

# Port = EMISSION FACTORS USED FOR POS MARITIME GHG INVENTORY: 2022 of Seattle Updated: 7/18/2023

Scope 1 &2 Emission Factors

Scope	Year	Fuel	Emission Factor	Original Units	Converted Emission Factor	Converted Units	Citation	Notes
1	All	Natural Gas in Boilers	53.0600	kg CO2/MMBTU	0.00530600	tonnes CO2/therm	2023-Default-Emission-Factors-Final.pdf (theclimatere	Emission Factors for Greenhouse Gas Inventories
	All	Natural Gas III Bollers	33.0000	kg CO2/WWBTO	0.00550000	tolliles CO2/tileffil	2025-Detault-Ellission-Factors-Filial.pdr (theclimatere	(epa.gov)
1	All	Gasoline in Vehicles	8.7800	kg CO2/gallon	0.00878000	tonnes CO2/gallon	2023-Default-Emission-Factors-Final.pdf (theclimatere	Emission Factors for Greenhouse Gas Inventories
							_	(epa.gov) Emission Factors for Greenhouse Gas Inventories
1	All	Fossil Diesel in Vehicles (1)	10.2100	kg CO2/gallon	0.01021000	tonnes CO2/gallon	2023-Default-Emission-Factors-Final.pdf (theclimatere	(epa.gov)
_				/ 6		/	2023-Default-Emission-Factors-Final.pdf	(chaigos)
1	All	Natural Gas in Vehicles	0.0545	kg CO2/scf	0.00690352	tonnes CO2/GGE	(theclimateregistry.org)	
1	All	Propane	5.72	kg CO2/gallon	0.00572000	tonnes CO2/gallon	2023-Default-Emission-Factors-Final.pdf	
	7	Topane	3.72	ng coz/ganon	0.00372000	tormes eez, ganon	(theclimateregistry.org)	
1	2005- 2011	Steam (2)	156	Lbs. CO2e/MMBti	0.069084097	tonnes CO2e/klb	Calculations: http://collab.portseattle.org/sites/SEP_Air/climate/_la youts/xlviewer.aspx?id=/sites/SEP_Air/climate/_la youts/xlviewer.aspx?id=/sites/SEP_Air/climate/Shared %20Documents/GHG%20Accounting%202018/Electric ity-Natural%20Gas- Steam/Steam/Steam%20calcs.xlsx&Source=http%3A% 2F%2Fcollab%2Eportseattle%2Eorg%2Fsites%2F5EP% 5FAir%2Fcollab%2Eportseattle%2Eorg%2Fsites%2F5EP% 5FAir%2Fclimate%2FShared%2520Documents%2FFor ms%2FAllItems%2Easpx%3FRootFolder%3D%252Fsite s%252FSEP%255FAir%252Fclimate%252FShared%252 0Documents%252FGHG%2520Accounting%25202018 %252FElectricity%252DNatural%2520Gas%252DStea m%252FSteam&DefaultItemOpen=1	
2	2010	SCL Retail Electricity	45.57	lb CO2/MWh (2)	0.00002066	tonnes CO2/kWh	SCL correspondence & SCL retail factors found at https://www.theclimateregistry.org/our-members/cris public-reports/	
2	2011	SCL Retail Electricity	13.77	lb CO2/MWh (2)	0.00000625	tonnes CO2/kWh	SCL correspondence & SCL retail factors found at https://www.theclimateregistry.org/our-members/cris public-reports/	
2	2012	SCL Retail Electricity	25.62	lb CO2/MWh (2)	0.00001162	tonnes CO2/kWh	SCL correspondence & SCL retail factors found at https://www.theclimateregistry.org/our-members/cris public-reports/	
2	2013	SCL Retail Electricity	33.23	lb CO2/MWh (2)	0.00001507	tonnes CO2/kWh	SCL correspondence & SCL retail factors found at https://www.theclimateregistry.org/our-members/cris public-reports/	
2	2014	SCL Retail Electricity	20.08	lb CO2/MWh (2)	0.0000911	tonnes CO2/kWh	SCL correspondence & SCL retail factors found at https://www.theclimateregistry.org/our-members/cris public-reports/	
2	2015	SCL Retail Electricity	52.44	lb CO2/MWh (2)	0.00002379	tonnes CO2/kWh	SCL correspondence & SCL retail factors found at https://www.theclimateregistry.org/our-members/cris public-reports/	
2	2016	SCL Retail Electricity	31.22	lb CO2/MWh (2)	0.00001416	tonnes CO2/kWh	SCL correspondence & SCL retail factors found at https://www.theclimateregistry.org/our-members/cris public-reports/	
2	2017	SCL Retail Electricity	46.37	lb CO2/MWh (2)	0.00002103	tonnes CO2/kWh	SCL retail factors found at https://www.theclimateregistry.org/our-members/cris public-reports/	
2	2018	SCL Retail Electricity	32.05	lb CO2/MWh (2)	0.00001454	tonnes CO2/kWh	SCL retail factors found at https://www.theclimateregistry.org/our-members/cris public-reports/. 2018 EF found at https://www.theclimateregistry.org/wp-content/uploads/2021/05/2021-Default-Emission-Factor-Document.pdf?mc_cid=4b45d12237&mc_eid=5f138d 1baa	

