Attachment 4
Energy Modeling Outputs

ESA

600 Foothill Project

Construction Energy Consumption Calculations

Trips and VMT

PhaseName	WorkerTripNumber	VendorTripNumber	HaulingTripNumber	WorkerTripLength	VendorTripLength	HaulingTripLength	WorkerVehicleClass	VendorVehicleClass	HaulingVehicleClass
Demolition	20	6	330	14.7	6.9	20	LD_Mix	HDT_Mix	HHDT
Site Preparation	10	6	0	14.7	6.9	20	LD_Mix	HDT_Mix	HHDT
Grading/Excavation	20	6	3257	14.7	6.9	20	LD_Mix	HDT_Mix	HHDT
Drainage/Utilities/Trenching	10	6	0	14.7	6.9	20	LD_Mix	HDT_Mix	HHDT
Foundations/Concrete Pour	20	0	1762	14.7	6.9	20	LD_Mix	HDT_Mix	HHDT
Building Construction -2022	60	14	0	14.7	6.9	20	LD_Mix	HDT_Mix	HHDT
Building Construction -2023	60	14	0	14.7	6.9	20	LD_Mix	HDT_Mix	HHDT
Architectural Coating	18	4	0	14.7	6.9	20	LD_Mix	HDT_Mix	HHDT
Landscaping	10	6	0	14.7	6.9	20	LD_Mix	HDT_Mix	HHDT

OffRoad Equipment

PhaseName	OffRoadEquipmentType	OffRoadEquipmentUn	UsageHours	HorsePower	LoadFactor
Demolition	Concrete/Industrial Saws	1	8	81	0.73
Demolition	Rubber Tired Dozers	1	8	247	0.4
Demolition	Tractors/Loaders/Backhoes	3	8	97	0.37
Site Preparation	Graders	1	8	187	0.41
Site Preparation	Rubber Tired Dozers	1	7	247	0.4
Site Preparation	Tractors/Loaders/Backhoes	1	8	97	0.37
Grading/Excavation	Bore/Drill Rigs	1	8	221	0.5
Grading/Excavation	Excavators	1	8	158	0.38
Grading/Excavation	Graders	1	8	187	0.41
Grading/Excavation	Rubber Tired Dozers	1	8	247	0.4
Grading/Excavation	Sweepers/Scrubbers	1	4	64	0.46
Grading/Excavation	Tractors/Loaders/Backhoes	1	8	97	0.37
Drainage/Utilities/Trenching	Tractors/Loaders/Backhoes	1	8	97	0.37
Drainage/Utilities/Trenching	Trenchers	1	8	78	0.5
Foundations/Concrete Pour	Cranes	2	4	231	0.29
Foundations/Concrete Pour	Pumps	2	8	130	0.42
Building Construction	Cranes	1	4	231	0.29
Building Construction	Forklifts	1	8	89	0.2
Building Construction	Generator Sets	1	8	84	0.74
Building Construction	Tractors/Loaders/Backhoes	1	8	97	0.37
Architectural Coating	Air Compressors	1	6	78	0.48
Landscaping	Forklifts	1	8	89	0.2
Landscaping	Sweepers/Scrubbers	1	4	64	0.46

MT CO2 per Gallon of Diesel (applicable to Vendor and Haul Trips and Offroad Equipment)	MT CO2 per Gallon of Gasoline (applicable to Worker Trips)
0.01018	0.008887

Source: https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references#diesel

On-site Offroad Construction Equipment Fuel Usage

	Onsite GHG (MTCO2e/year)	Onsite Construction Equipment Diesel Use (gal/year)
Demolition	29	2,813
Site Preparation	6	599
Grading/Excavation	27	2,673
Drainage/Utilities/Trenching	4	395
Foundations/Concrete Pour	20	1,922
Building Construction -2022	113	11,136
Building Construction -2023	31	3,027
Landscaping	10	962
Architectural Coating	5	502
Total:		**24,029**

