

Appendix G

**Ramboll Memorandum Regarding
GHG Analysis**

G1

Memo Describing the Components of the GHG Mitigation Toolbox

MEMO

Date February 24, 2016
To Chevis Hosea, Squaw Valley Ski Corporation
CC Gary Jakobs, Ascent Environmental
Alexander Fisch, Placer County Community Development Resource Agency
From Michael Keinath
Megan Neiderhiser
Re **Squaw Valley Village GHG Mitigation Toolbox**

Date February 24, 2016

Dear Mr. Hosea:

Ramboll Environ US Corporation (“Ramboll Environ”) has compiled a greenhouse gas (GHG) mitigation “toolbox” to assist in quantifying the reduction in GHG emissions that are expected from implementation of various available measures associated with the Village at Squaw Valley project and consistent with the Draft Environmental Impact Report (DEIR) mitigation measures for GHG. The analyses are intended to support the Final Environmental Impact Report (FEIR) and demonstrate how reductions can be achieved. This memorandum discusses the methodologies and potential use of the toolbox.

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Project Background

Ascent Environmental conducted a GHG analysis for the Project operational emissions in 2020 and 2037. Emissions sources include energy consumption from the built environment (electricity and propane use), mobile (traffic) emissions, and water and waste emissions. The DEIR also considered a “Business-as-Usual” (BAU) scenario in 2020.

Mitigation Measure Calculations

Ramboll Environ compiled a Microsoft Excel “toolbox” to assist in quantifying GHG emissions reductions from the Project. The toolbox contains approximately 25 reduction strategies, with quantification methodology and assumptions for each strategy. Most strategies are measures that the developer can choose to adopt, but the toolbox also presents refinements to the modelled assumptions that will reduce the Project emissions whether or not mitigation strategies are adopted.

Example strategies include the following:

- Installing solar panels on rooftops
- Installing Energy Star® appliances instead of conventional appliances
- Third party HVAC commissioning of non-residential buildings
- Replacing low-efficacy street or building lighting with LED lighting
- Exceeding Title 24 Building Energy Efficiency Standards
- Reducing the number of propane hearths
- Adding insulating covers on all pools and spas
- Installing electric vehicle charging stations for visitors
- Replacing diesel or gasoline transit buses with electric transit buses
- Planting additional trees

In addition to these example strategies, Ramboll Environ included a few potential refinements to Ascent Environmental's model into the toolbox. These potential refinements should result in a more accurate GHG emissions inventory. This is because Ascent took a conservative approach by not assuming GHG reductions from implementation of certain existing and future regulatory requirements.

Potential model refinements that were not used by Ascent in preparation of the FEIR include the following:

- Accounting for emissions benefits from the California 75% solid waste diversion goal (as shown in Toolbox Measure # 37)

The GHG emission reductions associated with each strategy is given in i) a "per unit" metric, e.g. metric tons of CO₂e per 1000 square feet (or other unit) per year, or ii) a "project total" metric tons of CO₂e per year. The "per unit" reductions can be scaled depending on the number of units the Project is able to commit to. For example, installing 10 electric vehicle charging stations will give the GHG emissions reduction of 10 x the per unit reduction. The "project total" set of reductions is based on the land uses and emissions assumed in the Dry Utility Master Plan and CalEEMod® models. For example, the GHG reduction from updating the electricity emission factor to incorporate the 33% and 50% Renewable Portfolio Standards is applied to the total project electricity emissions.

Example Scenario

An example scenario including select measures and benefits is displayed in Table 1. Potential model refinements are included in the example.

Measures include:

- Install Energy Star Appliances (measures # 2-6)
- Third Party HVAC Commissioning (measures # 7-8)
- LED Street Lighting and Energy Efficient Lighting plus Occupant Sensor Lighting Controls (measures # 10-11, 23)
- Exceed 2013 Title 24 Requirements by 15% (measure # 24)
- Covers on pools and spas (measure # 30)
- Plant additional trees on-site (measure # 36)
- Removal of Propane Hearths (measure # 38)

- Electric vehicle charging stations (measures # 39-40)
- Transit Improvement Measures (measures # 41-46)
- Other VMT Reduction Measures (measures # 47-55)

Energy Efficient Lighting (measure #11) overlaps with Occupant Sensors (measures #22 and #23). Table 1 shows reductions for these measures as if they were implemented individually. If there are dwelling units which have both energy efficient lighting and occupancy sensors, the user cannot quantify both reductions. Instead, the savings generated by implementation of occupancy sensors should be applied only to the emissions reduced by energy efficient lighting. Therefore, since measure #11 provides improvements of 75%, only 25% of the reductions from measures #22 and #23 can be quantified. Similarly CAPCOA measures # 41 – 46 are limited to 20% in VMT reductions in total, and the toolbox reflects that limitation.

Total MT CO₂e reductions using this example are 5,627 MT CO₂e in 2020 and 5,097 MT CO₂e in 2037.

Caveats

Care should be taken to avoid double-counting emissions reductions benefits. While many strategies are additive, some may overlap. Reductions in building energy emissions can come from improvements over Title 24, Energy Star® appliances, energy efficient lighting, and HVAC commissioning; the GHG benefits if all four strategies are chosen will be less than the sum of each individual benefit. Ramboll Environ has noted items in the toolbox “Guidance” column.

The calculation benefits of certain measures use substantiated methodology, but do not necessarily represent emissions savings that can be readily taken from the existing emissions inventory. CalEEMod® does not explicitly quantify GHG emissions from street lighting, so a reduction from installing LED street lights cannot be directly subtracted from the inventory.

Conclusion

In conclusion, the mitigation toolbox can be used to estimate potential GHG reductions from the Project for incorporating selected measures. In some cases, the reductions present a range of possible GHG benefits. Per the tool interface, the user can enter amount of commitment to each proposed measure and tally potential reductions. This tool should be used to inform future decision making and demonstrate how achievement of GHG reductions may be realized to ensure the Project does not conflict with AB 32. It is not intended to be a list of required commitments for the Project.

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Toolbox of Measures that Could Reduce GHG Emissions

Village at Squaw Valley

Table 1. Example Application of GHG Mitigation Measure Toolbox

				User Input					
Measure	Category/ Sector	Guidance	Amount [user enter]	Units	Reduction Metric 2020	Reduction Metric 2037	MT CO ₂ e Avoided (2020)	MT CO ₂ e Avoided (2037)	
1 Solar panels on rooftops	Conventional Electricity Replacement	Energy	[Suggestion: 1 system per unit, or 1 system per ~2,000 commercial sqft]. Should not exceed total electricity GHG emissions after other reductions.	0	# systems	6.95E-01	5.19E-01	0.0	0.0
	Propane Replacement	Energy	Should not exceed total propane GHG emissions	0	# systems	4.58E-01	4.58E-01	0.0	0.0
2	Install Energy Star Appliances ¹	Clothes Washer	[Suggestion: 1 per unit]. Potential overlap with other Energy Star reductions	650	# of appliances	0.048	0.036	31.2	23.3
3		Clothes Dryer	[Suggestion: 1 per unit]. Potential overlap with other Energy Star reductions	650	# of appliances	0.050	0.037	32.5	24.3
4		Refrigerator	[Suggestion: 1 per unit]. Potential overlap with other Energy Star reductions	650	# of appliances	0.029	0.022	18.9	14.1
5		Dishwasher	[Suggestion: 1 per unit]. Potential overlap with other Energy Star reductions	650	# of appliances	0.027	0.020	17.4	13.0
6		Ceiling Fan	[Suggestion: 1 per unit]. Potential overlap with other Energy Star reductions	1950	# of appliances	0.002	0.001	3.8	2.8
7	Third Party HVAC Commissioning	Residential	[Up to total square footage of residences]. Potential overlap with Title 24 reductions and building envelope efficiencies.	500	1000 sf	0.44	0.34	220.5	169.1
8		Commercial	[Up to total square footage of non-residential buildings]. Potential overlap with Title 24 reductions and building envelope efficiencies.	200	1000 sf			88.2	67.7
9	Using CFC-free HVAC & R based building system	Refrigerants	Not applicable to the Villages at Squaw Valley, unless CFC and Refrigerant based systems are in use						
10	LED Street Lighting	Energy	Street lighting emissions not quantified in original analysis; this reduction would be an off-project 'offset'.	1	1000 lights	94.00	70.15	94.0	70.1
11	Energy Efficient Lighting	Energy	[up to total number of dwelling units]. Potential overlap with Title 24 improvements	0	# of Mid Rise Apartments	0.18	0.14	0.0	0.0
				850	# of Condo/Townhouses	0.24	0.18	207.5	155.1
12	Use Battery-based Systems to Store Off-Peak Electricity for Mid-day Peak Usage for Residential Land use	Energy	Not quantified. Small potential benefit with significant uncertainty. Can pursue further if interested.						
13	Use Battery-based Systems to Store Off-Peak Electricity for Mid-day Peak Usage for Commercial Land use	Energy	Not quantified. Small potential benefit with significant uncertainty. Can pursue further if interested.						
14	White roofs on all residential units	Energy	Not applicable to the Villages at Squaw Valley						
15	Cool Roofs	Residential	Not applicable to the Villages at Squaw Valley						
16		Commercial	Not applicable to the Villages at Squaw Valley						
17	Use Geothermal resources for snow clearing	Energy	Not applicable to the Villages at Squaw Valley						
18	Energy Star or equivalent windows	Energy	Not quantified separately. Overlaps with Title 24 Improvements and HVAC Commissioning.						
19	Participation in California Energy Commission's New Solar Homes Partnership (NSHP)	Residential	Not quantified separately. Assume adoption rate, then apply reductions from Solar panels on rooftops.						
20		Thermal	Not quantified separately. Overlaps with Title 24 Improvements and HVAC Commissioning.						
21		Ventilation	Not quantified separately. Overlaps with Title 24 Improvements and HVAC Commissioning.						

Village at Squaw Valley

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	Measure		Category/ Sector	Guidance	Amount [user enter]	Units	Reduction Metric 2020	Reduction Metric 2037	MT CO ₂ e Avoided (2020)	MT CO ₂ e Avoided (2037)
22	Occupant sensor control	Lighting	Energy	[Up to total number of dwelling units] Potential overlap with Title 24 Improvements and Energy Efficient Lighting.	0	# of Mid Rise Apartments	0.06	0.04	0.0	0.0
23					250	# of Condo/Townhouses	0.07	0.06	18.7	14.0
24	Title 24 Requirements	All new construction should exceed 2013 Title 24 by at least 15%	Energy	[0-100%] Reduction from 2008 Title 24 to 15% above 2013 Title 24 for residences. Potential overlap with HVAC and Energy Efficient Lighting. Reductions shown are applied after measures A and B	100%	% of square footage	50	38	50.2	37.5
25	California Energy Star Certified Homes Program	Residential	Energy	Not quantified separately. Overlaps with Energy Efficient Lighting, Energy Star homes, and Energy Star Appliances						
26	Building Envelope Efficiencies		Energy	Not quantified separately. Overlaps with Title 24 Improvements and HVAC Commissioning.						
27	Building Orientation Efficiencies		Energy	Not quantified separately. Overlaps with Title 24 Improvements and HVAC Commissioning.						
28	Small single-cell Solar Lighting		Energy	Not quantified.						
29	Small hydroelectric generation systems	See specific Plan page 6-15	Energy	Not quantified. Could further reduce electricity emissions.						
30	Covers on pools and spas		Energy	[0-100%]	100%	% of pools/spas with covers	1,496	1,496	1,496	1,496
31	Reduce Outdoor Water Consumption 20% (e.g., greywater or reclaimed water)		Water	Not quantified because GHG emissions from Water Consumption are very small in DEIR.						
32	Minimize water intensive landscaping such as turf areas		Water	Not quantified because GHG emissions from Water Consumption are very small in DEIR.						
33	Install water-conserving appliances and plumbing	Residential	Water	Not quantified because GHG emissions from Water Consumption are very small in DEIR.						
34	Install flow restrictors on lavatory, sink, and shower	Residential	Water	Not quantified because GHG emissions from Water Consumption are very small in DEIR.						
35	Install automatic fixture sensors and low-consumption fixtures	Commercial	Water	Not quantified because GHG emissions from Water Consumption are very small in DEIR.						

