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Building Energy Efficiency Standards

2019 Building Energy Efficiency Standards ZNE Strategy

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Countdown to 2020

April 20, 2017

2019 ZNE Strategy

Content

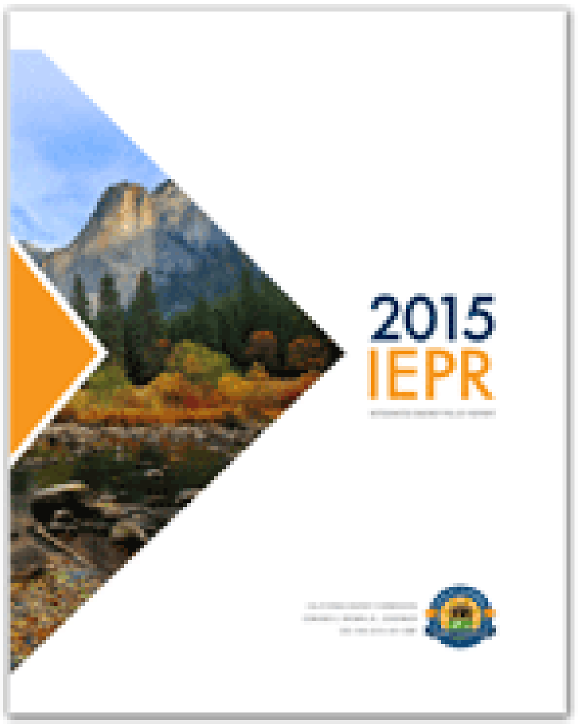
1. ZNE Strategy – What is it and how we arrived there; explaining EDR
2. Cost Effectiveness for Prescriptive PV Requirements and NEM rules
3. Strategies for Reach Codes
4. CBECC-Res Software Tools for ZNE

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 - Since ZNE policy was first set we have learned about the impact of

- **50% RPS and** large scale PV deployment on the grid
- large scale deployment of **building-based PVs** which **lowers the value of additional electricity around midday**, coincident with utility solar production
- Net energy metering (**NEM)** and Time-Of-Use (**TOU**) on **compensation for residential customer-owned generation and cost effectiveness of PVs**

Also, we have learned that as the **electric grid becomes greener** in the future, rooftop **PVs will have diminished carbon reduction benefits**

ZNE Goals – Lessons Learned - Continued

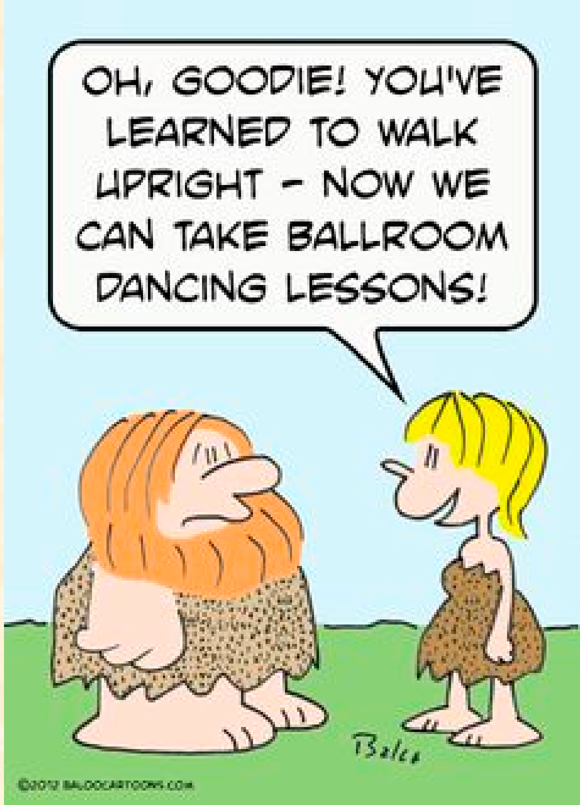
- The current NEM rules treat the grid as "**virtual storage**" (or a bank), where the overgenerated kWhs can be "stored" and retrieved later in the day, or even as if summer kWhs could be stored until winter
- In reality, the **grid as it is now has very little capability** to store and effectively use overgenerated kWhs from PVs
- **Electrification of homes,** which results in a larger PV array**,** must be coupled with **grid harmonization strategies** to avoid aggravating the duck curve issues and to realize the expected environmental benefits
- Currently, customer-owned storage at about $450/kWh is still too expensive to be cost effective using the LCC for the 2019 Standards, but this is a fast evolving technology which can become cost effective under a future cycle of the Standards

ZNE Goals – Lessons Learned - Continued

The most important lesson is that **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 minimizes uneconomic exports to the grid, examples of GHS include but not limited to battery storage, demand response, thermal storage, and EV integration.

the 2019 Standards approach must consider these issues



ZNE Goals – 2019 Standards Goals

The 2019 Standards should be structured to **send the right signal to the market** to pave the way for achieving full ZNE in a later cycle of Standards by encouraging:

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.

A possible structure is proposed later in the presentation.

The ZNE Challenge: Grid Harmonization

The value of midday PV generated kWhs decrease as we approach the 50% Renewable Portfolio Standard (RPS) by 2030 and increasing customer-owned renewables; this necessitates developing GHS strategies that prevent the so called "Duck Curve" Issues – Curtailment is already happening in California

However, Hawaii and Australia that have already encountered these problems, are adopting grid integration/harmonization strategies to maximize self-utilizations and minimize exports to the grid

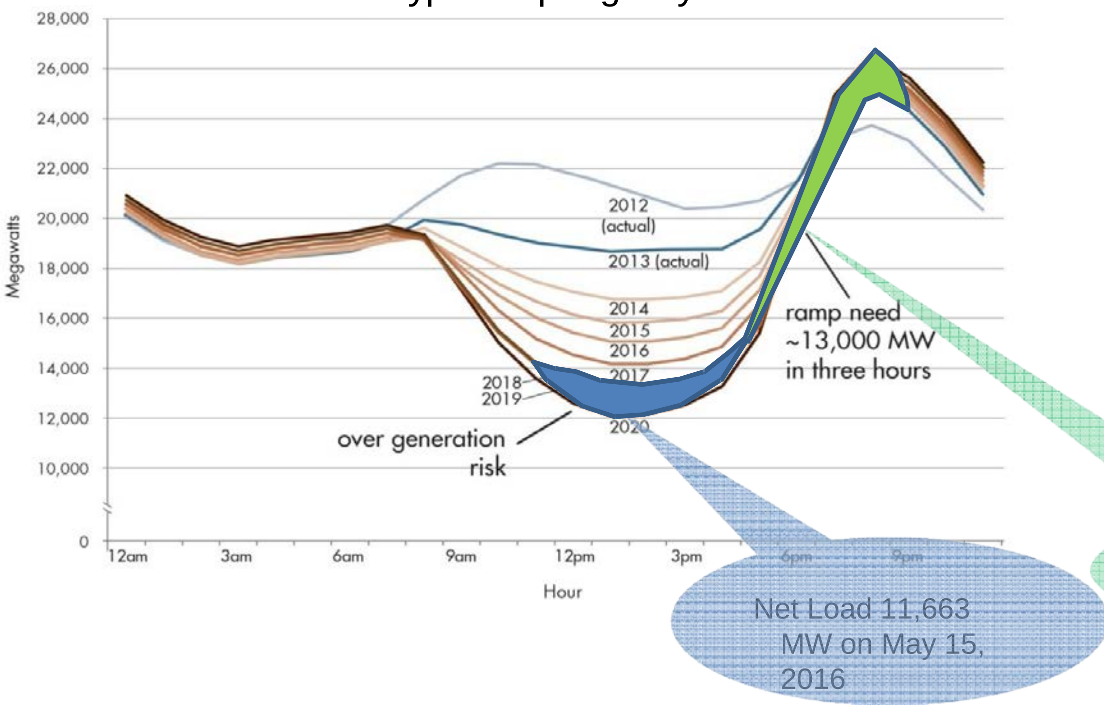
Recent News Article

April 10, 2017

http://www.utilitydive.com/news/california-solar-spike-leads-to-negative-caiso-real-time-prices-in-march/440114/

