

# Appendix G

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## Construction and Operational Energy Use Calculations



## Construction Energy Use

### Off-Road Construction Equipment Energy Use

Phase	Equipment	Fuel	HP	Load Factor	Equipment Count	Hours/Day	Work Days	Gallons /HP-Hr	Gallons /Hour	Gallons /Day	Total Gallons	Total kBtu
Site Preparation	Rubber Tired Dozers	Diesel	367	0.4	3	8.0	20	0.0453607	6.65895	159.815	3,196.3	444,285
	Tractors/Loaders/Backhoes	Diesel	84	0.37	4	8.0	20	0.0564883	1.75566	56.181	1,123.6	156,183
Grading	Excavators	Diesel	36	0.38	2	8.0	45	0.0560979	0.76742	12.279	552.5	76,803
	Graders	Diesel	148	0.41	1	8.0	45	0.0538288	3.26633	26.131	1,175.9	163,447
	Rubber Tired Dozers	Diesel	367	0.4	1	8.0	45	0.0453607	6.65895	53.272	2,397.2	333,214
	Scrapers	Diesel	423	0.48	2	8.0	45	0.0476817	9.68129	154.901	6,970.5	968,903
	Tractors/Loaders/Backhoes	Diesel	84	0.37	2	8.0	45	0.0564883	1.75566	28.090	1,264.1	175,706
Paving	Pavers	Diesel	81	0.42	2	8.0	35	0.0565364	1.92337	30.774	1,077.1	149,715
	Paving Equipment	Diesel	89	0.36	2	8.0	35	0.0595865	1.90915	30.546	1,069.1	148,608
	Rollers	Diesel	36	0.38	2	8.0	35	0.0578510	0.79140	12.662	443.2	61,603
Building Construction	Cranes	Diesel	367	0.29	2	4.4	375	0.0515293	5.48427	47.987	17,995.2	2,501,340
	Forklifts	Diesel	82	0.2	4	7.5	375	0.0573234	0.94010	28.203	10,576.2	1,470,087
	Generator Sets	Diesel	14	0.74	2	5.0	375	0.0177766	0.18417	1.842	690.6	95,997
	Tractors/Loaders/Backhoes	Diesel	84	0.37	4	6.6	375	0.0564883	1.75566	46.086	17,282.2	2,402,231
	Welders	Diesel	46	0.45	2	5.0	375	0.0258137	0.53434	5.343	2,003.8	278,527
Architectural Coating	Air Compressors	Diesel	37	0.48	1	6.0	162	0.0177766	0.31571	1.894	306.9	42,655
<b>Project Construction Off-Road Total</b>											<b>68,124.5</b>	<b>9,469,304</b>

### On-Road Construction Energy Use

Phase	Trip Type (Fleet Mix)	Trips	Distance (miles)	Work Days	Total VMT	Diesel Gallons / VMT	Diesel Gallons	Gas Gallons / VMT	Gas Gallons	NG Gallons / VMT	NG Gallons	kWh/VMT	Total kWh	Total kBtu
Site Preparation	Worker (LDA, LDT1, LDT2)	17.5	11.97	20	4,190	8.56E-05	0	3.54E-02	148	0.00E+00	-	2.23E-02	93	18,739
	Vendor (HHDT, MHDT)	1	7.63	20	153	1.37E-01	21	1.46E-02	2	5.69E-03	1	1.07E-02	2	3,313
Grading	Worker (LDA, LDT1, LDT2)	20	11.97	45	10,773	8.56E-05	1	3.54E-02	381	0.00E+00	-	2.23E-02	240	48,185
	Vendor (HHDT, MHDT)	1	7.63	45	343	1.37E-01	47	1.46E-02	5	5.69E-03	2	1.07E-02	4	7,455
Paving	Worker (LDA, LDT1, LDT2)	15	11.97	35	6,284	8.56E-05	1	3.54E-02	222	0.00E+00	-	2.23E-02	140	28,108
	Vendor (HHDT, MHDT)	2	7.63	35	534	1.37E-01	73	1.46E-02	8	5.69E-03	3	1.07E-02	6	11,597
Building Construction	Worker (LDA, LDT1, LDT2)	1065.6	11.97	375	4,783,212	8.56E-05	409	3.54E-02	169,142	0.00E+00	-	2.23E-02	106,550	21,394,142
	Vendor (HHDT, MHDT)	158.212	7.63	375	452,684	1.37E-01	62,121	1.46E-02	6,611	5.69E-03	2,576	1.07E-02	4,861	9,829,229
Architectural Coating	Worker (LDA, LDT1, LDT2)	213.12	11.97	162	413,270	8.56E-05	35	3.54E-02	14,614	0.00E+00	-	2.23E-02	9,206	1,848,454
<b>Project Construction On-Road Total</b>					<b>5,671,442</b>		<b>62,709</b>		<b>191,133</b>		<b>2,582</b>		<b>121,101</b>	<b>33,189,222</b>

