



**GREEN CAR INSTITUTE**

*A Non-Profit Corporation*

# The Current and Future Market for Electric Vehicles

- *Market Estimates*
- *Consumer Market Research*
- *Fleet Market Manager Survey*
- *Review of Current EV Models*
- *Review of Industry Estimates of the EV Market*

# The Current and Future Market For Electric Vehicles

- *Market for EVs*
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- *Fleet Manager Survey and Fleet Market Size Estimate*
- *Market Review of Current EV Models*
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## Executive Summary

This market study seeks to review the past and current state of the electric vehicle market as well as estimate what its future potential might be. To accomplish this, we have conducted original market research in both the consumer and fleet markets, reviewed other studies in both areas, analyzed past and current marketing programs and proposed methodology that might help the EV market attain its full potential. Our findings could be summarized as follows:

1. There is a healthy consumer market for EVs. Our market research, conducted using standard automotive industry techniques, shows 12 to 18 percent of new light-duty vehicle purchases in California could be EVs if consumer-oriented vehicles were available at reasonable prices. This equates to approximately 151,200 to 226,800 consumer EVs annually which, without factoring in fleet EVs, is approximately 7 to 10 times larger than the 2003 production requirement under California regulations.
2. In the fleet market segment, we found that the potential for EVs in municipal, transit, utility and university fleets alone could likely absorb a large portion of the number of EVs California requires be produced in 2003. While the fleet market is a difficult one to gauge, EVs have made inroads during the past four years, laying the groundwork for many more sales. We estimate EV penetration of the fleet market conservatively to be 5 to 10 percent annually by 2003. This equates to 12,000 to 24,000 vehicles, which alone is equal to about 50 to more than 100 percent of the total number of EVs required to be delivered for sale in California in 2003.
3. One of the key findings in our research is that marketing of EVs to consumers needs to take a different tack than it has in the past few years. Our research indicates EVs need to be offered for sale as well as lease, since a purchase is the overwhelming choice of consumers. Electric vehicles also need to be tailored to consumer tastes in size, features and functionality. That means they need to include four-door, four- or five-passenger

sedans that include the amenities found in gasoline vehicles. Consumers have indicated they can deal with a contemporary EV's range limitations if pricing is reasonable. Further, the public needs more information and education about EVs than has been available to date.

4. In the fleet market, the biggest impediment to growth currently appears to be the lack of product. Fleet managers have reported frustration in trying to order or get confirmed delivery of any of the EVs offered by the six major manufacturers. With a supply of vehicles and a revival of marketing efforts, the fleet market should be able to contribute significantly to the overall EV market in 2003, particularly if those efforts begin soon.

### **Current and Future Market for EVs**

What is clear from the basic market research we have reviewed and/or conducted is that substantial fleet and consumer markets for EVs exist. The desire to purchase EVs is there, which represents the basis of a market. Consumers and fleet managers alike have an understanding of the functionality of current EV technology and feel it can fit their family or fleet needs. In aggregate, that market is more than sizeable enough to absorb the numbers of EVs required by the state of California to be offered for sale in 2003.

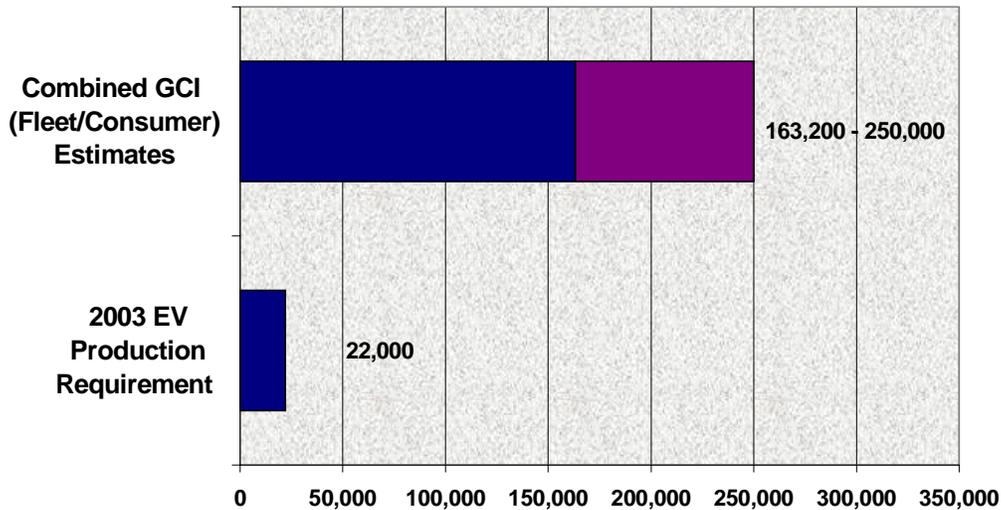
Regulatory policies, like the California Zero Emission Vehicle production requirements and the federal Energy Policy Act of 1992 (EPAct), have stimulated fleet adoption of EVs. As an example, five of California's largest utilities have stated their willingness to buy approximately 1,000 EVs per year. Programs like "evSacramento" have additionally increased EV placements at state and local public agencies in that region.

The consumer market, according to the automotive manufacturers in California's Memoranda of Agreement (MOA), is more difficult to gauge. Still, the potential California market of car and truck buyers who could accommodate and afford an EV is quite large. Public stated opinion about purchasing an EV is positive and significant. Even allowing a sizable discount for overstatement of those opinions, it indicates that presented with electric vehicles of the appropriate configuration and price, a significant market for EVs exists.

It is clear from Green Car Institute's original market research, conducted with an experienced automotive market research firm, The Dohring Company, the annual consumer market for EVs is between 12 and 18 percent of the new light-duty vehicle market in California. This equates to approximately 151,200 to 226,800 EVs annually, which is 7 to 10 times larger than the 2003 production requirement under California regulations (approximately 22,000 vehicles).



## 2003 ZEV Production Requirement vs. GCI Estimate of EV Market Demand



*California ZEV Production Requirements based on CARB estimates, 4% of "Big 6" market series of ~985,000 vehicles.  
GCI estimates based on manufacturer estimates of light truck and car market series of ~1,500,00 vehicles.*

One key to achieving that kind of market penetration already appears to be in progress. As the precursor to a major shift in consumer attitudes towards fuel economy and the environment in relation to automobiles, manufacturers have elevated these features to a higher level than in previous years.

Ford and General Motors are battling for SUV fuel economy supremacy. Ford, Honda and Toyota have each said at the highest corporate level that its corporate goal is to be known as *the* leading environmental automotive company. The automakers have shown that the only path to achieving their goals is through the introduction of advanced technology vehicles, which means there will be a continued emphasis on the benefits of incorporating advanced technologies in new vehicles and platforms.

### Consumer Market for EVs

Green Car Institute's market research, conducted by The Dohring Company in July 2000, quantified the potential consumer market for EVs. More than 900 California new car buyers were surveyed about their next car purchase, and they showed a strong interest in adding an EV to their households.

The market research, which sampled a representative group of the California car-buying public, showed a strong consumer market for EVs among new car purchasers. Almost one-third (29.2 percent) of those polled indicated they would be "likely" or "very likely" to acquire an EV as their next car purchase if that vehicle were priced close the same price as a gasoline vehicle. After being provided further information on EVs (both their limitations and benefits), purchase intent rose to more to 33.4 percent. Interestingly, the actual people responding positively to EVs changed between the two questions because of the information (some who initially chose EVs changed their minds while others who had not considered EVs initially decided they would like to buy one). Further, more than two-thirds (69.6 percent) of those who wanted to buy an EV indicated a willingness to pay a premium for that vehicle.

Those percentages indicating an interest in purchasing an EV can be converted into an estimate of an annual market share for EVs using some of the findings of earlier research into EV purchase patterns. Turrentine and Kurani of UC Davis/ITS found that, in general, households would own both electric and gasoline vehicles, but only one EV at a time (minimum), or they would replace all vehicles but one with EVs (maximum). Assuming the same rate of replacement and length of ownership with EVs as with gasoline vehicles, the annual market share for EVs is estimated to be 12 to 18 percent of all California light-duty vehicle sales to consumers. With total – consumer and fleet combined – annual sales running in excess of 1.5 million vehicles, that translates conservatively into EVs per year to consumers.

The total light-duty vehicle sales numbers used here correspond to the total light-duty vehicle market, as normally construed by the auto industry. The California Air Resources Board (CARB), in looking at the light-duty vehicle market for EVs, considers only vehicles with a gross vehicle weight (GVW) of fewer than 3,750 pounds, which eliminates many popular mid-size and full-size vehicles, particularly popular full-size pickups and sport utility vehicles. GCI/Dohring’s market research considered the whole spectrum of new vehicle choice, even though many are beyond the expected configurations of EVs.

**EV Purchasers Believe EVs Are:**

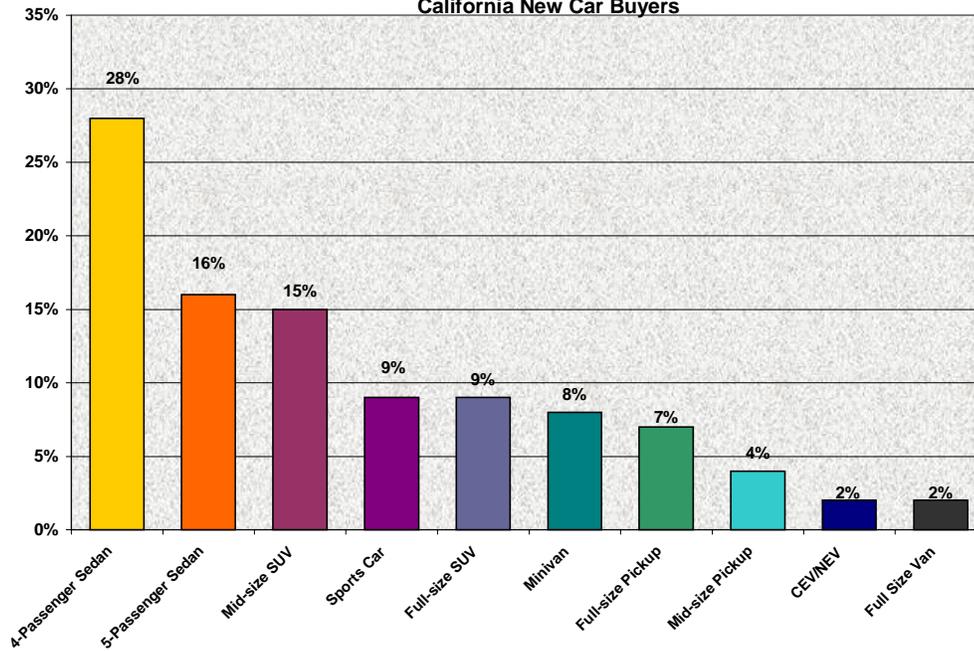
- Practical
- Clean
- Inexpensive to operate

*Source: GCI/Dohring Market Research, July 2000*

Consumers in this research study were attracted to EVs because of their positive environmental benefits, followed by their economic advantages (such as lower fuel and maintenance costs) and the perception that electric vehicles are “the cars of the future.” Those who chose to stick with gasoline-powered vehicles did so because of those vehicles’ greater driving range, use for out-of-town travel and proven reliability.

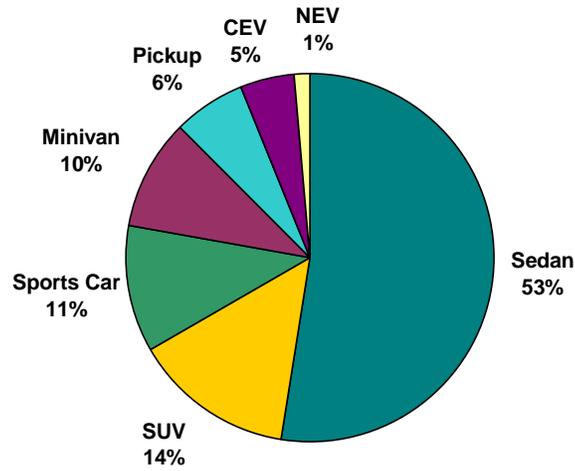


Vehicle Types Preferred by California New Car Buyers



Source: GCI/Dohring Market Research, July 2000

Some limitations of current EV marketing also were highlighted by the survey. Less than 27 percent were interested in buying compact pickups, sub-compact sedans or coupes, sport cars, minivans or compact sport utilities (SUVs), the only models of EVs offered to date (and the latter two were not even marketed to consumers). When presented with information and choices about EVs and when faced with direct questions about which vehicle they plan to acquire next, EV intenders and gasoline vehicle intenders alike overwhelmingly chose four-seat sedans. Nearly twice as many people – 27.9 percent – chose a four-passenger sedan, as we would expect from prior statements about body style intentions. Among those who chose a four-passenger sedan, 43 percent chose an EV.



### Body Style Choices of EV Intenders

Source: GCI/Dohring Market Research, July 2000

In addition, the restriction to a lease-only purchase eliminates nearly 40 percent of the EV intenders and would be a cause for reconsideration of their EV choice among nearly 40 percent more. Only 23 percent of EV intenders said that, if leasing was the only option to acquire an EV, then leasing was fine with them. This low rate of leasing acceptance is in keeping with the low level of intention to lease the next new vehicle in any event. Prior to any questions about EVs, only 13.6 percent of all respondents stated they would be leasing their next vehicle. There was no significant difference between EV intenders and the other respondents. Experience with leasing is also relatively low; only 16.6 percent of all households are currently leasing one of their vehicles, a number consistent between EV intenders and others.



## **Fleet Market for EVs**

In the fleet market segment, we found that the potential for EVs in municipal, transit, utility and university fleets alone could likely absorb a large portion of the number of EVs California requires be produced in 2003. While the fleet market is a difficult one to gauge, EVs have made inroads during the past four years, laying the groundwork for many more sales. We estimate EV penetration of the fleet market conservatively to be 5 to 10 percent annually by 2003. This equates to 12,000 to 24,000 vehicles, which alone is equal to about 50 to more than 100 percent of the total number of EVs required to be delivered for sale in California in 2003

The fleet market has been targeted by automakers as the logical starting point for EVs during the MOA period (1998-2000). While GM and Honda first aimed at the consumer market with the EV1 and EV Plus, all manufacturers focused on fleets. The strategy appealed to them because it offers the advantages of:

- Moving more vehicles per sale (group purchases).
- Allowing for a more information-intensive, one-on-one sales relationship than the typical consumer sale.
- Delivering EVs to those most likely to take advantage of the early models – companies with fixed, limited routes and/or a central refueling structure.
- Allowing manufacturers to limit the amount of dealer training, parts stocking and other investments necessary.
- Putting EVs in a more controlled environment where the manufacturer could get more feedback on their operational performance.