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

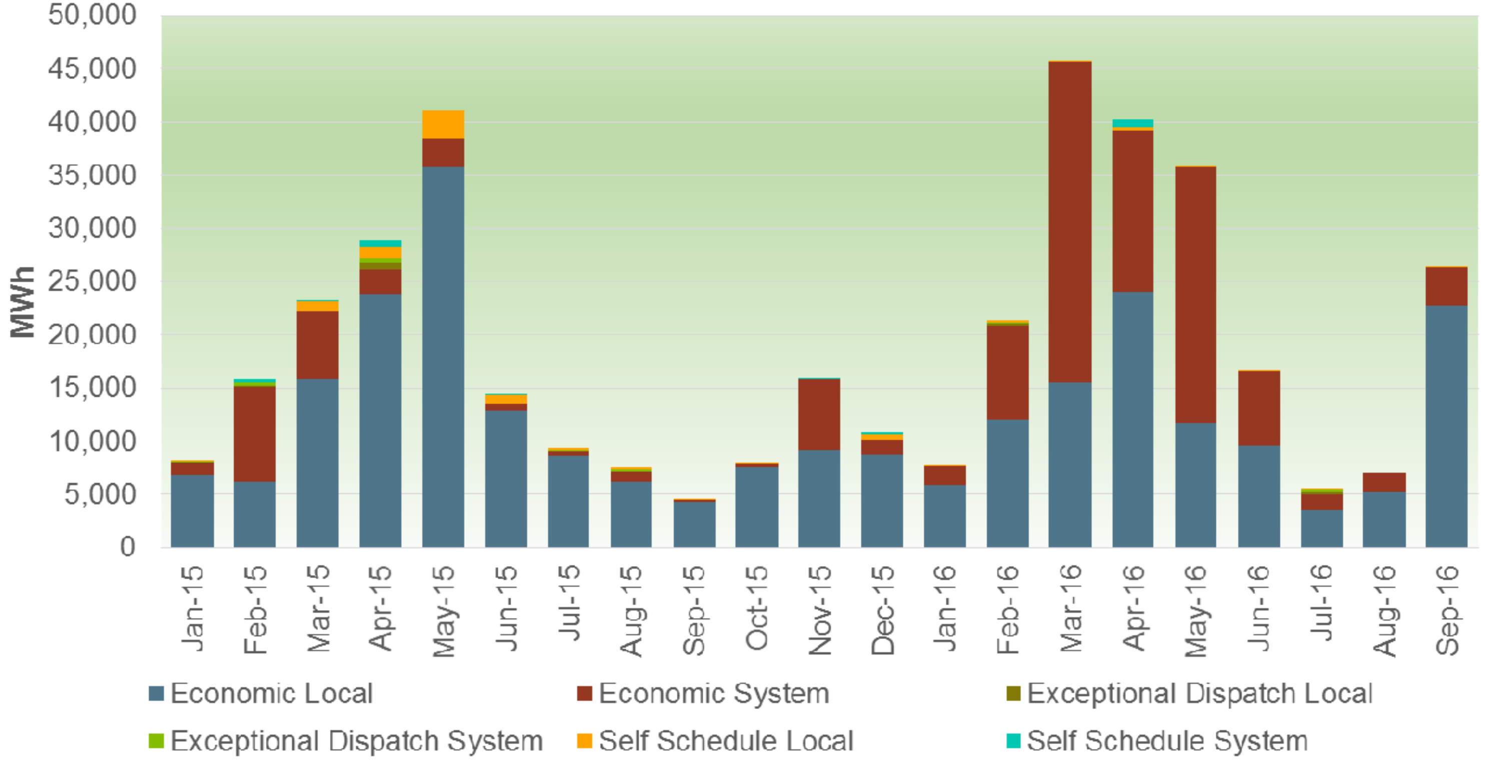
Typical Spring Day



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

Oversupply *is here already* and is increasingly managed using renewable resource's economic bids



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 50% RPS by 2030, the LCC finds:

Appropriately sized PVs that displace the site kWh are found to be cost effective in all climate zones, even if the NEM2 rules are changed to compensate hourly exported kWhs at avoided cost, and assuming no Federal ITC

Proposed Prescriptive 2019 Standards PV Size

Prescriptively, the PV size will be sized to displace the annual site kWhs of the home

The prescriptive PV size will be calculated as follows:

$PV_s = W_{sf} \times CFA \times A_{aj} \times CZ_{aj}$

Where

PV_s is the DC size of the PV system

W_{sf} is the PV size per square foot of the CFAfor a dwelling of 1200 sf or less

CFA is the conditioned floor area

A_{aj} is the area adjuster

CZ_{aj} is the climate zone adjuster

There will be look up tables for the area and CZ Adjusters

For performance compliance, we'll use the Energy Design Rating (EDR) Tool

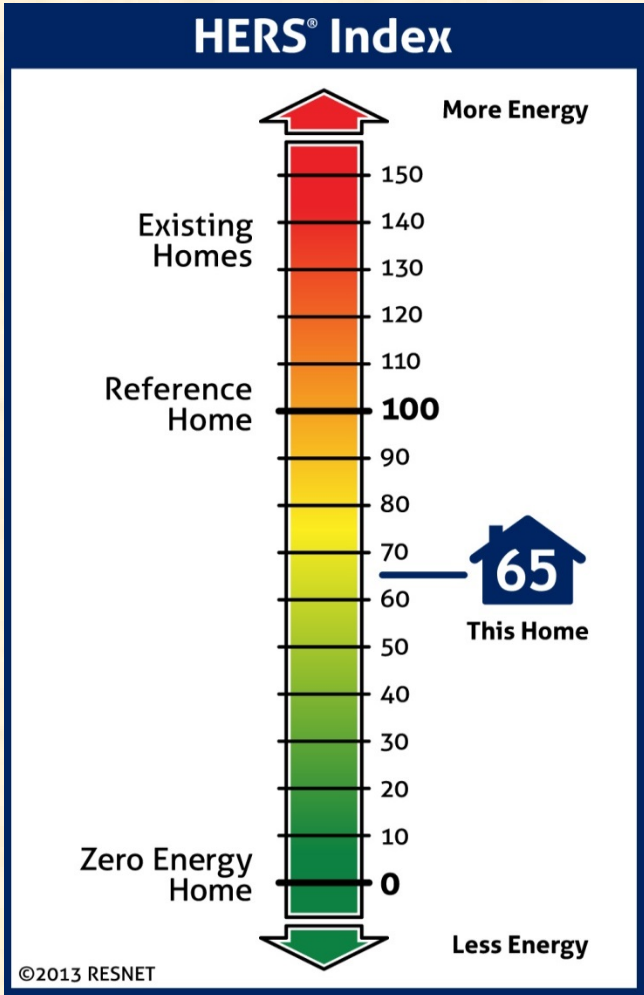
Builds on Commission's Energy Design Rating Tool

- **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



Proposed 2019 Standards Approach

Energy Design Rating (EDR) targets for each climate zone:

1. An EDR level for energy efficiency features based on 2019 prescriptive measures – This EDR target can only be met using energy efficiency measures
2. An EDR Contribution for PV array that is sized to displace the annual site kWhs (no more PV tradeoff)
3. Combine the energy efficiency EDR with the PV EDR for one final target EDR

Proposed 2019 Standards Approach

1. Maximize envelope efficiency as allowed by LCC and calculate EE EDR
   i. HPA to R19 in severe CZs – Currently R13
   ii. HPW to 0.043 ~ 0.046 U-factor in severe CZs – Currently 0.051
   iii. Windows U-factor of 0.30 and SHGC of 0.23 – Currently 0.32 and 0.25
   iv. QII as a prescriptive requirement
2. Establish an Energy Design Rating (EDR) for energy efficiency in each CZ **that can only be met with efficiency measures (no PV tradeoff against EE)**
3. Calculate EDR of PV array as follows:
   i. Calculate the PV size required to displace the site kWh in each CZ
   ii. Calculate the EDR contribution of the PV array
4. Combine the EDR contribution of EE to the EDR contribution of PV and **establish a Target EDR in each CZ that the building must meet to comply**

Note: Examples are presented in later slides

Target EDR's Many Advantages

1. A target EDR establishes a **performance benchmark that the building must meet to comply**; the concept is similar to **performance standards** consistent with the Warren-Alquist Act expectation to provide builders with compliance flexibility
2. As shown by the **2016 HPA and HPW approach, builders appreciated having many options** to comply, leading to a flurry of **innovation in attics and walls**, which continues to date
3. **Target EDR** can send the **right signals to the market about EE, PV sizing, storage, demand response and flexibility, and other grid harmonization strategies** that can achieve ZNE in the future
4. Target EDR allows the builder **to use more efficiency and less PV to get to the target**; the builder can also **use high performance glazing or appliances that are higher than minimum efficiency** levels that we are prevented to require because of preemption
5. Target EDR is fully **compatible with the reach codes**, local jurisdiction simply identify a lower target EDR (or zero) that can be met with a combination of additional EE, PV, demand response/flexibility, EV integration, or storage
6. Target EDR works well with **varying building sizes** – static PV size does not

Target EDR Advantages - Example

Here is an example of how CBECC-Res calculates the Target EDR for both EE and PV in CZ12 for the 2,700 sf house:

2016CZ12_2700ft2 - CZ12 STD2700 EGLASS20 2016PKG

Energy Use Details | Summary | Energy Design Rating

EDR of Proposed Design:	43.1	EDR of Proposed PV+Battery:	18.8	Final Proposed EDR:	**24.3**
EDR of Standard Design:	43.7	EDR of Minimum Required PV:	18.6	Final Std Design EDR:	25.1

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	607	504.9	46.84	207	241.5	21.66	25.18
Space Cooling	1,782		61.32	347		19.03	42.29
IAQ Ventilation	259		2.66	259		2.66	0.00
Other HVAC			0.00			0.00	0.00
Water Heating		176.3	13.03		121.9	9.01	4.02
Photovoltaics				-4,992		-43.79	43.79
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	9,846	754.6	208.52	0	408.5	56.65	151.87

Done

All-Electric Home Option

What should be the EE EDR and Target EDR for All-Electric Homes (AEH)? Staff proposes the same EDRs used for mixed fuel homes be used for the AEH:

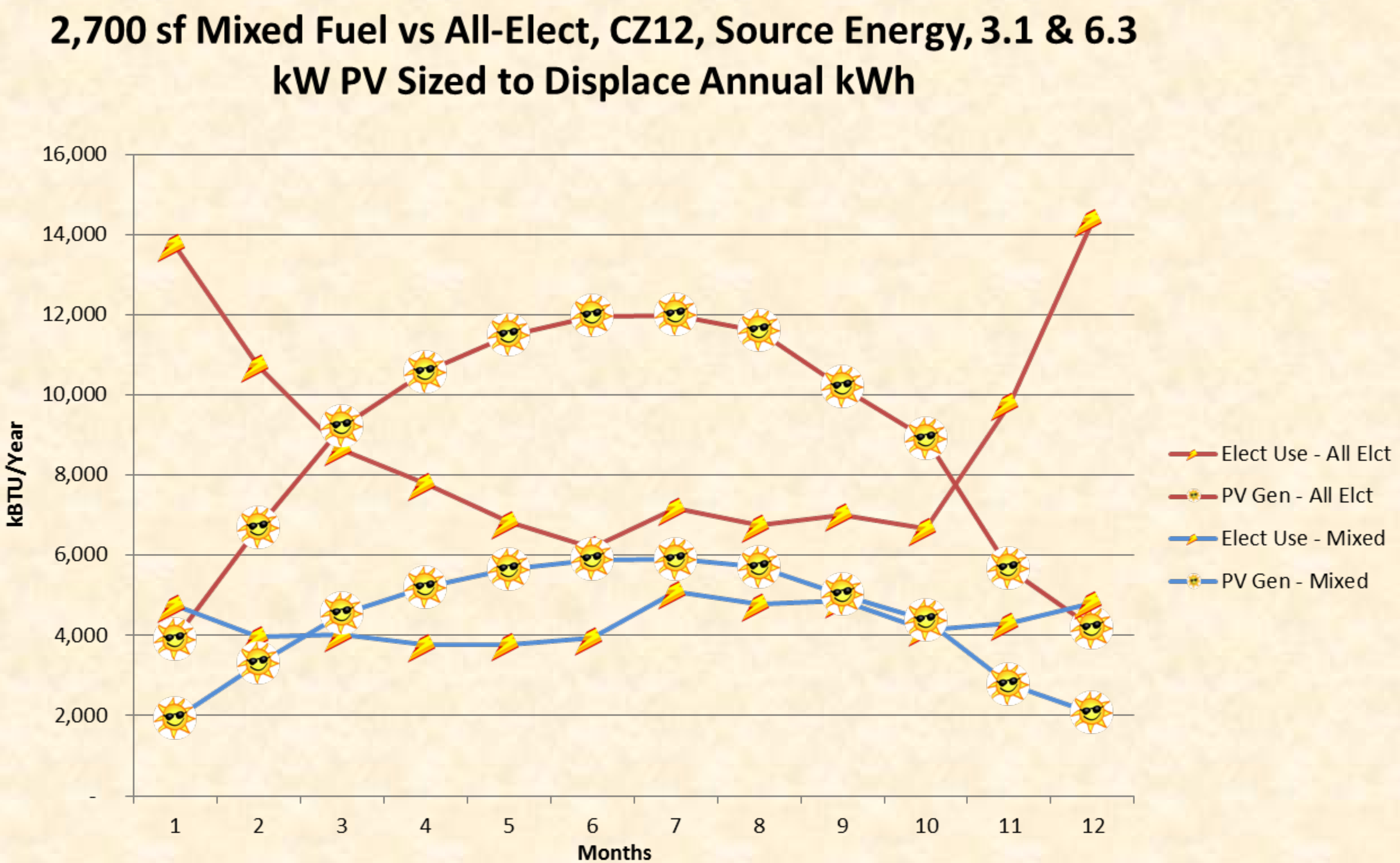
1. Requiring a much larger PV system on AEH to displace the larger annual kWh will disincentivize the AEH approach
2. The larger PV needed to displace the AEH kWh, without grid harmonization strategies, will aggravate duck curve issues

Large number of AEHs, due to higher winter kWh usage than summer, can cause a winter peak that may be as large or larger than the summer peak with limited solar resources in the winter to help.

	All-Electric Challenge	
CZ	Summer Cooling kWh	Winter Heating kWh
1	0	4,686
2	30	2,367
3	3	932
4	52	2,128
5	-	2,339
6	37	909
7	9	139
8	302	307
9	632	845
10	839	1,020
11	1,577	2,179
12	543	2,208
13	1,757	1,868
14	1,578	2,266
15	5,282	119
16	105	5,596
Total	12,746	29,908

All-Electric - Summer Duck vs Christmas Turkey

All-Electric homes use more kWhs in the winter than summer that may result in higher peak and demand in winter – Grid harmonization becomes more important – Like a broken clock, a dumb PV systems is correct twice a YEAR



Target EDR Examples by Climate Zone

Here is are examples of how Target EDRs might look for different scenarios in different CZs for the 2,700 sf Mixed Fuel Homes:

Note: At this time these numbers are examples only and may change as our tools evolve

NEM = Net Energy Metering; GH = Grid Harmonization

1	2	3	4	5	6	7	8	9	10	11
CZ	Efficiency EDR without PV, based on 2019 Efficiency Measures	Target Design Rating Score for Displacing kWh Elect with PV from Col 4	kW PV Size for Displacing kWh Electric Only – Cool with NEM, not so Cool with GH	Standalone PV Sized to Zero EDR (Dumb PV) – Violates NEM, Not Cool with GH	PV Size for Zero EDR with Basic Battery Controls – May Violate NEM, OK with GH	PV Size for Zero EDR with Optimum Battery Controls – Cool with NEM and GH	Similar to Col 7 But With 95 Furn, 0.95 WH – Real Cool with NEM and GH	Col 6 to 4 Ratio	Col 7 to 4 Ratio	Col 8 to 4 Ratio
1	48.0	26.5	3.4	7.7	6.9	4.6	4.1	2.0	1.4	1.2
2	41.2	18.0	2.9	6.1	5.5	3.1	2.8	1.9	1.1	1.0
3	46.9	22.7	2.8	5.8	5.3	3.2	2.9	1.9	1.1	1.0
6	48.0	20.9	2.9	5.3	4.5	2.9	2.8	1.6	1.0	1.0
7	48.0	14.9	2.7	4.6	3.9	2.4	2.3	1.4	0.9	0.9
8	43.0	14.6	2.9	5.3	4.3	2.7	2.6	1.5	0.9	0.9
11	43.3	23.4	3.8	8.5	6.5	4.4	4.2	1.7	1.2	1.1
12	43.1	24.5	3.1	7.0	5.8	3.8	3.5	1.9	1.2	1.1
13	44.8	22.1	4.0	9.0	6.2	4.9	4.6	1.6	1.2	1.2
14	44.6	21.3	3.4	7.4	5.4	4.4	4.1	1.6	1.3	1.2
15	48.0	17.9	5.7	10.5	8.1	6.9	6.8	1.4	1.2	1.2
16	46.3	27.5	3.0	7.6	6.5	4.8	4.3	2.2	1.6	1.4

Target EDR Examples by Climate Zone

Here is are examples of how Target EDRs might look for different scenarios in different CZs for the 2,700 sf All-Electric Homes:

Note: At this time these numbers are examples only and may change as our tools evolve

NEM = Net Energy Metering; GH = Grid Harmonization

1	2	3	4	5	6	7	8	9	10	11
CZ	Target Design Rating Score for Displacing kWh Elect with PV Size from Col 3	kW PV Size for Displacing kWh Electric Only in Mixed Fuel Homes–Cool with NEM	Standalone PV Size Needed to Displace Annual kWh – Cool with NEM, not Cool with GH	Standalone PV Sized for Zero EDR (Dumb PV) – Violates NEM, Not Cool with GH	PV Sized for Zero EDR with Basic Battery Controls – May Violate NEM, OK for GH	PV Sized for Zero EDR with Optimum Battery Controls – Cool with NEM and GH	Similar to Col 7 But With 14 EER HP, 3.5 COP HPWH – Real Cool with NEM and GH	Col 6 to 4 Ratio	Col 7 to 4 Ratio	Col 8 to 4 Ratio
1	33.9	3.4	7.7	9.4	8.4	5.6	5.3	1.1	0.8	0.7
2	29.6	2.9	5.9	7.2	6.5	3.9	3.7	1.1	0.7	0.6
3	32.1	2.8	5.4	7.0	6.0	3.8	3.6	1.1	0.7	0.7
6	26.6	2.9	4.6	5.9	4.9	3.2	3.0	1.1	0.7	0.7
7	26.0	2.7	4.1	5.3	4.4	2.7	2.6	1.1	0.7	0.6
8	26.0	2.9	4.6	6.1	4.8	3.1	2.9	1.0	0.7	0.6
11	31.4	3.8	6.6	9.9	7.6	5.9	5.3	1.2	0.9	0.8
12	30.0	3.1	5.9	8.4	6.7	4.8	4.4	1.1	0.8	0.7
13	30.8	4.0	6.7	10.3	8.0	6.5	5.8	1.2	1.0	0.9
14	33.3	3.4	5.9	8.6	6.7	5.8	5.3	1.1	1.0	0.9
15	26.2	5.7	7.0	11.5	9.2	8.0	7.0	1.3	1.1	1.0
16	48.3	3.0	7.7	10.2	8.9	7.0	6.9	1.3	1.0	1.0

2 – Life Cycle Costing

Life Cycle Costing for Prescriptive PV Requirement

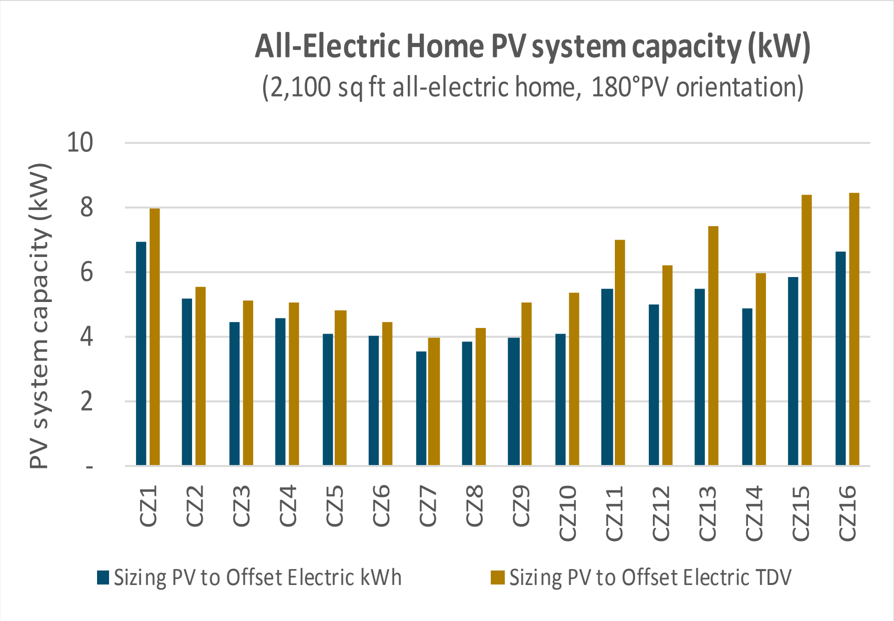
E3 Life Cycle Costing Analysis Finds:

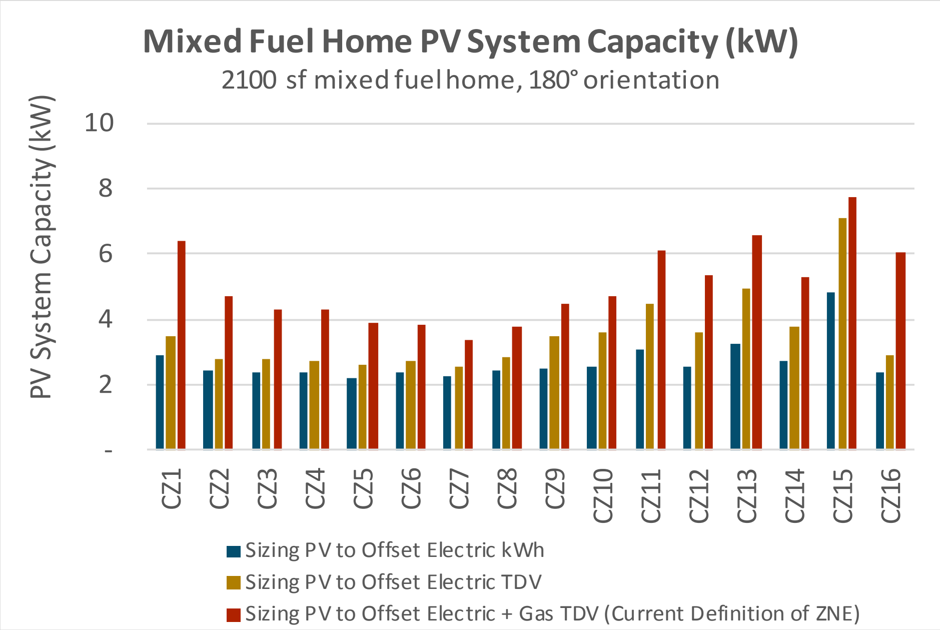
1. **PV systems sized to displace site annual kWh cost effective in all climate zones**
2. **Even if NEM2 rules are changed to compensate exported kWhs at avoided cost**
3. **With no federal ITC**

The followings are a partial representation of E3 analysis and findings (E3's greatest hits) – The full report will be available online

TDV ZNE requires a larger PV system than Site ZNE

- **Solar production occurs during low TDV hours, and households demand energy during high TDV hours**
  - PV must be sized larger to reach TDV ZNE vs. Site ZNE (which doesn't account for the changing value of kWh)
- **For a 2,100 ft² home with 180° PV orientation, TDV ZNE requires 7% - 44% larger PV capacity than Site ZNE (average: 21%)**
- **Because PV interconnection rules limit sizing to electric kWh, this presentation focuses on that size**



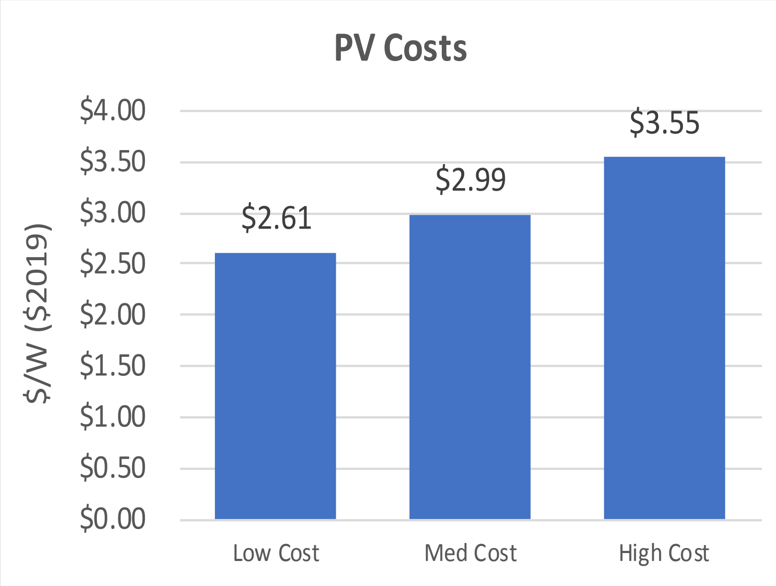


PV Costs

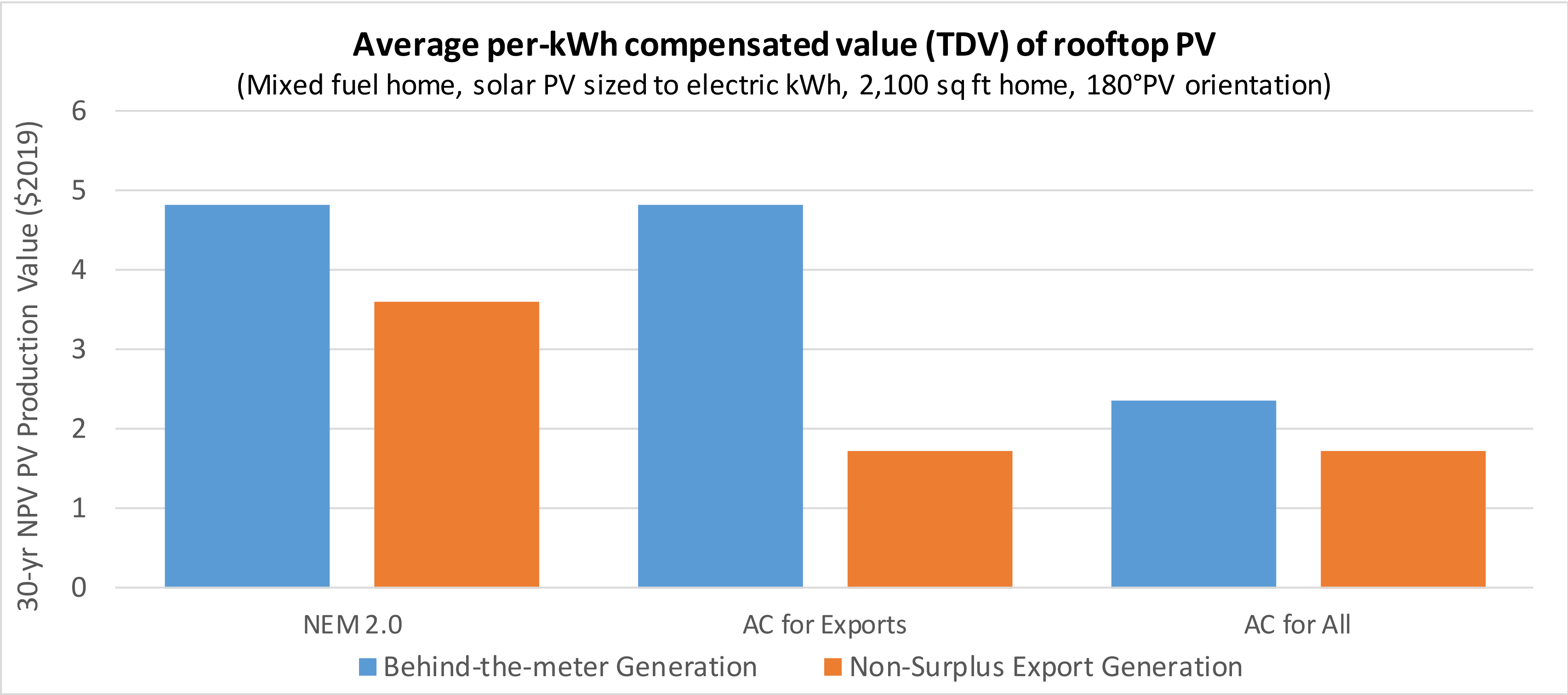
+ **No ITC Assumed -** The ITC is scheduled to step down throughout the 2020-2022 building standard cycle (26%, 22%, 20%) and then to 0% for residential systems beginning in 2023

+ All costs assume a 30-yr panel life and inverter replacements after 10 and 20 years (comprises ~$0.40/W in the costs)

+ Price based on NREL 2016 Installer Price
  - Low cost case:
    - 30% cost reduction 2016 – 2020 (GreenTech Media)
  - Medium cost case:
    - 18% cost reduction 2016 – 2020 (Bloomberg)
  - High cost case:
    - No cost reduction 2016 - 2020