Village at Squaw Valley

Table 1. Example Application of GHG Mitigation Measure Toolbox

				User Input						
Measure	Category/ Sector	Guidance	Amount [user enter]	Units	Reduction Metric 2020	Reduction Metric 2037	MT CO ₂ e Avoided (2020)	MT CO ₂ e Avoided (2037)		
36	Aspen	Vegetation	This metric assumes a 40-year project lifetime.	50	# of trees	0.0176	0.0176	0.9	0.9	
	Soft Maple	Vegetation		100	# of trees	0.02165	0.02165	2.2	2.2	
	Mixed Hardwood	Vegetation		50	# of trees	0.01835	0.01835	0.9	0.9	
	Hardwood Maple	Vegetation		100	# of trees	0.02605	0.02605	2.6	2.6	
	Juniper	Vegetation		50	# of trees	0.00605	0.00605	0.3	0.3	
	Cedar/Larch	Vegetation		50	# of trees	0.0132	0.0132	0.7	0.7	
	Douglas Fir	Vegetation		100	# of trees	0.02235	0.02235	2.2	2.2	
	True Fir/Hemlock	Vegetation		50	# of trees	0.01905	0.01905	1.0	1.0	
	Pine	Vegetation		50	# of trees	0.01595	0.01595	0.8	0.8	
	Spruce	Vegetation		50	# of trees	0.01685	0.01685	0.8	0.8	
	Miscellaneous	Vegetation		50	# of trees	0.0177	0.0177	0.9	0.9	
37	Improved Waste Diversion	Waste	[Not adjustable. Assumes compliance with CA 75% waste diversion goal for Project]	n/a	[applied to total solid waste generation from DEIR]	n/a	n/a	69	69	
38	Reducing the Number of Propane/Natural Gas Hearths	Area	[Limited to the number of hearths to be installed]	250	# of hearths avoided	2.12E-01	2.12E-01	53.0	53.0	
39	Electric Vehicle Charging Stations	Visitors	Assumes 10 hours of charge per station per day	10	# of stations	38	24	376.4	244.0	
40		Transit Buses	Assumes a bus charges once per day at the charging station	10	# of buses	67	66	665.6	662.1	
41	Bicycle/Pedestrian Network*	Mobile	Reduction depends on extent to which the measure is adopted	1.00%	% VMT Reduction	1.58E+04	1.42E+04	158.3	142.4	
42	Car-Sharing Program (Low Emission Vehicles)*	Mobile	Reduction depends on extent to which the measure is adopted	0.39%	% VMT Reduction	1.58E+04	1.42E+04	61.7	55.5	
43	Employee Housing*	Mobile	Reduction depends on extent to which the measure is adopted	1.00%	% VMT Reduction	1.58E+04	1.42E+04	158.3	142.4	
44	Public/Mass Transit Improvements*	Mobile	Reduction depends on extent to which the measure is adopted	1.00%	% VMT Reduction	1.58E+04	1.42E+04	158.3	142.4	
45	Regional Transit Improvements*	Mobile	Reduction depends on extent to which the measure is adopted	1.00%	% VMT Reduction	1.58E+04	1.42E+04	158.3	142.4	
46	Incentives for transit systems*	monetary (traffic impact fee), preferred parking, etc.	Mobile	Reduction depends on extent to which the measure is adopted	1.00%	% VMT Reduction	1.58E+04	1.42E+04	158.3	142.4
47	Low-emission vehicle shuttle service within the Village to provide mobility for visitors, guests, and employees	Mobile	Reduction depends on extent to which the measure is adopted	1%	% VMT Reduction	1.58E+04	1.42E+04	158.3	142.4	
48	Low-emission/alternative fuel vehicle shuttle service within Olympic Valley	Program 1: fixed-route shuttles which go between Village at Squaw Valley and the Resort at Squaw Creek	Mobile	Reduction depends on extent to which the measure is adopted	1%	% VMT Reduction	1.58E+04	1.42E+04	158.3	142.4
49		Program 2: Peak-hour ski days only, fixed-route circulating hillside neighborhoods north of Squaw Valley	Mobile	Reduction depends on extent to which the measure is adopted	1%	% VMT Reduction	1.58E+04	1.42E+04	158.3	142.4
50		Program 3: dial-a-ride shuttles that circulate the hillside neighborhoods during non-peak-hour ski days	Mobile	Reduction depends on extent to which the measure is adopted	1%	% VMT Reduction	1.58E+04	1.42E+04	158.3	142.4

Village at Squaw Valley

Table 1. Example Application of GHG Mitigation Measure Toolbox

				User Input						
Measure	Category/ Sector	Guidance	Amount [user enter]	Units	Reduction Metric 2020	Reduction Metric 2037	MT CO ₂ e Avoided (2020)	MT CO ₂ e Avoided (2037)		
51	Transit services connecting Village with Remainder of Squaw Valley/Alpine Meadows	Service between the Village and other key lodging/residential areas in the Olympic Valley, most new vehicles will use alternative fuels	Mobile	Reduction depends on extent to which the measure is adopted	1%	% VMT Reduction	1.58E+04	1.42E+04	158.3	142.4
52	Transit services connecting the Village with the North Tahoe/Truckee Region	Provided during peak ski season, 3 routes (see Specific Plan page 5-30)	Mobile	Reduction depends on extent to which the measure is adopted	1%	% VMT Reduction	1.58E+04	1.42E+04	158.3	142.4
53	Enhanced Alternatives to the Private Automobile for Regional Access	Promote use of North Lake Tahoe Express Service	Mobile	Reduction depends on extent to which the measure is adopted	1%	% VMT Reduction	1.58E+04	1.42E+04	158.3	142.4
54		Promote charter bus services through marketing materials - ex. Discounts on lodging packages for groups traveling by charter bus	Mobile	Reduction depends on extent to which the measure is adopted	1%	% VMT Reduction	1.58E+04	1.42E+04	158.3	142.4
55		Partner with a ridesharing program for visitor access to the Truckee-Tahoe region as well as employee commute ridesharing	Mobile	Reduction depends on extent to which the measure is adopted	1%	% VMT Reduction	1.58E+04	1.42E+04	158.3	142.4
Total								5,735	5,178	
Adjusted Total**								5,627	5,097	

Note:

* Items 41-46: Mobile Reductions with CAPCOA Reductions Framework: **Measures should not sum to more than 20% reduction in VMT** (limit for a 'suburban center' in CAPCOA). More details on these measures are in tab 'Additional_Transport_Research' and <http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf>
 [Total annual VMT modeled for the Project is 44,104,014 miles per year]

** Adjusted total accounts for overlap of mitigation measure 11 with 22 and 23. Mitigation measures 22 and 23 are reduced by 75%. The total also does not include reductions from LED street lighting. The original analysis of the Village at Squaw Valley did not include emissions from street lighting, thus LED street lighting should be seen as a project "offset".

G3

GHG Reduction Calculations

Village at Squaw Valley

Table 1. Example Application of GHG Mitigation Measure Toolbox

User Input

Measure	Category/ Sector	Guidance	User Input		Reduction Metric 2020	Reduction Metric 2037	MT CO ₂ e Avoided (2020)	MT CO ₂ e Avoided (2037)	
			Amount [user enter]	Units					
1 Solar panels on rooftops	Conventional Electricity Replacement	Energy	[Suggestion: 1 system per unit, or 1 system per ~2,000 commercial sqft]. Should not exceed total electricity GHG emissions after other reductions.	0	# systems	6.95E-01	5.19E-01	0.0	0.0
	Propane Replacement	Energy	Should not exceed total propane GHG emissions	0	# systems	4.58E-01	4.58E-01	0.0	0.0
2	Install Energy Star Appliances ¹	Clothes Washer	[Suggestion: 1 per unit]. Potential overlap with other Energy Star reductions	650	# of appliances	0.048	0.036	31.2	23.3
3		Clothes Dryer	[Suggestion: 1 per unit]. Potential overlap with other Energy Star reductions	650	# of appliances	0.050	0.037	32.5	24.3
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7	Third Party HVAC Commissioning	Residential	[Up to total square footage of residences]. Potential overlap with Title 24 reductions and building envelope efficiencies.	500	1000 sf	0.44	0.34	220.5	169.1
8		Commercial	[Up to total square footage of non-residential buildings]. Potential overlap with Title 24 reductions and building envelope efficiencies.	200	1000 sf			88.2	67.7
9	Using CFC-free HVAC & R based building system	Refrigerants	Not applicable to the Villages at Squaw Valley, unless CFC and Refrigerant based systems are in use						
10	LED Street Lighting	Energy	Street lighting emissions not quantified in original analysis; this reduction would be an off-project 'offset'.	1	1000 lights	94.00	70.15	94.0	70.1
11	Energy Efficient Lighting	Energy	[up to total number of dwelling units]. Potential overlap with Title 24 improvements	0	# of Mid Rise Apartments	0.18	0.14	0.0	0.0
				850	# of Condo/Townhouses	0.24	0.18	207.5	155.1
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13	Use Battery-based Systems to Store Off-Peak Electricity for Mid-day Peak Usage for Commercial Land use	Energy	Not quantified. Small potential benefit with significant uncertainty. Can pursue further if interested.						
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19	Participation in California Energy Commission's New Solar Homes Partnership (NSHP)	Residential	Not quantified separately. Assume adoption rate, then apply reductions from Solar panels on rooftops.						
20	Occupant sensor control	Thermal	Not quantified separately. Overlaps with Title 24 Improvements and HVAC Commissioning.						
21		Ventilation	Not quantified separately. Overlaps with Title 24 Improvements and HVAC Commissioning.						
22	Lighting	Energy	[Up to total number of dwelling units] Potential overlap with Title 24 Improvements and Energy Efficient Lighting.	0	# of Mid Rise Apartments	0.06	0.04	0.0	0.0
23				250	# of Condo/Townhouses	0.07	0.06	18.7	14.0
24	Title 24 Requirements	Energy	[0-100%] Reduction from 2008 Title 24 to 15% above 2013 Title 24 for residences. Potential overlap with HVAC and Energy Efficient Lighting. Reductions shown are applied after measures A and B	100%	% of square footage	50	38	50.2	37.5
25	California Energy Star Certified Homes Program	Residential	Not quantified separately. Overlaps with Energy Efficient Lighting, Energy Star homes, and Energy Star Appliances						

Village at Squaw Valley

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27	Building Orientation Efficiencies	Energy	Not quantified separately. Overlaps with Title 24 Improvements and HVAC Commissioning.						
28	Small single-cell Solar Lighting	Energy	Not quantified.						
29	Small hydroelectric generation systems	See specific Plan page 6-15	Energy	Not quantified. Could further reduce electricity emissions.					
30	Covers on pools and spas	Energy	[0-100%]	100%	% of pools/spas with covers	1,496	1,496	1,496	
31	Reduce Outdoor Water Consumption 20% (e.g., greywater or reclaimed water)	Water	Not quantified because GHG emissions from Water Consumption are very small in DEIR.						
32	Minimize water intensive landscaping such as turf areas	Water	Not quantified because GHG emissions from Water Consumption are very small in DEIR.						
33	Install water-conserving appliances and plumbing	Residential	Water	Not quantified because GHG emissions from Water Consumption are very small in DEIR.					
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Village at Squaw Valley
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		Soft Maple	Vegetation		100	# of trees	0.02165	0.02165	2.2	2.2
		Mixed Hardwood	Vegetation		50	# of trees	0.01835	0.01835	0.9	0.9
		Hardwood Maple	Vegetation		100	# of trees	0.02605	0.02605	2.6	2.6
		Juniper	Vegetation		50	# of trees	0.00605	0.00605	0.3	0.3
		Cedar/larch	Vegetation		50	# of trees	0.0132	0.0132	0.7	0.7
		Douglas Fir	Vegetation		100	# of trees	0.02235	0.02235	2.2	2.2
		True Fir/Hemlock	Vegetation		50	# of trees	0.01905	0.01905	1.0	1.0
		Pine	Vegetation		50	# of trees	0.01595	0.01595	0.8	0.8
		Spruce	Vegetation		50	# of trees	0.01685	0.01685	0.8	0.8
Miscellaneous	Vegetation	50	# of trees	0.0177	0.0177	0.9	0.9			
37	Improved Waste Diversion	Waste	[Not adjustable. Assumes compliance with CA 75% waste diversion goal for Project]	n/a	[applied to total solid waste generation from DEIR]	n/a	n/a	69	69	
38	Reducing the Number of Propane/Natural Gas Hearths	Area	[Limited to the number of hearths to be installed]	250	# of hearths avoided	2.12E-01	2.12E-01	53.0	53.0	
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45	Regional Transit Improvements*	Mobile	Reduction depends on extent to which the measure is adopted	1.00%	% VMT Reduction	1.58E+04	1.42E+04	158.3	142.4	
46	Incentives for transit systems*	monetary (traffic impact fee), preferred parking, etc.	Mobile	Reduction depends on extent to which the measure is adopted	1.00%	% VMT Reduction	1.58E+04	1.42E+04	158.3	142.4
47	Low-emission vehicle shuttle service within the Village to provide mobility for visitors, guests, and employees	Mobile	Reduction depends on extent to which the measure is adopted	1%	% VMT Reduction	1.58E+04	1.42E+04	158.3	142.4	
48	Low-emission/alternative fuel vehicle shuttle service within Olympic Valley	Program 1: fixed-route shuttles which go between Village at Squaw Valley and the Resort at Squaw Creek	Mobile	Reduction depends on extent to which the measure is adopted	1%	% VMT Reduction	1.58E+04	1.42E+04	158.3	142.4
49		Program 2: Peak-hour ski days only, fixed-route circulating hillside neighborhoods north of Squaw Valley	Mobile	Reduction depends on extent to which the measure is adopted	1%	% VMT Reduction	1.58E+04	1.42E+04	158.3	142.4
50		Program 3: dial-a-ride shuttles that circulate the hillside neighborhoods during non-peak-hour ski days	Mobile	Reduction depends on extent to which the measure is adopted	1%	% VMT Reduction	1.58E+04	1.42E+04	158.3	142.4

