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Environmental Life Cycle Assessment of San Francisco Bay Area Muni Light Rail and Rapid Transit with Wholesale and Renewable Electricity

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BACKGROUND AND METHODS

The environmental life cycle assessment of electric rail public transit modes requires an assessment of electricity generation mixes. The provision of electricity to a region does not usually adhere to geopolitical boundaries. Electricity is governed based on lowest cost marginal dispatch and reliability principles. Additionally, there are times when a public transit agency may purchase wholesale electricity from a particular service provider. Such is the case with electric rail modes in the San Francisco Bay Area.

An environmental life cycle assessment of San Francisco Bay Area public transit systems was developed by Chester and Horvath (2009) and includes vehicle manufacturing/maintenance, infrastructure construction/operation/maintenance, energy production, and supply chains, in addition to vehicle propulsion. For electric rail modes, vehicle propulsion was based on an average electricity mix for the region. Since 2009, new electricity contract information and renewable electricity goals have been established. As such, updated life cycle results should be produced.

Using recent wholesale electricity mix and renewable electricity goal data from the transit agencies, updated electricity precombustion, generation, transmission, and distribution environmental impacts of vehicle propulsion are estimated. In summary, SFMTA Muni light rail is currently purchasing 100% hydro electricity from the Hetch Hetchy region of California (SFMTA 2010) and the Bay Area Rapid Transit (BART) system is purchasing 22% natural gas, 9% coal, 2% nuclear, 66% hydro, and 1% other renewables from the Pacific Northwest (BARTa 2010, BARTb 2010). Furthermore, the BART system has set a goal of 20% renewables by 2016. Using the GREET1 2012 electricity pathway, a life cycle assessment of wholesale and renewable electricity generation for these systems is calculated.

RESULTS

Adjustment factors for vehicle propulsion and energy production life cycle components are shown in Tables 1 and 2 for BART. They should be applied to the Chester and Horvath (2009) results. For Muni light rail, electricity generation emissions are treated as zero for wholesale electricity since it is 100% hydro. The results are available as an interactive figure at www.transportationlca.org/tlcadb.html.

Table 1: BART 2010 Wholesale Electricity Adjustment Factors

	CO2e	SOx	CO	NOx	VOC	PM10
Vehicle Propulsion	90.74%	30.49%	29.05%	100%	8.12%	100%
Energy Production	100%	23.19%	35.92%	100%	100%	100%

Table 2: BART 2016 20% Renewable Electricity Adjustment Factors

	CO2e	SOx	CO	NOx	VOC	PM10
Vehicle Propulsion	33.86%	10.17%	11.25%	86.60%	3.03%	41.20%
Energy Production	100%	18.62%	27.81%	100%	100%	100%

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