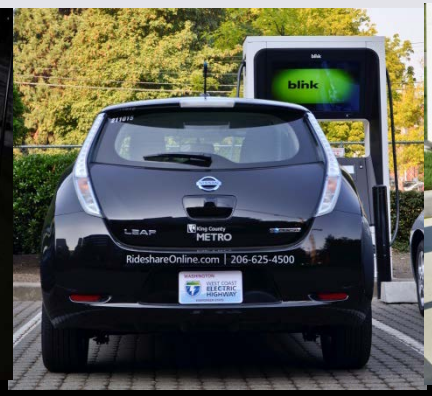
King County METRO

Rideshare Operations

The Challenges and Successes of EVs in a Vanpool Fleet

Getting Government Plug-in Ready! Workshop, NOAA

April 30, 2014



King County Metro Rideshare Operations

Commuter Van Program

- Largest publicly owned and operated commuter van program in the nation since 1979
- Mandated to recover 100% capital & operating costs through customer fares
- 1387 vehicles in revenue service
- 5-15 people sharing the commute beginning and/or ending in King Co. w/ volunteer drivers

In 2011 the first all-electric vehicles were introduced into the fleet.

2011 Nissan LEAFS: 20
2013 Nissan LEAFS: 5

A LEAF costs $14K more…
And it’s not a van…
How did we sell it?

- Partnerships
- Branding
- Life Cycle Cost Analysis
- Greening the Fleet

Partnerships

Area Employers

- Children's Hospital
- Amgen
- Amazon
- Microsoft
- …And more

Clean Cities of Western Washington

City of Seattle

- Combined RFP for EV Charging Stations

Branding

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Pilot program

5 passenger limit

60 RTM maximum

Interested in trailblazing

Life Cycle Cost Analysis

Difficulty forecasting operating costs and salvage value for the LEAF

Even with conservative gas prices of $3.60/gal over 7 years, in NPV the Ownership CPM is 8 cents less than the Dodge Caravan and shows an approximate $6K lifetime savings

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(Rideshare Operations explored CNG and Propane fueled vehicles but the increased capital cost/conversion didn't pencil out)

GreenHouse Gas Savings

In 2013 program saved 232 metric tons of tailpipe emissions and over 10,000 gallons of fuel over traditional gas-powered vanpools.

(Comparing LEAF against average fuel economy of 21.6 mpg)

The Challenges

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ALL ELECTRIC | ZERO EMISSION

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Range Anxiety

- Available range indicator fluctuations
- Ability to charge

Charging Stations

- Employer partners
    - Employee policy (fees, reserved parking, etc.)
- At-home charging not sanctioned and is driver's responsibility.
- Issues with some charging stations eroded driver confidence.

Odometer Readings

- No regular reading at the gas pump
- Reliant on monthly reports (immediately outdated meter readings) and occasional work order meter reading

The Battery

- Battery Life?
- Annual Inspection required
- Performed at dealership
- Inadequate data sharing

The Successes!

KING COUNTY METRO'S ELECTRIC VEHICLE PROGRAM: A COST-SAVINGS SUCCESS!

King County Metro Rideshare Operations, based in Seattle, manages the largest publicly owned and operated commuter van program in the nation, providing vans (and now electric vehicles) and everything required to operate them. They have over 1,300 vehicles in their revenue fleet, and in

support the metropool vehicles. In many cases, the employers cover the cost of electricity as part of their commitment to the project. Western Washington Clean Cities supported the program with six ARRA grant-funded EV charging stations. The stations were deployed at two work place charging locations

Summer 2013 Fuel Fix magazine
(http://www.fuelsfix.com/ezines/FuelsFix_Smr13_Final.pdf, pg 30)

Everyone Has an Opinion

Public Opinion

- **Seattle Times reporter**
- **Demand**

Assessment & Survey

- **Like Least?**
  - **Compact size**
  - **Range limitations**

- **Like Most?**
  - **It's Green**
  - **Drivability**

And the Moral of the Story is…

A Definite Success

Customer satisfaction:
92% satisfaction rating

Higher Capital Cost offset by absence of fuel costs and GHG savings, resulting in overall lifetime savings

What’s Next?

The Crème de la Crème…
An EV minivan?

20??: Nissan NV200

- 6-passenger 100% electric van
- United States testing in 2014

Questions Remaining

Need More Data

- Battery Life
- Maintenance
- Salvage value?
- Longer than 7 year life cycle?