Village at Squaw Valley

Table 1. Example Application of GHG Mitigation Measure Toolbox

				User Input						
Measure	Category/ Sector	Guidance	Amount [user enter]	Units	Reduction Metric 2020	Reduction Metric 2037	MT CO ₂ e Avoided (2020)	MT CO ₂ e Avoided (2037)		
51	Transit services connecting Village with Remainder of Squaw Valley/Alpine Meadows	Service between the Village and other key lodging/residential areas in the Olympic Valley, most new vehicles will use alternative fuels	Mobile	Reduction depends on extent to which the measure is adopted	1%	% VMT Reduction	1.58E+04	1.42E+04	158.3	142.4
52	Transit services connecting the Village with the North Tahoe/Truckee Region	Provided during peak ski season, 3 routes (see Specific Plan page 5-30)	Mobile	Reduction depends on extent to which the measure is adopted	1%	% VMT Reduction	1.58E+04	1.42E+04	158.3	142.4
53	Enhanced Alternatives to the Private Automobile for Regional Access	Promote use of North Lake Tahoe Express Service	Mobile	Reduction depends on extent to which the measure is adopted	1%	% VMT Reduction	1.58E+04	1.42E+04	158.3	142.4
54		Promote charter bus services through marketing materials - ex. Discounts on lodging packages for groups traveling by charter bus	Mobile	Reduction depends on extent to which the measure is adopted	1%	% VMT Reduction	1.58E+04	1.42E+04	158.3	142.4
55		Partner with a ridesharing program for visitor access to the Truckee-Tahoe region as well as employee commute ridesharing	Mobile	Reduction depends on extent to which the measure is adopted	1%	% VMT Reduction	1.58E+04	1.42E+04	158.3	142.4
Total							5,735	5,178		
Adjusted Total**							5,627	5,097		

Note:

* Items 41-46: Mobile Reductions with CAPCOA Reductions Framework: **Measures should not sum to more than 20% reduction in VMT** (limit for a 'suburban center' in CAPCOA). More details on these measures are in tab 'Additional_Transport_Research' and <http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf>
 [Total annual VMT modeled for the Project is 44,104,014 miles per year]

** Adjusted total accounts for overlap of mitigation measure 11 with 22 and 23. Mitigation measures 22 and 23 are reduced by 75%. The total also does not include reductions from LED street lighting. The original analysis of the Village at Squaw Valley did not include emissions from street lighting, thus LED street lighting should be seen as a project "offset".

GHG Emission Factors for Electricity Usage

	Energy Delivered ¹ [MWh]			Average	Units
	2006	2007	2008		
Total Energy Delivery ¹	33,184,400	33,923,300	32,784,953		MWh
from renewables ²	706,199	1,756,896	3,510,130		MWh
from non-renewables	32,478,201	32,166,404	29,274,823		MWh
% of Total Energy From Renewables	2%	5%	11%		
Total CO ₂ Emissions ¹	12,156,010	12,927,789	19,751,108		metric tonnes CO ₂
% of Total Energy From Non-Renewables	98%	95%	89%		
CO ₂ Emissions per Total Energy Delivered	807.59	840.16	1328.16		lbs CO ₂ /MWh delivered
CO ₂ Emissions per Total Non-Renewable Energy ³	825.15	886.04	1487.41		lbs CO ₂ /MWh delivered
Estimated Emission Factors for Total Energy Delivered^{4,5}					
2010 RPS (20%)	660.1	708.8	1189.9	853.0	lbs CO ₂ /MWh delivered
2020 RPS (33%)	552.9	593.6	996.6	714.36	lbs CO ₂ /MWh delivered
				716.92	lbs CO ₂ e/MWh delivered
2035/2050 RPS (50%)	412.6	443.0	743.7	533.10	lbs CO ₂ /MWh delivered
				535.66	lbs CO ₂ e/MWh delivered
Emission Factor used in DEIR⁶				1,330.67	lbs CO ₂ e/MWh delivered

Notes:

- Total energy delivery and total CO₂ emissions are provided in Sierra Pacific Resources dba NV Energy (PUP) Reports available at: <http://www.climateregistry.org/tools/carrot.html>
- Renewable energy delivered is the sum of biogenic, geothermal and other renewable generations in PUP reports.
- The emissions metric presented here is calculated based on the total CO₂ emissions divided by the energy delivered from non-renewable sources.
- The emission factors for total energy delivered are estimated by multiplying the percentage of energy delivered from non-renewable energy by the CO₂ emissions per total non-renewable energy metric calculated above. The estimate provided here and the PUP reports issued by Sierra Pacific Resources assume that renewable energy sources do not result in any CO₂ emissions.
- Sierra Pacific Resources was acquired by California Pacific Electric Company, LLC (Liberty Utilities) in 2012. According to Liberty Utilities, they will meet the standards set by California RPS. Estimated emission factors use Sierra Pacific Resources PUP report data with Liberty Utility goals. http://www.libertyutilities.com/west/customer_support/greenhouse_gas.html
- From Ascent Environmental: These are the default GHG emission rates associated with the consumption of electricity produced by Sierra Pacific Power Company in 2008, as provided by CalEEMod V2.2. Sierra Pacific's generation and distribution assets are now owned and operated by California Pacific Electric Company (CalPeco). These factors are for 2008.

Abbreviations:

CH₄ - methane
 CO₂ - carbon dioxide
 CO₂e - carbon dioxide equivalent
 GHG - Greenhouse gas
 kWh - kilowatt-hour
 lbs - pounds
 MWh - Megawatt-hour
 N₂O - nitrous oxide
 PUP - Power/Utility Protocol
 RPS - Renewables Portfolio Standard

Emission Factors⁶

CH₄ 0.029 lb/MWh
 N₂O 0.00617 lb/MWh

Global Warming Potential

CH₄ 25 MT CO₂e/MT CH₄
 N₂O 298 MT CO₂e/MT N₂O

Conversions:

2204.62 lb/metric tonne

PUP Report Data	2006	2007	2008
Owned Generation Total (Net)	16,220,817	18,552,378	19,584,011
Fossil Generation (Net)	16,220,817	18,552,378	19,584,011
Biogenic Generation (Net)	0	0	0
Geothermal Generation (Net)	0	0	0
Other Renewable Generation (Net)	0	0	0
Zero Emission Generation (Net)	0	0	0
Co-generation (Net)	0	0	0
Purchased Generation Total (Net)	16,963,583	15,370,922	13,200,942
Purchased Fossil Generation (Net)	9,909,466	9,480,785	8,414,281
Purchased Biogenic Generation (Net)	220,159	170,617	143,890
Purchased Geothermal Generation (Net)	339,101	285,899	258,738
Purchased Other Renewable Generation (Net)	146,939	1,300,380	3,107,502
Purchased Zero Emission Generation (Net)	6,347,918	4,133,241	1,276,531
Purchased Co-generation (Net)	0	0	0
Purchased Wholesale Power (Net)	0	0	0
TOTAL FOSSIL GENERATION/PURCHASES	26,130,283	28,033,163	27,998,292
TOTAL FROM BIOGENIC SOURCES	220,159	170,617	143,890
TOTAL FROM GEOTHERMAL SOURCES	339,101	285,899	258,738
TOTAL OTHER GENERATION/PURCHASES	6,494,857	5,719,520	4,384,033
TOTAL FROM ALL GENERATION SOURCES	33,184,400	33,923,300	32,784,953
TOTAL FROM RETAIL SALES	29,827,109	30,117,708	30,188,836
TOTAL CO2 EMISSION FROM ALL GENERATION SOURCES	12,156,010	12,927,789	19,751,108

Estimating GHG Emissions Reduction to Replace Conventional Vehicle with Electric Vehicle in 2020			
	Passenger Vehicle	Transit Buses	
Liberty Utilities electricity emission factor ¹	0.32	0.32	(MT CO ₂ /MWh)
Fuel Economy ^{2,3}	0.3	1.9	(KWh/mile)
CO ₂ emission while running ⁴	303	2,018	(g/mile)
Annual VMT reduction per station ^{5,6}	182,500	47,647	(VMT/charging station/year)
Estimated Benefit from Installing Electric Vehicle Charging Stations			
GHG emissions of gasoline vehicle ⁷	55	96	(MT CO ₂ /year)
GHG emissions of electric vehicle	18	30	(MT CO ₂ /year)
GHG reduction per charging station per year ⁸	38	67	(MT CO ₂ /year)

Notes:

1. CO₂ intensity factor for Liberty Utilities accounts for CO₂ emissions rates under the 2020 33% Renewable Portfolio Standard.
2. Fuel economy of a passenger vehicle obtained From US Department of Energy, 2013. Benefits and Considerations of Electricity as a Vehicle Fuel. Available at: http://www.afdc.energy.gov/fuels/electricity_benefits.html. Accessed: December 2015.
3. Fraunhofer Institute for Transportation and Infrastructure Systems IVI, <http://www.edda-bus.de/en/Operation.html>
4. CARB, 2015. EMFAC 2014, running exhaust emission rate for CO₂ for vehicles in Placer County, aggregated for all models and speeds, averaged over all seasons for 2020. Passenger vehicles are estimated to be LDA, LDT1, or LDT2 gasoline or diesel vehicles. Transit buses are assumed to be UBUS gasoline or diesel vehicles. Emission rate includes reductions for ACC and Pavley. Available at: <http://www.arb.ca.gov/emfac/>. Accessed: January 2016.
5. Annual VMT reduction for passenger vehicles estimated based on assumption of ten hours of charge time for a ChargePoint Level 2 charging station. Assumes that there are two charging ports per station.
6. Assumes charging station is a fast charging station with a maximum charging capacity of 250 kW. http://www.edda-bus.de/en/Technologie/Charging_station.html
7. GHG emissions calculated using annual VMT reduction at all stations and CO₂ emission rate. Nitrous oxide and methane are conservatively not included.
8. GHG emissions reduction is a difference of GHG emissions of conventional vehicles and GHG emissions of electric vehicles. Nitrous oxide and methane are conservatively not included.

