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A COMMUNITY WIDE EFFORT TO KEEP ELEVATED RAIL OUT OF OUR CITY

Honolulu's rail line will use more energy than buses or autos

Our city government would like you to believe that the proposed Honolulu train would be energy-efficient, but this is almost certainly not true. The average modern urban rail line in America is less energy-efficient than the average automobile, as the following analysis will explain.

The following comments relate to the attached Appendix A, a five-page excerpt from the annual Transportation Energy Data Book, Edition 30, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy, June 2011.

The comparisons made here conclude that Honolulu's buses are more energy efficient than either automobiles or rail transit, and that even automobiles are more energy efficient than the Honolulu Rail project would be.

Highlighted on Appendix A-1 you will note that nationally automobiles use 3,538 Btus (British Thermal Units) per passenger mile (PPM), personal trucks and SUVs use 3,663 Btus PPM, and transit buses 4,242 Btus PPM, while rail transit only uses 2,594 Btus PPM (see table below). From this City officials would have you believe that rail transit is more energy efficient than autos or buses.

However, as always, the devil is in the details.

Rail transit energy use is not what it seems.

Appendix A-4 shows that a majority of the nation's light rail lines use more energy per passenger mile than automobiles; only the twelve most efficient from Charlotte, North Carolina, to San Diego, California, perform better than the auto.

Appendix A-5 shows the energy usage for heavy rail systems, such as the Honolulu rail project.[i] This chart shows that two-thirds of these lines use more energy than automobiles. Note that New York's rail transit system, which has a great deal of two-way traffic, uses less than 2,000 Btu PPM.

Note that the two lines most like the Honolulu's project, in that they are nearly all elevated, are Miami and San Juan. Both of these rail lines are energy hogs, using 5,400 and 10,800 Btus PPM respectively.

Mode	Btus/PPM Nationally	Btus/PPM Honolulu
Rail Transit	2,594	4,000
Autos	3,538	3,538
SUVs & sm. trucks	3,663	3,663
Buses	4,242	2,000

The obvious question is how do these light and heavy rail examples shown square with the average rail transit usage of 2,594 Btu PPM shown in Appendix A-1?

The 2,594 Btu PPM number is a *weighted*[ii] average and includes the New York rail systems which are not only highly energy efficient but also constitute two-thirds of the nation's rail transit passenger miles.[iii] Thus, using a *weighted* average and including New York leads us astray if we are looking for evidence of the likely energy efficiency of Honolulu's projected rail transit line. We have to look at modern rail lines *excluding* New York if we are to review energy use that is are more likely to be like ours.

The average of heavy rail lines is 3,700 Btus PPM and given the heavy energy use of the elevated lines we believe it would be prudent to use at least 4,000.

Honolulu's rail line would be a suburban oriented line. The highest use would be one-way into town in the morning, then returning almost empty, with the reverse pattern in the late afternoon. There would be light use during the middle of the day and in the evenings. This is not conducive to energy efficiency.

On the other hand, the big city heavy rail lines, especially New York City, carry a great deal of traffic in both directions and are still quite busy in the non-rush hours, which is the reason for their energy efficiency.

While the Final EIS makes blanket statements about rail being energy efficient and even gives energy usage data, it contains no evidence that it has done anything other than pull numbers out of the air. The only reference is to the Air Quality and Energy Use Technical Memorandum but that is no better in providing sources.

If the City had proof that its rail line would be more energy efficient the automobiles, their arguments would be well documented; they are not. The Final EIS has not justified any reason why the Honolulu rail project should be any more energy efficient than others in its reference class while intuitively, given the route's projected operations, one should expect less energy efficiency.

How did we come to believe rail would be energy efficient?

In the 1970s, there were almost no light rail lines left since most cities had abandoned them in favor of buses.[iv] The only heavy rail lines in existence were the energy efficient ones in the densely populated cities like New York, Boston, Philadelphia and New Jersey. In addition, automobile usage then was 4,868 Btus PPM versus 3,538 today. One would be right at that time in believing that rail transit was more energy efficient than automobiles.

Our problem with thinking that rail transit is energy efficient is legacy thinking; we have not changed our thinking with the times and transit officials have not encouraged it.

TheBus is highly energy efficient.

While the average Btus PPM for buses nationally is over 4,000, TheBus averages 2,000 — half the energy usage of the average mainland bus system.