Off-site Vehicular Fuel Usage

	Hauling (MTCO2e/year)	Vendor (MTCO2e/year)	Worker (MTCO2e/year)	Offsite GHG (MTCO2e/year)	Total Diesel (gal/year)	Total Gasoline (gal/year)
Demolition	12	2	3	17	1,418	290
Site Preparation	0	1	0	1	58	43
Grading/Excavation	123	1	2	126	12,200	193
Drainage/Utilities/Trenching	0	1	1	2	101	75
Foundations/Concrete Pour	66	0	2	69	6,530	279
Building Construction -2022	0	32	53	84	3,096	5,931
Building Construction -2023	0	8	14	22	815	1,553
Landscaping	0	6	4	9	552	409
Architectural Coating	0	2	3	5	186	373
					24,955	**9,146**

Energy Summary

Total Diesel (gal)	48,985	
Total Gasoline (gal)	9,146	
Project Length	1.5	
Annual Average Diesel Use (gal/year)	32,656	
Annual Average Gasoline Use (gal/year)	6,097	
2019 Los Angeles County Diesel Consumption (gal)	584,745,763	Source: CEC, 2010-2019 CEC-A15 Results and Analysis, https://www.energy.ca.gov/media/3874 (Note: Non-retail sales, which comprise 52.8% of all diesel sales, are not reported in this chart.)
2019 Los Angeles County Gas Consumption (gal)	3,559,000,000	Source: CEC, 2010-2019 CEC-A15 Results and Analysis, https://www.energy.ca.gov/media/3874
% of County Diesel	0.008%	
% County Gasoline	0.00026%	

Estimated Fuel Savings from Anti-Regulation (64 percent based on estimated CARB emissions reductions): [1]

Vendor Fuel Savings:

Phase	Days	Trips/Day	Idle Hours	miles/gallon
Demolition	27	6	14	7.7
Site Preparation	8	6	4	
Grading/Excavation	18	6	9	
Drainage/Utilities/Trenching	14	6	7	
Building Construction -2022	184	14	215	
Building Construction -2023	50	14	58	
Architectural Coating	40	4	13	
Landscaping	79	6	40	

EMFAC2017 Diesel Fuel Consumption Factor:[2]	0.6523	gallons/hour
Total Vendor Truck Idle-Hours per Year:	359	hours
Total Idling diesel gallons (on-road vendor trucks):	**234**	

Haul Truck Fuel Savings:

Phase	Days	Total One-Way Trips	Idle Hours	miles/gallon
Demolition	27	330	28	6.6
Grading/Excavation	18	3257	271	
Foundations/Concrete Pour	26	1762	147	

EMFAC2017 Diesel Fuel Consumption Factor:[2]	0.7597	gallons/hour
Total Haul Truck Idle-Hours per Year:	446	hours
Total Idling diesel gallons (on-road haul trucks):	**339**	

Total Idling diesel gallons (vendor and haul trucks)	**573**

1. Source: California Air Resources Board (CARB), 2004. Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Airborne Toxic Control Measure to Limit Diesel-Fueled Commercial Motor Vehicle Idling, Appendix F, July 2004, https://www.arb.ca.gov/regact/idling/idling.htm, accessed December 2020.

2. California Air Resources Board, EMFAC2017 (Los Angeles County; HHDT and MHDT; Annual; CY 2022; Aggregate MY; 5 miles per hour converted to hourly rate)

600 Foothill

Air Quality and Greenhouse Gas Assessment

Title 24 Energy Savings Adjustment

Non-Residential

% savings over Title 24 (2019)	% savings over Title 24 (2016)		
	Electricity	Lighting	NG
Non-Residential:	10.7%	0%	1%
0%	10.7%	0.0%	1.0%
5%	15.2%	5.0%	6.0%
10%	19.6%	10.0%	10.9%
15%	24.1%	15.0%	15.9%

Residential

% savings over Title 24 (2019)	% savings over Title 24 (2016)		
	Electricity	Lighting	NG
Multi-Family without PV:	2%	0%	5%
0%	2.0%	0.0%	5.0%
5%	6.9%	5.0%	9.8%
10%	11.8%	10.0%	14.5%
15%	16.7%	15.0%	19.3%

Project Energy Use Factors Adjustment	Electricity	Lighting	NG
Non-Residential % savings over Title 24 (2016) =	10.7%	0.0%	1.0%
Residential % savings over Title 24 (2016) =	2.0%	0.0%	5.0%

