▶ Solar Feasibility Study for the City of Sunnyvale

FINAL

Attachment A-1: Solar PV Project Financial Analysis Summary (3% Utility Escalator)

	Corporation Yard	Hamilton Well / Water Plant	Mary-Carson Water Plant	Ortega Well	Raynor Well	San Lucar Pump Station	Serra Well	Wolfe-Evelyn Water Plant	Wright Avenue Water Plant	Sunken Garden - Lift Meter	Sunken Garden - Golf Range Meter	Baylands Park - Lift Meter	Baylands Park - Park Meter	Baylands Park - Storm Lift Meter	SMaRT Station	Landfill	Wastewater Treatment Plant Retention Ponds	Total for Utility Sites	Total Including Community Solar Sites
System Overview																			
System Size (kW)	25			122						<i>-</i>		28	38		241	5,000	5,000	454 1,438	10,454
Yield (kWh/kW)	1,507			1,410	:		l	L			:	1,451	1,451		1,441	1,576	1,607		1,585
Annual onsite energy usage (kWh) 1	47,780	68,320	448,960	227,067	5,480	400,640	15,920	329,760	154,880	73,498	36,772	58,960	57,840	76,512	419,369			2,421,758	2,421,758
Year 1 Solar Output (kWh)	37,665	0	0	172,312	0	0	0	0	0	0	0	40,620	55,127	0	347,282	7,880,404	8,036,925	653,005	16,570,335
Annual PV degradation	0.50%	0.50%		0.50%	0.50%		0.50%	0.50%	0.50%	0.50%	0.50%		0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
Facility Energy Offset by Solar	79%	0%	0%	76%	0%	0%	0%	0%	0%	0%	0%	69%	95%	0%	83%		-	81%	81%
Current Utility Information	0005	0005	0005	0005	0005	0005	0005	200	200	0005	200	2005	0000	2005	0005	200	2005		
Utility Provider Utility Rate Schedule	PG&E A-10 S TOU	PG&E A-1	PG&E	PG&E	PG&E A-6 TOU	PG&E A-6 TOU	PG&E		PG&E	PG&E A-1	PG&E	PG&E	PG&E	PG&E	PG&E E-19 SV	PG&E	PG&E		,
Average Utility Cost (\$/kWh)	\$0.1315	\$0.1883	A-6 TOU \$0.2324	A-6 TOU \$0.2324	\$0.2324		A-1 \$0.1883		A-6 TOU \$0.2324	\$0.1883	A-1 \$0.1883	A-1 \$0.1883	A-1 \$0.1883	A-6 TOU \$0.2324	\$0.0966	N/P	N/A	\$0.2012	\$0.2012
Utility Annual Inflator (%)	30.1313	3.0%	30.2324	30.2324	30.2324		30.1883	30.2324	30.2324	3.0%	30.1883		30.1883	30.2324	3.0%	3.0%	3.0%	30.2012	3.0%
Direct Purchase Information	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.076	3.0%	3.0%	3.076	3.0%	3.0%	3.0%	5.0%	3.0%	3.0%	3.0%
Engineering, Procurement, and Construction \$ 2	\$95,750	\$0	\$0	\$489,000 \$0.000	\$0	\$0 \$0.000	\$0	\$0	\$0	\$0	\$0	\$80,080	\$108,680 \$0.000	\$0	\$689,260	\$19,150,000	\$19,150,000	\$1,462,770	\$39,762,770
Solar Rebate (\$/kWh)	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000		,
Solar Rebate Term	year(s)	year(s)	year(s)	year(s)	year(s)	year(s)	year(s)	year(s)	year(s)	year(s)	year(s)	year(s)	year(s)	year(s)	year(s)	year(s	year(s)		
Year 1 O&M Discount Rate	\$375 3.00%	\$0 3.00%	\$0 3.00%	\$1,834 3.00%	\$0 3.00%	\$0 3.00%	\$0 3.00%	\$0 3.00%	\$0 3.00%	\$0 3.00%	\$0 3.00%	\$420 3.00%	\$570 3.00%	\$0 3.00%	\$3,615 3.00%	\$75,000 3.00%	\$75,000 3.00%	\$6,814 3,00%	\$156,814
	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Lease/Loan Information	45	45(-)	45(-)	45(-)	45(-)	45(-)	45(1)	45(-)	45(-)	45(-)	45(-)	45(-)	45	45(-)	45(-)	45	45(-)		
Lease/Loan Term	15 year(s) 3.8%	15 year(s) 3.8%	15 year(s)	15 year(s)	15 year(s) 3.8%	15 year(s)	15 year(s)	15 year(s)	15 year(s)	15 year(s) 3.8%	15 year(s)	15 year(s)	15 year(s) 3.8%	15 year(s)	15 year(s) 3.8%	15 year(s) 3.8%	15 year(s) 3.8%		,
