

Accessory Dwelling Unit & Large Office

Cost Effectiveness Results
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Farhad Farahmand
Sr. Project Manager, TRC



Agenda

- High Level Findings
- ADU Methodology and Results (15 min)
- Large Office Methodology and Results (10 min)
- Next Steps + Q/A



High Level Findings

All-Electric Accessory Dwelling Unit (ADU) – Detached New Construction

- “Reach-code ready” in all climate zones
 - Positive compliance margins with efficiency measures
 - Cost effective via on-bill or TDV metrics
 - With heat pump water heater located in outdoor closet
- TDV-cost effectiveness improves using 2022 TDV

All-Electric Large Office

- “Reach-code ready” in all climate zones except 1 and 16 (heating dominant, not many large offices)
 - Positive compliance margins with efficiency measures
 - Cost effective via on-bill or TDV metrics
- Solar PV cost effective



Accessory Dwelling Unit (ADU) Methodology and Findings

ADU Background and Methodology

Background

- Builds on and expands the 2019 Residential Reach Codes
- Focuses on all-electric packages per jurisdiction requests

Methodology

- Examines on-bill and TDV cost effectiveness over 30-years
- Interviewed four ADU builders and two City staff members across the state
- Two all-electric packages studied
 1. Prescriptive code-minimum
 2. Efficiency + PV
 - \$600-\$3,000 of efficiency measures depending on Climate Zone (CZ)
 - Additional solar PV to offset 90% of electricity usage, 0.3-1.7 kW additional depending on CZ

Detached, New Construction ADU Findings

- Mechanical **equipment footprints** may be too large for inside ADU or setbacks
- Heat pump water heater (HPWH) **noise** can be reduced via sound blankets or sheds
- **Variety of conditions** that can drastically affect costs, including
 - Size of ADU (350 ft² – 1,200 ft²)
 - Distance between primary residence (10-100 feet or more)
 - Obstructions and access for heavy machinery
 - Location of existing utilities
- **Electrical service upgrades** nearly always necessary (mixed-fuel and all-electric ADUs both)
- **Gas service upgrades** occasionally necessary (not examined in this study)

All-electric ADU requires larger circuiting than dual-fuel and a HPWH shed, but saves \$ on infrastructure overall due to avoided gas plumbing (~\$1,000 with our assumptions)

Developed prototype that is **1-story, 750 ft², 50 ft from primary dwelling**, with utilities in a common trench, and without major obstructions.

ADU Results

Key:

Cost effective through

Either On-Bill or TDV

Both On-Bill and TDV

CZ	Utility	All Electric EDR Margin (2019 TDV)		All Electric EDR Margin (2022 TDV)	
		Code Minimum	EE + PV	Code Minimum	EE + PV
1	PG&E	0.0	29.3	0.0	29.3
2	PG&E	0.1	18.7	0.1	18.7
3	PG&E	-0.1	19.0	-0.1	19.0
4	PG&E	1.7	16.1	1.7	16.1
5	PG&E	0.1	20.0	0.1	20.0
5-2	SCG	0.1	20.0	0.1	20.0
6	SCE	0.0	16.1	0.0	16.1
7	SDG&E	0.1	14.0	0.1	14.0
8	SCE	0.4	12.2	0.4	12.2
9	SCE	0.2	12.9	0.2	12.9
10	SDG&E	0.1	12.2	0.1	12.2
10-2	SCE	0.1	12.2	0.1	12.2
11	PG&E	0.5	15.0	0.5	15.0
12	PG&E	0.1	15.6	0.1	15.6
13	PG&E	0.1	13.3	0.1	13.3
14	SDG&E	0.1	14.8	0.1	14.8
14-2	SCE	0.1	14.8	0.1	14.8
15	SCE	0.0	7.5	0.0	7.5
16	PG&E	-0.4	23.1	-0.4	23.1



Large Office Methodology and Findings

Large Office Background and Methodology

Background

- Builds on and expands the 2019 Nonresidential Reach Codes study
- Focuses on all-electric packages per jurisdiction requests