	T24 Electricity	NT24 Electricity	Lighting Electricity	T24 NG	NT24 NG
Title 24 (2016 - CalEEMod Default)					
Project Non-Residential Land Uses					
Enclosed Parking with Elevator	3.92	0.19	1.75	-	-
General Office Building	4.60	4.62	3.77	10.02	0.39
Hotel	2.55	2.89	2.14	19.92	4.06
Storage	0.65	1.34	1.91	0.84	0.03
Project Residential Land Uses					
Retirement Community	257.27	3,172.76	1,001.10	9,955.77	6,384.00
	-	-	-	-	-
Title 24 (2019)					
Project Non-Residential Land Uses					
Enclosed Parking with Elevator	**3.50**	**0.19**	**1.75**	**-**	**-**
General Office Building	**4.11**	**4.62**	**3.77**	**9.92**	**0.39**
Hotel	**2.28**	**2.89**	**2.14**	**19.72**	**4.06**
Storage	**0.58**	**1.34**	**1.91**	**0.83**	**0.03**
Project Residential Land Uses					
Retirement Community	**252.12**	**3,172.76**	**1,001.10**	**9,457.98**	**6,384.00**
0	**-**	**-**	**-**	**-**	**-**

Sources:

California Emissions Estimator Model (CalEEMod), version 2016.3.2.

California Energy Commission, Impact Analysis, 2019 Update to the California Energy Efficiency Standards for Residential and Non-Residential Buildings, Section 1.2 (Non-Residential), Table 19 (Multi-Family without PV), June 10, 2015. Available: https://ww2.energy.ca.gov/title24/2019standards/post_adoption/documents/2019_Impact_Analysis_Final_Report_2018-06-29.pdf. Accessed January 2020.

600 Foothill
Construction Energy Analysis

Construction Water Energy Estimates

Project Acres	1.29
Construction Duration	1.50

Source	Construction Water Use per Day (Mgal)	Total Construction Water Use (Mgal)	Total Electricity Demand from water Demand (kWh)	Annual Electricity Demand from water Demand (kWh)
Project	0.004	1.517	19,753	13,169
CalEEMod Water Electricity Factors	**Electricity Intensity Factor To Supply (kWh/Mgal)**	**Electricity Intensity Factor To Treat (kWh/Mgal)**	**Electricity Intensity Factor To Distribute (kWh/Mgal)**	**Electricity Intensity Factor For Wastewater Treatment (kWh/Mgal)**
Project	9727	111	1272	1911

Sources:

Electricity Intensity Factors - California Emissions Estimator Model (CalEEMod).

Estimated construction water use assumed to be generally equivalent to landscape irrigation, based on a factor of 20.94 gallons per year per square foot of landscaped area within the Los Angeles area (Mediterranean climate), which assumes high water demand landscaping materials and an irrigation system efficiency of 85%. Factor is therefore (20.94 GAL/SF/year) x (43,560 SF/acre) / (365 days/year) / (0.85) = 2,940 gallons/acre/day, rounded up to 3,000 gallons/acre/day. (U.S. Department of Energy, Energy Efficiency & Renewable Energy, Federal Energy Management Program. “Guidelines for Estimating Unmetered Landscaping Water Use." July 2010. Page 12, Table 4 - Annual Irrigation Factor – Landscaped Areas with High Water Requirements).

600 Foothill
Existing Operational Energy Demand

Electricity	kWh/yr	GWh/yr
Church	116,883	0.117
Total Building Energy	**116,883**	**0.117**
Total	**116,883**	**0.117**
Total (including water, see below)	**127,873**	**0.128**

Source: California Air Resources Board, CalEEMod, Version 2016.3.2.

Electricity	GWh/yr
SCE 2019 Total Energy Sales	84,654
Existing Annual	0.128

Source: Southern California Edison, 2019 Annual Report,
https://www.annualreports.com/HostedData/AnnualReports/PDF/NYSE_EIX_2019.pdf

Water	Mgal/yr
Church	0.84
Total	**0.844**

Electricity Intensity Factors	kWh/Mgal
Electricity Factor - Supply	9,727
Electricity Factor - Treat	111
Electricity Factor - Distribute	1,272
Electricity Factor - Wastewater Treatment	1,911

Electricity from Water Demand	kWh/yr	GWh/yr
Total	**10,989.72**	**0.011**

Source: California Air Resources Board, CalEEMod, Version 2016.3.2.
Water Demand based on Existing CalEEMod
Sewage Facilities Charge, Sewage Generation Factor for Residential and Commercial Categories, 2012.

