Metro Fleet Upgrade
Volunteer Citizen Evaluation

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Special Acknowledgement of all those contributing from Vehicle Maintenance, Operators, Managers, Public Pro Bono, Councilmembers and Staff contributions from KC Metro, City of Seattle, Vancouver B.C., San Francisco

Our Evaluation

LCCA:

Favors Electric Trolley Bus for long term affordability

AND:

Provides future opportunity for more savings from service extension, renewable energy, and renewable energy jobs

LCCA – Life Cycle Cost Analysis [1]

Life Cycle Cost Advantages

Vehicle Capital Costs

❑ Leverage the entire lifecycle

Longer design life of the Electric Trolley Buses (ETB) causes a slightly higher initial acquisition cost [2]

❑ Valuable ETBs

Cities and developing countries commitment to ETBs, e.g. San Francisco, Vancouver B.C., Philadelphia, Brazil, etc. [3]

❑ Acquisition advantage

Federal subsidies reduce Metro's capital acquisition costs by 83% for ETB and 80% for Diesel Hybrid [4]

Life Cycle Cost Advantages

Operation Costs

❑ Electric Motors

Fewer moving parts, less wear, greater torque, provides greater life over Diesel Hybrid (DH) traction engines

❑ Reduced Fuel Costs [5]

Optimum urban “Seats per Mile” vs. DH

❑ Less Fuel Consumption

Cost/mi improved with ETB in urban and hill travel by 4x

Life Cycle Cost Advantages

Maintenance Costs

❑ Hill Routes

Would create higher DH maintenance costs and would require a special fleet using special gear reduction for hill climbing

❑ Compare DH if Substituted in ETB Routes

Difficult demands in urban service – more stops, quick acceleration, and steeper hills than current DH services

❑ NEW ETBs [6]

Leverage dollars saved from new fleet to fund **restoration** of service

❑ **Off-wire Service** – Modern ETB provides 24x7 Service, eliminates expensive weekend diesels

Life Cycle Cost Advantages

Power/Maintenance Overhead-wire Costs

- **Net Gain of $6M**

FTA annual grant of $11M

- **Off-wire Battery-Capable Trolley**

Reduces overhead use and maintenance

- **More Use of Overhead Wire Service**

Reduces passenger seat/mile cost

Life Cycle Cost Advantages

Vehicle Flexibility [7]

❑ Travel-around Barriers

Construction closures, adverse weather rerouting

❑ Expanded Service

Interconnecting routes, non-arterial streets

❑ Greater Throughput

Fewer assists, passing EBTs, shorter deadheading

Life Cycle Cost Advantages

Energy Costs

❑ Fuel Consumption

Likely greater in urban miles if DH is selected in place of NEW ETBs

❑ Diesel Price Volatility [8]

Much greater than electricity

- West Coast Retail fuel cost 12 March 2001– Diesel: $1.41/gal
- Current US retail fuel cost, 14 March 2011 – Diesel: $4.09/gal
- Fuel price escalation was 12.5% (annual compounding) over last 10 years
- Past, present and future fuel cost volatility suggests 400% increase in 20 years if escalation continues at 12.5%

❑ Electricity Costs Stable [9]