The Washington DC Cato Institute's Randal O'Toole first noticed how energy efficient our bus system was. We checked his results using data from the National Transit Database and agreed with his calculations. See endnote for details.[v]

There is room for improvement. In Honolulu, for example, we have the same number of bus passengers that we had 20 years ago, 73 million annually, yet we have had a one-third increase in the number of buses and many of these are larger articulated buses. While we are presently highly efficient compared to the national average, there are bus systems that are close to experiencing energy usage of 1,000 Btus per passenger mile; it gives some indication that there are energy savings yet to be made for TheBus.

The relative inefficiency between rail transit and automobiles will widen in the future. Today's transit energy use shows no sign of declining while automobile CAFE standards are to be increased 65 percent by 2025.[vi]

The growing use of electric cars will change matters because they can recharge their batteries at times when daily energy use is at its nadir. By 2030, the horizon year for the rail project, it seems fairly certain that automobiles being charged between midnight and 5:00 AM will do so in Hawaiʻi through the use of wind power and ocean wave generated energy.[vii] Rail transit, however, sees nothing significant that will reduce its energy use in the future or its reliance, for the most part, on fossil fuels.

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Endnotes:

i The City keeps trying to use the term "light metro" rather "heavy rail." However, light metro is descriptive rather than definitive. FTA has no definition for "light metro" only "heavy rail," which is also described as "rapid transit" by FTA. The City defines the Project in the Final EIS as "rapid transit." While it is a smaller heavy rail, it is still heavy rail.

ii A *weighted* average is not a system average. Appendix A-5, fig. 2.3 shows that an average of the rail lines would be around 3,700 Btus PPM. A weighted average weighs the results according to how many passenger miles the various lines have travelled and, of course, since New York is 60 percent of all urban rail transit in the nation, it weighs heavily and distorts the averages.

iii "It is useful to note that although our sample includes twenty five systems, trips on New York City's system account for roughly two-thirds of the nation's rail transit passenger miles." Clifford Winston & Vikram Maheshri. *On the social desirability of urban rail transit systems.* Journal of Urban Economics. 2006. p. 7 of 21

iv Slater, Cliff. *General Motors and the Demise of Streetcars.* Transportation Quarterly, Summer 1997 (45-66)

v http://www.ntdprogram.gov/ntdprogram/data.htm Select "Annual Tables section" then select "Data Tables (Self-extracting xls)" for the appropriate year. Download the zip file and unzip into the folder you have designated. The two files to open are the T17 and the T19. T17 for annual diesel use in thousands of gallons and T19 for annual passenger miles in thousands. In each case the line to be selected is:
HI City and County of Honolulu Department of 9002 B MB
For example, for 2010 the data are: 386,225,000 passenger miles and 5,624,700 gallons of diesel used. The conversion for a gallon diesel fuel to Btus is 138,700, which can be found at:
http://cta.ornl.gov/data/tedb30/Edition30_Full_Doc.pdf on page B-5. The 2010 calculation is:
(Diesel in gallons x 138,700) ÷ passenger miles, or (5,624,700 x 138,700) / 386,225,000 = 2,020 Btus PPM.
For 2009 it is (5,727,500 x 138,700) / 405,039,600 = 1,961 Btus PPM.

vi http://en.wikipedia.org/wiki/Corporate_Average_Fuel_Economy#Standards_by_model_year.2C_1978-2011

vii http://www.hawaiisenergyfuture.com/articles/Ocean_Energy.html
http://peswiki.com/index.php/Directory:Ocean_Wave_Energy

Great care should be taken when comparing modal energy intensity data among modes. Because of the inherent differences among the transportation modes in the nature of services, routes available, and many additional factors, it is not possible to obtain truly comparable national energy intensities among modes. These values are averages, and there is a great deal of variability even within a mode.

