Balancing Zero

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ABSTRACT

Community-scale developments represent unique opportunities and challenges to achieve zero energy. However, sustainability goals and zero net energy requirements are just some of the many criteria developers and builders must consider. With early integration and the correct use of energy modeling tools, passive design analysis, budgeting, and renewable energy, it is possible to influence the adoption of a net zero community without compromising other project goals. This paper takes a deep-dive into a utility program case study of a two million square foot mixed-use, zero net energy community development in Santa Clarita Valley, California, highlighting the process of balancing energy efficiency goals, market realities, and the associated project development uncertainties. This community is designed as an innovative live, work, walk and ride community with a new Metrolink station, transit center, electric vehicle charging stations, trail system, office and retail spaces, and strong water and energy conservation goals.[1] Early modeling efforts considered options for the layout of the residential portions of the plan to help inform multi-family building selection, optimizing the building orientations and layout based on passive design opportunities, energy efficiency and roof-top solar energy generation opportunities. The energy efficiency and passive design recommendations were quantified through various methods (energy modeling, computational fluid dynamics, daylighting and glare analysis, economic evaluation, etc.). This was followed by an in-depth analysis of photovoltaic systems required to meet solar generation goals, including a study of roof-top availability compared to ground-mounted solar. This paper presents lessons learned for this project while balancing many, sometimes competing, objectives.

Introduction

Community-scale developments represent unique opportunities and challenges to achieve zero energy. However, the development process is about more than just balancing zero net energy; it is also about balancing developers' responsibilities. Although the main goal for energy consultants is to conserve energy, the developers have additional goals (i.e. construction timelines, owner's interests, marketability, costs and responsible parties, design guidelines, architectural styles, coordinating project teams, development layout, PV locations, etc.). With early integration and the correct use of energy modeling tools, passive design analysis, budgeting, and renewable energy, it is possible to influence the adoption of a net zero community without compromising other project goals. This paper covers how these goals can be achieved through a utility program such as Southern California Edison's Sustainable Communities Program (SCP). The SCP implements a strong analysis strategy while understanding and respecting the importance of all the developer's goals. This is explained through a deep-dive into one of SCP's community-scale projects.

[1] www.vistacanyon.com

ZNE Opportunities and Challenges

Zero Net Energy (ZNE) Community Developments can be large, complex endeavors that can span almost a decade from concept to completion with multiple phases of construction, building code upgrades, and an overwhelming number of involved parties. Examples include Meritage Homes[2], Pacific Housing's 2500 R Street Zero Net Energy Community Development[3], and West Village[4] near the University of California, Davis. Potential challenges associated with energy goals for projects of this scale include competing goals and priorities, as well as a lack of education about efficiency options, constructability, and future building codes.

As sustainability consultants, all of these challenges must be kept in mind in order to take full advantage of the great ZNE opportunities of a large-scale development, such as community-scale photovoltaic systems, transportation and walkability, Design Guidelines (Tenant Guidelines), and program layout and orientation. Early integration, education, practicality and balancing goals are of the utmost importance for success.

These opportunities and challenges are key drivers for how project support is implemented through Southern California Edison's Sustainable Communities Program.

Sustainable Communities Program

Southern California Edison (SCE) developed the Sustainable Communities Program (SCP) to encourage and support the construction of zero net energy buildings and sustainable community developments. The SCP is an innovative program focusing on commercial, mixed-use, and/or multiple building new construction projects willing to commit to aggressive energy efficiency and sustainable design goals. By way of design assistance, SCP supports the inclusion of sustainable and energy efficient features in new construction, major retrofits, and master planned community projects. The SCP targets commercial and residential project teams striving to achieve aggressive energy efficiency goals that aspire to reach zero net energy potential.

