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Field Operations Program Toyota RAV4 (NiMH) Fleet Evaluation Final Report



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EXECUTIVE SUMMARY

The U.S. Department of Energy's Field Operations Program evaluates electric and other advanced technology vehicles in real-world applications and environments. Information generated by the Program is targeted to fleet managers and others considering the leasing and deployment of advanced technology vehicles. The Program subjects vehicles to several types of performance and operations tests; this report only addresses the Fleet Evaluation testing of 10 electric Toyota RAV4s by Southern California Edison (SCE). Vehicles subjected to Fleet Evaluation are driven in "normal" fleet environments. Most of the data addresses the 1-year test period (4th quarter 1998 through 3rd quarter 1999). The 10 RAV4s were picked randomly from SCE's fleet of 245 RAV4s.

The 10 RAV4s performed well, with only one component failure. Nine hours were required to replace a motor inverter, but the vehicle was out of service for 12 days, waiting for parts. There were a total of 31 maintenance occurrences, with 16 of these relating to problems with the tires. Seven occurrences were related to preventive maintenance or installing backup alarms. The 31 problems required an average of 1.3 hours to correct, but the 31 occurrences included an average of 2.7 days of downtime. However, 21 of the 31 required less than a day of downtime.

The RAV4s were driven 68,440 miles during the test period, traveling 29 miles per charge (despite their test ranges of 76 to 100 miles), averaging 1.9 miles per AC-kWh charged. At the end of the test period, the 10 RAV4s had a total of 122,182 miles on their odometers (includes pre test-period driving), with no battery module failures.

For additional information on testing and other Program activities, visit the Program's web site at <u>http://ev.inel.gov/sop</u>.

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ACRONYMS

AC	Alternating current
DOE	U.S. Department of Energy
ETA	Electric Transportation Applications
EVSE	Electric vehicle supply equipment
EVTC	Electric Vehicle Technical Center
F	Fahrenheit
INEEL	Idaho National Engineering and Environmental Laboratory
kWh	kilowatt-hour
mm	Millimeter
NEMA	National Electrical Manufacturers Association
NiMH	Nickel metal hydride (battery)
QVTs	Qualified Vehicle Testers
SCE	Southern California Edison Company
SOC	state-of-charge

Field Operations Program Toyota RAV4 (NiMH) Fleet Evaluation Final Report

1. INTRODUCTION

The Field Operations Program was established by the U.S. Department of Energy (DOE) to implement electric vehicle (EV) activities dictated by the Electric and Hybrid Vehicle Research, Development, and Demonstration Act of 1976. In the ensuing years, the Program has evolved in response to new legislation, interests, and technologies. The Program's goals include evaluating electric and other advanced technology vehicles in realworld applications and environments, developing infrastructure elements necessary to support significant advanced technology vehicle use, and increasing the awareness and acceptance of advanced technology vehicles. Personnel of the Idaho National Engineering and Environmental Laboratory (INEEL) manage the Field Operations Program. To support the field evaluation of electric vehicles, during 1996 DOE selected two Qualified Vehicle Testers (QVTs) through competitive bids. One of the QVTs is Southern California Edison Company (SCE). The other QVT is a consortium led by Electric Transportation Applications (ETA), with other members consisting of Arizona Public Service, Salt River Project, and Potomac Electric Power Company. For a more complete description of Program activities, Program reports, and test results, visit the Program's website at http://ev.inel.gov/sop.

One of the tasks of the Program is the fleet evaluation of commercially available electric vehicles. This report summarizes the fleet evaluation of 10 nickel-metal-hydride (NiMH) equipped Toyota RAV4 EVs by the Field Operations Program and its testing partner, SCE. SCE employees operated the RAV4s in normal fleet operations.

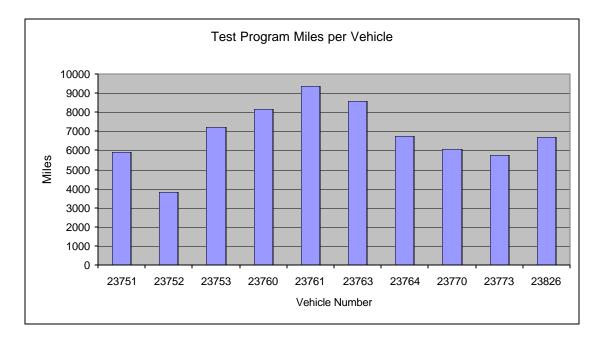
SCE's purpose for evaluating EVs, EV chargers, batteries, and related items is to support the safe and efficient use of EVs and to minimize potential utility system impacts. The following supports this purpose:

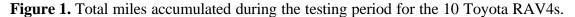
- As a fleet operator and an electric utility, SCE uses EVs to conduct business.
- In order to make informed decisions in the purchase of EVs, batteries, and charging equipment, SCE must evaluate them.
- SCE must determine if there are safety issues with the related equipment or their usage.
- SCE has a responsibility to educate and advise customers about efficient and safe operation of EVs.

This report summarizes the vehicles' performance during the October 1998 to September 1999 test period. Maintenance records as well as efficiency data are used to document the vehicles' capabilities in a large, fully operational electric utility fleet.

2. TESTING RESULTS

Southern California Edison's (SCE) Fleet of 245 Toyota RAV4 EVs may be the world's largest fleet of RAV4s. Out of the 245, 10 RAV4s were randomly selected to be fleet tested as part of DOE's Field Operations Program. They were operated in coastal, urban, and desert areas to provide data under a variety of climactic conditions. In the 12-month test period, the vehicles logged 68,440 miles (Figure 1) in meter reading applications. (The variance in total miles is due to the different meter reading routes the vehicles were assigned to). This equates to a per vehicle average of 6,844 miles of fleet use during the test year.





Most months, each vehicle was driven between 300 and 900 miles, averaging 570 miles (Figure 2). The highest miles driven for a single vehicle was during December, when vehicle 23761 was driven 1,135 miles. The lowest monthly total was for vehicle number 23760, when it was driven 67 miles. During December, Vehicle 23760 was out of service for 12 days for a controller/power control unit problem. The 12 days were likely spent waiting for parts, as the actual repair only required 9 hours (Table 1). The hours per incident required to correct most problems was fairly low. An average of 1.3 hours was required to fix the 31 incidents. While most (21 of 31) of the incidents involved downtime of a day or less, the average downtime per incident was 2.7 days.

An important part of evaluating an electric vehicle is feedback from the vehicle operators. Surprisingly, the most outstanding concern the drivers had was not range, but

tire performance. As seen in some of the driver questionnaires (see Appendix 1), the low-rolling-resistance tires did not provide the desired traction. Additionally, tire life is another issue that deserves attention, as it was the most troublesome vehicle component (Figure 3); tire repair or replacement was the most frequently performed service on the RAV4s. The rubber compound, softer sidewalls, and higher inflation pressure may all contribute to the shorter tread life and perhaps make them more susceptible to punctures. The need to repair the tires adversely impacted the number of servicing hours required to maintain the RAV4s (Figure 4).

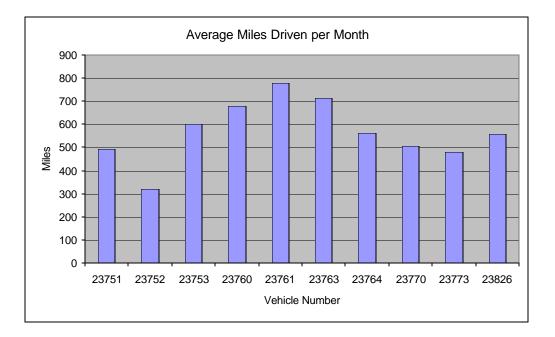


Figure 2. Average miles driven per month for the 10 RAV4s.

Tire-related issues accounted for 16 of the 31 maintenance items reported (Table 1). Seven items were for either preventive maintenance or installing backup alarms; five were for things like burned-out light bulbs, a windshield crack, and a misadjusted door. One occurrence involved recharging the air conditioner and one involved the ABB kWh meter installed by SCE to monitor the energy use. The final occurrence involved Vehicle 23760's power control unit (PCU), which required the previously mentioned twelve days to repair. The PCU problem could arguably be considered the only EV-specific component that required maintenance. While the ABB kWh meter is EV-specific, it was added by SCE for testing purposes only.