Table 2.12
Passenger Travel and Energy Use, 2009

	Number of vehicles (thousands)	Vehicle-miles (millions)	Passenger-miles (millions)	Load factor (persons/ vehicle)	Energy intensities (Btu per vehicle-mile)	Energy intensities (Btu per passenger-mile)	Energy use (trillion Btu)
Cars	**134,880.0**	**1,606,815**	**2,490,564**	**1.55**	**5,484**	**3,538**	**8,811.0**
Personal trucks	**88,683.4**	**934,631**	**1,719,722**	**1.84**	**6,740**	**3,663**	**6,299.4**
Motorcycles	**7,929.7**	**20,800**	**24,128**	**1.16**	**2,854**	**2,460**	**59.4**
Demand response[a]	**68.9**	**1,529**	**1,477**	**1.0**	**15,111**	**15,645**	**23.1**
Buses	[b]	[b]	[b]	[b]	[b]	[b]	**200.0**
Transit	65.4	2,345	21,645	9.2	39,160	4,242	91.8
Intercity[c]	[b]	[b]	[b]	[b]	[b]	[b]	31.4
School[c]	683.7	[b]	[b]	[b]	[b]	[b]	76.9
Air	[b]	[b]	[b]	[b]	[b]	[b]	**1,751.4**
Certificated route[d]	[b]	5,453	541,646	99.3	280,734	2,826	1,530.8
General aviation	223.9	[b]	[b]	[b]	[b]	[b]	220.6
Recreational boats	**13,290.7**	[b]	[b]	[b]	[b]	[b]	**245.7**
Rail	**20.7**	**1,402**	**36,150**	**25.8**	**66,916**	**2,594**	**93.8**
Intercity (Amtrak)	0.3	283	5,914	20.9	50,924	2,435	14.4
Transit	13.5	775	19,004	24.5	61,663	2,516	47.8
Commuter	6.9	344	11,232	32.7	91,936	2,812	31.6

Source:
See Appendix A for Passenger Travel and Energy Use.

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[a] Includes passenger cars, vans, and small buses operating in response to calls from passengers to the transit operator who dispatches the vehicles.

[b] Data are not available.

[c] Energy use is estimated.

[d] Only domestic service and domestic energy use are shown on this table. (Previous editions included half of international energy.) These energy intensities may be inflated because all energy use is attributed to passengers–cargo energy use is not taken into account.

Great care should be taken when comparing modal energy intensity data among modes. Because of the inherent differences among the transportation modes in the nature of services, routes available, and many additional factors, it is not possible to obtain truly comparable national energy intensities among modes. These values are averages, and there is a great deal of variability even within a mode.

Table 2.13
Energy Intensities of Highway Passenger Modes, 1970–2009

	Automobiles		Light truck[a]	Transit Buses[b]	
Year	(Btu per vehicle-mile)	(Btu per passenger-mile)	(Btu per vehicle-mile)	(Btu per vehicle-mile)	(Btu per passenger-mile)
1970	9,250	4,868	12,480	31,796	2,472
1975	8,993	4,733	11,879	33,748	2,814
1976	9,113	4,796	11,524	34,598	2,896
1977	8,950	4,710	11,160	35,120	2,889
1978	8,839	4,693	10,807	36,603	2,883
1979	8,647	4,632	10,468	36,597	2,795
1980	7,916	4,279	10,224	36,553	2,813
1981	7,670	4,184	9,997	37,745	3,027
1982	7,465	4,109	9,268	38,766	3,237
1983	7,365	4,092	9,124	37,962	3,177
1984	7,202	4,066	8,931	38,705	3,307
1985	7,164	4,110	8,730	38,876	3,423
1986	7,194	4,197	8,560	37,889	3,545
1987	6,959	4,128	8,359	36,247	3,594
1988	6,683	4,033	8,119	36,673	3,706
1989	6,589	4,046	7,746	36,754	3,732
1990	6,169	3,856	7,746	37,374	3,794
1991	5,912	3,695	7,351	37,732	3,877
1992	5,956	3,723	7,239	40,243	4,310
1993	6,087	3,804	7,182	39,043	4,262
1994	6,024	3,765	7,212	37,259	4,262
1995	5,902	3,689	7,208	37,251	4,307
1996	5,874	3,683	7,247	37,452	4,340
1997	5,797	3,646	7,251	38,861	4,434
1998	5,767	3,638	7,260	41,296	4,399
1999	5,821	3,684	7,327	40,578	4,344
2000	5,687	3,611	7,158	41,695	4,531
2001	5,626	3,583	7,080	38,535	4,146
2002	5,662	3,607	7,125	37,548	4,133
2003	5,535	3,525	7,673	37,096	4,213
2004	5,489	3,496	7,653	37,855	4,364
2005	5,607	3,571	7,009	37,430	4,250
2006	5,511	3,510	6,974	39,568	4,316
2007	5,513	3,512	6,904	39,931	4,372
2008	5,465	3,526	6,830	39,906	4,348
2009	5,484	3,538	6,862	39,160	4,242
		Average annual percentage change			
1970–2009	-1.3%	-0.8%	-1.5%	0.5%	1.4%
1999–2009	-0.6%	-0.4%	-0.7%	-0.4%	-0.2%

Source:
See Appendix A for Highway Passenger Mode Energy Intensities.