Transit Bus Charging Parameters

Specific Energy Demand ²	1.19	kWh/km
Charging Capacity	250	kW/charge

Conversion Factors

2204.62 lb/MT
 1.00E-06 MT/g
 0.001 MWh/kWh
 1.60934 km/mile
 365 days/year

Electricity Intensity¹

714.36 lb CO₂/MWh

Abbreviations

CO ₂ - carbon dioxide	KWh - kilowatt hour
EV - electric vehicle	lb - pound
g - grams	MT - metric ton
GHG - greenhouse gas	MWh - megawatt hour
km - kilometer	SCE - Southern California Edison
kW - kilowatt	VMT - vehicle miles traveled

Estimating GHG Emissions Reduction to Replace Conventional Vehicle with Electric Vehicle in 2037			
	Passenger Vehicle	Transit Buses	
Liberty Utilities electricity emission factor ¹	0.24	0.24	(MT CO ₂ /MWh)
Fuel Economy ^{2,3}	0.3	1.9	(KWh/mile)
CO ₂ emission while running ⁴	206	1,853	(g/mile)
Annual VMT reduction per station ^{5,6}	182,500	47,647	(VMT/charging station/year)
Estimated Benefit from Installing Electric Vehicle Charging Stations			
GHG emissions of gasoline vehicle ⁷	38	88	(MT CO ₂ /year)
GHG emissions of electric vehicle	13	22	(MT CO ₂ /year)
GHG reduction per charging station per year ⁸	24	66	(MT CO ₂ /year)

Notes:

1. CO₂ intensity factor for Liberty Utilities accounts for CO₂ emissions rates under the 2035 50% Renewable Portfolio Standard.
2. Fuel economy of a passenger vehicle obtained From US Department of Energy, 2013. Benefits and Considerations of Electricity as a Vehicle Fuel. Available at: http://www.afdc.energy.gov/fuels/electricity_benefits.html. Accessed: December 2015.
3. Fraunhofer Institute for Transportation and Infrastructure Systems IVI, <http://www.edda-bus.de/en/Operation.html>
4. CARB, 2015. EMFAC 2014, running exhaust emission rate for CO₂ for vehicles in Placer County, aggregated for all models and speeds, averaged over all seasons for 2037. Passenger vehicles are estimated to be LDA, LDT1, or LDT2 gasoline or diesel vehicles. Transit buses are assumed to be UBUS gasoline or diesel vehicles. Emission rate includes reductions for ACC and Pavley. Available at: <http://www.arb.ca.gov/emfac/>. Accessed: January 2016.
5. Annual VMT reduction for passenger vehicles estimated based on assumption of ten hours of charge time for a ChargePoint Level 2 charging station. Assumes that there are two charging ports per station.
6. Assumes charging station is a fast charging station with a maximum charging capacity of 250 kW. http://www.edda-bus.de/en/Technologie/Charging_station.html
7. GHG emissions calculated using annual VMT reduction at all stations and CO₂ emission rate. Nitrous oxide and methane are conservatively not included.
8. GHG emissions reduction is a difference of GHG emissions of conventional vehicles and GHG emissions of electric vehicles. Nitrous oxide and methane are conservatively not included.

Transit Bus Charging Parameters

Specific Energy Demand ²	1.19	kWh/km
Charging Capacity	250	kW/charge

Conversion Factors

2204.62 lb/MT
 1.00E-06 MT/g
 0.001 MWh/kWh
 1.60934 km/mile
 365 days/year

Electricity Intensity¹

533.10 lb CO₂/MWh

Abbreviations

CO ₂ - carbon dioxide	KWh - kilowatt hour
EV - electric vehicle	lb - pound
g - grams	MT - metric ton
GHG - greenhouse gas	MWh - megawatt hour
km - kilometer	SCE - Southern California Edison
kW - kilowatt	VMT - vehicle miles traveled

GHG Emissions from Electricity Demand in 2020

Land Use ¹	CalEEMod Land Use Type	Estimated Units ¹	Sqft Estimated ¹	Dry Utility Master Plan		2008 Title 24						2013 Title 24			Squaw Valley Policy CC-1							
				Avg Peak KVA/unit or Watts/sqft ¹	Combo Demand KVA/Unit and Watts/sqft (MVA)	Total Annual Electricity Consumption ² (MWh)	Annual CO ₂ e Emissions (MT/yr)	Annual Electricity Consumption per Unit or sqft (kWh/yr)	CalEEMod Electricity per Unit or sqft ³ (kWh/yr)	Modified Electricity per Unit or sqft ⁴ (kWh/yr)	Modified Electricity Consumption (MWh/yr)	Modified Annual CO ₂ e Emissions (MT/yr)	CalEEMod 2013 T24 Electricity per Unit or sqft ⁵ (kWh/yr)	Modified 2013 T24 Electricity per Unit or sqft ⁶ (kWh/yr)	Modified 2013 T24 Electricity Consumption (MWh/yr)	CalEEMod Policy CC-1 Electricity per Unit or sqft ⁷ (kWh/yr)	Modified 2013 Policy CC-1 Electricity per Unit or sqft ⁸ (kWh/yr)	Modified 2013 Policy CC-1 Electricity Consumption (MWh/yr)	15% Over 2013 T24 Annual CO ₂ e Emissions (MT/yr)			
Proposed Land Uses	Residential	Condo Hotel	Condo/Townhouse High Rise	772	1,239,433	2.5000	1.93	9,329	3,034	12,085	4,624	4,624	3,569	1,161	4,499	4,499	3,474	1,130	4,444	4,444	3,430	1,116
		Timeshare	Condo/Townhouse	47	62,438	3.0000	0.14	682	222	14,502	4,624	4,624	217	71	4,499	4,499	211	69	4,444	4,444	209	68
		Fractional Cabins	Condo/Townhouse	31	93,000	3.0000	0.09	450	146	14,502	4,624	4,624	143	47	4,499	4,499	139	45	4,444	4,444	138	45
	Non-Residential	Employee Housing	Apartments Mid Rise	18	38,916	2.8000	0.05	244	79	13,535	3,522	3,522	63	21	3,466	3,466	62	20	3,441	3,441	62	20
		Retail	--	--	33,620	0.0053	0.18	861	280	26	--	26	861	280	--	26	861	280	--	26	861	280
		Restaurants	--	--	31,120	0.0102	0.32	1,534	499	49	--	49	1,534	499	--	49	1,534	499	--	49	1,534	499
		Hotel Common Area	--	--	54,555	0.0038	0.21	1,002	326	18	--	18	1,002	326	--	18	1,002	326	--	18	1,002	326
		Amenities	--	--	92,500	0.0102	0.94	4,561	1,483	49	--	49	4,561	1,483	--	49	4,561	1,483	--	49	4,561	1,483
		Meeting Space	--	--	12,000	0.0038	0.05	220	72	18	--	18	220	72	--	18	220	72	--	18	220	72
		Ski Services	--	--	75,000	0.0030	0.23	1,088	354	15	--	15	1,088	354	--	15	1,088	354	--	15	1,088	354
		Transit Facilities	--	--	4,000	0.0039	0.02	75	25	19	--	19	75	25	--	19	75	25	--	19	75	25
Total Estimated Peak Demand at Buildout				--	4.15	20,046	6,519	--	--	--	13,335	4,337	--	--	13,229	4,302	--	--	13,181	4,286		
Net Estimated Electric Peak Demand				--	3.75	18,122	5,893	--	--	--	11,412	3,711	--	--	11,305	3,676	--	--	11,257	3,661		
Demolished Land Uses	Non-Residential	Clinic	--	--	1519	0.0055	-0.01	-40	-13	-27	--	-27	-40	-13	--	-27	-40	-13	--	-27	-40	
		Race Team	--	--	2050	0.0037	-0.01	-37	-12	-18	--	-18	-37	-12	--	-18	-37	-12	--	-18	-37	
		Snoventures	--	--	2360	0.0025	-0.01	-29	-9	-12	--	-12	-29	-9	--	-12	-29	-9	--	-12	-29	
		Maintenance/Operations	--	--	38,485.00	0.0053	-0.20	-986	-321	-26	--	-26	-986	-321	--	-26	-986	-321	--	-26	-986	
		Far East (Retail Warehouse)	--	--	5928	0.0029	-0.02	-83	-27	-14	--	-14	-83	-27	--	-14	-83	-27	--	-14	-83	
		Far East (Cantina)	--	--	1595	0.0102	-0.02	-79	-26	-49	--	-49	-79	-26	--	-49	-79	-26	--	-49	-79	
		Far East (Central Reservations)	--	--	3,000.00	0.0038	-0.01	-55	-18	-18	--	-18	-55	-18	--	-18	-55	-18	--	-18	-55	
		Clock Tower	--	--	2593	0.0038	-0.01	-48	-15	-18	--	-18	-48	-15	--	-18	-48	-15	--	-18	-48	
		Olympic Valley Lodge (Meeting)	--	--	15120	0.0038	-0.06	-278	-90	-18	--	-18	-278	-90	--	-18	-278	-90	--	-18	-278	
		Olympic Valley Lodge (Office)	--	--	5000	0.0045	-0.02	-109	-35	-22	--	-22	-109	-35	--	-22	-109	-35	--	-22	-109	
		Employee Housing	--	--	13872	0.0027	-0.04	-181	-59	-13	--	-13	-181	-59	--	-13	-181	-59	--	-13	-181	
Total Estimated Peak Demand at Buildout				--	-0.40	-1,924	-626	--	--	--	-1,924	-626	--	--	-1,924	-626	--	--	-1,924	-626		
Net Estimated Electric Peak Demand				--	3.75	18,122	5,893	--	--	--	11,412	3,711	--	--	11,305	3,676	--	--	11,257	3,661		

Notes:

- MacKay & Soms. 2015 (January 27). Dry Utility Master Plan - Village as Squaw Valley Specific Plan, Appendix F.
- Assumes year-round operation and a power factor of 1.
- Obtained from CalEEMod Appendix D, Table 8.1. Available at: <http://www.aqmd.gov/docs/default-source/caleemod/caleemod-appendixd.pdf?sfvrsn=2>. Accessed: January 2016.
- Modified electricity demand uses CalEEMod factors when available, else factors from the Dry Utility Study are used.
- Assumes improvement over 2008 Title 24 by 25% for residential land uses and 30% for commercial land uses. Improvement was not applied to Non-Residential land uses, as data was not available to distinguish between Title 24 and Non-Title 24 electricity types.
- Assumes Policy CC-1 is in effect, which requires 15% improvement over current Title 24 standards.
- CO₂e intensity factor for Liberty Utilities accounts for CO₂ emissions rates under the 2020 33% Renewable Portfolio Standard. CH₄ and N₂O intensity factors are obtained from CalEEMod Appendix D. Available at: <http://www.aqmd.gov/docs/default-source/caleemod/caleemod-appendixd.pdf?sfvrsn=2>. Accessed: January 2016.

Constants:

	Power Factor	1	Electricity Intensity ⁷		Global Warming Potential		
Average Occupancy Rate	55%		CO ₂	714.36	lb/MWh	CO ₂	1
Operation	8760	hr/yr	CH ₄	0.029	lb/MWh	CH ₄	25
			N ₂ O	0.00617	lb/MWh	N ₂ O	298

Conversion Factors:

1000 kWh/MWh
2204.62 lb/MT

Abbreviations:

- CalEEMod - California Emissions Estimator Model
- CH₄ - methane
- CO₂ - carbon dioxide
- CO₂e - carbon dioxide equivalent
- hr - hour
- KVA - kilovolt ampere
- kWh - kilowatt hour
- lb - pound
- MT - metric tonne
- MVA - megavolt ampere
- MWh - megawatt hour
- N₂O - nitrous oxide
- sqft - square feet
- yr - year