2	2019	SCL Retail Electricity (3)	41.57	lb CO2/MWh (2)	0.00001886		SCL retail factor for 2019, found at: https://www.theclimateregistry.org/our-members/cris	The 2019 SCL retail electricity emissions factor was applied to 2019 electricity use, as the most recent
							public-reports/	published emissions factor.
				lb CO2/MWh (2)	0.0000891		SCL retail factor for 2020, found at:	The 2020 emissions factor was used to recalculate
,	2020	SCL Retail Electricity (3)	19.64			tonnes CO2/kWh	https://theclimateregistry.org/wp-	2020 and 2021 emissions herein, and to calculate
	2020	SCE Retail Electricity (5)	15.04			tollies CO2/KWII	content/uploads/2023/06/2023-Default-Emission-	2022 emissions.
							Factors-Final-1.pdf (Table 3.8)	

#### Notes:

- (1) The emission factor for Renewable Diesel as a vehicle fuel is 0 because combustion of the fuel is considered to produce biogenic CO2 emissions.
- Emissions from renewable diesel are not included in the total emissions estimate, because they are considered to be part of the natural carbon cycle and so are excluded under UNFCCC guidelines.
- (2) Enwave Seattle provides an emission factor for CO2e, not CO2.
- (3) SCL emissions factors converted from lb CO2/Mwh to tonnes CO2 as follows: (lb CO2/MWh)\*(0.0004536 MT/lb)\*1 MWH/1000KWh) or value\*0.000454/1000

#### **Scope 3 Emission Factors**

Scope	Year	Fuel	Emission Factor	Original Units	Converted Emission Factor	Converted Units	Citation
3	2015	Jet-A in Regional Flights	70.0000	seat-mile/gallon	0.000139286	tonnes CO2/seat-mile	https://en.wikipedia.org/wiki/Fuel_economy_in_aircraft
3	2015	Jet-A in Medium Haul Flights	75.0000	seat-mile/gallon	0.00013	tonnes CO2/seat-mile	http://www.wsj.com/articles/SB10001424052748704 901104575423261677748380
3	2015	Jet-A in Long Haul Flights	70.0000	seat-mile/gallon	0.000139286	tonnes CO2/seat-mile	https://en.wikipedia.org/wiki/Fuel_economy_in_aircraft
3	All	Gasoline in Vehicles	8.7800	kg CO2/gallon	0.00878000	tonnes CO2/gallon	2023-Default-Emission-Factors-Final.pdf (theclimateregistry.org)
3	All	Diesel in Vehicles	10.2100	kg CO2/gallon	0.01021000	tonnes CO2/gallon	2023-Default-Emission-Factors-Final.pdf (theclimateregistry.org)
3	All	Propane	5.72	kg CO2/gallon	0.00572000	tonnes CO2/gallon	2023-Default-Emission-Factors-Final.pdf (theclimateregistry.org)
3	All	Natural Gas in Boilers	53.0600	kg CO2/MMBTU	0.00530600	tonnes CO2/therm	2023-Default-Emission-Factors-Final.pdf (theclimateregistry.org)

