



Moving to Electric-Drive

Conference Presentation

New Energy Dynamics – Recession and Beyond

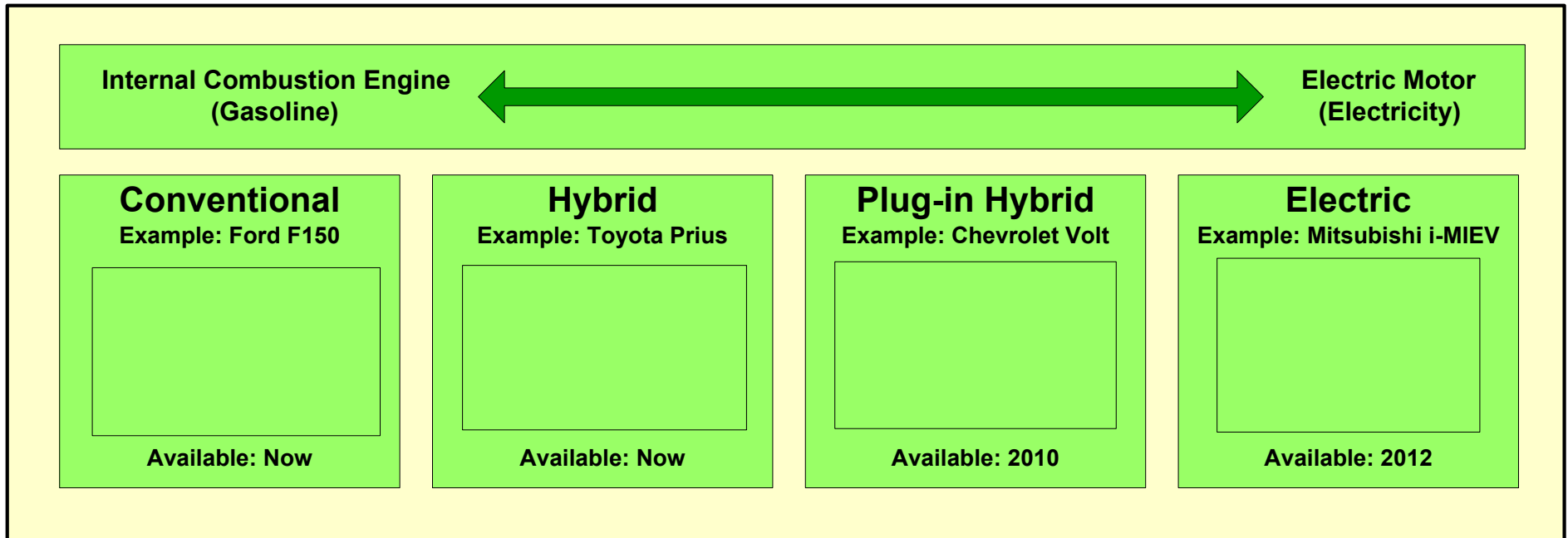
Rusty Heffner

Booz Allen Hamilton

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One of the major changes in light-duty cars and trucks over the next two decades will be a migration to electric-drive technologies.



- ▶ Electric-drive vehicles have significant advantages over conventional gasoline-powered vehicles
 1. **Environmental Benefits:** Lower emissions of greenhouse gas and criteria pollutants
 2. **Energy Security Benefits:** Reduced dependence on petroleum-based fuels
 3. **Experiential Benefits:** Quiet ride and quick “off-the-line” acceleration