❑Community Solar

"Free" community generated electricity can further offset energy cost

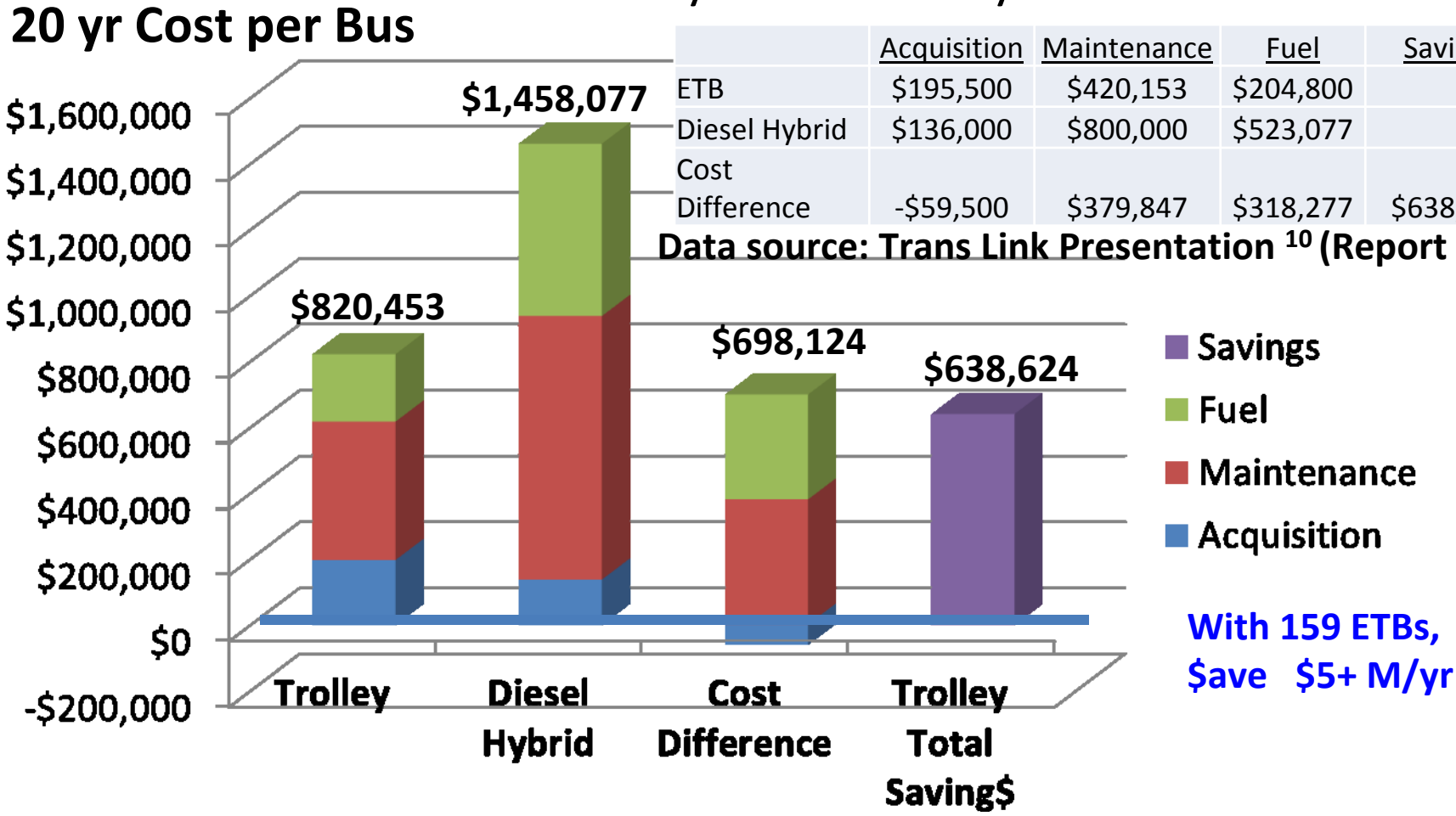
Electric Trolley Bus Advantages

Acquisition – Maintenance – Fuel

20 Year Life Cycle Cost Analysis

	Acquisition	Maintenance	Fuel	Savings
ETB	$195,500	$420,153	$204,800	
Diesel Hybrid	$136,000	$800,000	$523,077	
Cost Difference	-$59,500	$379,847	$318,277	$638,624

Data source: Trans Link Presentation [10] (Report #1)



With 159 ETBs, $ave $5+ M/yr

Very similar results from 2nd LCA using Metro data from 2009 [11] (Report #2)

Future Opportunities:

"… Understanding how King County government's infrastructure can support economic recovery and growth."

Councilmember Larry Phillips http://www.kingcounty.gov/Phillips/legislation.aspx

- **Did you know Portland is making their own Streetcars AND plan to export?**
- **Did you know of PACCAR/Kenworth's history of bus and trolley manufacturing?**
- **Did you know 2010 WA State legislation, SB 6658 - Community Solar Projects -- Cost Recovery Incentives could provide free electricity to power EBTs with all the available roof space in King County**
- **This helps put the over 30% of the areas unemployed electricians back to work, … jobs, jobs, jobs "engine".**
- **ETB off-wire capability could span bridges as well as provide service to neighborhoods where overhead wire is undesirable.**

"Back-to-the-Future"

KC ETB Network, 2010

Seattle Transit ETB Network, 1963

FOOTNOTES/Appendix

Report #1 LCCA using exclusively the fleet data from South Coast British Columbia Transportation Authority (TransLink) (Footnote 10)

1. The Art of Life Cycle Cost Analysis
   http://www.touchstoneenergy.com/efficiency/bea/Documents/TheArtofLifeCycleCostAnalysis.pdf

   Analysis conducted in accordance with Metro 2010-RPT0172, Work Plan, Scope and Schedule, Table 2, Line by Line