## **Biogenic Emission Factors**

Scope	Year	Fuel	Emission Factor Original Units		Converted Emission Factor	Converted Units	Citation
1 411	All	Renewable Diesel (2)	10.2100	la CO3/gallan	0.01021000	tannas CO2/gallan	2023-Default-Emission-Factors-Final.pdf
1 1	All	Reflewable Diesel (2)	10.2100	kg CO2/gallon	0.01021000	tonnes CO2/gallon	(theclimateregistry.org)
		2422 2: 1: 1/1: 1/4)	0.4500	1 000/ "	0.00045000		2023-Default-Emission-Factors-Final.pdf
1	All	B100 Diesel in Vehicles (1)	9.4500	kg CO2/gallon	0.00945000	tonnes CO2/gallon	(theclimateregistry.org)

#### Notes:

(1) B100 is not currently used by POS Maritime. When biofuel blends are used, a composite emission factor calculation will be performed in the applicable worksheet. For example, B20 used in fleet vehicles is accounted for as 80% Diesel in Tab 3-Mobile Fleet Fossil Fuel Use and 20% B100 in Tab 4 - Biogenic Fuel Use.



## Energy Use from Scope 3 Sources at Port of Seattle Maritime 2005 - 2022

			2005	2007	2015	2016	2017	2018	2019	2020	2021	2022	% Ch Prior Yr % Ch Baseline		
CONTROL	Staff Business Travel	Regional Flights	8,169	8,169	8,169	11,168	11,168	16,216	16,216	258	2,394	14,675	513%	80%	seat-miles/gal Jet A Fuel
		Medium (intra-US) Haul Flights	631,281	631,281	631,281	532,852	532,852	750,716	750,716	96,567	62,654	508,734	712%	-19%	seat-miles/gal Jet A Fuel
		Long Haul Flights	118,050	118,050	118,050	109,186	109,186	181,773	181,773	19,277	-	189,010	#DIV/0!	60%	seat-miles/gal Jet A Fuel
	Tenant Natural Gas (1)	Terminal 91		-	9,688	16,722	22,917	25,663	36,405	13,701	8,670	32,852	279%	#DIV/0!	therms
	Tenant Steam (2)	Pier 66	-	-	-	-	-	-	-		-	-	#DIV/0!	#DIV/0!	klbs
	Tenant Electricity	Fishermen's Terminal (3)	2,672,519	3,355,174	2,508,794	2,485,026	2,730,594	2,699,000	2,598,150	2,059,581	2,233,681	2,790,149	25%	4%	kWh
		Marine Maintenance						-	-	-	-	-	#DIV/0!	#DIV/0!	kWh
		Marine Maintenance - Parks						-	-	-	-		#DIV/0!	#DIV/0!	kWh
		Maritime Industrial Center (4)	614,958	1,000,984	721,780	532,927	512,629	475,484	413,465	300,180	356,247	392,059	10%	-36%	kWh
		Pier 2 Uplands & CEM						-	-	-	-	-	#DIV/0!	#DIV/0!	kWh
		Pier 28						-	-	-	-	-	#DIV/0!	#DIV/0!	kWh
		Pier 48	-	54,240	-	-	-	-	-	-	-	-	#DIV/0!	#DIV/0!	kWh
		Pier 66 & Marina	1,045,051	977,233	1,090,915	1,050,376	1,081,585	1,182,750	1,165,074	745,452	1,106,172	1,091,215	-1%	4%	kWh
		Pier 69	18,612	3,796	166,952	184,612	187,504	176,328	164,580	83,232	131,729	5,392	-96%	-71%	kWh
		Salmon Bay Marina (5)	-		-	-	-	-	-	-	-	228,956	#DIV/0!	#DIV/0!	kWh
		Shilshole Bay Marina	3,728,173	3,541,512	3,101,025	3,147,752	4,387,781	3,312,374	3,240,445	3,200,956	3,383,048	3,276,525	-3%	-12%	kWh
		Terminal 5 Southeast						-	-	-	-	79,510	#DIV/0!	#DIV/0!	kWh
		Terminal 18 (6)						-	-	18,590	27,409	-	-100%	#DIV/0!	kWh
		Terminal 34 (6)						-	-	-	-	-	#DIV/0!	#DIV/0!	kWh
		Terminal 86 (7)	9,590,358	10,129,624	7,176,901	8,366,709	8,679,486	8,762,063	7,590,623	9,429,451	9,315,587	8,876,188	-5%	-7%	kWh
		Terminal 91 (8)	14,819,055	19,300,354	17,392,884	15,167,510	20,165,609	17,016,667	18,103,662	10,359,168	14,149,942	19,109,815	35%	29%	kWh
		T91 Cruise Shore Power (9)						2,076,982	4,281,856	-	2,498,115	3,154,961	26%	#DIV/0!	kWh
		Terminal 102 & Marina, T104	206,111	214,889	106,014	88,672	113,857	95,430	97,666	107,034	86,899	244,808	182%	19%	kWh
		Terminal 106						-	-	-	-	-	#DIV/0!	#DIV/0!	kWh
		Terminal 108						-	-	-	-	-	#DIV/0!	#DIV/0!	kWh
		Terminal 117						-	-	-	-	-	#DIV/0!	#DIV/0!	kWh
		World Trade Center West (10)								-	-	-	#DIV/0!	#DIV/0!	kWh
		Duwamish River Hub (11)						-	-		-		#DIV/0!	#DIV/0!	kWh
		subtotal	32,694,837	38,577,806	32,265,265	31,023,584	37,859,045	35,797,079	37,655,521	26,303,644	33,288,829	39,249,578	18%	20%	kWh
INFLUENCE	Employee Commute (2)	direct calculation of CO2	1,007	1,021	1,345	1,392	1,305	1,335	1,254	560	324	807	149%	-20%	tonnes CO2
I	Solid Waste Mgmt (2)	direct calculation of CO2	139	139	139	185	188	190	198	93	101	117	15%	-16%	tonnes CO2
	Maritime Supply Chain (2)	direct calculation of CO2	93,208	93,208	104,329	74,231	74,231	74,231	74,231	74,231	74,231	74,231	0%	-20%	tonnes CO2
		subtotal	94,354	94,368	105.813	75,808	75.724	75,756	75,683	74,884	74,656	75.038	1%	-20%	tonnes CO2

