Senate Energy Committee Hearing

Electrification of the Automobile

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Testimony by

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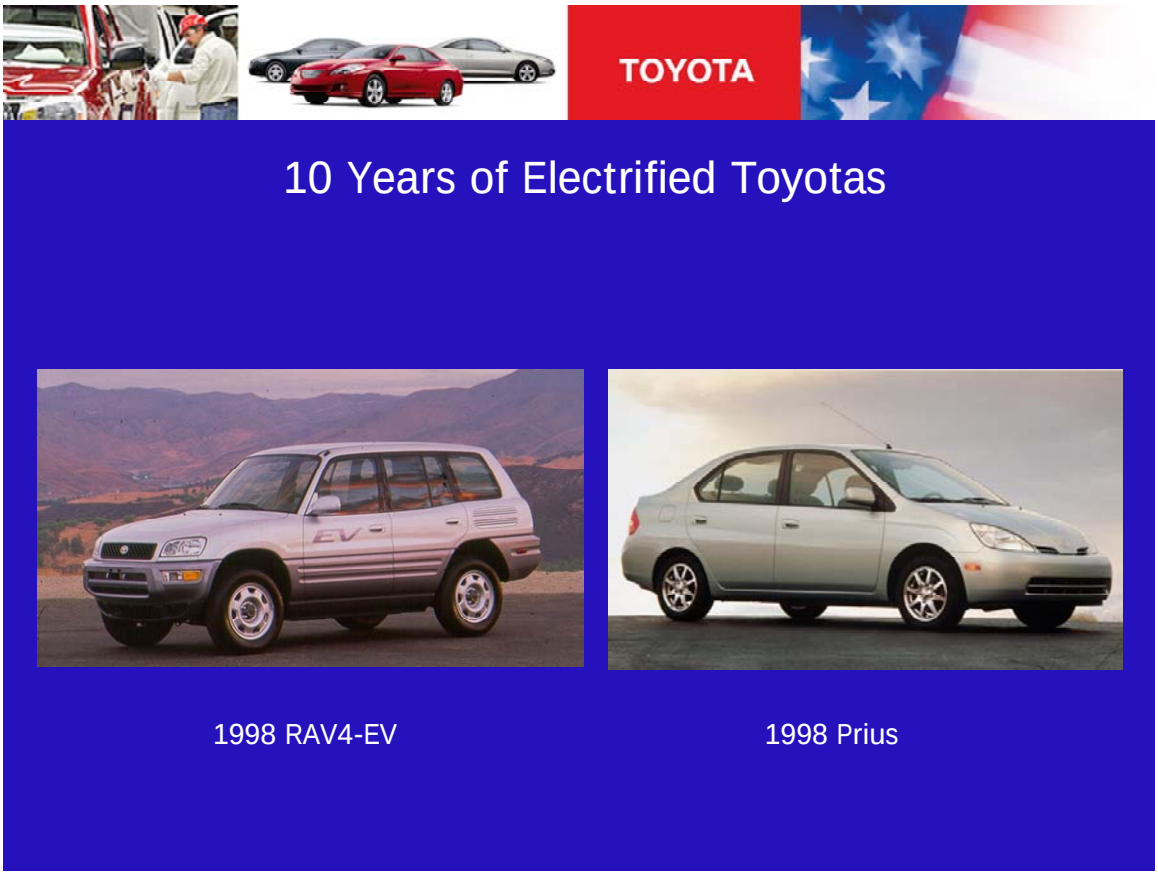
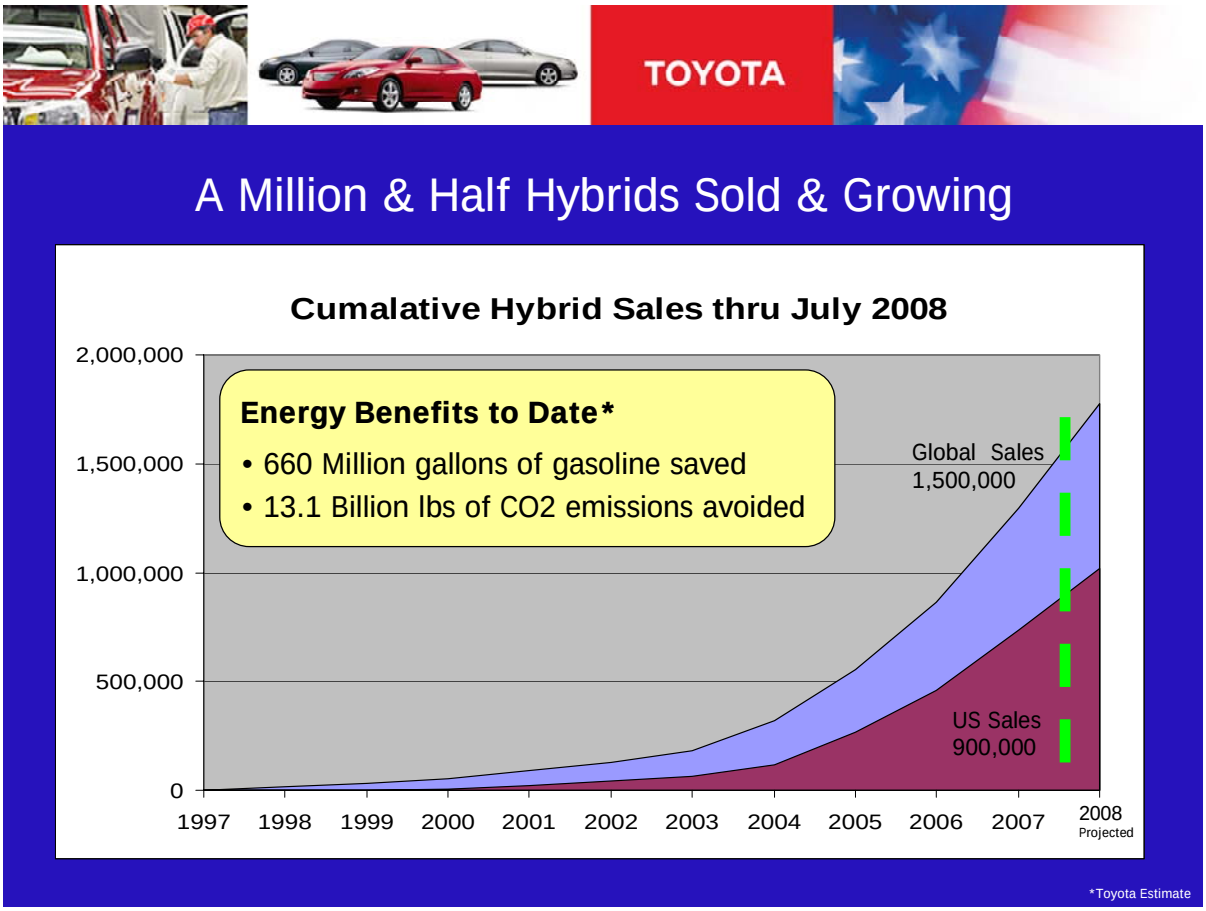
I am Robert Wimmer, a National Manager in Toyota's Washington DC office, working on energy and environmental research, and with over 15 years' experience in hybrid and fuel cell vehicle development. I would like to thank Chairman Bingaman and the Senate Energy Committee for inviting Toyota to testify at this hearing on a topic we feel passionately about: Electric Drive Vehicles.

