Appendix E
Energy Calculations

ESA

E-1 Construction Calculations

EF International Campus Project
Construction Energy Analysis

Annual Fuel Summary

	Heavy-Duty Construction Equipment
39,825	Total Project Consumption
39,825	Annual Consumption
	Haul Trucks
20,126	Total Project Consumption
20,126	Annual Consumption
	Vendor Trucks
9,588	Total Project Consumption
9,588	Annual Consumption
	Workers
12,464	Total Project Consumption
12,464	Annual Consumption
29,714	Project Consumption of diesel for Haul Trucks and Vendors
29,714	Annual Consumption
69,540	Total Gallons Diesel
12,464	Total Gallons Gasoline

1.0 Estimated Project Construction Duration (years)

69,540 Annual Average Gallons Diesel
12,464 Annual Average Gallons Gasoline

Orange County			Percent of Annual Project Compared to Orange County
Source	**Fuel Type**	**Gallons**	
Workers	Gasoline	1,402,000,000	0.0009%
Off-Road/Vendor/Haul Trucks	Diesel	114,583,333	0.1%

Notes:

1 Gasoline and diesel amounts from CEC, 2019. Available: https://ww2.energy.ca.gov/almanac/transportation_data/gasoline/piira_retail_survey.html

Annual Electricity Summary		
Construction Water Energy Estimates	31,121	kWh/year
Construction Trailer Energy Estimates	12,990	kWh/year
Total Project Construction Electricity	**44,111**	**kWh/year**
SCE Total (2018)	87,143,000,000	kWh/year
% of Total	0.0001%	

EF International Campus Project
Construction Energy Analysis

Off-Road Equipment

Equipment ≤ 100 hp		
pounds diesel fuel/hp-hr (lb/hp-hr):[1]	0.408	lb/hp-hr
diesel density (lb/gal):[1]	7.11	lb/gal
diesel gallons/hp-hr:	0.0574	gal/hp-hr
Total <100	397,154	hp-hr
Total diesel gallons:	22,794	gal
Equipment > 100 hp		
pounds diesel fuel/hp-hr (lb/hp-hr):[1]	0.367	lb/hp-hr
diesel density (lb/gal):[1]	7.11	lb/gal
diesel gallons/hp-hr:	0.0516	gal/hp-hr
Total >100	329,906	hp-hr
Total diesel gallons:	17,032	gal
Total diesel gallons (off-road equipment):	**39,825**	**gal**

1. OFFROAD2017 Emission Factor Documentation

Construction Phase	Equipment	Number	Hours/Day	HP	Load	Days	Total hp-hr
Demolition	Concrete/Industrial Saws	1	8	81	0.73	20	9,461
Demolition	Excavators	3	8	158	0.38	20	28,819
Demolition	Rubber Tired Dozers	2	8	247	0.4	20	31,616
Site Preparation	Rubber Tired Dozers	2	8	247	0.4	5	7,904
Site Preparation	Tractors/Loaders/Backhoes	4	8	97	0.37	5	5,742
Grading	Excavators	1	8	158	0.38	60	28,819
Grading	Graders	1	7	187	0.41	60	32,201
Grading	Rubber Tired Dozers	1	8	247	0.4	60	47,424
Grading	Tractors/Loaders/Backhoes	3	8	97	0.37	60	51,682
Paving	Cement and Mortar Mixers	2	6	9	0.56	18	1,089
Paving	Pavers	1	8	130	0.42	18	7,862
Paving	Paving Equipment	2	6	132	0.36	18	10,264
Paving	Rollers	2	6	80	0.38	18	6,566
Paving	Tractors/Loaders/Backhoes	1	8	97	0.37	18	5,168
Building Construction	Cranes	1	7	231	0.29	159	74,560
Building Construction	Forklifts	3	8	89	0.2	159	67,925
Building Construction	Generator Sets	1	8	84	0.74	159	79,068
Building Construction	Tractors/Loaders/Backhoes	3	7	97	0.37	159	119,837
Building Construction	Welders	1	8	46	0.45	159	26,330
Architectural Coating	Air Compressors	1	6	78	0.48	66	14,826
						Total >100	329,906
						Total <100	397,154