- (1) Natural gas use in the Terminal 91 cruise building was reassigned as Scope 3 from 2011-2022, based on improved metering formation.
- (2) Emissions from this category are expressed in tonnes CO2e; this is assumed proxy for CO2 value.
  (3) Fishermen's Terminal 2005 Scope 3 kWh adjusted to 39% of total due to data anomalies.
- (4) Maritime Industrial Center (MIC) 2005 Scope 2 kWh adjusted to 51% of total due to data anomalies.
- (4) Maritime industrial Center (MIC) 2005 Scope 2 kWn adjusted to 51% of total (
  (5) Salmon Bay Marina was purchased by Port of Seattle in 2018.
- (c) Starting in 2022, Terminal 18 and Pier 34 are omitted from the inventory because they are NWSA facilities. This change was not made to past inventories due to small impact (<5%) baseline emissions.
- (7) Terminal 86 values for 2005, 2007, 2011, and 2015 were estimated based on 2017 actuals and annual cargo throughput.
- (8) Terminal 91 Scope 3 kWh adjusted to 56% of total for 2005, 87% of total for 2015 and 2018, and 80 Cope 3 kWh adjusted to 56% of total for 2005, 87% of total for 2016 and 2018, and 80 Cope 3 kWh adjusted to 56% of total for 2005, 87% of total for 2018, and 80 Cope 3 kWh adjusted to 56% of total for 2005, 87% of total for 2018, and 80 Cope 3 kWh adjusted to 56% of total for 2005, 87% of total for 2018, and 80 Cope 3 kWh adjusted to 56% of total for 2005, 87% of total for 2018, and 80 Cope 3 kWh adjusted to 56% of total for 2005, 87% of total for 2018, and 80 Cope 3 kWh adjusted to 56% of total for 2005, 87% of total for 2018, and 80 Cope 3 kWh adjusted to 56% of total for 2005, 87% of total for 2018, and 80 Cope 3 kWh adjusted to 56% of total for 2005, 87% of total for 2018, and 80 Cope 3 kWh adjusted to 56% of total for 2005, 87% of total for 2018, and 80 Cope 3 kWh adjusted to 56% of total for 2005, 87% of total for 2018, and 80 Cope 3 kWh adjusted to 56% of total for 2005, 87% of total for 2018, and 80 Cope 3 kWh adjusted to 56% of total for 2005, 87% of total for 2018, and 80 Cope 3 kWh adjusted to 56% of total for 2005, 87% of total for 2018, and 80 Cope 3 kWh adjusted to 56% of total for 2005, 87% of total for 2018, and 80 Cope 3 kWh adjusted to 56% of total for 2005, 87% of total for 2018, and 80 Cope 3 kWh adjusted to 56% of total for 2005, 87% of total for 2018, and 80 Cope 3 kWh adjusted to 56% of total for 2005, 87% of total for 2018, and 80 Cope 3 kWh adjusted to 56% of total for 2005, 87% of total for 2018, and 80 Cope 3 kWh adjusted to 56% of total for 2005, 87% of total for 2018, and 80 Cope 3 kWh adjusted to 56% of 10 kWh adjusted to 56
- (9) Terminal 91 Cruise Shore Power Port began collecting data on electricity usage in 2018. There was no cruise season in 2020 due to COVID-19 restrictions.
- (10) World Trade Center West (WTCW) was newly added to the GHG inventory in 2018 with adjustments in prior years' inventories.
- (11) Duwamish River Hub is new property the Port rents, added in 2021.