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2013 Dodge Grand Caravan SE

	Year	Capital Costs*	RO Salvage Value	Avg Maint Costs	Maint Cost per Mile	Avg NonMaint	Avg Fuel	Avg Miles Traveled	Avg Op Costs	Op Cost per Mile	Avg Life Cycle Cost	Ownership Cost per Mile
0	2013	1 $ 21,865	$ (21,525)	$ 439	$ 0.04	$ 241	$ 2,016	10,080	$ 2,696	$ 0.27	$ 3,036	$ 0.30
	2014	2	$ (19,325)	$ 554	$ 0.05	$ 343	$ 2,016	10,080	$ 2,913	$ 0.29	$ 8,149	$ 0.40
	2015	3	$ (18,325)	$ 392	$ 0.04	$ 163	$ 2,016	10,080	$ 2,571	$ 0.26	$ 11,720	$ 0.39
	2016	4	$ (16,025)	$ 1,220	$ 0.12	$ 356	$ 2,016	10,080	$ 3,592	$ 0.36	$ 17,612	$ 0.44
	2017	5	$ (14,300)	$ 1,375	$ 0.14	$ 472	$ 2,016	10,080	$ 3,863	$ 0.38	$ 23,200	$ 0.46
	2018	6	$ (10,400)	$ 1,633	$ 0.16	$ 343	$ 2,016	10,080	$ 3,992	$ 0.40	$ 31,092	$ 0.51
	2019	7	$ (9,175)	$ 999	$ 0.10	$ 242	$ 2,016	10,080	$ 3,257	$ 0.32	$ 35,574	$ 0.50
Salvage Value based on NADA values				$ 6,612		$ 2,160	$ 14,112	70,560	$ 22,884			

Accessory expenses not included

Based on 10 mpg & average per gallon gas price of $ 3.60

Operating Costs based on 2012 costs for minivans in each year of operation.

Discount Rate		Annual Costs	Cost in $2013
7%	0	$ 24,561	$ 24,561
	1	$ 2,913	$ 2,722
	2	$ 2,571	$ 2,246
	3	$ 3,592	$ 2,932
	4	$ 3,863	$ 2,947
	5	$ 3,992	$ 2,846
	6	$ (5,918)	$ (3,943)
7 Year Lifecycle Cost in $2013			$ 34,311

2013 Nissan LEAF SV

	Year	Capital Costs	RO Salvage Value	Avg Maint Costs	Maint Cost per Mile	Avg NonMaint	Avg Electricity	Avg Miles Traveled	Avg Op Costs	Op Cost per Mile	Avg Life Cycle Cost	Ownership Cost per Mile
	2013	1 $ 32,771	$ (25,495)	$ 90	$ 0.01	$ 185	$ 269	10,080	$ 544	$ 0.05	$ 7,820	$ 0.78
	2014	2	$ (21,516)	$ 199	$ 0.02	$ 161	$ 269	10,080	$ 629	$ 0.06	$ 12,427	$ 0.62
	2015	3	$ (20,656)	$ 90	$ 0.01	$ 161	$ 269	10,080	$ 520	$ 0.05	$ 13,808	$ 0.46
	2016	4	$ (18,384)	$ 90	$ 0.01	$ 161	$ 269	10,080	$ 520	$ 0.05	$ 16,600	$ 0.41
	2017	5	$ (14,747)	$ 323	$ 0.03	$ 161	$ 269	10,080	$ 753	$ 0.07	$ 20,989	$ 0.42
	2018	6	$ (12,453)	$ 199	$ 0.02	$ 166	$ 269	10,080	$ 634	$ 0.06	$ 23,917	$ 0.40
	2019	7	$ (11,142)	$ 90	$ 0.01	$ 166	$ 269	10,080	$ 525	$ 0.05	$ 25,752	$ 0.36
				$ 1,081		$ 1,161	$ 1,882	70,560	$ 4,123			

General Nissan Assumptions:

Assumes no recovery of dealer tax credit

Discount Rate		Annual Costs	Cost in $2013
7%	0	$ 33,315	$ 33,315
	1	$ 629	$ 588
	2	$ 520	$ 454
	3	$ 520	$ 424
	4	$ 753	$ 574
	5	$ 634	$ 452
	6	$ (10,618)	$ (7,075)
7 Year Lifecycle Cost in $2013			$ 28,732

Avg LifeCycle Cost - NPV 7%	7 Yr Total
LEAF	$ 28,732
Dodge	$ 34,311
Savings	$ (5,579)

Ownership CPM	7 Yr Total
LEAF	$ 0.41
Dodge	$ 0.49
Savings	$ (0.08)

	2013 Dodge GC	2013 Nissan LEAF
Estimated 7-Year TCO	$ 35,574	$ 25,752
Ownership CPM	$ 0.50	$ 0.36
NPV $2013		
Estimated 7-Year TCO	$ 34,311	$ 28,732
Owership CPM	$ 0.49	$ 0.41
	Savings	**$ (5,579)**
		$ (0.08)
GHG Reduced (metric tons)	Tailpipe Only	232.2
	Well to Wheels	265.4