EF International Campus Project
Construction Energy Analysis

On-Road Workers (LDA, LDT1, LDT2)

EMFAC2014 Gasoline Fuel Consumption Factor:[1]	0.0409	gallons/mile	miles/gallon
Total Worker VMT:	305,040	miles	24.5
Total VMT gasoline gallons (workers):	**12,464**		

California Air Resources Board, EMFAC2014 (South Coast Air Basin; LDA, LDT1, LDT2; CY 2017; Aggregate MY; Aggregate Speed)

Worker Trips	Days	Total One-Way Trips	Miles/Trip	VMT
Demolition	20	15	14.7	4,410
Site Preparation	5	18	14.7	1,323
Grading	60	15	14.7	13,230
Building Construction	159	111	14.7	259,440
Paving	18	20	14.7	5,292
Architectural Coating	66	22	14.7	21,344
			Total Worker VMT:	**305,040**

EF International Campus Project
Construction Energy Analysis

On-Road Vendor Trucks

			miles/gallon
	0.1571	gallons/mile	6.4
	59,243	miles	
Total VMT diesel gallons (on-road vendor trucks):	**9,307**		
EMFAC2014 Diesel Fuel Consumption Factor:[2]	0.7855	gallons/hour	*Estimated Fuel Savings from Anti-Idling Regulation (64 percent based on estimated CARB emissions reductions):* [3]
Total Haul Truck Idle-Hours per Year:	358	hours	
Total Idling diesel gallons (on-road haul trucks):	**281**		*781*
Total diesel gallons (on-road haul trucks):	**9,588**	gal	

California Air Resources Board, EMFAC2014 (South Coast Air Basin; HHDT and MHDT; Annual; CY 2017; Aggregate MY; Aggregate Speed)

California Air Resources Board, EMFAC2014 (South Coast Air Basin; HHDT and MHDT; Annual; CY 2017; Aggregate MY; 5 miles per hour converted to hourly rate)

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 November 2016.

Phase	Days	Trips/Day	Miles/Trip	VMT	Idle Hours
Demolition	20	0	6.9	-	-
Site Preparation	5	0	6.9	-	-
Grading	60	0	6.9	-	-
Building Construction	159	27	6.9	59,243	358
Paving	18	0	6.9	-	-
Architectural Coating	66	0	6.9	-	-
			Total Vendor Truck VMT:	59,243	
			Total Idle-Hours:		358

EF International Campus Project
Construction Energy Analysis

On-Road Haul Trucks

	0.1560	gallons/mile	miles/gallon	
	127,680	miles	6.41	
Total VMT diesel gallons (on-road haul trucks):	**19,918**			
				Estimated Fuel Savings from
EMFAC2014 Diesel Fuel Consumption Factor:[2]	0.7800	gallons/hour		*Anti-Idling Regulation (64 percent based on*
Total Haul Truck Idle-Hours per Year:	266	hours		*estimated CARB emissions reductions):* [3]
Total Idling diesel gallons (on-road haul trucks):	**207**			*576*
Total diesel gallons (on-road haul trucks):	**20,126**	gal		

California Air Resources Board, EMFAC2014 (South Coast Air Basin; T7 Single Construction; Annual; CY 2017; Aggregate MY; Aggregate Speed)

California Air Resources Board, EMFAC2014 (South Coast Air Basin; T7 Single Construction; Annual; CY 2017; Aggregate MY; 5 miles per hour converted to hourly rate)

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 November 2016.

Phase	Total One-Way Trips	Miles/Trip	VMT	Idle Hours
Demolition	692	20	27,680	58
Site Preparation	0	20	0	0
Grading	2,500	20	100,000	208
Building Construction	0	20	0	0
Paving	0	20	0	0
Architectural Coating	0	20	0	0
		Total Haul Truck VMT:	127,680	
		Total Idle-Hours:		266

EF International Campus Project
Construction Energy Analysis

Construction Water Energy Estimates

Source	Acres	Water for Dust Conveyance Usage Factor (mgal/acre/day)	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	6.13	0.003	0.018	5.751	31,121	31,121
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	2117	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).

