

## Issue Brief – Fleet Hybrids

NUMBER CFGO-08-11

### SUMMARY

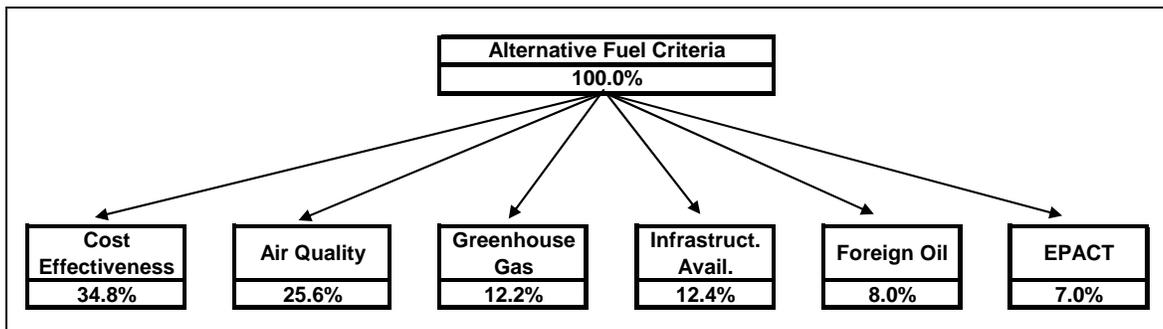
The Division of Fleet Operations is required by House Bill 110 *State Fleet Efficiency Requirements* (2007 General Session) to purchase the most economically appropriate vehicles for the purposes and driving conditions for which they will be used. In addition, the Governor has asked the Division to pursue alternative fuel options that will improve the air quality and environment of Utah and specifically look at alternative fuel options.

The Division of Fleet Operations finds that hybrid vehicle options are the most cost efficient means to accomplishing the Governor's energy and environmental policy initiatives based on several different criteria. However, if the Legislature's requirement of cost efficiency were the only criteria, regular-gasoline vehicles would be the best option in most cases.

### DISCUSSION AND ANALYSIS

#### *Criteria*

The Division of Fleet Operations has selected several criteria for evaluating vehicle purchases to comply with both the Legislature's and Governor's directives. These six criteria are: Cost Effectiveness, Air Quality Emissions, Greenhouse Gas Reduction, Available Infrastructure, Decreased Dependence on Foreign Oil, and Federal EPACT Compliance.



- *Cost Effectiveness.* This criterion measures the total cost of the vehicle over its useful lifetime by adding the MSRP purchase cost from the manufacturer to the vehicle's lifetime fuel cost. The lifetime fuel cost is determined by multiplying 100,000 miles (the current replacement mileage on most vehicles) times the current cost of a gallon of gas divided by the vehicle's miles per gallon of fuel consumption. This criterion gives preference to vehicles with lower total lifetime costs.
- *Air Quality Emissions.* This criterion measures the amount of air pollution a vehicle emits and gives preference to vehicles with low emissions. The pollutants measured include: NOx (Nitrogen Oxide), NMOG (Non-Methane Organic Gases), CO (Carbon Monoxide), PM (Particulate Matter), and HCHO (Formaldehyde).
- *Greenhouse Gas Reduction.* This criterion measures the amount of carbon dioxide a vehicle emits and gives a preference to vehicles with low emissions.
- *Available Infrastructure.* This criterion measures the amount of infrastructure available for the various sources of vehicle fuel and gives a preference to vehicles that have access to an existing fuel network.
- *Decreased Dependence on Foreign Oil.* This criterion measures the annual amount of oil consumption for each vehicle based on the miles per gallon and source of fuel. This measure gives preference to vehicles that consume less barrels of oil annually.

- **Federal EPACT Compliance.** Congress passed the Energy Policy Act of 1992 which requires states to acquire a certain number of alternative fuel vehicles which are capable of operating on non-petroleum fuels. Preference for this measure is given to vehicles that comply with EPACT.

**Alternatives**

The State operates a variety of vehicle classes ranging from small sedans to heavy-duty trucks. To best optimize the fleet in response to the Legislature’s request for cost efficiency and the Governor’s request for environmental efficiency, the Division of Fleet Operations focused their attention five major class types – compact sedan, midsize sedan, compact SUV, Midsize SUV, and pickup trucks.