Lease/Loan Interest Rate (%) End of Term Buyout	\$0.00	\$0.00	3.8% \$0.00	3.8% \$0.00	\$0.00	3.8% \$0.00	3.8% \$0.00	3.8% \$0.00	3.8% \$0.00	\$0.00	3.8% \$0.00	3.8% \$0.00	\$0.00	3.8% \$0.00	\$0.00	\$0.00	\$0.00		,
PPA Information	\$0.00	\$0.00	30.00	\$0.00	\$0.00	\$0.00	30.00	30.00	50.00	\$0.00	50.00	30.00	50.00	\$0.00	30.00	50.00	\$0.00		
Initial PPA rate (\$/kWh) ² PPA annual escalator	\$0.1500 3.00%	\$0.1500 3.00%	\$0.1500 3.00%	\$0.1500 3.00%	\$0.1500 3.00%		\$0.1500 3.00%	\$0.1500 3.00%	\$0.1500	\$0.1500 3.00%	\$0.1500	\$0.1500	\$0.1500 3.00%	\$0.1500	\$0.1500	\$0.1500	\$0.1500 3.00%		
S-REC Value (keep/sell) (\$/kWh)	\$0.0000	\$0.0000	\$0.0000	\$0.0000	\$0.0000	3.00% \$0.0000	\$0.0000	\$0.0000	3.00% \$0.0000	\$0.0000	3.00% \$0.0000	3.00% \$0.0000	\$0.0000	3.00% \$0.0000	3.00% \$0.0000	\$0.0000	\$0.0000		,
S-REC escalator	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%		0.00%	0.00%	0.00%	0.00%	0.00%		
S-REC Contract Term	year(s)	vear(s)	year(s)	year(s)	year(s)	year(s)	vear(s)	year(s)	year(s)	year(s)	year(s)	year(s)	vear(s)	year(s)	year(s)	vear(s)			
Buver sells S-REC (Direct Purchase/Loan)	, <u>(0)</u>	N	N N	N	N	, , , , , , , , , , , , , , , , , , ,	N	N N	N	N	N	, co. (c)	N	N	N		N N		,
Environmental Impact							-									-			
Annual CO2 Reduction (Tons) Annual VMT Reduction Equivalent	10 22,543			45 103,130								11 24,311	14 32,994		91 207,851	2,055 4,716,478	2,096 4,810,157	170 390,828	4,322 9,917,463
Equivalent Annual Carbon Sequestration by US Forests (acres)	8			37				-				9	12	-	74	1,685	1,718	140	3,543
NPV of Total Energy COST																			
Utility Energy Purchase (25 year)	\$228,251	\$309,390	\$1,681,714	\$1,035,934	\$31,070	\$1,700,116	\$77,203	\$1,242,809	\$580,904	\$322,348	\$166,169	\$272,082	\$269,525	\$295,290	\$2,501,756	\$0 \$0	\$0 \$0	\$5,091,354	\$10,714,560
PPA (25 year)	\$135,402	L		\$668,371			l	L				\$159,810	\$216,581	1	\$1,348,398		\$0	\$2,528,562	\$2,528,562
Direct Purchase - incl O&M, rebate (25 year)	\$107,441			\$594,370 \$631,877	L			I		l		\$106,865 \$113,008	\$144,727 \$153,063	L	\$900,949	\$0	\$0	\$1,854,352	\$1,854,352
Lease/Loan (25 year)	\$114,785	-	-	\$631,877	-	-	-	-		-		\$113,008	\$153,063	-	\$953,816	\$0	\$0	\$1,966,549	\$1,966,549
% Energy Cost Savings (Undiscounted)																			
Direct Purchase (25 year) Lease/Loan (25 year)	66% 57%			57% 47%								69% 63%	58% 49%		72% 66%		L		
PPA (25 year)	41%	-	_	35%	-	-	-	-				41%	19%	-	46%		·		
Levelized Cost of Energy (LCOE) Analysis														-					,
Utility LCOE (\$/kWh) - (25 year)	0.2787 0.0952			0.2661	L <i>-</i> -				:		l	0.2692	0.2718	L	0.3480	:	4	0.3111	, [
Direct Purchase LCOE (\$/kWh) - (25 year)	0.0952	L		0.1151			ļ ⁻	ļ			:	0.0826	0.1139		0.0973		i	0.1024	, 4
Lease/Loan LCOE (\$/kWh) - (25 year)	0.1203			0.1421						ļ		0.0996	0.1375	L	0.1179		 	0.1250	, -
PPA LCOE (\$/kWh) - (25 year)	0.1649	_	-	0.1724	-	-	-	-		-		0.1588	0.2194	-	0.1884		-	0.1836	

Note: The above analysis uses 3% utility escalation rate.

