Global market review of mild hybrid vehicles – forecasts to 2017

2010 edition

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Chapter 1 Introduction

The year 2009 was relatively quiet for the simplest type of electric-drive vehicles, known as mild hybrids. Sexier battery electric vehicles, various flavours of plug-in hybrids, and even conventional full hybrids have lately gotten far more media attention.

The sole new entry in the mild hybrid game was the 2010 Honda Insight, the company's first dedicated hybrid since the demise of the original 1999-2006 Insight two-seater. This Prius-shaped five-door B-segment hatchback arrived to high hopes, but fell flat in its largest expected market, North America. The consensus was that in its quest to offer the world's least expensive hybrid, Honda had cut too many corners, producing a cramped car with unimpressive dynamic qualities that paled in comparison to the less expensive, more flexible Fit model next to it on showroom floors.

Honda is by far the global leader in mild hybrids, and the Insight is the first of three new global models based on the latest evolution of its IMA system. Next year, however, General Motors will roll out a revised, second-generation version of its Belt-Alternator-Starter system that uses a lithium-ion battery pack and provides much greater capability than its frankly unsuccessful first-generation model. It plans to spread this system across a wide range of vehicles globally. Hyundai last year launched a low-volume mild hybrid system on a LPG-fuelled vehicle in its home market, which it is expected to extend to petrol-engine cars this year or next.

Other recent entrants include Mercedes-Benz and BMW, who collaborated on the first mild hybrid system based on a lithium-ion battery pack for their respective full-size luxury sedans. The two German makers took different tacks in exploiting the technology, however. Daimler paired its mild hybrid with a downsized engine, producing impressive fuel efficiency in a full-size S-Class saloon, while BMW opted for minor improvements in fuel efficiency but used its hybrid to boost performance above comparable petrol-engine models. Subsequent iterations of this system are expected to elevate it into 'full hybrid' territory by adding the capability of pure electric running.

Chapter 2 Mild hybrid manufacturers and technologies

Honda

By far the largest and most significant producer of mild hybrid vehicles, Honda has been building hybrids since 1999 and was the second vehicle maker in the world to do so, after Toyota. As of February 2009, it had built xxxxxxx mild hybrids, of which xxxxxxx represented two generations of the Honda Civic Hybrid model.

The company has evolved its Integrated Motor Assist (IMA) hybrid system, comprised of a small electric motor mounted between the engine and either a manual gearbox or continuously variable transmission, through six generations.

Table 1: Honda mild hybrid sales by model/region, as of the end of January 2009 (no. of vehicles sold)

Model	Region	Start of sales	Cumulative unit sales
Insight	Japan	Nov. 1999	xxxxx
	North America	Dec. 1999	xxxxxx
	Europe	Mar. 2000	xxx
	Total		**xxxxxx**
Civic Hybrid	Japan	Dec. 2001	xxxxxx
	North America	Mar. 2002	xxxxxxx
	Europe	May. 2003	xxxxxx
	Asia/Oceania	Feb. 2004	xxxxx
	China	Nov. 2007	xxx
	Others	May. 2006	xxx
	Total		**xxxxxxx**
Accord Hybrid	North America	Dec. 2004	xxxxxx
	Total		**xxxxxx**
Total unit sales of Honda hybrid models			**xxxxxxx**

Source: Honda Motor Co

Chapter 3 Estimates on market take-up

While the future for electric-drive vehicles of all types (see Chapter 4 Technologies and definitions) looks bright, mild hybrids seem likely to have the lowest growth curve among all versions of electric drive. This is largely because their basic business case will be squeezed from both ends.

On the low end, mild hybrids' fuel efficiency gains of xxxxx% will come under heavy attack from downsized petrol engines with direct-injection and turbochargers. While DI and turbo hardware is expensive now, its price will fall substantially once volumes in the millions are achieved – and virtually every OEM is looking at a quick ramp-up for these engines.

Ford may be the most instructive case. It has announced that xx% of its global nameplates will offer an EcoBoost option (its brand for downsized DI and turbocharged engines) by 2013. That year, it expects to sell xxxm EcoBoost engines – just five years after the first one launched. Following the first EcoBoost engine, a xxx-litre V-6, Ford has already released details of a xxx-litre four and a xxx-litre four to follow it. And at least in US large cars, the company says its EcoBoost take rate has almost doubled the original projection of xx%, with the highest rate – well over xx% – in the Lincoln MKT seven-seat crossover.

And on the high end, mild hybrids will face increasing pressure from full hybrid systems as the cost of components – especially the per-kilowatt-hour cost of lithium-ion cells – falls steadily with greater volume. The cost of increasing hybrid performance is not entirely linear. A mild hybrid requires adding a small electric motor of xx-xxkW, a nickel-metal-hydride battery pack of slightly less than 1kWh, the associated power electronics, and regenerative braking, the sum of which may add approximately US$xxxxx to the cost of a vehicle.