2. Vehicle Capital Costs (DH and EBT difference of $59,000) (TransLink Data)

3. San Francisco – Electric Trolley Buses: http://www.sfmta.com/cms/mfleet/trolley.htm

4. PERFORMANCE AUDIT OF TRANSIT TECHNICAL REPORT A: FINANCIAL & CAPITAL PLANNING, Metro Report No. 2009-01A, September 15, 2009 ["Diesel Hybrids save $8.7 M/yr"]

5. Operation Costs ($318,000 fuel savings per bus over 20 years)

6. Maintenance Costs (difference ETB less by $380,000 per bus over 20 yrs)

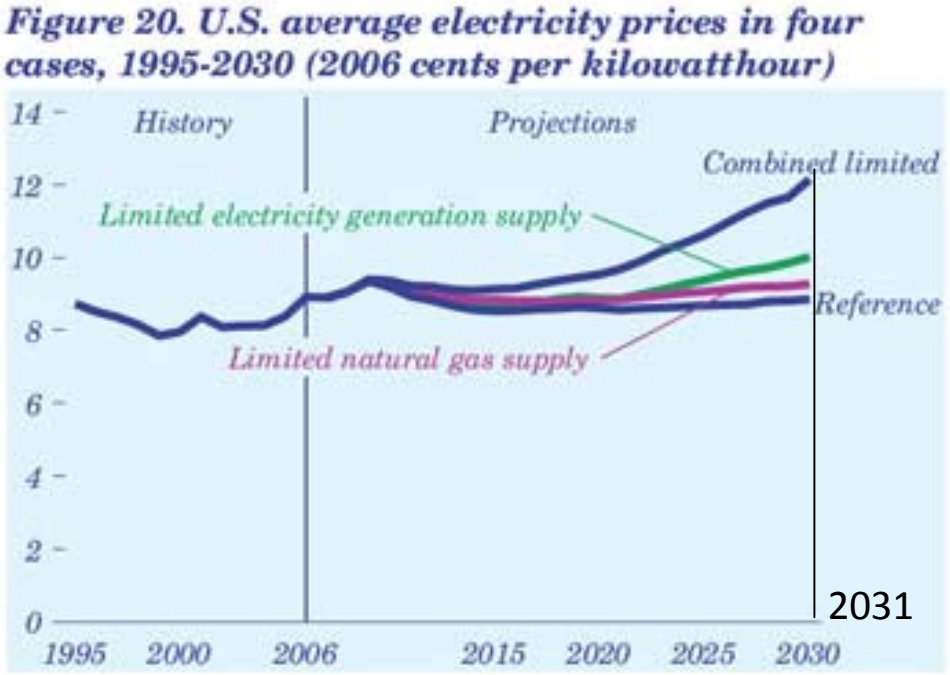
7. Vehicle Flexibility - thousand$$ of Service Hours from Off-wire operations

8. Cost of Energy – Diesel
   West Coast retail Diesel cost 12 March 2001– Diesel: **$1.41/gal**
   http://www.eia.doe.gov/emeu/international/prices.html#Diesel (Download the xls file)
   Current US retail diesel cost, 14 March 2011 – Diesel: **$4.09/gal**
   http://www.eia.doe.gov/oog/info/gdu/gasdiesel.asp

FOOTNOTES/Appendix

9. Cost of Energy - Electricity

http://tonto.eia.doe.gov/oiaf/aeo/otheranalysis/aeo_2008analysispapers/legslng.html



Worst case electricity cost increase in 20 yrs: 8.5c/kWh increased to 12.5c/kWh,
= + 4c/kWh,
= 47% increase, i.e. less than 3% inflation over 20 years