Methodology

- Examines on-bill and TDV cost effectiveness over 15 years
- 191,000 ft² four-story prototype with hydronic VAV-reheat and central gas boiler
- Determined costs through detailed feedback from a mechanical engineering firm and an electrical engineering firm
- Three packages studied
 1. Federal code-minimum (no prescriptive pathway)
 2. Efficiency (~\$200,000 of fenestration and lighting efficiency measures)
 3. Efficiency + 285 kW solar PV array covering 50% of roof area

Large Office Findings

- Selected electric resistance VAV reheat as all-electric system
 - ~15% less expensive than hydronic VAV-RH and gas central boiler
 - Produces negative compliance margin when swapping gas appliances to electric (no prescriptive path)
 - Increases annual kWh by 6% in CZ-7 and 20% in CZ-1
- Offices have high internal loads (lighting, computers, occupants) and usually need cooling
- Efficiency measures cost effectively achieve positive compliance

Large Office Results

Cost effective through

Either On-Bill or TDV

Both On-Bill and TDV

CZ	Utility	All Electric Compliance Margin		
		Fed Code Min	EE	EE + PV
1	PG&E	-30%	-11%	-11%
2	PG&E	-12%	6%	6%
3	PG&E	-17%	5%	5%
4	PG&E	-11%	9%	9%
5	PG&E	-18%	2%	2%
5-2	SCG	-18%	2%	2%
6	SCE	-8%	13%	13%
7	SDG&E	-8%	14%	14%
8	SCE	-5%	14%	14%
9	SCE	-3%	14%	14%
10	SDG&E	-5%	13%	13%
10-2	SCE	-5%	13%	13%
11	PG&E	-6%	9%	9%
12	PG&E	-7%	9%	9%
13	PG&E	-6%	10%	10%
14	SDG&E	-7%	8%	8%
14-2	SCE	-7%	8%	8%
15	SCE	2%	16%	16%
16	PG&E	-38%	-19%	-19%

Next Steps

- Complete analysis using municipal utility rates
 - SMUD
 - LADWP
 - Palo Alto
 - Truckee
- **Questions or Suggestions?**

Thank you!



Farhad Farahmand
Ffarahmand@trccompanies.com

ADU Upfront Cost Assumptions

Mixed-fuel measure	Mixed-fuel cost	All-electric measure	All-electric cost	All-electric incremental cost	Source
Appliances					
Furnace (80% AFUE) plus split air-conditioner,	\$	Split heat pump (8.2 HSPF)	\$	(\$221)	Residential New Construction Report (2019a)
Gas tankless (80% AFUE)	\$	Heat pump water heater (2.0 UEF)	\$	\$0	
Gas clothes dryer	\$	Electric clothes dryer	\$	\$0	
Gas range	\$	Electric range	\$	\$0	
Infrastructure					
In-house gas plumbing	\$540	In-house circuit upgrades	\$600	\$60	RSMeans
Site gas service extension	\$1,998	Exterior shed for HPWH	\$650	(\$1,348)	Interviews, RSMeans
- 225A service connection	\$3,500	- 225A service connection	\$3,500	\$0	
- 100A feeder to ADU with breaker	\$933	- 125A feeder to ADU	\$1,206	\$273	
- 100A ADU subpanel	\$733	- 125A ADU subpanel	\$946	\$213	
Total	\$7,704		\$6,901	(\$1,024)	