GHG Emissions from Electricity Demand in 2037

Land Use ¹	CalEEMod Land Use Type	Estimated Units ¹	Sqft Estimated ¹	Dry Utility Master Plan		Total Annual Electricity Consumption ² (MWh)	Annual CO ₂ e Emissions (MT/yr)		
				Avg Peak KVA/unit or Watts/sqft ¹	Combo Demand KVA/Unit and Watts/sqft (MVA)				
Proposed Land Uses	Residential	Condo Hotel	Condo/Townhouse High Rise	772	1,239,433	2.5000	1.93	9,329	2,267
		Timeshare	Condo/Townhouse	47	62,438	3.0000	0.14	682	166
		Fractional Cabins	Condo/Townhouse	31	93,000	3.0000	0.09	450	109
		Employee Housing	Apartments Mid Rise	18	38,916	2.8000	0.05	244	59
	Non-Residential	Retail	--	--	33,620	0.0053	0.18	861	209
		Restaurants	--	--	31,120	0.0102	0.32	1,534	373
		Hotel Common Area	--	--	54,555	0.0038	0.21	1,002	243
		Amenities	--	--	92,500	0.0102	0.94	4,561	1,108
		Meeting Space	--	--	12,000	0.0038	0.05	220	54
		Ski Services	--	--	75,000	0.0030	0.23	1,088	264
		Transit Facilities	--	--	4,000	0.0039	0.02	75	18
Total Estimated Peak Demand at Buildout				--	--	4.15	20,046	4,871	
Demolished Land Uses	Non-Residential	Clinic	--	--	1519	0.0055	-0.01	-40	-10
		Race Team	--	--	2050	0.0037	-0.01	-37	-9
		Snoventures	--	--	2360	0.0025	-0.01	-29	-7
		Maintenance/Operations	--	--	38,485.00	0.0053	-0.20	-986	-240
		Far East (Retail Warehouse)	--	--	5928	0.0029	-0.02	-83	-20
		Far East (Cantina)	--	--	1595	0.0102	-0.02	-79	-19
		Far East (Central Reservations)	--	--	3,000.00	0.0038	-0.01	-55	-13
		Clock Tower	--	--	2593	0.0038	-0.01	-48	-12
		Olympic Valley Lodge (Meeting)	--	--	15120	0.0038	-0.06	-278	-67
		Olympic Valley Lodge (Office)	--	--	5000	0.0045	-0.02	-109	-26
		Employee Housing	--	--	13872	0.0027	-0.04	-181	-44
Total Estimated Peak Demand at Buildout				--	--	-0.40	-1,924	-467	
Net Estimated Electric Peak Demand						3.75	18,122	4,403	

Notes:

1. MacKay & Somps. 2015 (January 27). Dry Utility Master Plan - Village as Squaw Valley Specific Plan, Appendix F.
2. Assumes year-round operation and a power factor of 1.
3. Obtained from CalEEMod Appendix D, Table 8.1. Available at: <http://www.aqmd.gov/docs/default-source/caleemod/caleemod-appendixd.pdf?sfvrsn=2>. Accessed: January 2016.
4. Modified electricity demand uses CalEEMod factors when available, else factors from the Dry Utility Study are used.
5. Assumes improvement over 2008 Title 24 by 25% for residential land uses and 30% for commercial land uses. Improvement was not applied to Non-Residential land uses, as data was not available to distinguish between Title 24 and Non-Title 24 elect
6. Assumes Policy CC-1 is in effect, which requires 15% improvement over current Title 24 standards.
7. CO₂e intensity factor for Liberty Utilities accounts for CO₂ emissions rates under the 2035 50% Renewable Portfolio Standard. CH₄ and N₂O intensity factors are obtained from CalEEMod Appendix D. Available at: <http://www.aqmd.gov/docs/default-sou>

Constants:

Power Factor	1	
Average Occupancy Rate	55%	
Operation	8760	hr/yr

Electricity Intensity⁷

CO ₂	533.10	lb/MWh
CH ₄	0.029	lb/MWh
N ₂ O	0.00617	lb/MWh

Global Warming Potential

CO ₂	1	MT CO ₂ e/MT CO ₂
CH ₄	25	MT CO ₂ e/MT CH ₄
N ₂ O	298	MT CO ₂ e/MT N ₂ O

Conversion Factors:

1000 kWh/MWh
2204.62 lb/MT

Abbreviations:

- CalEEMod - California Emissions Estimator Model
- CH₄ - methane
- CO₂ - carbon dioxide
- CO₂e - carbon dioxide equivalent
- hr - hour
- KVA - kilovolt ampere
- kWh - kilowatt hour
- lb - pound
- MT - metric tonne
- MVA - megavolt ampere
- MWh - megawatt hour
- N₂O - nitrous oxide
- sqft - square feet
- yr - year

GHG Emissions from Energy Star Appliances in 2020

Project	Electricity Use per Appliance		CO ₂ e Emissions per Appliance		GHG Mass Difference
	Unmitigated ²	Mitigated ³	Unmitigated	Mitigated ³	Per Appliance
	(kWh/year)		(MT/year)		(MT/year)
Clothes Washer	590	442.5	0.192	0.144	0.048
Clothes Dryer	769	615.2	0.250	0.200	0.050
Refrigerator	596	506.6	0.194	0.165	0.029
Dishwasher	206	123.6	0.067	0.040	0.027
Ceiling Fan ¹	12	6	0.004	0.002	0.002

Notes:

- Assumes ceiling fans do not have lights. Approximate energy usage obtained from: https://www.energystar.gov/index.cfm?c=most_efficient.me_ceiling_fans_under_52_inches.
- 'Unmitigated' electricity usage is based on standard CalEEMod energy intensity defaults for specific land use.
- 'Mitigated' electricity usage and CO₂e emissions are based on reductions for energy efficient - energy star appliances. Currently, this mitigation measure has been applied to residential land uses only. Providing mitigation for commercial land use (e.g., dishwasher, refrigerator) may provide additional reductions to energy usage and GHG emissions. Energy Star is currently excluded from commercial land uses based on expectation of ability for the developer to meet this commitment. The following appliances have been included for energy efficiency mitigation per CalEEMod defaults for Energy Star Appliances:
 - Clothes Washer 25%
 - Clothes Dryer 20%
 - Refrigerator 15%
 - Dishwashers 40%
 - Ceiling Fans 50%
- CO₂e intensity factor for Liberty Utilities accounts for CO₂ emissions rates under the 2020 33% Renewable Portfolio Standard. CH₄ and N₂O intensity factors are obtained from CalEEMod Appendix D. Available at: <http://www.aqmd.gov/docs/default-source/caleemod/caleemod-appendixd.pdf?sfvrsn=2>. Accessed: January 2016.

Electricity Intensity⁴

CO ₂	714.36	lb/MWh
CH ₄	0.029	lb/MWh
N ₂ O	0.00617	lb/MWh

Global Warming Potential

CO ₂	1	MT CO ₂ e/MT CO ₂
CH ₄	25	MT CO ₂ e/MT CH ₄
N ₂ O	298	MT CO ₂ e/MT N ₂ O

Conversion Factors:

1000 kWh/MWh
2204.62 lb/MT

Abbreviations:

- CalEEMod - California Emissions Estimator Model
- CH₄ -methane
- CO₂ - carbon dioxide
- CO₂e - carbon dioxide equivalent
- kWh - kilowatt hour
- lb - pound
- MT - metric tonne
- MWh - megawatt hour
- N₂O - nitrous oxide

GHG Emissions from Energy Star Appliances in 2037

Project	Electricity Use per Appliance		CO ₂ e Emissions per Appliance		GHG Mass Difference
	Unmitigated ²	Mitigated ³	Unmitigated	Mitigated ³	Per Appliance
	(kWh/year)		(MT/year)		(MT/year)
Clothes Washer	590	442.5	0.143	0.108	0.036
Clothes Dryer	769	615.2	0.187	0.149	0.037
Refrigerator	596	506.6	0.145	0.123	0.022
Dishwasher	206	123.6	0.050	0.030	0.020
Ceiling Fan ¹	12	6	0.003	0.001	0.001

Notes:

1. Assumes ceiling fans do not have lights. Approximate energy usage obtained from: https://www.energystar.gov/index.cfm?c=most_efficient.me_ceiling_fans_under_52_inches.
2. 'Unmitigated' electricity usage is based on standard CalEEMod energy intensity defaults for specific land use.
3. 'Mitigated' electricity usage and CO₂e emissions are based on reductions for energy efficient - energy star appliances. Currently, this mitigation measure has been applied to residential land uses only. Providing mitigation for commercial land use (e.g., dishwasher, refrigerator) may provide additional reductions to energy usage and GHG emissions. Energy Star is currently excluded from commercial land uses based on expectation of ability for the developer to meet this commitment. The following appliances have been included for energy efficiency mitigation per CalEEMod defaults for Energy Star Appliances:

Clothes Washer	25%
Clothes Dryer	20%
Refrigerator	15%
Dishwashers	40%
Ceiling Fans	50%

4. CO₂e intensity factor for Liberty Utilities accounts for CO₂ emissions rates under the 2035 50% Renewable Portfolio Standard. CH₄ and N₂O intensity factors are obtained from CalEEMod Appendix D. Available at: <http://www.aqmd.gov/docs/default-source/caleemod/caleemod-appendixd.pdf?sfvrsn=2>. Accessed: January 2016.

Electricity Intensity⁵

CO ₂	533.10	lb/MWh
CH ₄	0.029	lb/MWh
N ₂ O	0.00617	lb/MWh

Global Warming Potential

CO ₂	1	MT CO ₂ e/MT CO ₂
CH ₄	25	MT CO ₂ e/MT CH ₄
N ₂ O	298	MT CO ₂ e/MT N ₂ O

Conversion Factors:

1000 kWh/MWh
2204.62 lb/MT

Abbreviations:

- CalEEMod - California Emissions Estimator Model
- CH₄ -methane
- CO₂ - carbon dioxide
- CO₂e - carbon dioxide equivalent
- kWh - kilowatt hour
- lb - pound
- MT - metric tonne
- MWh - megawatt hour
- N₂O - nitrous oxide

GHG Reductions from Lighting Electricity

		CO ₂ e Emissions (MT/year)		
		2008	2020 Project	2037 Project
Conventional	Apartments Mid Rise	0.45	0.24	0.18
	Condo/Townhouse	0.60	0.33	0.24
Increased Efficiency	Apartments Mid Rise	0.11	0.06	0.05
	Condo/Townhouse	0.15	0.08	0.06
Reductions	Apartments Mid Rise	0.34	0.18	0.14
	Condo/Townhouse	0.45	0.24	0.18

Notes:

1. Obtained from CalEEMod Appendix D, Table 8.1 for apartments mid rise and condo/townhouses. Available at: <http://www.aqmd.gov/docs/default-source/caleemod/caleemod-appendixd.pdf?sfvrsn=2>. Accessed: January 2016.
2. According to Energy Star, LED lighting uses at least 75% less energy than incandescent lighting. Available at: https://www.energystar.gov/products/lighting_fans/light_fixtures/why_choose_energy_star_qualified_led_lighting. Accessed: February 2016.

CO₂e Emissions Factor

Ascent Emissions (2008)	2020	2037	Units
1330.67	716.92	535.66	lb/MWh
0.000603584	0.000325189	0.000242974	MT/kWh

Lighting Electricity Factor¹

Apartments Mid Rise	741.44	(KWh/dwelling unit/year)
Condo/Townhouse	1001.1	(KWh/dwelling unit/year)

Reduction:² 75%

Conversion Factors:

2204.62 lb/MT

Abbreviations:

- CalEEMod - California Emissions Estimator Model
- CO₂e - carbon dioxide equivalent
- kWh - kilowatt hour
- lb - pound
- MT - metric tonne
- MWh - megawatt hour

GHG Emissions from Fireplace Propane Consumption in 2020 and 2037

Fireplace Input¹	7500	BTU/hr
Propane Heating Value²	91,000	BTU/gal
Operation	3	hr/day
	30	day/month
	5	month/year
Fuel Consumption³	0.25	gal/day
	7.42	gal/month
	37.1	gal/year
GHG emissions	2.07E-01	MT CO ₂ /year
	3.79E-06	MT CH ₄ /year
	1.52E-05	MT N ₂ O/year
	2.12E-01	MT CO₂e/year

Notes:

1. Rating obtained from <https://chimneysweepsonline.com/g0compil.htm>. A low rating was used to be conservative.
2. MacKay & Somps. 2015 (January 27). Dry Utility Master Plan - Village as Squaw Valley Specific Plan, Appendix I.
3. Assumes operation of 3 hours per day, 30 days per month, 5 months per year (winter months only).
4. Climate Registry, The. 2014 (April 11). 2014 Climate Registry Default Emission Factors. Available at <https://www.theclimateregistry.org/wp-content/uploads/2014/11/2014-Climate-Registry-Default-Emissions-Factors.pdf>. Accessed October 13, 2014. (See Table 13.1 on p.17 and Table 12.4 on p.10).

