

PG&E, California and Zero Net Energy

**Getting to Zero National Forum
NASEO 2013 Annual Meeting**

**Denver, CO
September 17, 2013**



Fast Facts: Pacific Gas and Electric Company

- One of America's largest "Investor Owned Utilities" (IOUs)
- Serves about 15 million people in northern and central California; nearly 1 out of every 20 Americans
- Has about 20,000 employees
- Strong environmental commitment: 35+ years of customer energy efficiency programs: budgets for energy efficiency are currently in the \$400 million/yr range
- National leader in renewables and in customer PV installations, +/- 85,000
- Clean fuel mix: electricity generated by natural gas, nuclear, hydro-electric and renewable sources—the carbon footprint is about ½ of the national average.

ZNE: Context and Overview from a Utility

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ZNE means different things to different people: there are different definitions appropriate in different arenas

ZNE "claims" greatly exceed documented ZNE "performance"

For ZNE to succeed at scale, it is our view that it must be driven by the energy code (aka “Title 24”); code definitions are arcane, difficult concepts

Does ZNE make sense as a goal "unto itself"? Or as a policy tool?

California's "Loading Order" for Energy Supply

1. **Energy Efficiency**
2. **Demand Response**
3. **Renewables**
4. **Distributed Generation**
5. **Conventional (Fossil) Supply**

California's "Loading Order" for Energy Supply

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2. Demand Response
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4. Distributed Generation
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Applies to all aspects of energy policy in CA, governing utility demand side programs, generation procurement and building codes (. . . and so on)

PG&E ZNE Efforts--Pilot Program 2010-2012 (and continuing)

Consultations

Design Assistance

Performance Measurement (diagnose, correct, validate)

Analysis

Technical “Feasibility”

Major Policy Issues

Information, Outreach, Education

Competition (www.architectureatzero.com)

Classes, Publications

ZNE Will Soon be *Technically Feasible*

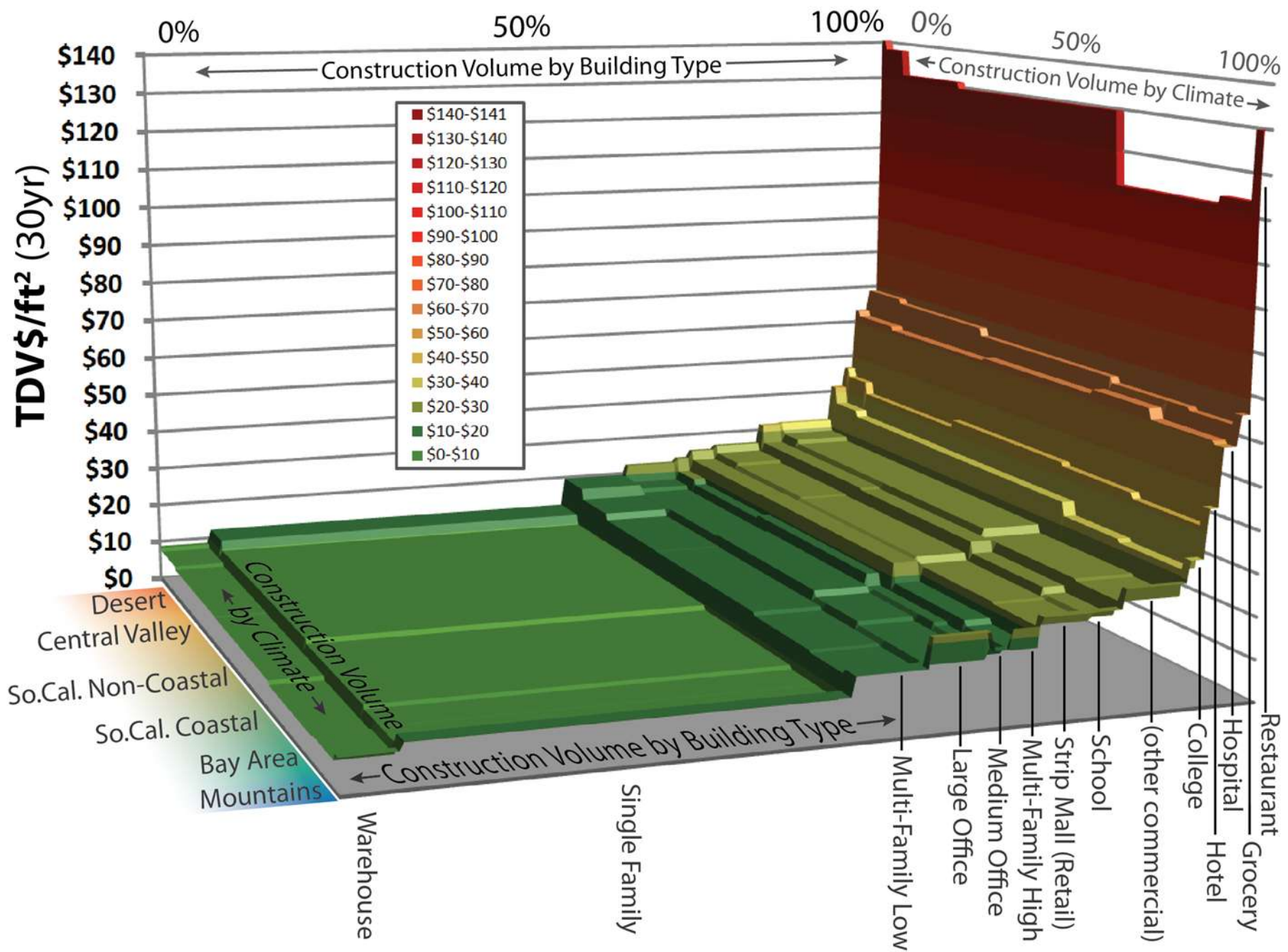
PG&E believes ZNE will be technically feasible for much of the new construction market by 2020