ADU: All-Electric Code Minimum, 2019 TDV

CZ	Utility	Elec Savings (kWh)	Gas Savings (therms)	GHG Reductions (mtons)	Total EDR Margin	Incremental Package Cost	Lifecycle Utility Cost Savings	\$TDV Savings	B/C Ratio (On-bill)	B/C Ratio (TDV)	NPV (On-bill)	NPV (TDV)
CZ01	PG&E	(3,600)	259	0.7	0.00	-\$1,024	-\$7,865	-\$6,951	0.1	0.1	-\$6,841	-\$5,927
CZ02	PG&E	(2,646)	198	0.5	0.10	-\$1,674	-\$4,469	-\$3,897	0.4	0.4	-\$2,796	-\$2,223
CZ03	PG&E	(2,397)	174	0.5	-0.10	-\$1,024	-\$4,160	-\$4,366	0.2	0.2	-\$3,136	-\$3,342
CZ04	PG&E	(2,263)	170	0.5	1.70	-\$1,674	-\$3,537	-\$2,765	0.5	0.6	-\$1,864	-\$1,092
CZ05	PG&E	(2,524)	170	0.4	0.10	-\$1,024	-\$5,108	-\$4,883	0.2	0.2	-\$4,084	-\$3,860
CZ05-2	SCG	(2,524)	170	0.4	0.10	-\$1,024	-\$5,204	-\$4,883	0.2	0.2	-\$4,180	-\$3,860
CZ06	SCE	(1,853)	136	0.4	0.00	-\$1,024	-\$2,943	-\$3,154	0.3	0.3	-\$1,920	-\$2,131
CZ07	SDG&E	(1,604)	121	0.4	0.10	-\$1,024	-\$3,993	-\$3,035	0.3	0.3	-\$2,970	-\$2,012
CZ08	SCE	(1,594)	122	0.4	0.40	-\$1,674	-\$2,282	-\$2,279	0.7	0.7	-\$609	-\$605
CZ09	SCE	(1,669)	128	0.4	0.20	-\$1,674	-\$2,403	-\$2,476	0.7	0.7	-\$729	-\$803
CZ10	SDG&E	(1,714)	130	0.4	0.10	-\$1,674	-\$5,035	-\$2,544	0.3	0.7	-\$3,362	-\$871
CZ10-2	SCE	(1,714)	130	0.4	0.10	-\$1,674	-\$2,549	-\$2,544	0.7	0.7	-\$876	-\$871
CZ11	PG&E	(2,333)	177	0.5	0.50	-\$1,674	-\$4,188	-\$3,676	0.4	0.5	-\$2,514	-\$2,003
CZ12	PG&E	(2,319)	182	0.5	0.10	-\$1,674	-\$3,376	-\$3,257	0.5	0.5	-\$1,702	-\$1,584
CZ13	PG&E	(2,158)	167	0.5	0.10	-\$1,674	-\$3,695	-\$3,334	0.5	0.5	-\$2,022	-\$1,661
CZ14	SDG&E	(2,388)	175	0.5	0.10	-\$1,674	-\$7,894	-\$3,378	0.2	0.5	-\$6,220	-\$1,705
CZ14-2	SCE	(2,388)	175	0.5	0.10	-\$1,674	-\$4,476	-\$3,378	0.4	0.5	-\$2,803	-\$1,705
CZ15	SCE	(1,330)	99	0.3	0.00	-\$1,674	-\$1,766	-\$2,398	0.9	0.7	-\$92	-\$724
CZ16	PG&E	(3,439)	274	0.8	-0.40	-\$1,674	-\$5,812	-\$6,187	0.3	0.3	-\$4,138	-\$4,514

