

TO: CALLA OSTRANDER – CITY AND COUNTY OF SAN FRANCISCO
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SUBJECT: TBIF SUMMARY – CITY AND COUNTY OF SAN FRANCISCO
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The Center for Sustainable Infrastructure Systems (CSIS) at the University of Colorado Denver (UCD) has estimated the 2008 Greenhouse Gas (GHG) Emissions Footprint for the City and County of San Francisco (CCSF), using the Trans-Boundary Infrastructure Footprint (TBIF) method. TBIF accounts for GHG emissions from: energy used directly in buildings and road transportation in the city, purchased electricity used in the city, and life-cycle GHG emissions from fuel supply, water supply, waste management, construction materials, and trans-boundary transport (road, air, freight) serving cities. GHG emissions from these sectors are added together to yield the total community-wide GHG footprint.

We estimate SF 2008 community-wide GHG emissions footprint equal to 10 million mt-CO₂e (or 12.4 mt-CO₂e/person). Of the community-wide GHG emissions, sector contributions are as follows: Buildings = 35%, Road Transport = 20%, Mass Transit = 1%, Water and Waste = 2%, and Trans-Boundary Infrastructures = 42%; Food and Air Travel contributed 19% and 12%, respectively, most among the trans-boundary infrastructure GHG emissions.

The following discussion is supported by data contained in Table 1. In-Boundary energy use was obtained from CCSF, and benchmarked with State and National level energy use by sector (Residential, Commercial, Industrial). Vehicle Miles Traveled (VMT) was collected from CCSF, and UCD applied California state estimates of fuel efficiencies by vehicle type (Caltrans, 2009), to arrive at fuel use estimates in road transportation. Energy used in Muni, BART, and Caltrain were all retrieved from CCSF. Total estimates of volumes and energy used in water/wastewater treatment and pumping were also obtained from CCSF. For municipal solid waste, CCSF reports diversion rates equal to 78%; estimates shown in Table 1 accounts for diversion. Next are material flow estimates of the Trans-Boundary sectors.

Estimates of Air Travel accounted for SFO passengers only, for which the total domestic jet fuel loaded at SFO was allocated to CCSF using a survey conducted by the city, which estimated that 35% of SFO passengers has CCSF related trips. Cement and Long Distance Freight were estimated for CCSF using the US Economic Census (USEC, 2009). Lastly, estimates of food expenditures by households were obtained from the Bureau of Labor Statistics (BLS) Consumer Expenditure Survey (CES) (BLS, 2010).

San Francisco’s TBIF GHG emissions create the potential for innovative cross-sector policy actions. Below are a number of policy scenarios, which are relevant to SF, and whose trade-offs/impacts can be shown using the TBIF.

Regional Commuter Travel – Impacts from SF current ridership of Caltrain is shown in Figure 1. Future impacts and trade-offs from shifts in driving to rail (Caltrain, or BART) can be explicitly shown with the TBIF.

Air Travel – Using the TBIF, SF can also show impacts of displacing air travel through teleworking technologies such as Tele-Presence.

Food Supply-Chains – SF food sector is significant (19% of community-wide TBIF GHGs). The TBIF can be used to show impacts of urban farms, and impacts from diet change campaigns.

Construction Supply-Chains – Although cement production is already included in the TBIF, SF may use the method to evaluate environmental impacts from substitutions in the supply-chain of large material flows used in urban construction (e.g., cement, aggregates, asphalt).

Event/Visitor Supply-Chains – Large events/conventions attract many visitors to SF annually (15.9 million people in 2010 (SFT, 2011)) which have significant impacts on SF economy and environment. The supply-chains of large businesses, hotels, and convention centers, which are not accounted for in consumption-based footprints, are amenable to greening, and impacts can be shown with the TBIF.

Figure 1: Summary of San Francisco’s community-wide GHG Emissions Footprint, estimated via the TBIF approach.