## CO2 Emissions from Scope 3 Sources at Port of Seattle Maritime 2005 - 2022

Scope 3

Scope 1-2

All units in tonn	or		Scope 1-2 baseline year	baseline year										
All utilits in tolli	es	1	2005	2007	2015	2016	2017	2018	2019	2020	2021	2022	% Ch Prior Yr	% Ch Baseline
CONTROL	Staff Business Travel	Regional Flights	2003	1	2013	2010	2017	2010	2013	0	0.3	2022	519%	79%
CONTROL	Stail Busiliess Havei	Medium (intra-US) Haul Flights	82	82	82	69	69	98	98	13	8	66	711%	-19%
		Long Haul Flights	16	16	16	15	15	25	25	3	-	26	#DIV/0!	60%
		subtotal	100	100	100	86	86	125	125	15	8	95	#BIV/0!	-5%
		subtotal	100	100	100	80	80	123	123	13	•	33	1014/6	-3/0
	Tenant Natural Gas (1)	Terminal 91	-	-	51	89	122	136	193	73	46	174	279%	#DIV/0!
	Tenant Steam (2)	Pier 66	-	-	- 1	-	-	-	-			-	#DIV/0!	#DIV/0!
	Tenant Electricity (3)	Fishermen's Terminal (4)	55	69	60	35	57	39	49	18	20	25	25%	-55%
		Marine Maintenance	-	-	-	-	-	-	-	-	-	-	#DIV/0!	#DIV/0!
		Marine Maintenance - Parks	-	-	-	-	-	-	-	-	-	-	#DIV/0!	#DIV/0!
		Maritime Industrial Center (5)	13	21	17	8	11	7	8	3	3	3	10%	-73%
		Pier 2 Uplands & CEM	-	-	-	-	-	-	-	-	-	-	#DIV/0!	#DIV/0!
		Pier 28	-	-	-	-	-	-	-	-	-	-	#DIV/0!	#DIV/0!
		Pier 48	-	1	-	-	-	-	-	-	-	-	#DIV/0!	#DIV/0!
		Pier 66 & Marina	22	20	26	15	23	17	22	7	10	10	-1%	-55%
		Pier 69	0	0	4	3	4	3	3	1	1	0	-96%	-88%
		Salmon Bay Marina (6)	-	-	-	-	-	-	-	-	-	2	#DIV/0!	#DIV/0!
		Shilshole Bay Marina	77	73	74	45	92	48	61	29	30	29	-3%	-62%
		Terminal 5 Southeast	-	-	-	-	-	-	-	-	-	1	#DIV/0!	#DIV/0!
		Terminal 18 (7)	-	-	-	-	-	-	-	0	0	-	-100%	#DIV/0!
		Terminal 34 (7)	-	-	-	-	-	-	-	-	-	-	#DIV/0!	#DIV/0!
		Terminal 86 (8)	198	209	171	118	183	127	143	84	83	79	-5%	-60%
		Terminal 91 (9)	306	399	414	215	424	247	341	92	126	170	35%	-44%
		T91 Cruise Shore Power (10)	-	-	-	-	-	30	81	-	22	28	26%	#DIV/0!
		Terminal 102 & Marina	4	4	3	1	2	1	2	1	1	2	182%	-49%
		Terminal 106	-	-	-	-	-	-	-	-	-	-	#DIV/0!	#DIV/0!
		Terminal 108	-	-	-	-	-	-	-	-	-	-	#DIV/0!	#DIV/0!
		Terminal 117	-	-	-	-	-	-	-	-	-	-	#DIV/0!	#DIV/0!
		World Trade Center West (11)	-	-	-	-	-		-	-	-	-	#DIV/0!	#DIV/0!
		Duwamish River Hub (12)	,	÷	÷		-	-	÷	÷	÷	-	#DIV/0!	#DIV/0!
1		subtotal	676	797	767	439	796	520	710	234	297	350	18%	-48%
INFLUENCE	5 I 6 1. (2)	P69 and Maritime work locations	1,007	1,021	1,345	1.392	1,305	1,335	1,254	560	324	807	149%	-20%
INFLUENCE	Employee Commute (2)	P69 and Maritime work locations	1,007	1,021	1,345	1,392	1,305	1,335	1,254	560	324	807	149%	-20%
	Solid Waste Mgmt (2)	Maritime solid waste off-site mgmt	139	139	139	185	188	190	198	93	101	117	16%	-15%
1	Maritime Supply Chain (2)	Ocean-going vessels	70,890	70,890	#REF!	58,539	58,539	58,539	58,539	58,539	58,539	58,539	0%	-17%
		Commercial harbor vessels	2,967	2,967	#REF!	4,083	4,083	4,083	4,083	4,083	4,083	4,083	0%	38%
		Recreational vessels	7,867	7,867	#REF!	6,701	6,701	6,701	6,701	6,701	6,701	6,701	0%	-15%
		Locomotives	7,545	7,545	#REF!	4,540	4,540	4,540	4,540	4,540	4,540	4,540	0%	-40%
		Cargo-handling equipment	3,926	3,926	#REF!	354	354	354	354	354	354	354	0%	-91%
		Cruise buses on terminals	13	13	#REF!	15	15	15	15	15	15	15	0%	14%
		subtotal	93,208	93,208	#REF!	74,231	74,231	74,231	74,231	74,231	74,231	74,231	0%	-20%
		TOTAL	95,129	95,265	#REF!	76,422	76,727	76,538	76,711	75,206	75,007	75,774	1%	-20%