Veh. No.	Component Name	Odometer Reading	Reported Problem	Date Reported	Date Repaired	Downtime (Days)*	Hours	Corrective Action
			4 th Qua	arter 1998	-			
23751	Tires / wheels	4,576	Front tires need to be replaced	10/29/98	10/29/98	0	1	R&R front tires
23773	Tires / wheels	NA	Right front tire flat	11/16/98	11/20/98	4	1	R&R tire
			1 st Qua	arter 1999				
23751	Tire	6,233	Nail in left front tire	03/04/99	03/05/99	1	0.5	Repaired tire
23760	ABB meter	N/A	ABB meter bad	01/11/99	01/12/99	1	1.5	R&R ABB meter
23760	Controller/ PCU	8,521	Vehicle quit on road	01/13/99	01/29/99	12	9	R&R motor inverter
23761	Tire	11,345	Nail in left front tire	01/04/99	01/05/99	1	0.5	Repaired tire
23761	Tire	12,601	Right front tire flat	02/03/99	02/08/99	3	1.5	R&R tire
23761	Tire	13,755	Rear tires flat	03/15/99	03/17/99	2	1	Repaired rear tires
23763	Tire	11,291	Right front tire has a slow leak	02/01/99	02/08/99	5	1.25	Repaired tire
			2 nd Qu	arter 1999				
23751	Tire	7,075	Front tire worn	05/03/99	05/03/99	1	0.75	R&R front tires (2)
23751	Backup alarm	7,111	Install backup alarm	05/05/99	05/05/99	1	0.75	Installed backup alarm
23751	Tire	7,734	Right front tire flat	06/14/99	06/14/99	1	0.5	R&R tire
23751	Preventive maintenance	7,734	Service due	06/14/99	06/14/99	1	1.5	Service completed
23752	Backup alarm	4,564	Install backup alarm	05/05/99	05/05/99	1	2	Installed backup alarm
23752	A/C system	5,065	A/C not cold enough	06/18/99	06/18/99	1	1.5	Recharged by vendor

Table 1. Maintenance performed on the 10 RAV4s during the test period.

Veh. No.	Component Name	Odometer Reading	Reported Problem	Date Reported	Date Repaired	Downtime (Days)*	Hours	Corrective Action
23753	Tire	12,896	Front tires wearing out	04/19/99	04/23/99	5	2	R&R front tires (2)
23753	Backup alarm	13,517	Install backup alarm	05/13/99	05/13/99	1	1.5	Installed backup alarm
23760	Tire	12,091	Nail in left rear tire	06/17/99	06/19/99	3	1	Repaired tire
23764	Backup alarm	5,969	Install backup alarm	05/06/99	05/06/99	1	0.75	Installed backup alarm
23773	Tire	8,477	Right front and right rear tires flat	04/06/99	04/14/99	7	1.75	Repaired both tires
23773	Non EV related	9,548	Right rear brake light burned out	06/24/99	06/24/99	1	2.5	R&R brake light bulb
			3 rd Quarte	er 1999				
23751	Non EV related	7,734	Right front turn lens damaged	06/21/99	07/01/99	9	1	R&R right front turn lens
23751	Tire	9,424	Left front tire worn	09/02/99	09/02/99	1	0.5	R&R tire
23760	Tire	12,561	Left front tire flat	07/06/99	07/06/99	1	0.5	Repaired tire
23761	Tire	14,162	Flat tire	07/02/99	07/02/99	1	1	Repaired tire
23763	Brakes	16,308	Left brake light out	08/26/99	08/26/99	1	0.5	R&R brake light bulb
23764	Preventive maintenance	9,263	Service due	07/28/99	08/27/99	1	1	Service completed
23764	Non EV related	9,263	Crack in windshield	09/10/99	09/29/99	14	1	R&R windshield
23770	Preventive maintenance	8,240	Service due	07/28/99	08/27/99	1	1	Service completed
23773	Tire	10,098	Nail in right rear tire	08/04/99	08/04/99	1	N/A	R&R tire by parkhouse
23826	Non EV related	9,168	Fuel door bent \ out of adjustment	08/16/99	08/16/99	1	1	Repaired

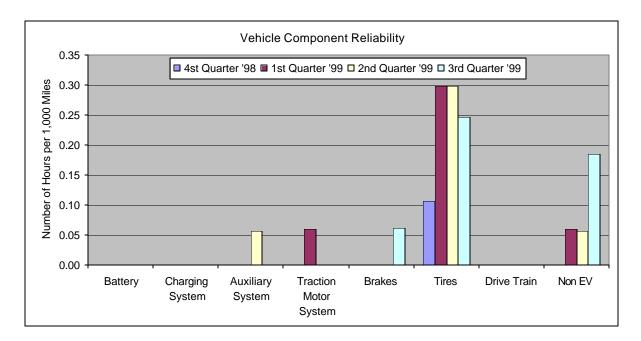


Figure 3. Vehicle component failure per 1,000 miles for the 10 RAV4s during the fourth quarter of 1998 and the first, second and third quarters of 1999 test period.

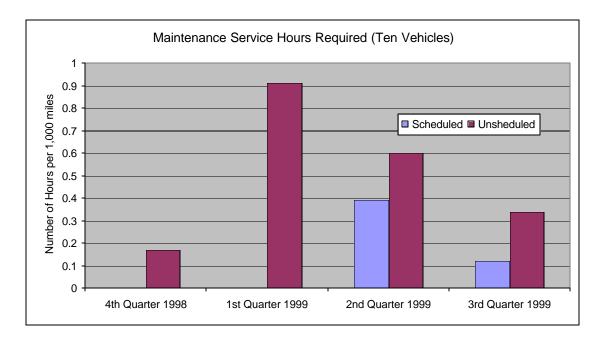


Figure 4. Number of hours (per 1,000 miles of operation) required for scheduled and unscheduled maintenance on the 10 RAVs.

The Toyota RAV4s accumulated 68,440 miles (Table 2) during the fleet evaluation testing period and each had previously accumulated an average of 5,400 miles before the start of testing. Thus, at the conclusion of the testing, they had accumulated a total of 122,182 miles (Table 3). All of the RAV4s were equipped with Panasonic NiMH batteries and conductive connectors for charging.

Vehicle	Oct	Nov	Dec	Jan	Feb	Mar	Anr	May	Jun	Jul	Ang	Son	Totals
No.	Oct	INUV	Dec	Jan	reb	Iviai	Apr	wiay	Juli	Jui	Aug	Sep	Totais
23751	622	420	394	227	395	478	449	399	639	517	794	608	5,942
23752	249	272	364	323	110	309	268	302	585	320	417	323	3,842
23753	874	551	843	896	665	842	892	378	413	251	301	321	7,227
23760	518	654	722	67	686	863	830	787	796	685	739	813	8,160
23761	921	1,080	1,135	831	900	883	627	586	586	634	479	700	9,362
23763	630	690	760	485	545	926	739	752	701	821	633	910	8,592
23764	955	651	725	509	582	474	663	276	509	449	535	429	6,757
23770	619	320	590	431	425	638	729	268	570	501	654	328	6,073
23773	515	430	584	707	486	532	533	461	260	408	380	482	5,778
23826	533	552	578	524	502	517	607	567	565	460	719	583	6,707
Totals	6,436	5,620	6,695	5,000	5,296	6,462	6,337	4,776	5,624	5,046	5,651	5,497	68,440

Table 2. Monthly and total mileage accumulated for each RAV4 during the test period.

SCE Vehicle #	Range as Tested (Date)	Delivery Date	Assigned Garage	Assigned Application	Status	Odometer as of 09/30/99
23751	90 (01/98)		Arrowhead	Meter Reading	In Use	10,032
23752	93 (12/97)		Santa Monica	Meter Reading	In Use	6,422
23753	86 (12/97)		Santa Monica	Meter Reading	In Use	14,975
23760	88 (12/97)		Covina	Meter Reading	In Use	14,720
23761	76 (12/97)		Covina	Meter Reading	In Use	17,859
23763	95 (12/97)		Covina	Meter Reading	In Use	17,318
23764	100 (12/97)		San Jacinto	0	In Use	9,768
23770	98 (12/97)		San Jacinto	Meter Reading	In Pomona for preventive maintenance	8,639
23773	84 (01/98)		Montebello	Meter Reading	In Use	10,893
23826	80 (12/97)		Montebello	Meter Reading	In Use	11,556
Total						122,182

Table 3. Vehicle status at the conclusion of the Fleet evaluation testing. The Pomona Urban Loop was used to determine the Range as Tested.

Table 4 shows the total number of miles driven and charge cycles for the 122,182 miles driven before and during the test cycle. The average miles driven per charge cycle in Table 4 is only 20 miles, while during the test period the vehicles averaged 29 miles per charge cycle (Figures 5 - 8). (While an organizational theorist might be able to explain the influence of being tested on the drivers' behaviors, this report will limit itself to simply identifying the average miles driven per charge cycle). The RAV4s averaged a cumulative 1.9 miles per AC-kWh charged (Figures 9 - 12) during the test period.