Natural Gas	kBtu/yr	cubic foot (cf)
Church	190,593	184,148
Mobile Sources	8	8
Total	**190,601**	**184,156**

Source: California Air Resources Board, CalEEMod, Version 2016.3.2.
Conversion factor of 1,035 Btu per cubic foot based on United States Energy Information Administration data
(see: USEIA, Natural Gas, Heat Content of Natural Gas Consumed, February 28, 2018,
https://www.eia.gov/dnav/ng/ng_cons_heat_a_EPG0_VGTH_btucf_a.htm. Accessed March 2020.)

Natural Gas	million cubic foot (cf)
SoCalGas 2025	854,830
Existing Annual	0.184

Source: California Gas and Electric Utilities, 2020 California Gas Report, p. 145,2020.

600 Foothill
Project Operational Energy Demand

Electricity	kWh/yr	GWh/yr
Enclosed Parking with Elevator	232,827	0.233
General Office Building	95,170	0.095
Hotel	51,224	0.051
Retirement Community	208,016	0.208
Storage	5,740	0.006
EV Charging (see worksheet)	1,817	0.002
Solar PV	(57,614)	(0.058)
Total Building Energy	**592,977**	**0.593**
Total	**537,180**	**0.537**
Total (including water, see below)	**635,905**	**0.636**

Source: California Air Resources Board, CalEEMod, Version 2016.3.2.

Electricity	GWh/yr
SCE 2019 Total Energy Sales	84,654
Project Annual	0.636
Existing Annual	0.128
Net Project Annual	0.508032
Percent Net Project of LADWP	0.0006%

Source: Southern California Edison, 2019 Annual Report, https://www.annualreports.com/HostedData/AnnualReports/PDF/NYSE_EIX_2019.pdf

Water	Mgal/yr
City Park	0.68
General Office Building	1.92
Hotel	0.29
Retirement Community	4.40
Storage	0.29
Total	**7.582**

Electricity Intensity Factors	kWh/Mgal
Electricity Factor - Supply	9,727
Electricity Factor - Treat	111
Electricity Factor - Distribute	1,272
Electricity Factor - Wastewater Treatment	1,911

Electricity from Water Demand	kWh/yr	GWh/yr
Total	**98,725.22**	**0.099**

Source: California Air Resources Board, CalEEMod, Version 2016.3.2.
Water Demand based on Project CalEEMod
Sewage Facilities Charge, Sewage Generation Factor for Residential and Commercial Categories, 2012.

Natural Gas	kBtu/yr	cubic foot (cf)
General Office Building	78,500	75,846
Hotel	166,650	161,014
Retirement Community	744,573	719,394
Storage	1,290	1,246
Mobile Sources	35	34
Total	**991,048**	**957,534**

Source: California Air Resources Board, CalEEMod, Version 2016.3.2.
Conversion factor of 1,035 Btu per cubic foot based on United States Energy Information Administration data (see: USEIA, Natural Gas, Heat Content of Natural Gas Consumed, February 28, 2018, https://www.eia.gov/dnav/ng/ng_cons_heat_a_EPG0_VGTH_btucf_a.htm. Accessed March 2020.)

Natural Gas	million cubic foot (cf)
SoCalGas 2025	854,830
Project Annual	0.958
Existing Annual	0.184
Net Project Annual	0.773379
Percent Net Project of SoCalGas	0.0001%

Source: California Gas and Electric Utilities, 2020 California Gas Report, p. 145,2020.

600 Foothill
Operational Energy Analysis

Estimated Electricity demand from Electric Vehicle Supply Equipment (EVSE)

Land Use Type	Number of EVSE Charging Spaces	Percent of Spaces with EV Chargers	Average Charge (kWh/day) [a]	Days/Year	Electricity Demand (kWh/yr)	Electricity Demand (MWh/yr)
EVSE Total	**11**	**10.3%**	**4.4**	**365**	1,817	1.82

Electricity Emission Factor (MT CO2e/MWh)	Electricity Emission Factor (lbs CO2e/MWh)	Total EV Charging GHG Emissions Per Year (MT CO2e/year)
0.20	449.47	0.37

Notes:

a. Estimated based on reference sources listed below.

