

# HYBRIDS

IS NOW THE TIME?

Colorado State Fleet  
Management

## HYBRIDS

# What is a Hybrid?

- Basic Definition: Electric Motor assists internal combustion engine (ICE)
- "Full Hybrid": Electric Motor or ICE power the vehicle alone or in combination depending on real-time monitoring of demand and electrical charge.
- Various Configurations
  - Series – Only electric motor drives the wheels
  - Parallel – Both electric motor and ICE drive the wheels
  - Series/Parallel – ICE, Electric, or Both at any time
  - Single or Two-Mode
  - Plug-in Hybrid – External electric charge

## HYBRIDS

# A Hybrid is NOT:

- Flexible Fuel Vehicle  
(Although there can be flex fuel hybrids)
- Alternative Fuel Vehicle
- Dual Fuel Vehicle
- All Electric Vehicle

## HYBRIDS

# Why Consider Hybrids?

- "Greening"

Fuel saving initiatives are VERY big in many states

- May be a good financial decision
- May be other worthwhile incentives
- May be REQUIRED regardless of economics

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# Potential Benefits

- Fuel Savings
- Tax Credits or Rebates
  - Federal rebate declining thru 2010
  - May or may not be available to states (vendor pass-thru?)
  - Some states offer their own incentives
- Reduced Environmental Impact
- Higher Resale Values? (Opinions differ)
- Other Incentives (Limited value to states)
  - Use of HOV Lanes
  - Privileged Parking

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# It's Not All Positive

- Initial cost premium (Often significant)
- Usually only available with High Option packages
- Limited Models and Types
- May be higher insurance costs
- Long term maintenance costs are unknown
- Battery pack life & cost unknown (8 yrs/100,000 miles)
- Unusual safety concerns
  - High voltage danger to technicians
  - Noiseless when electric

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# Fuel Economy

- Estimated 13% to 45% improvement
  - Based on EPA combined ratings
  - Varies significantly by model
  - Real Life fuel results may differ from EPA rating
- EPA ratings reduced for all models
  - More closely related to real world driving conditions
  - Hybrid ratings were impacted the most
    - Prius reduced from 55 to 46
    - Civic Hybrid reduced from 50 to 42
- City driving offers greatest potential benefit  
(Prius even shows higher city rating than highway)

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# Hybrid Dilemma for States

Dilemma: Huge initial cost premium makes hybrids difficult to justify

- Good News / Bad News
  - Good News: Extremely good price on non-hybrids
  - Bad News: Premium almost impossible to overcome
- Fed incentives often not available to states
- Individual incentives often not available or of little value
- No EPA credits for hybrids

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# Economics

- Analysis is only as good as the data
- Assumptions are critical
  - Be conservative
  - Don't be swayed by your desired outcome
- Use your own fleet data wherever you can
- Sensitivity analysis is useful (What if?)
- Life Cycle Analysis is the best approach

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# Life Cycle Analysis

## Key Variables

- Initial net purchase price (certainty: HI)
- MPG Estimates (certainty: HI)
- Fuel Price (certainty: MED)
- Annual Miles Driven (certainty: MED)
- Estimated Economic Life (certainty: MED)
- Estimated Resale (certainty: LOW)
- Maintenance Cost Difference (certainty: LOW)

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## Using NAFA Analysis (Chris Amos)

### Lifecycle Cost Analysis - Owned (Lease Financed)

	Jeep Liberty	Escape Hybrid
<b>Acquisition Cost</b>		
MSRP	\$ 26,680.00	\$ 28,525.00
Fleet Bid Price	\$ 17,172.00	\$ 24,019.00
Hybrid Tax Credit	\$ -	\$ -
<b>Net Acquisition Cost</b>	<b>\$ 17,172.00</b>	<b>\$ 24,019.00</b>

	Jeep Liberty	Escape Hybrid
<b>Fixed Costs</b>		
Effective Depreciation	\$ 11,284.77	\$ 17,724.65
<i>Projected Resale Price</i>	\$ 5,887.23	\$ 6,294.35
Interest (Opportunity Cost of Money)	\$ 3,198.85	\$ 4,360.37
<b>Total Fixed Cost:</b>	<b>\$ 14,483.62</b>	<b>\$ 22,085.01</b>

	Jeep Liberty	Escape Hybrid
<b>Operating Costs</b>		
Total Fuel Cost	\$ 15,876.92	\$ 10,675.86
<i>Estimated Miles-per-Gallon</i>	19.5	29
Hybrid Battery Pack	NA	\$ 2,500.00
Total Maintenance Cost	\$ -	\$ -
<b>Total Operating Cost:</b>	<b>\$ 15,876.92</b>	<b>\$ 13,175.86</b>

<b>Total Lifecycle Cost:</b>	<b>\$ 30,360.54</b>	<b>\$ 35,260.88</b>
Lifecycle Cost-per-Mile:	\$ 0.2530	\$ 0.2938
<b>Incremental Hybrid Cost / (Saving)</b>		<b>\$ 4,900.34</b>
<b>Break-Even Cost per Gallon</b>		<b>\$ 5.43</b>

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## Simplified Analysis

### HYBRID BREAK-EVEN ANALYSIS

FORD ESCAPE HYBRID VS. JEEP LIBERTY

Based on 2007 State Acquisition Prices

#### ASSUMPTIONS:

Annual miles driven =	15,000 miles
Mile per gallon basic model =	19.5 mpg
Mile per gallon hybrid =	29 mpg
Fuel cost per gallon (State cost) =	\$ 2.58 \$/gal. = \$ 3.00 pump price
Life of Vehicle =	8 years
Finance Rate =	3.79%
Battery Pack Replacement Cost =	\$2,500

