

Appendix D

Energy Modeling

Energy Summary

Construction Fuel Consumption Summary

	gallons		
Phase	Diesel	Gas	# Years
Total Project	60,538	5,832	1.17
Annual Average	51,890	4,999	
Total Project	60,538	5,832	
Annual Average	51,890	4,999	
County Usage¹	1,402,000,000	55,000,000	
Project % County	0.0037%	0.0091%	

Construction	Total Gallons	
Total		
Onsite Equipment	56,309	diesel
Water Truck	0	gasoline
Haul Trucks	3,229	diesel
Vendor Trucks	1,000	diesel
Worker Trips	5,832	gasoline

Annual Operational Consumption

	gallons		MMBTU/yr	GWh/yr		
	Diesel	Gas	Natural Gas	Electric		
2022						
Unmitigated	1,358.00	7,603.00	0.00	0.04	38	38,115.00
% of County	0.0001%	0.01382%	0.00000%	0.0002%		
%SCE/SoCal (2018)			0.00000%	0.000%		
%SCE/SoCal (2025)			0.00000%	0.000%		

	kBTU	MMBTU	kWh	GWh	MWh
Total Project ²	0.00	0.00	12	0.00	
Project			54,645	0.05	
				0.00	
Orange (2019) ^{3,4}		62		19,460	
SCE (2019) ⁵				87,143	87,143,000
SCE (2023) ^{5,6}				118,294	118,294,000
SoCalGas (2018) ⁷		515,607,000			
SoCalGas (2023) ^{6,7}		514,101,159			

Note: Total Project includes energy from increase in existing booster station.

Operational Vehicle Fuel Consumption

source: EMFAC2017: Goetz

	Project		
	Unmitigated	Mitigated	
Gasoline	245		gallons
Diesel	91		gallons
Natural Gas	0		MMBTU

Assumptions/Constants

- 8.78 Kg of CO₂ per gallon of Gasoline
- 10.21 Kg of CO₂ per gallon of Diesel
- 1040 MMBtu/MMCF 1040 MMBtu
- 1 MWh= 0.001 GWh
- 100,000 BTU/therm
- 53.12 kg CO₂/ thousand cubic feet⁸
- 1036 btu/cubic foot
- 623.1464 Orange (2019) Therms³
- 5156070000 SoCalGas (2018) Therms⁷
- 1.21192053 hundred cubic feet of natural gas per gallon

Construction diesel Used for trucks (haul and vendor) and off-road equipment
 gasoline worker vehicles

Operation diesel Majority of trucks and buses
 gasoline remaining vehicle mix

LCFS & Pavley assumed for on-road vehicles after year 2011

Sources:

- 1 California Energy Commission, 2018. California Retail Fuel Outlet Annual Reporting (CEC-A15) Results. http://listserver.energy.ca.gov/almanac/transportation_data/gasoline/piira_retail_survey.html Accessed, October 2019.
- 2 ESA, 2020; CalEEMod output
- 3 <http://www.ecdms.energy.ca.gov/gasbycounty.aspx>
- 4 <http://www.ecdms.energy.ca.gov/elecbycounty.aspx>
- 5 Edison International and Southern California Edison, 2018. 2018 Annual Report. Available: <https://www.edison.com/content/dam/eix/documents/investors/corporate-governance/eix-sce-2018-annual-report.pdf>. Accessed October, 2019.
- 6 California Energy Commission, 2018. SCE TAC Peak and Energy Forecast: CED 2017, Mid Baseline- Mid AAEE/AAPV. Available: https://ww2.energy.ca.gov/2017_energypolicy/documents/, Accessed 10/2019.