Emission Factors⁴

CO ₂	5.59	kg/gal
CH ₄	0.027	g/L
N ₂ O	0.108	g/L

Global Warming Potential

1	MT CO ₂ e/MT CO ₂
25	MT CO ₂ e/MT CH ₄
298	MT CO ₂ e/MT N ₂ O

Conversion Factors

1000000	g/MT
1000	kg/MT
3.78541	L/gal

Abbreviations:

BTU - British thermal unit
 CH₄ - methane
 CO₂ - carbon dioxide
 CO₂e - carbon dioxide equivalent
 g - gram
 gal - gallon
 hr - hour
 kg - kilogram
 L - liter
 MT - metric tonne
 N₂O - nitrous oxide

GHG Emissions from Maintaining Pool and Spa Temperatures in 2020 and 2037

	Current Heating Rate				Reduced Heating Rate				Unit
	Non-Winter		Winter		Non-Winter		Winter		
	Pool/Other Water Features	Spa	Pool/Other Water Features	Spa	Pool/Other Water Features	Spa	Pool/Other Water Features	Spa	
Ambient Temperature ¹	51	51	31	31	51	51	31	31	°F
Desired Pool Temperature ¹	80	100	80	100	80	100	80	100	°F
BTU's Required ²	305	515	515	725	305	515	515	725	BTU/sqft/hr
BTU's for Heater (80% efficiency)	381	643	643	906	381	643	643	906	BTU/sqft/hr
Surface Area ¹	10,205	4,200	10,205	4,200	10,205	4,200	10,205	4,200	sqft
Gal Propane Required	43	30	72	42	21	15	36	21	gal/hr
	683	475	1,154	669	341	237	577	334	gal/day
	145,468	101,159	175,400	101,653	72,734	50,579	87,700	50,826	gal/year

	Current	Reduced	Unit
Annual Propane Consumption	523,680	261,840	gal/year
Annual Emissions from Propane Consumption	2,927	1,464	MT CO ₂ /year
	0.05	0.03	MT CH ₄ /year
	0.21	0.11	MT N ₂ O/year
	2,993	1,496	MT CO₂e/year
Reductions	1,496		MT CO₂e/year

Notes:

1. MacKay & Soms. 2015 (January 27). Dry Utility Master Plan - Village as Squaw Valley Specific Plan, Appendix I.
2. Assumes an average wind speed of 3.5 mph, consistent with Dry Utility Master Plan. Available at: <http://www.ordinis.com/buyers/heatbuyer.htm>. Accessed: January 2016.
3. Savings from pool covers were obtained from <http://energy.gov/energysaver/swimming-pool-covers>
4. Climate Registry, The. 2014 (April 11). 2014 Climate Registry Default

Proposed Project Water Surface Area¹

22 Spas 3300 sqft
11 Pools 8800 sqft

Proposed Mountain Adventure Water Surface Area¹

Other Water Features 39634 sqft
2 Pools 1405 sqft
3 Spas 900 sqft

Current Heating Operation¹

16 hr/day
152 winter days/year
213 non-winter days/year
50% Evaporation Energy Loss Savings³

Emission Factors⁴

CO₂ 5.59 kg/gal
CH₄ 0.027 g/L
N₂O 0.108 g/L

Global Warming Potential

1 MT CO₂e/MT CO₂
25 MT CO₂e/MT CH₄
298 MT CO₂e/MT N₂O

Conversion Factors/Constants

1000000 g/MT
1000 kg/MT
3.78541 L/gal
Propane Heating Value¹ 91000 BTU/gallon
Heating Rate² 10.5 BTU/(1 sqft x 1 °F x 1 hr)
Heater Efficiency¹ 80%

Abbreviations:

- *F - degrees Fahrenheit
- BTU - British thermal unit
- CH₄ - methane
- CO₂ - carbon dioxide
- CO₂e - carbon dioxide equivalent
- g - gram
- gal - gallon
- hr - hour
- kg - kilogram
- L - liter
- MT - metric tonne
- N₂O - nitrous oxide
- sqft - square feet

GHG Reductions from Installation of Solar Panels in 2020

System Specifications¹

Monthly System Output	January	94	kWh/month
	February	126	
	March	271	
	April	280	
	May	288	
	June	319	
	July	352	
	August	359	
	September	304	
	October	235	
	November	192	
	December	138	
Maximum Annual System Output		2,958	kWh/year
Adjusted Annual System Output ²		2,137	kWh/year
		7,291,743	BTU/year
DC System Size		2	kW
Module Efficiency		15	%
Array Area		13.3	m ²

Annual GHG Reductions per System

	Solar vs. Electricity	Solar vs. Propane	
CO ₂	6.92E-01	4.48E-01	MT/year
CH ₄	2.81E-05	8.19E-06	MT/year
N ₂ O	5.98E-06	3.28E-05	MT/year
CO ₂ e	6.95E-01	4.58E-01	MT/year

Notes:

1. Data obtained from <http://pvwatts.nrel.gov/pvwatts.php>. Module type is assumed to be standard (crystalline silicon, with an approximate efficiency of 15%).
2. Assumes solar panels are only in use during non-winter months of April - October. Panels are conservatively assumed to be covered with snow during the winter months.
3. CO₂e intensity factor for Liberty Utilities accounts for CO₂ emissions rates under the 2020 33% Renewable Portfolio Standard. CH₄ and N₂O intensity factors are obtained from CalEEMod Appendix D. Available at: <http://www.aqmd.gov/docs/default-source/caleemod/caleemod-appendixd.pdf?sfvrsn=2>. Accessed: January 2016.
4. Climate Registry, The. 2014 (April 11). 2014 Climate Registry Default Emission Factors. Available at <https://www.theclimateregistry.org/wp-content/uploads/2014/11/2014-Climateregistry-Default-Emissions-Factors.pdf>. Accessed October 13, 2014. (See Table 13.1 on p.17 and Table 12.4 on p.10).

Electricity Intensity³

CO ₂	714.36	lb/MWh
CH ₄	0.029	lb/MWh
N ₂ O	0.00617	lb/MWh

Global Warming Potential

1	MT CO ₂ e/MT CO ₂
25	MT CO ₂ e/MT CH ₄
298	MT CO ₂ e/MT N ₂ O

Propane Emission Factors⁴

CO ₂	5.59	kg/gal
CH ₄	0.027	g/L
N ₂ O	0.108	g/L

Conversion Factors:

1000 kWh/MWh
2204.62 lb/MT
3412.14 BTU/kWh
1000000 g/MT
1000 kg/MT
3.78541 L/gal

<u>Propane Heating Value</u>	91000	BTU/gal
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Abbreviations:

- BTU - British thermal unit
- CalEEMod - California Emissions Estimator Model
- CH₄ - methane
- CO₂ - carbon dioxide
- CO₂e - carbon dioxide equivalent
- g - gram
- gal - gallon
- kg - kilogram
- kWh - kilowatt hour
- L - liter
- lb - pound
- m² - square meter
- MT - metric tonne
- MWh - megawatt hour
- N₂O - nitrous oxide

GHG Reductions from Installation of Solar Panels in 2037

System Specifications¹

Monthly System Output	January	94	kWh/month
	February	126	
	March	271	
	April	280	
	May	288	
	June	319	
	July	352	
	August	359	
	September	304	
	October	235	
	November	192	
	December	138	
Maximum Annual System Output		2,958	kWh/year
Adjusted Annual System Output ²		2,137	kWh/year
		7,291,743	BTU/year
DC System Size		2	kW
Module Efficiency		15	%
Array Area		13.3	m ²

Annual GHG Reductions per System

	Solar vs. Electricity	Solar vs. Propane	
CO ₂	5.17E-01	4.48E-01	MT/year
CH ₄	2.81E-05	8.19E-06	MT/year
N ₂ O	5.98E-06	3.28E-05	MT/year
CO ₂ e	5.19E-01	4.58E-01	MT/year

Notes:

1. Data obtained from <http://pvwatts.nrel.gov/pvwatts.php>. Module type is assumed to be standard (crystalline silicon, with an approximate efficiency of 15%).
2. Assumes solar panels are only in use during non-winter months of April - October. Panels are conservatively assumed to be covered with snow during the winter months.
3. CO₂e intensity factor for Liberty Utilities accounts for CO₂ emissions rates under the 2037 50% Renewable Portfolio Standard. CH₄ and N₂O intensity factors are obtained from CalEEMod Appendix D. Available at: <http://www.aqmd.gov/docs/default-source/caleemod/caleemod-appendixd.pdf?sfvrsn=2>. Accessed: January 2016.
4. Climate Registry, The. 2014 (April 11). 2014 Climate Registry Default Emission Factors. Available at <https://www.theclimateregistry.org/wp-content/uploads/2014/11/2014-Climateregistry-Default-Emissions-Factors.pdf>. Accessed October 13, 2014. (See Table 13.1 on p.17 and Table 12.4 on p.10).

Electricity Intensity³

CO ₂	533.10	lb/MWh
CH ₄	0.029	lb/MWh
N ₂ O	0.00617	lb/MWh

Global Warming Potential

1	MT CO ₂ e/MT CO ₂
25	MT CO ₂ e/MT CH ₄
298	MT CO ₂ e/MT N ₂ O

Propane Emission Factors⁴

CO ₂	5.59	kg/gal
CH ₄	0.027	g/L
N ₂ O	0.108	g/L

Conversion Factors:

1000 kWh/MWh
2204.62 lb/MT
3412.14 BTU/kWh
1000000 g/MT
1000 kg/MT
3.78541 L/gal

<u>Propane Heating Value</u>	91000	BTU/gal
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Abbreviations:

- BTU - British thermal unit
- CalEEMod - California Emissions Estimator Model
- CH₄ - methane
- CO₂ - carbon dioxide
- CO₂e - carbon dioxide equivalent
- g - gram
- gal - gallon
- kg - kilogram
- kWh - kilowatt hour
- L - liter
- lb - pound
- m² - square meter
- MT - metric tonne
- MWh - megawatt hour
- N₂O - nitrous oxide

GHG Emissions from Solid Waste Generation in 2020 and 2037

Land Use	Waste Disposed¹ (tons)	Total CO₂e¹ (MT/year)
Apartments Mid Rise	9.66	4.3945
Condo/Townhouse	14.26	6.4871
Condo/Townhouse High Rise	342.24	155.6904
Enclosed Parking Structure	0	0
Other Asphalt Surfaces	0	0
Parking Lot	0	0
User Defined Retail	0	0
Total with 100% occupancy	366.16	166.572
Prorated with Average Occupancy	202.1	91.9
Improved Waste Diversion²	50.5	23.0
Reductions	151.5	68.9

Notes:

1. Data obtained from The Villages at Squaw Valley Draft Environmental Impact Report, Appendix H.

2. Statewide goal of 75% recycling, composting, or source reduction of solid waste by 2020. Available at: <http://calrecycle.ca.gov/75percent/>. Accessed: February 2016.

Constants:

Average Occupancy Rate ¹	55%
Waste diversion ²	75%

Abbreviations:

MT - metric tonne

GHG Emissions from Public Street Lighting in 2020

	BAU	Project	Reductions
	High Pressure Sodium (HPS) lights	Light Emitting Diode (LED) lights	
W / hr / light ¹	138.32	69.21	--
No. of lights ²	1000	1000	--
No. of hours	11.5	11.5	--
Wh/day	1,590,680	795,915	--
MWh/day	1.59	0.80	--
Emission Factor ³ (lb CO ₂ /MWh)	714.36	714.36	--
lb of CO ₂ /day	1,136	569	--
lb of CO ₂ /year	414,753	207,527	--
MT CO₂ / yr	188.13	94.13	94.00

Notes:

1. Assumes a 138.32 W HPS Type II full cutt off light bulb is replaced with a 50% more efficient LED light bulb of 69.21. Light bulb comparison was obtained from the base case and LED D in LED Street Lighting Study prepared for the U.S. Department of Energy. Available at: http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/gateway_sf-streetlighting.pdf. Accessed: February 2016.
2. Assumed metric of 1000 lights.
3. CO₂e intensity factor for Liberty Utilities accounts for CO₂ emissions rates under the 2020 33% Renewable Portfolio Standard.

