



# Plug Loads and Zero Net Energy Buildings in California

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Presentation drawn from “**The Technical Feasibility of ZNE Buildings in California**” study, [Arup (PG&E), 2012]

*See [CALMAC.org](http://CALMAC.org), search ZNE to download*



# ZNE Tech Feasibility Methodology

Estimate lowest possible EUI of **12 Building Types**

- Repeat analysis in **5-7 California Climate Zones**
- Define resulting building characteristics
- Model **solar** production
- **Assess ZNE Feasibility**
  
- Identify primary barriers and opportunities
- Develop a tool for the analysis of design variants

# Findings

- **ZNE buildings are technically feasible** for 75% of all buildings square footage projected for 2020
  - With existing and expected technologies
- **Plug Loads play a large role!**
  - Assumed 50% reduction in average plug load usage for commercial buildings (except hospitals and schools)
    - from baseline of projected usage
  - Assumed 20% reduction in residential
- **High overall uncertainty in plug load assumptions**
  - Ubiquitous controls, but average occupants
    - No behavioral assumptions included
    - Developed by New Buildings Institute

# Plug Loads and ZNE

- **Must be addressed to reach ZNE**
  - Efficiency trends are good
  - Overall volume is problematic
- **Software and controls will improve auto-off functions**
- **Monitors and T.V.s are a big part**
  - LED improvements should help here
- Need to move from “just in case” (systems always on) to **“just in time” (systems that respond to need)**

# Key Measures

Rank	Measure	TDV\$/ft <sup>2</sup> *
1	LED Efficiency	-\$4.70
2	Plug Load Reductions	-\$2.57
3	Fan and Duct Efficiency	-\$0.77
4	95%+ Efficiency Gas Appliances	-\$0.54
5	Natural Ventilation	-\$0.41
6	Windows U Factor and SHGC	-\$0.32
7	Heat Recovery (air, mech., and water)	-\$0.28

\*Values are projected TDV\$ reductions per total construction volume.

# Technical Feasibility Summary

TDV\$/ft<sup>2</sup> (30 yr)

<i>Percent of 2020 New Build</i>		15: Palm Springs			12: Sacramento			3: Oakland		
		<i>Load:</i>	<i>Solar:</i>	<i>Net:</i>	<i>Load:</i>	<i>Solar:</i>	<i>Net:</i>	<i>Load:</i>	<i>Solar:</i>	<i>Net:</i>
Single Family Home	47%	12	-12	0	10	-10	0	8	-8	0
Multi-family Low-rise	8.5%	20	-20	0	15	-15	0	14	-14	0
Multi-family High-rise	3%	30	-11	19	23	-11	12	17	-12	5
Medium Office	2.1%	24	-24	0	19	-19	0	16	-16	0
Large Office	6.9%	22	-7	15	17	-7	10	15	-8	7
Strip Mall	6.7%	27	-27	0	24	-24	0	22	-22	0
School	2.8%	32	-32	0	27	-27	0	22	-22	0
Large Hotel	1.5%	47	-14	33	41	-13	28	41	-14	27
Grocery	1.8%	69	-69	0	68	-68	0	64	-64	0
Sit-down Restaurant	1.0%	150	-95	55	132	-93	39	114	-99	15
Hospital	1.9%	64	-16	48	61	-15	46	61	-17	44
Warehouse	6.6%	9	-9	0	7	-7	0	7	-7	0
College	1.7%	41	-40	1	36	-36	0	31	-31	0
Other Commercial	7.9%	32	-22	10	28	-20	8	25	-19	6

# Plug Load Energy Consumption Study: Evaluation of Available UEC estimates (residential)

*IOU 2013-14 study (SCE- Dan Hopper)*

## Phase I Objective:

- Develop better UECs and household saturation estimates
- Develop more accurate building models and energy usage intensity (**EUI**) **targets for ZNE buildings Method**

## Method

- Identify the most current and defensible estimates of UECs
- Explore using utility smart meter disaggregation for UEC estimation
- Conduct limited MEL metering and household surveying
  - to provide additional UEC and market saturation data

## Phase II Objective (budget permitting):

- Select group of plug loads for deeper study
  - estimation of UECs and AECs for baselines
- Focus on PLs with
  - UECs, operating hours, and quantities per household that differ significantly or for which little research has been done.
- Focus on measures already included as PLA program offerings or that may be “good candidate” measures for future EE programs.