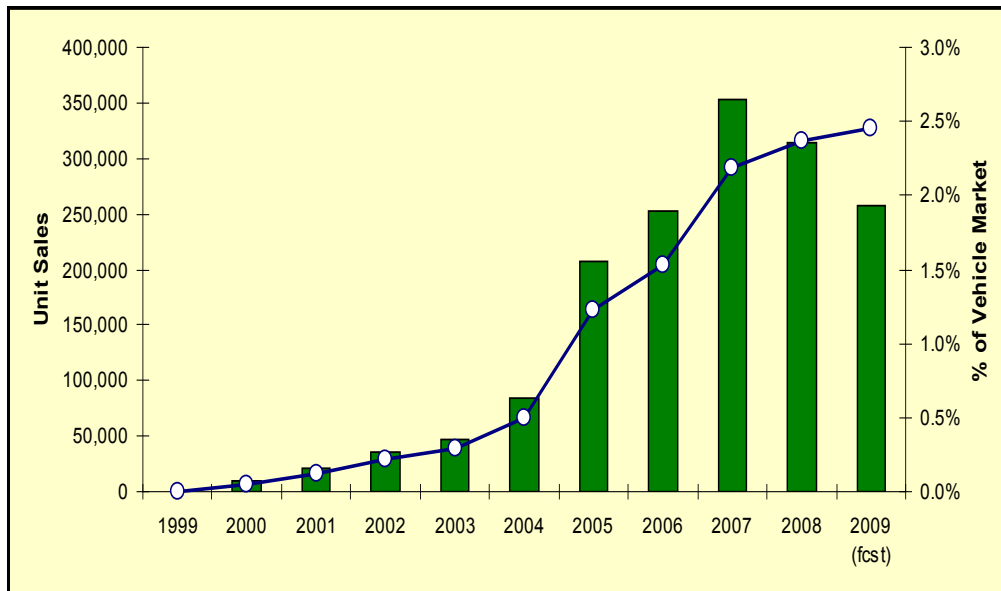
Electric-drive vehicles - particularly “grid-connected” vehicles – are receiving increased attention from both government and industry.

- ▶ The Obama administration has pledged to put 1M grid-connected vehicles (PHEVs and EVs) on US roads by 2015, and has allocated significant stimulus funding for battery development, vehicle deployment, and electricity infrastructure upgrades.
- ▶ As part of their restructuring efforts, all three of the Detroit automakers have expanded plans to offer plug-in hybrid and electric vehicles by 2012.
- ▶ Other automakers, including Nissan, Toyota, and Mitsubishi have already announced plans to commercialize electric vehicles.
- ▶ A host of smaller companies in the US, China, and Europe have also made product announcements and vying to become players in the electric-drive market.
 - High-profile contenders include Tesla Motors (USA), BYD (China), and Th!nk (Norway).



Grid-connected vehicles are likely to penetrate the US vehicle market gradually. Historical sales of hybrid vehicles suggest that we should temper our expectations for future EV and PHEV sales.

US Hybrid Sales: 1999-Present



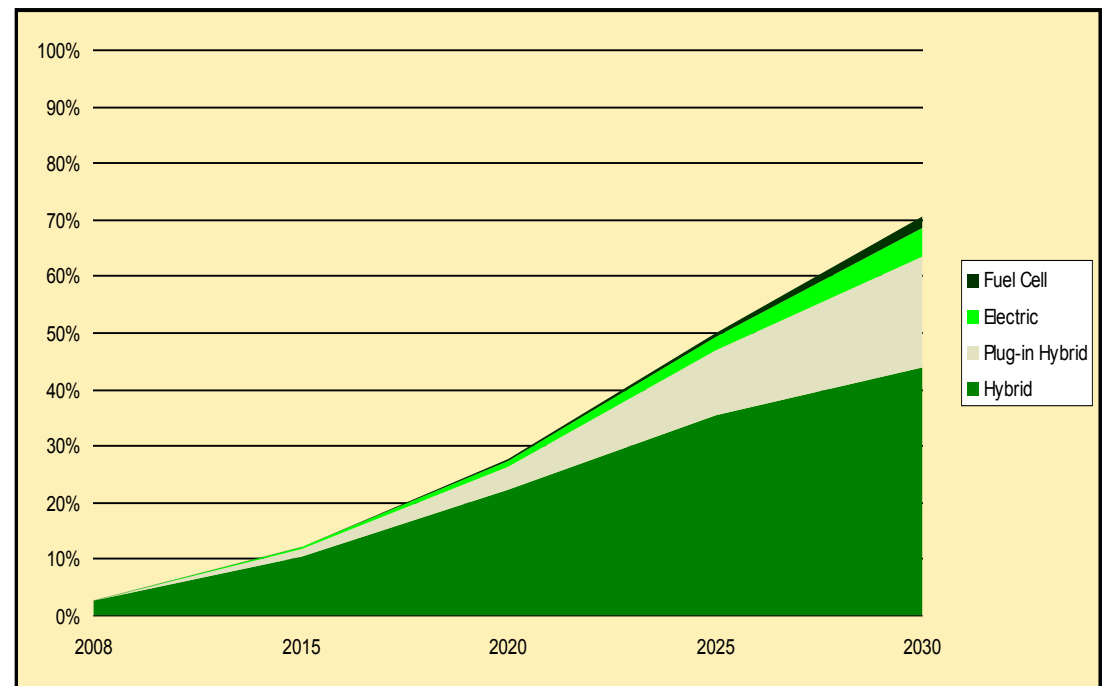
Source: Hybridcars Market Dashboard/Booz Allen