[a] All two-axle, four-tire trucks.
[b] Series not continuous between 1983 and 1984 because of a change in data source by the American Public Transportation Association (APTA).

Great care should be taken when comparing modal energy intensity data among modes. Because of the inherent differences between the transportation modes in the nature of services, routes available, and many additional factors, it is not possible to obtain truly comparable national energy intensities among modes.

Table 2.14
Energy Intensities of Nonhighway Passenger Modes, 1970–2009

	Air	Rail		
Year	Certificated air carriers[a] (Btu per passenger-mile)	Intercity Amtrak (Btu per passenger-mile)	Rail transit (Btu per passenger-mile)	Commuter rail (Btu per passenger-mile)
1970	10,115	[b]	2,157	[b]
1975	7,625	3,548	2,625	[b]
1976	7,282	3,278	2,633	[b]
1977	6,990	3,443	2,364	[b]
1978	6,144	3,554	2,144	[b]
1979	5,607	3,351	2,290	[b]
1980	5,561	3,065	2,312	[b]
1981	5,774	2,883	2,592	[b]
1982	5,412	3,052	2,699	[b]
1983	5,133	2,875	2,820	[b]
1984	5,298	2,923	3,037	2,804
1985	5,053	2,703	2,809	2,826
1986	5,011	2,481	3,042	2,926
1987	4,827	2,450	3,039	2,801
1988	4,861	2,379	3,072	2,872
1989	4,844	2,614	2,909	2,864
1990	4,875	2,505	3,024	2,822
1991	4,662	2,417	3,254	2,770
1992	4,516	2,534	3,155	2,629
1993	4,490	2,565	3,373	2,976
1994	4,397	2,282	3,338	2,682
1995	4,349	2,501	3,340	2,632
1996	4,172	2,690	3,017	2,582
1997	4,166	2,811	2,856	2,724
1998	4,146	2,788	2,823	2,646
1999	4,061	2,943	2,785	2,714
2000	3,952	3,235	2,797	2,551
2001	3,968	3,257	2,803	2,515
2002	3,703	3,212	2,872	2,514
2003	3,587	2,800	2,837	2,545
2004	3,339	2,760	2,750	2,569
2005	3,264	2,709	2,783	2,743
2006	3,250	2,650	2,707	2,527
2007	3,153	2,516	2,577	2,638
2008	3,051	2,398	2,521	2,656
2009	2,901	2,435	2,516	2,812
		Average annual percentage change[c]		
1970–2009	-3.2%	-1.1%	0.5%	0.0%
1999–2009	-3.3%	-1.9%	-1.0%	0.4%

Source:
See Appendix A for Nonhighway Passenger Mode Energy Intensities.

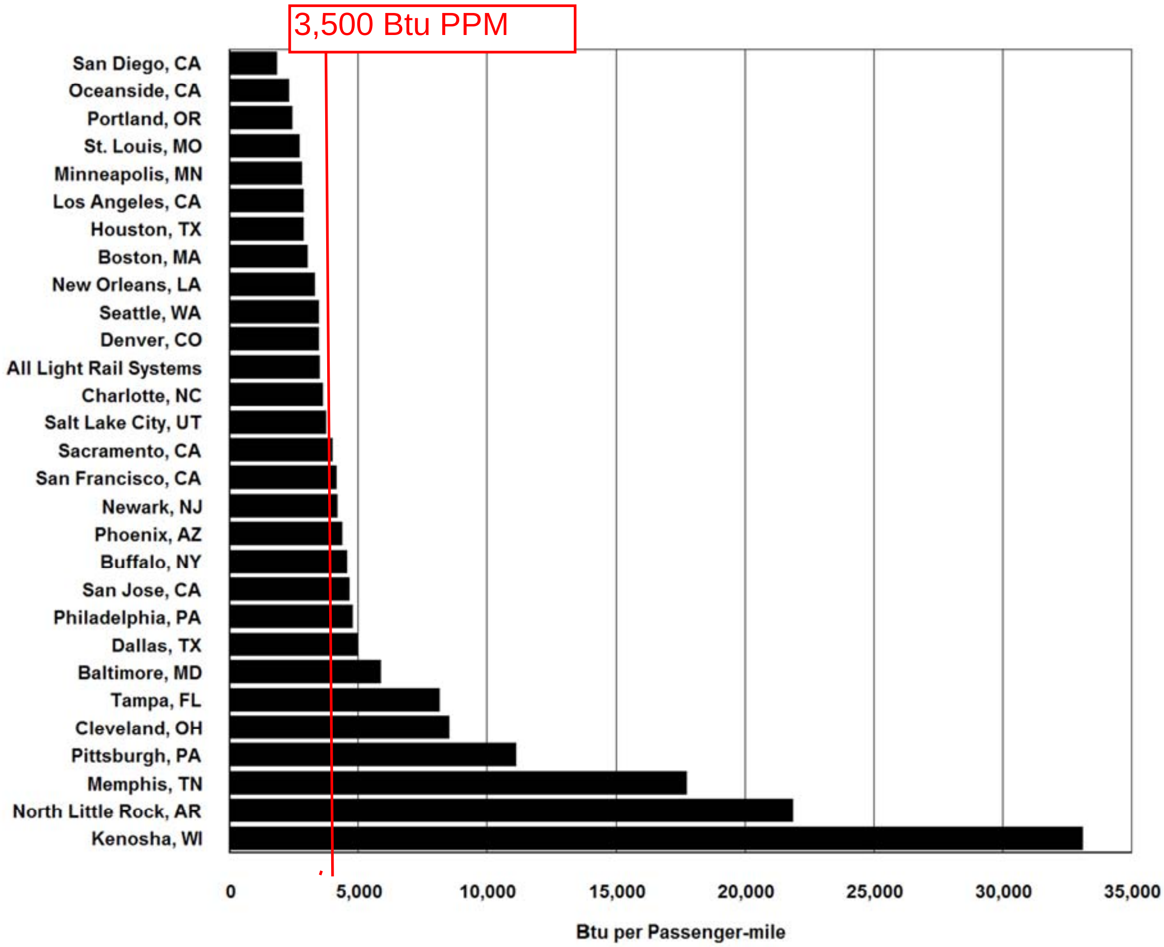
[a] These data differ from the data on Table 2.12 because they include half of international services. These energy intensities may be inflated because all energy use is attributed to passengers–cargo energy use is not taken into account.