Under its ZNE Pilot Program in 2010-2012, PG&E commissioned and managed a study entitled “The Technical Feasibility of Zero Net Energy Buildings in California” (authored by Arup)

- Central finding: yes, ZNE will be technically feasible for much of the newly constructed market
- Although there are technical issues and performance improvements needed in building systems, the most important barriers appear to be non-technical
- http://www.energydataweb.com/cpucFiles/pdaDocs/904/California_ZNE_Technical_Feasibility_Report_Final.pdf

Companion study to the Technical Feasibility Study: “The Road to ZNE”

- <http://www.energydataweb.com/cpucFiles/pdaDocs/897/Road%20to%20ZNE%20FINAL%20Report.pdf>



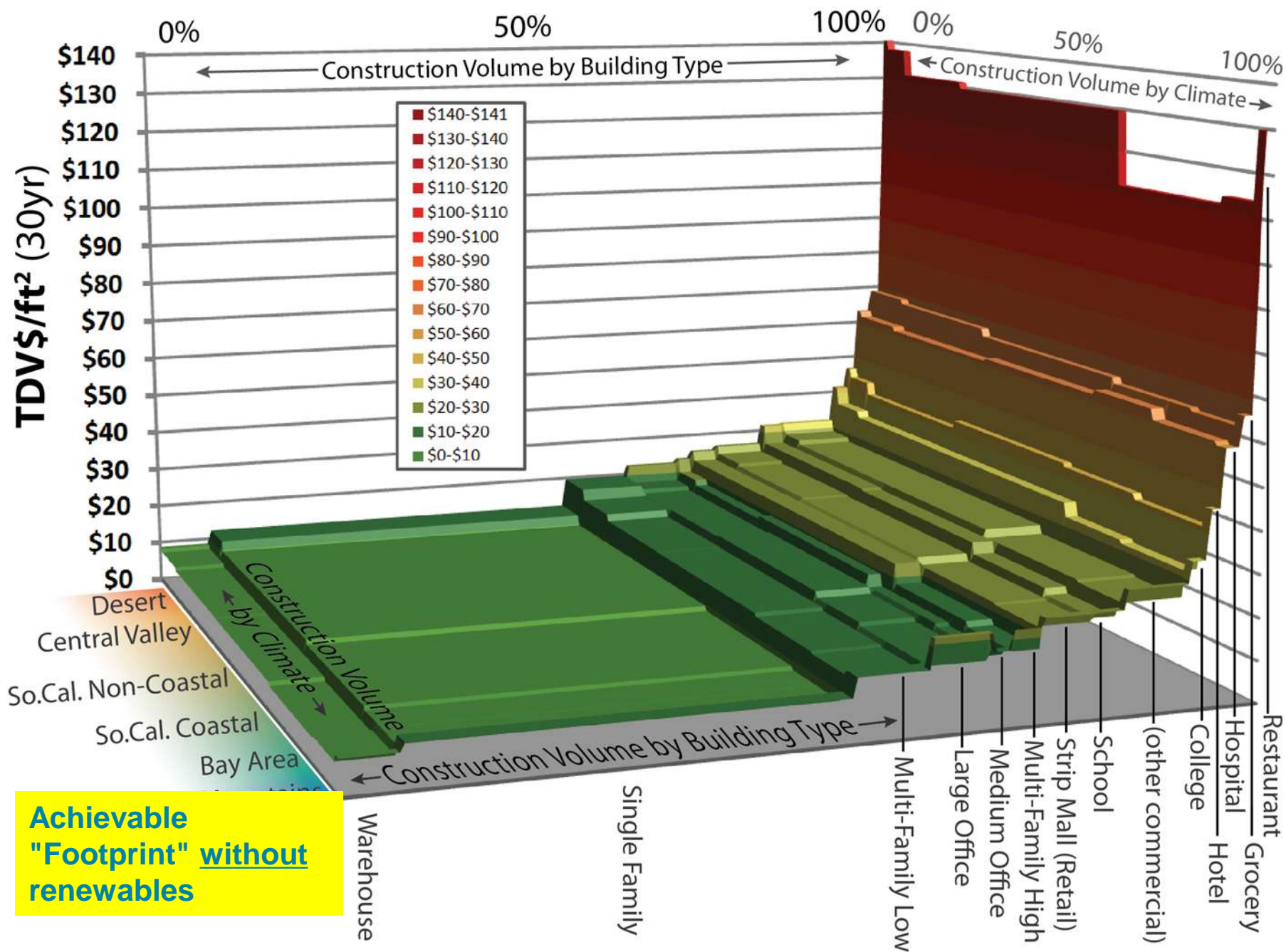
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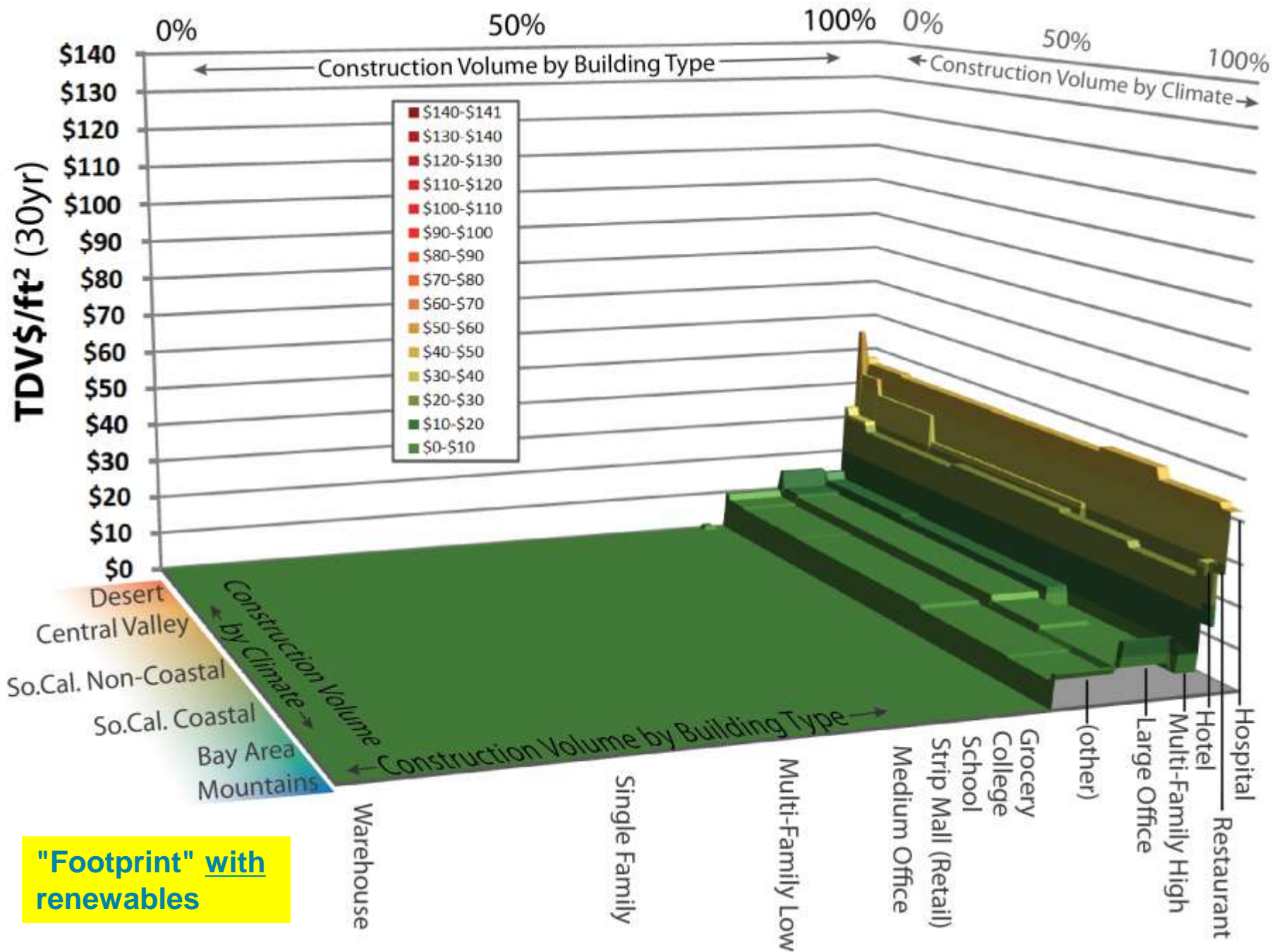
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Together with the other IOUs and other stakeholders, PG&E is deeply engaged with the CEC on a measure-based tactical plan to advance the building standards in support of the state’s ZNE goals



