 | 3 | 15 |
| 5 | Resiliency | 4 | 20 | 4 | 20 | 5 | 25 | 1 | 5 |
| 5 | Carbon Zero/Neutral Development | 3 | 15 | 4 | 20 | 5 | 25 | 3 | 15 |
| 1 | Infrastructure Modernization | 1 | 1 | 3 | 3 | 5 | 5 | 1 | 1 |
| 2 | Local Energy Supply | 5 | 10 | 5 | 10 | 5 | 10 | 1 | 2 |
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| 2 | Economic Development | 1 | 2 | 3 | 6 | 5 | 10 | 1 | 2 |
| 1 | Asset Control/Management | 5 | 5 | 2 | 2 | 4 | 4 | 1 | 1 |
| 1 | Ease of Access | 5 | 5 | 3 | 3 | 2 | 2 | 5 | 5 |
| 2 | Architecture Flexibility | 3 | 6 | 5 | 10 | 5 | 10 | 5 | 10 |
| 1 | Load Management | 2 | 2 | 4 | 4 | 5 | 5 | 4 | 4 |
| 2 | Costs | 3 | 6 | 3 | 6 | 2 | 4 | 5 | 10 |
| 3 | Financing Options | 3 | 9 | 2 | 6 | 5 | 15 | 1 | 3 |
| | **Score** | | **104** | | **114** | | **145** | | **74** |

# Next Steps to Commercial Action Plan

- Test and Discuss Values and Definitions
- Develop and Test Phase 1. Decision Making Tool
- Complete the Commercial Buildings Action Plan
- Coordination with other Agencies

  Energy Efficiency Collaborative
  Ongoing Coordination with CEC

# Questions?

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