For those reasons, all six manufacturers (General Motors, Ford, DaimlerChrysler, Toyota, Honda and Nissan) marketed to fleets during the MOA period. DaimlerChrysler, Toyota and Nissan focused exclusively on fleet sales. All manufacturers worked with partners like utility companies to extend their marketing reach.

Some high-visibility successes came out of those efforts, like the fleet of Dodge EPIC minivans used by Xpress Shuttle in Los Angeles that showcases the everyday use of EVs and fast-charging technology. But ultimately, fleet sales were limited by vehicle availability.

Our “mystery shopper” program confirmed the basic problem in current fleet sales, which is that no vehicles were available. Auto dealer fleet sales managers contacted were often reluctant to even talk about EVs, which they are not able to order or deliver. What they confirmed was that no vehicles were available or in production and the earliest delivery of a new EV would be January 2001. The lack of physical presence of EVs on the dealer lot, while not as critical in fleet sales as for consumers, certainly limits the market. More disturbing is the news from automakers through dealers that delivery dates cannot be assured.

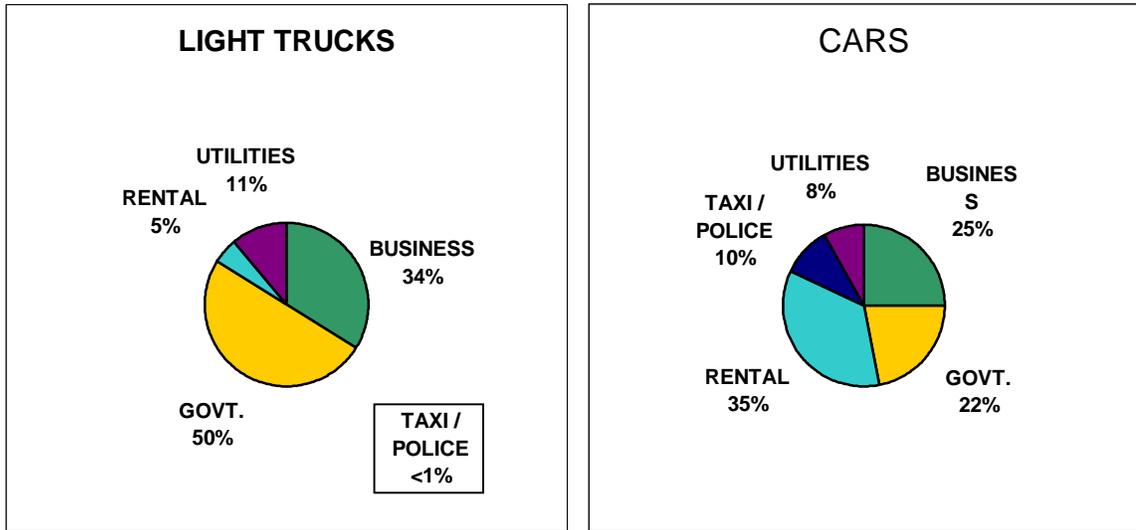
The inability to guarantee a product delivery date poses a serious impediment to sales in any industry, but especially so in the fleet vehicle realm. Fleet purchase decisions take place within a defined budget timeframe. With no EVs deliverable in the current market, whatever demand might exist in the market will naturally be channeled into other products.

In California there are somewhat more than 12,000 fleets of more than 10 vehicles, about one-third autos, one-third light-duty trucks and the remainder medium- and heavy-duty trucks, according to industry sources. The car and light-truck component of this represents more than 900,000 vehicles, about one-fourth of which are purchased new each year, though many of the light trucks exceed the 3750-pound GVW limit of the EV market as defined by the Air Resources Board.

Fleet industry studies indicate that government use represents one of the biggest fleets—22 percent of cars and 50 percent of trucks. It's followed by business use (25 percent of cars and 34 percent of trucks) and rental use (35 percent of cars and 5 percent of trucks).



### Distribution of California Fleet Markets



### Approximately 900,000 Vehicles Total for Both Types of Fleets

Source: Automotive Fleet Magazine Online, 2000

Thus an investigation of government fleet adoption of EVs is a valuable look at the fleet potential of these vehicles. A limited study of EVs in 59 municipal, government, transit agency and university fleets in Southern California by Southern California Edison's Electric Transportation Division (March 1999) found 178 EVs in operation and another 67 in the process of being acquired. Fleet size ranged from a single vehicle in many municipalities to 51 deployed by the City of Los Angeles (still a small percentage of its more than 22,000 vehicle fleet). A number of California cities, such as Westlake Village and Burbank, converted their entire fleets to EVs. In several, EVs represented 5 to 10 percent of their fleets. Others indicated EVs could be added to fleet vehicles contracted for municipal use.

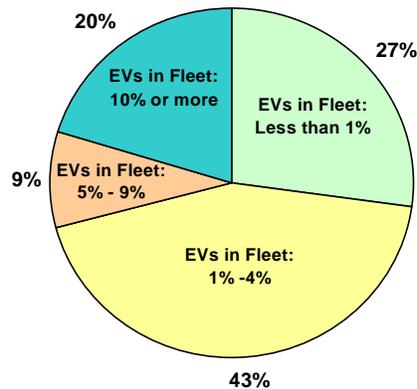
It is difficult to extrapolate directly from such a survey, but given its scope and thoroughness, it presents some intriguing possibilities for future EV fleet sales. The municipalities surveyed—which were the early adopters of EVs—represent about one-third of California's population, although GCI estimates they alone represent about one-sixth of California's current fleet EV population at the time (including vehicles on order).

Of the municipalities surveyed, 72 percent of those fully reporting their data showed EVs comprising at least 1 percent of their fleets. That breaks down into 27 percent with EVs comprising less than 1 percent of their fleets, 43 percent with EVs comprising 1 to 4 percent of their fleets, 9 percent with EVs comprising 5 to 9 percent of their fleets, and 20 percent (nine municipalities) with EVs comprising at least 10 percent of their fleets.



## Municipal EV Fleet Size

Percentage of Southern California Municipal Fleets that have an EV Component



*Source: Municipal EV Fleets, Southern California Edison Electric Transportation Division, March 1999*

If these numbers were consistent throughout the state—and there is some reason to believe they are given some Northern California cities’ aggressive pro-EV stance (San Francisco and Vacaville, for example)—a campaign to bring municipalities up to the 10 percent EV fleet standard would net approximately 10,000 new EV placements, or about 3,350 annually, solely from municipalities, some transit fleets and universities.

From a marketing perspective, this is a sizeable portion of the projected number of EVs that are required to be offered for sale under the terms of the 2003 mandate, all focused in a relatively easy-to-reach sub-segment.

Green Car Institute’s California Fleet Manager’s survey, which sampled a variety of small, medium and large public and private fleets, found a similar pattern to that exhibited in national fleet managers’ surveys and the Southern California Edison municipal government fleet survey. EVs and other alternative fuel vehicles (AFVs) are sprinkled throughout current fleets (two-thirds of fleets had some AFVs), but future purchase plans are unclear, likely reflecting the uncertain vehicle availability presented by all the automakers. While municipality, state and utility fleets all had EVs in their current fleets, with one exception future purchases were not planned. Of the private fleets surveyed, only one had EVs, although another planned a major AFV addition.

Our survey found that fleet managers’ main objections to EVs were their limited range, long recharging times, and the need to outsource service. Not surprisingly, lower purchase price, wider availability and greater range (at least 100 miles) would make EVs more attractive to these fleet managers.

### **Fleet Managers EV Wish List**

- **Lower purchase price**
- **Wider availability**
- **Greater range (at least 100 miles)**

*Source: GCI Fleet Managers Survey, June 2000*

This survey reinforces the targeting of government fleets while it indicates that adding EVs to private fleets may be more difficult.

Fleet industry studies indicate that fleet sales account for about 16 percent of total vehicle sales. For the EV fleet market to maintain this ratio, it will take strong commitments from various government fleets (federal, state and municipal) to add EVs, along with commitments from key fleets like utilities, who have already pledged to add a significant number of EVs to their annual vehicle purchases. This could be augmented by a growing presence in rental fleets led by companies like Budget EV Rental and Zapworld, and augmented by mainstream companies like Hertz (as is happening in Europe).

Our survey also uncovered what may be an unexploited opportunity for EV marketing. The overwhelming concern expressed by fleet managers in new vehicle purchase decisions is safety. An EV could be positioned to fleet buyers with central refueling facilities as “safer” because it would not require transportation and on-site storage of a volatile fuel like gasoline on company premises. The survey also underscores that any EV safety concerns need to be aggressively addressed with fleet managers.

Other marketing angles that would help EVs fit fleet managers’ purchase requirements would be to more aggressively promote the electric vehicle’s relative fuel economy and the low cost of fuel (electricity) compared to gasoline and diesel.

### **Market Review of Current EV Models**

Green Car Institute found that automakers’ EV marketing programs:

- Presented fleet buyers with a different purchase process than many were used to;
- Were not consistent in their marketing programs to fleets;
- Presented a more difficult buying process than normal to consumers;
- Used confusing marketing, such as advertising that had no retail component.

In summary, the automakers’ marketing strategies appeared to be shaped more by their desire to quickly fulfill MOA requirements than to build a long-term EV market.

Although two automakers might protest, it is clear that the marketing of EVs to consumers (as opposed to fleet customers) has not yet truly begun. That is not to say that these companies have expended little effort at presenting their vehicles to consumers. On the contrary, their public positioning has been relatively high profile in some cases. The troubling thing is that this effort has not resulted in an emerging consumer market. In all, of the six manufacturers leasing EVs in California, only GM and Honda made an effort to

market to consumers. While other vehicles may have been available to consumers, the marketing focus of the other manufacturers was almost exclusively fleet customers.

The problem with GM's EV1 and Honda's EV Plus was not necessarily in their marketing strategy, plans or execution. The two companies made a serious effort to get their EVs before the public. But the vehicles themselves limited the market, as did some of the additional hurdles presented by the automakers.

In total, three vehicles were offered to consumers—the GM EV1, Ford Ranger EV and Honda EV Plus, although the Ranger received limited retail promotion. All were two-door vehicles. Two of the three were essentially two-passenger vehicles, far from the most universally accepted seating configuration. The pickup also had a limited carrying capacity and was not offered in the most popular configuration in the class—an extended cab. (The Ranger EV offers a bench seat that could conceivably accommodate a child in the middle position, but its function would essentially be that of a two-seat vehicle and is discussed in that capacity here.)

In the automotive market classifications used by J.D. Power and Associates, the EV1 would fall into the "Premium Sporty" segment, pitted against the Chevrolet Corvette, BMW Z3 and Porsche Boxster (a segment disproportionately popular in California, but it is only one-half of 1 percent of the total market). The Ranger is in the "Compact Pickup" category where, in addition to its internal combustion engine brethren, it competes against the Toyota Tacoma, a very strong contender in the California market (again, a market segment that in total is less than 7 percent of the total market). The EV Plus would be a "Premium Compact" based on its size, where it would compete against its relative, the segment leader Honda Civic, as well as the Toyota Corolla, Saturn, Ford Escort and Chevy Cavalier.

Some marketers would break this category down further into the price-oriented entry level vehicles and the more fully equipped ones selling for thousands more (although nowhere near the price of the EV Plus, which becomes a critical issue). If classification were based on price, the EV Plus would probably be labeled a "Near Luxury" car competing against the BMW 3-series, Volvo C70 and Acura CL, although it has none of the other attributes of that class of vehicle.

The problem for the electric models is readily apparent. In spite of peppy performance delivered courtesy of the instant torque of an electric motor, they are mismatched in the performance-dominated sporty and luxury classes, and in classes that are minor players in the automotive marketplace.

In the EV1's case, the car is marketed through Saturn, which has neither a performance nor luxury heritage to justify the price or image of the car. In addition, it was the first vehicle ever to be identified directly with the General Motors brand.

At Honda, the EV Plus was a similar mismatch, sitting in a showroom dominated by established bread-and-butter, four-door, four- and five-passenger internal combustion engine Civics and Accords selling for half the price of the electric car. It might have fit better in the Acura showroom, where its sticker would have caused less of a shock and the car could still trade on the Honda tradition of reliability.

What is clear is that, at least to an extent, EV marketing programs have served to underscore the technical prowess and environmental image of the auto companies conducting these campaigns. Interestingly, significant advertising expenditures have been made in sustained campaigns at times when little or no product was available to the consumer. Some industry analysts have pondered whether this was really designed to create consumer interest in electric vehicle products or simply to enhance company images.

## **EV Market Predictions**

The past decade of the electric vehicle market did not evolve quite as anyone had predicted.

University of California, Davis, researchers—based on research done in 1995—estimated a potential annual consumer market of between 13 to 15 percent of the new consumer light-duty vehicle market in the state in 1998. That survey used some of the same assumptions found in GCI's current market research, namely that

a variety of vehicle body styles would be available and priced comparably to gasoline vehicles. That survey did not look at the fleet market, which obviously increases the potential market.

A study of the broad spectrum of the U.S. EV market (beyond on-road vehicles and including components), published in June 2000 by the Business Communications Company, estimated that this market is currently valued at \$1.8 billion and will grow to more than \$7 billion by 2005. At present, the study found 86 percent of the EV market focused on smaller EVs, including golf carts, NEVs, bicycles and industrial equipment, but projected that larger EVs would experience a higher growth rate (17 percent annually) during the next five years. This growth rate is predicated in part on a market driven by mandated production of EVs for sale in California and other states, but is also expected to be led by an explosive growth in the hybrid electric market.

A 1997 study led by John Maples of the University of Tennessee predicted the EV market would take about 15 years (until 2015, with 2000 as its starting point) to reach maturity because of high vehicle production costs and resulting high consumer prices. This study assumed that manufacturers would introduce EVs to the market at twice the price of comparable conventionally powered vehicles, which in part accounts for the predicted slow growth.

Such market assumptions about pricing show the powerful effect it can have on market projections. For example, from the same report, hybrids are shown being introduced at only a 25 percent price premium and thus achieving market maturity in only four years. Today, gas-electric hybrids are being subsidized by their makers and sold at a small premium with the aim of rapidly creating a market for these vehicles. A similar scenario has yet to be employed to help create a mass market for mainstream electric vehicles in popular vehicle segments.