Three solar compensation policies

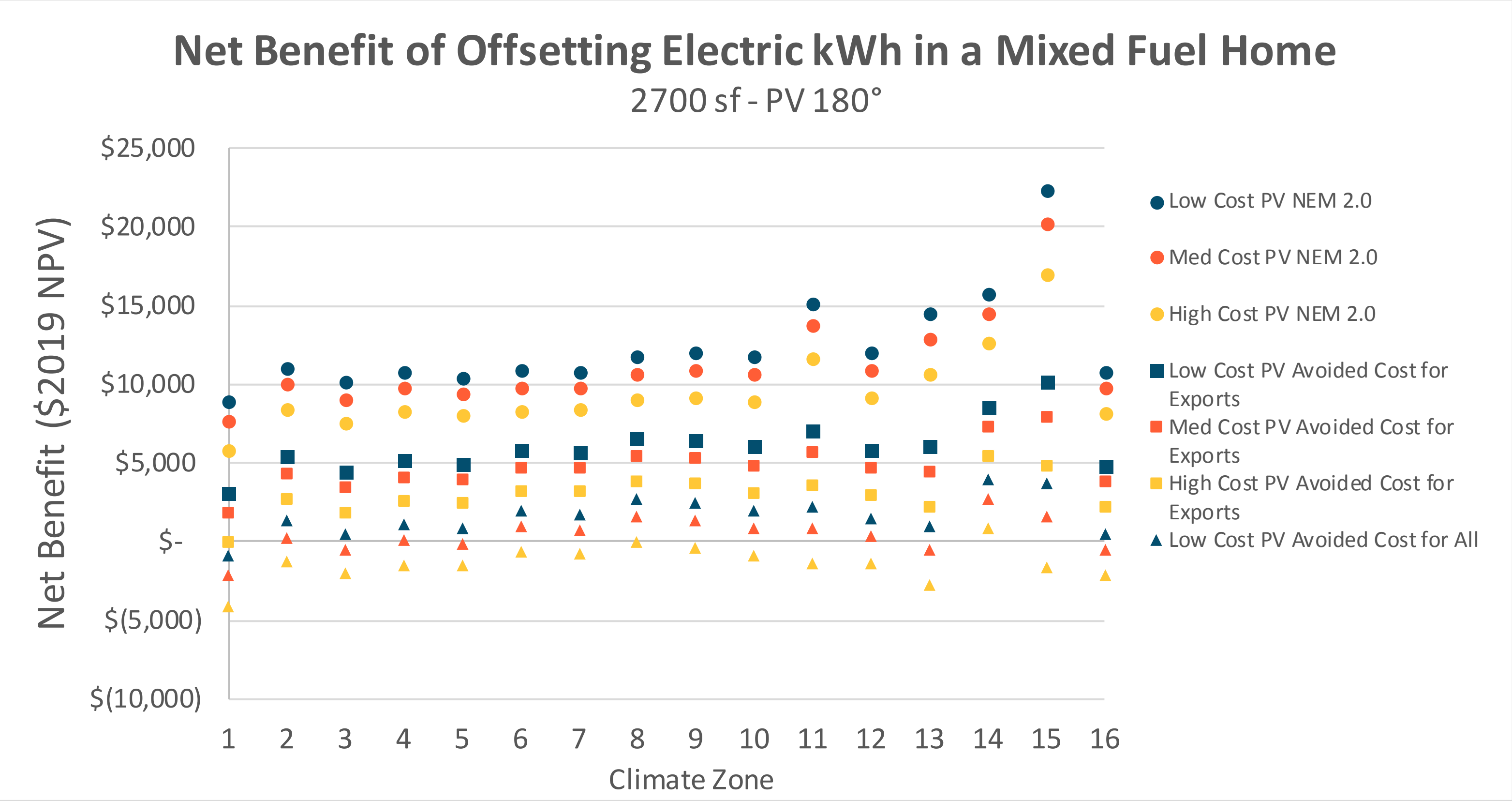


AC = Avoided Costs

Non-surplus Export Generation are the hourly exports

Cost-Effectiveness of Offsetting Elec kWh in a Mixed Fuel Home

+ **Offsetting electric kWh with solar PV is cost-effective except under the most aggressive NEM reform scenarios**



CZ	PV kW
1	2.89
2	2.46
3	2.38
4	2.36
5	2.22
6	2.38
7	2.26
8	2.46
9	2.51
10	2.58
11	3.10
12	2.58
13	3.28
14	2.73
15	4.83
16	2.37

Energy+Environmental Economics

3 - Strategies for Reach Codes

NEM Rules and Oversizing PV – DRAFT

March 2, 2017

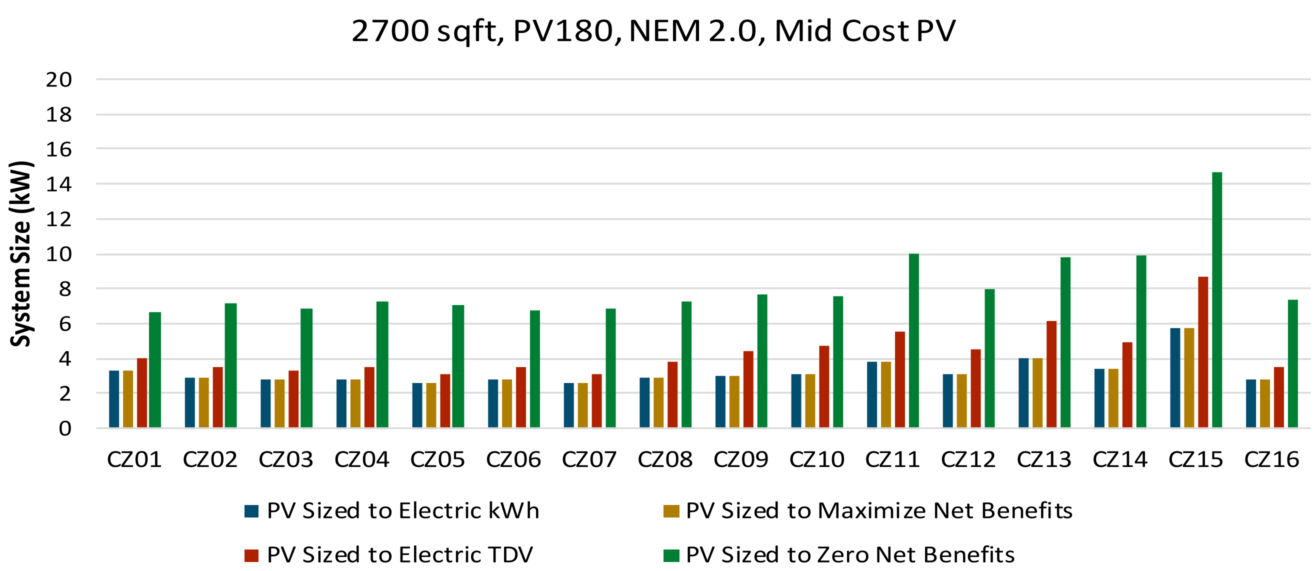
Snuller Price, Zachary Ming, Brian Conlon

PV Sizing Methods

+ **Electric kWh**
  - PV scaled such that annual generation = annual electric load
+ **Maximize Net Benefits**
  - PV scaled to maximize net TDV benefit to customer
    - Practically, this is the same capacity as sizing to kWh, i.e., further generation will only receive Net Surplus Compensation (NSC)
+ **Electric TDV**
  - PV scaled such that annual TDVs generated = annual TDV of electric load
+ **Zero Net Benefits (Breakeven Point)**
  - PV scaled to point at which a larger system will not be cost-effective
  - Cost of PV system = Revenue from PV generation

Sizing Comparison
NEM 2.0, Mid Cost PV

- **PV sized to max net benefits is smaller than sized to electric TDV**
  - Sizing to TDV does not reflect lower compensation for exports from NEM 2.0
- **At sizes beyond max net benefits, incremental kW only receive NSC**
  - Large net benefit and small marginal net cost (PV cost – NSC) at the point of maximum net benefits require much larger systems to zero out net benefits
  - NEM2 for self-use and exports, NSC for net surplus



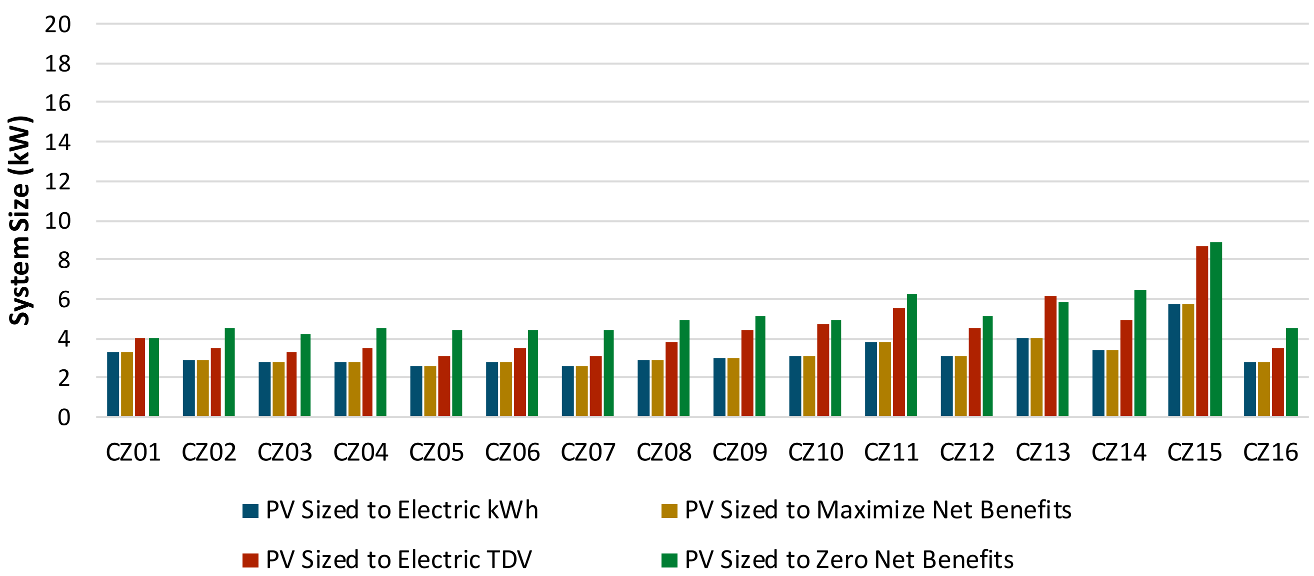
Ratio of PV Sized to Zero Net Benefits / PV Sized to Electric kWh

CZ1	1.98
CZ2	2.51
CZ3	2.49
CZ4	2.62
CZ5	2.76
CZ6	2.42
CZ7	2.61
CZ8	2.49
CZ9	2.55
CZ10	2.43
CZ11	2.65
CZ12	2.59
CZ13	2.43
CZ14	2.96
CZ15	2.55
CZ16	2.61

Sizing Comparison
AC for Exports, Mid Cost PV

- **Valuing export PV generation at avoided cost reduces cost-effectiveness of PV sized to offset kWh**
  - Smaller net benefits for systems sized to offset kWh means less kW at marginal net cost are needed to zero out net benefits
  - Retail for self-use, AC for exports, NSC for net surplus