Table 4. Number of cycles, miles, and average miles per cycle placed on the 10 RAV4s and their Panasonic MHB-100 NiMH batteries at the conclusion of the testing. The manufacturer rated capacity is 100 Amp-hour at C/3. All of the RAV4s were placed in service during December 1997. The data includes miles accumulated before and during the test period. The data reflects the test fleet status as of September 31 1999.

Vehicle No.	Total number of charge cycles	Total miles	Battery modules replaced	Average miles per charge cycle
110.	charge cycles		replaced	charge cycle
23751	502	10,032	0	19.98
23752	320	6,422	0	20.07
23753	749	14,975	0	19.99
23760	736	14,720	0	20.00
23761	893	17,859	0	20.00
23763	866	17,318	0	20.00
23764	488	9,768	0	20.02
23770	432	8,639	0	20.00
23773	545	10,893	0	19.99
23826	578	11,556	0	19.99
Totals	6,109	122,182	0	20.00

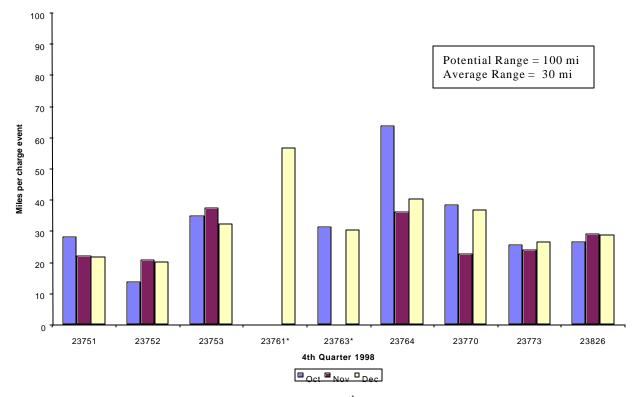


Figure 5. Average miles per charge event during the 4th Quarter 1998. (*Problems with the ABB meter programming led to missed or incorrect data).

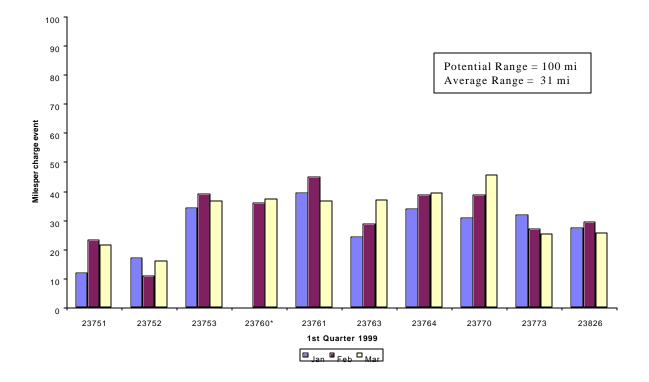


Figure 6. Average miles per charge event during the 1st Quarter 1999. (*Problems with ABB meter programming led to missed or incorrect data).

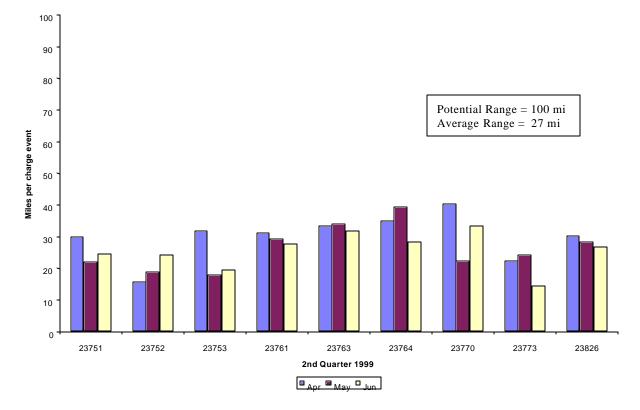


Figure 7. Average miles per charge event during the 2nd Quarter 1999.

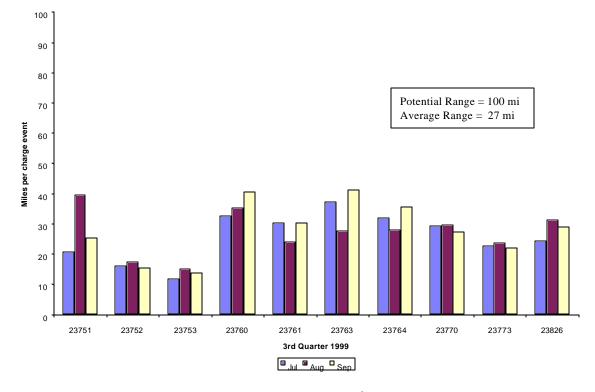


Figure 8. Average miles per charge event during the 3rd Quarter 1999.

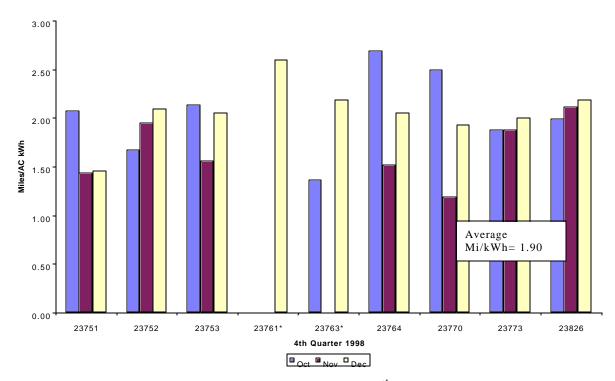


Figure 9. Average miles per AC kWh charged during the 4th Quarter 1998. (*Problems with ABB meter programming led to missed or incorrect data.)

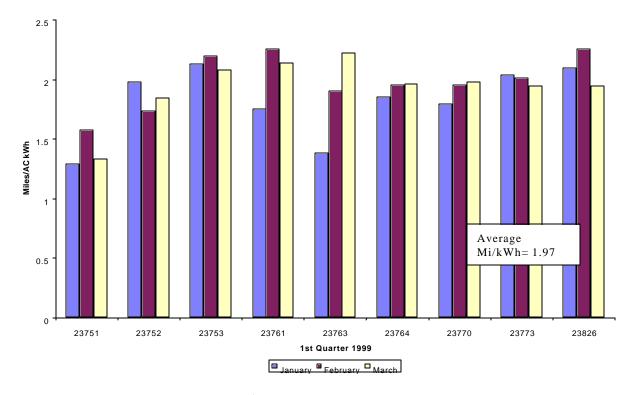


Figure 10. Average Miles/AC kWh 1st Quarter 1999. (*Problems with ABB meter programming led to missed or incorrect data.)

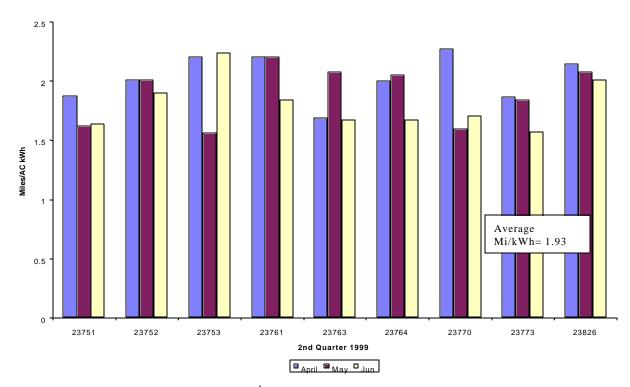


Figure 11. Average Miles/AC kWh 2nd Quarter 1999.

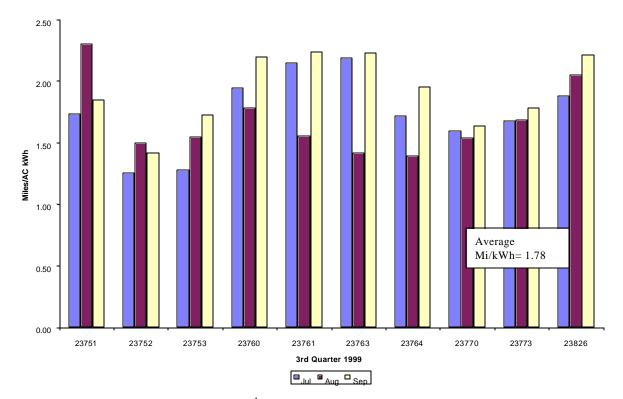


Figure 12. Average Miles/AC kWh 3rd Quarter 1999.

3. CONCLUSION

While a vehicle's appeal will vary from person to person, the majority of the RAV4 drivers surveyed preferred electric vehicles to internal combustion engine (ICE) vehicles in their job applications. SCE's fleet of 245 RAV4s has an approval rating of over 70% amongst drivers.