Construction Energy Analysis

Temporary Construction Trailer - Electricity

Land Use	Square Feet	kWh/sq ft			Total kWh
		Title 24 Electricity	Non-Title 24 Electricity	Lighting Electricity	
General Office	1,000	4.60	4.62	3.77	**12,990**

Assumptions and Sources:

-CalEEMod 2016.3.2 default emission factors used to estimate energy use for temporary construction office

-Construction offices assumed to total 1,000 square feet

This tool provides a quick estimation of the fuel use and emissions for your equipment in a specific year. The results may slightly differ from those from the official inventory model.

Instructions:

Enter the horsepower, model year, and other details about your equipment in the Input box.

Make sure to update the ***load factor*** for your equipment using the lookup table.

The ***Output*** box gives a quick estimation of the fuel use, NOx, PM, and THC emission for your equipment.

Input

	Input Engine Here
Horsepower (hp)	120
Model year	2011
Calendar year	2015
Activity (annual hours)	250
Accumulated hours on equipment (estimate using annual-hours*age if you only know the age of the equipment)	1000
Load factor (check the lookup table)	0.2

Results

Fuel Used (gallon)	310
NOx Emissions (kg)	15.4
PM Emissions (kg)	0.7
THC Emissions (kg)	0.7
CO2 Emissions (kg)	3162.6
NOx Emission Factor (including deterioration and fuel correction factor): gram/bhp-hr	2.57
PM Emission Factor (including deterioration and fuel correction factor): gram/bhp-hr	0.12
THC Emission Factor (including deterioration and fuel correction factor): gram/ bhp-hr	0.11

Intermediate steps

HPbin	175
NOx_EF0	2.67
NOx_DR	3.5E-05
NOx_FCF	0.950
PM_EF0	0.12
PM_DR	8.6E-06
PM_FCF	0.90
THC_EF0	0.10
THC_DR	2.5E-05
THC_FCF	0.90
NOx_EF (g/hp-hr)	2.57
PM_EF (g/hp-hr)	0.12
THC_EF (g/hp-hr)	0.11
CO2_EF (kg/gallon-diesel)*	10.21
BSFC (lb/hp-hr)	0.367
Unit conversion (lb/gallon)	7.109

*Reference: www.epa.gov/sites/production/files/2015-07/documents/emission-factors_2014.pdf

Loac Factor Lookup Table

Equipment Category	Equipment Type	Details	Load Factor
Agriculture equipment	Agricultural tractors		0.48
	Combine harvesters		0.44
	Forage & silage harvesters		0.44
	Cotton pickers		0.44
	Nut harvester		0.44
	Other harvesters		0.44
	Balers (self propelled)		0.50
	Bale wagons (self propelled)		0.50
	Swathers/windrowers/hay conditioners		0.48
	Hay Squeeze/Stack retriever		0.42
	Sprayers/Spray rigs		0.42
	Construction equipment		0.40
	Other non-mobile		0.48
	Forklifts		0.40
	Atvs		0.40
	Others		0.40
Portable equipment	All portable equipment		0.31
Cargo Handling Equipment	Construction equipment		0.55
	Container handling equipment		0.59
	Forklift		0.30
	Other general industrial equipment		0.51
	Rtg crane		0.20
	Yard tractor		0.39
Transport Refrigeration Units (TRU)	TRU on trailers	25 HP and over, MY2012 and Older	0.46
	TRU on trailers	25 HP and over, MY2013 and Newer	0.38
	TRU on trailers	23 HP and Over, below 25 HP, All years	0.46
	TRU on trucks	Below 23 HP, All Model years	0.56
	TRU on railcars	25 HP and over, MY2012 and Older	0.33
	TRU on railcars	25 HP and over, MY2013 and Newer	0.27
	TRU on railcars	Below 25 HP, All Model years	0.33
	TRU with generators	25 HP and over, MY2012 and Older	0.46
	TRU with generators	25 HP and Over, MY2013 and Newer	0.38
	TRU with generators	23 HP and Over, below 25 HP, All Model Years	0.46
Ground Support Equipment	Passenger Stand		0.40
	A/C Tug Narrow Body		0.54
	A/C Tug Wide Body		0.54
	Baggage Tug		0.37
	Belt Loader		0.34
	Bobtail		0.37
	Cargo Loader		0.34
	Cargo Tractor		0.36
	Forklift (GSE)		0.20
	Lift (GSE)		0.34
	Other GSE		0.34
Construction and Industrial Equipment	Cranes		0.29
	Crawler Tractors		0.43
	Excavators		0.38
	Graders		0.41
	Off-Highway Tractors		0.44
	Off-Highway Trucks		0.38
	Other Construction Equipment		0.42
	Pavers		0.42
	Paving Equipment		0.36
	Rollers		0.38
	Rough Terrain Forklifts		0.40
	Rubber Tired Dozers		0.40
	Rubber Tired Loaders		0.36
	Scrapers		0.48
	Skid Steer Loaders		0.37
	Surfacing Equipment		0.30
	Tractors/Loaders/Backhoes		0.37
	Trenchers		0.50
	Aerial Lifts		0.31
	Forklifts		0.20
	Other General Industrial Equipment		0.34
	Other Material Handling Equipment		0.40
	Sweepers/Scrubbers		0.46
Oil and Drill Rigs	Drill Rig (Mobile)		0.50
	Workover Rig (Mobile)		0.50
	Bore/Drill Rigs		0.50

