



Building Energy Efficiency Standards

Proposed 2019 Building Energy Efficiency Standards ZNE Strategy

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Countdown to 2020

September 12, 2017

Content

1. Proposed ZNE Strategy – What is it and how we arrived there; explaining EDR
2. CBECC-Res Software Tools for ZNE

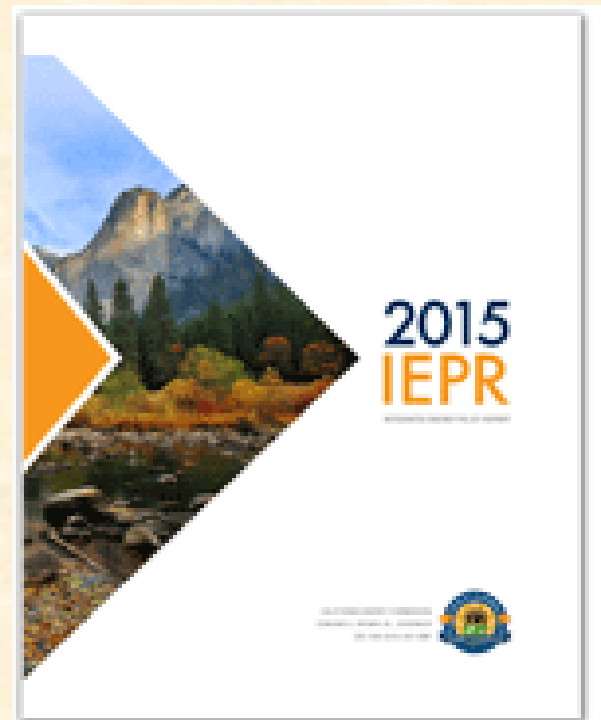
ZNE Strategy: the 2015 IPER Vision



A decade ago when the ZNE goal was first set it was a simple idea: All newly constructed residential buildings by the year 2020 must be ZNE as defined by the IEPR:

“...the value of the **net amount of energy produced by on-site renewable energy resources is equal to the value of the energy consumed annually by the building**, at the level of a single “project” using the California Energy Commission’s **Time Dependent Valuation** metric.”

Improving building energy efficiency and deploying PVs were identified as the primary tools to achieve the ZNE goals



ZNE Goals – Lessons Learned



Reality turns out to be more nuanced – in the intervening years, new developments have had a significant impact on the ZNE approach, including:

- **50% RPS and large scale PV deployment on the grid**
- **large scale utility deployment of PVs and to a lesser extent building-based PVs lower the value of additional electricity around midday**
- **Net energy metering (NEM) and Time-Of-Use (TOU) on compensation for residential customer-owned generation and cost effectiveness of PVs**



ZNE Goals – Lessons Learned - Continued

- The current NEM rules treat the grid as “**virtual storage**” (or a bank), where the overgenerated kWhs can be “stored” and used later in the day, or another season
- In reality, the **grid as it is now has very little capability** to store and effectively use overgenerated kWhs from PVs
- **Electrification of homes**, which results in a larger PV array, must be coupled with **grid harmonization strategies** to realize the expected environmental and home owner benefits
- Currently, customer-owned storage at about \$500/kWh is still too expensive to be cost for the 2019 Standards, but this rapidly changing and can cost effective in a future cycle of Standards

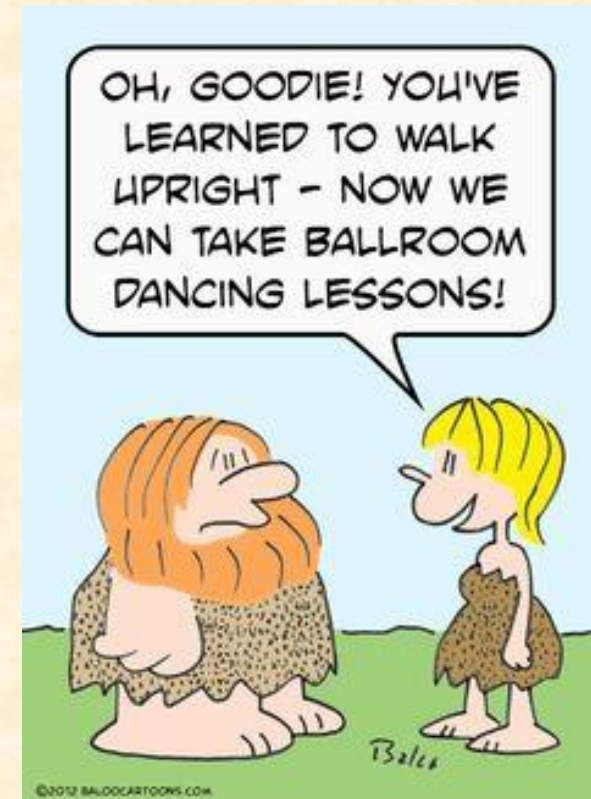
Although ZNE is the goal for 2020, the 2019 Standards must operate within the confines of NEM and life cycle costing, which are the overriding factors for PV requirements



Lessons Learned – Grid Harmonization

Grid harmonization strategies (GHS) must be coupled with customer owned PV systems to bring maximum benefits to the grid, environment, and the home owner

GHSs are strategies that maximize self-utilization of the PV array output and minimize exports back to the grid; examples of GHS include but are not limited to battery storage, demand response, thermal storage, and for some homeowners, EV grid integration.