Achievable "Footprint" without renewables



"Footprint" with renewables

ZNE and ZNE “Capable” Definitions (Residential)

Zero Net Energy (ZNE)-Capable

- Per the "Loading Order," optimizes Energy Efficiency (EE) and Demand Response (DR) to minimize renewable requirement (however, does not include DG)
- Equates to design rating (HERS) of approximately 30-40

ZNE

- Includes photovoltaics to offset remaining loads after energy efficiency
- Based upon fair cost allocation, does not "zero out" the bill, so customers will continue to pay for electricity and gas usage and service
- Equates to HERS Rating of 0

Three Title 24 Code Steps Remain between Now and 2020

- 2013 update (effective January, 2014--finished, awaiting implementation)
- 2016 update (to be effective January, 2017)
- 2019 update (to be effective January, 2020)

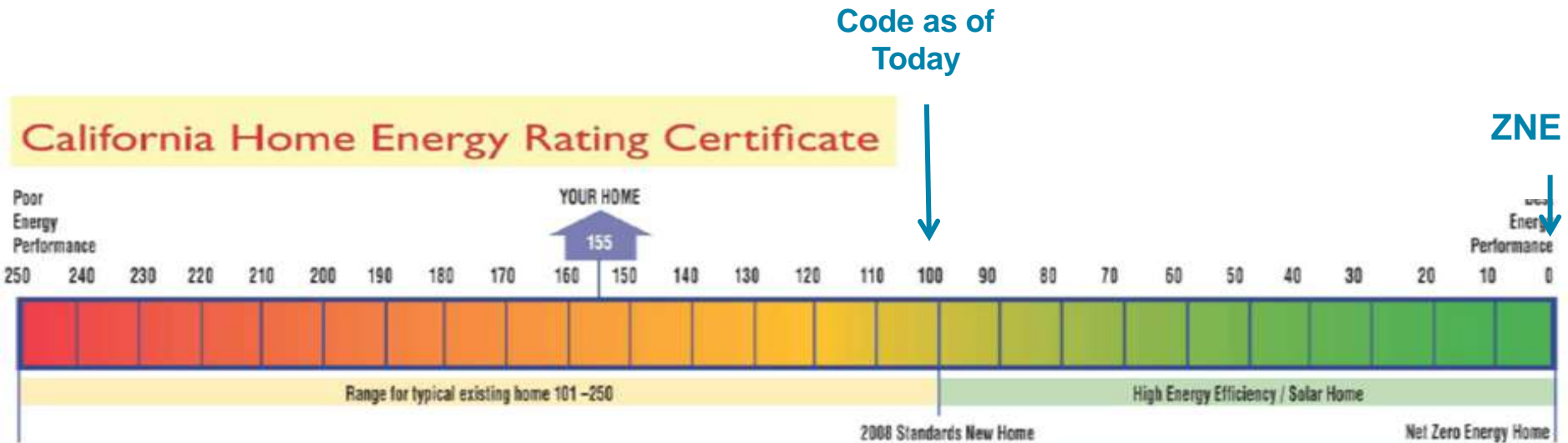
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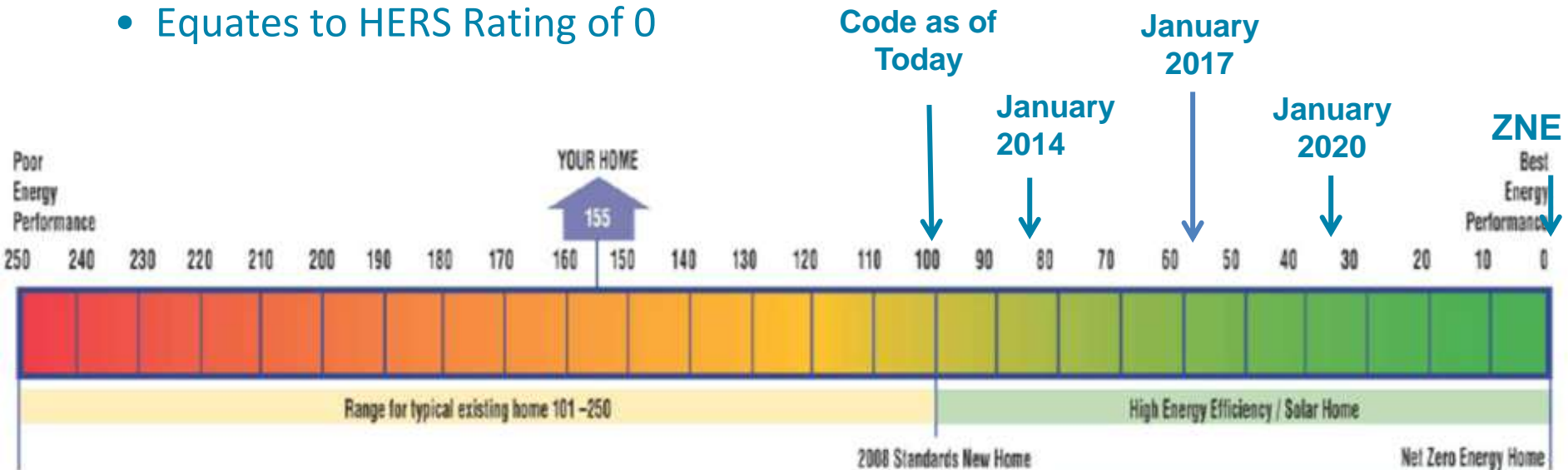
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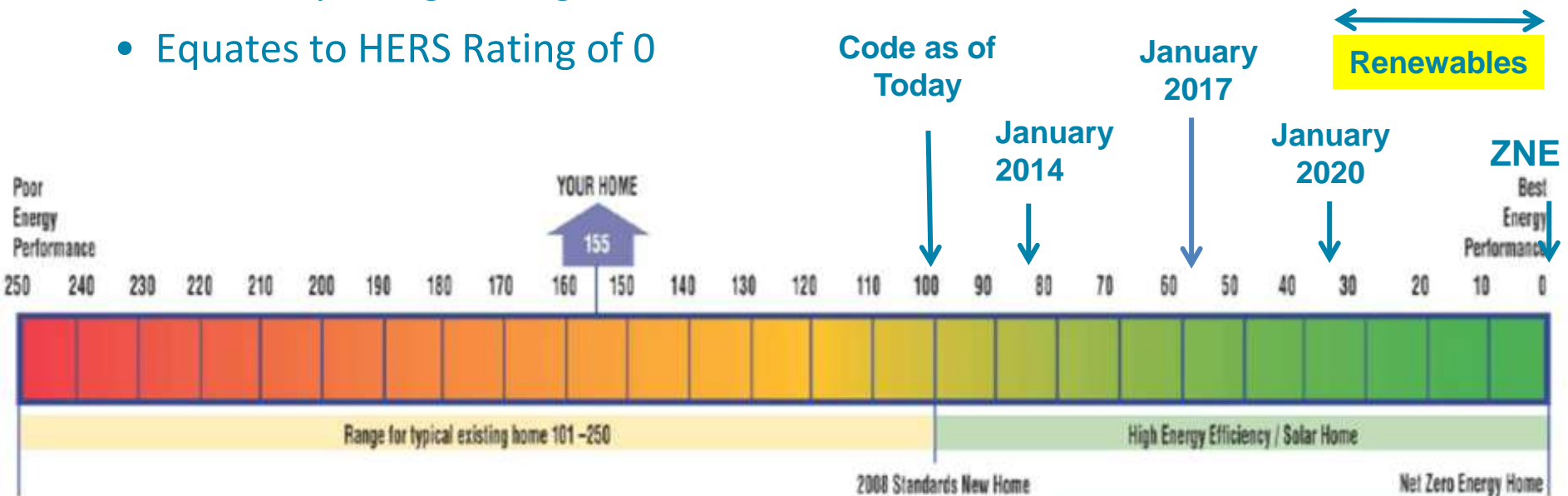
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2016 T-24: Potential Residential Case Measures