Though the average price of a gallon of gasoline has declined from record highs over the summer, consumers continue to demand greater fuel efficiency in their vehicles. This has led to an increased interest in vehicle electrification as a way to reduce petroleum consumption. But, as far back as the early-1990's when a gallon of gas cost less than $1.50 / gallon, Toyota was investing in vehicle electrification by developing both hybrid and battery electric automobiles.

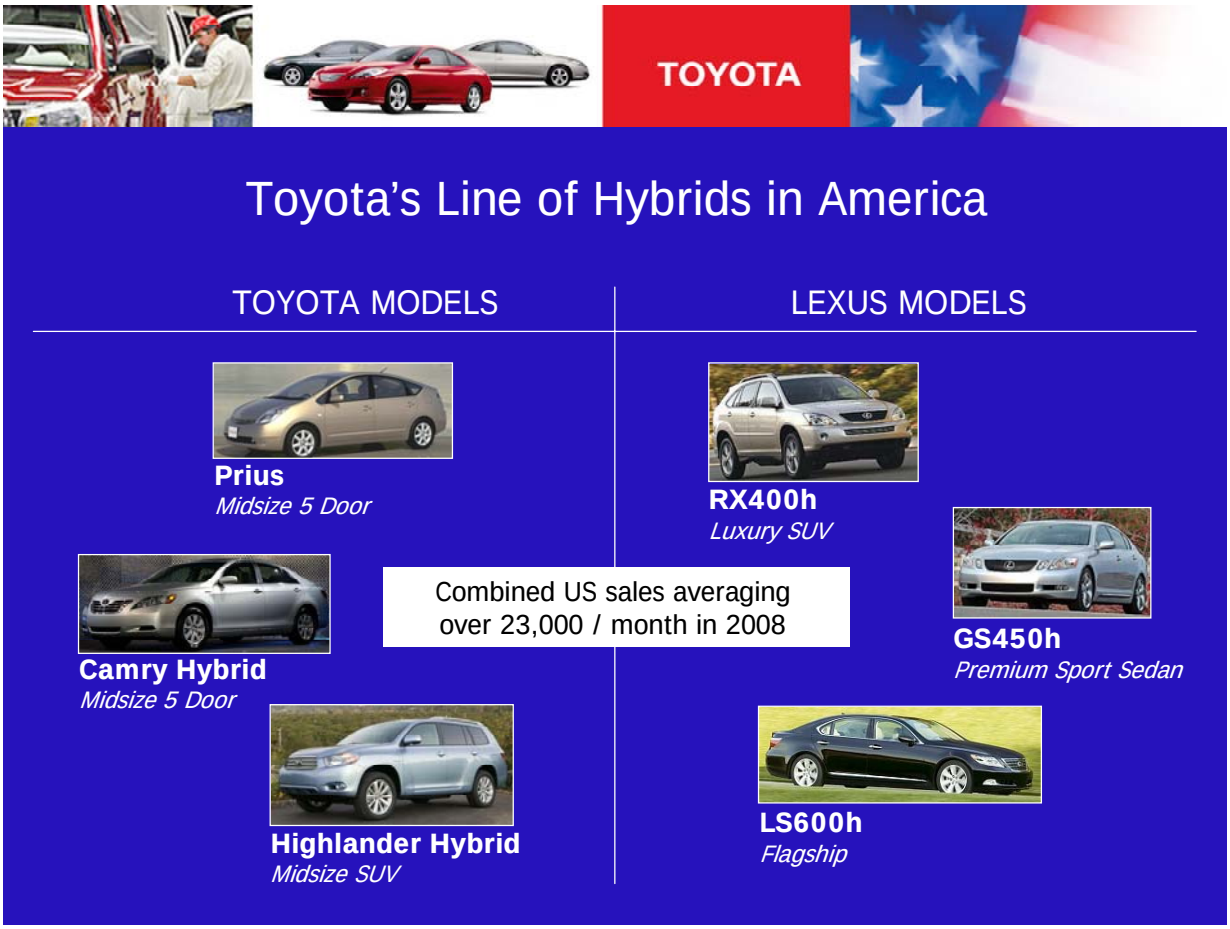


This type of forward thinking is summarized in the phrase “TODAY for TOMORROW.” Said another way - think for the future, but act now. This is one of Toyota’s core philosophies and the basis for our environmental vision.

Over the last 15 years of hybrid development, we have established more than 700 hybrid patents and hybridized more than a dozen vehicle models globally. Perhaps more importantly, we believe hybrid technology will be the foundation for our emerging electric propulsion systems.