There are environmental as well as financial benefits when incorporating electric vehicles into a fleet. 16,426 pounds of pollutants were reduced while driving the RAV4s instead of driving 10 ICE vehicles for the same amount of time. Thirteen oil changes were avoided, saving 65 quarts of oil, nor did the vehicles have to undergo smog checks every 2 years. 34,220 kWh of electricity were consumed, saving 2,738 gallons of gasoline, netting savings of over \$1,700 in fuel costs.

The RAV4s were leased for 3 years at a cost of \$16,000 per vehicle. The lease includes a 3-year bumper to bumper warranty, which covers all necessary repairs not resulting from driver negligence or abuse. In addition, subsidizing funds exist in California, which lowers the lease cost of an electric vehicle, making it comparable to an ICE vehicle. EVs have 10 times fewer moving parts than an ICE vehicle, which results in fewer component failures.

Assuming a 1-year lease cost of \$5,333, an energy cost of 8.2 cents per kWh, an average of 3,422 kWh per vehicle year, and an average of 6,844 miles driven per year, the cost to operate the RAV4s averaged 82 cents per mile.

Southern California Edison has made a strong commitment to incorporate electric vehicles into its fleet. Original equipment manufacturers continue to advance EV technology, in turn increasing the applications that electric vehicles could be assigned for. This report shows that EVs are not only capable of being matched to a mission successfully, they also have the ability to reduce the overall cost of operating a utility fleet.

Appendix A Driver Questionnaires

	SCE Electric Vehicle	Driver	Quest	ionna	re			
	IVER NAME: CON PRICE	LOCAT	ION:	Arm	whead			
	HICLE #: 23751		Color States			oyota	RAI	14
VE	HICLE APPLICATION: METER REAL	JING			TE:	9	241.	99
VE	HICLE AFFEIGATION	0						
DR	IVEABILITY		SA	A	NS	D	SD	NA
1.	The vehicle feels stable and safe		X					
2.	The vehicle steering is responsive		X	_				
3.	The vehicle acceleration is adequate		<u>_X</u>					_
4.	The vehicle braking is responsive and safe			×				
DF	IVING CONTROLS AND GAUGES					·		
1.	The cabin temperature controls are easy to operat			×	-	<u> </u>		
2.	The "state-of-charge" gauge is helpful and easy to	read		<u>_X</u>		_	-	_
з.	The "range remaining" gauge is helpful and easy t	o read		X			-	
CH	ARGING CONTROLS AND GAUGES							
1.	The charging controls are easy to operate			X				
2.	The charging connector (plug) is easy to use			×	-			_
З.	The charging cord is easy to manage		_	X				_
4.	The vehicle charges adequately (full in the mornin	g)		×				-
5.	The charger is reasonably quiet Do you know the differences between inductive an			<u>_x</u>	_	-		-
	If yes, please describe*							ţ
IN	TERIOR							
1.	The heater provides adequate heat			×		_		
2.	The air conditioner provides adequate cooling				<u>x</u> -	-	_	-
3.	The vehicle is quiet		_	X			_	_
4.	Did you use electronic equipment (cell phone, rad							
	If yes, please list equipment(s) and describe any p	problems	encount	ered* Ra	dio,	it would	d Dri	tin B
	uptil they book it to the key.						-	-
G	ENERAL			~				
1.	The vehicle has adequate payload		-	-		X	_	
2.	The vehicle has adequate range						-	
3.		3	_	7	-	*		
-	The vehicle is suited for your job application			_		-		-
5.	· · · · · · · · · · · · · · · · · · ·				<u>A</u>		which	
6.	If you had to choose between this vehicle or a sim would you select? (Circle One) Electric V				ehicle		her	one
	OMMENTS*							
W	hat did you like best? The vehicle is a	omfort	:6/e,	8454	to Dr.	ive, e	454	+0
4	hat did you like least? <u>The places</u> hat did you like least? <u>The range is not</u> per co Radio then Drive, we call, tese things you are like to get so	,	-				,	
W	hat did you like least? The range is not	secol	Because	if ;	100 00	n her	ter,	115 475
Ja	ptr co Radio then Drive we carty	get ad	lout.	10-15	mile	F" .	14-9	z, w
7)	ise things you are lucky to get 30	miles	12 "	chors.				

SA: Strongly Agree; A: Agree; NS: Not Sure; D: Disagree; SD: Strongly Disagree; NA: Not Applicable

DR	RIVER NAME: MAKK KODRIGUEZ LOCATION: JANTA MONICA
/E	HICLE NUMBER: 23732 1 VEHICLE MAKE & MODEL: TOYOTA GV K
E	HICLE APPLICATION: METER KEADING DATE: 5/20/99
	RIVEABILITY SA A NS D SD A
	The vehicle feels stable and safe
	The vehicle steering is responsive
	The vehicle acceleration is adequate
	The vehicle braking is responsive and safe
)F	RIVING CONTROLS AND GAUGES
_	The cabin temperature controls are easy to operate
	The "state-of-charge" gauge is helpful and easy to read
	The "range remaining" gauge is helpful and easy to read
2	ARGING CONTROLS AND GAUGES
	The charging controls are easy to operate
	The charging connector (plug) is easy to use
3.	The charging cord is easy to manage
4.	The vehicle charges adequately (full in the morning)
	The charger is reasonably quiet
5.	The charger is reasonably quiet
5.	The charger is reasonably quiet
5.	The charger is reasonably quiet
	The charger is reasonably quiet
i. i.	The charger is reasonably quiet
5. 5. 7.	The charger is reasonably quiet
5. 5. 7.	The charger is reasonably quiet
5.	The charger is reasonably quiet
5. 5. 7. W 1. 2. 3.	The charger is reasonably quiet
N	The charger is reasonably quiet Do you know the differences between Inductive and Conductive charging? Yes No If yes, which do you prefer? Inductive Conductive Mo preference Did you have any problems charging? Yes No If yes, please describe*
N	The charger is reasonably quiet
N	The charger is reasonably quiet
	The charger is reasonably quiet
N	The charger is reasonably quiet
N	The charger is reasonably quiet
	The charger is reasonably quiet Do you know the differences between Inductive and Conductive charging? Yes No If yes, which do you prefer? Inductive Conductive No preference Did you have any problems charging? Yes No If yes, please describe* No If yes, please describe* The heater provides adequate heat The heater provides adequate heat The vehicle is quiet Inductive Inductive Inductive Inductive Inductive No If yes, please list equipment (cell phone, radio, etc.) inside the EV? Yes No If yes, please list equipment(s) and describe any problems encountered* Inductive No If yes, please list equipment (cell phone, radio, etc.) inside the EV? Yes No If yes, please list equipment(s) and describe any problems encountered* Inductive
N	The charger is reasonably quiet Do you know the differences between Inductive and Conductive charging? Yes No If yes, which do you prefer? Inductive Conductive No preference Did you have any problems charging? Yes No If yes, please describe* No If yes, please list equipment (cell phone, radio, etc.) inside the EV? Yes No If yes, please list equipment(s) and describe any problems encountered* No If yes, please list equipment(s) and describe any problems encountered* No If yes, please list equipment(s) and describe any problems encountered* No If yes, please list equipment(s) and describe any problems encountered* No If yes, please list equipment(s) and describe any problems encountered* No If yes, please list equipment(s) and describe any problems encountered* No If yes, please list equipment(s) and describe any problems encountered* No If yes, please list equipment(s) and describe any problems encountered* No If yes, please list equipment(s) and describe any problems encountered*
S. S. N. S. S. L.	The charger is reasonably quiet
5.	The charger is reasonably quiet
5. 5. 7. 1. 2. 3. 4. GE 5. 5. CC	The charger is reasonably quiet

