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Lancaster ZNE Ordinance Cost-Effectiveness Analysis

Completed in Collaboration with  ENERGY SOLUTIONS

Executive Summary

This document provides further background into the methodology for the analysis conducted in support of the adoption of the ZNE ordinance by the City of Lancaster. The analysis shows that all three compliance options are cost-effective. The analysis was created using actual customer information available to Lancaster Choice Energy, the City's Community Choice Aggregator and information provided by the Building Industry Association and local homebuilders.

Introduction

The City of Lancaster, located in California Climate Zone 14 has taken ambitious steps to reduce consumer energy costs including adopting a mandatory solar ordinance, becoming the City's energy provider and now introducing a ZNE ordinance. Lancaster was the first city in California to adopt a mandatory residential solar photovoltaic ordinance in 2014. The solar ordinance required builders to install a minimum of one kW of solar photovoltaics per home. The ordinance provided some flexibility giving builders the option of installing solar on a per home basis or aggregating their solar requirement. In the case of a 10 home development two homes would have 5 kW system and the builder's requirement would be met. In 2015, Lancaster Choice Energy (LCE) became the City's energy provider and is currently serving over 51,000 accounts annually. By becoming a Community Choice Aggregator the City of Lancaster has decreased energy costs for consumers, provided a cleaner and greener baseline product for customers¹ and developed a net energy program (NEM) program that supports and incentivizes solar consumers². Lancaster also recently developed a utility scale solar project (10MW) which will provide energy to its customers. The City has been successful in its energy endeavors and believes that the ZNE ordinance is the next natural step to reduce consumer energy costs and support the State's green energy goals. The ZNE ordinance was developed through a collaborative effort with stakeholders including the Building Industry Association, local home builders, the City's Planning Commission and local solar developers.

Prototype Building Sizes

The cost-effectiveness analysis was completed using building sizes that are common for Lancaster and for which data from existing buildings is available. The prototype building sizes deviate slightly from the 2,200 sq. ft. single-story and 2,700 sq. ft. two-story single family prototypes that are typically used to calculate Title 24, Part 6 cost-effectiveness. In the case of the single-story single family prototype, the electricity saving calculations available were limited to those of existing homes, with the closest size to 2,200 sq. ft.

¹ LCE's baseline product is comprised of 35% renewable energy

² Overproduction is compensated at the rate of \$0.06 per kWh

prototype being 2,500 sq. ft. For the two-story homes, the average size in Lancaster is 2,900 sq. ft.; the closest size of existing home covered by the savings calculations was 3,000 sq. ft.

Proposed and Baseline Assumptions

The baseline was assumed to be minimally compliant with the 2016 Title 24, Part 6 Standards assuming the use of high-performance walls (HPW) and high-performance attics (HPA) options. While not part of the cost-effectiveness analysis, the baseline code requires newly constructed buildings comply with the existing landscaping and irrigation requirements of Section 17.08.110.A.12 and Section 8.30.040.B of the Lancaster Municipal Code, and the ZNE ordinance provides a waiver from this landscaping and irrigation requirement. The previously existing Solar Energy Systems ordinance in Section 15.28.020 of the Lancaster Municipal Code, specifically 1 kW of solar photovoltaics (PV) per unit for the average home, was overridden by the new Title 24 code effective on January 1, 2017, so was not accounted for in the analysis.

All three compliance options were evaluated.

Option 1 requires a minimum of 2 watts of solar PV per sq. ft. of building floor space.

Option 2 requires the builder to pay a mitigation fee of \$1.40/sq. ft. of building floor space. The assumption underlying this option is that the builder will opt to pay the mitigation fee as opposed to installing a solar PV system. This option is a good option if the building site is not conducive to an on-site solar PV system (e.g., roof is too small, shaded, or has a sub-optimal orientation).

Option 3 requires a hybrid of 2 kW of solar PV and a mitigation fee of \$1.40/sq. ft. of building floor space for the remaining balance of sq. footage after accounting for the 2 watts of solar PV per sq. ft. requirement.