EMFAC2017 (v1.0.2) Emissions Inventory
Region Type: County
Region: ORANGE
Calendar Year: 2019
Season: Annual
Vehicle Classification: EMFAC2007 Categories
Units: miles/day for VMT, trips/day for Trips, tons/day for Emissions, 1000 gallons/day for Fuel Consumption

VMT	Fuel Consumption (gal/day)	Annual VMT	Annual Fuel Consumption (gals)
1195200	187770	436,248,146.63	68,536,110.62
gal/mi			
0.1571035			

Region	Calendar Y	Vehicle Cat	Model Yea	Speed	Fuel	Population	VMT	SOx_TOTEX	N2O_RUNEX	N2O_IDLEX	N2O_STREX	N2O_TOTE	Fuel Consumption
ORANGE	2019	HHDT	Aggregatec	Aggregated	GAS	13.82239905	937.8742547	2.224E-05	0.000213121	0	5.44261E-06	0.000219	0.237240048
ORANGE	2019	HHDT	Aggregatec	Aggregated	DSL	10235.96097	1166560.486	0.0196081	0.308371509	0.01786472	0	0.326236	184.9728833
ORANGE	2019	HHDT	Aggregatec	Aggregated	NG	732.8439311	29817.6193	0	0.023494638	0.000692068	0	0.024187	13.7136357
ORANGE	2019	LDA	Aggregatec	Aggregated	GAS	1223281.615	48498865.51	0.1548196	0.290906055	0	0.180707623	0.471614	1651.375965
ORANGE	2019	LDA	Aggregatec	Aggregated	DSL	10330.87174	421338.5715	0.0009664	0.016067838	0	0	0.016068	9.110313311
ORANGE	2019	LDA	Aggregatec	Aggregated	ELEC	18325.57796	702764.686	0	0	0	0	0	0
ORANGE	2019	LDT1	Aggregatec	Aggregated	GAS	129886.4448	4932435.319	0.018216	0.053473812	0	0.021161108	0.074635	194.3004571
ORANGE	2019	LDT1	Aggregatec	Aggregated	DSL	59.74119808	1165.606511	5.149E-06	8.56085E-05	0	0	8.56E-05	0.048539197
ORANGE	2019	LDT1	Aggregatec	Aggregated	ELEC	343.8294903	12346.46979	0	0	0	0	0	0
ORANGE	2019	LDT2	Aggregatec	Aggregated	GAS	443301.5271	17104474.16	0.0700791	0.149755882	0	0.085002636	0.234759	747.4953953
ORANGE	2019	LDT2	Aggregatec	Aggregated	DSL	2169.432959	100227.6974	0.0003181	0.005289679	0	0	0.00529	2.999198297
ORANGE	2019	LDT2	Aggregatec	Aggregated	ELEC	2041.175939	71154.82913	0	0	0	0	0	0
ORANGE	2019	LHDT1	Aggregatec	Aggregated	GAS	37244.75433	1425183.134	0.012831	0.022301918	0.000139984	0.027374404	0.049816	136.8616829
ORANGE	2019	LHDT1	Aggregatec	Aggregated	DSL	20401.21161	864878.3854	0.0044222	0.073043155	0.000485944	0	0.073529	41.69031
ORANGE	2019	LHDT2	Aggregatec	Aggregated	GAS	6421.009976	235470.9989	0.0024388	0.003999199	2.36221E-05	0.004629756	0.008653	26.01371823
ORANGE	2019	LHDT2	Aggregatec	Aggregated	DSL	7812.976815	327195.984	0.0018539	0.030525926	0.000298512	0	0.030824	17.47716723