The SCP expands the traditional focus of utilities from building shell, HVAC, and lighting and controls, to include complete sustainable development – addressing design and construction practices that affect occupant health and environmental well-being, as well as lowered energy use. SCP is also leading the way to overcome the following common Zero Net Energy (ZNE) barriers in the field:

- **Funding.** Projects accepted into the Sustainable Communities Program receive no cost customized design and technical assistance, depending on project size and scope.
- **Constructability and Education.** SCP brings the ability to understand, teach, and incorporate sustainable design to projects by working with developers, MEP engineers, architects, etc. (i.e. through eco-charrettes and education sessions). SCP also can create Design Guidelines.
- **Early Integration.** SCP begins work on a project during the early stages of development in order to integrate sustainability measures before too many decisions, drawings, and details have been decided. Incorporating sustainability measures too late in the design process can often result in added costs of rework.

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[2]http://cleantechnica.com/2015/04/28/first-zero-net-energy-community-california-announced/
[3]http://www.cleanegroup.org/ceg-projects/resilient-power-project/featured-installations/2500-r-street/
[4]http://cityminded.org/two-thousand-live-net-zero-and-love-it-13361

Project Information

Vista Canyon is designed as an innovative new live, work, walk and ride community. The new community, nestled amid Santa Clarita Valley's mountains and winding river corridor, will include: 295 homes for sale, 805 apartments for rent, and 950,000 square feet of office, hotel and retail space. Additionally, a new Metrolink station and transit center, and a trail system will make it easy to get to and from Vista Canyon by car, rail, bus or bike. The Vista Canyon development is planned as a sustainable development and includes many water conservation, energy conservation, and sustainable material use initiatives.

Analysis Methodology

One of SCP's main goals is to aid in the development of ZNE buildings and communities. In simplest terms, a Zero Net Energy[5] building is highly energy efficient and produces enough renewable energy to meet or exceed its own annual energy use. To reach ZNE, project teams incorporate passive design strategies to reduce energy projections (or load) as low as possible, then specify the most efficient energy consuming equipment, which then creates the most cost effective opportunity to install renewable energy sources to offset the remaining energy load. Passive design strategies may include (but are not limited to) using advanced daylighting, natural ventilation and passive solar design. As seen in Figure 1, there is a specific loading order in which to implement EEMs to optimize savings and minimize annual energy use.

Figure 1. Path to ZNE. *Source*: DNV GL.

Case Study Results

Early modeling efforts considered options for the layout of the residential portions of the plan to help inform multi-family building selection, optimizing the building orientations and layout based on passive design opportunities, energy efficiency and roof-top solar energy generation opportunities. The passive design and energy efficiency recommendations were quantified through various methods (energy modeling, computational fluid dynamics, daylighting and glare analysis, economic evaluation, etc.). This was followed by an analysis of

[5] A Zero Net Energy building or community utilizes on-site renewable energy to produce as much, or more, energy as it uses in a given year. ZNE may still be grid-connected for power supply during times when its on-site renewables are not generating power. See also: http://energy.gov/eere/buildings/downloads/common-definition-zero-energy-buildings

photovoltaic systems required to meet solar generation goals, including a study of roof-top availability compared to ground-mounted solar. This section of the paper covers the results from benchmarking, energy modeling, daylighting, solar orientation, and wind analysis studies.

Benchmarking Results

In order to determine the amount of renewable energy required for Vista Canyon to achieve zero net energy status, we first estimate the annual energy use of the development. Average energy use calculations are based on results of the California Commercial End Use Survey (CEUS) and the United States Energy Information Administration's Residential Energy Consumption Survey (EIA RECS.) These surveys include actual energy use information from over 12,000 homes and a random sample of 2,790 commercial facilities[6] to create a baseline energy benchmark. This existing building stock includes many homes built according to older, less-stringent (or non-existent) vintages of building code, and therefore the average energy use intensity (EUI) for Vista Canyon's buildings is modified to be lower. These results were then used to estimate the required size of a photovoltaic (PV) system for the development to be ZNE (produce at least as much energy as the development consumes).[7] This was then used to confirm ZNE feasibility and suggest possible locations for the PV array.

At an early stage in the project, when building design details are not yet available, benchmarking is an appropriate form of analysis to provide an estimated value of annual energy consumption for the community. Estimates assuming equivalent energy use to the California benchmark as well as estimates including a 50% reduction are included. While it is likely that some homes in the community will use more energy than the benchmark average, we believe that due to the inclusion of ultra-high efficient building systems and level of construction that the community's average will be 50% below the benchmark average and PV sizing should be based on this estimate. The Vista Canyon is estimated to use 10.2 million kWh per year (see Table 1).