Costs and Benefits of Proposed Code (Relative to Baseline Code)

Costs

Table 1 below highlights the assumptions of costs and calculations of incremental costs between the baseline code and the three proposed code compliance pathways.

Table 1: Costs for Baseline and Proposed Code

Baseline - Building Code (2017 Title 24 Building Code and City of Lancaster Code)		
Compliance with Title 24: High-Performance Attics and High-Performance Walls (prescriptive baseline)		
Option 1 - Install Solar PV System on-site	2500 square feet	3000 square feet
Requirement: W per square foot	2	2
Requirement: kW based on square foot	5	6
Cost of PV capacity (@ \$2800/kW)	\$14,000	\$16,800
Total Incremental Cost	\$14,000	\$16,800
Cost per Square Foot	\$5.60	\$5.60

Option 2 - Mitigation Fee	2500 square feet	3000 square feet
Requirement: Mitigation Fee @ \$1.40 per square foot		
Solar mitigation fee to meet ZNE ordinance	\$3,500	\$4,200
Total Incremental Cost	\$3,500	\$4,200
Cost per Square Foot	\$1.40	\$1.40
Option 3 - Hybrid / Solar and Mitigation Fee	2500 square feet	3000 square feet
Requirement: 2kW and Mitigation Fee @ \$1.40 per sq. foot for the balance of the watts installed and the required watts based on the square footage of each home.		
2kW PV system	\$5,600	\$5,600
Solar mitigation fee to meet ZNE Ordinance	\$2,100	\$2,800
Total Incremental Cost	\$7,700	\$8,400
Cost per Square Foot	\$3.08	\$2.80

Assumptions

High Performance Attics & Walls

Source: Communication with builders 2016	1.5	\$/SF
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Gross PV Cost

Source: Communication with builders 2016	\$4,000	\$/kW
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Federal Tax Credit (30%)	(\$1,200)	\$/kW
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Net PV Cost	\$2,800	\$/kW
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Solar Mitigation Fee	\$1.40	\$/SF
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Benefits

The energy cost savings resulting from the three compliance options relative to the baseline code are presented below in Table 2 and Table 3 for each prototype. The energy cost savings were derived from actual utility bills from Lancaster Choice Energy customers, and includes the costs of both electricity delivery and generation. Lancaster Choice Energy was able to identify customer data and used the same sized homes in the same neighborhood with and without solar to make a comparison. The rate of cost increases over time are assumed to be canceled out by the discount rate.

The benefits do not include the cost savings of a waiver from the landscape and irrigation requirements, or the resulting decrease in water utility bills.

There is no difference in natural gas benefits as a result of the proposed ordinance, given the focus of scope on photovoltaics.

In a few cases, the monthly electricity cost for prototype buildings with solar PV is negative as a result of net metering. The negative value in April for the 2,500 sq. ft. baseline home is a result of the one-time annual California Climate Credit as prescribed by the California Public Utilities Commission enabled by the Global Warming Solutions Act of 2006.³

Table 2: Electricity Cost Savings Analysis - 2,500 Sq. ft. Prototype

	Baseline Total (Delivery & Generation)	Option 1: Total	Option 2: Total (w/ discounted generation)	Option 3: Total (minus 2kw and discounted generation)
Jan-16	\$ 105.30	\$ 50.54	\$ 82.26	\$ 60.15
Feb-16	\$ 59.34	\$ 24.18	\$ 47.21	\$ 34.07
Mar-16	\$ 83.69	\$ (16.63)	\$ 67.89	\$ 27.66
Apr-16	\$ 11.89	\$ (81.02)	\$ 1.34	\$ (35.54)
May-16	\$ 55.50	\$ (59.01)	\$ 44.16	\$ (0.51)
Jun-16	\$ 61.35	\$ (2.28)	\$ 48.70	\$ 12.49
Jul-16	\$ 124.27	\$ 7.96	\$ 101.66	\$ 55.21
Aug-16	\$ 124.19	\$ 39.20	\$ 101.76	\$ 71.21
Sep-16	\$ 141.60	\$ 34.02	\$ 116.18	\$ 78.56
Oct-16	\$ 34.06	\$ (16.07)	\$ 19.31	\$ 1.72
Nov-16	\$ 54.23	\$ 17.28	\$ 43.40	\$ 30.32
Dec-16	\$ 91.55	\$ 41.67	\$ 70.36	\$ 49.41
TOTAL	\$ 946.97	\$ 39.84	\$ 744.20	\$ 384.74