ADU: All-Electric Efficiency + PV, 2019 TDV

CZ	Utility	Elec Savings (kWh)	Gas Savings (therms)	GHG Reduction (mtons)	Total EDR Margin	Incremental Package Cost	Lifecycle Utility Cost Savings	\$TDV Savings	B/C Ratio (On-bill)	B/C Ratio (TDV)	NPV (On-bill)	NPV (TDV)
CZ01	PG&E	(524)	259	1.2	29.30	\$6,287	\$8,481	\$4,123	1.3	0.7	\$2,194	-\$2,164
CZ02	PG&E	(497)	198	0.9	18.70	\$3,576	\$6,259	\$3,333	1.8	0.9	\$2,683	-\$242
CZ03	PG&E	(459)	174	0.8	19.00	\$2,677	\$5,526	\$2,348	2.1	0.9	\$2,849	-\$329
CZ04	PG&E	(465)	170	0.7	16.10	\$2,622	\$5,375	\$2,635	2.0	1.0	\$2,753	\$12
CZ05	PG&E	(472)	170	0.7	20.00	\$2,650	\$5,364	\$2,206	2.0	0.8	\$2,715	-\$444
CZ05-2	SCG	(472)	170	0.7	20.00	\$2,650	\$5,268	\$2,206	2.0	0.8	\$2,619	-\$444
CZ06	SCE	(427)	136	0.6	16.10	\$1,764	\$1,836	\$1,898	1.0	1.1	\$72	\$133
CZ07	SDG&E	(404)	121	0.5	14.00	\$1,382	\$2,843	\$1,134	2.1	0.8	\$1,461	-\$248
CZ08	SCE	(421)	122	0.5	12.20	\$1,464	\$1,503	\$1,618	1.0	1.1	\$39	\$154
CZ09	SCE	(439)	128	0.5	12.90	\$1,537	\$1,641	\$2,170	1.1	1.4	\$104	\$633
CZ10	SDG&E	(449)	130	0.5	12.20	\$1,903	\$2,168	\$2,065	1.1	1.1	\$265	\$162
CZ10-2	SCE	(449)	130	0.5	12.20	\$1,903	\$1,632	\$2,065	0.9	1.1	-\$272	\$162
CZ11	PG&E	(535)	177	0.8	15.00	\$4,286	\$5,595	\$3,433	1.3	0.8	\$1,309	-\$853
CZ12	PG&E	(494)	182	0.8	15.60	\$4,449	\$5,810	\$3,510	1.3	0.8	\$1,360	-\$939
CZ13	PG&E	(525)	167	0.7	13.30	\$4,280	\$5,232	\$3,109	1.2	0.7	\$952	-\$1,171
CZ14	SDG&E	(541)	175	0.7	14.80	\$4,253	\$2,755	\$3,348	0.6	0.8	-\$1,498	-\$905
CZ14-2	SCE	(541)	175	0.7	14.80	\$4,253	\$1,869	\$3,348	0.4	0.8	-\$2,384	-\$905
CZ15	SCE	(555)	99	0.4	7.50	\$2,482	\$1,425	\$1,503	0.6	0.6	-\$1,057	-\$979
CZ16	PG&E	(547)	274	1.2	23.10	\$5,137	\$8,995	\$3,801	1.8	0.7	\$3,858	-\$1,336

ADU: All-Electric Code Minimum, 2022 TDV

CZ	Utility	Elec Savings (kWh)	Gas Savings (therms)	GHG Reductions (mtons)	Total EDR Margin	Incremental Package Cost	Lifecycle Utility Cost Savings	\$TDV Savings	B/C Ratio (On-bill)	B/C Ratio (TDV)	NPV (On-bill)	NPV (TDV)
CZ01	PG&E	(3,600)	259	0.7	0.00	-\$1,024	-\$7,865	-\$1,199	0.1	0.9	-\$6,841	-\$176
CZ02	PG&E	(2,646)	198	0.5	0.10	-\$1,674	-\$4,469	\$583	0.4	>1	-\$2,796	\$2,257
CZ03	PG&E	(2,397)	174	0.5	-0.10	-\$1,024	-\$4,160	-\$168	0.2	6.1	-\$3,136	\$856
CZ04	PG&E	(2,263)	170	0.5	1.70	-\$1,674	-\$3,537	-\$321	0.5	5.2	-\$1,864	\$1,353
CZ05	PG&E	(2,524)	170	0.4	0.10	-\$1,024	-\$5,108	-\$976	0.2	1.0	-\$4,084	\$48
CZ05-2	SCG	(2,524)	170	0.4	0.10	-\$1,024	-\$5,204	-\$976	0.2	1.0	-\$4,180	\$48
CZ06	SCE	(1,853)	136	0.4	0.00	-\$1,024	-\$2,943	\$42	0.3	>1	-\$1,920	\$1,066
CZ07	SDG&E	(1,604)	121	0.4	0.10	-\$1,024	-\$3,993	\$286	0.3	>1	-\$2,970	\$1,310
CZ08	SCE	(1,594)	122	0.4	0.40	-\$1,674	-\$2,282	\$463	0.7	>1	-\$609	\$2,137
CZ09	SCE	(1,669)	128	0.4	0.20	-\$1,674	-\$2,403	\$290	0.7	>1	-\$729	\$1,963
CZ10	SDG&E	(1,714)	130	0.4	0.10	-\$1,674	-\$5,035	\$644	0.3	>1	-\$3,362	\$2,318
CZ10-2	SCE	(1,714)	130	0.4	0.10	-\$1,674	-\$2,549	\$644	0.7	>1	-\$876	\$2,318
CZ11	PG&E	(2,333)	177	0.5	0.50	-\$1,674	-\$4,188	\$444	0.4	>1	-\$2,514	\$2,118
CZ12	PG&E	(2,319)	182	0.5	0.10	-\$1,674	-\$3,376	\$878	0.5	>1	-\$1,702	\$2,551
CZ13	PG&E	(2,158)	167	0.5	0.10	-\$1,674	-\$3,695	\$499	0.5	>1	-\$2,022	\$2,172
CZ14	SDG&E	(2,388)	175	0.5	0.10	-\$1,674	-\$7,894	\$301	0.2	>1	-\$6,220	\$1,974
CZ14-2	SCE	(2,388)	175	0.5	0.10	-\$1,674	-\$4,476	\$301	0.4	>1	-\$2,803	\$1,974
CZ15	SCE	(1,330)	99	0.3	0.00	-\$1,674	-\$1,766	\$364	0.9	>1	-\$92	\$2,038
CZ16	PG&E	(3,439)	274	0.8	-0.40	-\$1,674	-\$5,812	-\$1,924	0.3	0.9	-\$4,138	-\$251