Table 1. Energy Use per Space Type in Vista Canyon.

Housing Type	Total Area (sf)	EUI (kWh/sf/yr)	Benchmark Energy Use (kWh)	Benchmark with 50% Savings (kWh)
Single Family Housing	531,000	11.3	5,974,387	2,987,194
Multi-Family Housing	714,950	11.7	8,379,214	4,189,607
Office	575,400	5.6	3,222,240	1,611,120
Hotel	156,100	14.1	2,201,010	1,100,505
Retail	186,500	2.9	540,850	270,425
Theater	32,000	4.1	131,200	65,600
Totals	**2,195,950**	**-**	**20,448,901**	**10,224,451**

[6] http://www.energy.ca.gov/ceus/

[7] There are two common definitions for ZNE: Site and Equivalent (TDV). The most common definition of ZNE; a ZNE Site building produces at least as much energy as it uses annually when accounted for at the building site. All fuels used and generated within the site such as electricity, natural gas, and propane are converted to a common metric. A ZNE Equivalent building produces at least as much societal energy as it uses annually when accounted for at the building site. Societal energy is calculated using a methodology called time dependent valuation (TDV), which values energy differently depending on time, day and season of use, location, and fuel type. Weighting factors are used for every hour of the year to better reflect actual costs to users, utility systems, and society.

The most prevalent distributed renewable energy resource at building scale is far and away solar photovoltaic (PV) energy. Over the past five years, prices for solar panels have dropped substantially, and are now below $0.36 per watt.[8] As solar installers have grown to scale and governments have streamlined permitting, installation costs are also dropping rapidly. All the while, improvements in technology have increased the efficiency of PV modules and inverters, meaning that fewer panels need to be installed to realize the same annual kWh of energy. Additionally, solar power creates energy when the grid needs it most. The Cal ISO grid sees peak demand at the hottest parts of the day when air conditioning energy use is at its maximum (according to Enersource's Energy Savings & Tips). This is also the time when solar panels produce maximum output.

All these factors make solar PV the ideal option for renewable power generation at the new community. The following calculations are based on 2014 pricing (when the analysis was originally performed) and efficiency, and outline the path to a 100% renewable energy future at the Vista Canyon community. In order to meet Net Zero Energy with photovoltaic solar panels, the site will need approximately 470,000 ft2 (11 acres) of total site area (solar panels, circulation and spacing area), as shown in scale with the purple boxes in Figure 2. Total estimated cost of this installation is $18 million. This represents a ground-mounted solar array. The next step is to analyze the capacity for rooftop solar.

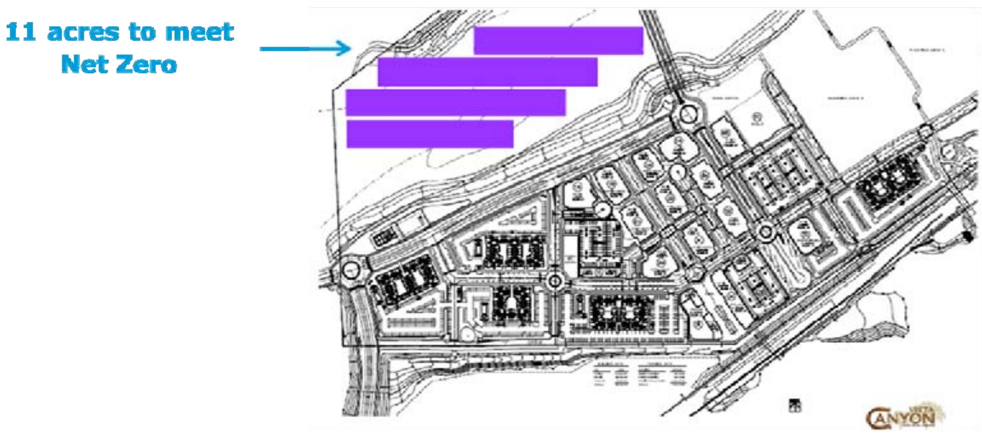


Figure 2. PV Area needed for Net Zero Site Energy. *Source*: DNV GL.