2700 sqft, PV180, Avoided Cost for Exported Energy, Mid Cost PV

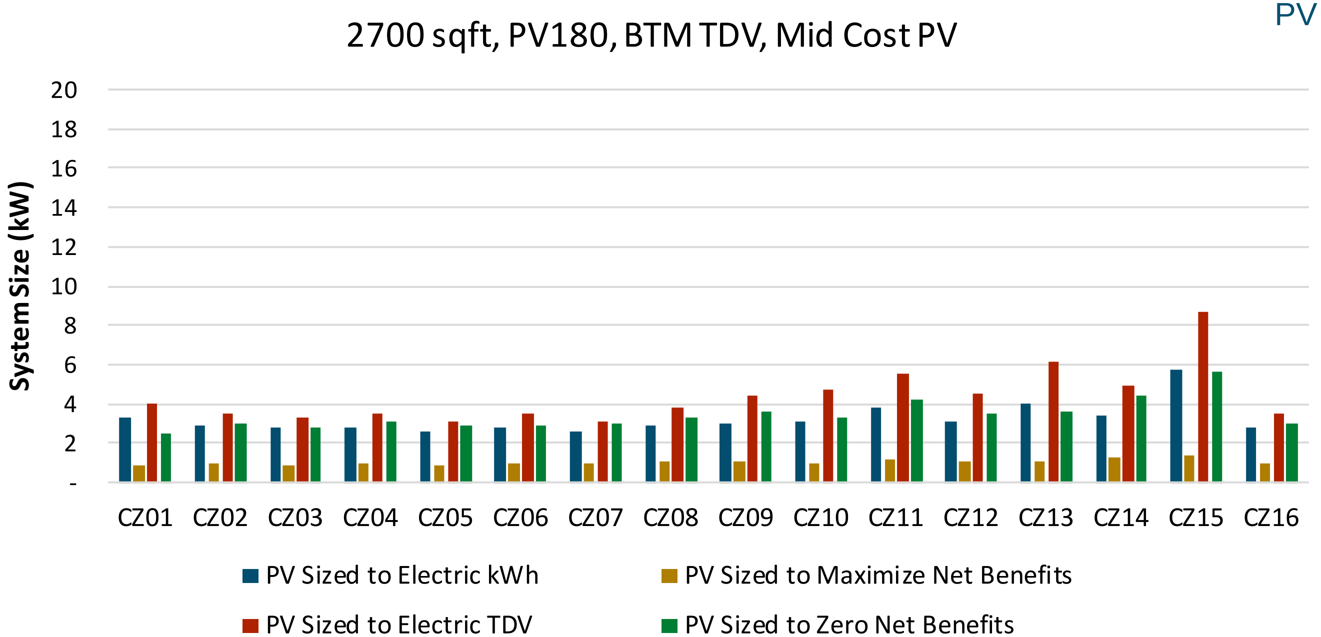


Ratio of PV Sized to Zero Net Benefits / PV Sized to Electric kWh

CZ01	1.21
CZ02	1.57
CZ03	1.52
CZ04	1.64
CZ05	1.71
CZ06	1.58
CZ07	1.67
CZ08	1.67
CZ09	1.69
CZ10	1.57
CZ11	1.65
CZ12	1.64
CZ13	1.45
CZ14	1.91
CZ15	1.55
CZ16	1.60

Sizing Comparison
BTM TDV, Mid Cost PV

- **BTM TDV means**
  - All PV production consumed behind-the-meter (BTM) receives full TDV value
  - All PV production exported to the grid as well as all net surplus above a system sized to annual kWh receives net surplus compensation (NSC)
- **PV sized to electric kWh and electric TDV are unchanged from previous rate structures**
- **PV sized to maximize net benefits and PV sized to zero net benefits are substantially reduced**
- Retail for self-use, NSC for exports and annual surplus



Ratio of PV Sized to Zero Net Benefits / PV Sized to Electric kWh

CZ1	0.74
CZ2	1.05
CZ3	1.01
CZ4	1.11
CZ5	1.14
CZ6	1.04
CZ7	1.12
CZ8	1.11
CZ9	1.18
CZ10	1.05
CZ11	1.11
CZ12	1.14
CZ13	0.89
CZ14	1.30
CZ15	0.98
CZ16	1.07

Storage Overview

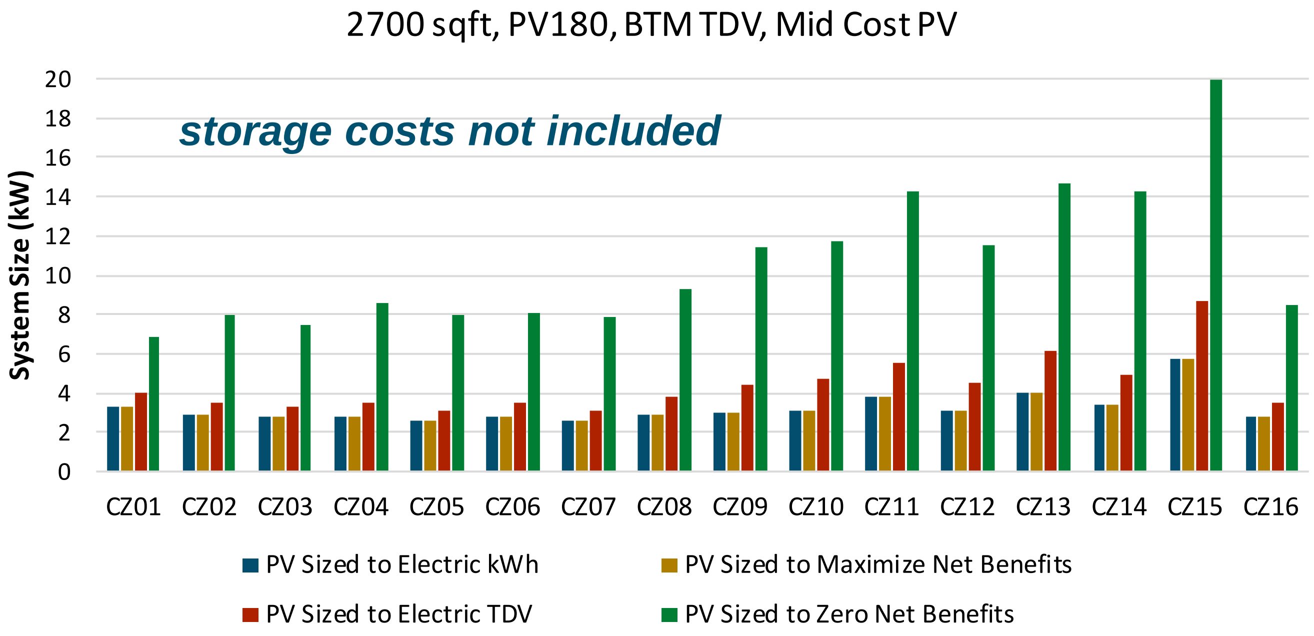
+ **E3 analyzed the additional value of a battery storage system to an existing PV system of a 2700 sf, mixed fuel home**

+ **BTM TDV rate scenario**
  - BTM generation receives full TDV value (~$0.20/kWh); exported generation receives net surplus compensation value (~$0.03/kWh)

+ **Battery assumptions**
  - 14 kWh
  - 5 kW
  - 90% round trip efficiency
  - $500/kWh fully installed

Sizing Comparison
BTM TDV With Storage, Mid Cost PV

- **Installing storage (without accounting for the storage costs) increases the benefits to the homeowner, allowing them to install more solar**
- The Santa option: Demonstrates how PV value increases if coupled with storage at no cost
- Retail for self-use, NSC for exports and annual surplus



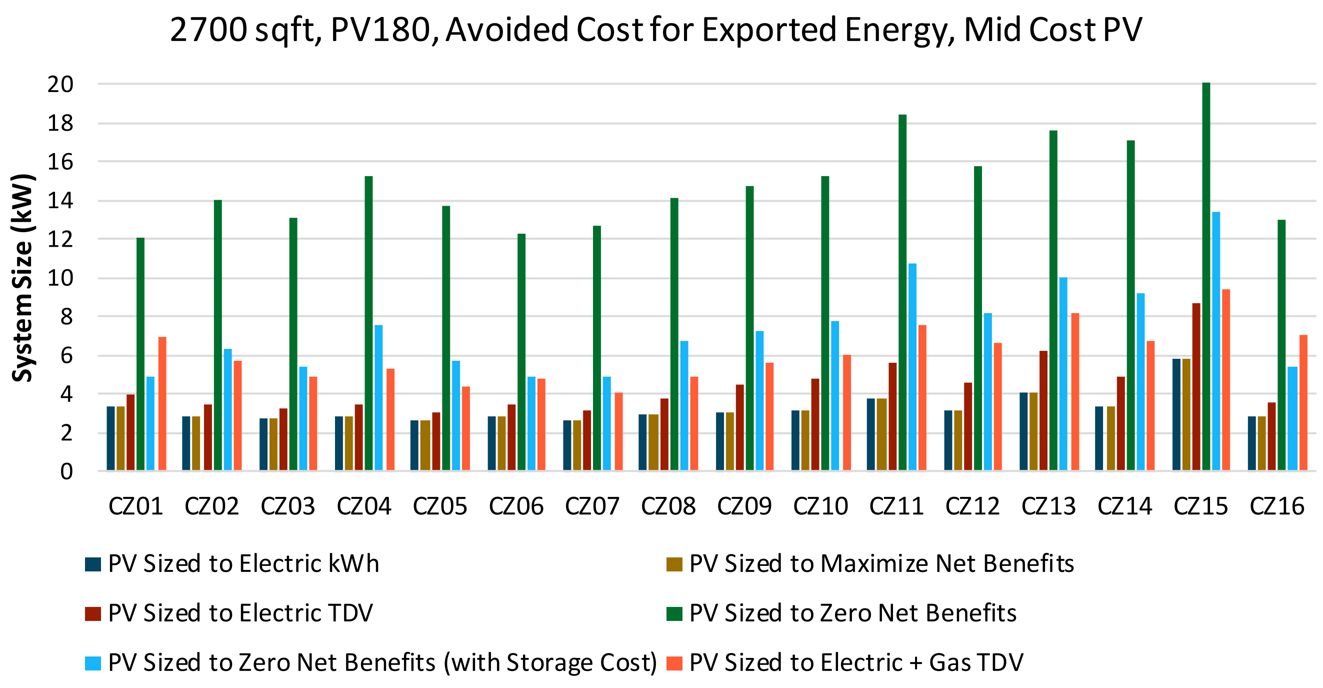
Ratio of PV Sized to Zero Net Benefits / PV Sized to Electric kWh

CZ1	2.05
CZ2	2.78
CZ3	2.70
CZ4	3.09
CZ5	3.09
CZ6	2.89
CZ7	2.97
CZ8	3.17
CZ9	3.77
CZ10	3.75
CZ11	3.76
CZ12	3.71
CZ13	3.66
CZ14	4.26
CZ15	3.47
CZ16	3.02