Sources:

US Department of Energy. Alternative Fuels Data Center, 2016. Hybrid and Plug-In Electric Vehicle Emissions Data Sources and Assumptions.
Available at: https://www.afdc.energy.gov/vehicles/electric_emissions_sources.html.

US Department of Energy. Smith, Margaret, 2016. Level 1 Electric Vehicle Charging Stations at the Workplace.
Available at: https://www.afdc.energy.gov/uploads/publication/WPCC_L1ChargingAtTheWorkplace_0716.pdf.

UCLA Luskin Center for Innovation. Williams, Brett and JR deShazo, 2013. Pricing Workplace Charging: Financial Viability and Fueling Costs.
Available at: http://luskin.ucla.edu/sites/default/files/Luskin-WPC-TRB-13-11-15d.pdf.

Project:	**Conditional Use Permit 511, Variance 15-01, Tree Removal Permit 17-33 (600 Foothill Boulevard)**
Sheet:	**Solar Assumptions**
Date:	**1/29/2021**

System Info	2,535	SF	
	236	m^2	
DC System Size	35	kw	
Module Type	standard		*assume 15% efficiency for standard modules
Array Type	fixed (open rack)		
System Losses	14%		
Tilt (deg)	20		
Azimuth(deg)	180		
Results	57,614	kwh/year	

Source: https://pvwatts.nrel.gov/pvwatts.php

Source: https://pvwatts.nrel.gov/pvwatts.php

600 Foothill
Operational Energy Analysis
Fuel Usage from VMT

Annual VMT[4]: 899,438 miles/year

Fuel Type:[1]	GAS	DSL	ELEC	NG
Percent:	93.9%	4.1%	1.9%	0.1%
Miles per Gallon Fuel:	27.0	11.0	-	3.42
Annual VMT by Fuel Type (miles):	844,240	37,053	17,322	824
Annual Fuel Usage (gallons):	31,255	3,356	-	35
Annual Fuel Savings from Electric Vehicles:[2]	-	-	641	

	Los Angeles County Fuel Consumption [3]	
	Gasoline	Diesel
Los Angeles County:	3,559,000,000	584,745,763
Project Annual:	31,255	3,356
Existing Annual:	8,366	841
Net Annual:	22,889	2,515
Percent Net Project of Los Angeles County:	0.0006%	0.0004%

Notes:

1. California Air Resources Board, EMFAC2017 (South Coast Air Basin; Annual; 2024', Aggregate Fleet).
2. Assumes electric vehicles would replace traditional gasoline-fueled vehicles.
3. California Energy Commission, California Retail Fuel Outlet Annual Reporting (CEC-A15) Results, 2018. Available at: https://ww2.energy.ca.gov/almanac/transportation_data/gasoline/piira_retail_survey.html. Accessed March 2020. Diesel is adjusted to account for retail (48%) and non-retail (52%) diesel sales.
4. Project CalEEMod

600 Foothill
Operational Energy Analysis
Fuel Usage from VMT

Annual VMT[4]: 219,353 miles/year

Fuel Type:[1]	GAS	DSL	ELEC	NG
Percent:	95.0%	3.8%	1.1%	0.1%
Miles per Gallon Fuel:	24.9	9.9	-	3.44
Annual VMT by Fuel Type (miles):	208,338	8,305	2,516	194
Annual Fuel Usage (gallons):	8,366	841	-	8
Annual Fuel Savings from Electric Vehicles:[2]	-	-	101	

	Los Angeles County Fuel Consumption [3]	
	Gasoline	Diesel
Los Angeles County:	3,559,000,000	584,745,763
Project Annual:	8,366	841
Percent Net Project of Los Angeles County:	0.0002%	0.0001%

Notes:

1. California Air Resources Board, EMFAC2017 (South Coast Air Basin; Annual; 2024', Aggregate Fleet).
2. Assumes electric vehicles would replace traditional gasoline-fueled vehicles.
3. California Energy Commission, California Retail Fuel Outlet Annual Reporting (CEC-A15) Results, 2018. Available at: https://ww2.energy.ca.gov/almanac/transportation_data/gasoline/piira_retail_survey.html. Accessed March 2020. Diesel is adjusted to account for retail (48%) and non-retail (52%) diesel sales.
4. Existing CalEEMod

Region	Los Angeles

Row Labels	Sum of Population	Sum of VMT	Sum of Fuel Consumption
2021	**7468237.219**	**286275112.3**	**12572.10351**
Diesel	282774.2662	17596625.39	1781.436102
Gasoline	7093203.593	264803056.8	10633.64519
Electricity	85653.10987	3335580.91	0
Natural Gas	6606.249146	539849.2037	157.022225
Grand Total	**7468237.219**	**286275112.3**	**12572.10351**

2021	7468237.219	286275112.3	12572.10351	**Fuel Type**	**gal/mile**	**mile/gal**
Diesel	282774.2662	17596625.39	1781.436102	3.8%	0.101237	9.877775
Gasoline	7093203.593	264803056.8	10633.64519	95.0%	0.040157	24.90238
Electricity	85653.10987	3335580.91	0	1.1%	0	#DIV/0!
Natural Gas	6606.249146	539849.2037	157.022225	0.1%	0.290863	3.438043

Region	Los Angeles

Row Labels	Sum of Population	Sum of VMT	Sum of Fuel Consumption
2024	**7861205.138**	**291022944.1**	**11736.24866**
Diesel	323843.8729	19421765.13	1758.927397
Gasoline	7378763.072	265004079.7	9810.867851
Electricity	151396.9413	6027624.143	0
Natural Gas	7201.252194	569475.1854	166.4534085
Grand Total	**7861205.138**	**291022944.1**	**11736.24866**

2024	7861205.138	291022944.1	11736.24866	**Fuel Type**	**gal/mile**	**mile/gal**
Diesel	323843.8729	19421765.13	1758.927397	4.1%	0.090565	11.04182
Gasoline	7378763.072	265004079.7	9810.867851	93.9%	0.037022	27.01128
Electricity	151396.9413	6027624.143	0	1.9%	0	#DIV/0!
Natural Gas	7201.252194	569475.1854	166.4534085	0.1%	0.292293	3.421229

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Caution: Photovoltaic system performance predictions calculated by PVWatts® include many inherent assumptions and uncertainties and do not reflect variations between PV technologies nor site-specific characteristics except as represented by PVWatts® inputs. For example, PV modules with better performance are not differentiated within PVWatts® from lesser performing modules. Both NREL and private companies provide more sophisticated PV modeling tools (such as the System Advisor Model at https://sam.nrel.gov) that allow for more precise and complex modeling of PV systems.

The expected range is based on 30 years of actual weather data at the given location and is intended to provide an indication of the variation you might see. For more information, please refer to this NREL report: The Error Report.

The energy output range is based on analysis of 30 years of historical weather data for nearby , and is intended to provide an indication of the possible interannual variability in generation for a Fixed (open rack) PV system at this location.

RESULTS

57,614 kWh/Year*

System output may range from 54,889 to 58,818 kWh per year near this location.

Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)	Value ($)
January	4.46	3,685	589
February	4.89	3,665	586
March	5.85	4,828	772
April	6.54	5,222	834
May	6.75	5,420	866
June	7.49	5,639	901
July	7.74	6,071	970
August	7.79	5,991	957
September	6.98	5,225	835
October	5.78	4,625	739
November	4.85	3,833	613
December	4.04	3,409	545
Annual	**6.10**	**57,613**	**$ 9,207**

Location and Station Identification

Requested Location	600 foothill, la canada, ca
Weather Data Source	Lat, Lon: 34.21, -118.18 0.9 mi
Latitude	34.21° N
Longitude	118.18° W

PV System Specifications *(Residential)*

DC System Size	35 kW
Module Type	Standard
Array Type	Fixed (open rack)
Array Tilt	20°
Array Azimuth	180°
System Losses	14.08%
Inverter Efficiency	96%
DC to AC Size Ratio	1.2

Economics

Average Retail Electricity Rate	0.160 $/kWh

Performance Metrics

Capacity Factor	18.8%