ORANGE	2019	MCY	Aggregatec	Aggregated	GAS	54112.22632	400119.9345	0.0010078	0.028778523	0	0.001790216	0.030569	10.74933419
ORANGE	2019	MDV	Aggregatec	Aggregated	GAS	311870.5264	11560839.57	0.057944	0.130970424	0	0.065100569	0.196071	618.0571412
ORANGE	2019	MDV	Aggregatec	Aggregated	DSL	5510.282581	236620.1064	0.00099	0.016461176	0	0	0.016461	9.333332699
ORANGE	2019	MDV	Aggregatec	Aggregated	ELEC	335.41455	12029.07966	0	0	0	0	0	0
ORANGE	2019	MH	Aggregatec	Aggregated	GAS	7139.194891	67065.36875	0.0012493	0.002053101	0	2.6195E-05	0.002079	13.32586198
ORANGE	2019	MH	Aggregatec	Aggregated	DSL	2838.244378	28639.91604	0.0002967	0.004933561	0	0	0.004934	2.797282801
ORANGE	2019	MHDT	Aggregatec	Aggregated	GAS	7568.270254	433786.8965	0.0081225	0.009796736	6.84212E-05	0.004850813	0.014716	86.63865792
ORANGE	2019	MHDT	Aggregatec	Aggregated	DSL	26731.98875	1724353.423	0.0180283	0.296339549	0.003612275	0	0.299952	170.0698721
ORANGE	2019	OBUS	Aggregatec	Aggregated	GAS	990.6247767	45703.06906	0.0008628	0.001388634	5.94982E-06	0.000563987	0.001959	9.203081706
ORANGE	2019	OBUS	Aggregatec	Aggregated	DSL	609.4053658	44377.77661	0.0005849	0.009411008	0.000319668	0	0.009731	5.517202455
ORANGE	2019	SBUS	Aggregatec	Aggregated	GAS	454.1043249	19687.82964	0.0002058	0.000821168	4.11748E-05	9.54514E-05	0.000958	2.195213978
ORANGE	2019	SBUS	Aggregatec	Aggregated	DSL	1349.431457	42134.30605	0.0006136	0.009354793	0.00085422	0	0.010209	5.788414878
ORANGE	2019	UBUS	Aggregatec	Aggregated	GAS	208.5732817	19704.69745	0.0005028	0.000643098	0	7.45422E-05	0.000718	5.363383616
ORANGE	2019	UBUS	Aggregatec	Aggregated	DSL	0	0	0	0	0	0	0	0
ORANGE	2019	UBUS	Aggregatec	Aggregated	NG	733.9588564	85007.66425	0	0.037760578	0	0	0.037761	21.40989389

EMFAC2017 (v1.0.2) Emissions Inventory

Region Type: County
Region: ORANGE
Calendar Year: 2019
Season: Annual
Vehicle Classification: EMFAC2011 Categories
Units: miles/day for VMT, trips/day for Trips, tons/day for Emissions, 1000 gallons/day for Fuel Consumption

Haul Trucks (T7 Single Construction)			
VMT	Fuel Consumption (gal/day)	Annual VMT	Annual Fuel Consumption
46512	7256	16,977,014	2,648,461
gal/mi			
0.156002739			

Workers (LDA,LDT1, LDT2)			
VMT	Fuel Consumption (gal/day)	Annual VMT	Annual Fuel Consumption
23345907	953954	8,521,256,177	348,193,175
gal/mi			
0.0409			