Attachment A-2: Solar PV Project Financial Analysis Summary (5% Utility Escalator)

	Corporation Yard	Hamilton Well / Water Plant	Mary-Carson Water Plant	Ortega Well	Raynor Well	San Lucar Pump Station	Serra Well	Wolfe-Evelyn Water Plant	Wright Avenue Water Plant	Sunken Garden - Lift Meter	Sunken Garden - Golf Range Meter	Baylands Park - Lift Meter	Baylands Park - Park Meter	Baylands Park - Storm Lift Meter	SMaRT Station	Landfill	Wastewater Treatment Plant Retention Ponds	Total for Utility Sites	Total Including Community Solar Sites
System Overview																			
System Overview System Size (kW)	25			122								28	38	1	241	5,000	F 000	454	10,454
Yield (kWh/kW)	1,507			1.410								1,451	1,451		1,441	1,576	5,000 1,607	1,438	1,585
Annual onsite energy usage (kWh) ¹	47,780	68.320	448,960	227,067	5.480	400,640	15.920	329.760	154.880	73,498	36,772	58,960	57,840		419,369			2,421,758	2,421,758
Year 1 Solar Output (kWh)	37,665	00,520	0	172,312	5,400	0	15,520	0	154,000	73,450	0	40,620	55,127		347,282	7.880.404	8,036,925	653,005	16,570,335
Annual PV degradation	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
Facility Energy Offset by Solar	79%	0%	0%	76%	0%	0%	0%	0%	0%	0%	0%	69%	95%	6 0%	83%			81%	81%
Current Utility Information																			
Utility Provider	PG&E A-10 S TOU	PG&E	PG&E A-6 TOU	PG&E A-6 TOU	PG&E A-6 TOU	PG&E	PG&E		PG&E A-6 TOU	PG&E	PG&E	PG&E	PG&E	PG&E A-6 TOU	PG&E E-19 SV	PG&E	PG&E	l	
Utility Rate Schedule	A-10 S TOU	A-1	A-6 TOU	A-6 TOU	A-6 TOU	A-6 TOU	A-1	A-6 TOU	A-6 TOU	A-1	A-1	A-1	A-1	A-6 TOU	E-19 SV	N/A	N/A		
Average Utility Cost (\$/kWh)	\$0.1315	\$0.1883	\$0.2324	\$0.2324	\$0.2324	\$0.2324	\$0.1883		\$0.2324	\$0.1883	\$0.1883		\$0.1883	\$0.2324	\$0.0966		li	\$0.2012	\$0.2012
Utility Annual Inflator (%)	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Direct Purchase Information			4.0					4.0											
Engineering, Procurement, and Construction \$ 2 Solar Rebate (\$/kWh)	\$95,750	\$0	\$0	\$489,000	\$0 \$0.000	\$0	\$0.000	\$0 \$0,000	\$0 \$0,000	\$0	\$0	\$80,080	\$108,680	\$0,000	\$689,260	\$19,150,000	\$19,150,000	\$1,462,770	\$39,762,770
Solar Rebate (\$/kWh)	\$0.000	\$0.000	\$0.000	\$0.000		\$0.000			\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000		
Year 1 O&M	year(s) \$375	year(s) \$0	year(s) \$0	year(s) \$1,834	year(s) \$0	year(s) \$0	year(s) \$0		year(s) \$0	year(s) \$0	year(s) \$0	year(s) \$420	year(s \$570		year(s) \$3,615	year(s \$75,000	year(s) \$75,000	\$6,814	\$156,814
Discount Rate	3.00%	3.00%		3,00%	3.00%		3.00%		3.00%	3.00%	3.00%		3.00%		3.00%	3,000	3,00%	3.00%	3,00%
Lease/Loan Information		0.007			0.007.	0.007	0.007.	0.00.1											
Lease/Loan Term	15 year(s)	15 year(s)	15 year(s)	15 year(s)	15 year(s)	15 year(s)	15 year(s)	15 year(s)	15 year(s)	15 year(s)	15 year(s)	15 year(s)	15 year(s	15 year(s)	15 year(s)	15 year(s	15 year(s)		
Lease/Loan Interest Rate (%)	3.8%	3.8%	3.8%	3.8%	3.8%	3.8%	3.8%	3.8%	3.8%	3.8%	3.8%		3.8%	3.8%	3.8%	3.8%	3.8%	1	