The predominant installation technique for distributed solar at community-scale is on buildings' roofs. It does not require additional acreage or structure, delivers energy where it is used, and, if designed correctly, does not have the perceived negative aesthetic impact sometimes associated with solar installations. It also transfers the cost of the renewable energy system to the prospective home owner, which lowers overall out-of-pocket cost for the developer and attracting home owners that value owning clean energy producing systems.

The California Energy Code now requires a minimum of 250 square feet of "solar-ready zone" on all new homes. This is area outside of fire-code related setbacks, oriented correctly (see recommendations on the next page), that is not shaded by trees or adjacencies, specifically designed for rooftop solar. This is not, however, enough to attain net zero energy status. The 295

[8] Bloomberg, New Energy Finance & pv.energytrend.com

single family homes planned on site will be required to provide a minimum area capable of providing 14% of Vista Canyon's total annual energy requirements.

A Net Zero Home will typically require a majority of the roof to be outfitted with solar panels. The efficiency of the solar panels increases (and the number of panels decreases) if the panels are south-facing with an upward tilt of the panel that equals the latitude of the site. Zero net energy on rooftops alone requires building orientation, street layout, and roof design to be considered for solar design at the onset. Below are the rankings of roofing types.

- **BEST: Shed Roof** - entire roof is south facing - most ideal setup
- **GOOD: Flat Roof** - gaps between angled solar panels to avoid shading, panels can also be placed flat on roof
- **GOOD: Well-Orientated Gable Roof** - only 50% covered by solar panels
- **BAD: Cross-Gable Roof, or (California) Hip Roof –** very little room for well-orientated solar panels that accommodate required setbacks from edges

Roof design has a significant impact on production potential. Where flat roof areas are possible, such as the Office Buildings, the Theater, and multi-family structures, they should be considered. However, rooftop PV alone may not meet the projects renewable energy goals. Other potential locations for solar panels include: parking shading structures, pool shading structures, picnic area and jungle gym shading, trellis features, skateboard park, ground-mounted solar, transit center, bus stops, and solar roads. Solar parking canopies have become very popular in Southern California over the past 5 years because they keep vehicles cool while parked and harvest solar energy in a location that would otherwise be wasted space. Energy savings implications include: generation of renewable energy, reduction in vehicle air conditioning use and associated gasoline use, as well as reduction in urban heat island and the resulting building air conditioning savings. Each shaded parking space provides a potential solar area of 162 square feet capable of hosting 2 kW producing roughly 3,000 kWh per year. Across the development, those 641 spaces yield 2 million kWh/year, which is 22% of the net zero requirements.

Wind Analysis Results

The wind analysis was performed using a simple Computation Fluid Dynamic model (and presented with Ecotect Analysis software) based on two alternate layouts with wind originating from most frequent prevailing direction (according to weather data from the local weather station). This is shown in Figure 3. Although wind is not an appropriate source of renewable energy for this site, by understanding the wind patterns through the site, the analyses informs the development layout in order to optimize the use of natural ventilation through operable windows in the buildings.

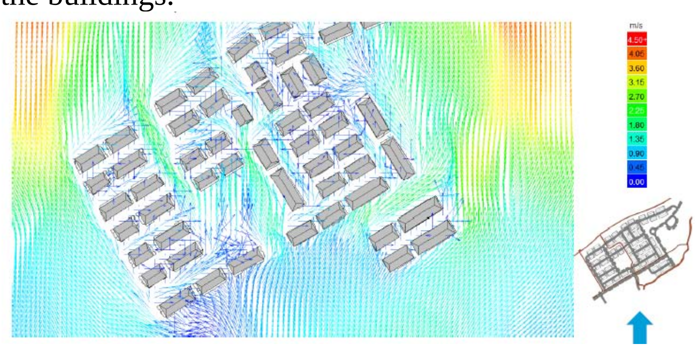


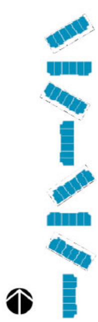
Figure 3. Ecotect Summer Wind Analysis. *Source*: DNV GL.