In each vehicle class, the Division identified vehicle options which included the current vehicle purchased by the Division, other gasoline fueled vehicles that could be purchased, alternative fueled vehicles (ethanol and natural gas), and hybrid electric-gas options. The Division then collected the data listed below for each vehicle to enable them to rate the vehicles based on the six criteria previously mentioned. Newer data is now becoming available; however, the Analyst was not able to assimilate all of that data before the print date.

Vehicle Type	Cost Effectiveness Criteria	Make/Model	Annual Fuel Efficiency					Vehicle Cost (MSRP from the Manufacturer)	Total Cost	Annual Petroleum Consumption (barrels per year)	Green House Gas Emissions (Range = 16.2 and 3.5 Tons per year)	Air Pollution Score (1-10, 10 being best)	Infrastructure (Stations Available)	EPACT compliant
			Cost per gallon (CPG)	City MPG	Higway MPG	Combined MPG	CPG x 100,000 miles / MPG							
Compact Sedan	Gasoline (currently used)	2007 Ford Focus	\$2.72	23	31	26.0	\$10,461.54	\$14,040	\$24,502	13.2	7.1	7	Extensive	No
	Gasoline (could be used)	2007 Honda Civic	\$2.72	25	36	29.0	\$9,379.31	\$15,010	\$24,389	11.8	6.3	6	Extensive	No
	Hybrid	2007 Toyota Prius*	\$2.72	48	45	46.0	\$5,913.04	\$22,175	\$28,088	7.4	4	8	Extensive	Possible
	Hybrid	2007 Honda Civic	\$2.72	40	45	42.0	\$6,476.19	\$22,600	\$29,076	8.2	4.4	9	Extensive	Possible
	E85	2006 Dodge Avenger	\$2.92	14	20	16.0	\$18,250.00	\$19,020	\$37,270	5	6.9	7	Very Limited	Yes
	CNG	2006 Honda Civic (07 & 08 N)	\$0.73	24	36	28.0	\$2,607.14	\$24,590	\$27,197	0.1	5.4	9	Limited	Yes
Midsize Sedan	Gasoline (currently used)	2007 Chevy Malibu	\$2.72	21	31	25.0	\$10,880.00	\$17,865	\$28,745	13.7	7.3	6	Extensive	No
	Gasoline (could be used)	2007 Toyota Camery	\$2.72	21	30	24.0	\$11,333.33	\$18,570	\$29,903	14.3	7.7	6	Extensive	No
	Gasoline (could be used)	2007 Ford Fusion	\$2.72	20	29	23.0	\$11,826.09	\$17,430	\$29,256	14.9	8	6	Extensive	No
	Hybrid	2007 Honda Accord	\$2.72	24	32	27.0	\$10,074.07	\$31,090	\$41,164	12.7	6.8	9	Extensive	Possible
	Hybrid	2007 Toyota Camery	\$2.72	33	34	34.0	\$8,000.00	\$25,200	\$33,200	10.1	5.4	8	Extensive	Possible
	Hybrid	2008 Chevrolet Malibu	\$2.72	24	32	27.0	\$10,074.07	Not Unavailable		12.7	6.8	8	Extensive	Possible
	Hybrid	2007 Toyota Prius	\$2.72	48	45	46.0	\$5,913.04	\$22,175	\$28,088	7.4	4	8	Extensive	Possible
E85	2008 Chevrolet Impala**	\$2.92	14	21	16.0	\$18,250.00	\$21,700	\$39,950	5	6.9	6	Very Limited	Yes	
Compact SUV	Gasoline (currently used)	Jeep Liberty	\$2.72	15	21	17.0	\$16,000.00	\$22,260	\$38,260	20.1	10.8	6	Extensive	No
	Gasoline (could be used)	2008 Ford Escape	\$2.72	19	24	21.0	\$12,952.38	\$18,770	\$31,722	16.3	8.7	6	Extensive	No
	Hybrid	2008 Ford Escape	\$2.72	29	27	28.0	\$9,714.29	\$25,075	\$34,789	12.2	6.6	8	Extensive	Possible
	Hybrid	2008 Mazda Tribute	\$2.72	29	27	28.0	\$9,714.29	Not Unavailable		12.2	6.6	8	Extensive	Possible
	Hybrid	2008 Mercury Mariner	\$2.72	29	27	28.0	\$9,714.29	\$27,705	\$37,419	12.2	6.6	8	Extensive	Possible
	E85	Many Options	\$2.92											
Midsize SUV	Gasoline (currently used)	2008 Dodge Durango	\$2.72	13	18	15.0	\$18,133.33	Not Unavailable		22.8	12.2	6	Extensive	No
	Gasoline (could be used)	2008 Ford Explorer	\$2.72	13	19	15.0	\$18,133.33	Not Unavailable		22.8	12.2	6	Extensive	No
	Hybrid	2007 Toyota Highlander	\$2.72	27	25	26.0	\$10,461.54	Not Unavailable		13.2	7.1	8	Extensive	Possible
	Hybrid	2008 Dodge Durango	\$2.72	N/A	N/A	N/A		Not Unavailable		N/A	N/A	N/A	Extensive	Possible
	Hybrid	Chevrolet Yukon	\$2.72	N/A	N/A	N/A		Not Unavailable		N/A	N/A	N/A	Extensive	Possible
	Hybrid	2008 Chevrolet Tahoe	\$2.72	N/A	N/A	N/A		Not Unavailable		N/A	N/A	N/A	Extensive	Possible
	E85	Many Options	\$2.92											
Pick-up Trucks	Gasoline (currently used)	2007 Dodge Ram	\$2.72	13	17	14	\$19,428.57	\$22,405	\$41,834	24.5	13.1	6	Extensive	No
	Hybrid	2008 Chevrolet Silverado	\$2.72	15	18	16	\$17,000.00	Not Unavailable		21.4	11.4	3	Extensive	Possible
	E85	Many Options	\$2.92											