- ▶ In the past ten years, US hybrid sales have grown to roughly 2.5% of the light-duty market.
- ▶ While individual models like the Toyota Prius have become very popular, in general hybrid technology has yet to “catch on” with mainstream carbuyers.
- ▶ Like hybrids, grid-connected vehicles will require consumers to pay more for new technology and cope with uncertainty in areas such as reliability and durability.
- ▶ Grid-connected vehicles will also demand greater changes in consumer behavior, including:
 - Adaptation to electric refueling
 - Investment in home recharging equipment
 - Management of restricted vehicle range
 - Tolerance for limited “fueling” infrastructure

Our market forecast places overall light-duty sales penetration of electric-drive vehicles at 28% in 2020 and 70% in 2030.

- ▶ Hybrid vehicles begin gaining mainstream acceptance in 2011 and grow rapidly to account for over 40% of vehicle sales in 2030.
- ▶ Grid-connected vehicles (PHEVs and EVs) enter the market in 2010-2012. They account for 1.5% of sales in 2015, falling short of 1M vehicle goal (annual sales: 260K units).
- ▶ In 2030, 25% of vehicle sales will be grid-connected vehicles (20% are PHEVs)
- ▶ Note that conventional vehicles still account for 30% of the market in 2030.

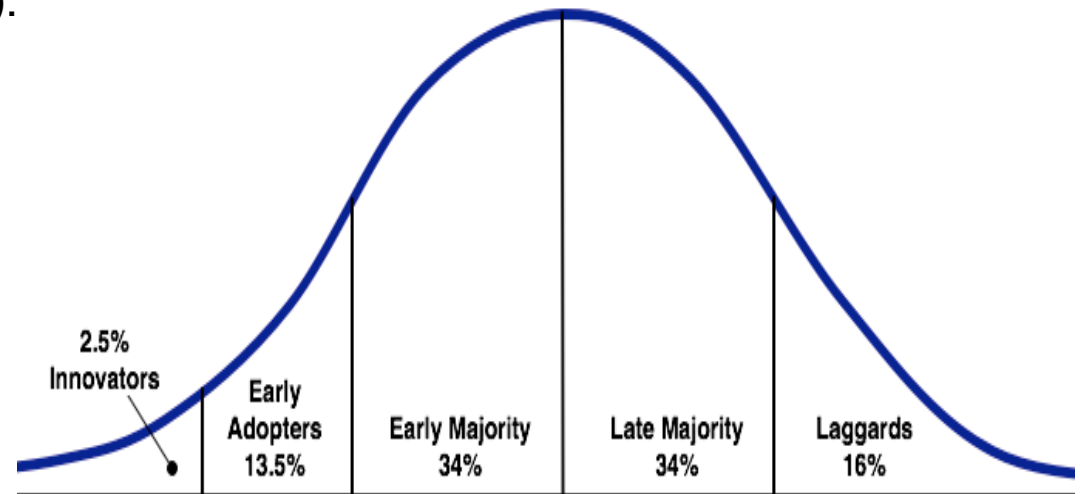
Electric-Drive Vehicle Sales Forecast: 2009 - 2030



Source: Booz Allen

Innovation Theory provides a useful framework for understanding the current electric-drive market and where it is headed.