Solar Orientation Results

The solar orientation analysis was performed using models for energy consumption (EnergyPlus) and generation (Grasshopper for Rhino) for eight differing orientations. The models are shown in Figure 4 and the results are summarized in Table 2. This analysis then informed the development layout in order to optimize rooftop solar generation while minimizing energy consumption. Some of the key takeaways include:

- For the townhouse products, orientation matters to energy consumption (+/- 2-3 percent)
- Orientation (and roof design) matters more for PV production (+/- 6-8 percent)
- Ultimately the ability for this development to get to zero will require significant energy efficiency improvements (target 20-30 percent better than T-24 2013) and/or consider opportunities for community solar and public area solar production (may need to be 20-30 percent of energy).

Table 2. Summary of Solar Generation Results (Whole Building).



Rotation	Annual Energy Consumption (kWh)	PV Energy Generation (kWh)	% of Energy Consumption met by Roof PV Generation
1 (SE)	66,691	44,237	66%
2 (S)	66,468	44,982	68%
3 (SW)	66,674	44,971	67%
4 (W)	68,230	41,601	61%
5 (NW)	66,534	44,237	66%
6 (N)	66,313	44,982	68%
7 (NE)	66,560	44,971	68%
8 (E)	67,436	41,601	62%

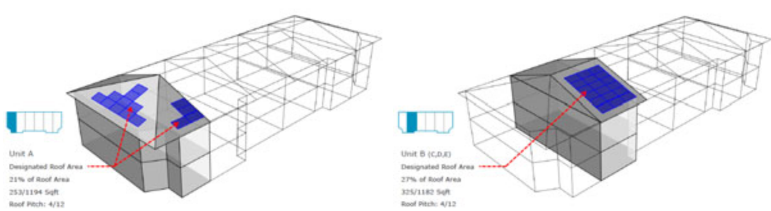


Figure 4. Solar Photovoltaic Locations. *Source*: DNV GL.

Energy Modeling Results

Detailed energy modeling was performed using models for energy consumption (EnergyPlus), which incorporated various energy conservation measures (i.e. improved envelope, lighting and HVAC systems) compared to a code-compliant (Title 24 2013) baseline energy model. This analysis then informed the building design (for an office building in the Town Center shown in Figure 5) in order to minimizing energy consumption while optimizing comfort in the space. Southern California Edison's (SCE) Sustainable Communities Program (SCP) partnered with JSB Development and Gensler to aid in the design of a 54,000 square foot Zero Net Energy (ZNE) office building in Santa Clarita, California (CA Climate Zone 9).

Figure 5. Office Building Perspective View. *Source*: Gensler.

There are 11 energy model iterations starting with the Baseline ("0-Baseline") which uses code minimum Title 24 2013 California Non-residential Prescriptive requirements. The following models cumulatively add in additional energy efficiency measures (EEM) with each version. The HVAC-alternatives (6a-6c) are then analyzed independently (but include all of the previous measures 1-5). Figure 6 shows the annual energy use for each of the models and how it reduces with each EEM. Table 3 summarizes results for each energy efficiency measure, their projected annual energy savings, and associated photovoltaic (PV) requirements to achieve ZNE.