**Scoring**

In order to get a true comparison by vehicle class of which vehicle is the best, a scoring system was created for each of the six criteria. The scores range from a low of 1 to a high of 9. Each criterion is scored independent of the others.

For criteria such as *Cost Efficiency*, *Greenhouse Gas*, and *Dependence on Foreign Oil* the scoring system defines each score based on a high and low value. For *Cost Efficiency* the high and low values are the total lifetime cost of the vehicle starting at \$24,000 or less and increasing to \$42,000 in increments of \$2,250. For *Greenhouse Gas* the high and low values are the tons of carbon produced by the vehicle each year starting at 4.5 tons or less and increasing to 16.5 tons in increments of 1.5 tons. For *Dependence on Foreign Oil* the high and low values are the annual barrels of oil consumed by the vehicle starting at four and increasing to 28 in increments of three barrels of oil per year.

*EPACT Compliance* and *Available Infrastructure* criteria cannot be scored based on a range of values because they have discreet possibilities of “Yes”, “No”, or “Somewhere in Between.” For the *EPACT Compliance* criterion, vehicles receive a score of 9 if they comply with the federal Act, a one if they do not comply with the Act, and a six if there is a possibility that the EPA will give credit to the State under EPACT for a vehicle that is not specifically listed as alternative fueled (such as hybrids). For the *Available Infrastructure* criterion, a vehicle

receives a nine if the fuel dispensing network is extensive (over 100 stations statewide), a four if the network is limited (over 25 stations statewide), and a two if the network is very limited (less than 25 stations statewide).

The scores for the *Air Quality* criterion were calculated by the EPA based on the amount of Nitrogen Oxides, Non-Methane Organic Gases, Carbon Monoxide, Particulate Matter, and Formaldehyde emitted by each vehicle model as shown in the table below. The table also shows the scoring of all the criteria as described above.