[b] Data are not available.

[c] Average annual percentage calculated to earliest year possible.

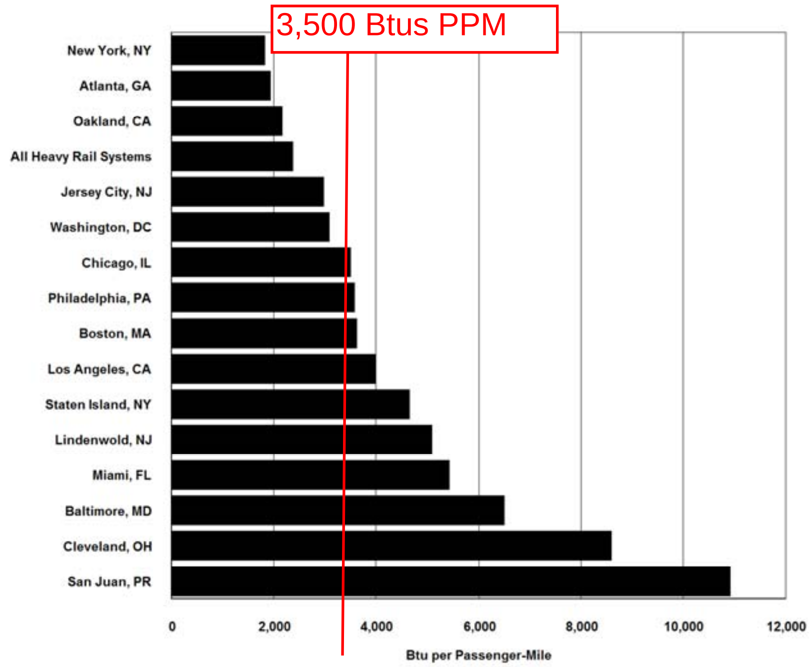
The energy intensity of light rail systems, measured in btu per passenger-mile varies greatly. The weighted average of all light rail systems in 2009 is 3,526 btu/passenger-mile.

Figure 2.2. Energy Intensity of Light Rail Transit Systems, 2009



Source:
U.S. Department of Transportation, *National Transit Database*, May 2011. (Additional resources: http://204.68.195.57/ntdprogram/data.htm)

Figure 2.3. Energy Intensity of Heavy Rail Systems, 2009



Source:
U.S. Department of Transportation, *National Transit Database*, May 2011. (Additional resources: www.ntdprogram.gov)

Figure 2.4. Energy Intensity of Commuter Rail Systems, 2009

Source:
U.S. Department of Transportation, *National Transit Database*, May 2011. (Additional resources: www.ntdprogram.gov)