Conversions:

0.000453592 MT/lb
 365 days/year
 1,000,000 Wh/MWh

Abbreviations:

W - watt
 hr - hour
 No. - number
 Wh - watt hour
 MWh - megawatt hour
 lb - pound
 CO₂ - carbon dioxide
 MT - metric tonne

GHG Emissions from Public Street Lighting in 2037

	BAU	Project	Reductions
	High Pressure Sodium (HPS) lights	Light Emitting Diode (LED) lights	
W / hr / light ¹	138.32	69.21	--
No. of lights ²	1000	1000	--
No. of hours	11.5	11.5	--
Wh/day	1,590,680	795,915	--
MWh/day	1.59	0.80	--
Emission Factor ³ (lb CO ₂ /MWh)	533.10	533.10	--
lb of CO ₂ /day	848	424	--
lb of CO ₂ /year	309,517	154,871	--
MT CO₂ / yr	140.39	70.25	70.15

Notes:

1. Assumes a 138.32 W HPS Type II full cutt off light bulb is replaced with a 50% more efficient LED light bulb of 69.21. Light bulb comparison was obtained from the base case and LED D in LED Street Lighting Study prepared for the U.S. Department of Energy. Available at: http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/gateway_sf-streetlighting.pdf. Accessed: February 2016.
2. Assumed metric of 1000 lights.
3. CO₂e intensity factor for Liberty Utilities accounts for CO₂ emissions rates under the 2035 50% Renewable Portfolio Standard.

Conversions:

0.000453592 MT/lb
 365 days/year
 1,000,000 Wh/MWh

Abbreviations:

W - watt
 hr - hour
 No. - number
 Wh - watt hour
 MWh - megawatt hour
 lb - pound
 CO₂ - carbon dioxide
 MT - metric tonne

HVAC Retrofit and Improvement GHG Reductions in 2020

Energy Source	Annual Unit GHG Reduction ²		Emission Factor ^{3,4}		Annual GHG Reduction	
					(lb CO ₂ e/sqft)	(MT CO ₂ e/1000 sqft)
Electricity	1.25	kWh/sqft	0.717	lb CO ₂ e/kWh	0.90	0.406
Natural Gas ¹	0.0055	Therm/sqft	138.4	lb CO ₂ e/MMBTU	0.08	0.035

Notes:

- Natural gas energy GHG reduction is assumed to be equivalent to propane.
- Contra Costa County published GHG reduction metrics (kWh/sqft or Therm/sqft) for HVAC Improvement and Retrofit in GHG Annual Reduction Metric (Available at: <http://www.cccounty.us/DocumentCenter/Home/View/3028>; Accessed: January 2016) This metric which was used in the Contra Costa County Municipal Climate Action Plan published in December 2008 suggests that a similar local government could expect annual reductions of 1.25 kWh of electricity and 0.0055 therms of natural gas per square foot of building if it were to implement HVAC re-commissioning program. No additional details on the basis for their estimates have currently been identified.
- CO₂e intensity factor for Liberty Utilities accounts for CO₂ emissions rates under the 2020 33% Renewable Portfolio Standard. CH₄ and N₂O intensity factors are obtained from CalEEMod Appendix D. Available at: <http://www.aqmd.gov/docs/default-source/caleemod/caleemod-appendixd.pdf?sfvrsn=2>. Accessed: January 2016.
- Climate Registry, The. 2014 (April 11). 2014 Climate Registry Default Emission Factors. Available at <https://www.theclimateregistry.org/wp-content/uploads/2014/11/2014-Climate-Registry-Default-Emissions-Factors.pdf>. Accessed October 13, 2014. (See Table 13.1 on p.17 and Table 12.4 on p.10.

<u>Global Warming Potential</u>				<u>Propane Heating Value</u>	91000	BTU/gal
	1	MT CO ₂ e/MT CO ₂		<u>Conversion Factors:</u>		
	25	MT CO ₂ e/MT CH ₄			1000 kWh/MWh	
	298	MT CO ₂ e/MT N ₂ O			1000000 BTU/MMBTU	
<u>Electricity Intensity³</u>					3412.14 BTU/kWh	
	CO ₂	714.36	lb/MWh		453.592 g/lb	
	CH ₄	0.029	lb/MWh		0.453592 kg/lb	
	N ₂ O	0.00617	lb/MWh		3.78541 L/gal	
<u>Propane Emission Factors⁴</u>					10 therm/MMBTU	
	CO ₂	5.59	kg/gal		2204.62 lb/MT	
	CH ₄	0.027	g/L			
	N ₂ O	0.108	g/L			

Abbreviations:

- BTU - British thermal unit
- CalEEMod - California Emissions Estimator Model
- CH₄ - methane
- CO₂ - carbon dioxide
- CO₂e - carbon dioxide equivalent
- g - gram
- gal - gallon
- kg - kilogram
- kWh - kilowatt hour
- L - liter
- lb - pound
- MMBTU - million British thermal units
- MT - metric tonne
- MWh - megawatt hour
- N₂O - nitrous oxide
- sqft - square feet

HVAC Retrofit and Improvement GHG Reductions in 2037

Energy Source	Annual Unit GHG Reduction ²		Emission Factor ^{3,4}		Annual GHG Reduction	
					(lb CO ₂ e/sqft)	(MT CO ₂ e/1000 sqft)
Electricity	1.25	kWh/sqft	0.536	lb CO ₂ e/kWh	0.67	0.304
Natural Gas ¹	0.0055	Therm/sqft	138.4	lb CO ₂ e/MMBTU	0.08	0.035

Notes:

- Natural gas energy GHG reduction is assumed to be equivalent to propane.
- Contra Costa County published GHG reduction metrics (kWh/sqft or Therm/sqft) for HVAC Improvement and Retrofit in GHG Annual Reduction Metric (Available at: <http://www.cccounty.us/DocumentCenter/Home/View/3028>; Accessed: January 2016.) This metric which was used in the Contra Costa County Municipal Climate Action Plan published in December 2008 suggests that a similar local government could expect annual reductions of 1.25 kWh of electricity and 0.0055 therms of natural gas per square foot of building if it were to implement HVAC re-commissioning program. No additional details on the basis for their estimates have currently been identified.
- CO₂e intensity factor for Liberty Utilities accounts for CO₂ emissions rates under the 2035 50% Renewable Portfolio Standard. CH₄ and N₂O intensity factors are obtained from CalEEMod Appendix D. Available at: <http://www.aqmd.gov/docs/default-source/caleemod/caleemod-appendixd.pdf?sfvrsn=2>. Accessed: January 2016.
- Climate Registry, The. 2014 (April 11). 2014 Climate Registry Default Emission Factors. Available at <https://www.theclimateregistry.org/wp-content/uploads/2014/11/2014-Climate-Registry-Default-Emissions-Factors.pdf>. Accessed October 13, 2014. (See Table 13.1 on p.17 and Table 12.4 on p.10.)

<u>Global Warming Potential</u>				<u>Propane Heating Value</u>	91000	BTU/gal
	1	MT CO ₂ e/MT CO ₂		<u>Conversion Factors:</u>		
	25	MT CO ₂ e/MT CH ₄			1000 kWh/MWh	
	298	MT CO ₂ e/MT N ₂ O			1000000 BTU/MMBTU	
<u>Electricity Intensity³</u>					3412.14 BTU/kWh	
	CO ₂	533.10	lb/MWh		453.592 g/lb	
	CH ₄	0.029	lb/MWh		0.453592 kg/lb	
	N ₂ O	0.00617	lb/MWh		3.78541 L/gal	
<u>Propane Emission Factors⁴</u>					10 therm/MMBTU	
	CO ₂	5.59	kg/gal		2204.62 lb/MT	
	CH ₄	0.027	g/L			
	N ₂ O	0.108	g/L			

Abbreviations:

- BTU - British thermal unit
- CalEEMod - California Emissions Estimator Model
- CH₄ - methane
- CO₂ - carbon dioxide
- CO₂e - carbon dioxide equivalent
- g - gram
- gal - gallon
- kg - kilogram
- kWh - kilowatt hour
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- MMBTU - million British thermal units
- MT - metric tonne
- MWh - megawatt hour
- N₂O - nitrous oxide
- sqft - square feet

GHG Reductions for Occupancy Sensors in a Dwelling Unit

	Apartments Mid Rise	Condo/Townhouse
Projected Electricity Usage¹ (kWh/yr) (same for 2020 and 2037)	741	1,001
2020 Projected Emissions from Lighting Electricity (MT/yr):	0.24	0.33
2037 Projected Emissions from Lighting Electricity (MT/yr):	0.18	0.24
2020 Projected Emissions from Lighting Electricity with Occupancy Sensors² (MT/yr):	0.186	0.251
2037 Projected Emissions from Lighting Electricity with Occupancy Sensors² (MT/yr):	0.139	0.187
2020 Emissions Reduction (MT/yr):	0.06	0.07
2037 Emissions Reduction (MT/yr):	0.04	0.06

Notes:

1. Obtained from CalEEMod Appendix D, Table 8.1 for apartments mid rise and condo/townhouses. Available at: <http://www.aqmd.gov/docs/default-source/caleemod/caleemod-appendixd.pdf?sfvrsn=2>. Accessed: January 2016.

2. EnergyStar estimates occupancy sensors save 15-30% on lighting costs. The average or 23% is assumed in this calculation. Available at: <https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/save-energy/find-cost-effective-investments>

3. CO₂e intensity factor for Liberty Utilities accounts for CO₂ emissions rates under the 2020 33% and 2035 50% Renewable Portfolio Standard. CH₄ and N₂O intensity factors are obtained from CalEEMod Appendix D. Available at: <http://www.aqmd.gov/docs/default-source/caleemod/caleemod-appendixd.pdf?sfvrsn=2>. Accessed: January 2016.

Reduction with Occupant Sensor Lighting²: 23%

Global Warming Potential

1	MT CO ₂ e/MT CO ₂
25	MT CO ₂ e/MT CH ₄
298	MT CO ₂ e/MT N ₂ O

Electricity Intensity³

	2020	2037	
CO ₂	714.36	533.10	lb/MWh
CH ₄	0.029	0.029	lb/MWh
N ₂ O	0.00617	0.00617	lb/MWh

Conversion Factors:

2204.62 lb/MT
1000 kWh/MWh

Abbreviations:

- CalEEMod - California Emissions Estimator Model
- CH₄ -methane
- CO₂ - carbon dioxide
- CO₂e - carbon dioxide equivalent
- kWh - kilowatt hour
- lb - pound
- MT - metric tonne
- MWh - megawatt hour
- N₂O - nitrous oxide
- yr - year

GHG Reduction for Transportation Measures

Metric	MT CO₂e/ VMT Avoided¹	MT CO₂e per 100% VMT Avoided¹
EPA ²	4.20E-04	18523.69
Squaw Valley, 2020 ³	3.59E-04	15832.44
Squaw Valley, 2037 ³	3.23E-04	14240.96

Notes:

1. VMT avoided can be applied to measures such as bicycle and pedestrian networks, car-sharing programs, transit services, and centralized employee housing to reduce VMT. Not all VMT is able to be reduced. CAPCOA suggested reduction ranges are 10-20%.
2. GHG Equivalencies Calculator- Miles driven by the average passenger vehicle: <http://www.epa.gov/energy/ghg-equivalencies-calculator-calculations-and-references#vehicles>
3. Data obtained from The Villages at Squaw Valley Draft Environmental Impact Report, Appendix H, Mobile-Source GHGs, Annual for 2020 and 2037. Metric is calculated using total mobile source emissions divided by total VMT.