#### Notes:

- Off-road equipment types and horsepower from CalEEMod defaults.
- Off-road equipment count and hours from CalEEMod for the AQ/GHG report.
- Off-road fuel consumption factors from CARB OFFROAD2021, for San Diego County, aggregate model years. <https://arb.ca.gov/emfac/emissions-inventory/>.
- On-road fleet mix and trip distances from CalEEMod for the AQ/GHG report.
- On-road fuel consumption factors weighted average for fleet mix from CARB EMFAC2021, for San Diego County, aggregate model years, aggregate speeds. <https://arb.ca.gov/emfac/emissions-inventory/>
- 1 Gallon of diesel = 139 kBtu; 1 gallon of gasoline = 124 kBtu; 1 gallon of natural gas = 139kBtu; 1 kWh = 3.412142 kBtu.

### Construction Energy Summary

Source	Diesel Gallons	Gas Gallons	NG Gallons	kWh	kBtu
Off-Road Construction Equipment	68,124	-	-	-	9,469,304
On-Road Construction Traffic	62,709	191,133	2,582	121,101	33,189,222
<b>Project Construction Total</b>	<b>130,834</b>	<b>191,133</b>	<b>2,582</b>	<b>121,101</b>	<b>42,658,526</b>

## Annual Operational Energy Use

<b>Project VMT</b>
14,000,900

Project On-Road Project Operational Energy Use								
Diesel Gallons / VMT	Diesel Gallons	Gas Gallons / VMT	Gas Gallons	NG Gallons / VMT	NG Gallons	kWh/VMT	Total kWh	Total kBtu
4.95E-03	69,365	3.66E-02	512,609	3.62E-04	5,075	2.13E-02	298,673	74,929,837

Project Electricity and Natural Gas			
Type	Source	kWhr	kBtu
Natural Gas	Hot Water, Heating	-	14,990,549
Electricity	Buildings, Lighting	5,189,080	17,705,877
<b>Total</b>		<b>5,189,080</b>	<b>32,696,426</b>

Project Water and Wastewater Energy Use							
Indoor (Mgal)	Outdoor (Mgal)	Supply (kWhr/Mgal)	Treat Water (kWhr/Mgal)	Distribute (kWhr/Mgal)	Treat Wastewater	kWhr	kBtu
51.996951	2.684968072	9,727	111	1,272	1,911	706,882	2,411,983

Project Total		
Energy Type	Quantity	kBtu
Gasoline (Gallons)	512,609	63,563,572
Diesel (Gallons)	69,365	9,641,721
Natural Gas (kBtu)	15,695,978	15,695,978
Electricity (kWhr)	6,194,635	21,136,974
<b>Total</b>		<b>110,038,246</b>

**Notes:**

1. VMT, electricity, natural gas, and water use from project CalEEMod annual output.
2. Fleet mix from CalEEMod default for San Diego County
3. Fuel consumption factors weighted average for fleet mix from CARB EMFAC2021, for San Diego County, aggregate model years for 2026, aggregate speeds.
4. Water electricity intensity factors from CalEEMod default for San Diego County.
5. 1 Gallon of diesel = 139 kBtu; 1 gallon of gasoline = 124 kBtu; 1 gallon of natural gas = 139 kbtu; 1 kWhr = 3.412142 kBtu.