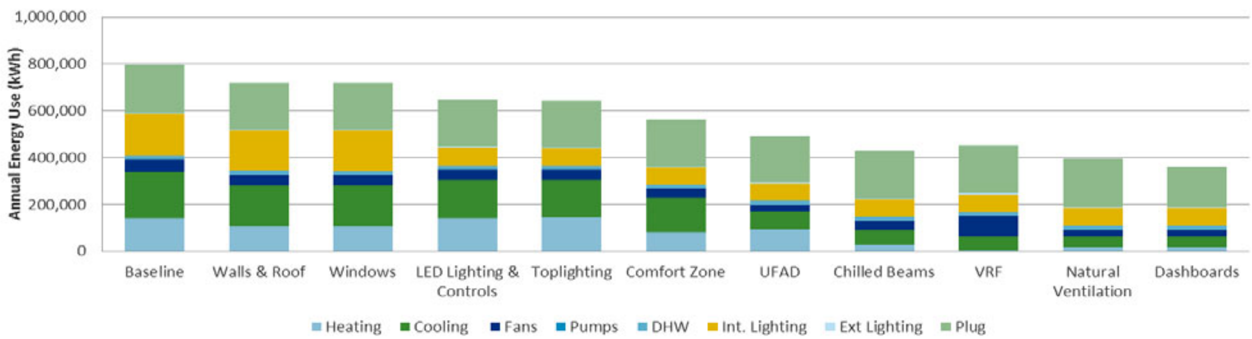


Figure 6. Annual Energy Consumption per Model. *Source*: DNV GL.

Table 3: Energy Efficiency Measures – Path to ZNE

#	Method	Annual Natural Gas Use (therms)	Annual Nat. Gas Savings (therms)	Annual Electricity Use (kWh)	Annual Electricity Savings (kWh)	Total Annual Energy Use (kWh)	Energy Use Intensity (kBtu/sf)	Estimated Resulting PV Size (kW DC)
0	Baseline	4,765	-	656,534	-	796,134	50	496
1	0+Walls & Roof	3,674	1,091	612,204	44,329	719,841	45	449
2	1+Windows	3,731	(57)	609,666	2,539	718,977	45	448
3	2+LED Lighting & Controls	4,859	(1,128)	504,835	104,830	647,192	41	403
4	3+Toplighting	4,909	(51)	498,635	6,200	642,483	40	401
5	4+Comfort Zone	2,811	2,099	480,183	18,451	562,544	35	351
6a	5+UFAD*	3,190	(379)	399,956	80,227	493,424	31	308
6b	5+Chilled Beams	0	2,811	429,839	50,345	429,839	27	268
6c	5+VRF*	0	2,811	451,132	29,052	451,132	28	281
7	6b+Nat. Vent.**	0	0	393,904	35,935	393,904	25	246
8	7+Dashboards**	0	0	363,248	44,965	363,248	23	226

*Not retained in modeled package of measures
**Savings for natural ventilation and dashboards cannot be guaranteed (dependent upon user interaction).

Below is a list of recommended measures.

- **Low Cost (or already a part of the design):**
  - Exterior walls: Decrease the U-Value to a maximum of 0.066 Btu/h-sf-F with R15 interior cavity insulation and R10 exterior rigid insulation. This is currently part of the design; therefore, there is no added cost.
  - Roof: Decrease the U-Value to a maximum of 0.045 Btu/h-sf-F with an 11" concrete slab and 5" insulation. This is currently part of the design; therefore, there is no added cost.
  - Windows: Solarban 70XL (U-Factor = 0.27, SHGC = 0.27, and VT = 0.64) with operable interior blinds (VT = 0.05) and fixed exterior shading devices. This will increase energy savings and decrease potential glare conditions. The cost difference between these windows and the current design is minimal.
  - Lighting and Controls: Upgrade all lighting to LED lighting circuited for bi-level control. Connect all lights to occupancy sensors and daylighting sensors. Although LED lighting is more expensive to install than other lighting types (i.e. CFL), LEDs have control capabilities built in whereas other lighting types require added costs for controls. Therefore, the overall cost of lighting and controls is comparable between the two.
  - Comfort Zone: Set heating setpoint at 68 F and cooling setpoint at 78 F. This can be done at no added cost.
- **Medium Cost:**
  - Window Controls: Connect all windows to an interlock system which shuts off the AC compressor when windows are open.
  - Tubular Daylighting Devices: Install 6-10 devices on the third floor. This will decrease the need for artificial lighting and therefore lower electric costs.
  - Dashboards: Mount a dashboard in the main lobby that displays the building's real-time energy consumption by end use (lighting, plug, HVAC, etc.). This can reduce the plug load by approximately 10%.
  - Gamification: Add additional submeters/sensors in order to display and download (in common format) energy use per tenant – make it a competition between spaces. This can reduce the plug load by an additional 10%.
- **High Cost:**
  - HVAC System: There are multiple options for HVAC systems. Currently the most efficient system is active chilled beam with chiller (6.5 COP) and electric baseboard heating. Other systems can still be assessed based on the design requirements and restrictions of the office building. This will require further discussion with the design team.
  - PV: Photovoltaics (PVs) can be purchased to meet the remaining energy consumption of the building. Currently, the rooftop is not large enough for all the required PV for a zero net energy office building. Additional PV can be ground-mounted or used shading for parking areas.