- ▶ Developed by E. Rogers; enhanced by numerous authors, including G. Moore
- ▶ Early Market (Innovators/Early Adopters): Minority of buyers who see promise of a new product earlier than others, and are willing to experiment despite additional cost and performance risks
- ▶ Majority Market (Early/Late Majority): Mainstream buyers who are more pragmatic, risk-averse, and price-sensitive.
- ▶ To get to the majority of buyers, a product must first gain traction in the early market. However, moving from the early market to the majority market can be very challenging (the chasm).



Source: Everett Rogers, Diffusion of innovations model

Analysis of the early market for hybrids shows that the vehicles had unique meaning to the buyers, and that these meanings were an important element in the purchase decision.



- ▶ Doing the right thing for the environment and future generations
 - *“I’m making a difference, not for me, but for my grandchildren. We all have a responsibility to take care of this planet. It’s not about environmentalism – it’s about values. My hybrid fits with my values.”* – Toyota Prius owner



- ▶ Being a smart consumer
 - *“Saving money is something you have to do whenever you can. Now I sit in traffic and think, ‘Thank God I’m in a hybrid.’”* – Honda Accord Hybrid owner



- ▶ Fighting back against oil companies and oil regimes
 - *“We’ve got to stop filling the money bags of the Middle Eastern sheiks...and the oil companies. We’ve got to stop supporting the blood-sucking oil companies.”* – Toyota Prius owner



- ▶ Embracing the latest technology
 - *“I’m always looking for something new to be a part of, and the Prius was just so different. The silent driving, the navigation system, everything. It’s a real conversation-maker, and everyone asks me about it.”* – Toyota Prius owner

As hybrids progress into the mainstream market, meanings will still matter, but will receive less emphasis. Consumers' emphasis will shift to more practical elements, including cost-of-ownership.

	Early Market	Majority Market	Fleet Buyer
Does the vehicle “say the right things” about me?	* * *	* *	*
Is the vehicle’s styling unique and attractive?	* * *	* *	*
Is the vehicle reliable?	* *	* * *	* * *
Will the vehicle last as long as a conventional car?	*	* * *	* * *
Is the vehicle’s performance proven?	*	* * *	* * *
Will the vehicle save me money in the long run?	*	* *	* * *

Accelerating adoption of electric-drive vehicles will require policy and product offerings that are tailored for particular market stages.

Vehicle	Consumer	Recommended Approach
<p>Hybrid</p>	<p>Early/Late Majority</p>	<ul style="list-style-type: none"> ▶ Offer affordable vehicles with lower “hybrid premium” (Honda Insight) ▶ Focus less on distinctiveness, and more on producing a vehicle that is as durable, reliable, and high-performing as a conventional vehicle ▶ Policy should focus on reducing vehicle cost and minimizing adoption risk - now is the time for tax credits and other sales incentives ▶ Gasoline price and cost of battery technology are extremely important variables in determining how quickly adoption will grow
<p>Plug-in Hybrid & Electric Vehicle</p>	<p>Innovator/Early Adopter</p>	<ul style="list-style-type: none"> ▶ Offer vehicles that look and feel different from conventional cars ▶ Price matters, but buyers are less concerned about whether the vehicle “pencils out” – sales incentives have less impact on this buyer ▶ Policy efforts should focus on educating buyers about the new technology as well as about the positive meanings of these vehicles ▶ Gasoline price and cost of battery technology will be more important later when these vehicles move into mainstream markets

Thank You

Reid (Rusty) Heffner
Booz Allen Hamilton
heffner_reid@bah.com
(703) 377-1149