ADU: All-Electric Efficiency + PV, 2022 TDV

CZ	Utility	Elec Savings (kWh)	Gas Savings (therms)	GHG Reductions (mtons)	Total EDR Margin	Incremental Package Cost	Lifecycle Utility Cost Savings	\$TDV Savings	B/C Ratio (On-bill)	B/C Ratio (TDV)	NPV (On-bill)	NPV (TDV)
CZ01	PG&E	(524)	259	1.2	29.30	\$6,287	\$8,481	\$9,144	1.3	1.5	\$2,194	\$2,857
CZ02	PG&E	(497)	198	0.9	18.70	\$3,576	\$6,259	\$7,254	1.8	2.0	\$2,683	\$3,678
CZ03	PG&E	(459)	174	0.8	19.00	\$2,677	\$5,526	\$5,985	2.1	2.2	\$2,849	\$3,308
CZ04	PG&E	(465)	170	0.7	16.10	\$2,622	\$5,375	\$5,644	2.0	2.2	\$2,753	\$3,022
CZ05	PG&E	(472)	170	0.7	20.00	\$2,650	\$5,364	\$5,506	2.0	2.1	\$2,715	\$2,856
CZ05-2	SCG	(472)	170	0.7	20.00	\$2,650	\$5,268	\$5,506	2.0	2.1	\$2,619	\$2,856
CZ06	SCE	(427)	136	0.6	16.10	\$1,764	\$1,836	\$4,626	1.0	2.6	\$72	\$2,861
CZ07	SDG&E	(404)	121	0.5	14.00	\$1,382	\$2,843	\$3,953	2.1	2.9	\$1,461	\$2,571
CZ08	SCE	(421)	122	0.5	12.20	\$1,464	\$1,503	\$4,158	1.0	2.8	\$39	\$2,694
CZ09	SCE	(439)	128	0.5	12.90	\$1,537	\$1,641	\$4,281	1.1	2.8	\$104	\$2,744
CZ10	SDG&E	(449)	130	0.5	12.20	\$1,903	\$2,168	\$4,719	1.1	2.5	\$265	\$2,816
CZ10-2	SCE	(449)	130	0.5	12.20	\$1,903	\$1,632	\$4,719	0.9	2.5	-\$272	\$2,816
CZ11	PG&E	(535)	177	0.8	15.00	\$4,286	\$5,595	\$6,262	1.3	1.5	\$1,309	\$1,977
CZ12	PG&E	(494)	182	0.8	15.60	\$4,449	\$5,810	\$6,295	1.3	1.4	\$1,360	\$1,846
CZ13	PG&E	(525)	167	0.7	13.30	\$4,280	\$5,232	\$5,842	1.2	1.4	\$952	\$1,561
CZ14	SDG&E	(541)	175	0.7	14.80	\$4,253	\$2,755	\$6,284	0.6	1.5	-\$1,498	\$2,031
CZ14-2	SCE	(541)	175	0.7	14.80	\$4,253	\$1,869	\$6,284	0.4	1.5	-\$2,384	\$2,031
CZ15	SCE	(555)	99	0.4	7.50	\$2,482	\$1,425	\$3,747	0.6	1.5	-\$1,057	\$1,265
CZ16	PG&E	(547)	274	1.2	23.10	\$5,137	\$8,995	\$7,967	1.8	1.6	\$3,858	\$2,831