- (1) Natural gas use in the Terminal 91 cruise building was reassigned as Scope 3 from 2011-2022, based on improved metering formation. (2) Emissions from this category are expressed in tonnes CO2e; this is assumed proxy for CO2 value.
- (3) As updated annual emission factors become available from Seattle City Light, they are applied to prior years' inventories. In 2022, emissions were recalculated for 2019 (using the 2019 emission factor), and 2020 and 2021 (using the 2020 emission factor).
- (4) Fishermen's Terminal 2005 Scope 3 kWh adjusted to 39% of total due to data anomalies.
- (5) Maritime Industrial Center (MIC) 2005 Scope 2 kWh adjusted to 51% of total due to data anomalies.
- (6) Salmon Bay Marina was purchased by Port of Seattle in 2018.
- (7) Starting in 2022, Terminal 18 and Pier 34 are omitted from the inventory because they are NWSA facilities. This change was not made to past inventories due to small impact (<5%) baseline emissions.
- (8) Terminal 86 values for 2005, 2007, 2011, and 2015 were estimated based on 2017 actuals and annual cargo throughput.
- (9) Terminal 91 Scope 3 kWh adjusted to 56% of total for 2005, 87% of total for 2015 and 2018, and 88% for 2021 due to data anomalies. (Proportions based on representative years.)
- (10) Terminal 91 Cruise Shore Power Port began collecting data on electricity usage in 2018. There was no cruise season in 2020 due to COVID-19 restrictions.
- (11) World Trade Center West (WTCW) was newly added to the GHG inventory in 2018 with adjustments in prior years' inventories.
- (12) Duwamish River Hub is new property the Port rents, added in 2021.