Sizing Comparison
Avoided Cost for Exported Energy With Storage, Mid Cost PV

NEW

- Changing the rate structure to avoided cost for exported energy increases the next benefits of solar + storage and therefore increases the amount of solar that can be installed before net benefits are reduced to zero; annual surplus at NSC
- Includes storage costs



Ratio of PV Sized to Zero Net Benefits (with Storage Costs) / PV Sized to Electric kWh

CZ1	1.48
CZ2	2.21
CZ3	1.96
CZ4	2.71
CZ5	2.23
CZ6	1.73
CZ7	1.87
CZ8	2.29
CZ9	2.39
CZ10	2.47
CZ11	2.82
CZ12	2.63
CZ13	2.49
CZ14	2.73
CZ15	2.33
CZ16	1.90

4. Software Tools

The CBECC-Res Compliance Software May Be Used For:

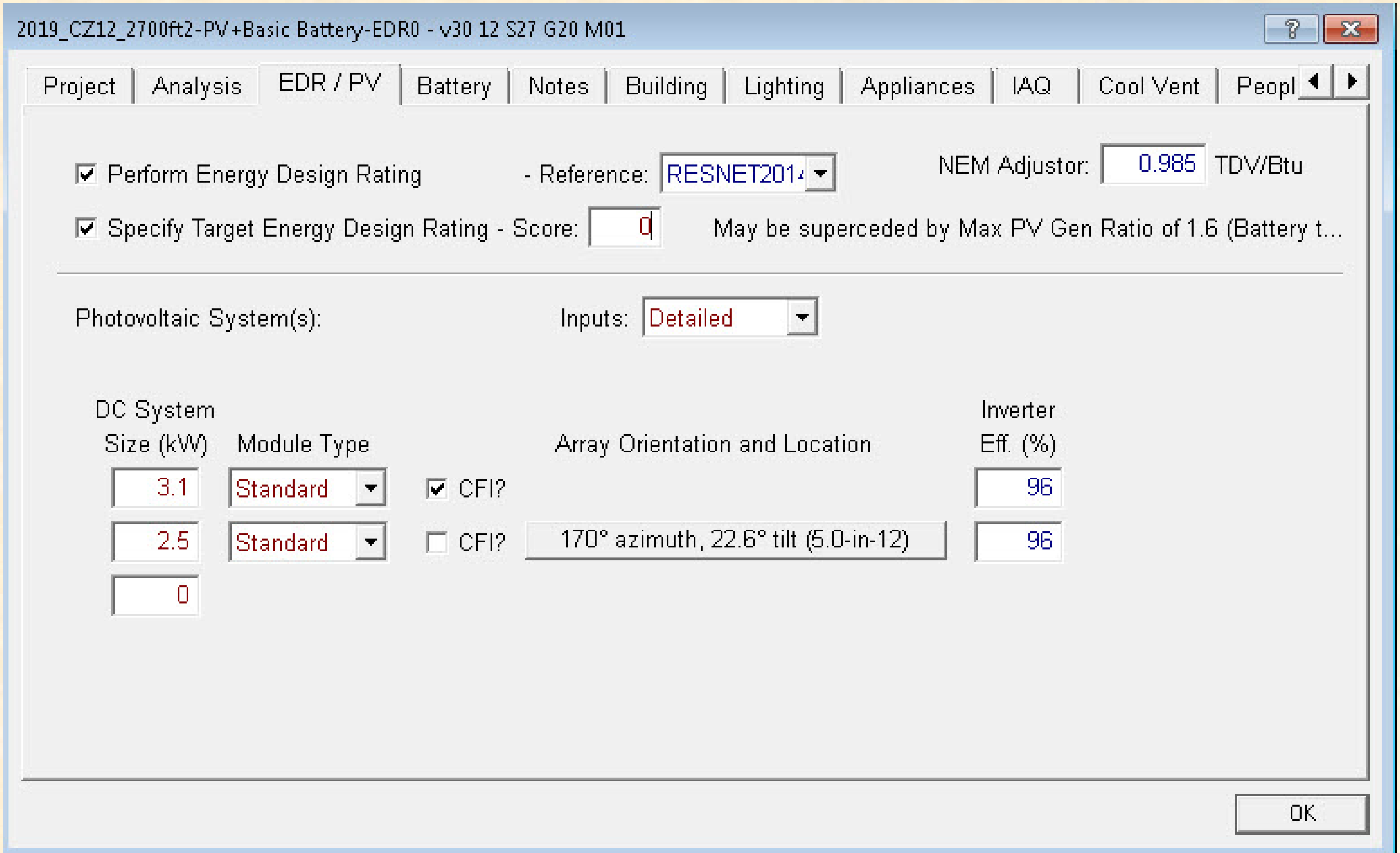
- Part 6 Compliance, and
- Part 11 (Calgreen, Reach Codes, etc)

The Software can be used to:

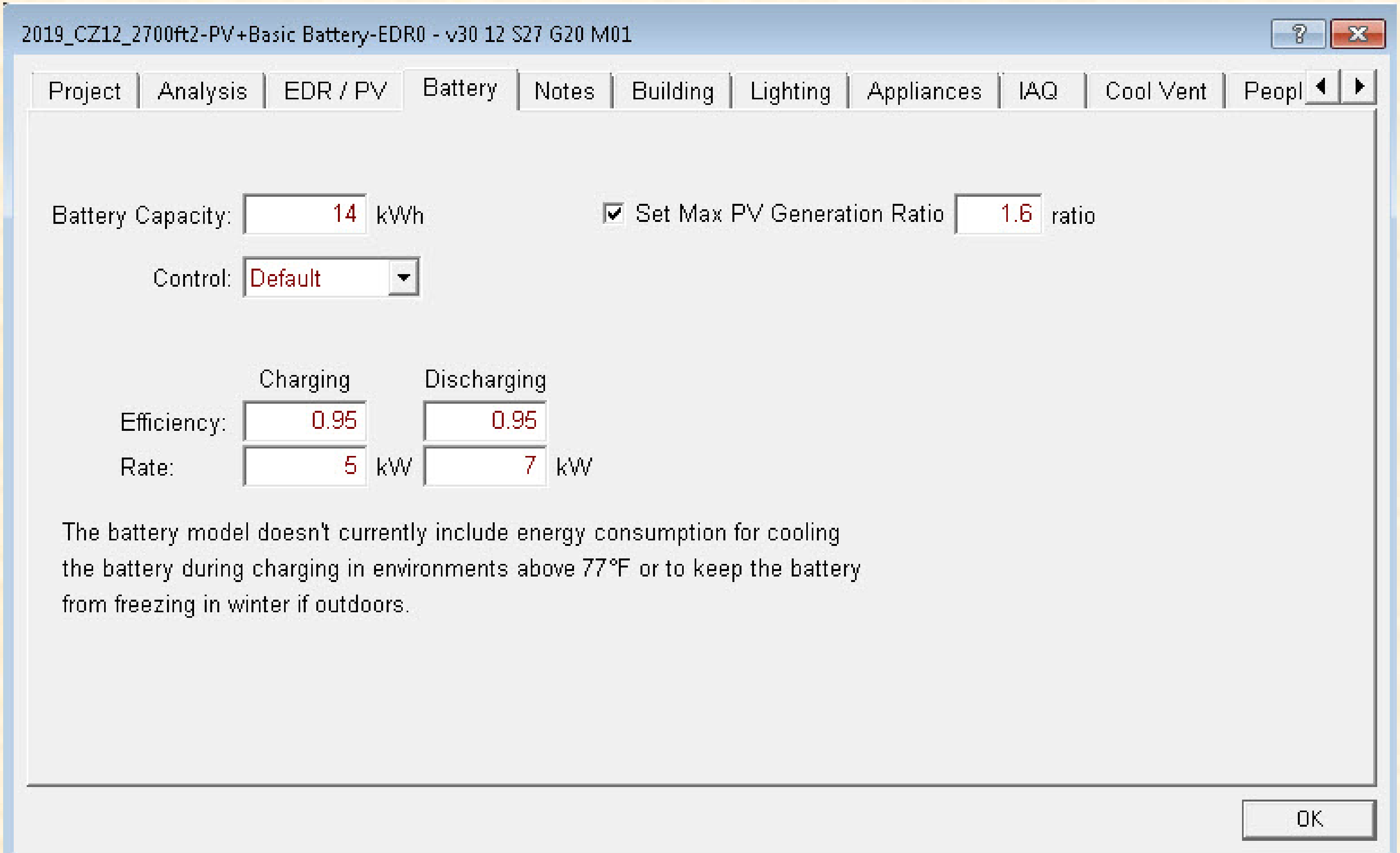
- Size PV for Part 6 compliance or lower target EDRs for Reach Codes
- Assess the impact of battery storage on lowering EDR
- Assess the impact of precooling and other DR strategies on lowering EDR
- Assess the impact HPWH DR on lowering EDR