Large Office Upfront Cost Assumptions

Mixed-fuel measure	Mixed-fuel cost	All-Electric measure	All-Electric cost	All-electric incremental cost	Source
Boilers (2) and Heating Hot Water Piping	\$1,378,326	N/A	\$0	\$(1,378,326)	Cost estimator
Hydronic VAV reheat terminal units	\$2,014,460	Electric resistance VAV reheat terminal units	\$2,322,839	\$281,379	Cost estimator
Gas plumbing distribution	\$6,843	Electrical upgrades, such as wiring, distribution boards, and transformers	\$478,656	\$471,813	RSMeans
Natural gas plan review, service extension, meter	\$18,316	N/A	\$0	\$18,316	Nonresidential New Construction Report (2019b)
Total	\$3,444,945		\$2,801,495	\$(643,450)	

Large Office: All-Electric Code Minimum, 2019 TDV

CZ	Utility	Elec Savings (kWh)	Gas Savings (therms)	GHG Reductions (mtons)	Compliance Margin	Incremental Package Cost	Lifecycle Utility Cost Savings	\$TDV Savings	B/C Ratio (On-bill)	B/C Ratio (TDV)	NPV (On-bill)	NPV (TDV)
CZ01	PG&E	(262,847)	16,395	5.1	-29.8%	\$(643,450)	\$(441,670)	\$(371,473)	1.5	1.7	\$201,779	\$271,977
CZ02	PG&E	(206,143)	12,600	1.9	-11.5%	\$(643,450)	\$(352,809)	\$(233,027)	1.8	2.8	\$290,640	\$410,423
CZ03	PG&E	(166,467)	9,905	-0.6	-16.6%	\$(643,450)	\$(279,009)	\$(206,276)	2.3	3.1	\$364,441	\$437,174
CZ04	PG&E	(147,048)	8,778	-0.4	-11.0%	\$(643,450)	\$(232,039)	\$(170,819)	2.8	3.8	\$411,411	\$472,631
CZ05	PG&E	(194,316)	11,756	0.5	-18.1%	\$(643,450)	\$(287,780)	\$(241,369)	2.2	2.7	\$355,669	\$402,080
CZ05-2	SCG	(194,316)	11,756	0.5	-18.1%	\$(643,450)	\$(337,271)	\$(241,369)	1.9	2.7	\$306,179	\$402,080
CZ06	SCE	(123,271)	7,088	-2.4	-7.7%	\$(643,450)	\$(67,862)	\$(146,660)	9.5	4.4	\$575,588	\$496,790
CZ07	SDG&E	(93,327)	5,092	-3.2	-7.9%	\$(643,450)	\$(53,113)	\$(116,624)	12.1	5.5	\$590,336	\$526,826
CZ08	SCE	(112,492)	6,371	-2.7	-5.1%	\$(643,450)	\$(54,321)	\$(134,973)	11.8	4.8	\$589,129	\$508,477
CZ09	SCE	(112,134)	6,444	-1.8	-2.6%	\$(643,450)	\$(54,466)	\$(131,390)	11.8	4.9	\$588,984	\$512,059
CZ10	SDG&E	(134,491)	7,574	-3.2	-4.8%	\$(643,450)	\$(86,408)	\$(160,839)	7.4	4.0	\$557,041	\$482,611
CZ10-2	SCE	(134,491)	7,574	-3.2	-4.8%	\$(643,450)	\$(76,599)	\$(160,839)	8.4	4.0	\$566,851	\$482,611
CZ11	PG&E	(179,689)	10,792	0.4	-5.9%	\$(643,450)	\$(298,663)	\$(200,734)	2.2	3.2	\$344,787	\$442,716
CZ12	PG&E	(177,729)	10,678	-0.3	-7.3%	\$(643,450)	\$(311,774)	\$(200,865)	2.1	3.2	\$331,676	\$442,584
CZ13	PG&E	(159,727)	9,590	-0.4	-5.8%	\$(643,450)	\$(268,553)	\$(183,952)	2.4	3.5	\$374,897	\$459,498
CZ14	SDG&E	(190,360)	10,986	-3.1	-7.4%	\$(643,450)	\$(254,901)	\$(221,327)	2.5	2.9	\$388,549	\$422,123
CZ14-2	SCE	(190,360)	10,986	-3.1	-7.4%	\$(643,450)	\$(170,887)	\$(221,327)	3.8	2.9	\$472,562	\$422,123
CZ15	SCE	(71,444)	3,890	-3.1	2.1%	\$(643,450)	\$(34,811)	\$(86,001)	18.5	7.5	\$608,639	\$557,449
CZ16	PG&E	(336,846)	18,599	-3.7	-37.8%	\$(643,450)	\$(630,673)	\$(576,006)	1.0	1.1	\$12,776	\$67,444