Top 4 measures:

- All high efficacy lighting (effectively, all LED)
- No Ducts in Unconditioned Space (NDUCS)
- Walls - R-21 + R5 in hot (all?) CZs
- QII - Quality Insulation Installation inspection

High Priority Mechanical

- High Performance Attics and Ducts (HPAD)
- Dual path PV with high efficiency HVAC and DHW
- FDD/CID refrigerant charge/condensables
- Evap cooling baseline hot/dry CZs
- Credit for evaporative FDD
- Combined hydronic water and space heating
-

High Priority DHW

- Shower/bath heat recovery above 1st floor
- Compact water distribution

High Priority Fenestration

- Windows 16% of floor area or high performance windows

High Priority Structural Changes

- Multi-family prescriptive package

Medium Priority

- Controlled supply mechanical ventilation
- Tested Infiltration < 3 ACH 50
- Heat recovery ventilation
- Plug load controller
- Smart Thermostat and Acc Test

Performance Simulation Tools

- Improved evaporative cooling model
- Heat pump water heating model
- Updated solar thermal model
- Thermal and humidity comfort

Location of Renewables . . . Not a Settled Issue in Code

A number of buildings will not have solar access (and will not otherwise have a feasible way of placing renewables on-site)

- Some residential locations
- High "energy density" buildings (restaurants, data centers)
- Most high-rise buildings

"Rooftop by Rooftop" renewables are unlikely to represent a "least cost" renewables solution in the case of large planned developments

- Cost to developer/builder/consumer (or taxpayer or utility ratepayer)
- Cost of grid impacts (integration, operation, maintenance)

Graphic from ED+C Magazine for a Colorado project

Typical Home 2,200 square feet



Cost = \$250,000

Down Payment (10%) = \$25,000
Mortgage Amount = \$225,000

Monthly Payment
\$1,074.18
\$154.00 energy bill

\$1,228.18 total cost/month



ZNE Home 2,200 square feet



Cost = \$280,000
Mortgage Incentive = \$8,000

Down Payment (10%) = \$27,200
Mortgage Amount = \$244,800

Monthly Payment
\$1,168.71
\$0.00 energy bill

\$1,168.71 total cost/month

"Prototype" vs. "At Scale" ZNE Implementation

"Prototypes"

- Essential to establish "proof of concept"
- Individual project "cost-effectiveness" (societal, individual) not necessarily the key issue *at the prototype/demonstration level*; not a "big deal" at low penetration rates
- PG&E and other utilities in CA actively pursuing such projects

Societal Objective: "At Scale"

- "At Scale" over time means "Everyone" ("All" buildings)
- Performance must be known and verified
- "Least cost" approach is essential; we cannot overspend
- Context: CA has +/- 150,000 housing starts per year (SF and MF)

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Utility Grid: Some Context on “Scale”

Over 140,000 “circuit miles” of distribution system (San Francisco to New York, round trip, 28 times)

About 1,000,000 distribution transformers

18,000 miles of transmission lines

20,000 employees (plus trucks, equipment, offices, etc.)

The addition of distributed renewables does not reduce the need for any of this; in fact, it may increase some infrastructure needs. The point is simply that while renewables definitely provide value, they also impose costs which need to be recovered to operate the grid

Typical Home

2,200 square feet



ZNE Home

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As a prototype = Great!

Utility business model = Fail!

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ZNE, “Zero Bill,” and the “Utility Business Model”

PG&E believes that AB 32 goals—around carbon reduction—require a robust power grid

PG&E believes that buildings with PV systems, including ZNE buildings, impose costs on the utility infrastructure

Under current rates, such costs are therefore borne by other customers in the residential class creating a “cost shift” to those customers which do not have PVs (or other renewables)

District-level renewables are likely to be less costly than individual rooftop systems in many cases--such systems would reduce "cost-shift" pressures and have other advantages

PG&E is concerned whenever there is messaging that associates ZNE with “zero energy bill;” PG&E believes “zero bill” for grid use and access for all newly constructed buildings to be unrealistic and impractical for any utility, public or private

Resolution of these issues will be important for ZNE to succeed “at scale”



THANK YOU!

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