2019 Standards Goals – Path to the Future



1. Increase building energy efficiency cost effectively
2. For Part 6, make **progress toward the ZNE** goal as possible within the **confines of NEM and life cycle costing rules**, while recognizing that Part 6 is an important but not the only tool for achieving ZNE
3. Contribute to the State's GHG reduction goals
4. **Promote self-utilization of the PV generation** by encouraging or requiring **demand flexibility and grid harmonization strategies**
5. Provide **independent compliance path** for both mixed-fuel and all electric homes
6. Achieve the above goals while ensuring real benefits for the building occupants with **positive benefit to cost ratios** for all efficiency and generation measures
7. Provide the tools for local governments to adopt **ordinances to achieve ZNE through Part 11 Reach Codes**, and other beyond code practices

The proposed 2019 Standards strategy will accomplish all seven goals listed above



Standards Goals – Beyond the 2019 Cycle



1. Extend the same seven goals from the previous slide to high-rise multifamily and nonresidential buildings
2. Improve integration of demand flexibility and grid harmonization strategies – consider making some measures prescriptive as technologies improve and cost effectiveness allows
3. Consider EV grid integration into the Standards - EV grid integration in nonresidential buildings offers huge potential for GHG reduction and self-utilization of PV generation

Prototypes were developed for the following building types:

- | | |
|---------------------------------------|------------------------------|
| 1. Small Office | 8. Small Restaurant |
| 2. Medium Office | 9. Hotel |
| 3. Large Office | 10. High Rise Apartment |
| 4. Stand-Alone Retail | 11. Warehouse |
| 5. Large Retail | 12. Small School |
| 6. Strip Mall | 13. Large School |
| 7. Ground Floor of Mixed Use Building | 14. Parking Garage |
| | 15. Laboratory (Educational) |

ZNE Goals – 2019 Standards Approach



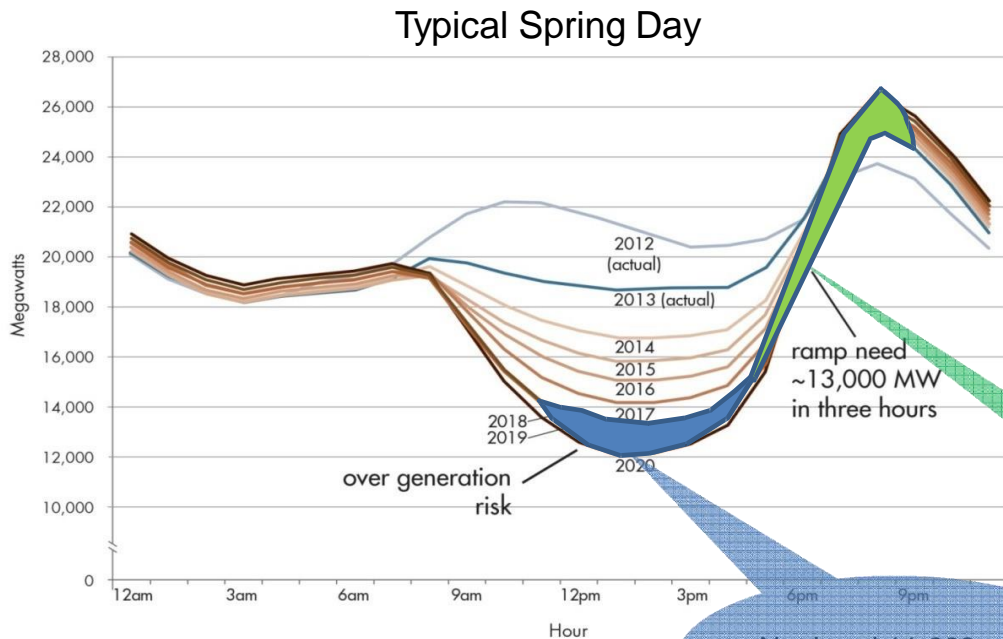
The 2019 Standards will recognize the following priority for efficiency and generation resources:

1. Envelope efficiency, 2. Appropriately sized PVs, and 3. Grid harmonization strategies that maximize self-utilization of the PV output and limit exports to the grid

Further, the standards must be framed in a way to **encourage competition, innovation, and flexibility** to foster new solutions as the grid and technologies evolve.