Participant R NAME:			NS	07070 07070 5/20 0 5/20 0	A F 5D SD	NA
LE NUMBER: 23753 VEHICL LE APPLICATION: HETCH KEADING ABILITY e vehicle feels stable and safe e vehicle steering is responsive e vehicle acceleration is adequate e vehicle braking is responsive and safe IG CONTROLS AND GAUGES e cabin temperature controls are easy to operate e "state-of-charge" gauge is helpful and easy to read e "range remaining" gauge is helpful and easy to read GING CONTROLS AND GAUGES	E MAKE		TE:	07070 5/20 D	0/99	NA
ABILITY a vehicle feels stable and safe a vehicle steering is responsive a vehicle acceleration is adequate a vehicle braking is responsive and safe IG CONTROLS AND GAUGES a cabin temperature controls are easy to operate a "state-of-charge" gauge is helpful and easy to read a "range remaining" gauge is helpful and easy to read GING CONTROLS AND GAUGES			TE:	D	0/99	NA
ABILITY a vehicle feels stable and safe a vehicle steering is responsive a vehicle acceleration is adequate a vehicle braking is responsive and safe IG CONTROLS AND GAUGES a cabin temperature controls are easy to operate a "state-of-charge" gauge is helpful and easy to read a "range remaining" gauge is helpful and easy to read GING CONTROLS AND GAUGES	SA 			р 	SD 	NA
e vehicle feels stable and safe e vehicle steering is responsive e vehicle acceleration is adequate e vehicle braking is responsive and safe IG CONTROLS AND GAUGES e cabin temperature controls are easy to operate e "state-of-charge" gauge is helpful and easy to read e "range remaining" gauge is helpful and easy to read GING CONTROLS AND GAUGES	SA 	~> > -		D	SD	NA
e vehicle feels stable and safe e vehicle steering is responsive e vehicle acceleration is adequate e vehicle braking is responsive and safe IG CONTROLS AND GAUGES e cabin temperature controls are easy to operate e "state-of-charge" gauge is helpful and easy to read e "range remaining" gauge is helpful and easy to read GING CONTROLS AND GAUGES		44 146	 			
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e vehicle acceleration is adequate e vehicle braking is responsive and safe <u>IG CONTROLS AND GAUGES</u> e cabin temperature controls are easy to operate e "state-of-charge" gauge is helpful and easy to read e "range remaining" gauge is helpful and easy to read <u>GING CONTROLS AND GAUGES</u>			Z	=	=	Ξ
e vehicle braking is responsive and safe I <u>G CONTROLS AND GAUGES</u> e cabin temperature controls are easy to operate e "state-of-charge" gauge is helpful and easy to read e "range remaining" gauge is helpful and easy to read <u>GING CONTROLS AND GAUGES</u>			_	_	-	-
IG CONTROLS AND GAUGES e cabin temperature controls are easy to operate e "state-of-charge" gauge is helpful and easy to read e "range remaining" gauge is helpful and easy to read GING CONTROLS AND GAUGES		4				
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GING CONTROLS AND GAUGES						
e charging controls are easy to operate	_	1				
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you know the differences between Inductive and Condu	ctive cha	arging?		Yes _	No	
es, which do you prefer? Inductive Cond	luctive	N	o prefer	rence		
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108						
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	nside the	EV?	Vye	s	No	
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	line vehi	icle for u	ise in vo	our wor	k which	one
ould you select? (Circle One) Electric Vehicle						
NENIS						
aid you like best?						
			1/			
	es, which do you prefer?InductiveCond d you have any problems charging?YesI res, please describe* e heater provides adequate heat e air conditioner provides adequate cooling e vehicle is quiet d you use electronic equipment (cell phone, radio, etc.) in res, please list equipment(s) and describe any problems 	a charging connector (plug) is easy to use a charging cord is easy to manage a vehicle charges adequately (full in the morning) a charger is reasonably quiet you know the differences between Inductive and Conductive charges, which do you prefer? a understand for the differences between Inductive and Conductive charges, which do you prefer? a understand for the differences between Inductive and Conductive charges, which do you prefer? a understand for the differences between Inductive and Conductive charges, which do you prefer? a understand for the differences between Inductive and Conductive charges, please describe* POR e heater provides adequate heat e air conditioner provides adequate cooling a vehicle is quiet a you use electronic equipment (cell phone, radio, etc.) inside the res, please list equipment(s) and describe any problems encount a cell phene FAL e vehicle has adequate payload e vehicle is suited for your job application e vehicle is suited for your job application e vehicle meets your expectations you had to choose between this vehicle or a similar gasoline vehicle uselect? Circle One Electric Vehicle Ga MENTS* did you like best?	a charging connector (plug) is easy to use a charging cord is easy to manage a vehicle charges adequately (full in the morning) a charger is reasonably quiet you know the differences between Inductive and Conductive charging? you know the differences between Inductive and Conductive charging? es, which do you prefer? Inductive Yes d you have any problems charging? Yes No Press, please describe* Image: the eater provides adequate heat e air conditioner provides adequate cooling e vehicle is quiet d you use electronic equipment (cell phone, radio, etc.) inside the EV? res, please list equipment(s) and describe any problems encountered* Image: the vehicle has adequate payload e vehicle is easy to operate e vehicle is suited for your job application res vehicle meets your expectations you had to choose between this vehicle or a similar gasoline vehicle for used of you like best? did you like best?	a charging connector (plug) is easy to use a charging cord is easy to manage a vehicle charges adequately (full in the morning) a charger is reasonably quiet you know the differences between Inductive and Conductive charging? you know the differences between Inductive and Conductive charging? es, which do you prefer? Inductive dyou have any problems charging? Yes No dyou have any problems charging? Yes No dyou have any problems charging? Yes No <	a charging connector (plug) is easy to use a charging cord is easy to manage a vehicle charges adequately (full in the morning) a charger is reasonably quiet you know the differences between Inductive and Conductive charging? Yes es, which do you prefer? Inductive Gonductive dyou have any problems charging? Yes dyou have any problems charging? Yes dyou have any problems charging? Yes MOR e heater provides adequate heat e air conditioner provides adequate cooling e vehicle is quiet dyou use electronic equipment (cell phone, radio, etc.) inside the EV? Yes Cell Act e vehicle has adequate payload we vehicle is suited for your job application me vehicle meets your expectations you had to choose between this vehicle or a similar-gasoline vehicle for use in your wor pould you select? (Circle One) Electric Vehicle Gasoline Vehicle	a charging connector (plug) is easy to use a charging cord is easy to manage a vehicle charges adequately (full in the morning) a charger is reasonably quiet you know the differences between Inductive and Conductive charging? Yes you know the differences between Inductive and Conductive charging? Yes you have any problems charging? Yes Yes A you have any problems charging? Yes Yes Yoe e heater provides adequate heat e air conditioner provides adequate cooling e vehicle is quiet d you use electronic equipment (cell phone, radio, etc.) inside the EV? Yes No res, please list equipment(s) and describe any problems encountered* Yoe RAL e vehicle has adequate payload e vehicle is suited for your job application ie vehicle is suited for your job application ie vehicle meets your expectations you had to choose between this vehicle or a similar gasoline vehicle for use in your work, which build you select? (Circle One) Electric Vehicle Gasoline Vehicle Either

SA: Strongly Agree; A: Agree; NS: Not Sure; D: Disagree; SD: Strongly Disagree; NA: Not Applicable