Daylighting Analysis Results

The daylighting analysis was performed using computer-based models (DIVA for Rhino) to analyze illuminance and glare based on varying window and shading options for one of the office buildings in the development's town center. This analysis then informed the window and shading selection in order to minimize glare and maximize natural daylighting. In turn, the natural daylighting saves energy by minimizing the demand for artificial lighting. The following are the final glazing recommendations for this building:

- Solarban 70XL (Visible Transmittance of 64%)
- Operable windows for natural ventilation
- Additional fixed exterior shading on southeast and southwest façades
- Operable interior blinds (Visible Transmittance of 5%)
- Toplighting for Level 3

Table 4: Illuminance Study Results

Option	Sept 21	% Floor Area w/Insufficient Lighting (below 25 fc)	% Floor Area w/Desirable Lighting (25-250 fc)	% Floor Area w/Potential Glare (above 250 fc)
Vt28%	9am	72%	25%	3%
	3pm	80%	18%	2%
Vt47%	9am	56%	41%	3%
	3pm	59%	39%	2%
Vt64%	9am	40%	57%	3%
	3pm	38%	60%	2%

The range of 25-250 foot candles is considered an acceptable lighting level range for typical office operations. Anything that exceeds the 250 foot candle range is considered to have potential glare issues. Over 50% of the building's floor area (whole building average) will experience insufficient natural daylighting for typical office and retail operations when using windows with a visible transmittance of 28% or 47%. These illuminance tests were conducted for 9am (as seen in Figure 7) and 3pm on September 21st (equinox) and are summarized in Table 4. Windows with a visible transmittance of 64% result in desirable natural daylighting for over 50% of the building's floor area.

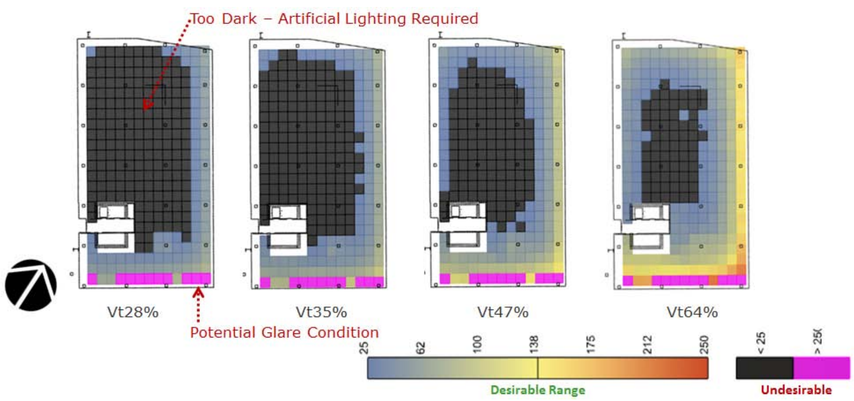


Figure 7. Illuminance Analysis-Level 1-9am. *Source*: DNV GL.

Glare Analysis was conducted for Model 1 (Vt28%) and Model 4 (Vt64%) at 9am on September 21st (equinox) for two different camera angles on Level 3 of the building. Original results yielded "Perceptible" glare for Model 1 (in Figure 8) and "Intolerable/Disturbing" glare for Model 4. By adding operable interior blinds (with a visible transmittance of 5%) the glare condition was reduced to an acceptable level of “Imperceptible/Perceptible” for Model 4.

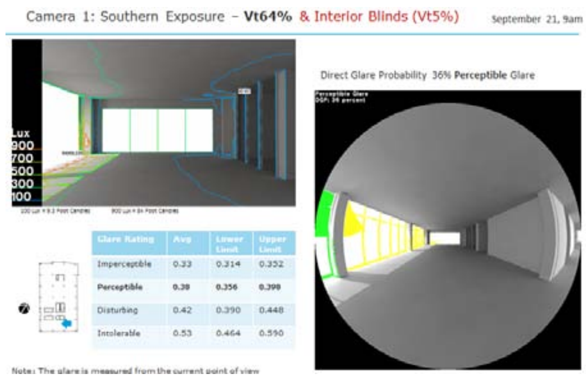


Figure 8. Glare Analysis-Southern Exposure. *Source*: DNV GL.