But doubling the size of the motor and the size of the pack to add full hybrid capacity may not double the cost again. And costs for full hybrid components are likely to be driven down further as they are used – with larger battery packs – in low-volume plug-in versions of those full hybrids. Toyota will use standard

Chapter 4 Technologies and definitions

The flurry of hybrid launches and concept cars during 2009 and the first quarter of 2010 highlights the need to understand the different varieties of hybrid and electric-drive propulsion systems.

The label ‘hybrid’ is frequently applied to everything from start-stop systems to extended-range electric vehicles. And journalists who should know better – let alone industry analysts and executives at some OEMs – seem to show precious little understanding of the fundamental differences between a conventional parallel hybrid with a larger battery pack that can be recharged from the mains (e.g. 2012 Toyota Prius plug-in hybrid) and a series hybrid or extended-range electric vehicle (e.g. 2011 Chevrolet Volt) than runs purely on electric power, whether or not the combustion engine is switched on.

To that end, it’s important to understand the differences among the different varieties of hybrids and vehicles powered by electricity. There are four main categories, only three of which we will cover in detail within this series of reports. And they can be roughly broken down by the size, and hence the cost, of the battery pack involved.

Stop-start system

Also known as idle-stop systems, these are sometimes erroneously referred to as hybrids. There’s even a made-up category name for them: micro-hybrid.

But in fact they’re not hybrids, in the sense that they have neither a secondary battery pack nor an extra electric drive motor. The sole factor that sets apart a vehicle fitted with a stop-start system from a standard petrol or diesel car is that the engine switches off when it decelerates or comes to a stop.

As soon as the driver puts in the clutch or moves the shift lever (in a manual-gearbox car), or lifts off the brake and accelerates (in cars with automatic transmission), the stop-start system uses a high-output version of a standard 12V battery to start up the engine, and the car moves away as usual.

Chapter 5 Factors affecting the market

As the global vehicle market has stabilised following the precipitous declines of 2008 and 2009, roll-outs of advanced technology vehicles have been delayed by some companies (e.g. General Motors) but sped up by others (e.g. Nissan, most German makers).

Still fresh in consumers' minds is the sharp run-up in oil prices during 2007 and 2008, largely attributed to soaring demand during a period of global economic expansion. Then came global financial declines and a virtual gridlock in the commercial credit markets, and markets fell. So, too, not only did vehicle sales, but also China's thirst for energy and, with it, the price of oil.

But fuel efficiency remains a consideration for most of the world's car buyers, and this can only push vehicle makers to the adoption of new technologies to make cars more efficient. Much of this, of course, will be improvements in combustion engines; electric-drive technologies will increase their penetration, but they are clearly not going to be ubiquitous even 15 years hence.

Oil prices are the most important among several factors likely to affect the adoption of electric-drive vehicles. The others are: the regulation of vehicular emissions, in particular carbon; battery costs; and overall vehicle costs and new financial models for usage.

There are also four concerns that must be addressed in the public eye to enable the widespread roll-out of electric-drive vehicles. They include concerns over adequate supplies of electricity to recharge plug-in cars; analyses of the 'wells to wheels' carbon impact of cars powered largely or exclusively by electricity; the troubling question for vehicle makers of whether they are willing to see their core energy storage medium produced by an entirely separate industry; and the emergence of lithium as a strategic commodity, along with the associated geopolitics.

Chapter 6 Regionality effects

Finally, it's worth discussing the differences in auto markets and how they'll affect the production and the consumer adoption rate of different electric-drive technologies.

In North America, hybrids have a higher penetration rate than in any other market except Japan – and that country's conversion has come only during the last year, courtesy of heavy government incentives for consumers who buy the most fuel-efficient vehicles on the market.

In the US last year, hybrids took a shade under xxx% of the vehicle market. The most popular hybrid model was the 2010 Toyota Prius, which has the interior space of a D-segment car. The upcoming 2011 Chevrolet Volt E-REV is a C-segment car, which is about the smallest size that sells in notable volume in the US.

Unlike Europe, diesel propulsion has never really taken off in the US – for a number of reasons that are outside the scope of this report. But to get better fuel efficiency, a small but significant number of Americans have chosen hybrids rather than buying small cars. Fuel prices in the US, of course, are lower than in most other developed countries, which tax fuel more aggressively.

Hybrids and, down the road, plug-in hybrids (PHEVs) and series hybrids (E-REVs) are likely to be the dominant form of electric drive vehicle. They are better suited to driving cycles resulting from large-scale suburban sprawl, in which exurbs built around office parks and shopping centres are connected by broad multi-lane roads punctuated every mile or two with stoplights.

This geography creates a duty cycle that is neither stop-and-go urban traffic nor high-speed highway cruising. Vehicles may crawl through shopping-centre car parks, then blast away from an intersection to travel at up to 60mph until the next light a mile or two away. Back down to zero, into and out of another shopping centre, and so forth; the process repeats. This suburban duty cycle turns out to be particularly suited to the characteristics of the series hybrid, or E-REV – more so than to either hybrids or battery-electric vehicles.