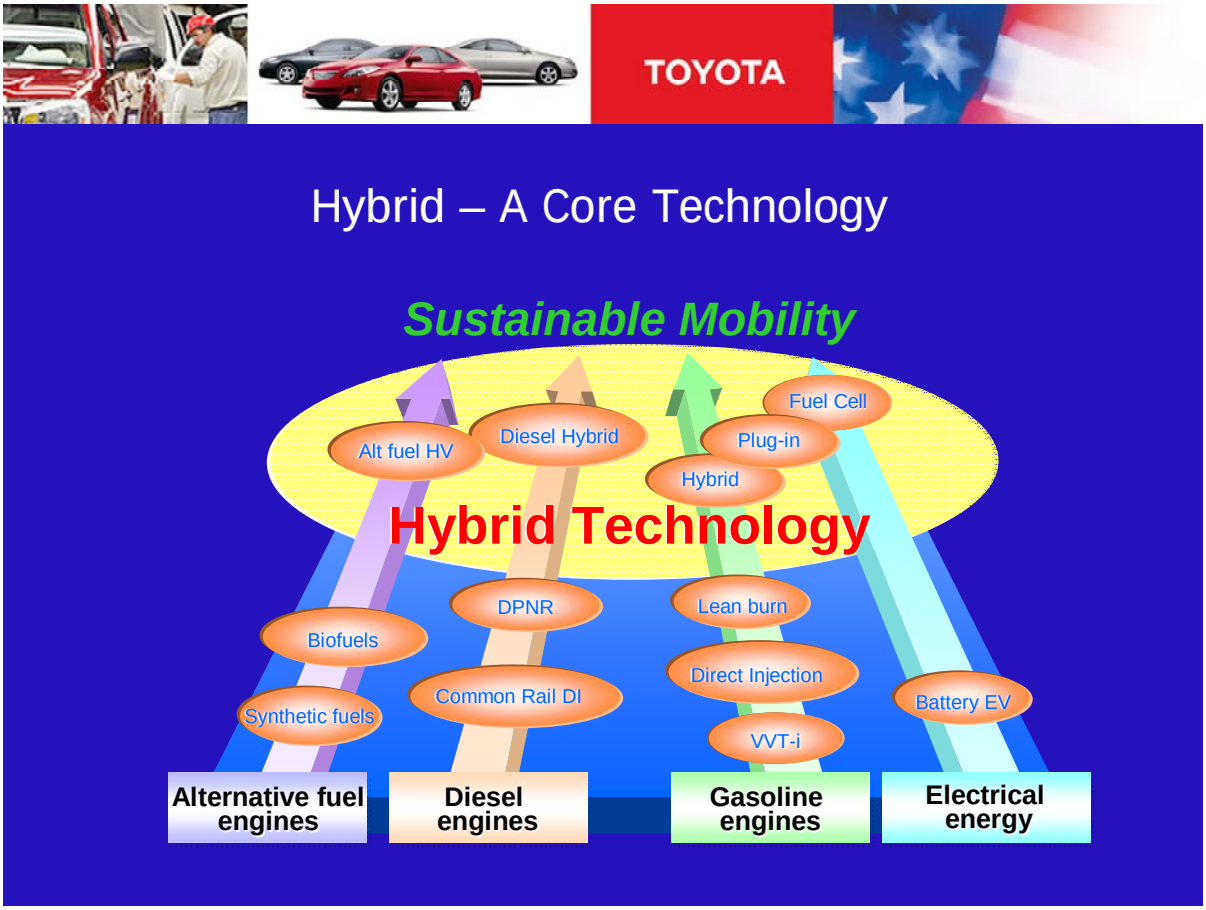
Since Toyota introduced our first hybrid, the Prius in Japan in 1997, we have sold over 1.5 million hybrids around the globe. These vehicles have saved over 660 million gallons of gasoline and eliminated 13 billon pounds of CO_2 emissions. In the US, fuel savings alone have saved Americans nearly a billion dollars.



Once considered science experiments by some and novelties by others, hybrids are now mainstream vehicles for Toyota. We currently sell six fuel-saving hybrids in the US -- 3 Toyota and 3 Lexus models, and they account for over 10% of our US sales. Next January in Detroit, we will introduce our third-generation Prius plus an all-new dedicated Lexus hybrid vehicle.

