APPENDIX D2

PV Loads Report

Integral Communities

North River Farms

Estimated PV Loads Report

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Introduction

The following report shows photovoltaic sizes required to support development planned for North River Farms and achieve the offset being shown in Integral Communities' CEQA reporting.

Residential Buildings

VCA Green utilized the draft language for the 2019 California Building Efficiency Energy Standards. Residential buildings under this code are expected to be zero net energy as defined by the California Energy Code. The code simplifies their expected photovoltaic (PV) requirements in Equation 150.1-C:

$$kW_{PV} = (CFA \times A) + B$$

where:

kW_{PV}	=	kW DC size of the PV system
CFA	=	conditioned floor area
A	=	Adjustment factor from Table 150.1-C
B	=	Dwelling adjustment factor from Table 150.1-C

A and B from Table 150.1-C for Oceanside's California climate zone are 0.000571663 and 1.145611739 respectively. Using this equation, we can calculate the required PV requirements for each of the single family homes

Zoning Categories	Average SF	kW system required	DU's	Total kW required
Riverside Village	2,361	2.495	250	623.827
Village Core	1,950	2.260	130	293.846
North Village	2,637	2.653	125	331.636
North Village	3,121	2.930	84	246.101
Hilltop Village	3,418	3.100	100	309.956
	MW requirement for single family homes			**1.805365**

Nonresidential Buildings

METHODOLOGY

For the conditioned buildings, energy use data for nonresidential buildings was gathered from one of two places. The US Department of Energy's Building Performance Database (BPD) is a collection of energy performance for a variety of building types across the nation. It has the capability to provide data based on specific geographical locations and building subtypes. Energy Star Portfolio Manager was utilized to crosscheck BPD data and as supplemental data when BPD data was unavailable.

Results from the databases are given in terms of Energy Use Intensities (EUI). EUI is common metric used to compare building energy use. It represents a building's energy use over the course of a year divided by its square footage. Electricity is converted to British Thermal Units so that EUI can be expressed one unit regardless of energy source—natural gas, propane, or electric. One EUI represents one kBtu/ft^2/year. EUI are given in two forms – site EUI and source EUI. Source energy includes transmission, generation, and distribution losses, while site energy includes only the electricity or gas consumed within the project boundary. For the purpose of these calculations, only site EUI is considered.

Department of Energy Building Performance Database

The data points for Energy Use Intensities provided by the Building Performance Database included: count, standard deviation, maximum, minimum, mean, and 25th, 50th, and 75th percentiles. In VCA Green's estimation, the projects built in North River Farms would operate somewhere in the 10th percentile. The BPD includes data from all over the state, from locations hotter and significantly colder than Oceanside. It only includes existing buildings, none of which were built under the 2016 energy code (a full year's data is required). North River Farms will be permitted under the 2019 energy code.

To estimate the energy use as the 10th percentile of the EUI listed in the BPD, we used the following assumptions:

- Oceanside's climate allows buildings to be 15% more energy efficient than average new building in California.
- Buildings represented under the 25th percentile are newer, most were permitted under the 2010 and 2013 energy codes.
- The average building permitted under the 2019 energy code will be at least 40% more efficient than the newer buildings listed in the BPD.
- North River Farms buildings will be around 8% more efficient than code (15% above the compliance margin).

With these assumptions, we estimate the energy use for most nonresidential building types at North River Farms to be 47% ((0.85)(0.6)(0.92)) of BPD's 25th percentile energy uses.

The following inputs were used in the BPD for the buildings listed:

NRF Building	BPD Region	BPD Space Type
Retail / Collaborative	California	Retail – Normal, Small Box, Strip Shopping, Uncategorized

Using the EUI found in the Building Performance Database for assumptions above, we were able to estimate the following energy uses for the Retail and Collaborative Work Space.

NRF Building	Area (sf)	Reference EUI (kbtu/sf/yr)	Adjustment Factor	Kbtu/year	kWh/year
Retail	3,250	30	0.47	134,268	39,341
Collaborative Work Space	3,250	30	0.47	134,268	39,341

Energy Star Portfolio Manager

Energy Star Portfolio Manager provides the median (50th percentile) for all buildings of each type nationwide, all of which are existing. The most recent data was taken from the US Energy Information Administration's Commercial Buildings Energy Consumption Survey (CBECS) in 2012.

To estimate the energy use as the 10th percentile of the EUI listed by Portfolio Manager, we used the following assumptions:

- Oceanside's climate allows buildings to be 20% more energy efficient than average new building in the United States.
- Buildings represented under Portfolio Manager's 50th percentile are newer.
- The average building permitted under the California's 2019 energy code will be at least 50% more efficient than buildings surveyed in 2012.
- North River Farms buildings will be around 10% more efficient than building energy codes for regulated and unregulated energy (8% above CA compliance margin).

With these assumptions, we estimate the energy use for most nonresidential building types North River Farms at be 36% ((0.8)(0.5)(0.90)) of the 50th percentile energy uses. Using the EUI published by Energy Star's Portfolio Manager, we were able to estimate the following energy uses for the Restaurant and Hotel.

NRF Building	Area (sf)	Reference EUI (kbtu/sf/yr)	Adjustment Factor	Kbtu/year	kWh/year
Restaurant	5,000	223.8	0.36	402,840	118,032
Hotel	66,000*	73.4	0.36	1,743,984	510,987

*Hotel size was given by Integral in number of rooms only. After aggregating data from similar projects, VCA used the 400 sf per room plus 150 sf of additional area for support, circulation, and amenities.

Unconditioned Buildings

There was insufficient data in the Building Performance Database or Portfolio Manager for the unconditioned buildings. VCA Green estimated that the buildings would consume electricity per the table below.

NRF Building	Indoor SF	Indoor Lighting LPD (w/sf)	Indoor Misc. Energy (w/sf)	Hours per Year	Outdoor SF	Outdoor LPD (w/sf)	Total kWh
Maker Space*	10,000	0	0	3,120	5,000	0.45	5,256
Ecology Center	3,500	0.7	0.75	2,080	1,250	0.45	12,199
Grocer / Farmer's Market	5,000	0	0.15	728	15,000	0.45	20,256
Agriculture Building	4000	0.4	0.1	2,500	1,000	0.45	6,314

*Assumed to be a cold/dark shell. Calculations do not consider energy use of future occupants. Only outdoor lighting is considered.

PV SIZING FOR NONRESIDENTIAL BUILDINGS

While PV sizing for residential is specified in the 2019 code, an additional calculation is required to convert annual energy use into a sized system. Using data from the National Renewable Energy Laboratory, VCA Green calculated a sizing conversion for the location. For a south-facing fixed system, with 11% system loss, and tilt optimized for the location, a 1 kW system will produce 1686 kWh/year. Note that VCA Green sizing calculation is for illustrative purposes only. VCA Green recommends consulting with a solar consultant for final system sizing of nonresidential buildings (using VCA Green calculations for annual energy use).

NFR Building	Annual Energy Use (kWh/year)	PV System Size (kW)
Maker Space	5256	3.1
Restaurant	118,032	70.0
Ecology Center	12,199	7.2
Retail	39,341	23.3
Collaborative	39,341	23.3
Grocer / Farmers Market	20,256	12.0
Hotel	510,987	303.1
Total kW requirement for affordable housing component		442

Conclusion

In total, approximately 2.25 megawatts of photovoltaic panels or other renewables would need to be installed. This accounts for 1.805 megawatts for 689 housing units and 442 kilowatts for the nonresidential building.