4. Software Tools – Input Screens

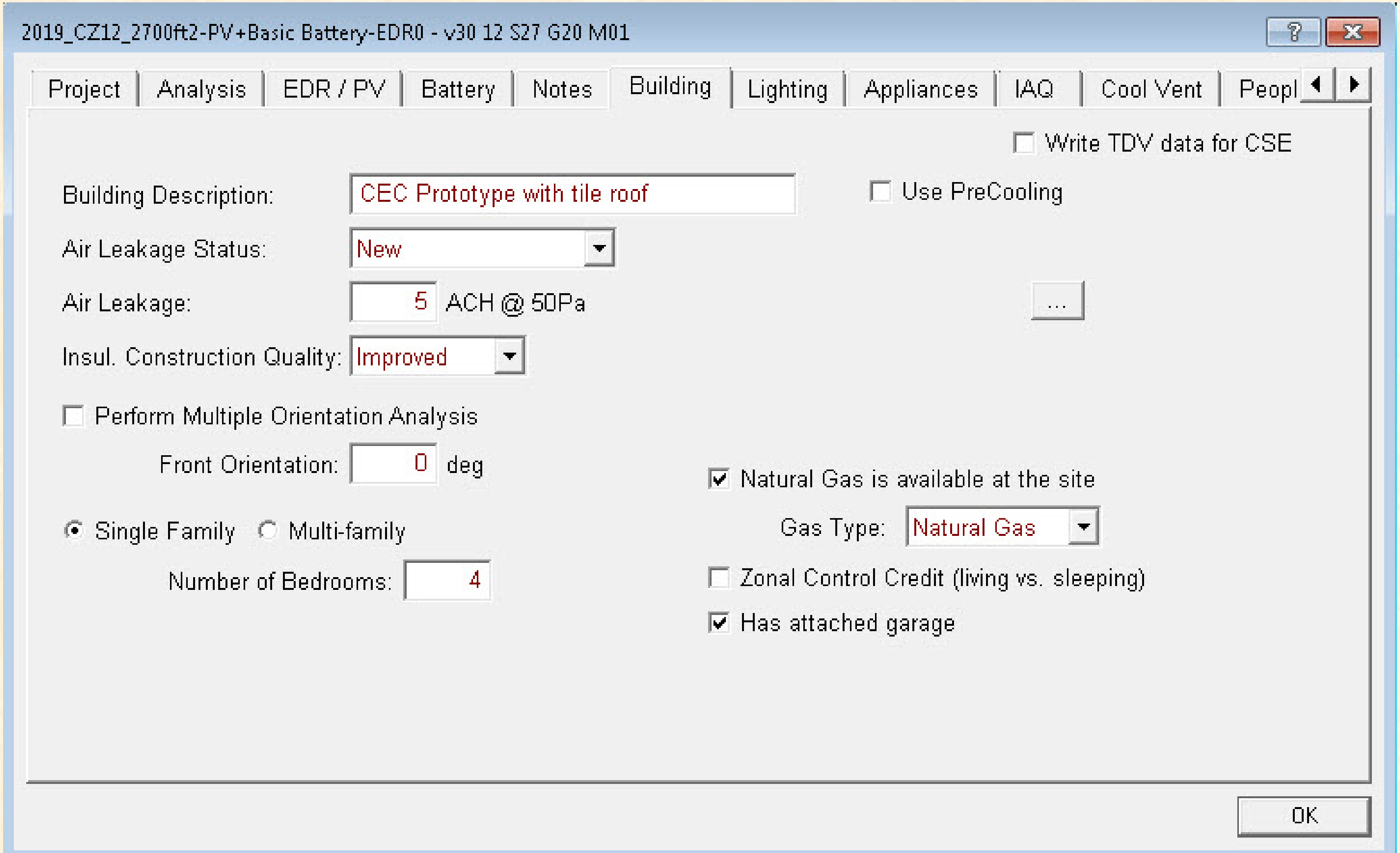
This screen can be used to specify EDR targets required by reach codes



4. Software Tools – Input Screens



4. Software Tools – Input Screens



4. Software Tools – Results Screens

For Compliance with Part 6

2019_CZ12_2700ft2-PV+Basic Battery-EDR0 - v30 12 S27 G20 M01

Energy Use Details | Summary | Energy Design Rating

End Use	Standard Design Site (kWh)	Standard Design Site (therms)	Standard Design (kTDV/ft²-yr)	Proposed Design Site (kWh)	Proposed Design Site (therms)	Proposed Design (kTDV/ft²-yr)	Compliance Margin (kTDV/ft²-yr)
Space Heating	187	217.2	19.51	187	217.2	19.51	0.00
Space Cooling	358		20.26	358		20.26	0.00
IAQ Ventilation	194		1.99	194		1.99	0.00
Other HVAC			0.00			0.00	0.00
Water Heating		119.9	8.86		119.9	8.86	0.00
Compliance Total			50.62			50.62	0.00
Photovoltaics				-9,131		-80.74	- %
Battery				275		-17.68	
Inside Lighting	616		6.98	616		6.98	Result:
Appl. & Cooking	1,040	45.1	14.46	1,040	45.1	14.46	PASS
Plug Loads	2,371		25.03	2,371		25.03	(not current)
Exterior	152		1.61	152		1.61	
TOTAL	4,917	382.3	98.70	-3,939	382.3	0.28	

Generation Coincident Peak Demand (kW): Standard Design: 1.90 Proposed Design: -0.03 Reduction: 1.93

Done

4. Software Tools – Input Screens

For Compliance with Part 11

2019_CZ12_2700ft2-PV+Basic Battery-EDR0 - v30 12 S27 G20 M01

Energy Use Details | Summary | Energy Design Rating

Target design rating achieved (final rating of 0.1 w/ PV size of 5.82 kWDC).

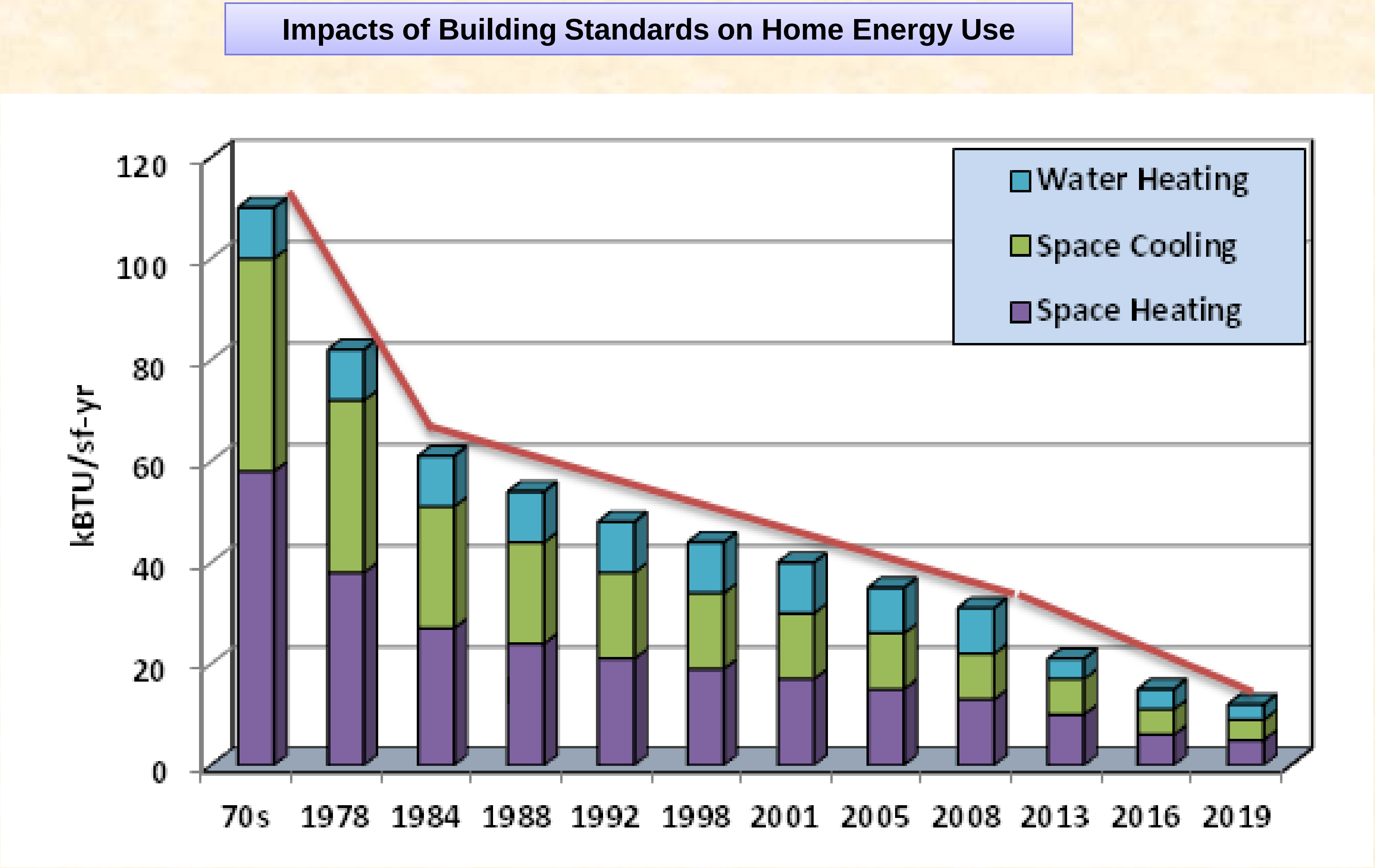
EDR of Proposed Design:	43.1	EDR of Proposed PV+Battery:	43.0	Final Proposed EDR:	**0.1**
EDR of Standard Design:	43.1	EDR of Minimum Required PV:	18.6	Final Std Design EDR:	24.5
					(not current)

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	358		20.26	39.45
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				-9,131		-80.74	80.74
Battery				275		-17.68	17.68
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	-3,939	382.3	0.28	204.21

Done

Questions?

BEES Impact on EUI



2019 BEES Schedule

2019 STANDARDS UPDATE SCHEDULE	
DATE	**MILESTONES**
February 2016-July 2016	Measures Identified and approval
August 2016 to June 2017	Stakeholder meeting/workshop & final staff workshop
April, 2017	CASE Reports submitted to the CEC
December 1, 2017	45-day Language Hearings
March 1, 2018	Adoption of 2019 Standards at Business Meeting
June1, 2018 to November 2018	Staff work on Software, Compliance Manuals, Electronic Documents Available to Industry
November 1, 2018	Approval of the Manuals
January 1, 2019	Software, Compliance Manuals, Electronic Documents Available to Industry
January 1, 2020	Effective Date

Informational Resources

- **Energy Efficiency Standards approved computer compliance programs, CBECC-Res and CBECC-Com can be downloaded for free at: http://www.energy.ca.gov/title24/2016standards/2016_computer_prog_list.html**

- **Information on the current 2016 Building Energy Efficiency Standards, including Compliance Manuals, worksheets and additional resources can be found at: http://www.energy.ca.gov/title24/2016standards/index.html**

- **To receive documents and notification of upcoming events, please sign up on the List Serve for the 2019 Building Energy Efficiency Standards (Docket #2016-BSTD-06) at: http://www.energy.ca.gov/title24/2019standards/prerulemaking/index.html**

- **Title 24 Support Hotline: Title24@energy.ca.gov**