7 <http://www.ecdms.energy.ca.gov/gasbyutil.aspx>

2018	2017	2016	2025
5156.07	5141.84	5124.14	5141.011589 MMtherms (from source 6)
7750	7750	7600	7700 Mmtherms (from source 7)
0.665299355	0.663463226	0.674228947	% difference
		0.667663843	average % difference

8 https://www.eia.gov/environment/emissions/co2_vol_mass.php

Unmitigated Fuel Conversion - Construction

	Total CO ₂ MT/yr	Fuel Type	Factor KGCO ₂ /gal	Gallons
<i>source:</i>		CalEEMod: Files: Goetz Tank Site; Goetz - Pipeline Construction		
Total Project				
Clearing and Grubbing	40.18	diesel	10.21	3,936
Grading	153.60	diesel	10.21	15,044
Paving and Construction	277.56	diesel	10.21	27,185
Landscaping	20.64	diesel	10.21	2,022
Site Preparation	3.21	diesel	10.21	314
Demolition	15.14	diesel	10.21	1,483
Utility Relocation	12.93	diesel	10.21	1,266
Storm Drain Construction	19.87	diesel	10.21	1,947
Sidewalk Construction (Newport)	5.04	diesel	10.21	494
Sidewalk Construction (Crawford)	5.29	diesel	10.21	518
Traffic Signal Modification	10.79	diesel	10.21	1,057
Paving	10.65	diesel	10.21	1,043
				56,309

	<i>source:</i>		EMFAC2017	
	Hauling	Vendor	Worker	
Total Project				
Clearing and Grubbing	0	0	160	
Grading	3100	0	481	
Paving and Construction	-	68	1967	
Landscaping	0	73	2150	
Site Preparation	0.00	0.00	50.00	
Demolition	129.00	0.00	156.00	4,229
Utility Relocation	0.00	0.00	69.00	56,309
Storm Drain Construction	0.00	373.00	411.00	60,538
Sidewalk Construction (Newport)	0.00	181.00	133.00	
Sidewalk Construction (Crawford)	0.00	181.00	133.00	
Traffic Signal Modification	0.00	124.00	114.00	
Paving	0.00	0.00	8.00	

Total On-Road Fuel Consumption

	gal/mile	gal/min
2020Hauling Hauling	0.15613658	1.50968E-05
2020Vendor Vendor	0.12720883	9.12128E-06
2020Worker Worker	0.03742093	2.06198E-06
2021Hauling Hauling	0.15194685	1.49226E-05
2021Vendor Vendor	0.12346263	8.98135E-06
2021Worker Worker	0.03636982	2.00421E-06
2022Hauling Hauling	0.14312318	1.42709E-05
2022Vendor Vendor	0.11698571	8.58941E-06
2022Worker Worker	0.03532451	1.94677E-06
2023Hauling Hauling	0.14107785	1.41309E-05
2023Vendor Vendor	0.11532828	8.40578E-06
2023Worker Worker	0.03445725	1.96264E-06

Construction Phase	Daily One-Way Trips	Haul Days per Phase (days)	Work Hours per Day (hours/day)	One-Way Trip Distance per Day (miles)	Idling per Day (minutes)	Regional Emissions (gallons)			
						gal/mile	gal/min	gal/day	Total Gallons/yr
<u>Clearing and Grubbing</u>									
	2021								
Total Haul Trips	0								
Hauling	0	20	8	20	15	0.15	1.49E-05	0	0
Vendor	0	20	8	6.9	15	0.12	8.98E-06	0	0
Worker	18	20	8	14.7	0	0.04	2.00E-06	10	192
<u>Grading</u>									
	2021								
Total Haul Trips	989								
Hauling	17	60	8	20	15	0.15	1.49E-05	52	3,100
Vendor	0	60	8	6.9	15	0.12	8.98E-06	0	0
Worker	20	60	8	14.7	0	0.04	2.00E-06	11	642
<u>Paving and Construction</u>									
	2021								
Total Haul Trips	0								
Hauling	0	80	8	20	15	0.15	1.49E-05	0	0
Vendor	1	80	8	6.9	15	0.12	8.98E-06	1	68
Worker	30	80	8	14.7	0	0.04	2.00E-06	16	1,283
<u>Landscaping</u>									
	2022								
Total Haul Trips	0								
Hauling	0	90	8	20	15	0.14	1.43E-05	0	0
Vendor	1	90	8	6.9	15	0.12	8.59E-06	1	73
Worker	28	90	8	14.7	0	0.04	1.95E-06	15	1,309