Oversupply and ramping: A new challenge as more renewables are integrated into the grid



Net Load 11,663
MW on May 15,
2016

Actual 3-hour ramp
10,892 MW on
February 1, 2016

Solutions

- Target energy efficiency
- Increase storage and demand response
- Enable economic dispatch of renewables
- Decarbonize transportation fuels
- Retrofit existing power plants
- Align time-of-use rates with system conditions
- Diversify resource portfolio
- Deepen regional coordination

PV Cost Effectiveness - Findings



All Standards measures , whether efficiency or renewables, must be cost effective in each CZ, using life cycle costing

Using the 2019 TDVs which captures the impact of NEM rules, the LCC finds:

Complying with NEM rules, appropriately sized PVs that displace annual kWhs are found to be cost effective in all climate zones, **even if the NEM2 rules are changed in the future to compensate hourly exported kWhs at avoided cost**



SAM Sec 1815:

Governor Brown's Executive Order B-18-12 requires the following actions to reduce the environmental impact of state facilities on climate change:

- All new State buildings and major renovations beginning design after 2025 shall be constructed as Zero Net Energy facilities.
- 50% of new facilities beginning design after 2020 shall be Zero Net Energy.
- State agencies shall also take measures toward achieving Zero Net Energy for 50% of the square footage of existing State-owned building area by 2025.

Definition of Zero Net Energy (ZNE)

Zero Net Energy means that a building or facility is energy efficient, meeting established energy efficiency targets (EUI), and consumes no more energy than it produces from clean, renewable resources over the course of a year using source energy definition. Renewable energy generation can occur onsite, and/or offsite

Source energy represents the total amount of raw fuel that is required to operate the building. It incorporates all fuel extraction, transmission, delivery, and production losses

ZNE for State Buildings - Strategies



1. **Energy Efficiency – Cost effective energy efficiency first to decrease the PV size needed for ZNE for both new and existing buildings**
2. **2015 historic state-owned buildings establish the EUI targets for different building types**
3. **Add renewables (primarily PVs) to offset annual energy use for buildings or multiple buildings (campus approach)**
4. **PVs can be on the roof, parking lot, adjacent land, and common areas**
5. **Community solar is acceptable as an alternative to onsite generation such as power purchase agreements (PPAs) and RECs, must extend to 20 years**

ZNE for State Buildings – Grid Harmonization



The state ZNE policy includes a number of grid harmonization strategies:

- **Share excess generation** – Whenever possible, excess generation should be utilized on-site through energy storage, with other buildings on campus, or through utility agreements with other buildings in portfolio.
- **Install energy storage** – Utilize on-site energy storage (batteries, thermal, etc.) to shift energy use for peak load reduction, limit over-generation sent back to the grid, reduce demand charges, reduce energy costs by taking advantage of time-of-use (TOU) rates, and provide cloud cover and outage protection for the facility.
- **PV array orientation** – To the extent possible, orient the PV arrays in way that maximizes alignment of the onsite generation with the onsite electrical load, to provide alignment with the needs of the utility grid.
- **Use over-generated energy for EVSE charging** – Electric vehicle service equipment (EVSE) can utilize excess energy generated to charge electric vehicles. This will help reduce or avoid export of over-generated electricity, and help agencies meet zero-emission vehicle charging infrastructure goals.

ARB Southern California Consolidation Project



Achieve highest level LEED “Platinum” certification



Meet Zero Net Energy (ZNE) building requirements;

Meet or exceed the CALGreen Code Tier 2 measures;

Provide sufficient fueling capacity for zero emission vehicles (ZEVs);

Provide good indoor air quality to protect occupant health, assure comfort, and maximize productivity; and

Be operated as a zero carbon building.

ARB Facility - ZNE Performance Goals



On-site renewable energy equals annual energy use

383,000 ft² Facility

Annual Energy Consumption
– 7,160 MWh

Source Energy ZNE

- EV Charging Stations
- Required 5-6 MW PV System
- Pursuing Green Power with RECs
- 1.5 MW battery storage system



ARB Facility - Next Steps and Milestones



Design Build Team	Date
Under Contract	Early 2018
Begin Construction	Spring 2018
Project Complete	Fall 2020
LEED Certification	Winter 2020
ZNE Verification	Fall 2021

Photo: LEED Platinum Laboratory
Sue and Bill Gross Stem Cell
Research Center
UC Irvine

For more information on the ARB facility :
<https://arb.ca.gov/html/socalfacility/socalfacility.htm>

Questions?