Region	Calendar Y	Vehicle Category	Model Yea	Speed	Fuel	Populatior	VMT	SOx_TOTEX	N2O_RUNEX	N2O_IDLEX	N2O_STREX	N2O	Fuel Consumption
ORANGE	2019	All Other Buses	Aggregate	Aggregate	DSL	473.877	27275.6404	0.000294078	0.004838047	5.47689E-05	0	0	2.774180967
ORANGE	2019	LDA	Aggregate	Aggregate	GAS	1223282	48498865.5	0.154819593	0.290906055	0	0.180707623	0.5	1651.375965
ORANGE	2019	LDA	Aggregate	Aggregate	DSL	10330.9	421338.571	0.000966363	0.016067838	0	0	0	9.110313311
ORANGE	2019	LDA	Aggregate	Aggregate	ELEC	18325.6	702764.686	0	0	0	0	0	0
ORANGE	2019	LDT1	Aggregate	Aggregate	GAS	129886	4932435.32	0.018216032	0.053473812	0	0.021161108	0.1	194.3004571
ORANGE	2019	LDT1	Aggregate	Aggregate	DSL	59.7412	1165.60651	5.14872E-06	8.56085E-05	0	0	0	0.048539197
ORANGE	2019	LDT1	Aggregate	Aggregate	ELEC	343.829	12346.4698	0	0	0	0	0	0
ORANGE	2019	LDT2	Aggregate	Aggregate	GAS	443302	17104474.2	0.070079095	0.149755882	0	0.085002636	0.2	747.4953953
ORANGE	2019	LDT2	Aggregate	Aggregate	DSL	2169.43	100227.697	0.000318136	0.005289679	0	0	0	2.999198297
ORANGE	2019	LDT2	Aggregate	Aggregate	ELEC	2041.18	71154.8291	0	0	0	0	0	0
ORANGE	2019	LHD1	Aggregate	Aggregate	GAS	37244.8	1425183.13	0.012831039	0.022301918	0.000139984	0.027374404	0	136.8616829
ORANGE	2019	LHD1	Aggregate	Aggregate	DSL	20401.2	864878.385	0.004422239	0.073043155	0.000485944	0	0.1	41.69031
ORANGE	2019	LHD2	Aggregate	Aggregate	GAS	6421.01	235470.999	0.002438835	0.003999199	2.36221E-05	0.004629756	0	26.01371823
ORANGE	2019	LHD2	Aggregate	Aggregate	DSL	7812.98	327195.984	0.001853865	0.030525926	0.000298512	0	0	17.47716723
ORANGE	2019	MCY	Aggregate	Aggregate	GAS	54112.2	400119.934	0.00100777	0.028778523	0	0.001790216	0	10.74933419
ORANGE	2019	MDV	Aggregate	Aggregate	GAS	311871	11560839.6	0.057944016	0.130970424	0	0.065100569	0.2	618.0571412
ORANGE	2019	MDV	Aggregate	Aggregate	DSL	5510.28	236620.106	0.00099002	0.016461176	0	0	0	9.333332699
ORANGE	2019	MDV	Aggregate	Aggregate	ELEC	335.415	12029.0797	0	0	0	0	0	0
ORANGE	2019	MH	Aggregate	Aggregate	GAS	7139.19	67065.3688	0.001249325	0.002053101	0	2.6195E-05	0	13.32586198
ORANGE	2019	MH	Aggregate	Aggregate	DSL	2838.24	28639.916	0.000296718	0.004933561	0	0	0	2.797282801
ORANGE	2019	Motor Coach	Aggregate	Aggregate	DSL	135.529	17102.1362	0.000290775	0.004572961	0.000264899	0	0	2.743021488
ORANGE	2019	OBUS	Aggregate	Aggregate	GAS	990.625	45703.0691	0.000862806	0.001388634	5.94982E-06	0.000563987	0	9.203081706
ORANGE	2019	PTO	Aggregate	Aggregate	DSL	0	29972.2636	0.000659075	0.010965591	0	0	0	6.217387485
ORANGE	2019	SBUS	Aggregate	Aggregate	GAS	454.104	19687.8296	0.000205805	0.000821168	4.11748E-05	9.54514E-05	0	2.195213978
ORANGE	2019	SBUS	Aggregate	Aggregate	DSL	1349.43	42134.3061	0.000613602	0.009354793	0.00085422	0	0	5.788414878
ORANGE	2019	T6 Ag	Aggregate	Aggregate	DSL	1.07	8.27546986	1.13029E-07	1.78153E-06	9.9033E-08	0	0	0.001066262
ORANGE	2019	T6 CAIRP heavy	Aggregate	Aggregate	DSL	85.7688	17259.335	0.000166712	0.002764101	9.61872E-06	0	0	1.572673108
ORANGE	2019	T6 CAIRP small	Aggregate	Aggregate	DSL	44.1748	2349.87599	2.4111E-05	0.000396153	5.00198E-06	0	0	0.227450914