Large Office: All-Electric Efficiency, 2019 TDV

CZ	Utility	Elec Savings (kWh)	Gas Savings (therms)	GHG Reductions (mtons)	Compliance Margin	Incremental Package Cost	Lifecycle Utility Cost Savings	\$TDV Savings	B/C Ratio (On-bill)	B/C Ratio (TDV)	NPV (On-bill)	NPV (TDV)
CZ01	PG&E	(164,077)	16,395	36.4	-11.3%	\$(443,034)	\$(189,085)	\$(145,177)	2.3	3.1	\$253,948	\$297,856
CZ02	PG&E	(91,089)	12,600	39.2	6.1%	\$(443,034)	\$(42,207)	\$57,472	10.5	>1	\$400,826	\$500,505
CZ03	PG&E	(47,376)	9,905	38.2	5.5%	\$(443,034)	\$43,335	\$84,923	>1	>1	\$486,368	\$527,956
CZ04	PG&E	(23,199)	8,778	40.1	9.2%	\$(417,195)	\$103,180	\$137,608	>1	>1	\$520,375	\$554,803
CZ05	PG&E	(80,683)	11,756	36.7	2.2%	\$(443,034)	\$18,036	\$34,757	>1	>1	\$461,070	\$477,791
CZ05-2	SCG	(80,683)	11,756	36.7	2.2%	\$(443,034)	\$(31,455)	\$34,757	14.1	>1	\$411,579	\$477,791
CZ06	SCE	10,223	7,088	41.7	12.6%	\$(417,195)	\$140,176	\$192,519	>1	>1	\$557,371	\$609,714
CZ07	SDG&E	42,211	5,092	42.0	14.1%	\$(417,195)	\$349,971	\$232,184	>1	>1	\$767,166	\$649,379
CZ08	SCE	21,755	6,371	41.9	13.6%	\$(417,195)	\$150,074	\$207,746	>1	>1	\$567,269	\$624,941
CZ09	SCE	18,792	6,444	41.2	13.8%	\$(417,195)	\$148,453	\$202,843	>1	>1	\$565,648	\$620,038
CZ10	SDG&E	4,572	7,574	42.9	13.0%	\$(417,195)	\$291,924	\$184,670	>1	>1	\$709,119	\$601,865
CZ10-2	SCE	4,572	7,574	42.9	13.0%	\$(417,195)	\$128,837	\$184,670	>1	>1	\$546,032	\$601,865
CZ11	PG&E	(58,308)	10,792	40.1	9.1%	\$(417,195)	\$37,421	\$102,806	>1	>1	\$454,616	\$520,001
CZ12	PG&E	(58,409)	10,678	38.4	8.8%	\$(417,195)	\$5,449	\$102,291	>1	>1	\$422,644	\$519,487
CZ13	PG&E	(43,265)	9,590	37.3	9.5%	\$(417,195)	\$41,569	\$104,812	>1	>1	\$458,764	\$522,007
CZ14	SDG&E	(70,979)	10,986	35.5	7.7%	\$(417,195)	\$63,337	\$80,053	>1	>1	\$480,532	\$497,248
CZ14-2	SCE	(70,979)	10,986	35.5	7.7%	\$(417,195)	\$(4,657)	\$80,053	89.6	>1	\$412,538	\$497,248
CZ15	SCE	55,545	3,890	38.4	15.6%	\$(417,195)	\$166,513	\$235,297	>1	>1	\$583,708	\$652,492
CZ16	PG&E	(217,178)	18,599	37.1	-18.9%	\$(443,034)	\$(349,687)	\$(289,187)	1.3	1.5	\$93,347	\$153,847