	AME: BAYNNAM LO		& MOD	EL: A	2.4		
				ATE:		1-99	
EHICLE							
DRIVEABI	LITY	SA	Α	NS	D	SD	NA
	hicle feels stable and safe	_	_				
	hicle steering is responsive						
	hicle acceleration is adequate	1					_
	hicle braking is responsive and safe	~					
	CONTROLS AND GAUGES	/					
	bin temperature controls are easy to operate	~	_				
2. The "s	tate-of-charge" gauge is helpful and easy to rea	d /			1		_
	ange remaining" gauge is helpful and easy to re						
	G CONTROLS AND GAUGES	-	/				
	arging controls are easy to operate	-			_		41
	arging connector (plug) is easy to use	~					
	narging cord is easy to manage	-					
	chicle charges'adequately (full in the morning)	~					
	narger is reasonably quiet	V					_
J. 1110 01	idiger is reasonably done	and the second			Van	No	
Cond	u know the differences between Inductive and C uctive <u>No preference</u> bu have any problems charging? <u>Yes</u> please describe*	If yes, which d	o you pi	refer? _			
7. Did yo If yes,	uctive <u>No preference</u> ou have any problems charging? <u>Yes</u> please describe*	If yes, which d	o you pi				
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Cond 7. Did yc If yes, <u>INTERIOI</u> 1. The h	uctive <u>No preference</u> ou have any problems charging? <u>Yes</u> please describe* eater provides adequate heat	If yes, which d	o you pi				
Cond 7. Did yo If yes, <u>INTERIOI</u> 1. The h 2. The a 3. The y	No preference bu have any problems charging?Yes please describe* eater provides adequate heat ir conditioner provides adequate cooling ehicle is guiet	If yes, which d		refer? _	Ind		
Cond 7. Did yo If yes, <u>INTERIOI</u> 1. The h 2. The a 3. The y	No preference bu have any problems charging?Yes please describe* eater provides adequate heat ir conditioner provides adequate cooling ehicle is guiet	If yes, which d		refer? _	Ind		
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Condi 7. Did yo If yes, <u>INTERIOI</u> 1. The h 2. The a 3. The v 4. Did yo If yes <u>GENERA</u>	No preference bu have any problems charging?Yes please describe* eater provides adequate heat ir conditioner provides adequate cooling ehicle is quiet bu use electronic equipment (cell phone, radio, or please list equipment(s) and describe any problems Red io) No Problems	If yes, which d	e you pi	refer? _	Ind		
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Condi 7. Did yd If yes, <u>INTERIOI</u> 1. The h 2. The a 3. The v 4. Did yd If yes, <u>GENERA</u> 1. The v 2. The v	No preference bu have any problems charging?Yes please describe* genter provides adequate heat ir conditioner provides adequate cooling ehicle is quiet bu use electronic equipment (cell phone, radio, or please list equipment(s) and describe any prot Redio Roblems L ehicle has adequate payload ehicle has adequate range	If yes, which d	e you pi	refer? _	Ind		
Condi 7. Did yd If yes, 1. The h 2. The a 3. The v 4. Did yd If yes <u>GENERA</u> 1. The v 2. The v 3. The v	No preference bu have any problems charging?Yes please describe* deater provides adequate heat ir conditioner provides adequate cooling ehicle is quiet bu use electronic equipment (cell phone, radio, or please list equipment(s) and describe any prot Redio No Please list equipment(s) and describe any prot Redio No please list equipment(s) and describe any prot Redio tehicle has adequate payload rehicle has adequate range rehicle is easy to operate	If yes, which d	e you pi	refer? _	Ind		
Conda 7. Did yo If yes, INTERION 1. The h 2. The a 3. The v 4. Did yo If yes GENERA 1. The v 2. The v 3. The v 4. Did yo If yes	No preference ou have any problems charging? Yes please describe* Yes geater provides adequate heat ir conditioner provides adequate cooling ehicle is quiet ou use electronic equipment (cell phone, radio, or please list equipment(s) and describe any protection Red io No Problems L ehicle has adequate payload rehicle has adequate range ehicle is easy to operate rehicle is suited for your job application enclose	If yes, which d	e you pi	refer? _	Ind		
Condi 7. Did yo If yes, INTERION 1. The h 2. The a 3. The v 4. Did yo If yes GENERA 1. The v 2. The v 3. The v 4. Did yo 1. The v 4. Did yo 1. The v 5. The v	No preference bu have any problems charging?Yes please describe* genter provides adequate heat ir conditioner provides adequate cooling ehicle is quiet bu use electronic equipment (cell phone, radio, or please list equipment(s) and describe any problems Redio Redio Redio be Redio Redio ehicle has adequate payload ehicle has adequate range ehicle is easy to operate rehicle is suited for your job application rehicle meets your expectations	If yes, which d	ered*	refer? _	Ind	No	one
Condi 7. Did yd If yes, INTERION 1. The h 2. The a 3. The v 4. Did yd If yes GENERA 1. The v 2. The v 3. The v 4. The v 5. The v 6. If you	No preference ou have any problems charging? Yes please describe* Yes geater provides adequate heat ir conditioner provides adequate cooling ehicle is quiet ou use electronic equipment (cell phone, radio, or please list equipment(s) and describe any protection Red io No Problems L ehicle has adequate payload rehicle is easy to operate ehicle is suited for your job application rehicle meets your expectations had to choose between this vehicle or a similar	If yes, which d	EV?	vse in yo	Ind	No	one
Condi 7. Did yo If yes, INTERION 1. The h 2. The a 3. The v 4. Did yo If yes, GENERA 1. The v 2. The v 3. The v 4. Did you 5. The v 6. If you would	No preference ou have any problems charging? Yes please describe*	If yes, which d	ered*	vse in yo	Ind	No	one
Condi 7. Did yo If yes, INTERION 1. The h 2. The a 3. The v 4. Did yo If yes GENERA 1. The v 3. The v 4. Did yo If yes GENERA 1. The v 3. The v 4. Did you 5. The v 6. If you would COMMENT	No preference ou have any problems charging? Yes please describe*	If yes, which d	EV? ered*	vse in yo	Ind	No	one

SA: Strongly Agree; A: Agree; NS: Not Sure; D: Disagree; SD: Strongly Disagree; NA: Not Applicable

	HICLE #: 2376 VEHIC	LE MAKE	& MOI	DEL: TOY	ATOY	RAVL	1
	ICLE APPLICATION:			ATE:		1	
					1		
DR	IVEABILITY	SA	A	NS	D	SD	NA
1.	The vehicle feels stable and safe	X	-				
2.	The vehicle steering is responsive	X				_	_
3.	The vehicle acceleration is adequate	X			-		
4.	The vehicle braking is responsive and safe		X				
DR	IVING CONTROLS AND GAUGES						
1.	The cabin temperature controls are easy to operate	$\underline{\propto}$					
2.	The "state-of-charge" gauge is helpful and easy to read		K				
3.	The "range remaining" gauge is helpful and easy to read	R_					
CH	ARGING CONTROLS AND GAUGES						
1.	The charging controls are easy to operate	K					
2.	The charging connector (plug) is easy to use	×					
3.	The charging cord is easy to manage	X					
4.	The vehicle charges adequately (full in the morning)	X					
5.	The charger is reasonably quiet	X					_
5.	Do you know the differences between Inductive and Cond	luctive cha	raina?	Y	es	VNO	
r.	Conductive No preference Did you have any problems charging? YesK_ If yes, please describe*	No		refer? _	Indi	ucuve	
	Conductive No preference Did you have any problems charging? YesK_ If yes, please describe*	No					
IN	Conductive No preference Did you have any problems charging? YesK If yes, please describe* TERIOR	No					
1.	Conductive No preference Did you have any problems charging? YesK If yes, please describe* TERIOR The heater provides adequate heat	No					
IN 1. 2.	Conductive No preference Did you have any problems charging? YesK_ If yes, please describe* <i>ERIOR</i> The heater provides adequate heat The air conditioner provides adequate cooling	No					
1. 2. 3.	ConductiveNo preference Did you have any problems charging?YesK_ If yes, please describe* <i>ERIOR</i> The heater provides adequate heat The air conditioner provides adequate cooling The vehicle is quiet	No	·	<u>\$</u>	×		
1. 2. 3.	Conductive No preference Did you have any problems charging? YesK_ If yes, please describe* <i>ERIOR</i> The heater provides adequate heat The air conditioner provides adequate cooling The vehicle is quiet Did you use electronic equipment (cell phone, radio, atc.)	No	<u>k</u>		×		
<u>IN</u> 1. 2. 3. 4.	ConductiveNo preference Did you have any problems charging?YesK If yes, please describe* The heater provides adequate heat The air conditioner provides adequate cooling The vehicle is quiet Did you use electronic equipment (cell phone, radio, etc.). If yes, please list equipment(s) and describe any problems	No	<u>k</u>		×		-///
IN 1. 2. 3. 4. GE	ConductiveNo preference Did you have any problems charging?YesK If yes, please describe* <i>ERIOR</i> The heater provides adequate heat The air conditioner provides adequate cooling The vehicle is quiet Did you use electronic equipment (cell phone, radio, etc.). If yes, please list equipment(s) and describe any problems <i>NERAL</i>	No	EV?	Yes	X P P	No	
IN 1. 2. 3. 4. GE	Conductive No preference Did you have any problems charging? YesK_ If yes, please describe* The heater provides adequate heat The air conditioner provides adequate cooling The vehicle is quiet Did you use electronic equipment (cell phone, radio, etc.). If yes, please list equipment(s) and describe any problems MERAL The vehicle has adequate payload	No	EV?	Yes	X P P	No	
IN 1. 2. 3. 4. 1. 2.	ConductiveNo preference Did you have any problems charging?YesK If yes, please describe* The heater provides adequate heat The air conditioner provides adequate cooling The vehicle is quiet Did you use electronic equipment (cell phone, radio, etc.). If yes, please list equipment(s) and describe any problems <u>NERAL</u> The vehicle has adequate payload The vehicle has adequate range	No	EV?	Yes EELL		NO	
IN 1. 2. 3. 4. GE 1. 2. 3.	ConductiveNo preference Did you have any problems charging?YesK If yes, please describe* <i>ERIOR</i> The heater provides adequate heat The air conditioner provides adequate cooling The vehicle is quiet Did you use electronic equipment (cell phone, radio, etc.). If yes, please list equipment(s) and describe any problems <i>NERAL</i> The vehicle has adequate payload The vehicle has adequate range The vehicle is easy to operate	No	EV?	Yes EELL		NO	
IN 1. 2. 3. 4. 1. 2. 3. 4. 1. 2. 3. 4.	ConductiveNo preference Did you have any problems charging?YesK If yes, please describe* The heater provides adequate heat The air conditioner provides adequate cooling The vehicle is quiet Did you use electronic equipment (cell phone, radio, etc.). If yes, please list equipment(s) and describe any problem: <u>NERAL</u> The vehicle has adequate payload The vehicle has adequate range The vehicle is easy to operate The vehicle is suited for your job application	No	EV?	Yes		NO	
IN 1. 2. 3. 4. 1. 2. 3. 4. 5.	ConductiveNo preference Did you have any problems charging?YesK If yes, please describe* The heater provides adequate heat The air conditioner provides adequate cooling The vehicle is quiet Did you use electronic equipment (cell phone, radio, etc.). If yes, please list equipment(s) and describe any problems <u>NERAL</u> The vehicle has adequate payload The vehicle has adequate range The vehicle is easy to operate The vehicle is suited for your job application The vehicle meets your expectations	No		Yes		No NONE	
IN 1. 2. 3. 4. 1. 2. 3. 4. 5.	ConductiveNo preference Did you have any problems charging?YesK If yes, please describe* <i>ERIOR</i> The heater provides adequate heat The air conditioner provides adequate cooling The vehicle is quiet Did you use electronic equipment (cell phone, radio, etc.). If yes, please list equipment(s) and describe any problems <i>NERAL</i> The vehicle has adequate payload The vehicle has adequate range The vehicle is suited for your job application The vehicle meets your expectations If you had to choose between this vehicle or a similar gas	No	EV?	Yes ELL use in you		No ACINIE 	
IN 1. 2. 3. 4. 1. 2. 3. 4. 5. 6.	ConductiveNo preference Did you have any problems charging?YesK If yes, please describe*	No		Yes ELL use in you		No NONE	
1. 2. 3. 4. 1. 2. 3. 4. 5. 6. CC	ConductiveNo preference Did you have any problems charging?YesK_ If yes, please describe*	No	EV?	Yes ELL ehicle		No ACINIE 	
IN 1. 2. 3. 4. 1. 2. 3. 4. 5. 6. CC	ConductiveNo preference Did you have any problems charging?YesK_ If yes, please describe*	No	EV?	Yes ELL ehicle		No ACINIE 	
IN 1. 2. 3. 4. 5. 6. WI	ConductiveNo preference Did you have any problems charging?YesK_ If yes, please describe*	No		Yes ELL ehicle		No AON E which o ther	