ORANGE	2019	T6 instate construction heavy	Aggregate	Aggregate	DSL	388.139	26101.3375	0.000285078	0.004697802	4.52784E-05	0	0	2.689282099
ORANGE	2019	T6 instate construction small	Aggregate	Aggregate	DSL	2744.5	138380.98	0.001491995	0.024500218	0.00032335	0	0	14.07473021
ORANGE	2019	T6 instate heavy	Aggregate	Aggregate	DSL	4029.93	574512.86	0.005768847	0.095516515	0.000464642	0	0.1	54.42041623
ORANGE	2019	T6 instate small	Aggregate	Aggregate	DSL	18116	935173.695	0.009928566	0.16308237	0.002107539	0	0.2	93.6611298
ORANGE	2019	T6 OOS heavy	Aggregate	Aggregate	DSL	48.9367	9853.00471	9.51927E-05	0.001578314	5.48792E-06	0	0	0.898000701
ORANGE	2019	T6 OOS small	Aggregate	Aggregate	DSL	25.9277	1374.00116	1.40888E-05	0.000231474	2.9341E-06	0	0	0.132906987
ORANGE	2019	T6 Public	Aggregate	Aggregate	DSL	915.246	13786.6321	0.00018969	0.002611914	0.000544114	0	0	1.789438291
ORANGE	2019	T6 utility	Aggregate	Aggregate	DSL	332.314	5553.42586	6.38975E-05	0.000958907	0.000104211	0	0	0.602777524
ORANGE	2019	T6TS	Aggregate	Aggregate	GAS	7568.27	433786.897	0.008122537	0.009796736	6.84212E-05	0.004850813	0	86.63865792
ORANGE	2019	T7 Ag	Aggregate	Aggregate	DSL	1	8.1781589	1.67378E-07	2.47243E-06	3.12373E-07	0	0	0.001578958
ORANGE	2019	T7 CAIRP	Aggregate	Aggregate	DSL	885.769	166354.017	0.002638388	0.039907658	0.003989424	0	0	24.88923348
ORANGE	2019	T7 CAIRP construction	Aggregate	Aggregate	DSL	98.8181	18748.8175	0.000282615	0.004633907	6.81976E-05	0	0	2.666049391
ORANGE	2019	T7 NNOOS	Aggregate	Aggregate	DSL	993.974	202806.277	0.003119605	0.046729213	0.005174285	0	0.1	29.42879667
ORANGE	2019	T7 NOOS	Aggregate	Aggregate	DSL	348.926	65358.0642	0.001060917	0.015697855	0.00195351	0	0	10.00815818
ORANGE	2019	T7 POLA	Aggregate	Aggregate	DSL	1245.58	149012.529	0.002638932	0.041857296	0.002048839	0	0	24.8943669
ORANGE	2019	T7 Public	Aggregate	Aggregate	DSL	1029.37	20852.675	0.000397122	0.006004777	0.000602468	0	0	3.746245888
ORANGE	2019	T7 Single	Aggregate	Aggregate	DSL	2097.92	150946.31	0.002463409	0.039416903	0.001568904	0	0	23.23856822
ORANGE	2019	T7 single construction	Aggregate	Aggregate	DSL	668.883	46512.3677	0.00076918	0.012423792	0.000373698	0	0	7.256056779
ORANGE	2019	T7 SWCV	Aggregate	Aggregate	DSL	394.657	16125.0533	0.000837013	0.01361665	0.000309443	0	0	7.895964153
ORANGE	2019	T7 SWCV	Aggregate	Aggregate	NG	732.844	29817.6193	0	0.023494638	0.000692068	0	0	13.7136357
ORANGE	2019	T7 tractor	Aggregate	Aggregate	DSL	1858.62	260175.442	0.004080943	0.066493967	0.001404123	0	0.1	38.49758044
ORANGE	2019	T7 tractor construction	Aggregate	Aggregate	DSL	547.409	38368.6084	0.000637624	0.010257468	0.000351218	0	0	6.015025294
ORANGE	2019	T7 utility	Aggregate	Aggregate	DSL	65.0323	1319.88193	2.30955E-05	0.000363961	2.02978E-05	0	0	0.21787144
ORANGE	2019	T7IS	Aggregate	Aggregate	GAS	13.8224	937.874255	2.22417E-05	0.000213121	0	5.44261E-06	0	0.237240048
ORANGE	2019	UBUS	Aggregate	Aggregate	GAS	208.573	19704.6975	0.000502827	0.000643098	0	7.45422E-05	0	5.363383616
ORANGE	2019	UBUS	Aggregate	Aggregate	DSL	0	0	0	0	0	0	0	0
ORANGE	2019	UBUS	Aggregate	Aggregate	NG	733.959	85007.6643	0	0.037760578	0	0	0	21.40989389
SOUTH CO	2020	UBUS	Aggregate	Aggregate	NG	5222.89	571203.409						