The international market is another factor that is likely to substantially affect the future EV market. Overseas sales have the potential to increase exponentially, bringing lower price EVs to market in the U.S. sooner than predicted. In the same way, the predicted rapid growth of the gasoline-electric hybrid and fuel cell market will spur the commercialization of the electric vehicle.

The reality of the 1995-2000 American EV market is that it has been very limited in scope, essentially an advanced battery demonstration as proscribed by the CARB MOA. Generally, automakers offered their first generation electric vehicles to select groups of consumers and fleet markets in limited numbers and models, and with other acquisition restrictions. The end result is that more than 3,500 EVs are on the road in the U.S., with the majority (2,300) in California, while a similar number are on the road in Japan and at least four times that number are motoring in Europe.

## **Conclusions**

Clearly, this study establishes that a significant number of consumers and fleet buyers are interested in electric vehicles for all the expected reasons – lower operating costs, positive environmental image, and so on – and that given the opportunity, they would own and drive them.

What's at issue is not the existence of an electric vehicle market, but what has been done to introduce products to address it. Automakers have come to market with EVs at high prices, with limited model availability offered for lease only, with limited geographic and dealer availability and backed by a limited marketing effort. In many instances, extensive buyer screening effectively kept a substantial number of potential EV purchasers from owning and driving an electric vehicle.

Regardless of the specific reasons why automakers have approached the market in this manner – high manufacturing costs, an unknown market, wish to limit risk, expectation of losses – the fact remains that there has been a consistent and significant mismatch between product and market. Currently, there is a substantial electric vehicle market in this country in search of a product.

According to the GCI/Dohring study, limited range and function – something universally cited by automakers as the most serious impediment to the EV's market success – is not such an obstacle after all. It's the unavailability of suitable product.

Our market research with consumers and fleet managers shows an understanding of the capabilities and limitations of current electric vehicles and a willingness to accept them “as is.” A consumer market of 12 to 18 percent, as our research has indicated, is ready to buy EVs now. This equates to a consumer market of 151,200 to 226,800 EVs annually, which is approximately 7 to 11 times larger than the total 2003 production requirement under California regulations.

We conservatively estimate the EV fleet market to start at between 5 to 10 percent, accounting for different acceptance rates between government and private fleets. It adds to the current potential market, equating to 12,000 to 24,000 vehicles annually, which alone is equal to about 50 percent to more than 100 percent of the total number of EVs required to be delivered for sale in California in 2003.

The cumulative fleet and consumer market of 163,200 to 250,800 vehicles annually is obviously, even by conservative market estimation, more than adequate to sustain EV sales of the scale needed to meet ZEV production requirements set by California for 2003.

Automakers have long held that battery technology precludes them from producing such vehicles. This is an application of conventional and traditional automotive wisdom, much the same as the conventional wisdom of just a few years ago that told us hybrid electric vehicles made absolutely no sense because they integrated two disparate powerplants and fuel systems, and were therefore too cumbersome, complicated, and expensive to prove successful in the marketplace.

Obviously, this argument is falling by the wayside, and the evolution of these thoughts is changing as this paper is being written. Honda, for instance, has now publicly stated that it expects to turn a profit on its Integrated Motor Assist-powered 2001 Civic hybrid because of the efficiencies of mass production. Just six months ago, this automaker was publicly mulling whether it could sell the 4,000-unit build it had planned for its initial hybrid model debut, the Insight, which was reportedly being sold at an \$8,000 per unit loss. A few short months after its launch, Honda increased Insight production by several thousand units to help meet the growing demand. Things change, sometimes quickly, in the automotive market.

Things change, too, with regard to battery electric vehicles. The very automakers that claimed electric vehicles were not economically viable are now gearing up to produce electrics like the neighborhood electric vehicle (NEV) and community (or city) electric vehicle (CEV). They are not being forced to do this, but are seeking out new market niches while enhancing a positive environmental image for the parent company and all of its vehicles. The intent is to create a viable electric vehicle (and related product) marketing unit.

While auto companies argued that EV components were too expensive and batteries too limited in range five years ago, these same companies have already offered their second generation of EVs that feature components costing half as much and with batteries that offer almost twice the range of the first generation vehicles. Development continues on both fronts, spurred by growing parallel markets in hybrid and fuel cell vehicles.

The environmental need for electric vehicles continues, something the California car-buying public clearly recognizes. Strong environmental convictions lay the groundwork for marketing EVs to consumers while their low operating cost and high fuel economy are strong additional advantages. In addition, recent spikes in gasoline prices have spurred a renewed public interest in vehicles that either offer high fuel economy or are powered by non-traditional fuels, including electricity.

For the fleet market, EVs offer the ability to meet regulatory requirements while saving money by providing lower operating costs compared to the gasoline or diesel-powered competition.

From market research it is clear that auto companies need to rethink their lease-only approach to EVs if they intend to broaden these vehicles’ appeal. The lease market, while strong, represents only about 11 percent of the total current California vehicle market and will only rise to 13.6 percent if all of those intending to lease their next vehicle, actually do so. Those indicating a desire to purchase an EV had similar

anti-lease convictions, which means that EVs are less likely to reach their market potential unless sold more in the manner of conventional gasoline vehicles.

Clearly, the rewards are substantial for the auto companies that boldly reach out with the right EV products at the right prices to meet the needs of consumers and fleets. In addition to EV sales, the companies that truly focus on mass market EVs will benefit from a positive environmental and technology leadership image that will bolster overall positioning in the marketplace.

# The Current and Future EV Market

What is clear from the basic market research we have reviewed and/or conducted is that substantial fleet and consumer markets for EVs exist. The desire to purchase EVs is there, which is the basis of a market. Consumers and fleet managers alike have an understanding of the functionality of current EV technology and feel it can fit their family or fleet needs. In aggregate, that market is more than sizeable enough to absorb the numbers of EVs mandated by the state of California to be offered for sale in 2003.

Regulatory policies, like the California Zero Emission Vehicle production requirements and the Federal Energy Policy Act of 1992 (EPA Act), have stimulated fleet adoption of EVs. As an example, five of California's largest utilities have stated their willingness to buy about 1,000 EVs per year. Programs like "evSacramento" have increased EV placements at state and local public agencies in that region. High-profile EV uses like the Xpress Shuttle at Los Angeles International Airport, and both Budget EV Rental and Zapworld EV rental, are putting electric vehicles in the public eye and raising awareness of the electric vehicle's everyday functionality. The other positive sign is that surveys of fleet EV users show an overall positive response to electric vehicle integration into fleet use, which will be critical to future EV fleet growth.<sup>1</sup>

The consumer market, according to all the automotive manufacturers bound by California's Memoranda of Agreement (MOA), is more difficult to gauge. The potential California market of car buyers who could accommodate and afford an EV is quite large. Public stated opinion about purchasing an EV is positive and significant. Even allowing a sizable discount for overstatement of those opinions, it indicates that presented with electric vehicles of the appropriate configuration and price, a large market for EVs exists.

It is clear from Green Car Institute's original market research, conducted with an experienced automotive market research company, The Dohring Company, the annual consumer market for EVs is between 12 and 18 percent of the new car market in California. We feel this number is conservative given a stated preference for EV purchase by more than one-third of the respondents to our survey.

One key to achieving that kind of market penetration appears already to be in progress. As the precursor to a major shift in consumer attitudes towards fuel economy and the environment in relation to automobiles, manufacturers have elevated these features to a higher level than in previous years. While fuel economy and the environmental impact of vehicles have been low-profile items in vehicle purchase decisions in recent years, that appears to be changing.

Ford and General Motors are battling for SUV fuel economy supremacy. Ford fired the first salvo in early 2000, announcing that it would produce a hybrid gasoline-electric version of its new compact sport utility, the Escape. Later, at the company's annual meeting, Ford Motor Company chairman William Ford offered a corporate "mea culpa" for its production of gas-guzzling, inefficient sport utility vehicles, comparing his company's position to that of cigarette companies (producing and profiting on a product that is harmful to the environment and humans) and pledging to rectify matters in the near future. One of the first follow-up announcements was Ford's pledge to increase the fuel efficiency of its SUV fleet by 25 percent during the next five years, which would include improving gas-powered vehicles and introducing new technology like the hybrid Escape.

GM countered with its own pledge to fuel economy supremacy, unveiling a gas-electric hybrid version of its best-selling full-size pickup that it said would go into production by 2004. In a similar vein, DaimlerChrysler has shown a hybrid version of its Durango sport utility and pledged to put it into production if a \$3,000 government purchase incentive program is put into place.

Ford, Honda and Toyota have each said at the highest corporate level that its corporate goal is to be known as *the* leading environmental automotive company. These companies are expending significant resources to attain this distinction, which, it is hoped, will lead to increased future market share.

The importance of these announcements and counter-announcements is two-fold. First, it indicates that fuel economy and environmental considerations are seen as positive consumer benefits in the eyes of automakers for marketing individual vehicles as well as for corporate positioning. Secondly, it demonstrates that the only path to achievement of the goals laid out by manufacturers is through the introduction of advanced technology vehicles, which means there will be a continued emphasis on the benefits of advanced technology for consumers.

The historical parallel is in the safety arena, where government regulation stimulated research in passive and active restraints. The classic marketing case history occurred when Chrysler Corporation added driver's side airbags to its cars in the early Nineties. While other companies balked at the cost of adding the safety equipment until it was mandated by the government or only made them standard in luxury models with higher profit margins, Chrysler made airbags standard throughout its whole lineup and reaped rewards in the marketplace by giving its cars a distinct advantage over the competition.

As if to reinforce the point in the contemporary market, Toyota's \$15 million (advertising) launch of its gas-electric hybrid Prius relies heavily on the vehicle's high-tech features and resulting diminished environmental impact.

Because many of the new vehicles and technologies "share components--batteries, electric motors, controllers and the like--...the more of one vehicle we build, the more we are able to spread costs across a large number of vehicles. Ultimately, these economies of scale will bring down the cost of all vehicles."<sup>2</sup>

The overall effect of this increased awareness of environmental issues and the advance of technology is to suggest that estimates of future EV markets, if anything, may be very conservative because they cannot fully take into account the impact of a trend that is just beginning.

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1. Natural Gas Fuels 2000 national survey of National Association Fleet Managers, confirmed in GCI California fleet managers survey in June 2000.

2. Jane Beseda, Strategic Planning Corporate Manager, Toyota Motor Sales USA, Cited from "TMS Strategic Planning Department, Prius Summer Tour, July, August, September 1998, Sept. 14, 1998

# Consumer Market

The consumer market for EVs is the most difficult to factor by all measures. Automakers that have offered electric vehicles to consumers for the past three-plus years adamantly maintain there is no market of the size envisioned by the 2003 mandate and that their market research shows high negative consumer response to EV shortcomings. EV advocates, including owners and potential owners, cry foul and claim no sincere marketing effort was made on behalf of the vehicles. They point to surveys of EV owners that show high satisfaction with the vehicles and a very positive ownership experience, and to waiting lines of potential EV owners.

Part of the issue is the complex problem presented by the introduction of a new product to an established market. The product, in this case an electric vehicle, is “disruptive” to the rest of the market and its introduction cannot follow normal product introduction processes.

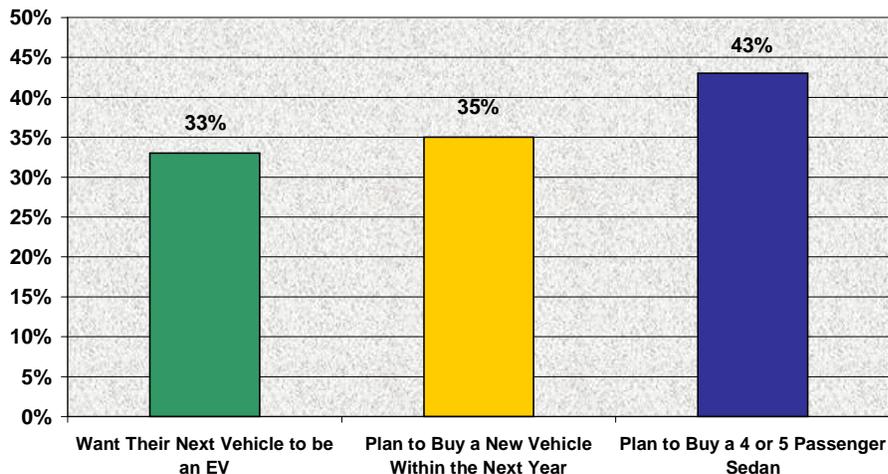
## GCI/Dohring Market Research

Independent market research has shown consistently, though, that the public does want electric vehicles. A survey of California car buyers done for industry trade journal Automotive News in 1994 showed 62.9 percent “definitely” or “probably” willing to buy an EV.<sup>1</sup> Green Car Institute’s market research, conducted by recognized automotive research firm The Dohring Company during July 2000, indicated that more than a third of Californians planning to buy a new car would buy an EV for their next vehicle.<sup>2</sup> Those percentages can be converted into an estimate of annual market share for EVs. Earlier research by Turrentine and Kurani of UC Davis/Institute of Transportation Studies argues that for the near to mid-term future, households that buy EVs are likely to continue to own and buy gasoline vehicles (or some other “long range” vehicle) too. Thus, in general, some households would own both electric and gasoline vehicles, but might only have one EV at a time (minimum), or they would replace all vehicles but one with EVs (maximum). Assuming the same rate of replacement and length of ownership with EVs as with gasoline vehicles, the annual market share for EVs is estimated to be 12 to 18 percent of all California light-duty vehicle sales. With annual sales running in excess of 1.5 million vehicles, that translates conservatively into 180,000 to 270,000 EVs per year to consumers.



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## California New Car Buyers Percentage of New Car Buyers in California that...



Source: GCI/Dohring Market Research, July 2000

The total light-duty vehicle sales numbers used here correspond to the total light-duty vehicle market, as normally construed by the auto industry. The California Air Resources Board (CARB), in looking at the light-duty vehicle market for EVs, considers only vehicles with a gross vehicle weight (GVW) of fewer than 3,750 pounds, which eliminates many popular mid-size and full-size vehicles, particularly popular full-size pickups and sport utility vehicles. The production requirement that CARB has in place for 2003 is based on four percent of the Big Six's (DaimlerChrysler, Ford, General Motors, Honda, Nissan, Toyota) estimated sales of under-3,750-GVW vehicles. GCI/Dohring's market research considered the whole spectrum of new vehicle choice, even though many are beyond the expected configurations of EVs, so our numbers were factored on the larger market estimation of 1.5 million vehicles.