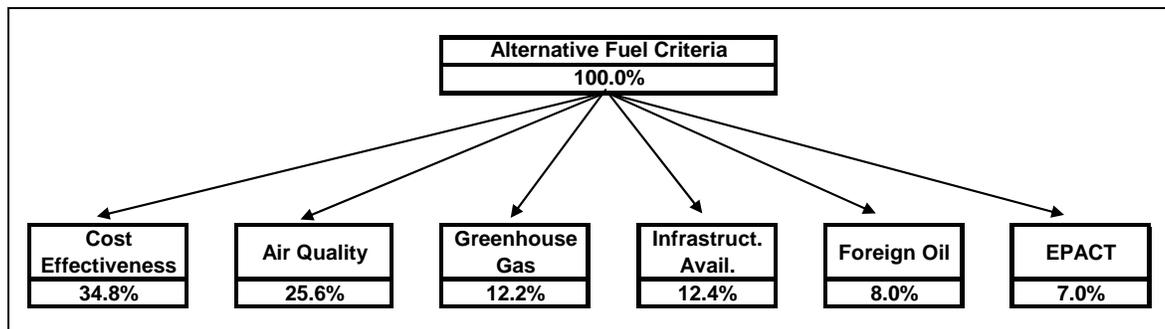
Total Cost			Greenhouse Gas (tons per year)			Foreign Oil (Annual Oil Consumption)			EPACT		Infrast. Avail	
High	Low	Score	High	Low	Score	High	Low	Score	Yes	Score	Extensive	Score
\$24,000	\$0	9	4.50	0.00	9	4	0	9	Yes	9	Extensive	9
\$26,250	\$24,001	8	6.00	4.51	8	7	4.1	8		8		8
\$28,500	\$26,251	7	7.50	6.01	7	10	7.1	7		7		7
\$30,750	\$28,501	6	9.00	7.51	6	13	10.1	6	Possible	6		6
\$33,000	\$30,751	5	10.50	9.01	5	16	13.1	5		5		5
\$35,250	\$33,001	4	12.00	10.51	4	19	16.1	4		4	Limited	4
\$37,500	\$35,251	3	13.50	12.01	3	22	19.1	3		3		3
\$39,750	\$37,501	2	15.00	13.51	2	25	22.1	2	No	2	Very Limited	2
\$42,000	\$39,751	1	16.50	15.01	1	28	25.1	1		1		1

Air Pollution Score	Emission Limits at Full Useful Life Maximum Allowed Grams per Mile					Air Quality Score
	NOx	NMOG	CO	PM	HCHO	
9	0.02	0.01	2.1	0.01	0.004	9
8	0.03	0.055	2.1	0.01	0.011	8
7	0.04	0.07	2.1	0.01	0.011	7
6	0.07	0.09	4.2	0.01	0.018	6
5	0.1	0.09	4.2	0.01	0.018	5
4	0.15	0.09	4.2	0.02	0.018	4
3	0.2	0.156	4.2	0.02	0.018	3
2	0.3	0.18	4.2	0.06	0.018	2
1	0.6	0.28	6.4	0.08	0.027	1

**Criteria Weighting**

The Division recognizes that not all criteria listed above are equal in weight when making decisions. To account for this fact, a methodology was created to weight the scores for each criteria based on their relevant importance. The higher the weight, the more important the criterion is relative to the others. The figure below shows how the Division allocated the weights to each of the six criteria.



**Results**

The table below shows the results of the scoring and the criteria weighting for the vehicles being compared in each of the five vehicle classes. The Toyota Prius scored the highest in both the compact sedan and midsize sedan categories with a score of 7.678 (out of 9). The Toyota Prius appears in both categories because it is classified by the industry as both a compact and midsize car (though arguably it is a little smaller than a midsize and a little bigger than a compact). For the Compact SUV category, the Ford Escape Hybrid scored a 6.243 making it the top choice, however, dealers are selling these vehicles so rapidly in the private market that none are available for state purchase. Finally, the Toyota Highlander hybrid scored the highest in the Midsize SUV category and the gasoline fueled Dodge Ram scored the highest in the pick-up truck category.

In general the results favor hybrid vehicles because of the available gasoline infrastructure and the low air quality and greenhouse gas emissions. Compressed Natural Gas vehicles don't score as high as hybrids because of the

lack of available infrastructure and slightly higher prices. Ethanol vehicles (E85) score at the bottom due to high costs, relatively higher emissions, and lack of an available infrastructure.