Daylight Autonomy (DA) is the percentage of the time-in-use that a certain user-defined lighting threshold is reached through the use of just daylight. Daylight Autonomy was analyzed for a typical work day (8am to 6pm) using windows with a visible transmittance of 64% for maximum daylight. Each model was run at 25fc (low range of acceptable lighting for typical operations) and 200fc (high range – above which could result in a potential glare condition). Ideal results would be for the “DA 25fc” area to be as large as possible (indicating that sufficient daylight—greater than 25 fc—is reaching the space) and as small as possible for “DA 200fc” areas (to mitigate the potential for glare—defined as greater than 250 fc). Model 5 (Vt64%) resulted in a mean DA 200fc of 9% with 4% of the floor area has a DA larger than 50%. In order to reduce these values, fixed exterior shading was added to the model on the southeast and southwest facades for Model 6.

Conclusion

To recap, early modeling efforts considered options for the layout of the residential portions of the Vista Canyon plan to help inform multi-family building selection, optimizing the building orientations and layout based on passive design opportunities, energy efficiency and roof-top solar energy generation opportunities. The energy efficiency and passive design recommendations were quantified through various methods (energy modeling, computational fluid dynamics, daylighting and glare analysis, economic evaluation, etc.). This was followed by an in-depth analysis of photovoltaic systems required to meet solar generation goals, including a study of roof-top availability compared to ground-mounted solar. This type of analysis is not typically done at this stage and often does not include qualitative studies at any stage. The modeling process however offers the developer information on the performance of the project and the ability of the design to meet future goals and requirements thereby improving the development investment and minimizing project risk.

Due to its natural climate with 280 sunny days per year, consistently comfortable temperatures, and natural breezes, Vista Canyon has enough renewable energy potential to be energy independent on an annual basis. Solar energy has the highest potential at the site, with the capability of producing more than the community will consume by installing solar panels on homes, as shading in recreational areas, and on planned trellis features.

Throughout this project we came across a handful of lessons learned and market realities. The first lesson learned is the challenge of balancing many, sometimes competing, objectives in the development of community-scale ZNE. Although the main goal for energy consultants is to conserve energy, the developers have additional goals (i.e. construction timelines, owner's interests, marketability, costs and responsible parties, design guidelines, architectural styles, coordinating project teams, development layout, PV locations, etc.). It is essential to understand and respect the importance of the developer's goals while trying to align energy conservation.

A second lesson, from the developer's perspective, is that there are some roadblocks to getting energy efficiency measures implemented in a typical project. For example, one main issue is change of ownership. Although the developer owns the properties and is responsible for the entitlement and site preparation (i.e. horizontal development), they will be selling portions of the entitled land before the vertical development begins. This affects how upfront costs and payback costs are viewed. Additionally, if they construct an energy efficient building but do not hold it, they do not see the payback of the upfront cost.

One way of ensuring the implementation of energy efficiency measures on for-sale lots is through the development of energy performance design guidelines. However, there is some hesitancy of making them too specific, which is perceived to add cost to the project, which results in a lower cost of land if there is a perception that the construction costs will increase, which can mean less profit for the developer. When energy efficiency measures no longer result in cost savings for the developer due to ownership structures, the energy goals can be encouraged through marketing and education. Energy efficiency is important to certain end users; therefore, if the development is marketed as a sustainable development, it generates increased interest and final sales.

Vista Canyon is still in early stages of development and is carefully weighing all sustainable recommendations in hopes to incorporate as many as feasibly possible. They will be breaking ground this year. SCE's Sustainable Communities Program will continue to be involved as the project progresses and aid as needed (i.e. drawing reviews). Additionally, they are coordinating with SCE's Savings By Design program to provide incentives and claim energy savings.

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