After an educational presentation that reviewed the limitations and advantages of electric vehicles, the percentage remained constant. While some people who initially thought they might buy an EV were disenchanted by the information presented, other people who initially were not interested in EVs later said they would buy one. Thus, while the overall percentages of who would or would not buy an EV did not change much when measured before and after the educational material, the specific people who would or would not buy did change.

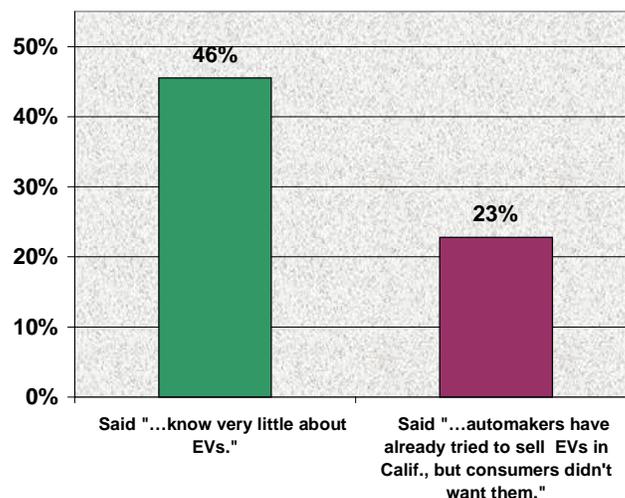
The market exists right now, as almost a third of those wishing to purchase an EV expect to buy a new car within the next year, a percentage comparable to those expressing a desire to purchase a gas-powered vehicle. And it is not limited to those who expect EVs to be priced at parity with gasoline-powered vehicles. In the survey almost half of the respondents said they would be willing to pay a premium for an EV, a number consistent with earlier studies such as the 1994 Automotive News study that found 33.5 percent answering similarly.<sup>3</sup>

In the 2000 survey, GCI tested this willingness two ways. First, as found in previous studies, we found that about half of all respondents said they would pay more for an EV than for a gasoline vehicle. In our case, this question was asked after an explanation of miles per charge, recharging, maintenance differences, environmental impacts and "convenience" incentives such as California's recently enacted high-occupancy vehicle (HOV or 'carpool') lane access for EVs. Second, we asked the question by associating expanded EV range with additional cost. This time more than two-thirds of the respondents opted to pay more for the EV of their choice.



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### EV Knowledge



Source: GCI/Dohring Market Research, July 2000

Another surprising result, contradicting the beliefs of many in the auto industry, is that consumers understand range issues with EVs and are prepared to see how they can incorporate them into their lifestyle. After an explanation of the miles per charge that an EV might get and a discussion of the respondents' vehicle usage patterns, almost half chose EVs with a range of 60-80 miles.

The EV market also exists in spite of limited, self-reported knowledge about EVs. Almost half (45.5 percent) said they "know very little about EVs" in response to one of the questions in the GCI study, while only 8.4 percent said they had ridden in an EV and 5.7 percent said they had driven an EV. In spite of automakers' claims of EV consumer marketing in the state, only 22.8 percent said they believed that "automakers have already tried to sell electric vehicles in California in the past few years, but consumers did not want them."

### **EV Intender Not Different**

GCI market research also found the California EV intender to be statistically undifferentiated from the gasoline car intender by socio-economic and demographic characteristics of the respondents or their households, a significant difference from much of the marketing information shared by the auto companies. That also may partially explain the failings of EV marketing thus far.

For example, GM's target audience for the EV1 was "highly educated men earning more than \$150,000 per year." That might be appropriate for a two-seat sports car, but obviously this is a very limited audience. In the GCI survey, for instance, only about 20 percent of all respondents reported post-graduate study or an advanced degree; and only 11.3 percent reported household incomes of more than \$150,000. Taken together, only 3.9 percent of the respondents reported both high education and high income. (If we take one step further to look at high income, high education respondents who are contemplating a sports car for their next vehicle, the percentage drops to 0.3 percent.) For its EV Plus, Honda's target retail customer was either an "Enviro Leader" in the vanguard of environmentalism or a "Techno Champ," an affluent innovator with a technology focus, similar to GM's target.

The EV1, with its extensive advertising /marketing program but paltry sales, is often held up as an example illustrating the absence of a present day electric vehicle market. Yet, considering the rarefied demographic target, high price, considerable acquisition hurdles (often including a several month wait for the vehicle) and the admittedly narrow and limited potential of the two-seat sports car target market, the EV1 experience could hardly be called a true market test upon which to base such an expansive assumption.

What the EV intender reported in the GCI survey is that he/she wants an EV because of its environmental and economic benefits, and because of a belief that the EV is "the car of the future." But in answer to environmental questions, those EV intenders do not distinguish themselves significantly from those who intend to purchase gasoline vehicles. What does distinguish EV intenders from gasoline intenders is that the former appear to bring into the survey the pre-disposition to believe that EVs are practical, clean and inexpensive to operate, which is the basis of their purchase intention

### **EV Intenders Believe EVs Are:**

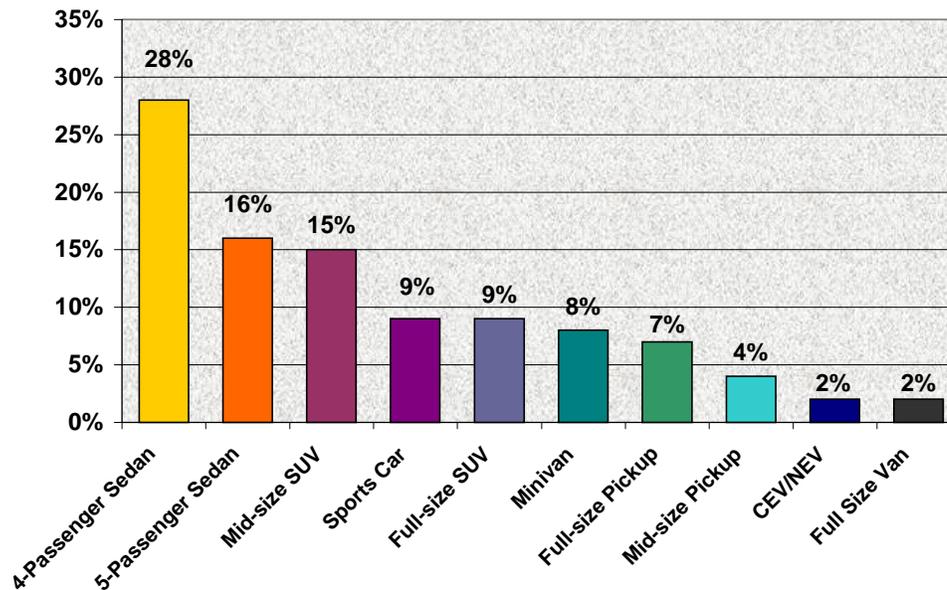
- 1. Practical**
- 2. Clean**
- 3. Inexpensive to operate**

*Source: GCI/Dohring Market Research, July 2000*

The survey response translates into a potential annual consumer EV market of 151,200 to 226,800 vehicles, with a sustained market likely during the next several years. But, critically, that is not necessarily a market desiring the electric vehicles that are currently available from the auto companies. More than half of the respondents chose a four- or five-seat sedan as their EV of choice. Not surprisingly, these are the most popular models among all new car buyers, usually in a four-door sedan configuration. Mid-size SUVs, sports cars and minivans followed as the next most popular choices, indicating a fractured EV market quite similar to that of conventional vehicles.



### Vehicle Types Preferred by California New Car Buyers

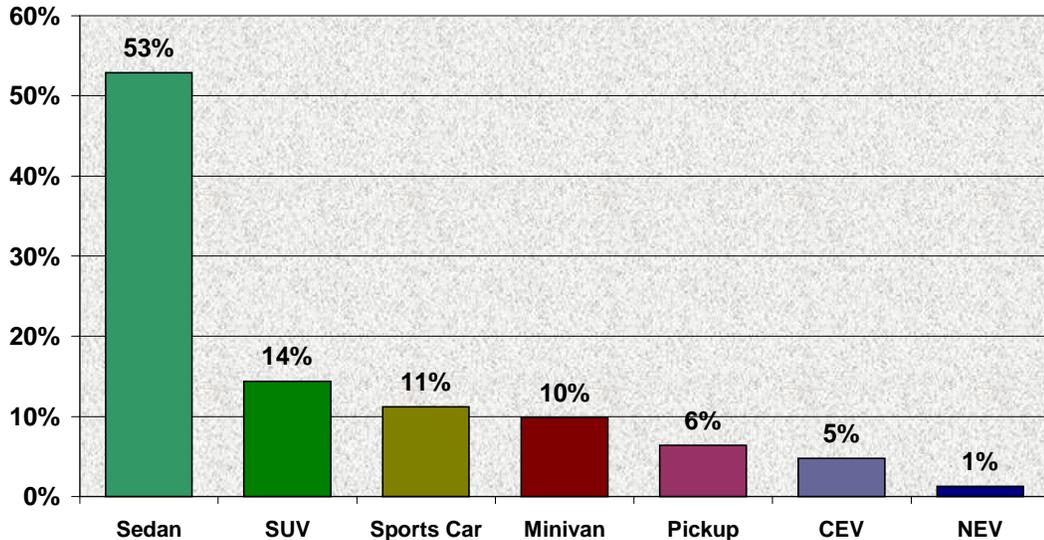


Source: GCI/Dohring Market Research, July 2000

Less than 27 percent were interested in buying compact pickups, sub-compact sedans or coupes, sport cars, minivans or compact sport utilities (SUVs), the only models of EVs offered to date (and the latter two were not even marketed to consumers). Yet 33 percent of the respondents chose EVs. The answer to these differing responses lies partly in shifts of body style choice by respondents, and partly in the optimistic EV body style options offered to them. A combined 14.7 percent of respondents initially said they want their next new vehicle to be a sub-compact or compact sedan or coupe (the most common model of which is a four-door version). When presented with information and choices about EVs and faced with the direct questions of which vehicle they plan to acquire next, EV intenders and gasoline vehicle intenders alike overwhelmingly chose four-seat sedans. Nearly twice as many people, 27.9 percent, chose a four-seat sedan as we would expect from prior statements about body style intentions. Among those who chose a four-seat sedan, 43 percent chose an EV.



## Body Style Choices of EV Intenders



*Source: GCI/Dohring Market Research, July 2000*

In the body styles offered to respondents, electric SUVs and pickup trucks were offered as “mid-size” or compact vehicles. This would include the Toyota RAV4 EV, Chevy S-10 EV and Ford Ranger EV that have been marketed, but also slightly larger vehicles. Thus some truck buyers may have been pulled into the EV market that might not have chosen an EV if only the smaller current EVs were available in the future. The size of this effect cannot be estimated precisely, but certainly it is unlikely to be larger than the total number of people who chose EV trucks and SUVs in the first place, which accounts for 21 percent of the EV intenders.

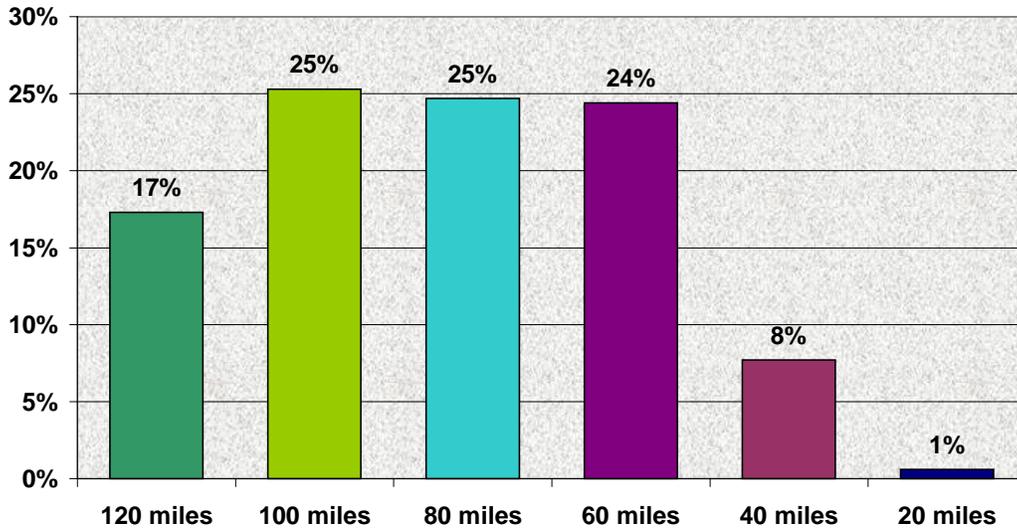
It does indicate that the introduction of Toyota’s RAV4 EV compact SUV and DaimlerChrysler’s EPIC minivan would be a step toward better meeting the desires of EV intenders, though their configuration does raise new marketing questions.

### **Performance Acceptable**

A key response in the consumer survey was that respondents felt comfortable with the performance limitations of contemporary EVs. Even though they were offered the potential of higher ranges at additional cost, almost half of those interested in EVs felt comfortable choosing EVs with a range of 60 or 80 miles per charge.



## EV Range Choice



Source: GCI/Dohring Market Research, July 2000

The GCI survey also tested the willingness of those who desire a gasoline car for their next vehicle to switch to an EV. They said they chose a gasoline vehicle because of its greater driving range, use for out-of-town travel or proven reliability, but indicated more range, more widespread charging and faster charging would make them more inclined to consider an EV.

Shown conclusively was that California drivers are more than willing to buy EVs, even current technology ones, for their personal fleets. But the survey also offered some marketing cautions for auto companies, some of which fly in the face of the way EVs have been marketed for the past several years.