Future hybrid goals include global sales of a million a year in the next decade. And sometime in the 2020s, we expect hybrid drivetrains to be

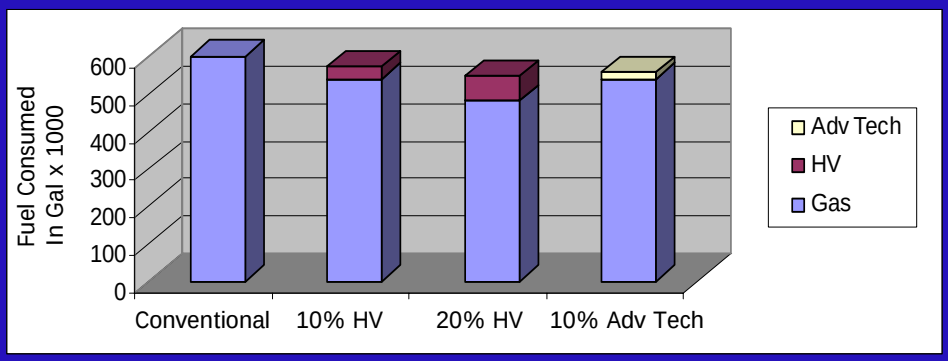
offered as either standard or optional equipment in all our passenger vehicles.



Hybrid is a core technology for Toyota and will serve as the foundation for the next generation of vehicles such as plug-ins, battery electrics and fuel cells. This evolution of mainstream technology will allow us to shorten development time and maximize use of shared components that will result in lower production costs and broader market penetration for these new technologies.

Benefits of High Volumes

		Vehicle Number			
		Baseline	10% HV	20% HV	10% Adv Tech
Conventional gas	(25 mpg)	1000	900	800	900
HV	(45 mpg)		100	200	
Adv Tech	(90 mpg)				100
Gallons Saved		N/A	26,667	53,333	43,333



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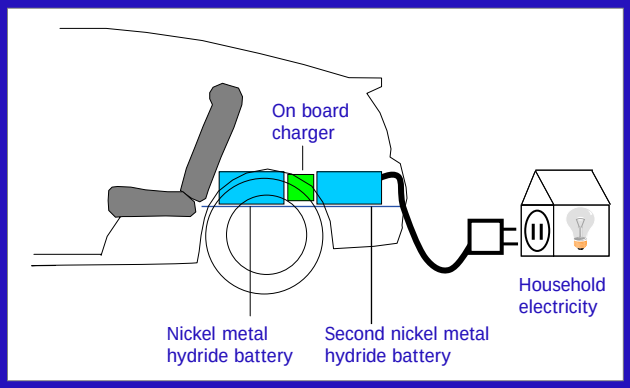
Assumes all vehicles travel 15,000 mi/yr

When considering the benefits of new technologies, we must understand the relationship between sales volume and fuel savings. For example, if we double sales of a hybrid model, the cumulative fuel savings is greater than doubling its fuel economy with no change in sales volume. Therefore, it is critical that new technologies, such as plug-ins, battery electrics or fuel cells, are introduced at a price point and utility that allow for high volume sales. Otherwise, their petroleum savings and environmental benefit will be negligible.

Mass market appeal is the basic philosophy behind the prototype plug-in Prius we have on display today. With minimal software changes and the addition of a second battery pack, the vehicle demonstrates the plug-in potential of Toyota's hybrid design.

Toyota's Current PHV Prototype



VEHICLE BENEFITS	PROTOTYPE OBJECTIVES	CHALLENGES
• Fuel diversification (energy security)	• Study consumer behavior (US)	• Battery cost & life – key for commercial introduction
• Potential greenhouse gas reduction	• Study public charging (Europe)	• Packaging
• Reduced fuel cost	• Demonstrate system, not battery capability	• Need for cleaner electricity

The vehicle operates in a manner similar to the current Prius, switching from pure-electric mode, to gas-engine mode, to a blended gas-electric mode. The larger battery allows the plug-in Prius to store greater amounts

of electricity and to be charged by plugging into a standard household electrical outlet. With more electric power in reserve, the vehicle is capable of operating in pure-electric mode for longer periods of time and at speeds up to 60 mph. That means substantial gains in fuel economy and a reduction in total tailpipe emissions versus current conventional hybrid systems.