SA: Strongly Agree; A: Agree; NS: Not Sure; D: Disagree: SD: Strongly Disagree: NA: Not Applicable

-	HIVER NAME: Tyrone Chamols LO		E & MOI	DEL: To	vota 1	lau	4EL
	HICLE APPLICATION:		D	ATE: 5	113/99	7	
					/		4
DF	RIVEABILITY	SA	A	NS	D	SD	NA
1.	The vehicle feels stable and safe		K	0 0 0	t <u>ceets</u>	Not	Free
2.	The vehicle steering is responsive		-				
3.	The vehicle acceleration is adequate	-	K				
4.	The vehicle braking is responsive and safe		K				
DF	RIVING CONTROLS AND GAUGES	/					
1.	The cabin temperature controls are easy to operate	V	. —		:		
2.	The "state-of-charge" gauge is helpful and easy to re-	ad					
3.	The "range remaining" gauge is helpful and easy to re-	ead L					
Cł	ARGING CONTROLS AND GAUGES			-			
1.	The charging controls are easy to operate			,×			
2.	The charging connector (plug) is easy to use		K	-			
з.	The charging cord is easy to manage		K				
4.	The vehicle charges adequately (full in the morning)		K				
5.	The charger is reasonably quiet		K			-	
6.	Do you know the differences between Inductive and (Conductive ch	narging?	Y	es V	No	
	1 .	If yes, which	do you p	refer?	Induc	tive	
14	ConductiveNo preference	,					
7.	Did you have any problems charging? Yes	1 No					
	If yes, please describe*		_		-		
	TERIAR						
	TERIOR						
1.	The heater provides adequate heat					_	
1.	The heater provides adequate heat The air conditioner provides adequate cooling	_	K	:-	_	_	=
1. 2. 3.	The heater provides adequate heat The air conditioner provides adequate cooling The vehicle is quiet	_			Ξ.	_	Ξ
1.	The heater provides adequate heat The air conditioner provides adequate cooling The vehicle is quiet Did you use electronic equipment (cell phone, radio,	etc.) inside th	e EV?	 Yes	N	~	
1. 2. 3.	The heater provides adequate heat The air conditioner provides adequate cooling The vehicle is quiet	etc.) inside th	e EV?	Yes Radio		~	 blem
1. 2. 3. 4.	The heater provides adequate heat The air conditioner provides adequate cooling The vehicle is quiet Did you use electronic equipment (cell phone, radio,	etc.) inside th	e EV?	V Yes Radio		~	 blem
1. 2. 3. 4.	The heater provides adequate heat The air conditioner provides adequate cooling The vehicle is quiet Did you use electronic equipment (cell phone, radio, If yes, please list equipment(s) and describe any prol	etc.) inside th	e EV?	Ves Radio	N	~	
1. 2. 3. 4. <u>G</u>	The heater provides adequate heat The air conditioner provides adequate cooling The vehicle is quiet Did you use electronic equipment (cell phone, radio, If yes, please list equipment(s) and describe any prol	etc.) inside th	e EV?	Yes Radio		~	
1. 2. 3. 4.	The heater provides adequate heat The air conditioner provides adequate cooling The vehicle is quiet Did you use electronic equipment (cell phone, radio, If yes, please list equipment(s) and describe any prol ENERAL The vehicle has adequate payload	etc.) inside th	e EV?	Ves Radio	N	~	
1. 2. 3. 4. G 1. 2.	The heater provides adequate heat The air conditioner provides adequate cooling The vehicle is quiet Did you use electronic equipment (cell phone, radio, If yes, please list equipment(s) and describe any prol ENERAL The vehicle has adequate payload The vehicle has adequate range	etc.) inside th	e EV?	Ves Radio		~	
1. 2. 3. 4. G 1. 2. 3.	The heater provides adequate heat The air conditioner provides adequate cooling The vehicle is quiet Did you use electronic equipment (cell phone, radio, If yes, please list equipment(s) and describe any prol ENERAL The vehicle has adequate payload The vehicle has adequate range The vehicle is easy to operate	etc.) inside th		Vyes Radio		~	
1. 2. 3. 4. G 1. 2. 3. 4.	The heater provides adequate heat The air conditioner provides adequate cooling The vehicle is quiet Did you use electronic equipment (cell phone, radio, If yes, please list equipment(s) and describe any prol ENERAL The vehicle has adequate payload The vehicle has adequate range The vehicle is easy to operate The vehicle is suited for your job application The vehicle meets your expectations	blems encoun		Radio		<u>?ro</u>	
1. 2. 3. 4. G 1. 2. 3. 4. 5.	The heater provides adequate heat The air conditioner provides adequate cooling The vehicle is quiet Did you use electronic equipment (cell phone, radio, If yes, please list equipment(s) and describe any prol ENERAL The vehicle has adequate payload The vehicle has adequate range The vehicle is easy to operate The vehicle is suited for your job application The vehicle meets your expectations	r gasoline veh		Radio		<u>?ro</u>	
1. 2. 3. 4. G 1. 2. 3. 4. 5. 6.	The heater provides adequate heat The air conditioner provides adequate cooling The vehicle is quiet Did you use electronic equipment (cell phone, radio, If yes, please list equipment(s) and describe any prol ENERAL The vehicle has adequate payload The vehicle has adequate range The vehicle is easy to operate The vehicle is suited for your job application The vehicle meets your expectations If you had to choose between this vehicle or a similar	r gasoline veh		Radio	UT Work, V	<u>?ro</u>	
1. 2. 3. 4. G 1. 2. 3. 4. 5. 6. C	The heater provides adequate heat The air conditioner provides adequate cooling The vehicle is quiet Did you use electronic equipment (cell phone, radio, If yes, please list equipment(s) and describe any prof ENERAL The vehicle has adequate payload The vehicle has adequate range The vehicle is easy to operate The vehicle is suited for your job application The vehicle meets your expectations If you had to choose between this vehicle or a similar would you select? (Circle One) Electric Vehi	r gasoline veh	icle for usoline V	Radio use in you ehicle	UT Work, V	<u>?ro</u>	

SA: Strongly Agree; A: Agree; NS: Not Sure; D: Disagree; SD: Strongly Disagree; NA: Not Applicable