### Leasing a Stumbling Block

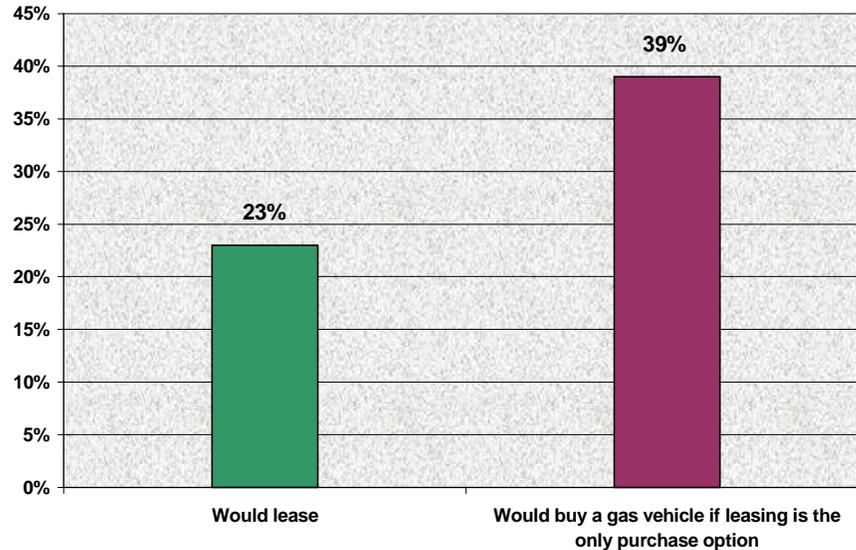
Leasing appears to be the biggest stumbling block to electric vehicles achieving a larger market. Almost all of the existing consumer EVs were sold on a lease-only basis. The most amusing anecdote, if only because it points out the absurdity of the hard-line stance on leasing, is when General Motors turned down comedian and well-known car collector Jay Leno's request to purchase an EV1. He was reportedly told the vehicles were only available for lease; he replied that he only bought his vehicles, so GM lost out on a very high-profile customer.

In the GCI survey we found that only 13.6 percent of the new car buyers planned on leasing their next vehicle. This compares with 16.6 of households currently leasing one of their vehicles, according to the same respondents, but obviously this is still a small portion of the market. When EV intenders were asked specifically whether leasing would inhibit their purchase, only 23 percent indicated it would be okay. The remainder said, "Maybe, I/we would rather not lease, but would consider doing so in order to acquire an EV" (38 percent) or "No, if leasing were the only option for EVs, I/we would probably acquire a gasoline vehicle instead" (39 percent).



## Leasing Limits EV Market

Percentage of EV Intenders that...



Source: GCI/Dohring Market Research, July 2000

There was no significant difference between EV intenders and the other respondents. Experience with leasing is also relatively low; only 16.6 percent of all households are currently leasing one of their vehicles, a number consistent between EV intenders and others.

That response seems to make clear that automakers need to develop EV marketing plans that include sales as well as leases if they are to reach the volumes projected for the 2003 requirements. A substantial market of serious buyers exists with solid reasons for choosing EVs and a good understanding of what an EV in the family would mean.

### Past Marketing Efforts

The research findings illustrate the shortcomings of past auto company EV marketing. As has been indicated, marketing in all cases in the auto industry starts with the product. In the first electric vehicles' case, these were products sadly mismatched with their market. For consumers, the EV1 was in a small market (two-seat sports cars) dominated by performance and image, the latter fueled primarily by convertible versions of the cars. While fast (particularly by EV standards), the EV1 was nowhere near any of this category's leaders except in price. It also lacked the heritage that drives many of the sales in this arena with marques like Corvette and BMW.

In the GCI/Dohring survey less than 10 percent of the respondents said they planned on buying a two-seat sports car as their next vehicle. Compact or mid-size pickups have half that many intenders. Compact sedan or coupes rate higher purchase intention, but as mentioned elsewhere, the typical configuration for those vehicles

is with four doors, with the coupe usually relegated to a low-volume, low-price entry-level model or high-performance sporty model.

The EV pickup available to the public was similarly out of place, lacking either the functionality or low price that brought consumers into this category.

The Honda EV Plus was closer to target, which may be why Honda was able to sell its MOA quota of the two-door, four-passenger cars relatively quickly and then halt production. But even the EV Plus, by Honda's own admission, was somewhat off-target. An anecdote illustrating this was relayed by Honda; one of its earlier lessees, who happened to be featured in the company's consumer advertising, actually turned in the vehicle early because the addition of a child strained the family functionality of the two-door vehicle. Of course, there was no other EV on the consumer market that could have fit their needs.

This anecdote is an interesting counterpoint to Honda's stated marketing goal with the EV Plus, which was, according to American Honda's executive vice president Tom Elliot, "an effort to be the EV maker to appeal to the American family as the EV's target market. Honda plans to lease about 300 EV Plus vehicles from four dealerships in California. 'From day one of our electric vehicle program we focused on quality, not quantity--in everything from our EV-specific design to our outreach to customers. Through this approach, we hope to demonstrate that feedback from the 'family next door' is the best test of the long-term potential of electric vehicles. If a car can't handle the day-to-day, stop-and-go commuting and around-town errands to piano lessons, Little League and other demands of today's families, it can't handle the American market. We never intended our vehicle to be a transportation gimmick--but a quiet, efficient, clean and fun-to-drive transportation alternative that offers the familiarity and comfort of a normal car.'"<sup>4</sup>

Our "mystery shopper" research, in which representatives posed as EV buyers calling and visiting various dealerships, illustrated an immediate problem for EV intenders. While the reception at Saturn dealerships selling the GM EV1 is generally very positive, Ford dealerships selling EVs were harder to locate, and the sales personnel were less likely to be knowledgeable about the Ranger EV. But neither channel has any product available—or could predict when it might arrive. Honda, of course, no longer markets its EV Plus. Nissan, DaimlerChrysler and Toyota EVs were only marketed to fleet users.

### **NEV/CEV Market**

While manufacturer interest in regular EVs may be waning, the consumer market for NEV/CEV models is just beginning to heat up. Automakers have new models (the Ford TH!NK, Toyota e-com and Nissan Hypermini) designed for this small-car market, which seems to be establishing itself in Europe and Japan, stimulated by high petroleum prices and tight driving conditions. Conventional wisdom says that these minicars would not appeal to Americans, but some of the marketing efforts and demonstration projects may prove otherwise.

In the City of San Francisco, Ford TH!NK City cars form the core of an EV-oriented municipal vehicle pool, a car-sharing program. To support the program, the city is installing charging stations in all 13 city garages, a project targeted for completion in September 2000. Broader-based consumer car-sharing programs, imitating ones that have been quite successful in Europe, are being launched in California.<sup>5</sup> Electric vehicles are usually a key part of the program, since one of the attractions of the service is a more environmentally friendly approach to vehicle use. As one San Francisco Supervisor said of the fledgling program, "It's not the sole solution to traffic, parking and congestion woes, but it's part of it." Such a comment could well describe the general introduction of battery electric vehicles to the U.S. auto market as well.

Also in San Francisco, neighborhood electric vehicles from Global Electric Motorcars (GEM) have become popular rental units for tourists, while also attracting enough attention from locals for the company to envision a consumer market as well. The instant torque from their 72-volt motors can handle the steep hills in town and their 35-mile range handles most in-town trips. "It's not a golf cart," said Mike Clevenger, director of sales and marketing at Global. "They've been designed from the ground up as an automobile."<sup>6</sup>

Similar to Ford, Toyota started a demonstration project with its e-com, where the mini EV will be used in a car-sharing project at the University of California, Irvine, and Irvine University Research Park. Nissan's

Hypermini also has begun arriving on these shores, part of a worldwide effort by Nissan and its Renault parent to find a market for the small EV.

The sum of these efforts is that EVs are becoming a regular part of the vehicle landscape, at least in California. More fleets are using them, and more rental companies are offering them. As with other rental vehicles, the consumer market is a likely destination after their fleet use.

Ford's San Francisco TH!NK demonstration project is the vanguard of 700 TH!NK cars being imported over the next two years primarily for fleet use.<sup>7</sup> Interestingly, though, in Europe fleet and consumer uses have overlapped as Ford has used its Hertz rental car subsidiary both to rent TH!NK EVs and also to serve as a backup to TH!NK owners when a larger or longer range car is needed.

TH!NK Nordic teamed up with Hertz to make leasing electric cars easier in Norway. According to TH!NK president Per Lilleng, "Customers will have one single number to call which gives access to a convenient package of leasing, distribution, and service." Hertz will handle delivery of the TH!NK cars to customer homes and businesses. The auto rental company will also pick up a TH!NK EV that needs service, and supply temporary replacement vehicles. TH!NK EV drivers additionally will be offered special rental rates for larger vehicles through Hertz when the short-range two-seat cars cannot meet a driver's needs, such as for family vacations.<sup>8</sup>

Ford and TH!NK will lease TH!NK EVs through Hertz in Norway, and say they will extend the arrangement to Sweden and Denmark this year. The companies are currently studying entry into German and U.S. cities. Fleet customers, such as utility companies, postal services, health-care organizations, and governments are the primary markets for the vehicles.<sup>9</sup>

GCI/Dorhing market research also tested the consumer potential for two new classes of battery electric vehicles—neighborhood electric vehicles (NEVs) and community or city electric vehicles (CEVs). Information was offered to respondents on the potential of these affordable but limited range and function vehicles, and about 2 percent of those intending to buy new vehicles expressed interest (0.4 percent in NEVs and 1.6 percent in CEVs). This could translate into a small but potentially growing market segment (ranging from 0.1 to 0.9 percent of the total light-duty market or 1,500 to 12,000 vehicles annually in California). This is particularly interesting since these vehicles are relatively unknown in the marketplace at present. NEV/CEV buyers are included in the overall electric vehicle market estimates.

It is inadvisable to attempt precise market estimates from these numbers for two reasons. First, any extrapolation would be based on very few respondents. Second, more so than "full-function" EVs, marketing NEVs and CEVs will depend on careful selection of compatible neighborhoods and cities. The sampling frame for this survey made no effort to identify such appropriate places.

The clear conclusion from this research is that a ready market exists for EVs priced competitively and configured to meet consumers' expected use. Those vehicles also need to be marketed aggressively to highlight the positive features of the vehicle such as the convenience of home recharging and the lower cost of electricity compared to gasoline.

That market exists now, according to the research. Almost one-third of the respondents said they planned on purchasing a new car within the next year, with declining percentages over the following four years. The purchase plans of EV intenders were parallel to those preferring gasoline vehicles'

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1. "Automotive News Electric Vehicle Study," The Dohring Company, 1994. Actual question: "Would you definitely consider purchasing an electric vehicle in the future, probably, may or may not, probably not or definitely not consider purchasing an electric vehicle in the future?"
2. Survey of 934 California new car buyers by The Dohring Company, July 2000. Actual question: "Given what you know right now about electric vehicles, if they were available the next time you buy or lease a vehicle, how likely would you be to acquire one, if it were close to the same price as a gasoline vehicle?" Margin of error plus/minus three percent.

3. 1994 question was: "If you were considering purchasing a gasoline-powered vehicle or an electric vehicle of similar size, features and quality, would you be willing to pay more, the same or less for the electric vehicle?" The 2000 question was: "Now that you know more about the benefits of EVs, would you be willing to pay more or less for an EV than a conventional gasoline vehicle?" The two questions also were parts of different sequences of questions about EV pricing considerations.
4. "Honda EV PLUS arrives on California Streets and Neighborhoods," Honda News, press release, June 6, 1997
5. The European ones cited were CarSharing Switzerland, which has 40,000 customers and operates 1,300 vehicles. Kaplan, Tracey, "Car-sharing seeks role in Bay Area," San Jose Mercury News, Aug. 2, 2000, p. 1A
6. Quoted in "Cartoon-like Electric 'Egg' Cruisers Tackle S.F. Streets," Chuck Squatriglia, San Francisco Chronicle, Aug. 7, 2000, p. A17
7. Green Car Journal, Feb. 2000
8. Ford press release, May 24, 2000, [www.th!nkcity.com](http://www.th!nkcity.com)
9. EV Update, July 30, 19

# The Fleet Market

The fleet market was where the automakers focused their attention when the time came (under the state of California MOA) to introduce electric vehicles into the marketplace. All six manufacturers targeted fleets and three—DaimlerChrysler, Nissan and Toyota—exclusively sold vehicles to fleets buyers.

From a car marketer's standpoint, introducing a new type of vehicle to the fleet market does not reflect conventional wisdom. Historically, auto companies have had a difficult time introducing alternative fuel vehicles to the fleet market, particularly where there was a cost-differential or new fueling infrastructure involved as with compressed natural gas vehicles. The fleet market is very conservative, reflecting buying patterns no longer seen (to such a degree of influence) in the consumer market. Fleet purchase decisions are based on:

- Brand loyalty;
- Past experience;
- Vehicle suitability for its planned use;
- Price, taking into consideration purchase price, operating cost, and infrastructure development costs.

While automakers can make a play for the first item based on the vehicle's brand, the EV had no track record with any fleets other than in a few small utility demonstration programs. The EV's suitability to the tasks assigned most fleet vehicles was not readily apparent to the fleet market, a fact complicated by the odd vehicle configurations in which the initial EVs were offered. Price was also not the EV's strong suit, as its lease-only arrangement and high (although usually subsidized) purchase price sometimes overshadowed its inherently low operating costs. In the auto industry, fleet sales are generally looked upon as the market of last resort because it typically has lower margins than is found in the retail end of the business. On the other hand, fleet sales have become a critical part of the model mix for most mass market auto brands. This is because the volume of fleet sales supports efficient manufacturing that drives economies of scale and permits better profit margins overall. The fleet market is thus an important part of building support for the mass production and commercialization of electric vehicles. Obviously, a two-seat sports car like the GM EV1 is not a suitable fleet vehicle, but if an appropriately configured vehicle is offered to the fleet market, the resulting component production may help lower the cost of both vehicles.

## **Fleet Advantages for the Manufacturer**

So, what drove the manufacturers' marketing decision? Fleets offered the following:

- Group purchases, moving more vehicles per sale;
- Purchasers more likely to be motivated to acquire EVs because of regulatory constraints;
- A more information-intensive, one-to-one sales relationship than the typical consumer sale;
- The potential of delivering EVs to those most likely to take advantage of the early models—companies with fixed, limited routes and/or a central refueling structure.

- Limited the amount of required dealer training, parts stocking and other investments necessary.
- A more controlled environment where the manufacturer could get more needed feedback on their operational performance.