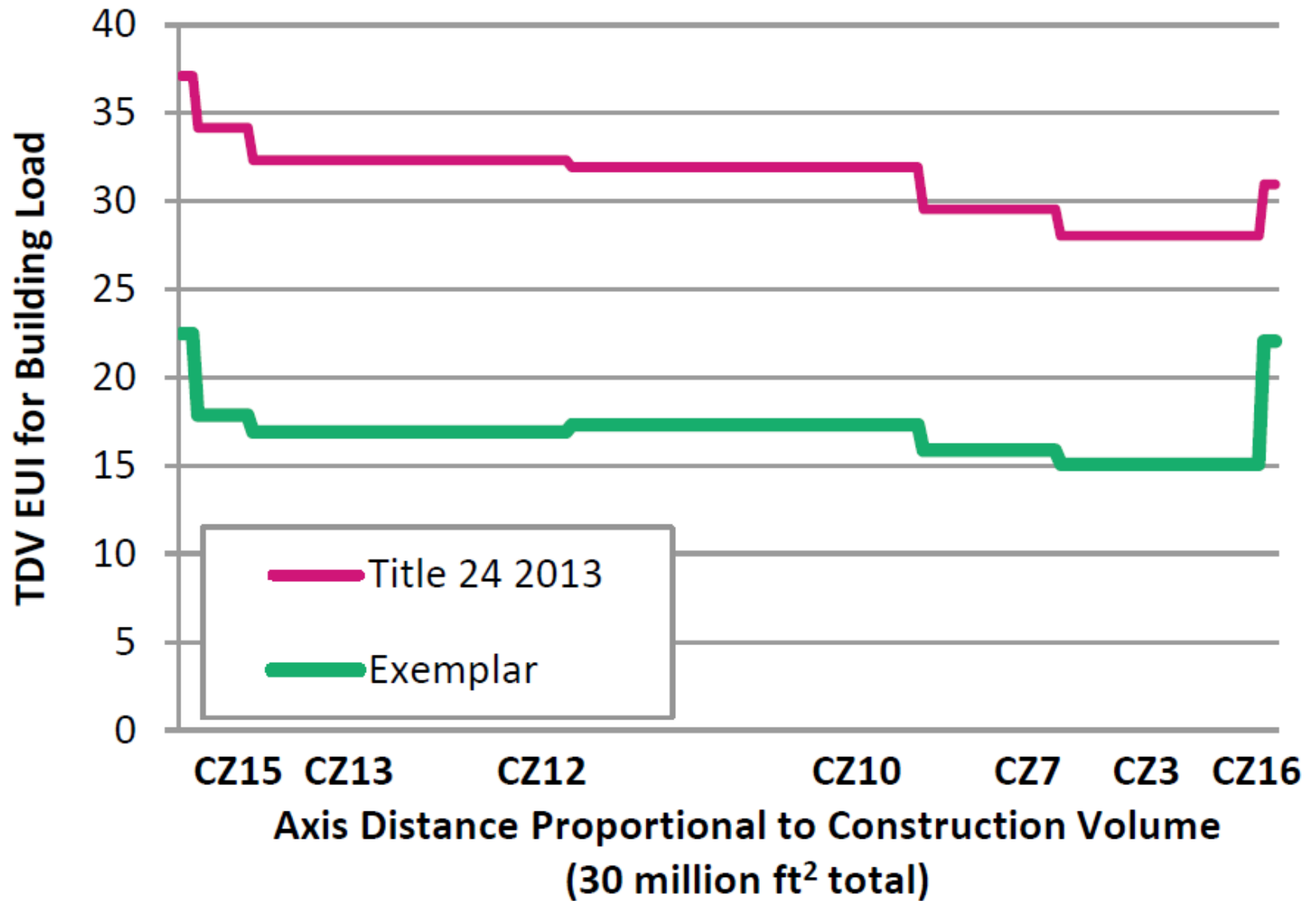
# Panel questions

- Coordinated manufacturer efforts would be helpful
  - Energy Division consultants working on Market Transformation policy framework paper to assist in crediting
  - Could include incentives or simply coordination
- Moving from EE to IDSM policy framework and programs?
  - PG&E “Whole Store” Retailer trial testing mid-stream incentives for a bundle of technologies
  - SDG&E testing HEMs engagement strategies → 5% reductions!
  - New integrated proceeding (IDSM) → challenging!
- Coordination- move to a Plug Loads Program Advisory Group
  - Could include IOUs, manufacturers, stakeholders, Energy Division, researchers
  - Envisioned as part of current *informal* “Rolling Portfolio Cycle” stakeholder discussions