Total On-Road Fuel Consumption

Total On-Road Fuel Consumption

		gal/mile	gal/min
2020Hauling	Hauling	0.15613658	1.50968E-05
2020Vendor	Vendor	0.12720883	9.12128E-06
2020Worker	Worker	0.03742093	2.06198E-06
2021Hauling	Hauling	0.15194685	1.49226E-05
2021Vendor	Vendor	0.12346263	8.98135E-06
2021Worker	Worker	0.03636982	2.00421E-06
2022Hauling	Hauling	0.14312318	1.42709E-05
2022Vendor	Vendor	0.11698571	8.58941E-06
2022Worker	Worker	0.03532451	1.94677E-06
2023Hauling	Hauling	0.14107785	1.41309E-05
2023Vendor	Vendor	0.11532828	8.40578E-06
2023Worker	Worker	0.03445725	1.96264E-06

Construction Phase	Daily One-Way Trips	Haul Days per Phase (days)	Work Hours per Day (hours/day)	One-Way Trip Distance per Day (miles)	Idling per Day (minutes)	Regional Emissions (gallons)			
						gal/mile	gal/min	gal/day	Total Gallons/yr
Site Preparation									
	2022								
Total Haul Trips	0								
Hauling	0	6	8	20	15	0.14	1.43E-05	0	0
Vendor	0	6	8	6.9	15	0.12	8.59E-06	0	0
Worker	16	6	8	14.7	0	0.04	1.95E-06	8	50
Demolition									
	2022								
Total Haul Trips	32								
Hauling	3	15	8	20	15	0.14	1.43E-05	9	129
Vendor	0	15	8	6.9	15	0.12	8.59E-06	0	0
Worker	20	15	8	14.7	0	0.04	1.95E-06	10	156
Utility Relocation									
	2022								
Total Haul Trips	0								
Hauling	0	11	8	20	15	0.14	1.43E-05	0	0
Vendor	0	11	8	6.9	15	0.12	8.59E-06	0	0
Worker	12	11	8	14.7	0	0.04	1.95E-06	6	69
Storm Drain Construction									
	2022								
Total Haul Trips	0								
Hauling	0	33	8	20	15	0.14	1.43E-05	0	0
Vendor	14	33	8	6.9	15	0.12	8.59E-06	11	373
Worker	24	33	8	14.7	0	0.04	1.95E-06	12	411
Sidewalk Construction (Newport)									
	2022								
Total Haul Trips	0								
Hauling	0	16	8	20	15	0.14	1.43E-05	0	0
Vendor	14	16	8	6.9	15	0.12	8.59E-06	11	181
Worker	16	16	8	14.7	0	0.04	1.95E-06	8	133
Sidewalk Construction (Crawford)									
	2022								
Total Haul Trips	0								
Hauling	0	16	8	20	15	0.14	1.43E-05	0	0
Vendor	14	16	8	6.9	15	0.12	8.59E-06	11	181
Worker	16	16	8	14.7	0	0.04	1.95E-06	8	133
Traffic Signal Modification									
	2022								
Total Haul Trips	0								
Hauling	0	11	8	20	15	0.14	1.43E-05	0	0
Vendor	14	11	8	6.9	15	0.12	8.59E-06	11	124
Worker	20	11	8	14.7	0	0.04	1.95E-06	10	114
Paving									
	2022								
Total Haul Trips	0								
Hauling	0	1	8	20	15	0.14	1.43E-05	0	0
Vendor	0	1	8	6.9	15	0.12	8.59E-06	0	0
Worker	16	1	8	14.7	0	0.04	1.95E-06	8	8