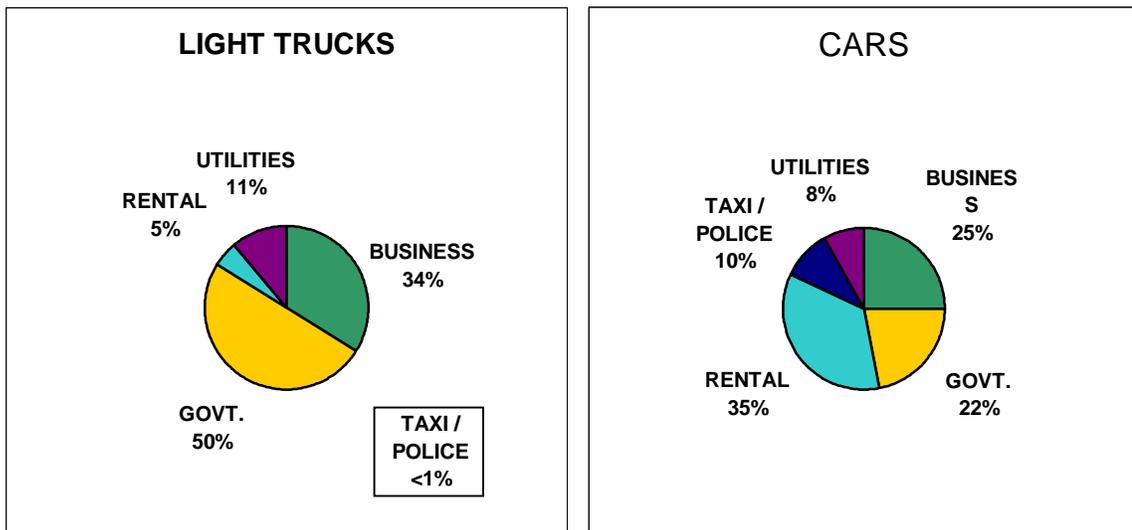
### Fleet Statistics

According to industry statistics, there are more than 12,000 fleets of 10 or more vehicles in California. These fleets represent a total of 1.4 million vehicles, divided roughly into thirds of passenger cars, light trucks and medium/heavy-duty trucks.<sup>1</sup> EVs, of course, compete primarily for the car and light truck portion of the market, which represents a new vehicle purchase pool of approximately 240,000 vehicles per year, given vehicle replacement cycles. Those fleets are found in differing places depending on their vehicle type. For cars, rental fleets represent 35 percent of the market, followed by business fleets at 25 percent and government fleets at 22 percent. Taxi and police fleet use comprise 10 percent, while utility fleets account for 8 percent. In trucks, government fleets have 50 percent of the market, followed by business at 34 percent, utility company fleets at 11 percent and rental fleets at five percent. Taxi and police truck fleets are negligible.<sup>2</sup>



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## Distribution of California Fleet Markets



**Approximately 900,000 Vehicles Total for Both Types of Fleets**

*Source: Automotive Fleet Magazine Online, 2000*

Extrapolating from these numbers, it is clear that if EVs comprised 10 percent of the government and utility markets, which appears to be obtainable, and even one percent of the remaining fleet markets, this would equal more than 10,000 vehicle sales annually. And this does not take into account business, rental and

smaller fleets (mostly business fleets of less than 10 vehicles), many of which may be amenable to a switch to EVs for environmental or economic reasons.

### **A Few Visible Successes**

The automakers' EV marketing efforts did produce a few highly visible success stories. One example is the fleet of Dodge EPIC minivans used by Xpress Shuttle in Los Angeles, which very effectively showcases the everyday use of EVs and demonstrates the potential of quick charging. Ford also scored a major coup with its contract to sell 500 EVs to the U.S. Postal Service, an agreement made sweeter by the option clause that potentially could add 5500 more EVs to the total. The USPS has the nation's largest civilian vehicle fleet (207,681 vehicles). Its existing inventory of 8,272 alternative fuel vehicles is fueled by CNG, ethanol, propane, and electricity. This AFV fleet is expected to grow by more than 30,000 vehicles in 2001.<sup>3</sup> The potential to integrate a sizeable number of EVs in that vehicle mix seems to be growing.

The USPS challenged Ford to have the electric vehicles priced as closely to flexible fuel vehicles as possible. Incentive dollars from New York State, the Washington D.C. metropolitan area, the state of California, the federal government and various utilities are helping make that a reality.

In contrast to this success is the major complaint registered at California Air Resources Board hearings in which fleet managers said they were unable to get the EVs they wished to add to their fleets. On one hand, the USPS experience demonstrated that there are innovative ways in which to make current EVs affordable fleet additions. On the other hand, the California fleet managers' experience demonstrates that price is not the only significant impediment to making further electric vehicle inroads into the fleet market. It also takes commitment to production on the part of auto marketers.

### **Mystery Shopper Program**

Green Car Institute's "mystery shopper" program confirmed those reports. Fleet sales managers contacted at multiple dealerships were often reluctant to even talk about EVs, which they were unable to order or deliver. Our interviews, in which we approached various dealerships in Southern, Central and Northern California as either private motorists or prospective fleet customers, confirmed that no vehicles were available or in production and the earliest delivery of a new EV would be January 2001. But even that delivery date was problematic, according to several of the salespersons and managers.

We also found that knowledge of Ford's EV program, for example, is not universal, as some dealership personnel were unaware that the Ranger EV variant even existed. Information beyond the dealership also suffers from a lack of consistency. For instance, some manufacturer websites (Ford's is a prominent example) provide a wealth of information on EVs, including local dealer contacts. The local dealership website, though, would typically present no information on EVs or their availability.

The physical presence of EVs on the dealer lot is not as critical in fleet sales as in sales to consumers, but the lack of EVs certainly serves to limit both the current market and its future. More disturbing is the news from automakers, through their dealers, that delivery dates cannot be assured. Fleet purchase decisions take place within a defined budget timeframe. With no EVs deliverable in the current market, whatever demand might exist in the market within this timeframe will be channeled into other products.

The lack of product then compounds that negative decision because another vehicle replaces the potential EV purchase and becomes a part of the fleet experience, forming a key basis for future vehicle purchase decisions. The current drought of electric vehicles, therefore, not only impedes any immediate sales, but will likely have a longer-lasting negative effect on future EV sales. That effect will, as a matter of course, extend into several future purchase cycles, having a much more severe impact on the overall EV market than the similar situation does in the consumer market today.

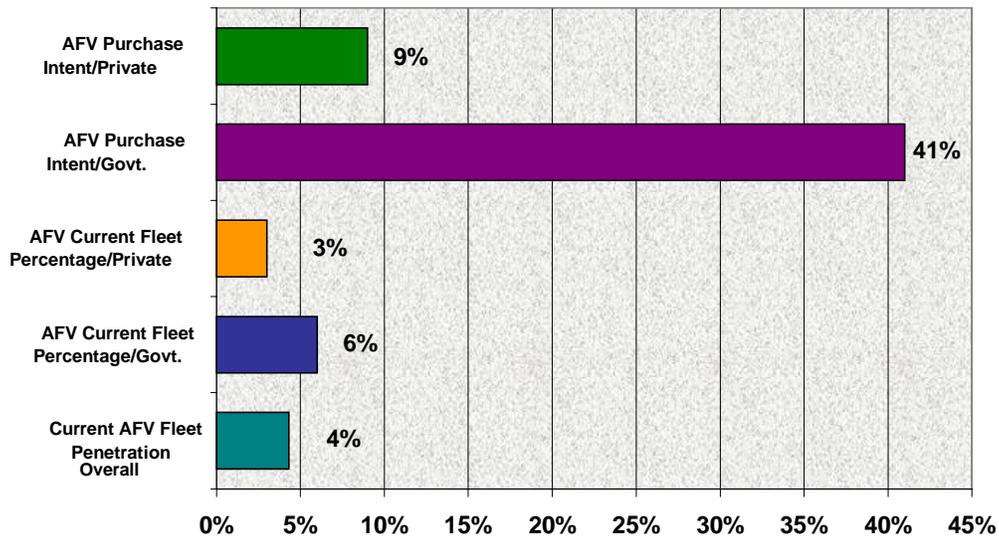
### **National Fleet Studies**

Because of its cyclical and traditional nature, the fleet market is a complicated one to approach and not one that is likely to produce quick results, as has been shown in national studies of the alternative fuel fleets. In

spite of extensive incentives from various government and other entities, the penetration of all alternative fuel vehicles (including electrics) is only about 4.3 percent of total U.S. fleet vehicles, according to one recent national study. Fleet managers' purchase plans, the same study determined, were to make 5.5 percent of new purchases AFVs, but a declining number of fleets were actually employing alternative fuel vehicles. In three years of surveys the percentage of fleets operating AFVs dropped from 56 percent to 11 percent. Of course, electric vehicles represent a small portion of these fleets, although electrics and hybrid-electrics were high on the list of new vehicles anticipated to be purchased.<sup>4</sup>



### Alternative Fuel Vehicle Fleets Nationwide



*Source: Natural Gas Fuels Survey, March 2000*

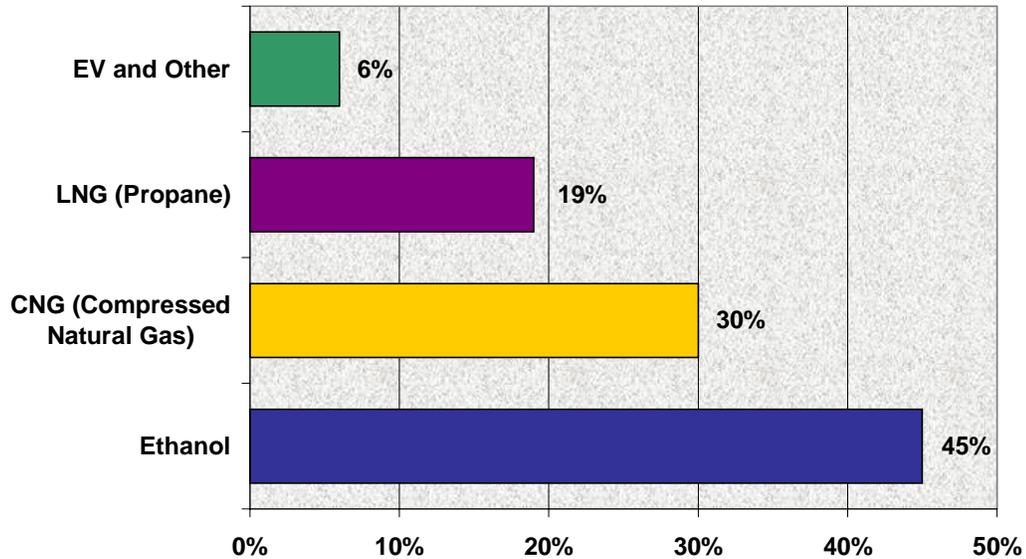
This national study also singled out public sector fleets as the ones most likely to purchase all AFVs. Fleet managers said government mandates, followed by environmental concerns, were the motivating factors for the purchase of AFVs. Other purchase factors were concern for a good corporate image or citizenship, OEM vehicle availability (as opposed to aftermarket conversions) and domestic fuel/energy security issues.

Those fleet managers who did not buy AFVs cited lack of access to the fuel required and cost of the vehicles as the biggest inhibiting factors to purchase. They also noted “not required by law to buy/use them,” limited vehicle availability and resale concerns as other aspects limiting their consideration of alternative fuel vehicles.

The survey also found, not surprisingly, that public fleets were more likely to purchase AFVs (66 percent had at least one AFV) and have a greater percentage of their fleet dedicated to non-gas or diesel vehicles (6 percent, twice the private sector percentage). It also found, again quite logically, that past positive experience with AFVs led to a higher consideration of AFVs for future purchases. The good news on that front is that 48 percent of the fleet managers reported a positive (good or very good) experience with AFVs while only 10 percent reported a poor experience and 20 percent reported a fair experience.



### National AFV Fleet Fuel Capability



Source: Natural Gas Fuels Survey, March 2000

The National Association of Fleet Administrators also surveyed its members on alternative fuel vehicles and found a great disparity in purchase plans between the public and private sectors.<sup>5</sup> Of public sector respondents (which included government and utility fleets, but not law enforcement), 41 percent planned to purchase AFVs during the coming year. In the commercial (private) sector, the AFV purchase intention was only 9 percent. Both of these categories showed a downturn from the previous year's survey, where the comparable numbers were 43 and 14 percent. The vast majority of the AFVs that were to be added to the fleet were expected to be powered by ethanol (45 percent), CNG (30 percent) or propane (19 percent).

That national survey also found the respondents intending to purchase a total of 64,649 vehicles during 2000, with 51 percent of these cars, 15 percent light-duty trucks and 13 percent passenger vans. The number of vehicles represents almost 25 percent of the total fleets operated by the respondents. According to the survey, NAFA members' purchase decisions were most heavily influenced by the vehicle's job suitability, initial cost and safety record.

The national policy promoting AFV use may be at a crossroads as well, with the Dept. of Energy proposing in May 2000 that the government move from a required percentage purchase goal for local government and private fleets to a plan focusing on niche markets. This would include taxicab fleets, transit buses and "activity centers" like airports or corporate/academic campuses that would be able to more quickly develop infrastructure support for AFVs.<sup>6</sup>

### California EV Fleet Study

As was noted in the fleet industry analysis, government fleets dominate a significant portion of the market (22 percent of cars; 50 percent of light trucks), so that sub-segment merits closer attention. One study by Southern California Edison's Electric Transportation Division, reported in March 1999, conducted a limited review of EV fleets in 61 government, transit agencies and university fleets in Southern California. This study found 178 EVs in operation and another 67 in the process of being acquired.<sup>7</sup> Fleet size ranged from a

single vehicle in many municipalities to 51 deployed by the City of Los Angeles, a very small percentage of its more than 22,000 vehicle fleet. Several cities, such as Westlake Village and Burbank, converted their complete fleets to EVs. In other cities, EVs represented 5 to 10 percent of their fleets.

It is difficult to extrapolate directly from such a survey, but given its scope and thoroughness, it presents some intriguing possibilities for future EV fleet sales. The municipalities surveyed—which were the early adopters of EVs represent about one-third of California’s population, although GCI estimates they represented only about one-sixth of California’s current fleet EV population at the time (including vehicles on order).

Of the municipalities surveyed, 72 percent of those fully reporting their data showed EVs comprising at least 1 percent of their fleets; this breaks down into 43 percent with EVs comprising 1 to 4 percent of their fleets, 9 percent with EVs comprising 5 to 9 percent of their fleet, and 20 percent (nine municipalities) with EVs comprising 10 or more percent of their fleet.

One of the key findings of this survey is that California local public fleets seem to be adopting EVs at a much faster rate than similar fleets nationally, encouraged no doubt by available incentives and a strong pro-EV stance by both local utilities and the state government.