10. Session 12 -Future Propulsion , Canadian Urban Transit Association Fall Conference

"Future Propulsion CUTA-Fall Conference Nov10.pdf" TransLink Fleet

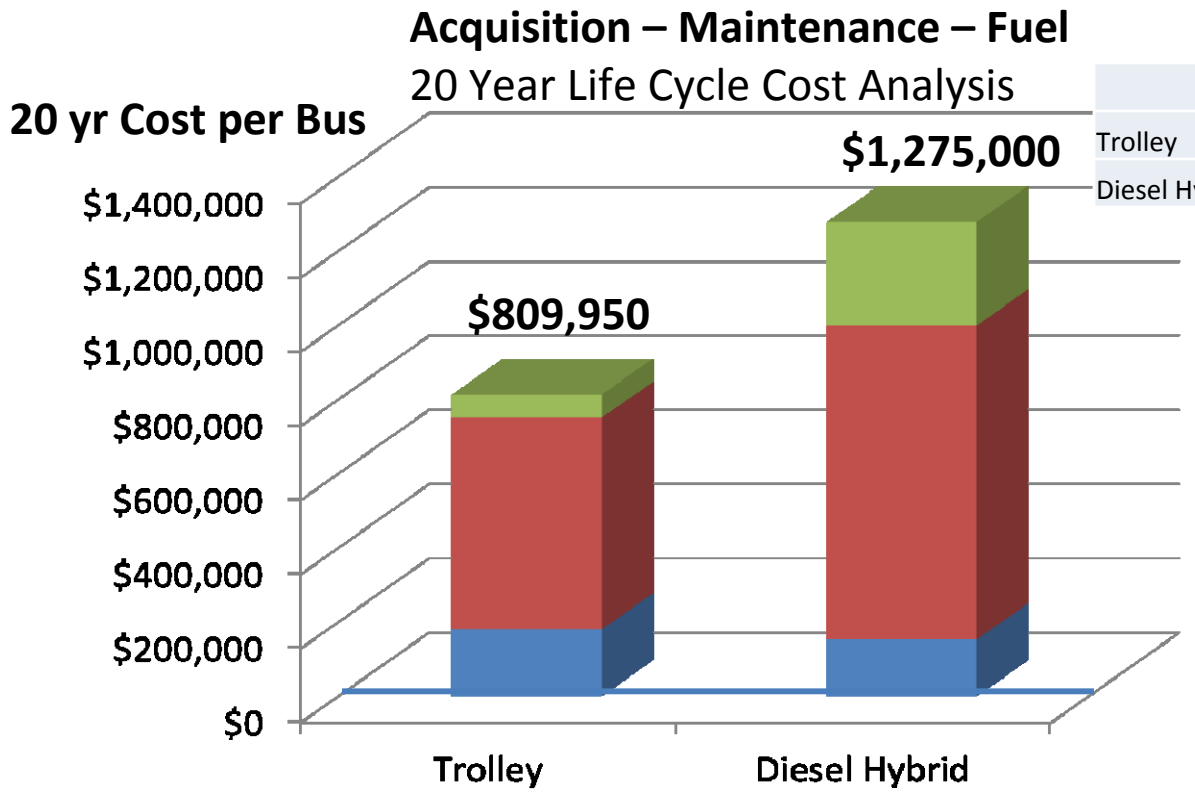
http://www.cutaactu.ca/en/eventsandawards/resources/Final%20Program%20CUTA%20Fall%20Conference%202010.pdf

11. Metro Spreadsheet obtained from Larry Brubaker, "KCMETBLCCAModel 072609.xls"

FOOTNOTES/Appendix

Report # 2 Data source: Metro's LCA Spreadsheet obtained from Larry Brubaker, "KCMETBLCCAModel 072609.xls"

A. Electric Trolley Advantages



	Acquisition	Maintenance	Fuel
Trolley	$177,250	$570,000	$62,700
Diesel Hybrid	$150,000	$846,000	$279,000

LC Savings: $465,050/bus

With 159 ETBs, $ave $3.7 M/yr

FOOTNOTES/Appendix

B. Acquisition Costs

	40 ft DH	60 ft DH	40 ft Trolley	60 ft Trolley
	$650,000	$850,000	$850,000	$1,200,000
After FTA offset	$130,000	$170,000	$144,500	$204,000

C. Maintenance Costs

	DIESEL HYBRID	HYBRID ELECTRIC TROLLEY
	40’ bus - 60’ bus	40’ bus - 60’ bus
Maintenance	$846,000	$570,000

D. Fuel Costs

Diesel fuel increase from 2000 to 2010 was +300% ($1.10 to$3.40/gal)

	DIESEL HYBRID	HYBRID ELECTRIC TROLLEY
Fuel mileage (actual on similar trolley routes)	4 to 5 miles/gallon	2.5 to 3 kwh/mile
Fuel Cost	$3.40/gallon	6.4 cents/kwh
Cost/mile	$.70 to .85/mile	$.16 to $.19/mile

FOOTNOTES/Appendix

D. Fuel Costs

DIESEL HYBRID	HYBRID ELECTRIC TROLLEY
Lifetime Fuel Cost	Lifetime Fuel Cost
360,000 miles x $.70/mile to $.85/mile = $252,000 to $306,000	360,000 x $.16/mile to .19/mile = $57,600 to $68,400