Table 3: Electricity Cost Savings Analysis - 3,000 Sq. ft. Prototype

	Baseline Total (Delivery & Generation)	Option 1: Total	Option 2: Total (w/ discounted generation)	Option 3: Total (minus 2kw and discounted generation)
Jan-16	\$ 160.76	\$ 79.99	\$ 134.36	\$ 102.07
Feb-16	\$ 152.71	\$ 26.90	\$ 128.22	\$ 83.90
Mar-16	\$ 132.60	\$ 9.33	\$ 110.78	\$ 61.17
Apr-16	\$ 100.60	\$ (61.76)	\$ 78.39	\$ 16.88
May-16	\$ 124.10	\$ (21.49)	\$ 103.47	\$ 47.71
Jun-16	\$ 120.88	\$ 77.18	\$ 100.25	\$ 83.65
Jul-16	\$ 233.27	\$ 121.02	\$ 191.95	\$ 154.10
Aug-16	\$ 257.90	\$ 157.27	\$ 214.31	\$ 179.86
Sep-16	\$ 182.65	\$ 29.64	\$ 145.99	\$ 96.90
Oct-16	\$ 113.24	\$ (40.06)	\$ 88.36	\$ 29.10
Nov-16	\$ 163.95	\$ 18.09	\$ 138.06	\$ 87.05
Dec-16	\$ 170.85	\$ 188.13	\$ 135.27	\$ 130.83
TOTAL	\$ 1,913.51	\$ 584.24	\$ 1,569.38	\$ 1,073.22

³ <http://www.cpuc.ca.gov/climatecredit/>

Results: Benefit-to-Cost Ratio

Table 4 and 5 below summarize the benefits and costs from the above section, including the annual energy cost and savings, the life-time savings, and the incremental costs. The benefit-to-cost (B/C) ratio compares the lifecycle benefits (cost savings) to the lifecycle costs. Measures that have a B/C ratio of 1.0 or greater are cost-effective. The larger the B/C ratio, the faster the measure pays for itself from energy savings. The avg. B/C ratio of the three options for the 2,500 sq. ft single-story home is 1.96, and the 3,000 sq. ft. two-story home is 2.61.

Table 4: Lifecycle Cost Impacts for 2,500 sq. ft. Prototype

	Total Annual Energy Costs	Annual Energy Cost Savings	Benefit: 30-year Energy Cost Savings [A]	Cost: Incremental First Costs¹ [B]	Total Lifecycle (30-year) Cost Savings [C] = A – B	Benefit-to-Cost Ratio [D] = A/B
Baseline	\$ 946.97					
Option 1	\$ 39.84	\$ 907.13	\$27,213.90	\$14,000.00	\$ 13,213.90	1.94
Option 2	\$ 744.20	\$ 202.77	\$ 6,083.10	\$ 3,500.00	\$ 2,583.10	1.74
Option 3	\$ 384.74	\$ 562.23	\$16,866.96	\$ 7,700.00	\$ 9,166.96	2.19

Table 5: Lifecycle Costs Impacts for 3,000 sq. ft. Prototype

	Total Annual Energy Costs	Annual Energy Cost Savings	Benefit: 30-year Energy Cost Savings [A]	Cost: Incremental First Costs¹ [B]	Total Lifecycle (30-year) Cost Savings [C] = A – B	Benefit-to-Cost Ratio [D] = A/B
Baseline	\$ 1,913.51					
Option 1	\$ 584.24	\$ 1,329.27	\$ 39,878.10	\$ 16,800.00	\$23,078.10	2.37
Option 2	\$ 1,569.38	\$ 344.13	\$ 10,323.90	\$ 4,200.00	\$ 6,123.90	2.46
Option 3	\$ 1,073.22	\$ 840.29	\$ 25,208.81	\$ 8,400.00	\$16,808.81	3.00