If these numbers were consistent throughout the state—and there is some reason to believe they are given some Northern California cities’ aggressive pro-EV stance (San Francisco and Vacaville, for example)—a campaign to bring municipalities up to the 10 percent EV fleet standard would net approximately 3,350 new EV placements annually, just from municipalities, some transit fleets and universities. The municipal fleets represent only one segment of the potential 10,000 government and utility EVs cited earlier. That would be a sizeable portion of the projected 2003 production requirement focused in, at least from a marketing perspective, one relatively easy-to-reach sub-segment.

That survey found fleet EV users to be generally satisfied with their vehicles. However, fleet managers did express concerns about the lack of charging standardization, inability to purchase a vehicle (lease only), lack of on-site service capability, lack of functionality of the models available (low payload for trucks, lack of four-door cars, lack of range) and questionable reliability (problems with specific vehicles and the GM recall of all S-10 EVs and first generation EV1s).

EV purchase subsidies were critical to most fleet managers’ decision to add electric vehicles to their fleet. Safety, initial price and the vehicle’s configuration were the top decision-making features for an EV to attract fleet buyers. Most fleet managers were accepting of the limitations of current EVs and expected, or perhaps hoped for, improvements in future versions, such as expanded range.

### **GCI Fleet Manager Survey**

In Green Car Institute’s California Fleet Manager’s survey, which sampled a variety of small, medium and large public and private fleets in June 2000, we found a similar pattern to that in the national fleet managers’ survey and the Southern California Edison municipal government fleet survey. EVs and other AFVs are sprinkled throughout current fleets (two-thirds of fleets had some AFVs), but future purchase plans are unclear, reflecting the uncertain vehicle availability currently presented by automakers.

The GCI survey found fleet managers’ main objections to EVs were their limited range and long recharging times, plus the need to outsource service. Not surprisingly, lower purchase price, wider availability and greater range (at least 100 miles) would make EVs more attractive to these fleet managers.

### **Fleet Managers' EV Wish List**

- **Lower Purchase Price**
- **Wider Availability**
- **Greater Range (at least 100 miles)**

*Source: GCI/Dohring Fleet Manager's Survey, July 2000*

Our survey also uncovered what may be an as-yet unexploited opportunity for EV marketing to fleets. The number one concern expressed by fleet managers in new vehicle purchase decisions is safety. An EV's potential to mitigate any safety concerns about the use and on-site storage of volatile fuels like gasoline could be exploited to make their purchase fit more closely with fleet requirements. This focus on safety also underscores that any EV safety concerns need to be aggressively addressed with fleet managers.

### **EV Fleet Marketing Focus**

- **Safety**
- **Fuel economy/low operating costs**
- **Education on capabilities/economics**

*Source: GCI/Dohring Fleet Manager's Survey, July 2000*

Other marketing angles that would help EVs fit fleet managers' purchase requirements would be to promote electric vehicles' relative fuel economy and the cost of fuel (electricity) compared to gasoline and diesel.

This survey also pointed out that an educational campaign to help private fleet managers understand the capabilities and economics of current EV technology could be beneficial in raising the sales potential of that segment of the market.

### **NEV/CEV Niche Market**

A niche that is in its embryonic stage, but that may represent a significant fleet market in the near future, is that of neighborhood and community electric vehicles. These vehicles are already on the market from several manufacturers, with more on the way. They have a lower purchase cost than larger EVs and additionally have established themselves as dependable, if limited use, vehicles. According to industry studies, these vehicles and off-road/industrial EVs account for 86 percent of the current electric vehicle marketplace.<sup>8</sup>

One pioneer manufacturer of NEVs, Bombardier, has said its studies found that 87 percent of vehicle trips were taken with only one or two persons in the vehicle, and most of the trips were of ten minutes or less in duration. According to Bombardier, this represents an opportunity for neighborhood electric vehicles, a product the company describes as "designed to bridge the gap between the automobile and the golf cart."<sup>9</sup>

Following the innovative approaches used in Europe and Japan may build fleet use of NEVs and CEVs as well as stimulate consumer demand.

For example, TH!NK Nordic teamed up with Hertz to make leasing electric cars easier in Norway. According to TH!NK president Per Lilleng, "Customers will have one single number to call which gives access to a convenient package of leasing, distribution, and service." Hertz will handle delivery of the TH!NK cars to customers' homes and businesses. Hertz will also pick up cars that need service, and supply temporary replacement vehicles. TH!NK will also offer TH!NK EV drivers special rental rates for larger vehicles through Hertz when the two-seat electric cars cannot meet a driver's needs, such as for family vacations.<sup>10</sup>

Ford TH!NK officials initially estimated this market to be in the hundreds of vehicles with the potential to grow fairly quickly to the thousands. Part of the growth will likely be driven by the quick-cycle pattern of rental car use, which finds vehicles replaced sooner than a typical owner-operated vehicle would be.

This innovative TH!NK business arrangement with Hertz will be extended to Sweden and Denmark this year. The companies are currently studying entry into German and U.S. cities. Fleet customers, such as utility companies, postal services, health-care organizations, and governments are the intended markets for the vehicles.<sup>11</sup>

In the U.S., Ford launched TH!NK marketing with a demonstration program at the Presidio in San Francisco, California. Ford plans to provide TH!NK city vehicles to the Presidio starting in the middle of 2000.<sup>12</sup> Ford will additionally import up to 700 TH!NK City battery electric vehicles for demonstration programs in North America over the next two years (2000-2002)<sup>13</sup>

Another NEV manufacturer, which claims to have produced more than 5,000 vehicles for on-road use, is Global Electric Motorcars. Its GEM electric cars are in high-profile use as rental vehicles in San Francisco. The company sees its vehicles filling many fleet niches.

GEM's NEV sales have reportedly been explosive on the Southeastern coast of Florida and in Port St. Lucie, Florida. Local EV retailer Treasure Coast Electric Cars recently sold a used car lot to focus full-time on selling EVs. Brian Sluster, owner of Treasure Coast Electric Cars, said, "Malls, airports, zoos, sports facilities, community police patrols, and military bases would be natural places to market this technology."<sup>14</sup>

In addition to Ford and Global, Toyota and Nissan have both brought their mini EVs, the e-com and Hypermini, respectively, to the U.S. for demonstration projects in anticipation of this growing market.

### **Fleet Growth Feeds Overall Market**

Growing fleet uses for a variety of EVs promise to feed the overall growth of the EV component and battery market, which will help bring it closer to the "critical mass" of volume needed to drive down costs and prices.

Large fleets like the USPS and other government uses can help assure manufacturers of a steady volume. Growing fleets like NEVs and CEVs, along with their equally plentiful off-road counterparts, feed into the component/battery volume.

Government incentives and regulations may spur further growth of off-road and on-road EV use, but industry officials see great potential for the vehicles in a pure business sense as well. New York Power Authority chairman and CEO C.D. Rappleyea noted increased use of non-road EVs, such as golf carts, forklifts, and airport support equipment could help pave the way for broader acceptance of electric cars and other forms of electric transportation. According to Rappleyea, airports are a potential growth area for non-road EVs, since major airlines in the U.S. are now operating 25,000 to 35,000 pieces of ground support equipment. Relatively few run on electricity now, but improved infrastructure "could increase the EV presence dramatically."<sup>15</sup>

Hybrid electrics and the just-developing fuel cell vehicles also promise to create more demand for these key EV components.

Ford's experience with its (relatively) high volume Ranger EV would seem to indicate a likely growth pattern for the fleet EV market. Its sales pattern is the result of some aggressive marketing, such as offering \$7,000 grants that brought the monthly lease price of a NiMH-battery equipped Ranger to about \$230. Ford reported sales of about 250 Ranger EVs in 1998; in 1999, that number jumped to 560 as a result of marketing campaigns.<sup>16</sup> Incidentally, those campaigns ended abruptly when Ford reached its MOA allotment and the company raised prices of its Ranger EV NiMH model substantially.

The 50 percent annual growth rate would be laudable for any vehicle launch, even though the total numbers are still low. If the rate is sustained, which should be possible for several years as the product improves and the market matures, annual sales could easily be in the thousands for just this single model.

All of this indicates that the fleet market, a key part of the overall EV market, should be able to absorb its portion of EVs during the coming years to fulfill the California state production requirements. A side benefit of the growth of the fleet market is that it should help drive down costs of EV components and batteries while also paving the way for a growing consumer market. In addition, the fleet market will continue to provide auto companies with a test bed for advances in technology, allowing them to gain feedback from the field before introducing the vehicle to the general public. Several companies use similar techniques now to speed development and refinement of their vehicles.

EVs clearly have many inherent attributes that fit the needs of fleets—such as environmental friendliness, low operating costs, and simple and safe refueling. Targeted marketing of vehicles that have been designed for the fleet market (as opposed to the first generation of fleet EVs that were essentially conventional vehicles converted to electric propulsion) should result in a steady and growing stream of sales.

In the fleet market segment, we found that the potential for EVs in municipal, transit, utility and university fleets alone could likely absorb a large portion of the number of EVs California requires to be produced in 2003. While the fleet market is a difficult one to gauge, EVs have made inroads during the past four years, laying the groundwork for many more sales. We estimate EV penetration of the fleet market conservatively to be 5 to 10 percent annually by 2003, allowing for differing adoption rates between government and commercial (private) markets. This equates to 12,000 to 24,000 vehicles, which alone is equal to about 50 to more than 100 percent of the total number of EVs required to be delivered for sale in California in 2003.

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# Review of Current EV Market

Green Car Institute found that the automakers' EV marketing programs:

- Presented fleet buyers with a different purchase process than many were used to;
- Were not consistent in their marketing programs to fleets;
- Presented a more difficult buying process than normal to consumers;
- Used confusing marketing, such as advertising that had no retail component.

In summary, the automakers' marketing strategies appeared to be shaped more by their desire to quickly fulfill MOA requirements than to build a long-term EV market.

Although two automakers might protest, it is clear that the marketing of EVs to consumers (as opposed to fleet customers) has not yet truly begun. That is not to say that these companies have expended little effort at presenting their vehicles to consumers. On the contrary, their public positioning has been relatively high profile in some cases. The troubling thing is that this effort has not resulted in an emerging consumer market. In all, of the six manufacturers leasing EVs in California, only GM and Honda made an effort to market to consumers.

## **Vehicles Limited Market**

The problem with GM's EV1 and Honda's EV Plus was not necessarily in their marketing strategy, plans or execution. The two companies made a serious effort to get their EVs before the public. But the vehicles themselves limited the market, as did some of the additional hurdles presented by the automakers.

In total, three vehicles were offered to consumers—the GM EV1, Honda EV Plus and Ford Ranger EV, although the Ranger received limited retail promotion. All were two-door vehicles. Two of the three were essentially two-passenger vehicles, far from the most universally accepted seating configuration. The pickup also had a limited carrying capacity and was not offered in the most popular configuration in the class—an extended cab.

In the automotive market classifications used by J.D. Power and Associates, the EV1 would fall into the "Premium Sporty" segment, pitted against the Chevrolet Corvette, BMW Z3 and Porsche Boxster (a segment disproportionately popular in California, but it is only one-half of 1 percent of the total market).

The Ranger is in the "Compact Pickup" category where, in addition to its internal combustion engine brethren, it competes against the Toyota Tacoma, a very strong contender in the California market (again, a market segment that in total is less than 7 percent of the total market).

The EV Plus would be a "Premium Compact" based on its size, where it would compete against its relative, the segment leader Honda Civic, as well as the Toyota Corolla, Saturn, Ford Escort and Chevy Cavalier. Some marketers would break this category down further into the price-oriented entry level vehicles and the more fully equipped ones selling for thousands more (although nowhere near the price of the EV Plus, which becomes a critical issue). If classification were based on price, the EV Plus would probably be labeled a "Near Luxury" car competing against the BMW 3-series, Volvo C70 and Acura CL, although it has none of the other attributes of that class of vehicle.

The problem for the electric models is readily apparent. In spite of peppy performance delivered courtesy of the instant torque of an electric motor, they are mismatched in the performance-dominated sporty and luxury classes, and in classes that are minor players in the automotive marketplace.

In the EV1's case, it is marketed through Saturn, which has neither a performance nor luxury heritage to justify the price or image of the car. It resembles GM's now abandoned attempt to create a "Geo" brand as a subset of its Chevrolet franchise, a several year effort that floundered because of the immense expense to establish and differentiate a new brand, one which in this case existed only as a collection of rebadged vehicles from different Japanese manufacturers. The EV1 was the first vehicle to literally wear the General Motors brand.

At Honda, the EV Plus is a similar mismatch, sitting in a showroom dominated by established bread-and-butter, four-door, four - and five-passenger internal combustion engine Civics and Accords selling for half the price of the electric car. It might have fit better in the Acura showroom, where its sticker would have caused less of a shock and the car could still trade on the Honda tradition of reliability.

### **Some Innovative Programs**

Still, many innovative programs have been tried by automakers to attempt to stimulate the EV market, although most were similar to ones already in use with conventional vehicles. GM lowered the lease price on the EV1, including, as some other companies did, the all-important home charger as part of the package. Ford tied a low lease rate on NiMH-equipped Ranger EVs to an educational grant that had minimal conditions—and appeared to have sold out its stock of vehicles. At least it took enough orders to meet its MOA requirements—after which it raised the lease price on the vehicle back to a much higher rate.

At present, consumer marketing has ground to a halt, hampered by a drought of vehicles, a severe lack of enthusiasm on the part of manufacturers who have now turned attention to other vehicle programs (like gas-electric hybrids and fuel cell), or simply opposition to the California ZEV production requirements.

What is clear is that, at least to an extent, EV marketing programs have served to underscore the technical prowess and environmental image of the auto companies conducting these campaigns. Interestingly, significant advertising expenditures have been made in sustained campaigns at times when little or no product was available to the consumer. Some industry analysts have pondered whether this was really designed to create consumer interest in electric vehicle products or simply to enhance the company's image.

# A Look at EV Market Predictions

## A View from the Past

Sometimes a good way to look at the present is to view it through the prism of the past—the predictions of what the present would be like when it was still the future.

In the electric vehicle market, a quick summary of the past decade's view of the EV world of today might be: ...it isn't what anyone had predicted.

In the midst of the oil crises of the 1970s, government programs spurred electric vehicle technology research and development and led to predictions that, by 2000, half of the nation's automobiles would be either EVs or hybrid electric/internal combustion powered.<sup>1</sup>

Back in 1995, University of California, Davis, researchers predicted a potential annual market of between 186,000 and 213,000 EVs in California in 1998,<sup>2</sup> approximately 13 to 15 percent of the consumer market (interestingly, very similar to our current research findings).<sup>3</sup> Of course, considerably fewer vehicles were actually made available by automakers in this timeframe.