Similar vehicles were recently given to two California universities for research and testing to evaluate real-world customer use, to help determine the optimal balance between electric mode range, charge time, battery size and cost.

Battery experts have estimated the cost of batteries for a plug-in hybrid to be $500-$1000/kW-hr. As such, the size of the battery pack will greatly influence the retail price of the vehicle and therefore, its market viability and sales potential. The Energy Tax package released late last week by the Finance Committee places an arbitrary 6kW-hr minimum on pack size before receiving a consumer tax credit. Toyota believes this is counterproductive. It will discourage manufacturers from developing smaller, lower cost plug-ins that are affordable to the greatest number of consumers. Toyota agrees the amount of tax credit should be based on

battery size, but it should begin at approximately two times the size of a typical hybrid battery, 1.2-2.0 kW-hr. This way the consumer market will drive plug-in vehicle design, not legislation.

Before high-volume production can begin, significant challenges such as battery cost, durability and safety must be addressed. We intend to examine these issues when we introduce our next generation plug-in hybrid with Li-Ion batteries as a 2010 model. A significant number of these vehicles will be deployed in commercial fleets around the world to help Toyota quantify real-world durability, performance and customer acceptance.

Toyota is also re-examining battery electric vehicles. Between 1998 and 2003 Toyota delivered more than 1200 RAV4-EVs to customers in Arizona and California. Many of these were sold – not leased – to the general public, making Toyota the only Original Equipment Manufacturer at the time to sell full-performance EVs. With many of these still on the road and millions of miles of cumulative experience, Toyota understands the opportunities and challenges of producing and marketing battery EVs.

To realize the full promise of plug-in hybrids or battery electric vehicles, they must use green electricity. From an energy security standpoint,

certainly any substitution of domestically produced electricity for gasoline is beneficial. Carbon reduction, on the other hand, varies greatly depending how the electricity is generated. In France, where over 80% of the electricity comes from nuclear power, plug-ins and battery electrics can significantly reduce carbon emissions. On the other extreme, if the electricity comes mostly from coal fired plants, the reduction of carbon emissions is modest at best.

Toyota's Current Fuel Cell Prototype

VEHICLE BENEFITS	PROTOTYPE OBJECTIVES	CHALLENGES
• Zero tailpipe emissions	• Public education on hydrogen	• Fuel cell system cost
• Potential non-petroleum, diversified fuel sources	• Demonstrate technology	• Fuel cell stack life
• Low / zero carbon fuel	• Identify infrastructure issues	• Lack of infrastructure

Let me conclude with a brief description of Toyota's Fuel Cell Hybrid Vehicle … another evolution of our basic hybrid drive technology. This vehicle is based on the previous-generation Toyota Highlander Hybrid SUV but with a fuel cell, of Toyota's own design and manufacture, in place of the Highlander's gasoline engine. The combination of an advanced fuel cell system with our hybrid drive technology more than doubles the vehicle fuel efficiency with zero tailpipe emissions.

Toyota has made great progress over the last decade improving fuel cell technology. Our next generation fuel cell vehicle will be able to start from -30 degrees Centigrade and will have a driving range of over 400 miles between refuelling.

As with plug-ins, challenges must be resolved before fuel cell commercialization can begin. Cost must drop significantly, while system power density and durability must increase. Also, a coordinated effort is required between the auto industry, energy providers and governments to assure a hydrogen refuelling infrastructure is in place to support fuel cell vehicle deployment.

So, why does Toyota continue to invest millions in a technology like fuel cells, which is more than a decade away from commercial viability? It goes

back to our “Today for Tomorrow” philosophy that drives us to develop technologies and products Today to improve society Tomorrow.

I would again like to thank Senator Bingaman and the Senate Energy Committee for inviting Toyota to be part of this hearing and am happy to take your questions.