Vehicle Type	Fuel Type	Make/Model	Cost Effect.	Air Quality	Green. Gas	Infrastr. Avail.	Foreign Oil	EPACT	Total	Rank
Compact Sedan	Gasoline (currently used)	2007 Ford Focus	8	7	7	9	5	1	7.02	4
	Gasoline (could be used)	2007 Honda Civic	8	6	7	9	6	1	6.84	5
	Hybrid	2007 Toyota Prius*	7	8	9	9	7	6	7.678	1
	Hybrid	2007 Honda Civic	6	9	9	9	7	6	7.586	2
	E85	2008 Dodge Avenger	3	7	7	2	8	9	5.208	6
	CNG	2006 Honda Civic (07 & 08 not avail.)	7	9	8	4	9	9	7.562	3
Midsize Sedan	Gasoline (currently used)	2007 Chevy Malibu	6	6	7	9	5	1	6.064	3
	Gasoline (could be used)	2007 Toyota Camery	6	6	6	9	5	1	5.942	4
	Gasoline (could be used)	2007 Ford Fusion	6	6	6	9	5	1	5.942	4
	Hybrid	2007 Honda Accord	1	9	7	9	6	6	5.522	6
	Hybrid	2007 Toyota Camery	4	8	8	9	6	6	6.432	2
	Hybrid	2008 Chevrolet Malibu		8	7	9	6	6	4.918	7
	Hybrid	2007 Toyota Prius	7	8	9	9	7	6	7.678	1
	E85	2008 Chevrolet Impala**	1	6	7	2	8	9	4.256	8
Compact SUV	Gasoline (currently used)	Jeep Liberty	2	6	4	9	3	1	4.146	5
	Gasoline (could be used)	2008 Ford Escape	5	6	6	9	4	1	5.514	3
	Hybrid	2008 Ford Escape	4	8	7	9	6	6	6.31	1
	Hybrid	2008 Mazda Tribute		8	7	9	6	6	4.918	4
	Hybrid	2008 Mercury Mariner	3	8	7	9	6	6	5.962	2
Midsize SUV	Gasoline (currently used)	2008 Dodge Durango		6	3	9	2	1	3.248	2
	Gasoline (could be used)	2008 Ford Explorer		6	3	9	2	1	3.248	2
	Hybrid	2007 Toyota Highlander		8	7	9	5	6	4.838	1
	Hybrid	2008 Dodge Durango				9		6	1.536	4
	Hybrid	Chevrolet Yukon				9		6	1.536	4
	Hybrid	2008 Chevrolet Tahoe				9		6	1.536	4
Pick-up Trucks	Gasoline (currently used)	2007 Dodge Ram	1	6	3	9	2	1	3.596	1
	Hybrid	2008 Chevrolet Silverado		3	4	9	3	6	3.032	2
Criteria Weights			34.8%	25.6%	12.2%	12.4%	8.0%	7.0%		

### Legislative Request

Each year the Legislature authorizes the amount of capital assets internal service funds may purchase. For the Division of Fleet Operations, vehicle purchases are the primary capital outlays. Last year the Legislature authorized Fleet to spend up to \$16.3 million on capital purchases. The Division would like to replace 169 vehicles in FY 2008 and 209 vehicles in FY 2009 with hybrids. Hybrid vehicles cost up to \$10,000 more than a standard vehicle to purchase which means the Division will need additional capital outlay authority to make those purchases. The Division therefore requests an additional \$1,300,000 Capital Outlay authorization for FY 2008 and a \$1,540,000 Capital Outlay authorization in FY 2009.

As of fiscal year end 2007, the motor pool program has a retained earnings balance of \$5.7 million, which the Division proposes using part of to fund the hybrid purchases. The Division, however, will still need Legislative authority for the capital outlay. The Division further proposes to extend the replacement mileage on the hybrid vehicles from the standard 90,000 miles to up to 120,000 miles in order to recoup the higher price of a hybrid vehicle over and above that of a regular fueled vehicle.

### CONCLUSION

The Division of Fleet Operations finds that the hybrid vehicle options are most cost efficient means to accomplishing the Governor's energy and environmental policy initiatives. However, if cost efficiency were the only criteria (which also includes miles per gallon and fuel prices), regular-gasoline vehicles would be the best option in most cases. Hybrid vehicles cost approximately \$10,000 more than a standard vehicle to purchase, though they save approximately \$5,000 to \$6,000 in fuel costs over their lifetime. The analysis above by the Division of Fleet Operations suggests, however, that hybrids have a greater environmental benefit than regular-fueled vehicles.