End of Term Buyout	\$0.00	\$0.00		\$0.00	\$0.00	\$0.00	\$0.00		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00		\$0.00	\$0.00			
PPA Information																			
Initial PPA rate (\$/kWh) 2	\$0.1500	\$0.1500	\$0.1500	\$0.1500	\$0.1500	\$0.1500	\$0.1500		\$0.1500	\$0.1500	\$0.1500	\$0.1500	\$0.1500	\$0.1500	\$0.1500	\$0.1500	\$0.1500	 	
PPA annual escalator	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%		3.00%	3.00%	3.00%	3.00%	3.00%		3.00%	3.00%	3.00%		
S-REC Value (keep/sell) (\$/kWh)	\$0.0000	\$0.0000	\$0.0000	\$0.0000	\$0.0000	\$0.0000	\$0.0000	\$0.0000	\$0.0000	\$0.0000 0.00%	\$0.0000	\$0.0000	\$0.0000		\$0.0000	\$0.0000	\$0.0000	ļ	
S-REC escalator	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%		 	
S-REC Contract Term Buyer sells S-REC (Direct Purchase/Loan)	year(s) N	year(s) N	year(s) N	year(s) N	year(s) N	year(s) N	year(s) N	year(s) N	year(s) N	year(s) N	year(s)	year(s) N	year(s) year(s)	year(s) N	year(s	year(s)		
Environmental Impact																			
Annual CO2 Reduction (Tons)	10			45				-				11	14	-	91	2,055	2,096	170	4,322
Annual VMT Reduction Equivalent	22,543	L		103,130		l	l					24,311	32,994	1	207,851	4,716,478	4,810,157	390,828	9,917,463
Equivalent Annual Carbon Sequestration by US										l		1				l		l	
Forests (acres)	8	-	-	37	-	-	-	-	-	-	-	9	12	-	74	1,685	1,718	140	3,543
NPV of Total Energy COST	6200 272	6202.450	62.420.677	64 347 433	620.542	62.462.070	Ć00 400	£4.500.544	6730.740	6400.030	6244 224	6246.042	6242.762	6275 527	63.404.544	- 60		46 474 000	642 525 050
Utility Energy Purchase (25 year) PPA (25 year)	\$290,273 \$136,557	\$393,459	\$2,138,677	\$1,317,422 \$690,735	\$39,512	\$2,162,079	\$98,180	\$1,580,511	\$738,749	\$409,938	\$211,321	\$346,013	\$342,762		\$3,181,544 \$1,393,969	\$0 \$0	\$0 \$0	\$6,474,800 \$2,611,461	\$13,625,968 \$2,611,461
Direct Purchase - incl O&M, rebate (25 year)	\$136,557	H		\$616,734			} <u>-</u>	h		l -		\$165,704 \$112,759	\$224,496 \$152,642	t	\$1,393,969	\$0 \$0	\$0 \$0	\$1,937,251	\$1,937,251
Lease/Loan (25 year)	\$115,940]	\$654,241								\$118,901	\$160,978		\$999,387		50	\$2,049,447	\$2,049,447
% Energy Cost Savings (Undiscounted)	7115,540			,054,241								\$110,501	Ç100,978		222,367	,,0	30	92,043,447	y2,043,447
Direct Purchase (25 year)	73%	-	-	65%	-	-	-	-		-		75%	65%	-	77%		-	İ	
Lease/Loan (25 year)	67%	-	-	65% 57%				-				70%	65% 59%	-	72%		·		
PPA (25 year)	54%		-	49%								53%	36%	-	57%			[-	
Levelized Cost of Energy (LCOE) Analysis														-					
Utility LCOE (\$/kWh) - (25 year)	0.3648			0.3484								0.3524	0.3558		0.4555			0.4072	
Direct Purchase LCOE (\$/kWh) - (25 year)	0.0970			0.1220			ļ ⁻					0.0895	0.1234		0.1049	ļ <i>-</i>	1	0.1096	
Lease/Loan LCOE (\$/kWh) - (25 year)	0.1222		-	0.1490	<i>-</i>					ļ ⁻		0.1066	0.1470		0.1255		4	0.1321	
PPA LCOE (\$/kWh) - (25 year)	0.1667			0.1793	-						-	0.1657	0.2289		0.1960	L	-	0.1908	

Note: The above analysis uses 5% utility escalation rate