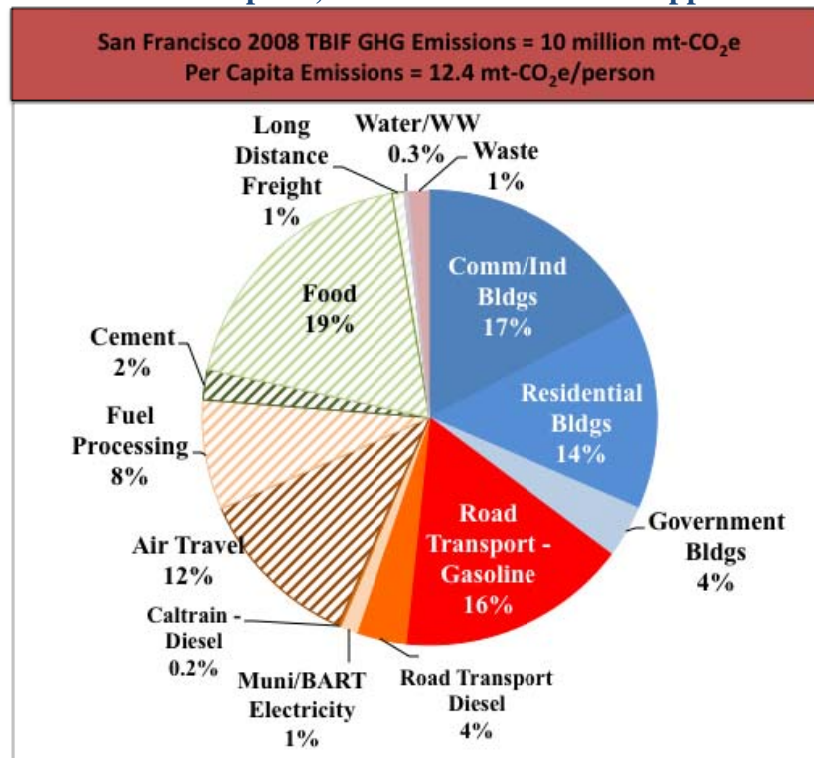


Table 1: Comprehensive Scopes 1-2-3 2008 GHG Emissions for San Francisco

	Sector/use	Community-wide annual urban material/energy flows (MFA)		GHG emissions factor (EF)	EF data source	Total GHG emitted = MFA x EF (million mt-CO ₂ e)
Scopes 1 & 2 plus waste	Buildings Electricity Use	5,899 GWh		0.30 kg CO ₂ e/kWh	CCSF	1.74
	Buildings Natural Gas Use	303 million therms		5.9 kg-CO ₂ e/therm	IPCC	1.79
	Surface Vehicle Miles Traveled (VMT)	180 million gallons – Gasoline		9.1 kg-CO ₂ e/gal Gasoline PTW	EPA Climate Leaders	1.99
		36 million gallons – Diesel 3,911 million VMT		10.2 kg-CO ₂ e/gal Diesel PTW		
	Muni and BART Electricity Use	409 GWh		0.30 kg CO ₂ e/kWh	CCSF	0.121
	Caltrain Diesel Use	2 million gallons – Diesel		10.2 kg-CO ₂ e/gal Diesel PTW	EPA Climate Leaders	0.02
	Water/Wastewater	57,921 million gallons		Varies	CCSF	0.03
	Municipal Solid Waste	617,658 tons landfilled		0.24 mt-CO ₂ e/ton	EPA WARM	0.15
Scope 3	Airline Travel (PTW)	122 million gallons – Jet Fuel		9.7 kg-CO ₂ e/gal Jet fuel PTW	EPA Climate Leaders	1.2
	Fuel Production (WTP)	122	Jet Fuel (million gallons)	2.3 kg-CO ₂ e/gal Jet fuel WTP	GREET	0.8
		36	Diesel (million gallons)	2.3 kg-CO ₂ e/gal Diesel WTP		
		180	Gasoline (million gallons)	2.3 kg-CO ₂ e/gal Gasoline WTP		
	Cement Use	235,198	mt-cement	0.92 mt-CO ₂ e/mt-cement	EPA, PCA	0.22
	Food Purchases	\$ 1,265	million (2002-\$)	1.5 kg-CO ₂ e/\$ (2002\$)	EIO-LCA	1.9
	Long Distance Freight	\$ 62	million (2002-\$)	1.4 kg-CO ₂ e/\$ (2002\$)	EIO-LCA	0.09
Total 2008 Community-Wide Emissions:					10	million mt-CO₂e
Community wide per-capita emissions:					12.4	mt-CO₂e/per capita

PTW = Pump to Wheels (tailpipe) GHG emissions. WTP = Wells-to-Pump GHG emissions.

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