Annual gallons used per year (annual miles / estimated miles per gallon):

Basic Model =	769 gallons
Hybrid =	517 gallons
Difference =	252 gallons

Annual savings per year = annual gallons difference \* fuel cost per gallon = **\$ 650**

#### Incremental Cost Differences:

Ford Escape Hybrid	\$ 24,019	(Net of credits or passthroughs)
Jeep Liberty	\$ 17,172	
Hybrid premium	\$ 6,847	
Plus Additional finance charges	\$ 1,218	(over life of vehicle)
Cost of Battery Pack	\$ 2,500	(only if over 100,000 miles)
Less additional resale value	\$ 408	estimated (may be negative)
<b>Total Hybrid premium</b>	<b>\$ 10,157</b>	
Less Total Fuel Savings	\$ 5,201	
<b>Net Cost or (Savings)</b>	<b>\$ 4,956</b>	

Hybrid Premium	Payback (Years)
\$ 10,157	15.6 years

Break-Even Fuel Price/Gal. = **\$5.46** (Regular pump price)

Break-Even Annual Miles = **29,294**

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## Prius vs. Malibu (Actual Colorado Data)

<b>HYBRID BREAK-EVEN ANALYSIS</b>			
<b>TOYOTA PRIUS VS. CHEVY MALIBU</b>			
<b>Based on 2007 State Acquisition Prices</b>			
<b>ASSUMPTIONS:</b>			
Annual miles driven =	15,000	miles	
Mile per gallon basic model =	27.3	mpg	
Mile per gallon hybrid =	43	mpg	(EPA=46)
Fuel cost per gallon (State cost) =	\$2.58	\$/gal. =	<b>\$3.00</b> pump price
Life of Vehicle =	8	years	
Finance Rate =	3.79%		
Battery Pack Replacement Cost =	\$2,500		
Annual gallons used per year (annual miles / estimated miles per gallon):			
Basic Model =	549	gallons	
Hybrid =	349	gallons	
Difference =	201	gallons	
Annual savings per year = annual gallons difference * fuel cost per gallon =			<b>\$518</b>
<b>Incremental Cost Differences:</b>			
Toyota Prius Hybrid	\$ 21,277	(Net of credits or passthroughs)	
Chevy Malibu	\$ 14,093		
Hybrid premium	\$ 7,184		
Plus Additional finance charges	\$ 1,278	(over life of vehicle)	
Cost of Battery Pack	\$ 2,500	(only if over 100,000 miles)	
Less additional resale value	\$ 500	estimated (may be negative)	
<b>Total Hybrid premium</b>	<b>\$ 10,462</b>		
Less Total Fuel Savings	\$ 4,141		
<b>Net Cost or (Savings)</b>	<b>\$ 6,322</b>		
<b>Hybrid Premium</b>		<b>Payback (Years)</b>	
\$ 10,462		<b>20.2</b>	years
<b>Break-Even Fuel Price/Gal. =</b>	<b>\$6.94</b>	(Regular pump price)	
<b>Break-Even Annual Miles =</b>	<b>37,901</b>		

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# Prius vs. Malibu (Base Assumptions)

- Hybrid Premium: \$7,184
- Annual Miles Driven: 15,000
- Malibu MPG: 27.3
- Prius MPG: 43.0
- Fuel \$/Gallon: \$3.00
- Vehicle Life: 8 years
- Finance Rate: 3.79%
- Battery Pack Cost: \$2,500
- Battery Cost After 100,000?: Yes
- Resale Premium for Hybrid: \$500

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# Sensitivity Analysis (What If?)

	BASE	4 Years	25,000 Miles	Battery Cost=\$0	Prius \$3,000 less
Annual Fuel Savings	\$518	\$518	\$863	\$518	\$518
Payback Period (Yrs)	20.2	15.4	12.1	15.4	13.4
B/E \$ per Gallon	\$6.94	\$10.34	\$4.33	\$5.38	\$4.74
B/E Annual Miles	37,901	57,689	37,901	28,844	25,000
Net Cost or (Savings)	\$6,322	\$5,892	\$3,561	\$3,822	\$2,788
B/E Resale Premium	\$6,822	\$6,392	\$4,061	\$4,322	\$3,388

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# Resale Sensitivity (Prius vs Malibu)

Hybrid Resale Premium	B/E \$ per Gallon	Net Cost or (Savings)
(\$2,000)	\$8.50	\$8,822
\$0	\$7.25	\$6,822
\$2,000	\$6.00	\$4,822
\$4,000	\$4.76	\$2,822
\$6,000	\$3.51	\$822
\$8,000	\$2.27	(\$1,178)

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# Resale Sensitivity (Prius vs Malibu)

If Held for 4 Years @ 20,000 per year		
Hybrid Resale Premium	B/E \$ per Gallon	Net Cost or (Savings)
(\$2,000)	\$10.20	\$7,702
\$0	\$8.33	\$5,702
\$2,000	\$6.46	\$3,702
\$4,000	\$4.59	\$1,702
\$6,000	\$2.72	(\$298)
\$8,000	\$0.85	(\$2,298)

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# Your results may vary!

- Do your own analysis
- Use your own data
- Make your own conclusions