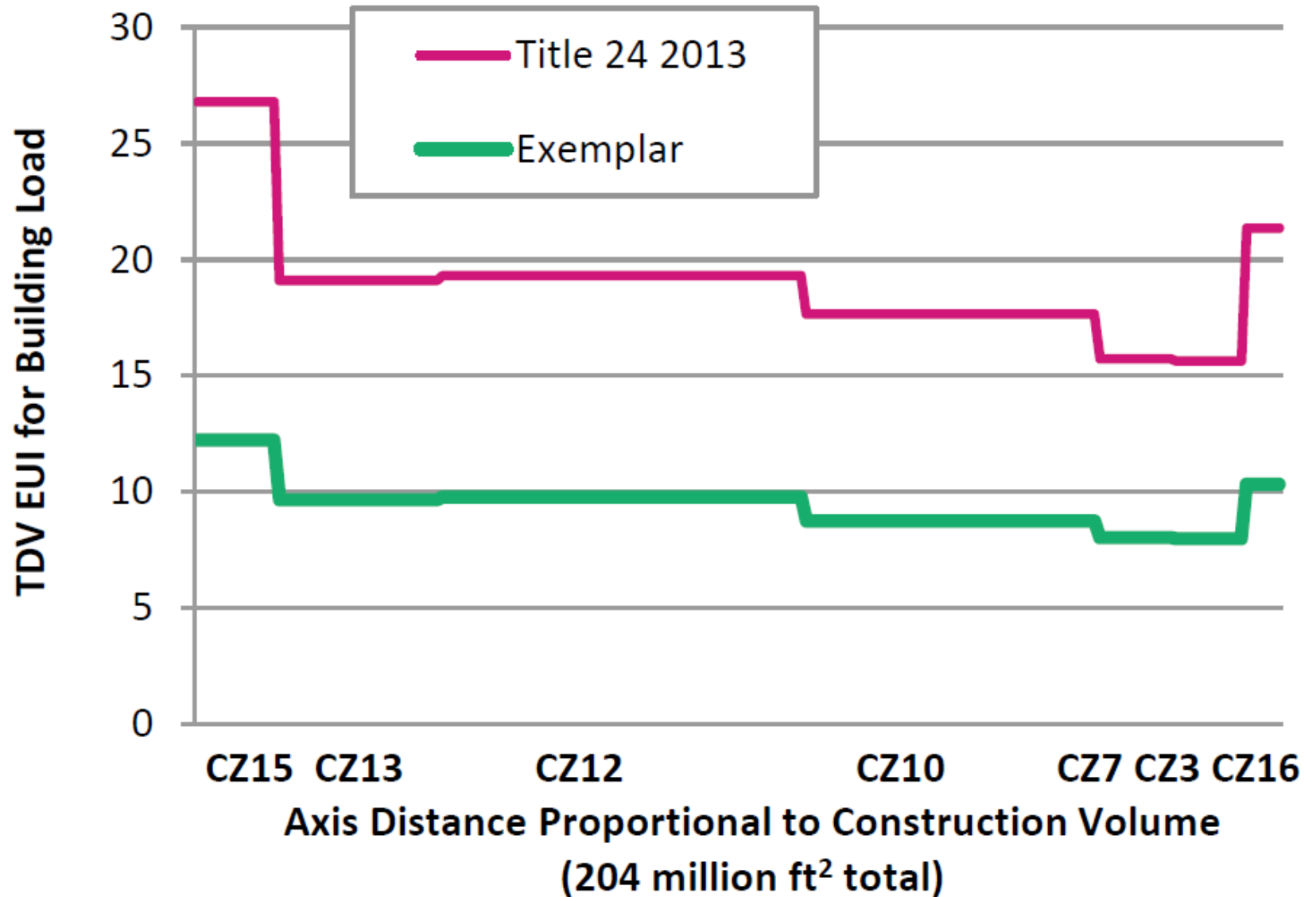


**ADDITIONAL SLIDES**

# Large Office EUIs Across Climate Zones



# Residential EUIs Across Climate Zones



# Climate Zone 12 – EUIs by Building Type (example)