E-2 Operational Calculations

EF International Language Campus
Operational Energy Summary

Electricity	Electricity Use (GWh/yr)
Proposed Project	
Building Energy	1.11
Water Heating and Conveyance	0.21
Total	**1.33**
SCE Total	**95,000**
% of SCE	**0.001%**

Source: SCE, https://efiling.energy.ca.gov/getdocument.aspx?tn=223244

Natural Gas	Natural Gas Use (million cf/yr)
Proposed Project	1.93
SoCalGas Total	**936,590**
% of SoCalGas	**0.0002%**

Source: SoCalGas, https://www.socalgas.com/regulatory/documents/cgr/2018_California_Gas_Report.pdf

Proposed Project	
Fuel	**Fuel Use (gal/yr)**
Gasoline	52,516
Diesel	4,745
County Total - Gas	**1,402,000,000**
% of County	**0.004%**
County Total - Diesel	**114,583,333**
% of County	**0.004%**

Source: California Energy Commission (CEC), California Annual Retail Fuel Outlet Report, 2018.

EF International Language Campus
Operational Energy Analysis

Energy and VMT Estimates

Source	Natural Gas demand (million kBTU/yr)	Natural Gas demand (million cubic feet/year)	Electricity demand (million kWh/yr)	Electricity demand from water demand (million kWh/yr)	Annual Worker and Visitor VMT
EF International Language Campus	2.0	1.93	1.11	0.213	1,375,027

Source	CalEEMod Indoor Water Use (Mgal/yr)	CalEEMod Outdoor Water Use (Mgal/yr)	Total Water Use (Mgal/yr)	Electricity Demand from water Demand (million kWh)
EF International Language Campus	9.17	8.423	17.593	0.213

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)
EF International Language Campus	9727	111	1272	1911

Source: California Emissions Estimator Model (CalEEMod).

EF International Language Campus
Operational Energy Analysis
Project Trips
Fuel Usage from VMT

Annual VMT (All): 1,375,027 miles/year

Fuel Type:[1]	GAS	DSL	ELEC	
Percent:	95.06%	3.89%	1.05%	
Miles per Gallon Fuel:	24.89	11.29	-	
Annual VMT by Fuel Type :	1,307,046	53,552	14,429	miles/year
Annual Fuel Usage :	52,516	4,745	-	gal/year

Notes:

1. California Air Resources Board, EMFAC2017, South Coast Air Basin; 2020; Annual; All vehicle types; Aggregate model year; Aggregate speed). https://www.arb.ca.gov/emfac/2017/?_ga=2.234790174.1232419908.1569513613-130214118.1569513613