Large Office: All-Electric Efficiency + PV, 2019 TDV

CZ	Utility	Elec Savings (kWh)	Gas Savings (therms)	GHG Reductions (mtons)	Comp- liance Margin	Incremental Package Cost	Lifecycle Utility Cost Savings	\$TDV Savings	B/C Ratio (On-bill)	B/C Ratio (TDV)	NPV (On-bill)	NPV (TDV)
CZ01	PG&E	208,501	16,395	115.9	-11.3%	\$211,496	\$689,503	\$652,657	3.3	3.1	\$478,007	\$441,161
CZ02	PG&E	355,791	12,600	134.6	6.1%	\$211,496	\$998,821	\$1,033,622	4.7	4.9	\$787,324	\$822,126
CZ03	PG&E	399,620	9,905	133.4	5.5%	\$211,496	\$1,084,199	\$1,041,892	5.1	4.9	\$872,703	\$830,396
CZ04	PG&E	440,513	8,778	139.4	9.2%	\$237,335	\$1,186,500	\$1,150,898	5.0	4.8	\$949,165	\$913,563
CZ05	PG&E	401,653	11,756	140.0	2.2%	\$211,496	\$1,137,468	\$1,068,395	5.4	5.1	\$925,972	\$856,899
CZ05-2	SCG	401,653	11,756	140.0	2.2%	\$211,496	\$1,087,978	\$1,068,395	5.1	5.1	\$876,482	\$856,899
CZ06	SCE	465,400	7,088	139.1	12.6%	\$237,335	\$703,167	\$1,210,243	3.0	5.1	\$465,833	\$972,909
CZ07	SDG&E	517,218	5,092	143.7	14.1%	\$237,335	\$1,405,346	\$1,282,704	5.9	5.4	\$1,168,012	\$1,045,370
CZ08	SCE	481,259	6,371	140.5	13.6%	\$237,335	\$711,812	\$1,274,010	3.0	5.4	\$474,477	\$1,036,675
CZ09	SCE	492,757	6,444	143.7	13.8%	\$237,335	\$720,848	\$1,283,827	3.0	5.4	\$483,513	\$1,046,493
CZ10	SDG&E	478,753	7,574	144.6	13.0%	\$237,335	\$1,330,981	\$1,229,995	5.6	5.2	\$1,093,647	\$992,661
CZ10-2	SCE	478,753	7,574	144.6	13.0%	\$237,335	\$699,956	\$1,229,995	2.9	5.2	\$462,622	\$992,661
CZ11	PG&E	399,585	10,792	138.2	9.1%	\$237,335	\$1,079,392	\$1,129,930	4.5	4.8	\$842,058	\$892,595
CZ12	PG&E	392,978	10,678	134.8	8.8%	\$237,335	\$1,048,954	\$1,115,934	4.4	4.7	\$811,620	\$878,600
CZ13	PG&E	404,328	9,590	133.4	9.5%	\$237,335	\$1,069,696	\$1,095,498	4.5	4.6	\$832,361	\$858,163
CZ14	SDG&E	449,987	10,986	146.8	7.7%	\$237,335	\$1,256,275	\$1,289,059	5.3	5.4	\$1,018,941	\$1,051,725
CZ14-2	SCE	449,987	10,986	146.8	7.7%	\$237,335	\$652,060	\$1,289,059	2.7	5.4	\$414,725	\$1,051,725
CZ15	SCE	544,152	3,890	142.1	15.6%	\$237,335	\$730,342	\$1,335,246	3.1	5.6	\$493,008	\$1,097,912
CZ16	PG&E	269,671	18,599	142.4	-18.9%	\$211,496	\$720,813	\$748,403	3.4	3.5	\$509,316	\$536,907