Electric Vehicle Driver Questionnaire Participant _____

DR	IVER NAME:	LOCATION	1:	SAN	J	ACIN	70	-
	HICLE NUMBER: 23764	VEHICLE						RAVE
VE	HICLE APPLICATION: METERING				2020 C			
DR	IVEABILITY		SA	A	NS	D	SD	NA
1.	The vehicle feels stable and safe					×		
2.	The vehicle steering is responsive		×				-	
3.	The vehicle acceleration is adequate		×					
4.	The vehicle braking is responsive and safe	•	×					
	IVING CONTROLS AND GAUGES		_		_	_	-	
1.	The cabin temperature controls are easy to opera	te	-	¥				
2.	The "state-of-charge" gauge is helpful and easy to				*			
3.	The "range remaining" gauge is helpful and easy			×				
Ch	ARGING CONTROLS AND GAUGES							
1.	The charging controls are easy to operate		÷.					
2.	The charging connector (plug) is easy to use		8		_			
3.	The charging cord is easy to manage		7					
4.	The vehicle charges adequately (full in the morning	ng)	*					
5.	The charger is reasonably quiet		+					
6.	Do you know the differences between Inductive a	nd Conductiv	e cha	rging?		res _	× No	
	If yes, which do you prefer? Inductive							
7.							×	
	If yes, please describe*							
IN	TERIOR							
1.	The heater provides adequate heat			¥		-		
2.	The air conditioner provides adequate cooling			*			_	
3.	The vehicle is quiet		×		-			
4.	Did you use electronic equipment (cell phone, rad	tio, etc.) insid	le the	EV?	× Yes		No	
	If yes, please list equipment(s) and describe any							
		•	e su ano					
GE	ENERAL						•	
1.	The vehicle has adequate payload					×		
2.	The vehicle has adequate range			×				
з.	The vehicle is easy to operate			¥				
4.	The vehicle is suited for your job application		_			×		
5.	The vehicle meets your expectations				×			
6.	If you had to choose between this vehicle or a sin	nilar gasoline	vehic	le for us	se in yo	ur work	, which	one
	would you select? (Circle One) Electric V	ehicle	Gas	oline Ve	hicle	Ei	ther	
C	OMMENTS*						,	
W	hat did you like best? not Supe Bur	+ Reople	Ci	K. To	TA	IKal	but	1+
		-						
W	hat did you like least? wind moves	+ AROU	nd	Tom	uch	and	Don	1
	Feel it would be Safe ,							
	and the second							

SA: Strongly Agree: A: Agree: NS: Not Sure: D: Disagree: SD: Strongly Disagree: NA: Not Applicable

Electric Vehicle	Driver	Questionnaire
Participant _		

DRIVER NAME:	LOCATION:	SAN	JA	CIN 7	0	
VEHICLE NUMBER: 23770	VEHICLE MAK	E & MODE	L: 70	YOT	4 RA	v4
VEHICLE APPLICATION: METERING	·	DA	TE:		_	
DRIVEABILITY	SA	A	NS	D	SD	NA
1. The vehicle feels stable and safe		X				_
2. The vehicle steering is responsive		X				
3. The vehicle acceleration is adequate		\times	_			
4. The vehicle braking is responsive and safe		X				
DRIVING CONTROLS AND GAUGES						
1. The cabin temperature controls are easy to ope	rate	X				
2. The "state-of-charge" gauge is helpful and easy	to read	$\underline{\times}$				
3. The "range remaining" gauge is helpful and eas	y to read	X				
CHARGING CONTROLS AND GAUGES						
1. The charging controls are easy to operate		X				
2. The charging connector (plug) is easy to use		\times				
3. The charging cord is easy to manage		×			_	
4. The vehicle charges adequately (full in the morn	ning)	X				
5. The charger is reasonably quiet		×		_		
6. Do you know the differences between Inductive	and Conductive ch	arging?	Y	es _	XNo	
If yes, which do you prefer? Inductive						
7. Did you have any problems charging?Y						
If yes, please describe*						
INTERIOR						
1. The heater provides adequate heat .			E	X		
2. The air conditioner provides adequate cooling		X	-			
3. The vehicle is quiet		x				
4. Did you use electronic equipment (cell phone, r	adio, etc.) inside the	EV?	XYes	-	No	
If yes, please list equipment(s) and describe an			2 -			
	,,					
GENERAL		1-				
1. The vehicle has adequate payload		A	—			
2. The vehicle has adequate range					X	
3. The vehicle is easy to operate		X				
4. The vehicle is suited for your job application		4	-		_	
5. The vehicle meets your expectations		4				
6. If you had to choose between this vehicle or a s	imilar gasoline vehi	icle for us	e in you	r work,	which o	ne
would you select? (Circle One) Electric	Vehicle Ga	soline Vel	hicle)	Ei	ther	
COMMENTS*			/			
What did you like best? Qui ETNESS	OF VEAK	it		_	11.5.5	
What did you like least? NOT LONG	ENOUGH	RA	NGF			
			-			

SA: Strongly Agree: A: Agree: NS: Not Sure: D: Disagree: SD: Strongly Disagree: NA: Not Applicable

SAVD VVVV VVVV e char hich do	A		D 	SD 	NA
					NA
		fer? _	Indu	ctive _	_
1					
1					
-					-
			-		
		Yes	VI	No	
		-			
V					-
/					
1				-	
V					
					e
Gaso	inte ver	incle	EIU	ier	
nes	5 0	nd s	smoot	thres	5
1		110	hill-	14	4
	vehicle	vehicle for us		vehicle for use in your work,	V

SA: Strongly Agree; A: Agree; NS: Not Sure; D: Disagree; SD: Strongly Disagree; NA: Not Applicable

RIVER NAME: MICHAEL VILLA	LOCATION	-			0	5	-
EHICLE #: 23926	VEHICLE	MAKE		1000	Roy	100	.70
EHICLE APPLICATION: M-t. R-,).	. <u>11</u>	-	DA	TE:	5/1	3/99	
RIVEABILITY		SA	A	NS	D	SD	NA
The vehicle feels stable and safe	-		\checkmark				
The vehicle steering is responsive			1				_
The vehicle acceleration is adequate			1				
The vehicle braking is responsive and safe						V	_
RIVING CONTROLS AND GAUGES							
. The cabin temperature controls are easy to c	operate _		L				_
. The "state-of-charge" gauge is helpful and ea			V				_
. The "range remaining" gauge is helpful and e			~				
HARGING CONTROLS AND GAUGES							
. The charging controls are easy to operate			~				
. The charging connector (plug) is easy to use			1				
. The charging cord is easy to manage			1			_	_
. The vehicle charges adequately (full in the m	noming)		1				
. The charger is reasonably quiet							
. Do you know the differences between Induct	tive and Conductiv	ve cha	rging?		Yes _	J No	
		hish de		for?	Indi	uctive	
	If yes, w	nich de	you pie				
Conductive No preference	If yes, w	nich de	you pie	ileit .			
Conductive No preference		nich de	you pre	Nerr .			
Did you have any problems charging?	_YesNo	nich de	o you pre	nent .			
	_YesNo		you pre				
7. Did you have any problems charging?	_YesNo						
Did you have any problems charging? If yes, please describe* NTERIOR	_YesNo						
Did you have any problems charging? If yes, please describe* NTERIOR The heater provides adequate heat	_YesNo						
	_YesNo	_	rkk			====	
Did you have any problems charging?	_YesNo	_	rkk			====	
 Did you have any problems charging?	Yes No	de the				====	
Did you have any problems charging? If yes, please describe* NTERIOR The heater provides adequate heat The air conditioner provides adequate coolir The vehicle is quiet Did you use electronic equipment (cell phon	Yes No	de the				====	
Did you have any problems charging? If yes, please describe* NTERIOR The heater provides adequate heat The air conditioner provides adequate coolir The vehicle is quiet Did you use electronic equipment (cell phon If yes, please list equipment(s) and describe GENERAL	Yes No	de the				====	
Did you have any problems charging? If yes, please describe* NTERIOR The heater provides adequate heat The air conditioner provides adequate coolir The vehicle is quiet Did you use electronic equipment (cell phon If yes, please list equipment(s) and describe GENERAL	Yes No	de the				====	
 Did you have any problems charging?	Yes No	de the				====	
Did you have any problems charging? If yes, please describe* MTERIOR The heater provides adequate heat The air conditioner provides adequate coolir The vehicle is quiet Did you use electronic equipment (cell phon If yes, please list equipment(s) and describe GENERAL The vehicle has adequate payload The vehicle has adequate range The vehicle is easy to operate	Yes No	de the				====	
Did you have any problems charging?	Yes No	de the				====	
 7. Did you have any problems charging?	Yes No	de the counte		 		.No	
 Did you have any problems charging?	Yes No	de the counte		↓ Ye	es	No	Done
 7. Did you have any problems charging?	Yes No	de the counte		↓ Ye	es	.No	one
 Did you have any problems charging?	Yes No	de the counte		↓ Ye	es	No	one
 7. Did you have any problems charging?	Yes No	de the counte		↓ Ye	es	No	one
 Did you have any problems charging?	Yes No	de the counte		↓ Ye	es	No	one

SA: Strongly Agree: A: Agree: NS: Not Sure: D: Disagree: SD: Strongly Disagree: NA: Not Applicable