From a slightly different perspective (encompassing the broad spectrum of the worldwide EV market beyond on-road vehicles—including industrial vehicles and components), a June 2000 study published by the Business Communications Company estimated that the 2000 EV market is worth more than \$2 billion and will grow to \$7 billion by 2005. BCC said that in large part this is driven by the development and marketing of hybrid electric vehicles. That study found 86 percent of the current EV market focused on smaller EVs, including golf carts, NEVs, bicycles and industrial equipment. It also predicted the larger on-road EVs would experience a higher growth rate (17 percent annually) during the next five years.<sup>4</sup>

Another just released study claims that EVs, components and related services currently represent a highly profitable \$13 billion market worldwide.<sup>5</sup> Much of the focus of this market is apart from on-road transportation vehicles, but it indicates an underlying strength in the industry and a potential base on which the personal transportation EV can be built. The author of the report said of the more than 1000 EV manufacturers in the world about 60 percent are profitable, accounting for a \$6.21 billion industry. Toyota is the biggest in the EV market with about \$2 billion in EV-related sales, led by the company's industrial forklifts.

Dr. Peter Harrop, the report's author, added that the EV forklift industry has established itself as a solid consumer value proposition. "For example, an EV fork lift can be used indoors, is smaller, more maneuverable and longer lasting (than its gasoline-powered competitors), has less down time, lower maintenance and fuel costs, a 35 percent lower total cost of ownership and is quieter." When on-road EVs can present a similar multi-faceted value proposition, they will be able move to a more profitable position, he feels.<sup>6</sup>

### **EV Forklift Value Proposition**

- **Longer lasting**
- **Less down time**
- **Lower maintenance costs**
- **Lower fuel costs**
- **35% lower total cost of ownership**
- **Can be used indoors**
- **Smaller**
- **More maneuverable**
- **Quieter**

*Source: Dr. Peter Harrop, author of "Electric Vehicles Are Profitable--Where, Why, What Next"*

A 1997 study led by John Maples of the University of Tennessee predicted the EV market would take about 15 years (until 2015, with 2000 as the start of the market) to reach maturity because of high vehicle production costs.<sup>7</sup> This study assumed that manufacturers would introduce EVs to the market at twice the price of comparable conventionally powered vehicles, which in part accounts for the predicted slow growth. Even at that point, this study predicted EV costs would be somewhat higher than comparable gasoline-powered vehicles. Another study by the same group, "Transportation and Fuel Technologies; Performance Analysis Methodology," forecast EVs accounting for less than 5 percent of the light vehicle market in 2010 with only a slight increase by 2020, again due to assumed high vehicle prices.<sup>8</sup>

What these studies show is the volatility of the market depending on projected vehicle pricing. With the Maples study showing EVs priced at twice the market price of comparable gasoline vehicles, the group naturally concludes a very slow growth path for the segment. A hybrid electric introduced at an approximate 25 percent premium over its gasoline counterpart reaches market maturity in only four years.

### **The Market Arrives?**

As the new millennium neared, the timetable for the growth and expected flourishing of the electric vehicle market found itself stretched further into the future. One date has to be recorded as the starting point—the day the GM EV1 went on sale to the public in Southern California: Dec. 5, 1996. With much fanfare and more than a little optimism on the part of both automakers and environmentalists, the modern era of factory-built EVs began.

The reality of the 1995-2000 American EV market is that it has been very limited in scope, essentially an advanced battery demonstration as proscribed by the CARB MOA. Generally, automakers offered their first generation electric vehicles to select groups of consumers and fleet markets in limited numbers and models, and with significant acquisition restrictions. The end result is that more than 3,500 factory-built EVs are on the road in the U.S., with the majority (2,300) in California, while a similar number are on the road in Japan.

## **International Markets**

At least four times the number of EVs in the U.S. are on the road in Europe, where a combination of government and industry promotion has made them more commonplace, but still not mainstream. The forthcoming THINK EVs and EV variants of the Mercedes-Benz A-Class and Smart cars may expand it further. American trade specialists from the Dept. of Commerce predict that there will be 200,000 EVs on the road in Europe within 10 years with annual sales reaching 50,000 units in 2009, led by the new class of city cars represented by the Mercedes (formerly Mercedes/Swatch) Smart venture.<sup>9</sup>

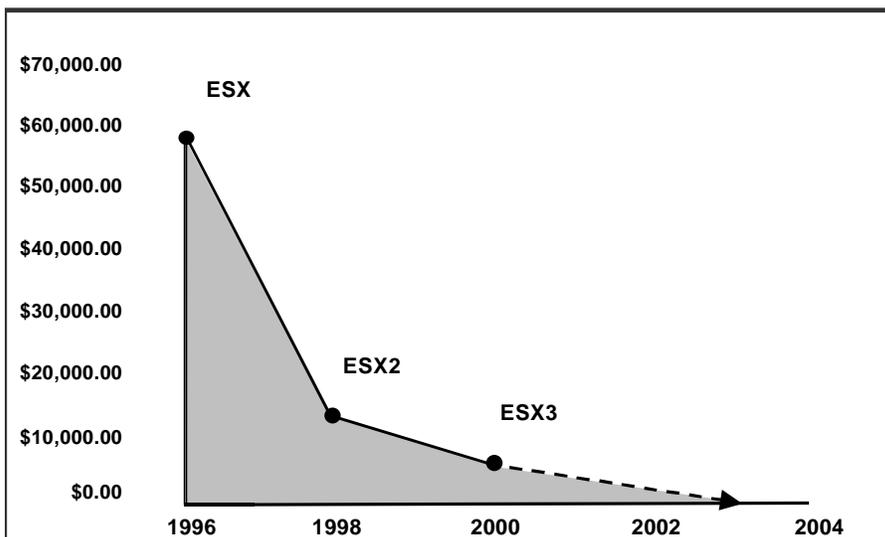
Other overseas markets also appear to be on the verge of expansion. India's first production EV was recently announced. The target for first year production of the low-cost car is a modest 1,500 units, which the company plans to double in the second year.<sup>10</sup> Mexico, a country with severe pollution problems in its major cities, expects the corporate and public EV population to grow 12 percent during the next two years. Major companies distributing products are beginning to use fleets of EVs and natural gas vehicles.<sup>11</sup> China is another potentially huge market where EVs are needed to combat extreme pollution. China's announced five-year plan calls for one-fifth of its domestically produced vehicles to be EVs or low-emission hybrids, a market that could reach 100,000 vehicles by 2005.<sup>12</sup>

Hybrid electric vehicles (HEVs) were introduced in Japan in 1997 and in the U.S. in 2000. They promise to greatly expand the volume of advanced technology vehicles on the road and also increase the total market for batteries used both in EVs and HEVs. Since its introduction in Japan, the Toyota Prius hybrid has sold more than 37,000 units, dwarfing pure EV sales. Its sales goal for 2001, its first full year in the U.S., is approximately 12,000 units. Honda expects to sell an additional 6,000 editions of its Insight hybrid during its first year on the market and has announced the extension of the powertrain to its high-volume Civic next year with the intent of producing a profitable, high-volume hybrid vehicle.

Ford has announced that it will soon bring a hybrid version of its Escape sport utility vehicle to market; DaimlerChrysler has indicated it will build a hybrid version of its Durango sport utility if government incentives help lower its effective consumer price, and GM has committed to selling hybrid electric Chevrolet Silverado and GMC Sierra pickups in 2004. Further, the CEO of DaimlerChrysler announced a \$1 billion project to put a fuel-cell vehicle into production within two years.

## **Quicker Development**

Beyond announced or implied vehicles, almost every manufacturer in the world has been showing one-of-a-kind concept cars with advanced propulsion systems, often hinting of the potential production of either the powertrain or the entire vehicle. The timeframe for production is usually closely guarded corporate information, but what is known is that GM, as one example, boasts of having a high-proportion of its vehicles on 18-month and 24-month design approval-to-production cycles.



*Data Source: DaimlerChrysler Corp.*

The dynamism of the advanced technology development is illustrated by DaimlerChrysler's series of showcase cars in its ESX series. The 1996 ESX showcased a hybrid drivetrain in a full-size sedan but carried an expected cost penalty compared to a conventionally powered sedan of \$60,000, even in mass production volumes. The 1998 edition, the ESX2, came with a more efficient, lighter weight and more sophisticated hybrid powerplant—and a cost differential that had dropped to \$15,000 compared to its internal combustion engine brethren. By the 2000 ESX3 version, shown as part of the PNGV (Partnership for a New Generation Vehicle) government-industry project, engineers and designers had once again produced a vehicle with more sophisticated technology than its predecessors, but at a significantly lower \$7,500 cost differential.<sup>13</sup>

In addition, DaimlerChrysler executives noted that technology from the concept cars was already finding its way into production vehicles, or would soon.

## Green Car Journal Archives

Green Car Institute reviewed literature on the electric vehicle market dating back to 1992, beginning with the archives of Green Car Journal, the definitive trade publication of the environmental auto industry.

Additionally, GCI researched other academic and media channels to gather this summary of the EV market as it was predicted and as it has unfolded in reality.

Highlights of the past decade's assertions on the EV market are gathered under the headings of Automaker Statements, Battery Company Statements, Utility Company Statements and General Statements (from the media and other sources). At the beginning of each section is a summary of the critical statements and an analysis of their significance. They are included in this report as appendix C.

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# Conclusions

Clearly, this study establishes that a significant number of consumers and fleet buyers are interested in electric vehicles for all the expected reasons – lower operating costs, positive environmental image, and so on – and that given the opportunity, they would own and drive them.

What's at issue is not the existence of a market, but what has been done to introduce products to address it. Automakers have come to market with EVs at high prices, with limited model availability offered for lease only, with limited geographic and dealer availability and backed by a limited marketing effort. In many instances, extensive buyer screening effectively kept a substantial number of potential EV purchasers from owning and driving an electric vehicle.

Regardless of the specific reasons why automakers have approached the market in this manner – high manufacturing costs, an unknown market, wish to limit risk, expectation of losses – the fact remains that there has been a consistent and significant mismatch between product and market. Currently, there is a substantial electric vehicle market in this country in search of a product.

According to the GCI/Dohring study, limited range and function – something universally cited by automakers as the most serious impediment to the EV's market success – is not such an obstacle after all. It's the unavailability of suitable product.

Our market research with consumers and fleet managers shows an understanding of the capabilities and limitations of current electric vehicles and a willingness to accept them "as is." A consumer market of 12 to 18 percent, as our research has indicated, is ready to buy EVs. A fleet market estimated between 5 to 10 percent, accounting for different acceptance rates between government and private fleets, adds to the current potential market. The cumulative fleet and consumer market of 163,200 to 250,800 EVs annually is more than adequate to sustain EV sales of the scale needed to meet ZEV production requirements set by California for 2003.

Automakers have long held that battery technology precludes them from producing such vehicles. This is an application of conventional and traditional automotive wisdom, much the same as the conventional wisdom of just a few years ago that told us hybrid electric vehicles made absolutely no sense because they integrated two disparate powerplants and fuel systems, and were therefore too cumbersome, complicated, and expensive to prove successful in the marketplace. Some of the most high-profile auto industry proponents of hybrid electric vehicles today were among the hybrid naysayers of just a few years ago. Hence, the danger of discounting any potentially popular automotive product before it has had an exhaustive and complete opportunity for development and market testing.

Obviously, many of the most powerful arguments against hybrid electric vehicles are falling by the wayside, and the evolution of these thoughts is changing as this paper is being written. Honda, for instance, has now publicly stated that it expects to turn a profit on its Integrated Motor Assist-powered 2001 Civic hybrid because of the efficiencies of mass production.

Just six months ago, this automaker was publicly mulling whether it could sell the 4,000-unit build it had planned for its initial hybrid model debut, the Insight, which was reportedly being sold at an \$8,000 per unit loss. A few short months after its launch, the Insight build was increased by several thousand units to help meet the growing demand and the vehicle still often commands a premium over its suggested retail price at many dealerships. Things change, sometimes quickly, in the automotive market.

Things change, too, with regard to battery electric vehicles. The very automakers that claimed electric vehicles were not economically viable are now gearing up to produce niche-market electrics like the neighborhood electric vehicle and community electric vehicle. They are not being forced to do this, but are seeking out new market niches while enhancing a positive environmental image for the parent company and all of its vehicles. The intent is to create a viable electric vehicle (and related product) marketing unit.

While auto companies argued that EV components were too expensive and batteries too limited in range five years ago, those same companies have already offered their second generation of EVs featuring components that cost half as much and with batteries that offer almost twice the range. Development continues on both fronts, spurred by growing parallel markets in hybrid and fuel cell vehicles.

Further development of hybrid gas-electric and fuel cell vehicles is synergistic with further battery electric vehicle improvements. As the EV components that these vehicles share increase in volume, their costs decrease across the board.

The environmental need for electric vehicles continues, something the California car-buying public clearly recognizes. Strong environmental convictions lay the groundwork for marketing EVs to consumers, while their low operating costs and fuel economy are strong additional advantages. For the fleet market, EVs offer the ability to meet regulatory requirements while saving money and providing lower operating costs compared to the gasoline or diesel-powered competition.

From market research it is clear that auto companies need to rethink their lease-only approach to EVs if they intend to broaden the vehicles' appeal. The lease market, while strong, represents only about 11 percent of the total current consumer vehicle market and will only rise to 13.6 percent if all of those intending to lease their next vehicle, do. Those indicating a wish to purchase an EV had similar anti-lease convictions, which means that EVs are less likely to reach their market potential unless sold more in the manner of gasoline vehicles.

Clearly, the rewards are substantial for the auto company that boldly reaches out with the right products at the right prices to meet the needs of consumers and fleets. In addition to EV sales, the company will benefit from a positive environmental image and also possibly a positive technology image. Such a position will bolster its overall position in the marketplace and, properly leveraged, lead to even more sales and profits throughout the corporate lineup.

Today's small hybrid electric vehicles, brought to market heavily subsidized in the hope that profits would follow, are leading to full-size hybrid electric sport utility vehicles and light trucks – core vehicles that sell in the hundreds of thousands of units annually. With that high volume they offer all the advantages of mass production and lowered unit costs, which are the automotive keys to profit. The advent of battery electric vehicles offered in popular models, at competitive prices, for purchase as well as lease, offers the similar promise of following the same evolutionary path.

The market for EVs exists. It is simply awaiting the right products, properly marketed to meet consumer needs, to blossom.