VMT Travelled²

44,104,014	VMT/year
441,040	1% reduction in VMT

CO₂e Emissions²

15,832	MT CO ₂ e/year (2020)
14,241	MT CO ₂ e/year (2020)

Abbreviations:

- CO₂e - carbon dioxide equivalent
- MT - metric tonne
- VMT - vehicle miles travelled
- EPA - Environmental Protection Agency
- GHG - Greenhouse Gas

42	Bicycle/Pedestrian Network		Mobile	VMT Reduction	<p>Bike paths / lanes / routes <0.1% VMT reduction Bike/ped facilities to support transit Limited quantitative data (Page A-7 of http://www3.epa.gov/otaq/stateresources/policy/420r11003.pdf) Estimates of VMT reductions from bicycle projects suggest that for a metropolitan area, bicycle projects may reduce regional VMT from under 0.01 percent to over 3 percent, with the latter figure assuming capital construction of facilities and an already existing favorable land-use configuration (Page 42 of http://www.fhwa.dot.gov/environment/glob_c5.pdf)</p> <p>EPA Commuter model to estimate? (http://www3.epa.gov/otaq/stateresources/policy/transp/commuter/420b05017.pdf) Possibly CMAQ Funding- http://www.fhwa.dot.gov/environment/air_quality/cmaq/index.cfm; http://www.epa.gov/sites/production/files/2014-08/documents/donovan.pdf</p>
43	Car-Sharing Program (Low Emission Vehicles)		Mobile	VMT Reduction	<p>Car-sharing Limited quantitative data (Page A-7 of http://www3.epa.gov/otaq/stateresources/policy/420r11003.pdf) 26.9% to 32.9% VMT Reduction (Page 6 of http://www.arb.ca.gov/cc/sb375/policies/carsharing/carsharing_brief.pdf)</p>
44	Employee Housing		Mobile	VMT Reduction	<p>The Transportation Research Board (2009) summarized the research literature with the conclusion that doubling residential density would be associated with a 5–12 percent reduction in VMT, and possibly up to a 25 percent reduction with complementary changes in transit availability, the jobs-housing balance and other factors. However, as mentioned above, doubling the density for even a large share of new housing would have only a modest effect on average residential density across a city or metropolitan area (Page 25 of http://www.ppic.org/content/pubs/report/R_211LBR.pdf) General benefits 3.4/5.0 (Page 19 of http://www.coolplan.org/ccap-report/source-material/15%20SCTA%20white%20paper.pdf)</p>
49	Low-emission/alternative fuel vehicle shuttle service within Olympic Valley	Program 2: Peak-hour ski days only, fixed-route circulating hillside neighborhoods north of Squaw Valley		Mobile, VMT Reduction	<p>Improved transit travel times and operations (busways, BRT, signal prioritization for transit vehicles, heavy and light rail, managed lanes) -0.4 (travel time elasticity with respect to ridership) Improved transit access through shuttle and feeder bus services, paratransit Relates to improving travel time above, not measured separately (Page A-7 of http://www3.epa.gov/otaq/stateresources/policy/420r11003.pdf)</p>
50		Program 3: dial-a-ride shuttles that circulate the hillside neighborhoods during non-peak-hour ski days		Mobile, VMT Reduction	
51	Transit services connecting Village with Remainder of Squaw Valley/Alpine Meadows	Provided during peak ski season, 3 routes (see Specific Plan page 5-30)		Mobile, VMT Reduction	<p>Peak/off-peak transit fares -0.1 to -0.3 (peak fares) and -0.1 to -0.7 (off-peak fares, depending on trip purpose; lower for work trips) (Page A-7 of http://www3.epa.gov/otaq/stateresources/policy/420r11003.pdf)</p>

G4

Memo Discussing the Role of Cap-and-Trade in GHG Emission Reductions

MEMORANDUM

To **Chevis Hosea, Squaw Valley Ski Corporation**
 CC **Gary Jakobs, Ascent Environmental**
Alexander Fisch, Placer County Community Development
Resource Agency

From **Michael Keinath**
Megan Neiderhiser

Subject **AB32 Analysis and GHG Significance Discussion**
Village at Squaw Valley Project, Olympic Valley, California

Date February 18, 2016

In order to assess the significance of the GHG emissions for the proposed Village at Squaw Valley ("Project") Specific Plan (VSVSP) by reference to AB 32, this memorandum evaluates the Project's GHG emissions with particular consideration of how continued implementation of the California Cap-and-Trade Program may also act to offset certain emissions of the Project. (See Cal. Code Regs., tit. 17, §§ 95800-96022).

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California's Cap-and-Trade Program regulates the emissions of large electric power plants and electricity importers, large industrial plants, and fuel distributors (including transportation fuel and natural gas/propane).¹ These sources are responsible for about 85 percent of the State's total GHG emissions inventory.² AB 32 required the California Air Resources Board (ARB) to develop a Scoping Plan that describes the approach California will take to reduce GHGs to achieve the goal of reducing emissions to 1990 levels by 2020. The Board first approved the Scoping Plan in 2008. The Board also adopted the First Update to the Climate Change Scoping Plan on May 22, 2014.³ As illustrated in Table 2 of the 2008 Scoping Plan, implementation of the Cap-and-Trade Program, in conjunction with other complimentary measures for the same emissions sources, would achieve approximately 146.7 MMT of the 174 MMT of CO₂e reductions needed to return the State of California to its 1990 emissions level by 2020.⁴

¹ California Code Regulations, Title 17, § 95811. Available at: [https://govt.westlaw.com/calregs/Document/I1A3D4C109A3011E4A28EDDF568E2F8A2?viewType=FullText&originContext=documenttoc&transitionType=CategoryPageItem&contextData=\(sc.Default\)](https://govt.westlaw.com/calregs/Document/I1A3D4C109A3011E4A28EDDF568E2F8A2?viewType=FullText&originContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default)). Accessed: January 2016.

² CARB, 2015. Available at: http://www.arb.ca.gov/cc/capandtrade/guidance/cap_trade_overview.pdf. Accessed: January 2016.

³ CARB. AB 32 Scoping Plan. Available at: <http://www.arb.ca.gov/cc/scopingplan/scopingplan.htm>. Accessed: January 2016.

⁴ CARB, 2008. Available at: http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf. Accessed: January 2016.

As described by the California Air Resources Board (CARB):

“Cap-and-trade is a market based regulation that is designed to reduce [GHGs] from multiple sources. Cap-and-trade sets a firm limit or cap on GHGs and minimize[s] the compliance costs of achieving AB 32 goals. The cap will decline approximately 3 percent each year beginning in 2013. Trading creates incentives to reduce GHGs below allowable levels through investments in clean technologies. With a carbon market, a price on carbon is established for GHGs. Market forces spur technological innovation and investments in clean energy. Cap-and-trade is an environmentally effective and economically efficient response to climate change.”⁵

“The Cap-and-Trade Program is a key element of California’s climate plan. It sets a statewide limit on sources responsible for 85 percent of California’s greenhouse gas emissions, and establishes a price signal needed to drive long-term investment in cleaner fuels and more efficient use of energy. The program is designed to provide covered entities the flexibility to seek out and implement the lowest-cost options to reduce emissions.”⁶

The Cap-and-Trade Program currently covers GHG emissions from electricity generators and importers and distributors of transportation fuels (i.e., gasoline and diesel)⁷, natural gas/propane (designated as liquefied petroleum gas, or LPG, in ARB documents), and other fossil fuels. Importantly, the Cap-and-Trade Program has been designed to provide a “firm cap, ensuring that the 2020 statewide emission limit will not be exceeded. Thus, the estimated emission reductions attributed to the Cap-and-Trade Program depend on the emissions forecast. For example, if the emissions forecast increases, the reductions associated with the Cap-and-Trade Program will increase.”⁸ (Italics added.) Moreover, CARB anticipates developing a “plan for a post-2020 Cap-and-Trade Program, including cost containment, to provide market certainty and address a mid-term emissions target.”⁹

As discussed in this memorandum, the GHG emissions from the Project are primarily due to fossil fuel combustion. Table 1 below illustrates that the Cap-and-Trade Program covers entities that are responsible for emissions from nearly all of the Project-related emission sources. Specifically:

- propane gas suppliers are responsible for the emissions associated with the propane gas used in the area sources;¹⁰

⁵ CARB, 2015. Cap-and-Trade Program. Available at: <http://www.arb.ca.gov/cc/capandtrade/capandtrade.htm>. Accessed: January 2016.

⁶ CARB, 2015. Overview of ARB Emissions Trading Program. Available at: http://www.arb.ca.gov/cc/capandtrade/guidance/cap_trade_overview.pdf. Accessed: January 2016.

⁷ CARB, 2012. Cap-and-Trade Regulation Instructional Guidance. Chapter 2. Table 2.1. Available at: <http://www.arb.ca.gov/cc/capandtrade/guidance/chapter2.pdf>. Accessed: January 2016.

⁸ CARB, 2014. First Update to the Climate Change Scoping Plan, Building on the Framework, Pursuant to AB 32, The California Global Warming Solutions Act of 2006. Page 93. Available at: http://www.arb.ca.gov/cc/scopingplan/2013_update/first_update_climate_change_scoping_plan.pdf. Accessed: January 2016.

⁹ Id. Page 98.

¹⁰ CARB, 2015. Facts About: Information for Entities That Take Delivery of Fuel for Fuels Phased into the Cap-And-Trade Program Beginning January 1, 2015. Available at: http://www.arb.ca.gov/cc/capandtrade/guidance/faq_fuel_purchasers.pdf

- electricity generators are responsible for the emissions associated with fuel combustion needed to produce electricity at utilities;
- gasoline and diesel fuel suppliers are responsible for emissions associated with gasoline and diesel fuel combustion from the area source, traffic and construction categories; and
- wastewater treatment facilities and landfills are responsible for emissions from water disposal and waste disposal, respectively.

As discussed above, the sources covered by the Cap-and-Trade Program are capped at progressively declining emissions levels; emission reductions are achieved by limiting the number of allowances available in the marketplace for purchase. Thus, for the emission sources also covered by the Cap-and-Trade Program, which are nearly all of the sources associated with the Project, there would be no net increase in GHG emissions from the Project in the State. In this context, although the Project's GHG emissions would increase relative to the existing emissions level generated from activities on the Project Site, the change in GHG emissions would not, in our view, conflict with AB 32 or the Scoping Plan.

A similar approach for showing compliance with AB 32 to assessing the significance of GHG emissions was incorporated in recent environmental analyses where the SCAQMD^{11, 12} has been the lead agency. Additionally, the SJVAPCD issued guidance indicating that "all GHG emission increases resulting from the combustion of any fuel produced, imported and/or delivered in California are mitigated under Cap-and-Trade, either directly by facilities identified under groups 1 or 2 (section 95811 (a) and (b)), or by fuel suppliers identified under the group 3 (section 95811 (c) through (f))" and "[t]herefore, GHG emission increases caused by fuel use (other than jet fuels) are determined to have a less than significant impact on global climate change under CEQA."¹³ As such, many jurisdictions throughout the state are relying on the Cap-and-Trade Program to support a finding that a project will not result in a significant impact on the environment by generating GHG emissions. This is because the vast majority of a land use project's GHG emitting activities and fuel sources are directly covered by the program.

¹¹ SCAQMD, 2014. Final Negative Declaration for: Ultramar Inc. Wilmington Refinery Cogeneration Project. State Clearinghouse No. 2012041014. Pages 2-31- and 2-32. Available at: http://www.aqmd.gov/docs/default-source/ceqa/documents/permit-projects/2014/ultramar_neg_dec.pdf?sfvrsn=2. Accessed: January 2016.

¹² SCAQMD, 2015. Final Environmental Impact Report for Breitburn Santa Fe Springs Blocks 400/700 Upgrade Project. Section 3.5. Available at: <http://www.aqmd.gov/docs/default-source/ceqa/documents/permit-projects/2015/breitburn-feir.pdf?sfvrsn=2>. Accessed: January 2016.

¹³ SJVAPCD, 2014. APR – 2025: CEQA Determinations of Significance for Projects Subject to ARB's GHG Cap-and-Trade Regulation, http://www.valleyair.org/policies_per/Policies/APR-2025.pdf. Issued June 25, 2014. Accessed: January 2016.

Table 1: GHG Emissions Sources Covered by Cap-and-Trade

Project GHG Emissions Sources	GHG Emissions Source Examples	Covered by Cap-and-Trade?
Area sources	Fuel combustion by snow removal equipment	Yes (gasoline and diesel fuel suppliers)
	Fuel combustion by landscaping equipment	Yes (gasoline and diesel fuel suppliers)
Energy use	Propane gas combustion (e.g., space heaters and water heaters)	Yes (propane gas suppliers)
	Fuel combustion at utilities for electricity production used in building energy use	Yes (electrical generators)
Water use	Production of electricity to supply and treat water	Yes (electrical generators)
	Methane generated by wastewater treatment	Yes (wastewater treatment facilities)
Waste disposed	Methane generated by waste disposal	Yes (landfills)
Traffic	Fuel combustion in car and trucks	Yes (gasoline and diesel fuel suppliers)
Construction	Fuel combustion in construction equipment	Yes (gasoline and diesel fuel suppliers)
Vegetation	Carbon sequestration lost due to vegetation removal	No

In conclusion, AB 32 covers GHG reduction commitments for all source categories except vegetation. Therefore, approval and implementation of the Project should not conflict with the goals of AB32 nor prevent their achievement.