METROPOOL	January	February	March	April	May							
Average Riders Per Vehicle	4.9	4.9	4.9	5.0	4.9							
Metropool Miles Traveled	13,357	13,607	14,475	14,435	16,029							
Total Prior Mode VMT [a]	42,059	42,820	45,583	46,071	50,519	44,035	44,019	43,620	46,068	47,497	51,187	50,408	553,886
VMT Reduced	**28,702**	**29,213**	**31,108**	**31,636**	**34,490**	**30,238**	**30,227**	**29,780**	**31,634**	**32,427**	**35,149**	**34,614**	**379,218**
Prior Mode Gas Consumption (gal) [b]	1,947	1,982	2,110	2,133	2,339	2,039	2,038	2,019	2,133	2,199	2,370	2,334	25,643
Metropool Gas Consumption (gal)	0	0	0	0	0	0	0	0	0	0	0	0	0
Gallons Gas Saved	**1,947**	**1,982**	**2,110**	**2,133**	**2,339**	**2,039**	**2,038**	**2,019**	**2,133**	**2,199**	**2,370**	**2,334**	**25,643**
GHG CALCULATIONS: TAILPIPE EMISSIONS ONLY													
Prior Mode - GHG (metric tons)	17.6	18.0	19.1	19.3	21.2	18.5	18.5	18.3	19.3	19.9	21.5	21.1	232.2
Metropool - GHG (metric tons)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GHG reduced (metric Tons) [d e]	**17.6**	**18.0**	**19.1**	**19.3**	**21.2**	**18.5**	**18.5**	**18.3**	**19.3**	**19.9**	**21.5**	**21.1**	**232.2**
GHG reduced (lbs) [f]	**38,875**	**39,579**	**42,132**	**42,583**	**46,694**	**40,701**	**40,686**	**40,318**	**42,580**	**43,901**	**47,312**	**46,592**	**511,952**
GHG CALCULATIONS: WELL TO WHEELS EMISSIONS													
Prior Mode - GHG (metric tons) [g]	21.5	21.9	23.3	23.6	25.9	22.5	22.5	22.3	23.6	24.3	26.2	25.8	283.5
Metropool - GHG (metric tons) [h i]	1.4	1.4	1.5	1.5	1.7	1.4	1.4	1.4	1.5	1.6	1.7	1.6	18.0
GHG reduced (metric Tons)	**20.1**	**20.5**	**21.8**	**22.1**	**24.2**	**21.1**	**21.1**	**20.9**	**22.1**	**22.8**	**24.5**	**24.2**	**265.4**
GHG reduced (lbs) [f]	**44,413**	**45,215**	**48,134**	**48,694**	**53,350**	**46,542**	**46,525**	**46,064**	**48,691**	**50,158**	**54,102**	**53,279**	**585,168**

The Metropool fleet consists of 20 all-electric, zero-emissions, 5-passenger Nissan LEAFs.

TAILPIPE EMISSIONS ONLY determines the GHG emissions from the vehicle itself, rather than upstream emissions.

WELL TO WHEELS EMISSIONS determines the GHG emissions of fuel from production, to delivery, to use in the vehicle. Calculations are based on the Argonne National Laboratory's GREET model, as recommended by Scott DeWees, Project Manager, Western Washington Clean Cities Coalition.

0.638324364 [a] Prior mode light duty vehicle trips per average person recruited (based on 2010 KCMRO commuter van entry survey data)

21.6 [b] Fuel economy light duty vehicles 21.6 mpg (http://www.epa.gov/cleanenergy/energy-resources/refs.html) FWHA 2012

0.00892 [d] Carbon Dioxide (CO2) emitted per gallon of gasoline burned in metric tons (http://www.epa.gov/cleanenergy/energy-resources/refs.html)

0.985 [e] Passenger vehicles ratio to convert CO_2 to GHG emissions (CO_2e). (http://www.epa.gov/cleanenergy/energy-resources/refs.html) EPA 2012

2,204.623 [f] Factor to convert between metric tons and pounds

24.37 [g] US Average pounds of GHG per gallon of gasoline, well-to-wheel (11056 grams/gal * 0.0022046226218488 lbs/gram) (US GREET 2012 model)

0.819 [h] Pounds of GHG per kWh Northwest Region (eGRID2012, version 1.0)

3.6 [i] Average miles per kWh. (Based on averaging Nissan's claim of 4.1 miles/kWH and the EPA's claim of 3.0 miles/kWh)

Hear it First Hand:

Metropool on YouTube

We LOVE the LEAF. Can't say enough great things about it and metropool! It's such a fun car to drive. We wanted to create a metropool to have the positive impact of taking multiple cars off the road and switch to the zero-emission LEAF, but now that we are driving it, we love it for so many more reasons."

- **Joanne D – SW Seattle to Fairmont Olympic Hotel**

King County METRO

Department of Transportation
Metro Transit Division
Rideshare Operations

206-477-3946
cindy.hudson@kingcounty.gov